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Town of Needham / Needham Public Schools Theater Sound & Light Study

Feasibility Report

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Introduction

Hewshott was engaged by the Town of Needham / Needham Public Schools to perform the Theater Sound & Light Study at:

- Newman Elementary School, 1155 Central Ave, Needham, MA 02492
- Pollard Middle School, 200 Harris Ave, Needham, MA 02492
- Needham High School, 609 Webster St, Needham, MA 02494

Objectives

1. Develop a detailed feasibility plan for updating the theatrical sound, lighting, and rigging systems in each venue based on the following:
 - o Condition of existing systems;
 - o Input from constituent users (staff, students, community theatre members);
 - o District's vision for each venue.
2. Assess the impact of new theatrical sound, lighting, and rigging equipment on associated building systems and structures.
3. Identify priorities with phased approach, timetable, and costs.
4. Identify any deficiencies or safety concerns within the existing rigging systems.

Scope

The scope is limited to theatrical sound, lighting, and rigging systems and to perform rigging and safety inspections at each theatre to include written reports with photos and list of deficiencies.

Specifically excludes enlargement of the physical auditorium and support spaces and reconfiguration of the stage and seating.

Methodology

To complete the analysis and services required for this project, Hewshott performed the following tasks:

1. Attended Steering Committee / Working Group meetings and made presentations.
2. Attended Focus Group meetings including school groups, performing arts group, student group, and community group to gather and organize feedback.
3. Attended Permanent Public Building Committee (PPBC) meetings.
4. Attended events (i.e. Shrek dress rehearsal @ Newman ES, band concert @ Needham HS)
5. Surveyed each theatre and reviewed sound, light, and rigging systems.
6. Performed Rigging and Safety Inspections at each theatre.



Executive Summary

This report is the final deliverable from the study performed over the past 5 months. It covers theatrical sound, lighting, and rigging at Newman Elementary School, Pollard Middle School, and Needham High School. We have surveyed the theaters, observed performances, met with staff, students, and community members to hear about their experiences, challenges, and needs.

It likely comes as no surprise that Pollard Middle and Needham High require significant work as the theatrical systems are several decades old. But even Newman Elementary, which was renovated and upgraded in 2012, requires updating due to the many fundamental technological shifts. Think about computers and mobile phones and how much they've changed in ten years. Audio signals and workflows have transitioned from analog to digital. The FCC has restructured the wireless frequencies leaving owners of wireless microphone systems operating in illegal frequencies, ultimately forcing them to replace the systems. Video has significantly increased resolution to "high definition" and widescreen aspect ratios which utilize digital signals. LED lighting is now commonplace and the numerous benefits of color-changing LED are quickly rendering lamp-based fixtures obsolete. The entertainment rigging industry has matured and implemented new standards and codes, putting safety first.

Herein, you will find descriptions of the existing systems, our assessment of their condition and state, list of recommendations, prioritized phased approach to implementation, impact to building systems and structures, and detailed cost estimates.

It is important to state that once all phases contributing to the benchmark have been completed, there is an estimated savings of \$100,000 annually. The savings come from the reduction in electrical load due to energy efficient LED lighting as well as a reduction in heat load, which requires less cooling. While the annual cost savings will not pay for the proposed \$3.5MM upgrades, the opportunity for savings, sustainability, and reducing carbon footprint must be observed. See Cost Savings section for more information.

The purpose of the study is to bring awareness to the condition of the theaters, educate readers on current benchmarking of theatrical systems, and identify the scope of work and cost impact to bring Needham's theaters up to the benchmark. Which, in hope, will initiate and justify the funding process.



Fundamental Shifts

Within the past 20 years there have been numerous advances and fundamental shifts in audio, video, and lighting technology. Audio has shifted from analog workflows including cabling, signals, communications, and controls to digital. Additionally, in 2017 – 2020 the Federal Communications Commission (FCC) restructured the wireless frequency spectrum. This specifically impacts wireless microphones which, in general, are no longer able to operate in the 600mHz and 700mHz spectrums. This has forced users to replace their wireless microphone systems with new compliant frequencies, free from interference. Video too has shifted from analog workflows to digital while increasing resolution and introducing widescreen aspect ratios. Video infrastructure as recent as 10 years old may be obsolete. Connectors and signal types are quickly superseded by newer versions capable of supporting the new technology. Projectors no longer utilize lamps (bulbs) as the light source but lasers which are more efficient and have a longer life. Viewers of standard definition video often perceive it as “old” and “outdated.”

Lighting has shifted from filament-based sources (i.e. incandescent, halogen, discharge) to solid state light emitting diode (LED). The Department of Energy (DOE) has restricted use of high wattage lamps, like those found in theaters. And because of that, lamps are increasingly difficult to source. In theatrical lighting today, use of color gels and replaceable lamps are uncommon. Single LED fixtures can produce millions of colors, which are remotely controlled. Specialty “moving lights” which can move (pan/tilt), change color, zoom, focus, and have numerous patterns called “gobos” inside are available. They are remotely controlled and do not require users to manually aim the fixtures per show.

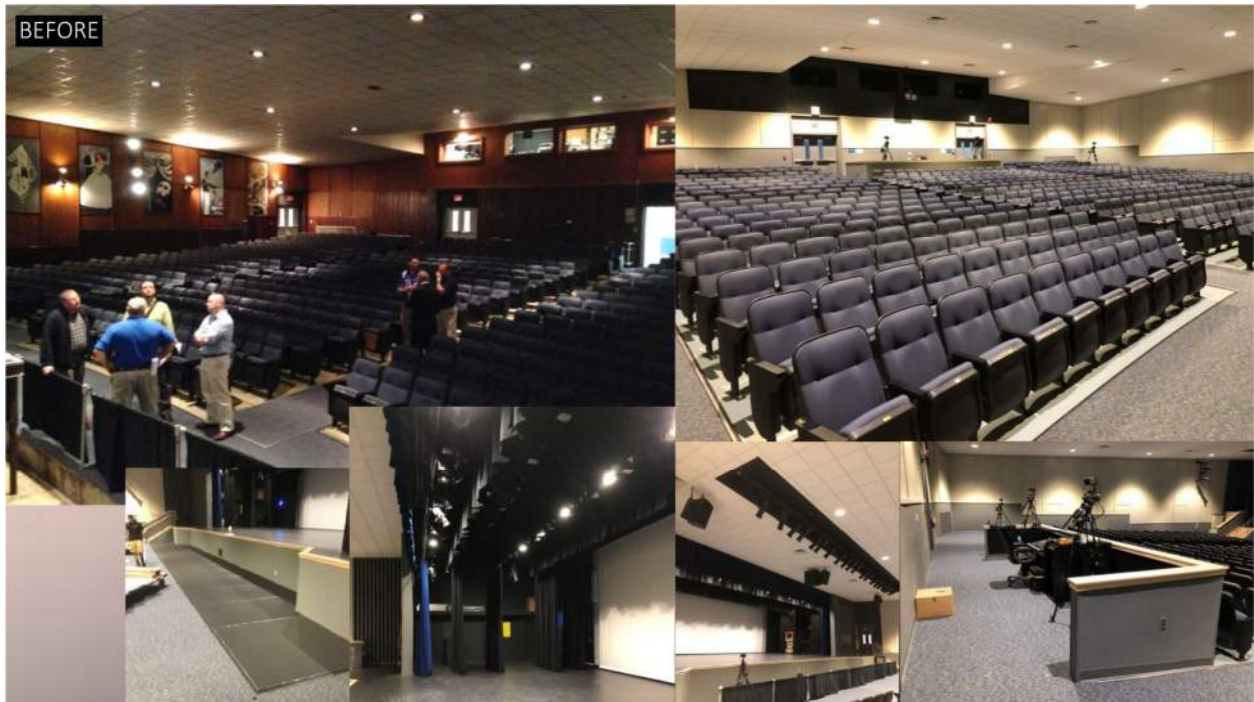
Rigging has historically borrowed hardware and techniques from other industries including arboristry, trucking/hauling, and the industrial market. Accidents, failures, and injuries have initiated progression through the development of numerous safety standards, which set a minimum safety level. Now, hardware is designed, rated, and used specifically for entertainment rigging. As part of the national and international standards, and manufacturer’s instructions, regular rigging and safety inspections are required. This leaves a great deal of theaters, requiring to take action to mitigate deficiencies by repairing, replacing, or removing parts of the rigging systems. Fire curtains are subject to the same maturation process and means and methods have advanced, providing safer theaters with less casualties. Synthetic fabrics are now available for stage draperies which are inherently (permanently) flame retardant. Further on safety, we now consider access and fall protection as part of the design and engineering process. Equipment and systems must be relatively accessible for service, maintenance, and inspections.

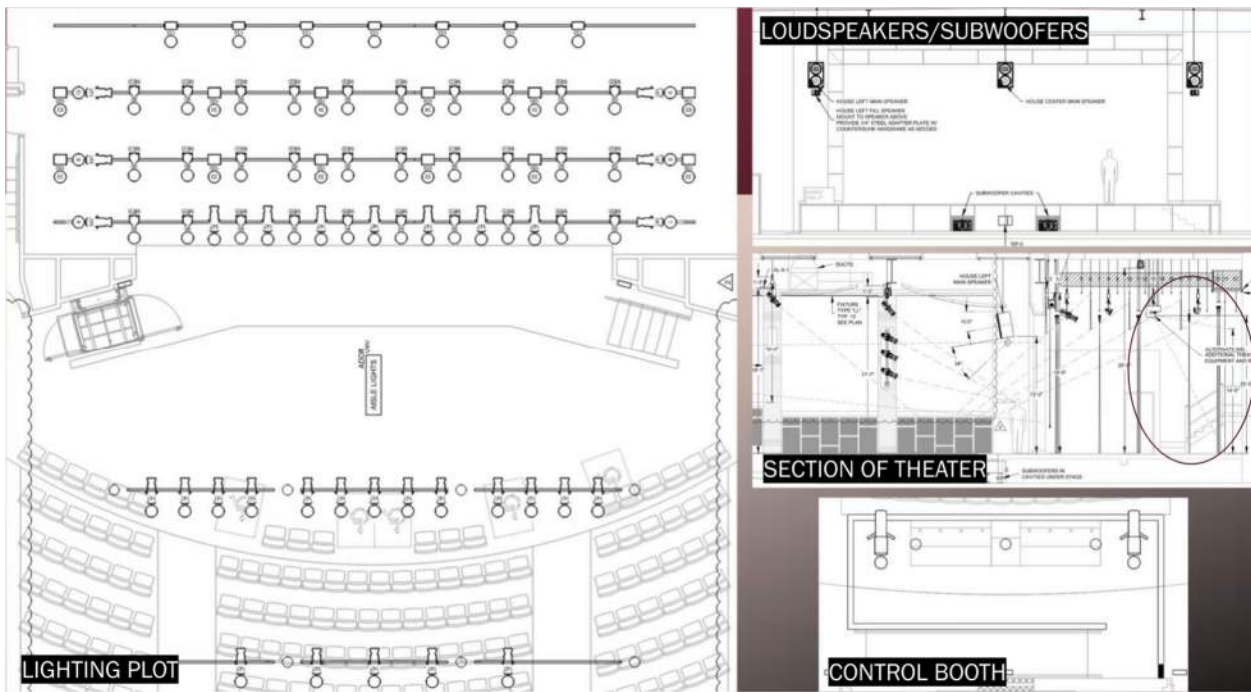


Benchmarking

To provide a frame of reference, what is typically done in today's theaters, let's review a few recently completed, publicly-funded, high school theatre renovations. This aids in defining what is adequate, or "good enough," without delivering substandard systems.









A. Description of Systems

Audio: Consists of a left, center, right (LCR) stereo sound system including fill speakers for even coverage of the seating area. The LCR system accommodates presentations, band/choral concerts, and plays/musicals. Subwoofers are recessed into the stage front for low-end reinforcement. The workflow is digital from microphone inputs, signal processing, and to the amplifiers. The mixer and stage box are digital utilizing a single Cat6 cable to connect them. There are (28) channels of wireless microphones to accommodate large scale plays/musicals. Antennae are located in the ceiling for optimal reception. The audio system is powered by an isolated (technical) ground power system to prevent ground induced noise. All cabling is in metallic conduit to prevent electromagnetic interference (EMI). A 3rd party control system allows for a “simple” operation mode using the lectern, wired microphone, or wireless microphone for basic presentations. And allows for “advanced” operation mode where the mixer is used by an operator. The system is run on a “Theatrical Systems” network backbone. The system is connected to the fire alarm system and mutes when activated.

Video: Consists of a high-definition large venue laser projector and widescreen motorized tensioned front projection screen. Inputs are available on stage, via the lectern, in the pit, control booth, and Blu-ray player (DVD). The system is controlled from a 3rd party control system (touch panel). It allows for a “simple” operation mode where a presenter can connect their laptop and show it on the screen without the need for an operator. In “advanced” mode, the touch panel allows for seamless switching between inputs. There was an alternate bid for scenic projection system (i.e. digital backdrops), however the Owner did not decide to accept it. The system utilizes uncompressed HDBaseT video and is run on a “Theatrical Systems” network backbone. The system is connected to the fire alarm system and mutes when activated.

Lighting: The house lighting consists of LED white light luminaires with theatrical dimming to 0%. There are wall sconces and color-changing linear fixtures for accent and mood lighting. Aisle lights are part of the normal and emergency scheme illuminating egress paths, which are automatically activated in the event of an emergency (i.e. fire alarm, normal power loss). Control keypads are adjacent to all entrances with a single button to turn on the house lights and another for stage “work” lights. Additional presets and granular adjustment are available via the 3rd party control system (touch panel). The theatrical lighting system consists of LED color-changing spot, wash, and cyclorama luminaires providing front, down, side, back, and effect lighting. There are manually operated LED follow spots in the elevated control booth. All lighting is available from the theatrical control board as well as the 3rd party control system (touch panel), with recordable presets for use without an operator. The system is run on a “Theatrical Systems” network backbone. Emergency lighting is connected to the fire alarm and in the event of normal power loss, goes to emergency state.

Rigging: Consists of (22) dead-hung (static) linesets on stage and (3) lighting positions in the house. It includes several empty pipe battens to support backdrops, scenery, and props for future production use. All curtains utilize synthetic velour fabrics which are inherently (permanently) flame retardant.

B. Conclusion

To align Needham theaters with this benchmark, SAC1, SAC2, TSU1, TSU2, and TSU3 phases are all required.



Optional enhancements vary from school and subsystem but typically are in two categories. That is, theatrical systems enhancements that are above and beyond the benchmark (TSU4) or architectural lighting (AL1) upgrades which may be funded or performed as a separate project (e.g. maintenance, energy conservation, capital improvement).



Phases

In this section, we have provided descriptions of existing systems, assessment of existing systems, overall recommendations, and a phased prioritized approach for implementation of our recommendations for each school. Each phase in the prioritized approach is a package and is cumulative. It is also viable to implement sequential phases concurrently, but this should not delay any phase in accordance with the time frames below.

Phase Category	Phase	Description	Timeline	Benchmark
Safety And Compliance	SAC1	Deficiencies requiring immediate action relating to safety & code/standard compliance	Immediate	X
	SAC2	Deficiencies requiring action within 1-year	Within (1) year	X
Theatrical System Upgrade	TSU1	Make existing systems operational	Once funding is secured	X
	TSU2	Minor construction, focused on equipment which can be reused/incorporated into future phase(s)	Within (2) years of TSU1	X
	TSU3	Major construction, requires general/electrical/theatrical contractors	Within (5) years of TSU2	X
	TSU4	Optional enhancement above and beyond the benchmark (i.e. scenic projection)	Open	
Architectural Lighting	AL1	Non-theatrical lighting, upgrade to LED	Open	



Newman Elementary School

1. Description of Existing Systems

Audio: A portable rental system consisting of mixer, wireless microphones, and powered loudspeakers on stands were in place. Users advised that the installed sound system is not operational. The sound system was installed in approximately 2012. Loudspeakers consist of left, center, and right “mains” with left/right “delays,” and a subwoofer. There are (4) powered monitors for floor use as needed. There is a roll-top control desk in the rear of the auditorium which contains two small equipment racks. A full-size AV equipment rack is in Audio room 413. Input/output plates are located throughout the stage and house. There is an assistive listening system installed. In the AV equipment rack are (2) wireless microphone receivers which are original to the system. In the control desk are (2) wireless microphone receivers which are a different brand and were added after the original system. There is a 4-channel wired production intercom system. There are in-ceiling loudspeakers in the cafeteria, band room, and (2) dressing rooms. A 3rd party control system, utilizing touch panels, allows for selective use of the system including control of video and lighting. Wireless EarTec production intercom was in use, which was added after the original system.

Video: Onstage is a motorized front projection screen with a 16:9 widescreen aspect ratio. The projector is in the rear of the auditorium and we understand it was recently replaced. In the AV equipment rack is an 8x8 HDBT matrix switcher. There are (3) inputs on stage, (2) inputs at the control desk, (1) output to the projector, and (1) output to the press plate. Video is controlled from the 3rd party control system via the touch panels.

Lighting: House lighting consists of LED downlights w/ color-changing LED wall sconces and LED aisle lights. The stage and catwalks have fluorescent “work” lights and there are wall-mounted fixtures with LED lamps for the backstage crossover. Theatrical lighting consists of incandescent ellipsoidal spot lights, fresnel wash lights, and color-changing LED cyclorama lights all utilizing stage pin plugs.

Lighting Control: A control equipment rack is located on stage right. It consists of a DMX splitter, network switch, UPS, and lighting system touch panel. The theatrical control board and DMX controller (for color-changing wall sconces) are in a roll-top desk in the rear of the auditorium. There are (3) 5-button lighting preset keypads. DMX outputs and connector strips (w/ stage pin receptacles) are located on each lighting pipe/catwalk.

Rigging: See Rigging and Safety Inspection Report.

2. Assessment of Existing Systems

Audio: The system is approximately 10 years old, but not functional, so our assessment is limited to the design (without hearing or using the system). The system is analog which requires a large amount of cabling infrastructure, which makes use with patch panels and routing cumbersome. The location of the main loudspeakers is very steep to the front seats which suggests a poor listening experience in those locations. While the delay loudspeakers assist in providing even coverage, they add complexity to the system. There is only one small subwoofer which is sufficient for speech, but not for music. The loudspeakers are 2-way



coaxial units, which are good for compactness, but don't offer the best audio quality. The desk was missing a handle on the tambour (roll-top) and the modesty panel on the rear was not installed. The assistive listening system was off. It is required by ADA and must be energized and available for use. No wired production intercom belt packs or main station (power supply) were observed. Both sets of wireless microphones are operating in illegal FCC frequencies (Shure 662-698 MHz, Sennheiser 626-668 MHz) and are likely not working properly or reliably.

Video: The projection system is understood to be partially operational. With the 3rd party control system not operational, there is no control over the video system. The large projection screen (298" diagonal) is too large for small classes which typically only use the first few rows. There is no option for wireless connectivity.

Lighting: The house light fixtures appeared to be in good operating condition. While the fixtures are dimmable, steps throughout the curve were observed and at a low intensity they shut off, rather than fading to 0%. We measured the house illumination at 35.9fc, which is adequate. All but 2 of the LED color-changing wall sconces were operational. They utilize Color Kinetics iFlex RGB Nodes which have a life expectancy of 60,000 hours. Approximately 50% of the fluorescent "work" lights were operational. The other 50% were either not working or flickering. Fluorescent lamps are energy efficient and have a long life, but not to the extent of LED. The illumination level is low and inadequate for many uses. The theatrical lighting is dated, but functional, and requires regular and routine maintenance to change lamps and gels. The cyclorama lights are color-changing LED and illuminate the rear white cyclorama curtain.

Lighting Control: There are numerous lighting control systems including theatrical lighting board, architectural system (i.e. preset keypads, lighting touch panel), sconce controller & keypad, and 3rd party AV control system (i.e. touch panels). This is overly complicated and not all systems are integrated with one another. The theatrical console is suitable for the current system, however the monitors are older and are not touchscreens. Also, the monitors must be turned down for the roll-top to close. The lighting control rack is onstage which is not the ideal location as it contains networking equipment and equipment that users do not (and should not) need to access. There is a portable lighting touch screen which is not being used. One keypad cover is broken. The system is on a physical separate network and not integrated with the AV or building networks. There are no receptacles or control at the front side (tormentor) positions.

Rigging: See Rigging and Safety Inspection Report for deficiencies. The rigging system is dead-hung (static) and is the newest of the (3) theaters. The layout is typical and adequate for the use cases. The curtains do not appear to be inherently flame retardant and the system does not allow for height adjustment. There are no additional battens for rigging of scenic elements and practicals. The upstage traveler track is undersized for the span. There is no rigging safety signage.

3. Recommendations

Audio: The primary goal is to have an operational system that provides uniform coverage, intelligible speech, supports the various room uses in an intuitive easy-to-use manner. That is, a system that does not require additional/rental systems.

- a. Replace the analog mixer with digital mixer and stage box
- b. Replace the signal processor with new digital signal processor



- c. Replace wireless microphone system with adequate quantity (i.e. 16-24)
- d. Replace wireless microphone antennae with directional type
- e. Provide stock of wired microphones, cables, stands, direct boxes, and accessories
- f. Remove delay loudspeakers
- g. Replace and relocate main loudspeakers
- h. Add subwoofers
- i. Replace amplifiers
- j. Remove patch panels
- k. Provide wired production intercom belt packs, headsets, and portable cables
- l. Provide minimal quantity of wireless production intercom stations
 - a. *Note: Wherever users are stationary, wired intercom should be used, leaving wireless stations only to those who require mobility.*
- m. Add inputs to the stage front for orchestra pit use
- n. Replace and relabel plates as needed
- o. Energize assistive listening system, add signage at entrances, relocate receivers to control desk
- p. Replace 3rd party control system (processor, touch panels, and programming)
 - a. Allow for iPad to be used as portable touch panel
- q. Install touch panel in, or adjacent to, the pit (ideal for classroom use)
- r. Install "Theatrical Systems" network and put all available items on network
- s. Test integrity of isolated ground power system, repair as needed
- t. Provide portable acoustical shell
- u. Ability to stream/record

Video: The primary goal is to have an operational system that provides clear video, proper brightness/contrast, and supports the various room uses in an intuitive easy-to-use manner.

- a. Provide a scaler that allows the existing system to display a smaller image adequate for closer viewing
- b. Replace DVD player with Blu-Ray player
- c. Replace 3rd party control system (processor, touch panels, and programming)
 - a. Allow for iPad to be used as portable touch panel
- d. Install touch panel in, or adjacent to, the pit (ideal for classroom use)
- e. Install "Theatrical Systems" network and put all available items on network
- f. Provide wireless connection option (i.e. AppleTV)
- g. Scenic projection system (e.g. digital backdrops)
- h. Ability to stream/record

Lighting: The primary goal is to have a system that provides adequate illumination for general stage use including set-building, cleaning, and practice which doesn't require energizing the theatrical fixtures. For theatrical lighting, it is desirable to minimize maintenance (e.g. gel, lamps), manual manipulation/adjustment, and reduce energy consumption (and heat load).

- a. Replace 0-10V LED house lights with DMX LED house lights using theatrical dimming to 0%
- b. Replace stage/catwalk fluorescent "work" lights, and add where needed, with LED to achieve 30-50fc.



- c. Replace conventional fixtures with color-changing LED luminaires
 - a. *Front light can be incandescent since they are accessible via catwalks*
- d. Add remote controlled LED “moving” lights
- e. Develop a repertory (standardized) plot which includes even white-light wash for practices and band/choral concerts
- f. Add lighting positions (apron sides, stage sides, onstage)
- g. Test the LED color-changing cyclorama lights and wall sconces to determine if there are any defective, or degrading, emitters.

Lighting Control: The primary goal is to provide an intuitive easy-to-use lighting control system that supports the various room uses.

- a. Install wireless access point on the lighting network for tablet remote use (of lighting board)
- b. Install portable touch panel at the lighting control desk
- c. Replace lighting touch panels with 3rd party touch panels
- d. Replace light board monitors with widescreen touch monitors
- e. Replace roll-top desk with new to include recessed monitor shelf to allow roll-top to close without moving monitors
- f. Upgrade the dimming panel to CEM3
- g. Install relay modules into the dimming panel for LED use
- h. Install “Theatrical Systems” network and put all available items on network
- i. Integrate color-changing sconces with architectural/theatrical system (eliminate additional controller)
- j. Replace connector strips and receptacles
- k. Add DMX outputs adjacent to stage pin receptacles
- l. Replace lighting board

Rigging: The primary goal is to provide a safe and workable system that supports the various performances and room uses.

- a. Replace curtains with inherently flame retardant fabric and a seamless cyclorama
- b. Replace the upstage traveler track with a model appropriate for the span
- c. Add spare pipe battens for rigging of scenic elements and practicals
- d. Add yellow safety batten caps to the ends of all pipe battens
- e. Motorize the lighting pipe battens (“electrics”)
- f. Motorize the valance pipe battens to allow for height adjustment
- g. Install venue specific rigging safety signage to alert users of the capacity and provide instructions on use of the system
- h. Install fall arrest system on catwalks with comprehensive managed fall protection program



4. Phased (Prioritized) Approach

A. Audio

TSU1: Engage an AV system integrator (contractor) to test, troubleshoot, and repair the sound system and 3rd party control system. Energize the assistive listening system, replace the existing wireless microphone system (minimal required quantity), and provide wired intercom belt packs, headsets, and cables.

TSU2: Engage a licensed electrical contractor with working knowledge of isolated ground systems to test, troubleshoot, and repair the system. This should include a 3rd party electrical testing company to confirm integrity of IG system. Engage an AV system integrator to replace the analog mixer with digital mixer and stage box, install additional wireless microphone systems, replace wireless microphone antennae to directional type, provide minimal quantity of wireless production intercom stations, and provide stock of wired microphones, cables, stands, direct boxes, and accessories. Add inputs to the stage front for orchestra pit use.

TSU3: Engage an AV system integrator to replace the signal processor with new digital signal processor, remove delay loudspeakers, replace and relocate main loudspeakers, add subwoofers, replace amplifiers, remove patch panels, replace and relabel plates, replace 3rd party control system including processor, touch panels, and programming, add additional touch panels in the pit, backstage, and lighting desk, replace existing network and hardware with new “Theatrical Systems” network, and provide a portable acoustical shell. To stream and record, add ambient microphones mid-house, connect audio feeds from mixer to camera (see video section), solid state recorder, and internet service/access.

TSU4: None.

B. Video

TSU1: None.

TSU2: Engage an AV system integrator to provide a scaler that allows the existing system to display a smaller image adequate for closer viewing.

TSU3: Engage an AV system integrator to replace 3rd party control system including processor, touch panels, and programming, add additional touch panels in the pit, backstage, and lighting desk, replace DVD player with Blu-Ray player, replace existing network and hardware with new “Theatrical Systems” network, and provide wireless video connectivity. To stream and record, add a remotely controlled pan/tilt/zoom (PTZ) camera, network solid state recorder, and audio inputs for program audio feed.

TSU4: For scenic projection, add edge blended projection system for animated digital backdrops, media server to store and playback content, and video inputs.

C. Lighting

TSU1: Test all fixtures and replace burned out lamps in architectural and theatrical fixtures. If any cells/nodes are found defective in the LED sconces or cyclorama lights, send out for repair (or replacement).

TSU2: Add LED color-changing fixtures to the system and develop a repertory plot.



TSU3: Add lighting positions (apron sides, stage sides, onstage), replace conventional fixtures with color-changing LED luminaires, and add minimal quantity of remote controlled LED “moving” lights.

TSU4: Add additional remote controlled LED “moving” lights.

AL1: Replace 0-10V LED house lights with DMX LED house lights using theatrical dimming to 0% and replace stage/catwalk fluorescent “work” lights with LED to achieve 30-50fc.

D. Lighting Control

TSU1: Install portable touch panel at the lighting control desk and replace damaged keypad cover.

TSU2: Install wireless access point on the lighting network for tablet remote use (of lighting board), replace light board monitors with widescreen touch monitors, replace roll-top desk with new to include recessed monitor shelf to allow roll-top to close without moving monitors, integrate color-changing sconces with architectural/theatrical system (eliminate additional controller), upgrade the dimming panel to CEM3, and install relay modules into the dimming panel for LED use.

TSU3: Replace connector strips and receptacles, add DMX outputs adjacent to existing receptacles, replace lighting board, replace lighting touch panels with 3rd party touch panels, and replace existing network and hardware with new “Theatrical Systems” network.

TSU4: None.

E. Rigging

SAC1: See Rigging and Safety Inspection Report.

SAC2: See Rigging and Safety Inspection Report.

TSU1: Install venue specific rigging safety signage to alert users of the capacity and provide instructions on use of the system, add yellow safety batten caps to the ends of all pipe battens, replace the upstage traveler track with a model appropriate for the span.

TSU2: Replace the curtains with inherently flame retardant fabric and a seamless cyclorama, add spare pipe battens for rigging of scenic elements and practicals.

TSU3: Install fall arrest system on catwalks with comprehensive managed fall protection program.

TSU4: Motorize the lighting pipe battens (“electrics”) and valance pipe battens to allow for system access and height adjustment.

5. Impact to Building Systems & Structures

A. Audio

Architectural: None.

Electrical: None.



HVAC: None.

Structural: None.

B. Video

Architectural: None.

Electrical: None.

HVAC: None.

Structural: None.

C. Lighting

Architectural: None.

Electrical: Theatrical lighting fixtures are approximately 25% of the wattage of conventional fixtures. That significantly reduces the electrical current draw. Therefore, existing feeder circuits have sufficient capacity for the proposed work. However, LED fixtures require constant power, not dimmed, circuits that are controlled so they can be de-energized when the system is not in use.

HVAC: Because the overall wattage is being reduced, the heat load is also. The reduction is beneficial to the air conditioning system. There is no impact to the heating system because it is not reliant on performance lighting to assist in tempering the air.

Structural: The static fixtures are typically 50% - 75% heavier and the moving lights can weigh up to 75 lbs each. This increases the rigging system load. Once repaired, the rigging system can support the additional load, see Rigging section below.

D. Rigging

Architectural: None.

Electrical: None for the target benchmark. If the school is interested in proceeding with optional TSU4 phase, the motorized hoists require power fed from a general panel board, not the AV panel board and not the dimming panel. The hoists can be operated from 120/208V or 277/480V systems and the impact is minimal.

HVAC: None.

Structural: A structural engineer should review the capacity of the stage roof framing. We reviewed the project drawings from 2012 and did not find any loading information, requirements, or the rigging system present on the structural drawings. While we expect the roof to have sufficient capacity, as it had stage rigging prior to the 2012 renovation, it may not have been reviewed in 2012 and previous drawings were not available.



Pollard Middle School

Upon review of Pollard's master plan, there was no scope of work specifically relating to the theatre nor any mention of a need to renovate it. Understanding the school will likely undergo a building-wide renovation process, longer term theatrical phases may be incorporated into the master plan project. Until then, the approach is to implement phases that focus on providing equipment and systems which can be reused into a renovated theatre (e.g. lighting fixtures, wireless microphone systems, mixer, lighting board, etc.).

1. Description of Existing Systems

Audio: There is a loudspeaker on house left and right, which appear to have been added after the original construction. The original loudspeakers are still installed but not used. On stage right is a wall mounted equipment rack that houses (4) wireless microphone receivers, mixer, amplifier, AM/FM tuner, and audio processor. There are (4) wired microphone inputs on the front of the stage. Wired production intercom belt packs were observed.

Video: A motorized 4:3 front projection screen is onstage. A projector is installed mid-house at an angle so the image is keystone corrected. There is a button control to turn the projector on/off and separate button to raise/lower the screen. There are VGA/HDMI inputs on the front of the stage and rear wall of the auditorium and an AppleTV to support wireless video. In the stage right equipment rack is a DVD player and video processor.

Lighting: At mid-house, there is a small lighting pipe with (6) ellipsoidal spot fixtures and temporary cabling. Above the pit are (8) ellipsoidal spot fixtures and adjustable heads (mixture of color temperatures and LED/incandescent). On stage is a light bar with color-changing LED fixtures and (2) ports each with (3) fresnel fixtures. Also on stage, are recessed downlights and fluorescent "work" lights. In the house are incandescent downlight cylinders. The theatrical system consists of portable dimmers and cabling with some installed "patch" cables which utilize ungrounded stage pin connectors. The lighting control board is in a makeshift platform with (2) monitors. (2) follow spots on stands were in the back corners of the auditorium.

Rigging: See Rigging and Safety Inspection Report.

2. Assessment of Existing Systems

Audio: The loudspeakers do not cover the audience which yields dead spots. Further, they are undersized for the application and there is no low-end reinforcement (subwoofers). The system is analog and can only be operated from stage right, which is a poor location to mix the sound as the operator is not in the field of the loudspeakers. The wireless microphones are using FCC compliant frequencies. There is no audio playback or recording devices and no ADA required assistive listening system. The system is not secured or locked from unauthorized use. The equipment rack is located adjacent to the electrical panels and installed dimming circuits which can cause electromagnetic interference (EMI) and introduce buzz/hum into the sound system. No sequencer is installed to turn on/off power in the proper order to prevent pops and



potential damage to the system. The wired microphone inputs are reported to intermittently work and are difficult to access with the stage thrust installed.

Video: The projection system is operable, but uses an outdated aspect ratio of 4:3. Both hardwired and wireless connections are available. The stage front video input is difficult to access with the stage thrust installed. The projector and screen controls are discrete which is likely confusing to the users. The lower limit of the projection screen is not set which permits the screen to hit the floor. There is no camera as part of the system and no way to record or stream video.

Lighting: The makeshift lighting platform is dangerous, not code compliant, and not ADA accessible. The lighting board is approximately 5 years old and in good condition. The theatrical fixtures are obsolete and largely installed with portable cabling and portable dimmer packs. Neither the house lights nor stage work lights dim or are connected to the theatrical lighting board. The theatrical lighting is inadequate and does not allow for full illumination/coverage of the stage. The stage has a hard ceiling limiting how and where lights can be mounted.

Rigging: See Rigging and Safety Inspection Report for deficiencies. The rigging system is inadequate due to the hard ceiling on stage. There are not enough pipe battens to fully illuminate the stage and curtains to mask it. The tracks are noisy, there is no cyclorama, and no rigging safety signage. Curtains do not appear to be inherently flame retardant and some are damaged and in very poor condition.

3. Recommendations

Audio: The primary goal is to have an operational system that provides uniform coverage, intelligible speech, supports the various room uses in an intuitive easy-to-use manner. That is, a system that does not require additional/rental systems.

- a. Create an audio mix (control) position
- b. Replace the analog mixer with digital mixer and stage box
- c. Replace the signal processor with new digital signal processor
- d. Increase quantity of wireless microphones (i.e. 12-16)
- e. Relocate wireless microphone antennae to the house ceiling
- f. Provide stock of wired microphones, cables, stands, direct boxes, and accessories
- g. Replace main loudspeakers
- h. Add subwoofers
- i. Replace amplifier
- j. Provide wired production intercom infrastructure and main station
- k. Increase quantity of wired intercom belt packs, headsets, and cables
- l. Provide a minimal quantity of wireless production intercom stations
- m. Replace and relabel plates as needed
- n. Provide assistive listening system and signage at entrances
- o. Provide 3rd party control system (processor, touch panels, and programming)
 - a. Allow for iPad to be used as portable touch panel
- p. Install touch panel in, or adjacent to, the pit (ideal for classroom use)
- q. Install "Theatrical Systems" network and put all available items on network



- r. Provide acoustical shell
- s. Provide isolated ground (technical) power system with receptacles throughout the theatre
- t. Provide portable stage monitors (i.e. 2-6)
- u. Ability to stream/record
- v. Add acoustical absorption wall panels on the rear wall to reduce slap and flutter echoes

Video: The primary goal is to have an operational system that provides clear video, proper brightness/contrast, and supports the various room uses in an intuitive easy-to-use manner.

- a. Replace the projection screen with tensioned screen in 16:9 widescreen aspect ratio
- b. Provide an installed high-definition laser projector in rear of auditorium (no lamps to replace)
- c. Provide a scaler that allows the existing system to display a smaller image adequate for closer viewing
- d. Replace DVD player with Blu-Ray player
- e. Provide isolated ground (technical) power system with receptacles throughout the theatre
- f. Provide 3rd party control system (processor, touch panels, and programming)
 - a. Allow for iPad to be used as portable touch panel
- g. Install touch panel in, or adjacent to, the pit (ideal for classroom use)
- h. Install “Theatrical Systems” network and put all available items on network
- i. Provide wireless connection option
- j. Scenic projection system (e.g. digital backdrops)
- k. Ability to stream/record

Lighting: The primary goal is to have a system that provides adequate illumination for general stage use including set-building, cleaning, and practice which doesn’t require energizing the theatrical fixtures. For theatrical lighting, it is desirable to minimize maintenance (e.g. gel, lamps), manual manipulation/adjustment, and reduce energy consumption (and heat load).

- a. Replace house incandescent lights with LED white light with theatrical dimming to 0%
- b. Replace stage fluorescent “work” lights, and add where needed, with LED to achieve 30-50fc
- c. Replace conventional fixtures with color-changing LED luminaires
- d. Add remote controlled LED “moving” lights
- e. New follow spots
- f. Develop a repertory (standardized) plot which includes even white-light wash for practices and band/choral concerts
- g. Add lighting positions (apron sides, stage sides, onstage)
 - a. Requires removal of hard stage ceiling
- h. Install wireless access point on the lighting network for tablet remote use (of lighting board)
- i. Provide 3rd party control system touch panels
- j. Replace light board monitors with widescreen touch monitors
- k. Create a lighting control booth/desk
- l. Install permanent power control system
- m. Provide connector strips and receptacles (power/control) throughout theater
- n. Install “Theatrical Systems” network and put all available items on network



Rigging: The primary goal is to provide a safe and workable system that supports the various performances and room uses.

- a. Replace curtains with inherently flame retardant fabric
- b. Add masking curtains (e.g. valances, legs, etc.) and a seamless cyclorama
- c. Replace traveler track carriers and pulleys
- d. Add pipe battens for additional lighting
- e. Add yellow safety batten caps to the ends of all pipe battens
- f. Install venue specific rigging safety signage to alert users of the capacity and provide instructions on use of the system
- g. Remove hard stage ceiling and raise rigging

4. Phased (Prioritized) Approach

A. Audio

TSU1: Engage an AV systems integrator to test, troubleshoot, and repair wired microphone inputs, and add assistive listening system and signage.

TSU2: Engage an AV systems integrator to replace (and relocate) loudspeakers, install rack mount digital mixer with remote iPad functionality, install lockable door on existing equipment rack, mount wireless microphone antennae on exterior of equipment rack, install and program digital signal processor, and add sequencer to start up and shut down system in proper order.

TSU3: Create a permanent audio mix position in the house, add a full-size equipment rack, replace analog mixer with digital mixer and stage box, increase the quantity of wireless microphones, relocate wireless microphone antennae to the house ceiling, provide stock of wired microphones, cables, stands, direct boxes, and accessories, add subwoofers, replace amplifier, provide wired production intercom infrastructure and main station, increase quantity of wired intercom belt packs, headsets, and cables, provide a minimal quantity of wireless production intercom stations, replace and relabel plates as needed, add 3rd party control system (processor, touch panels, and programming), install “Theatrical Systems” network and put all available items on network, provide acoustical shell, add portable stage monitors, and add power receptacles as needed throughout the theatre. To stream and record, add ambient microphones mid-house, connect audio feeds from mixer to camera (see video section), solid state recorder, and internet service/access. Add acoustical absorption wall panels on the rear wall to reduce slap and flutter echoes.

TSU4: None.

B. Video

TSU1: Set lower limit on projection screen.

TSU2: None.

TSU3: Replace the projection screen with tensioned screen in 16:9 widescreen aspect ratio, replace projector in rear of auditorium with laser (no lamps to replace) projector sized for new screen, provide a



3rd party control system with touch panels at strategic locations, install “Theatrical Systems” network and put all available items on network, provide wireless video connection option, and add power receptacles throughout the theatre. To stream and record, add a remotely controlled pan/tilt/zoom (PTZ) camera, network solid state recorder, and audio inputs for program audio feed.

TSU4: For scenic projection, add rear white cyclorama curtain to project onto, edge blended projection system for animated digital backdrops, media server to store and playback content, and video inputs.

C. Lighting

TSU1: Replace conventional fixtures with color-changing LED luminaires utilizing wireless DMX control and add two new follow spots.

TSU2: Increase quantity of LED color-changing fixtures and develop a repertory plot.

TSU3: Add lighting positions (apron sides, stage sides, onstage), add color-changing LED luminaires, and add remote controlled LED “moving” lights. Install a power control system, receptacles (power/control), architectural lighting controls, create a permanent lighting control position, replace light board monitors with widescreen touch monitors, install “Theatrical Systems” network and put all available items on network, install wireless access point for tablet remote use, and develop a repertory plot which includes even white-light wash for practices and band/choral concerts.

TSU4: Add additional remote controlled LED “moving” lights.

AL1: Replace house incandescent lights with LED white light with theatrical dimming to 0% and replace stage fluorescent “work” lights with LED to achieve 30-50fc.

D. Rigging

SAC1: See Rigging and Safety Inspection Report.

SAC2: See Rigging and Safety Inspection Report.

TSU1: Install venue specific rigging safety signage to alert users of the capacity and provide instructions on use of the system and replace existing damaged curtains.

TSU2: Add masking curtains and cyclorama, replace traveler track carriers and pulleys, add pipe battens for additional lighting, and add yellow safety batten caps to the ends of all pipe battens.

TSU3: None.

TSU4: Remove hard stage ceiling and raise rigging.

5. Impact to Building Systems & Structures

A. Audio

Architectural: Creation of a control booth is expected to require saw cutting the concrete floor and refinishing the area. Depending on the final location and layout, up to (30) seats may need to be removed.



Electrical: Panel “LPA” on stage right feeds (1) circuit to the AV equipment rack. The benchmark calls for the panel to be replaced with a motorized breaker panel to feed both the AV and the Lighting systems. New branch circuits are required throughout the theatre. The existing 100A, 3-phase, 120/208V feeder circuit has sufficient capacity for proposed work.

HVAC: None.

Structural: None.

B. Video

Architectural: See Audio section above for impact due to new control booth.

Electrical: Panel “LPA” on stage right feeds (1) circuit to the projector and the projection screen and as previously mentioned, (1) circuit to the AV equipment rack. The benchmark calls for the panel to be replaced with a motorized breaker panel to feed both the AV and the Lighting systems. New branch circuits are required throughout the theatre. The existing 100A, 3-phase, 120/208V feeder circuit has sufficient capacity for proposed work.

HVAC: None.

Structural: A larger and heavier projection screen is proposed to be suspended on stage. It will be distributed between multiple joists and the load impact is trivial.

C. Lighting:

Architectural: The hard stage ceiling does not allow for additional lighting positions. In benchmark phases, the stage ceiling will need to be cut open to allow for creation of additional lighting positions to fully illuminate the stage. See Audio section above for impact due to new control booth.

Electrical: Theatrical lighting fixtures are approximately 25% of the wattage of conventional fixtures. That significantly reduces the electrical current draw. Therefore, existing feeder circuit have sufficient capacity for the proposed work. However, LED fixtures require constant power, not dimmed, circuits that are controlled so they can be de-energized when the system is not in use. Panel “LPA” on stage right feeds (2) circuits to the theatrical lighting system and (6) circuits for receptacles which are used for portable dimming packs. The benchmark calls for the panel to be replaced with a motorized breaker panel to feed both the AV and the Lighting systems. New branch circuits are required throughout the theatre.

HVAC: Because the overall wattage is being reduced, the heat load is also. The reduction is beneficial to the air conditioning system. There is no impact to the heating system because it is not reliant on performance lighting to assist in tempering the air.

Structural: The static fixtures are typically 50% - 75% heavier and the moving lights can weigh up to 75 lbs each. This increases the rigging system load. See Rigging section below.

D. Rigging

Architectural: The stage ceiling will need to be cut open to allow for creation of additional pipe battens for rigging of lighting, curtains, and scenic elements.

Electrical: None.



HVAC: None.

Structural: A structural engineer should review the capacity of the stage roof framing (open web joists and W18x50 beams). We reviewed the project drawings from 1956 and did not find any loading information, requirements, or the rigging system present on the architectural or structural drawings.



Needham High School

1. Description of Existing Systems

Audio: A portable rental system consisting of mixer, wireless microphones, powered monitors, and powered loudspeakers on stands was in place. The age of the sound system is unknown. There are single suspended loudspeakers located left, center, and right. There are microphone inputs throughout the auditorium including stage left, stage right, proscenium wall, and front of the stage. There are (2) floor boxes at the mid-house mix position with A/V connectivity. There are (2) equipment racks. One is a wall mounted rack located on stage left which houses (2) wireless microphones and a mixer. The other one is a free-standing rack located in the control room which houses amplifiers, assistive listening transmitter, network switch, and video patch panel. There is a disconnected mixer in the control room (behind balcony).

Video: Onstage is a motorized front projection screen with a 16:9 widescreen aspect ratio. The screen is controlled from a wall switch in the rear of the stage equipment rack. There is small portable projector on a cart. There is installed wiring which goes to a video patch panel in the equipment rack located in the control room.

Lighting: The theatrical dimming panel is in a small storage room on stage right. The architectural dimming panel is in a closet on stage left. There is an architectural control panel with faders on stage left which controls both theatrical and architectural lighting. Stage “work” lights are fluorescent fixtures. House lighting consists of surface mounted cylinder downlights, recessed downlights below the balcony, and wall sconces - all of which are dimmable. The theatrical lighting consists of (16) ellipsoidal spot fixtures for front light, (2) rows of (5) 6’ border lights, and (1) row of (6) 6’ border lights. Border lights are red, blue, green, and white. In the balcony is a follow spot. In the control room is an obsolete lighting board which controls both the theatrical and architectural systems. In the stage floor are hinged floor pockets with receptacles.

Rigging: See Rigging and Safety Inspection Report.

2. Assessment of Existing Systems

Audio: The system is approximately 20-30 years old, but functionality is extremely limited. Some of the wired microphone inputs worked and all (3) loudspeakers were functioning. The amplifier for the in-ceiling speakers below and above the balcony was de-energized. With only a small rack-mount mixer, the system is limited. The system is analog which requires a large amount of cabling infrastructure, which makes use with patch panels and routing cumbersome. The location of the main loudspeakers is appropriate, however they do not adequately cover the balcony. There is no subwoofer(s) for low-end reinforcement. There is no permanent mix position or desk, aside from the control room which is a poor location to mix from. The assistive listening transmitter was deenergized and no receivers were observed. No wired production intercom belt packs or main station (power supply) were observed. It was reported that the existing microphone inputs are not operational. The portable system utilizes wireless microphones which are operating in illegal FCC frequencies (Shure 662-698 MHz) and are likely not working properly or reliably.

Video: The projection screen size and aspect ratio are appropriate, however the screen isn’t tensioned which can allow wrinkles. The location on stage is not ideal. The screen control switch is in the back pan



of the stage equipment rack, which requires the rack to be swung open to access. There is no permanently installed projector and the portable projector (on a cart) is obsolete utilizing VGA with a 4:3 aspect ratio and 640x480 resolution. The installed wiring infrastructure is obsolete and not used.

Lighting: The house lighting is not energy efficient due to use of incandescent lamps. The stage “work” lights are fluorescent, which is energy efficient and have a long life, but not to the extent of LED. The illumination level is low and inadequate for many uses. All overhead theatrical lighting fixtures were operational without any burned-out lamps. The system uses high wattage lamps which are not energy efficient. Border lights are dated and no longer used as a primary lighting source. The only way to control the lighting is by the architectural fader station on stage left, which was not working properly. Several faders were causing the lights to flicker and jump to various levels. The lighting board in the control room is obsolete and not in use. The follow spot is dated and noisy and should not be near any audience members. Several floor pockets have broken cover plates.

Rigging: See Rigging and Safety Inspection Report for deficiencies. The rigging system is dead-hung (static) and typical for the size and level of the theatre, except there is no cyclorama. The curtains do not appear to be inherently flame retardant and the system does not allow for height adjustment. Some travelers are difficult while others are noisy. There are no additional battens for rigging of scenic elements and practicals. The stage contains a hard ceiling which makes adding, changing, and inspecting rigging difficult. There is no rigging safety signage.

3. Recommendations

Audio: The primary goal is to have an operational system that provides uniform coverage, intelligible speech, supports the various room uses in an intuitive easy-to-use manner. That is, a system that does not require additional/rental systems.

- a. Create an audio mix (control) position
- b. Replace the analog mixer with digital mixer and stage box
- c. Replace the equipment racks with new
- d. Add a digital signal processor
- e. Add wireless microphones (i.e. 12-16)
- f. Add wireless microphone antennae in the house ceiling
- g. Provide stock of wired microphones, cables, stands, direct boxes, and accessories
- h. Test loudspeakers and repair/replace as needed
- i. Add fill or delay loudspeakers to cover the balcony
- j. Add subwoofers
- k. Replace amplifiers
- l. Provide wired production intercom infrastructure and main station
- m. Provide wired intercom belt packs, headsets, and cables
- n. Provide a minimal quantity of wireless production intercom stations
- o. Test wired microphone inputs and repair/replace as needed
- p. Replace and relabel plates as needed
- q. Provide assistive listening system and signage at entrances
- r. Provide 3rd party control system (processor, touch panels, and programming)



- a. Allow for iPad to be used as portable touch panel
- s. Install touch panel in, or adjacent to, the pit (ideal for classroom use)
- t. Install “Theatrical Systems” network and put all available items on network
- u. Install wireless access point for mixer remote
- v. Provide acoustical shell
- w. Provide isolated ground (technical) power system with receptacles throughout the theatre
- x. Provide portable stage monitors (i.e. 2-6)
- y. Ability to stream/record
- z. Acoustical wall panels on the house rear wall

Video: The primary goal is to have an operational system that provides clear video, proper brightness/contrast, and supports the various room uses in an intuitive easy-to-use manner.

- a. Replace the projection screen with tensioned screen in 16:9 widescreen aspect ratio
- b. Provide an installed high-definition laser projector in rear of auditorium (no lamps to replace)
- c. Provide a scaler that allows the existing system to display a smaller image adequate for closer viewing, if needed
- d. Add DVD/Blu-Ray player
- e. Provide isolated ground (technical) power system with receptacles throughout the theatre
- f. Provide 3rd party control system (processor, touch panels, and programming)
 - a. Allow for iPad to be used as portable touch panel
- g. Install touch panel in, or adjacent to, the pit (ideal for classroom use)
- h. Install “Theatrical Systems” network and put all available items on network
- i. Provide wireless connection option (via AppleTV)
- j. Ability to stream/record

Lighting: The primary goal is to have a system that provides adequate illumination for general stage use including set-building, cleaning, and practice which doesn’t require energizing the theatrical fixtures. For theatrical lighting, it is desirable to minimize maintenance (e.g. gel, lamps), manual manipulation/adjustment, and reduce energy consumption (and heat load).

- a. Replace house incandescent lights with LED white light with theatrical dimming to 0%
- b. Replace stage fluorescent “work” lights, and add where needed, with LED to achieve 30-50fc
- c. Replace conventional fixtures with color-changing LED luminaires
- d. Add remote controlled LED “moving” lights
- e. New follow spots
- f. Develop a repertory (standardized) plot which includes even white-light wash for practices and band/choral concerts
- g. Add lighting positions (apron sides, stage sides, onstage)
 - a. Requires removal of hard stage ceiling
- h. Install wireless access point on the lighting network for tablet remote use (of lighting board)
- i. Provide 3rd party control system touch panels
- j. Replace light board
- k. Create a lighting control booth/desk
- l. Replace the dimming panel with a power control system



- m. Replace floor pockets and other receptacles with new
- n. Provide connector strips and receptacles (power/control) throughout theater
- o. Install “Theatrical Systems” network and put all available items on network

Rigging: The primary goal is to provide a safe and workable system that supports the various performances and room uses.

- a. Replace curtains with inherently flame retardant fabric
- b. Add a seamless cyclorama
- c. Add 4th onstage electric pipe batten for cyclorama lighting
- d. Add spare pipe battens for rigging of scenic elements and practicals
- e. Add yellow safety batten caps to the ends of all pipe battens
- f. Replace traveler track carriers and pulleys
- g. Motorize the lighting pipe battens (“electrics”)
- h. Motorize the valance pipe battens to allow for height adjustment
- i. Install venue specific rigging safety signage to alert users of the capacity and provide instructions on use of the system
- j. Remove hard stage ceiling and raise rigging

4. Phased (Prioritized) Approach

A. Audio

TSU1: Engage an AV systems integrator to test the loudspeakers and repair/replace as needed, replace the analog mixer with digital mixer and stage box, install wireless access point for mixer iPad remote, install minimal cabling infrastructure to make system operational, provide assistive listening system and signage at entrances, add minimal quantity of wireless microphones (i.e. 3-8), add wireless microphone antennae adjacent to receivers.

TSU2: Engage an AV systems integrator to test wired microphone inputs and repair/replace as needed, replace and relabel plates as needed, provide portable stage monitors (i.e. 2-6), ability to stream/record, and provide a minimal quantity of wireless production intercom stations.

TSU3: Create an audio mix (control) position, replace the analog mixer with digital mixer and stage box, replace the equipment racks with new, add a digital signal processor, add wireless microphones (i.e. 12-16), relocate wireless microphone antennae in the house ceiling, provide stock of wired microphones, cables, stands, direct boxes, and accessories, add fill or delay loudspeakers to cover the balcony, add subwoofers, replace amplifiers, provide wired production intercom infrastructure and main station, provide wired intercom belt packs, headsets, and cables, provide a minimal quantity of wireless production intercom stations, replace and relabel plates as needed, provide 3rd party control system (processor, touch panels, and programming), install touch panel in, or adjacent to, the pit (ideal for classroom use), install “Theatrical Systems” network and put all available items on network, install wireless access point for mixer remote, provide acoustical shell, provide isolated ground (technical) power system with receptacles throughout the theatre, and provide portable stage monitors (i.e. 2-6). To stream and record, add ambient microphones mid-house, connect audio feeds from mixer to camera (see video section), solid state recorder, and internet service/access. Add acoustical wall panels on the house rear wall.



TSU4: None.

B. Video

TSU1: Engage an AV systems integrator to replace portable projector with high-definition 16:9 projector with lensing that can fill the screen. This requires use of local input for video source (e.g. laptop).

TSU2: Engage a licensed electrical contractor to relocate screen control to convenient location.

TSU3: Replace the projection screen with tensioned screen in 16:9 widescreen aspect ratio, install high-definition projector in rear of auditorium with laser (no lamps to replace), provide a scaler that allows the existing system to display a smaller image adequate for closer viewing, if needed, add DVD/Blu-Ray player, provide isolated ground (technical) power system with receptacles throughout the theatre, provide 3rd party control system (processor, touch panels, and programming), install touch panel in, or adjacent to, the pit (ideal for classroom use), install “Theatrical Systems” network and put all available items on network and provide wireless connection option. To stream and record, add a remotely controlled pan/tilt/zoom (PTZ) camera, network solid state recorder, and audio inputs for program audio feed.

TSU4: None.

C. Lighting

TSU1: Engage a theatrical systems integrator (contractor) to service the dimming panel and architectural controls. Add a new lighting board with (2) touch screen monitors.

TSU2: Regularly test system and replace burned-out lamps as needed, and replace follow spot.

TSU3: Replace conventional fixtures with color-changing LED luminaires, add minimal quantity of remote controlled LED “moving” lights, add a second follow spot, develop a repertory (standardized) plot which includes even white-light wash for practices and band/choral concerts, add lighting positions (apron sides, stage sides, onstage), install wireless access point on the lighting network for tablet remote use (of lighting board), provide 3rd party control system touch panels, create a lighting control booth/desk, replace the dimming panel with a power control system, replace floor pockets and other receptacles with new, provide connector strips and receptacles (power/control) throughout theatre, install “Theatrical Systems” network and put all available items on network.

TSU4: Additional remote controlled LED “moving” lights.

AL1: Replace house incandescent lights with LED white light with theatrical dimming to 0% and replace stage fluorescent “work” lights with LED to achieve 30-50fc. Add architectural lighting controls and switches.

D. Rigging

SAC1: See Rigging and Safety Inspection Report.

SAC2: See Rigging and Safety Inspection Report.



TSU1: Install venue specific rigging safety signage to alert users of the capacity and provide instructions on use of the system and replace traveler track carriers and pulleys.

TSU2: Replace the curtains with inherently flame retardant fabric and add a seamless cyclorama. Add space pipe battens for rigging of scenic elements and practicals, add 4th onstage electric pipe batten pipe batten for cyclorama lightings, and add yellow safety batten caps to the ends of all pipe battens.

TSU3: None.

TSU4: Remove hard stage ceiling, raise rigging, motorize the lighting pipe battens (“electrics”) and valance pipe battens to allow for system access and height adjustment.

5. Impact to Building Systems & Structures

A. Audio

Architectural: In TSU3, subwoofers and delay loudspeakers are proposed. These items require access to structure for attachment, which may require cutting/patching the ceiling. Creation of a control booth is expected to require saw cutting the concrete floor and refinishing the area. Depending on the final layout, some seating may need to be removed or relocated.

Electrical: The benchmark calls for a motorized breaker panel to be installed to feed the AV systems and receptacles. This will require a new 100A, 3-phase, 120/208V feeder. New branch circuits are required throughout the theatre.

HVAC: None.

Structural: The loads for the proposed subwoofers and delay loudspeakers are trivial.

B. Video

Architectural: The proposed projector is intended to be surface mounted to the face of the balcony, which requires cutting and patching. See Audio section above for impact due to new control booth.

Electrical: The benchmark calls for a motorized breaker panel to be installed to feed the AV systems and receptacles. This will require a new 100A, 3-phase, 120/208V feeder. New branch circuits are required throughout the theatre.

HVAC: None.

Structural: A larger and heavier projection screen is proposed to be suspended on stage. It will replace the existing screen (in a new location) and the load will be distributed between multiple joists. The overall load impact is trivial.

C. Lighting:

Architectural: None.

Electrical: Theatrical lighting fixtures are approximately 25% of the wattage of conventional fixtures. That significantly reduces the electrical current draw. Therefore, existing 225A, 3-phase, 120/208V feeder circuit has sufficient capacity for the proposed work. However, LED fixtures require constant power, not dimmed



circuits and the circuits should be controlled so they can be de-energized when the system is not in use. We call for the dimming panel to be replaced with a motorized breaker panel. Branch circuits may need to be added or relocated.

HVAC: Because the overall wattage is being reduced, the heat load is also. The reduction is beneficial to the air conditioning system. There is no impact to the heating system because it is not reliant on performance lighting to assist in tempering the air.

Structural: The static fixtures are typically 50% - 75% heavier and the moving lights can weigh up to 75 lbs each. This increases the rigging system load. See Rigging section below.

D. Rigging

Architectural: None for the target benchmark. If the school is interested in proceeding with optional TSU4 phase, we call for the stage ceiling to be removed.

Electrical: None for the target benchmark. If the school is interested in proceeding with optional TSU4 phase, the motorized hoists require power fed from a general panel board, not the AV panel board and not the dimming panel. The hoists can be operated from 120/208V or 277/480V systems and the impact is minimal.

HVAC: None for the target benchmark. If the school is interested in proceeding with optional TSU4 phase, the stage duct work needs to be reviewed and coordinated with the removal of the stage ceiling. This follows for the fire sprinkler system.

Structural: A structural engineer should review the capacity of the stage ceiling and roof framing. We reviewed the renovation project drawings from 2004 and did not find any relevant work or information on stage. Structural steel may be required.



Cost Estimate (Condensed)

*See Appendix B for detailed cost estimate.

Newman ES	SAC1	SAC2	TSU1	TSU2	TSU3	TSU4	AL1
	Total	Total	Total	Total	Total	Total	Total
Audio	\$ -	\$ -	\$ 26,750	\$ 116,275	\$ 171,850	\$ -	\$ -
Video	\$ -	\$ -	\$ -	\$ 6,550	\$ 39,338	\$ 147,500	\$ -
Lighting	\$ -	\$ -	\$ 17,300	\$ 144,600	\$ 158,400	\$ 59,250	\$ 286,250
Lighting Controls	\$ -	\$ -	\$ 600	\$ 40,300	\$ 118,850	\$ -	\$ -
Rigging	\$ 73,872	\$ 48,553	\$ 17,438	\$ 80,750	\$ 82,500	\$ 381,000	\$ -
Total	\$ 73,872	\$ 48,553	\$ 62,088	\$ 388,475	\$ 570,938	\$ 587,750	\$ 286,250

Pollard MS	SAC1	SAC2	TSU1	TSU2	TSU3	TSU4	AL1
	Total	Total	Total	Total	Total	Total	Total
Audio	\$ -	\$ -	\$ 17,775	\$ 41,575	\$ 254,075	\$ -	\$ -
Video	\$ -	\$ -	\$ 600	\$ -	\$ 57,700	\$ 147,500	\$ -
Lighting	\$ -	\$ -	\$ 88,500	\$ 65,850	\$ 329,500	\$ 59,250	\$ 205,000
Rigging	\$ 71,186	\$ 21,425	\$ 51,950	\$ 73,540	\$ -	\$ 125,000	\$ -
Total	\$ 71,186	\$ 21,425	\$ 158,825	\$ 180,965	\$ 641,275	\$ 331,750	\$ 205,000

Needham HS	SAC1	SAC2	TSU1	TSU2	TSU3	TSU4	AL1
	Total	Total	Total	Total	Total	Total	Total
Audio	\$ -	\$ -	\$ 41,200	\$ 36,688	\$ 358,675	\$ -	\$ -
Video	\$ -	\$ -	\$ 25,600	\$ 1,750	\$ 60,200	\$ -	\$ -
Lighting	\$ -	\$ -	\$ 27,250	\$ 12,100	\$ 443,900	\$ 59,250	\$ 227,500
Rigging	\$ 84,989	\$ 38,165	\$ 51,950	\$ 73,540	\$ -	\$ 556,000	\$ -
Total	\$ 84,989	\$ 38,165	\$ 146,000	\$ 124,078	\$ 862,775	\$ 615,250	\$ 227,500

All three schools	\$ 230,047	\$ 108,142	\$ 366,913	\$ 693,518	\$ 2,074,988	\$ 1,534,750	\$ 718,750
Inclusive of escalation	\$ 230,047	\$ 114,630	\$ 436,999	\$ 928,083	\$ 3,120,014	\$ 2,592,928	\$ 961,850

Notes:

SAC1, SAC2, TSU1, TSU2, TSU3 are all required to achieve the benchmark.

TSU4 is above and beyond the benchmark.

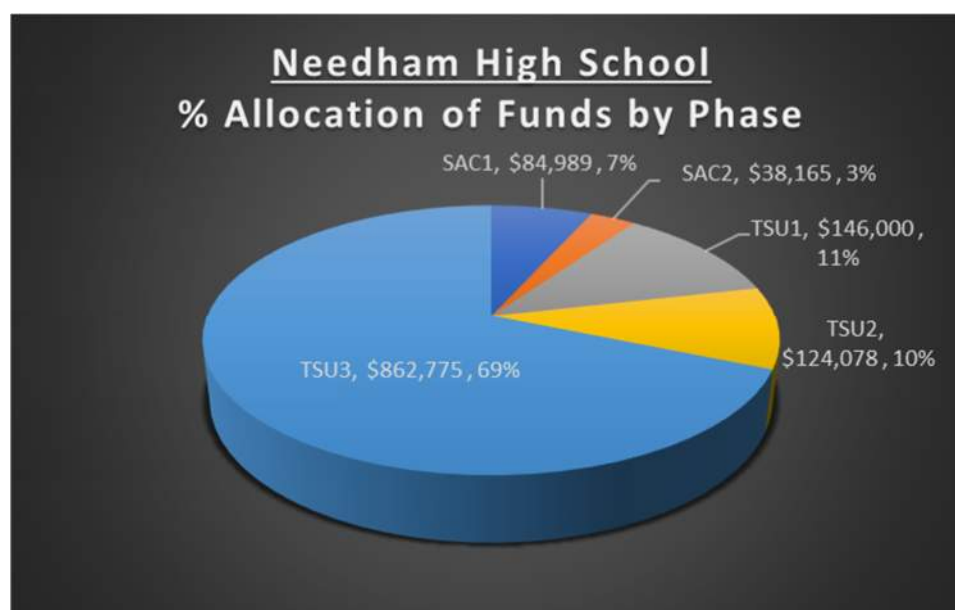
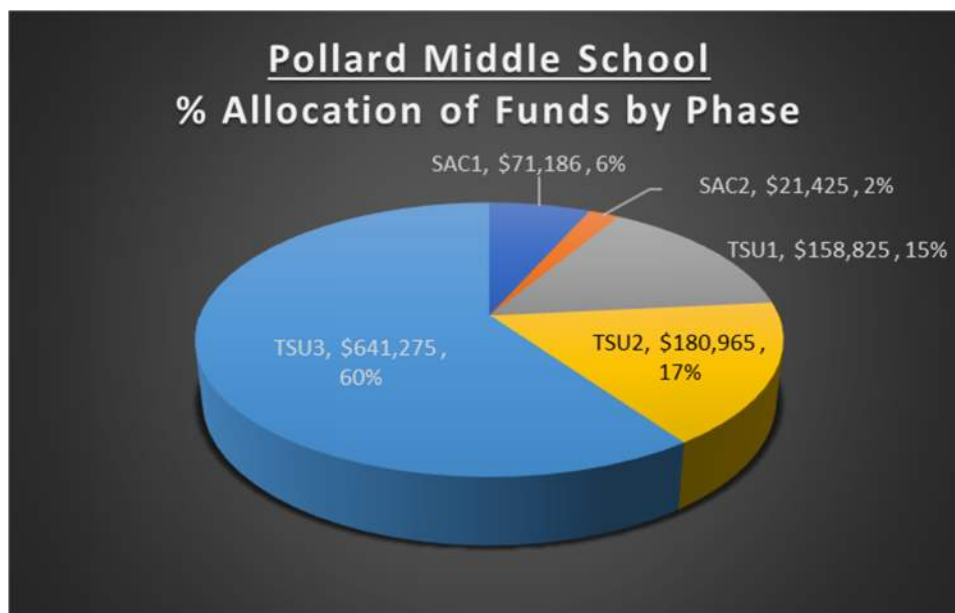
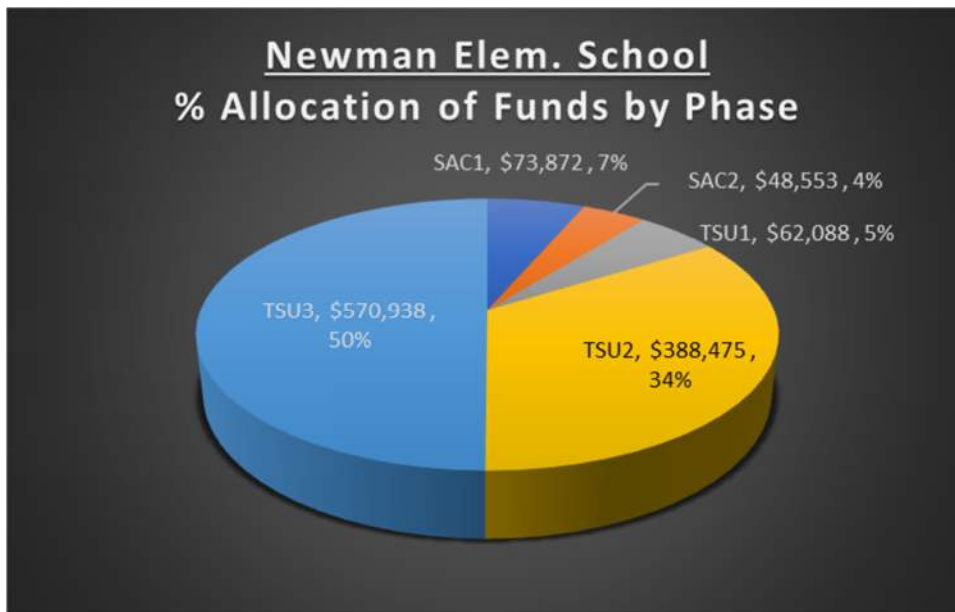
AL1 is limited to architectural (non-theatrical) lighting and largely independent of benchmark phases.

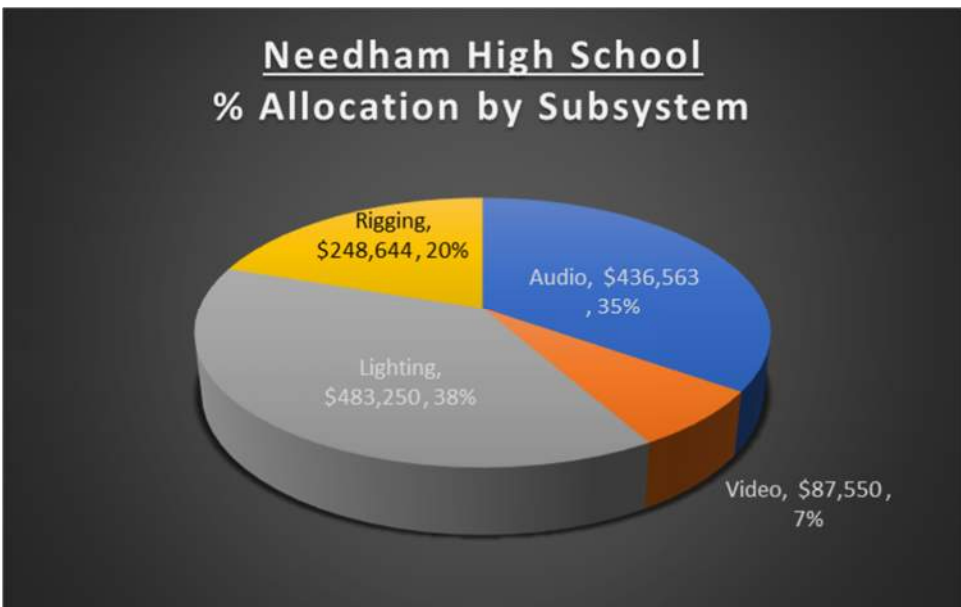
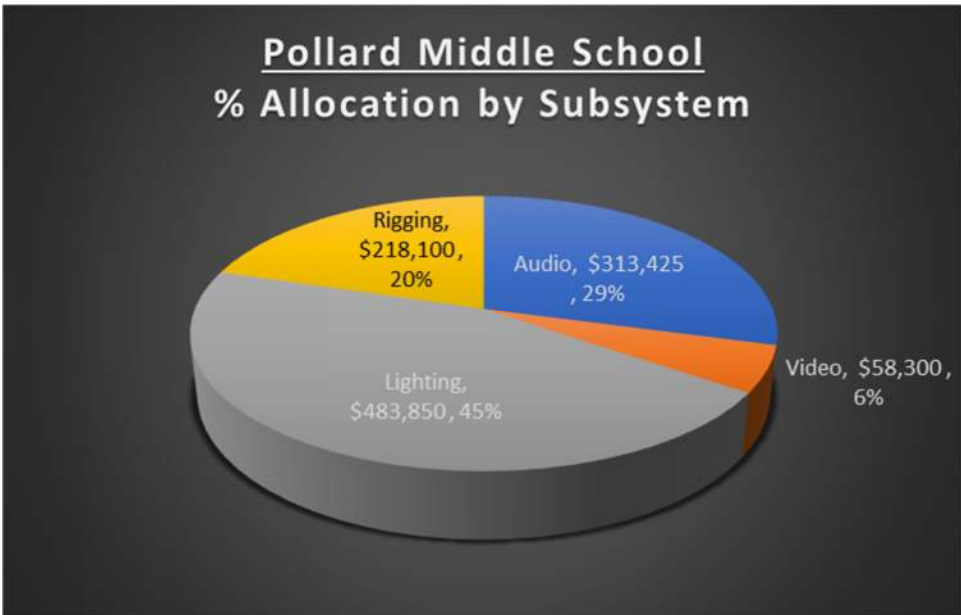
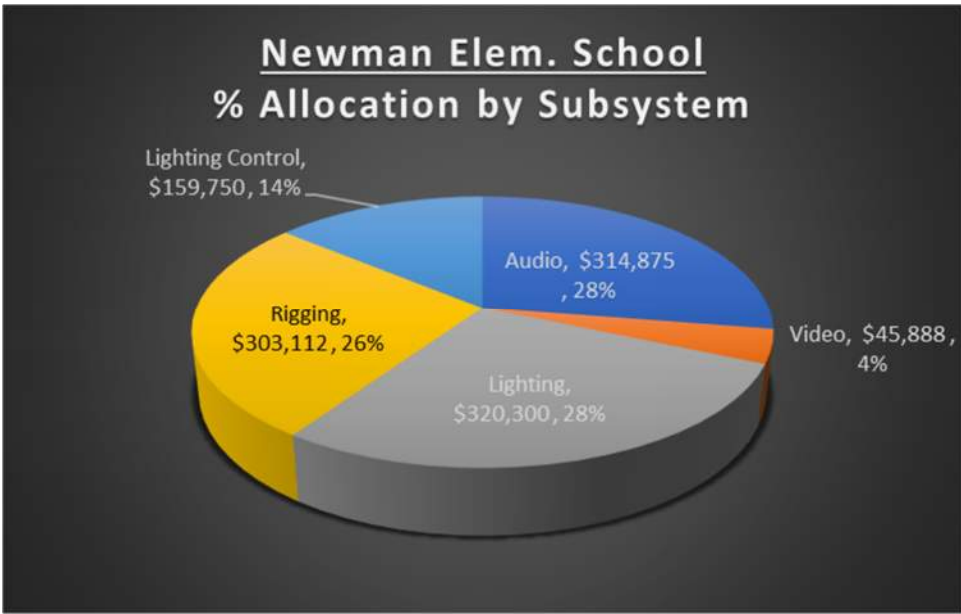
Assumes Soft Costs are 25% of Hard Costs, unless noted otherwise.

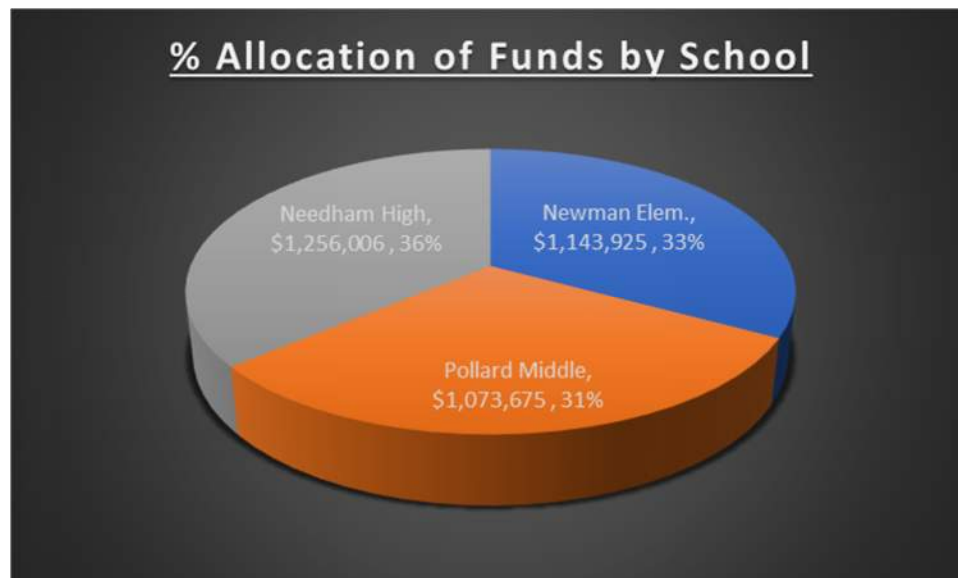
Rigging SAC1 & SAC2 Soft Costs are 35% of Hard Costs.

Cost escalation is estimated at 6% annually.

The following charts are based on the benchmark and do not include TSU4 or AL1 phases.









Cost Savings

LED Theatrical Lighting Upgrade

Sustainability: Converting to energy efficient LED lighting has an immediate positive sustainable impact on our environment including reducing electricity consumption, eliminating the need to purchase and replacement lamps, and lowering required maintenance.

Newman ES: LED Theatrical Lighting Estimated Cost & BTU Savings										
		Qty. Fixtures	Watts	Total Watts	kW	Hrs/Week	kWh/Week	kWh/Year	Cost/kWh	Cost/Year
Current System	FOH Spot Lights	18	750	13500	13.5	60	810	42120	\$0.18	\$7,581.60
	Stage Spot Lights	18	750	13500	13.5	60	810	42120	\$0.18	\$7,581.60
	Stage Fresnel Lights	24	1000	24000	24	60	1440	74880	\$0.18	\$13,478.40
Proposed System	LED Fixtures	80	150	12000	12	30	360	18720	\$0.18	\$3,369.60
<i>*With properly programmed lighting control system, use can be greatly reduced.</i>										
Annual Electricity Savings		\$25,272.00								
BTU Reduction		133427								

Pollard MS: LED Theatrical Lighting Estimated Cost & BTU Savings										
		Qty. Fixtures	Watts	Total Watts	kW	Hrs/Week	kWh/Week	kWh/Year	Cost/kWh	Cost/Year
Current System	FOH Spot Lights	15	1000	15000	15	8	120	6240	\$0.18	\$1,123.20
	Stage Fresnel Lights	6	1000	6000	6	8	48	2496	\$0.18	\$449.28
Proposed System	LED Fixtures	40	150	6000	6	16	96	4992	\$0.18	\$898.56
<i>*Currently, there is an insufficient amount of theatrical lighting, which doesn't yield much savings.</i>										
Annual Electricity Savings		\$673.92								
BTU Reduction		51318								

Needham HS: LED Theatrical Lighting Estimated Cost & BTU Savings										
		Qty. Fixtures	Watts	Total Watts	kW	Hrs/Week	kWh/Week	kWh/Year	Cost/kWh	Cost/Year
Current System	FOH Spot Lights	16	1000	16000	16	40	640	33280	\$0.18	\$5,990.40
	Stage Border Lights	14	1440	20160	20.16	40	806.4	41932.8	\$0.18	\$7,547.90
Proposed System	LED Fixtures	60	150	9000	9	20	180	9360	\$0.18	\$1,684.80
<i>*With properly programmed lighting control system, use can be greatly reduced.</i>										
Annual Electricity Savings		\$11,853.50								
BTU Reduction		92920								

**Color-changing fixtures utilize additive color mixing and rarely use maximum wattage.*

***This does not include lamp replacement costs, gel replacement costs, and related maintenance costs*

****Hours/Week and Cost/KWH are estimated values likely based on customer provided information*

*****Commercial electricity rate from energybot.com*

Current Annual Rental Expenses

\$18,800.00 plus labor to setup and take down equipment per event.

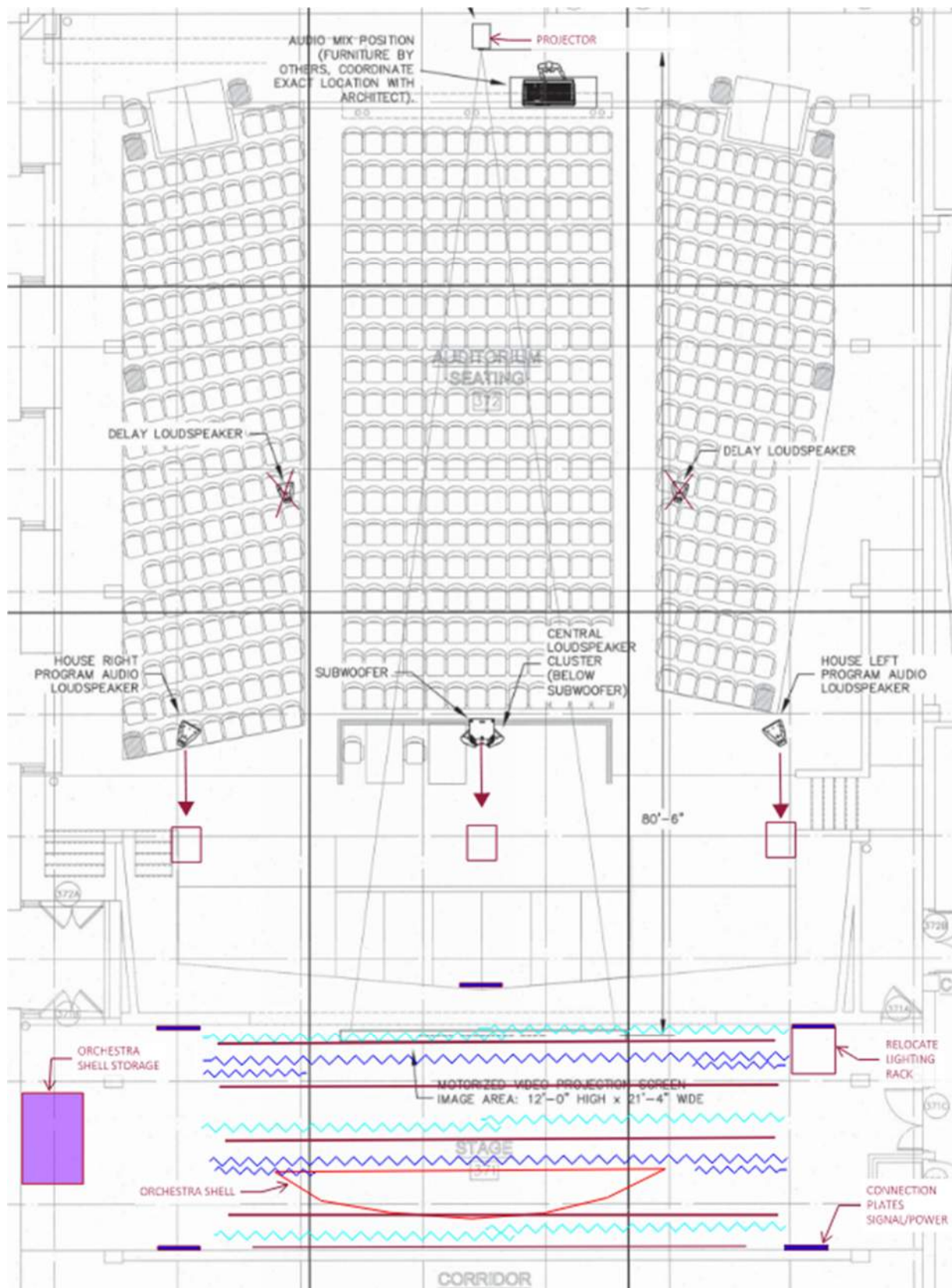
Analysis

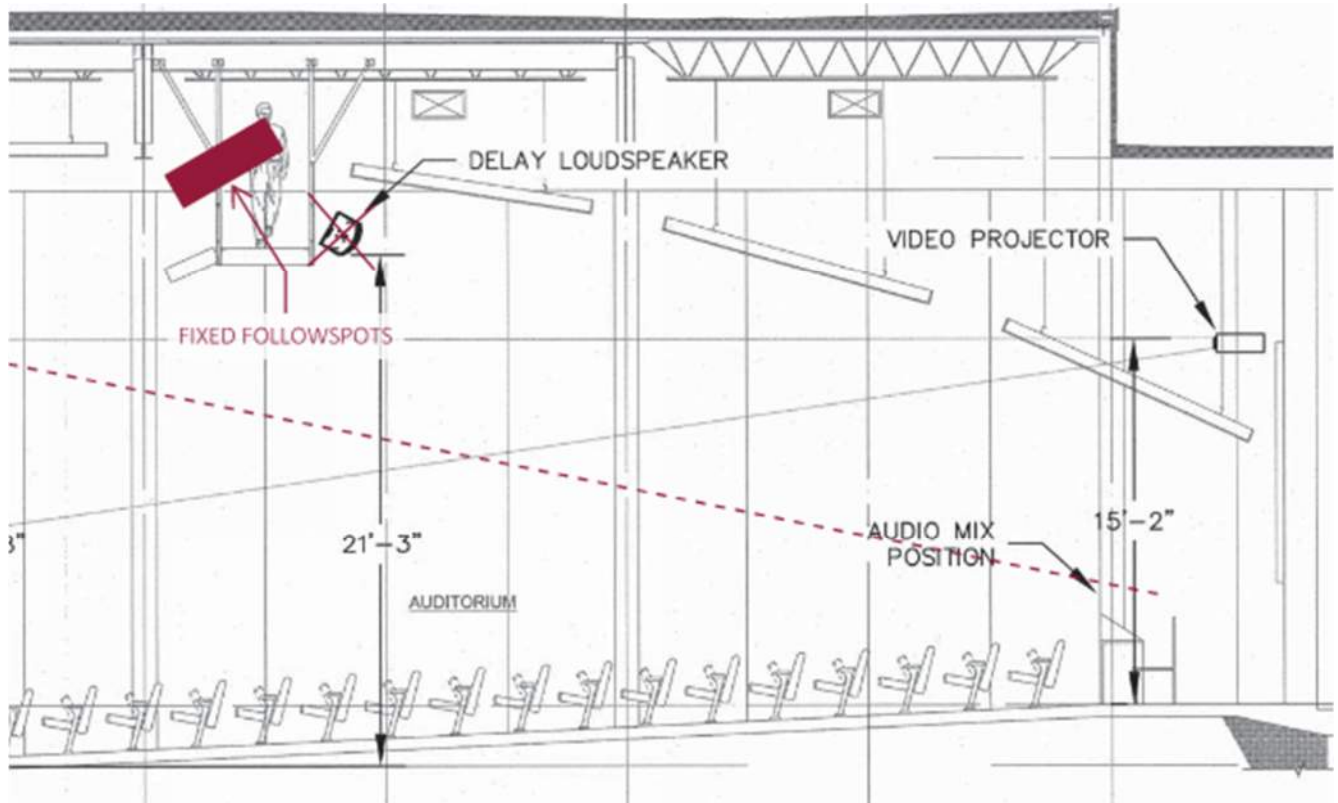
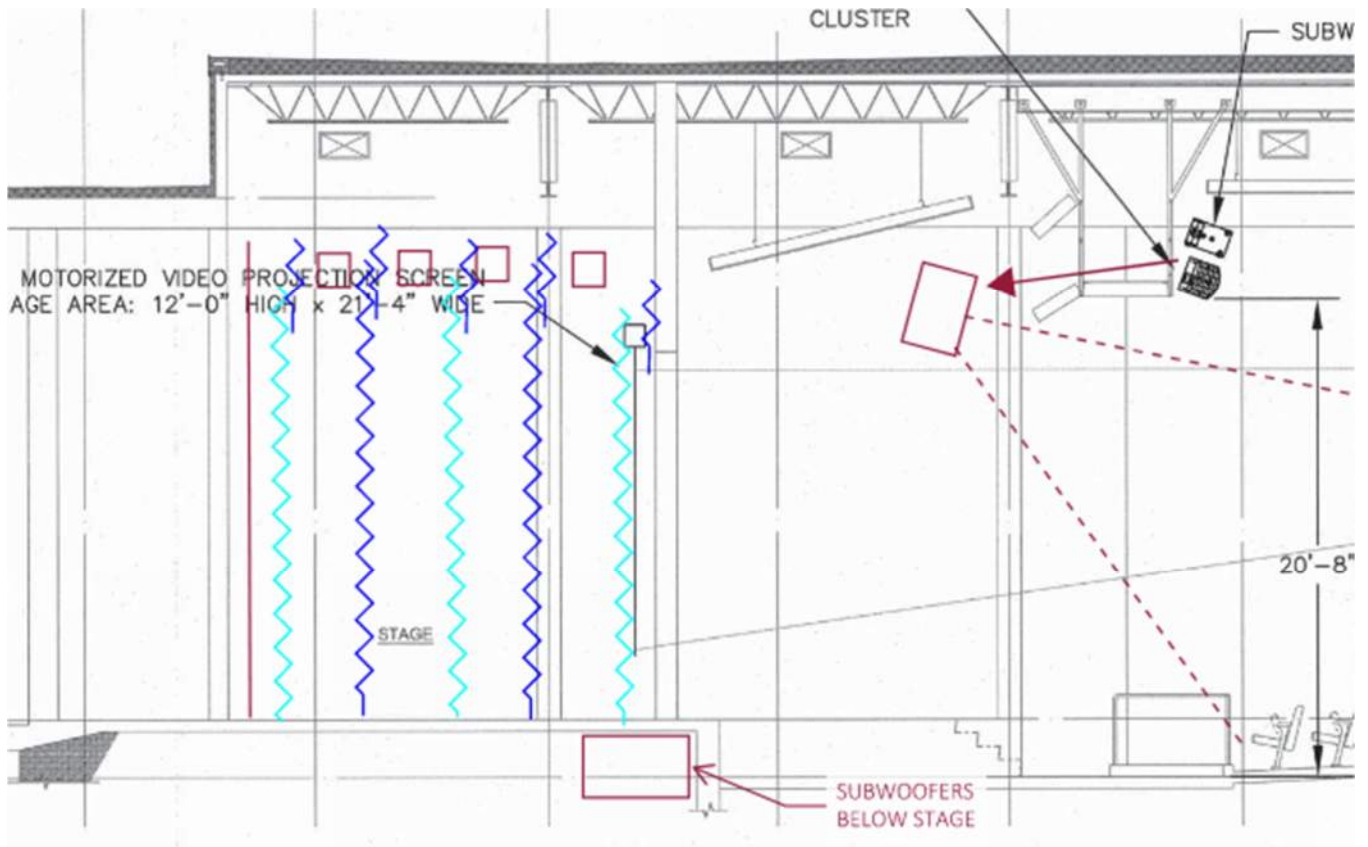
By upgrading the theatrical systems according to the recommendations, it is expected to save \$56,600 in electricity and rental expenses annually. Additional savings include no lamps or gels to purchase, reduce labor impact for maintenance and lamp replacement. And additional electricity savings due to heat load reduction. To reap the estimated \$100,000 of annual savings, an investment of \$3.5MM is required. Extrapolating the savings over 20 years yields a \$2MM savings.

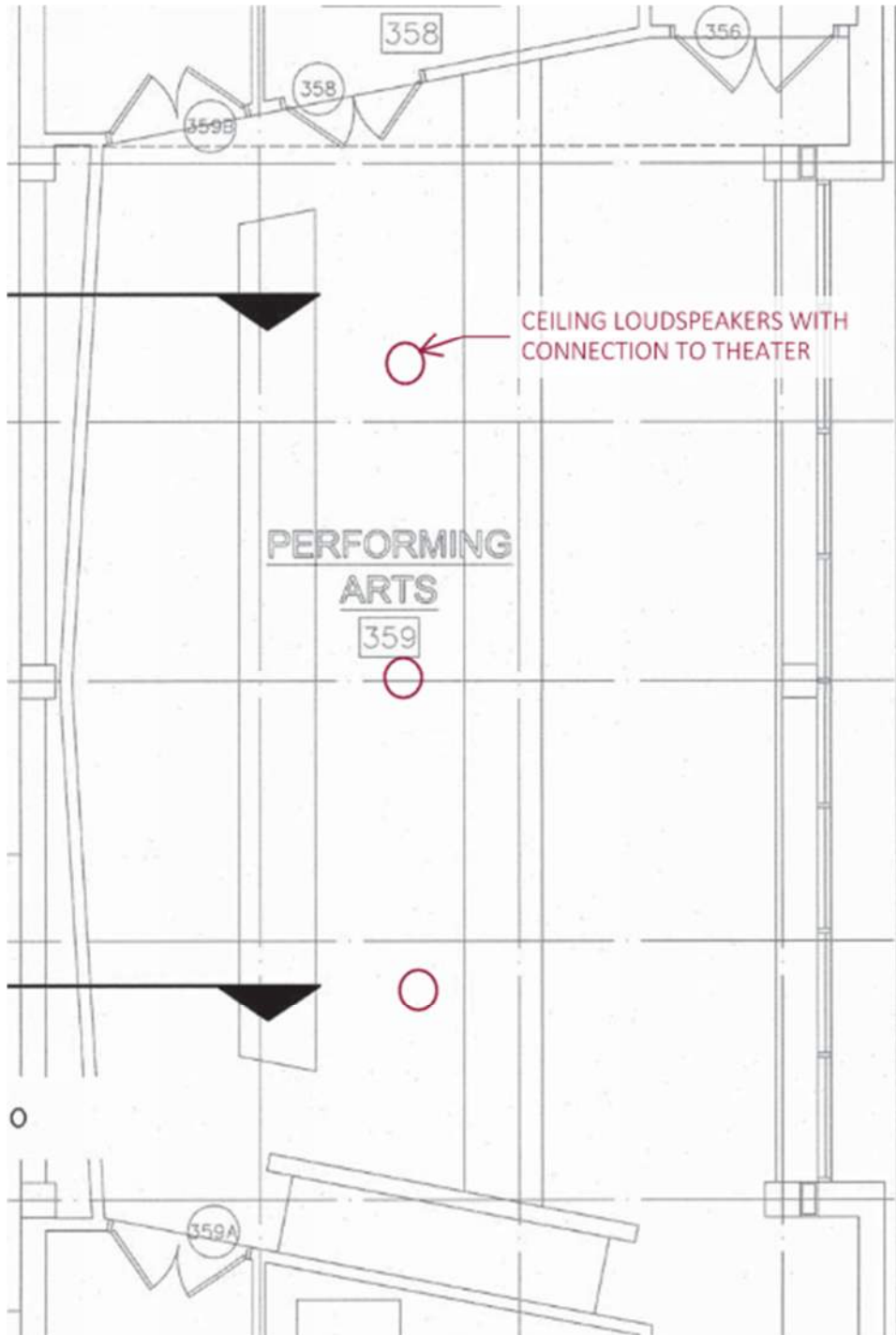


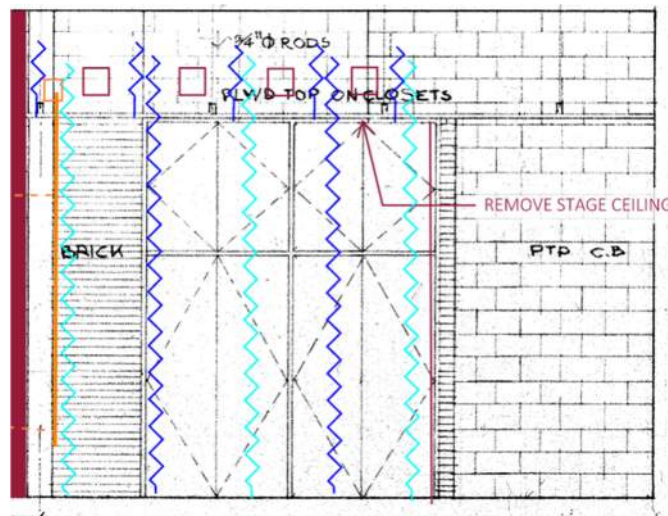
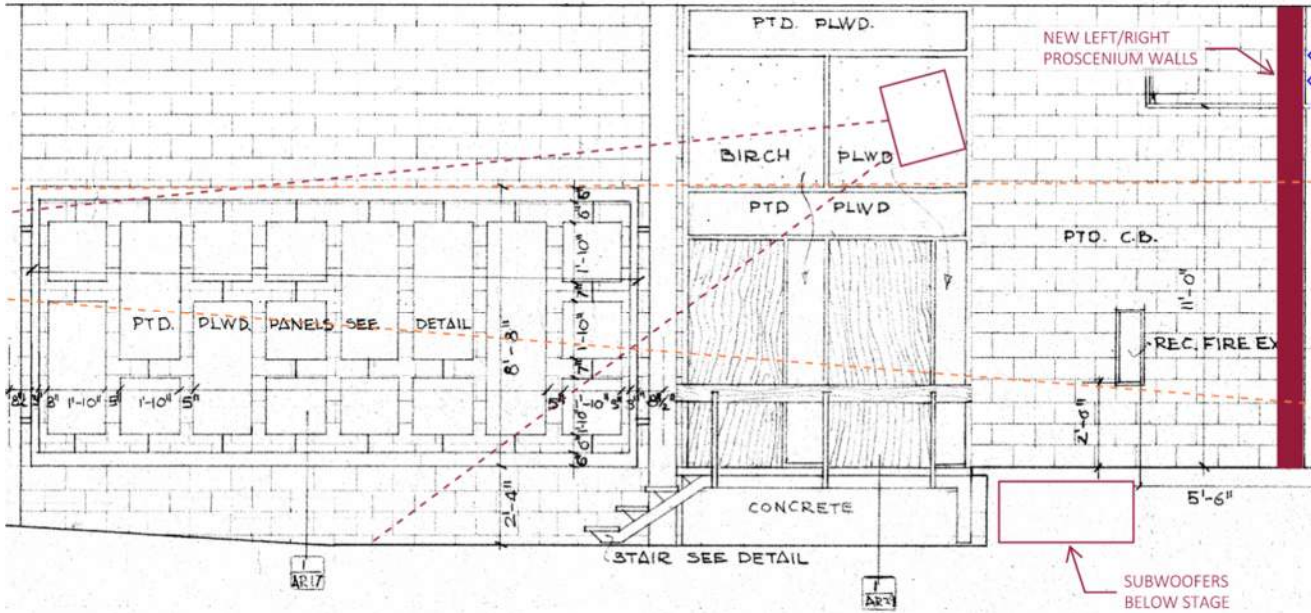
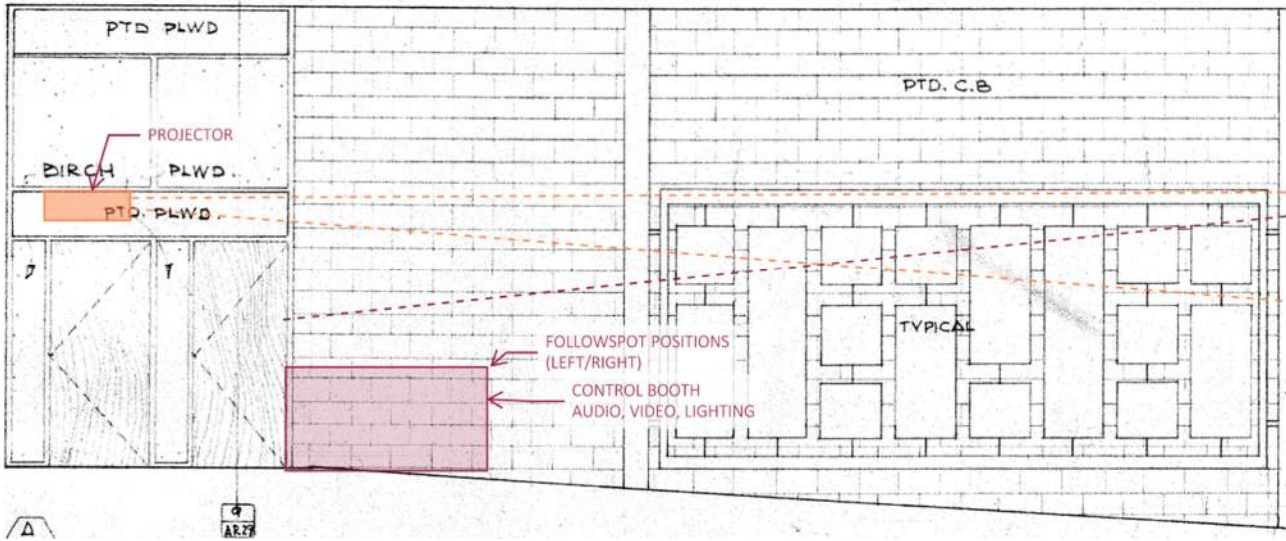
Sketches

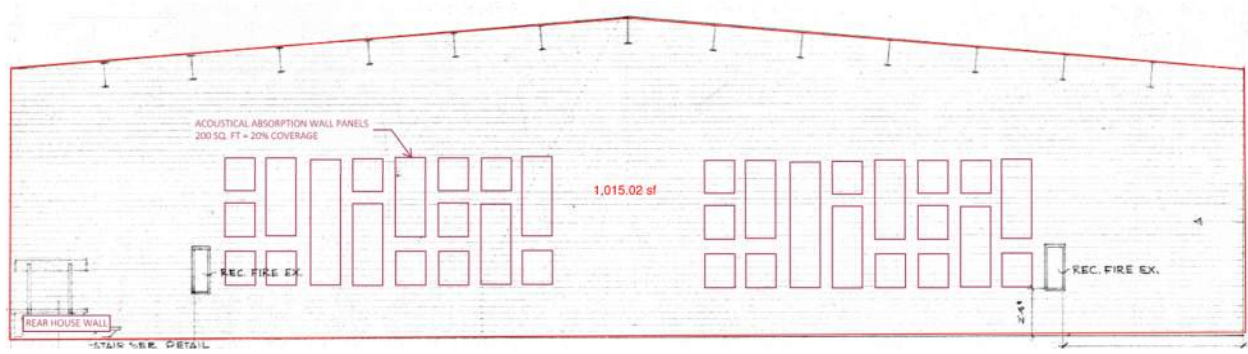
Newman Elementary School



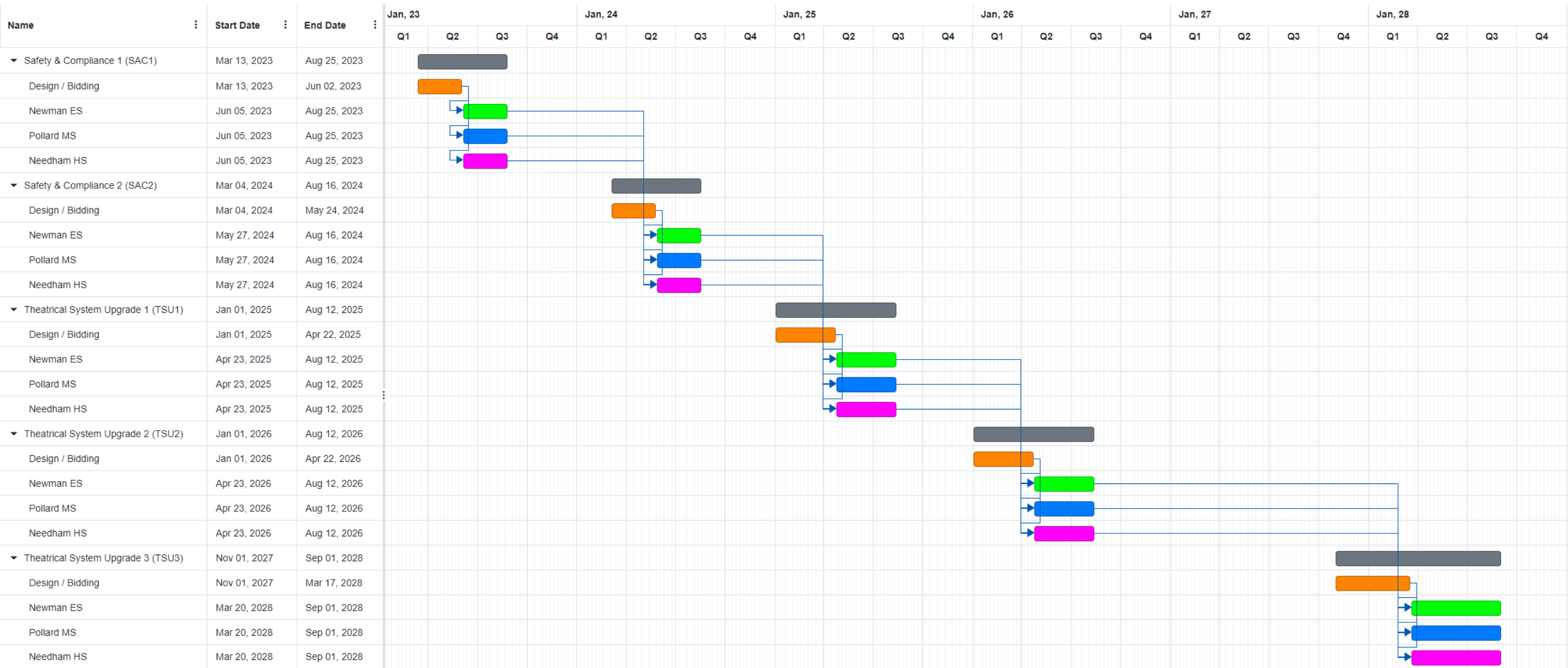








Appendix A: Proposed Project Timeline



Appendix B: Detailed Cost Estimate

Newman ES	SAC1			SAC2			TSU1			TSU2			TSU3			TSU4			AL1		
	Hard Costs	Soft Costs	Total	Hard Costs	Soft Costs	Total	Hard Costs	Soft Costs	Total	Hard Costs	Soft Costs	Total	Hard Costs	Soft Costs	Total	Hard Costs	Soft Costs	Total	Hard Costs	Soft Costs	Total
Audio	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 21,400	\$ 5,350	\$ 26,750	\$ 93,020	\$ 23,255	\$ 116,275	\$ 137,480	\$ 34,370	\$ 171,850	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Video	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,240	\$ 1,310	\$ 6,550	\$ 31,470	\$ 7,868	\$ 39,338	\$ 118,000	\$ 29,500	\$ 147,500	\$ -	\$ -	\$ -
Lighting	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 13,840	\$ 3,460	\$ 17,300	\$ 115,680	\$ 28,920	\$ 144,600	\$ 126,720	\$ 31,680	\$ 158,400	\$ 47,400	\$ 11,850	\$ 59,250	\$ 229,000	\$ 57,250	\$ 286,250
Lighting Controls	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 480	\$ 120	\$ 600	\$ 32,240	\$ 8,060	\$ 40,300	\$ 95,080	\$ 23,770	\$ 118,850	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Rigging	\$ 54,720	\$ 19,152	\$ 73,872	\$ 35,965	\$ 12,588	\$ 48,553	\$ 13,950	\$ 3,488	\$ 17,438	\$ 64,600	\$ 16,150	\$ 80,750	\$ 66,000	\$ 16,500	\$ 82,500	\$ 304,800	\$ 76,200	\$ 381,000	\$ -	\$ -	\$ -
Total			\$ 73,872			\$ 48,553			\$ 62,088			\$ 388,475			\$ 570,938			\$ 587,750			\$ 286,250

Pollard MS	SAC1			SAC2			TSU1			TSU2			TSU3			TSU4			AL1		
	Hard Costs	Soft Costs	Total	Hard Costs	Soft Costs	Total	Hard Costs	Soft Costs	Total	Hard Costs	Soft Costs	Total	Hard Costs	Soft Costs	Total	Hard Costs	Soft Costs	Total	Hard Costs	Soft Costs	Total
Audio	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 14,220	\$ 3,555	\$ 17,775	\$ 33,260	\$ 8,315	\$ 41,575	\$ 203,260	\$ 50,815	\$ 254,075	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Video	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 480	\$ 120	\$ 600	\$ -	\$ -	\$ -	\$ 46,160	\$ 11,540	\$ 57,700	\$ 118,000	\$ 29,500	\$ 147,500	\$ -	\$ -	\$ -
Lighting	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 70,800	\$ 17,700	\$ 88,500	\$ 52,680	\$ 13,170	\$ 65,850	\$ 263,600	\$ 65,900	\$ 329,500	\$ 47,400	\$ 11,850	\$ 59,250	\$ 164,000	\$ 41,000	\$ 205,000
Rigging	\$ 52,730	\$ 18,456	\$ 71,186	\$ 15,870	\$ 5,555	\$ 21,425	\$ 41,560	\$ 10,390	\$ 51,950	\$ 58,832	\$ 14,708	\$ 73,540	\$ -	\$ -	\$ -	\$ 100,000	\$ 25,000	\$ 125,000	\$ -	\$ -	\$ -
Total			\$ 71,186			\$ 21,425			\$ 158,825			\$ 180,965			\$ 641,275			\$ 331,750			\$ 205,000

Needham HS	SAC1			SAC2			TSU1			TSU2			TSU3			TSU4			AL1		
	Hard Costs	Soft Costs	Total	Hard Costs	Soft Costs	Total	Hard Costs	Soft Costs	Total	Hard Costs	Soft Costs	Total	Hard Costs	Soft Costs	Total	Hard Costs	Soft Costs	Total	Hard Costs	Soft Costs	Total
Audio	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 32,960	\$ 8,240	\$ 41,200	\$ 29,350	\$ 7,338	\$ 36,688	\$ 286,940	\$ 71,735	\$ 358,675	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Video	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 20,480	\$ 5,120	\$ 25,600	\$ 1,400	\$ 350	\$ 1,750	\$ 48,160	\$ 12,040	\$ 60,200	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Lighting	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 21,800	\$ 5,450	\$ 27,250	\$ 9,680	\$ 2,420	\$ 12,100	\$ 355,120	\$ 88,780	\$ 443,900	\$ 47,400	\$ 11,850	\$ 59,250	\$ 182,000	\$ 45,500	\$ 227,500
Rigging	\$ 62,955	\$ 22,034	\$ 84,989	\$ 28,270	\$ 9,895	\$ 38,165	\$ 41,560	\$ 10,390	\$ 51,950	\$ 58,832	\$ 14,708	\$ 73,540	\$ -	\$ -	\$ -	\$ 444,800	\$ 111,200	\$ 556,000	\$ -	\$ -	\$ -
Total			\$ 84,989			\$ 38,165			\$ 146,000			\$ 124,078			\$ 862,775			\$ 615,250			\$ 227,500

All three schools			\$ 230,047			\$ 108,142			\$ 366,913			\$ 693,518			\$ 2,074,988			\$ 1,534,750			\$ 718,750
Inclusive of escalation			\$ 230,047	1-year cost escalation		\$ 114,630	3-year cost escalation		\$ 436,999	5-year cost escalation		\$ 928,083	7-year cost escalation		\$ 3,120,014	9-year cost escalation		\$ 2,592,928	5-year cost escalation		\$ 961,850

Notes: SAC1, SAC2, TSU1, TSU2, TSU3 are all required to achieve the benchmark.

TSU4 is above and beyond the benchmark.

AL1 is limited to architectural (non-theatrical) lighting and largely independent of benchmark phases.

Assumes Soft Costs are 25% of Hard Costs, unless noted otherwise.

Rigging SAC1 & SAC2 Soft Costs are 35% of Hard Costs.

Cost escalation is estimated at 6% annually.

Cost Estimate for Newman Elementary School

Deficiencies Requiring Immediate Action per Rigging and Safety Inspection Report (dated 2/17/2023)

NEWMAN ES				
Item	Material	Labor	Extended	Notes
1	\$ 3,000.00	\$ 7,200.00	\$ 10,200.00	
2	\$ 5.00	\$ 30.00	\$ 35.00	
3	\$ 3,200.00	\$ 3,840.00	\$ 7,040.00	
4	\$ -	\$ -	\$ -	Owner to remove
5	\$ 800.00	\$ 5,760.00	\$ 6,560.00	Replacement
6	\$ 150.00	\$ 480.00	\$ 630.00	Reinstallation
7	\$ 750.00	\$ 1,920.00	\$ 2,670.00	Suspended from above
8	\$ 1,000.00	\$ 2,880.00	\$ 3,880.00	
9	\$ 2,500.00	\$ 960.00	\$ 3,460.00	Skirting replacement
10	\$ 1,000.00	\$ 2,000.00	\$ 3,000.00	In-situ retreatment
11	\$ -	\$ -	\$ -	In-situ retreatment (included in #10)
12	\$ -	\$ -	\$ -	In-situ retreatment (included in #10)
13	\$ 500.00	\$ 3,840.00	\$ 4,340.00	
14	\$ -	\$ 30.00	\$ 30.00	
15	\$ 600.00	\$ 960.00	\$ 1,560.00	
16	\$ 600.00	\$ 720.00	\$ 1,320.00	
17	\$ -	\$ 480.00	\$ 480.00	
18	\$ 50.00	\$ 240.00	\$ 290.00	
19	\$ 15.00	\$ 120.00	\$ 135.00	
20	\$ 150.00	\$ 1,440.00	\$ 1,590.00	
21	\$ 300.00	\$ 960.00	\$ 1,260.00	
22	\$ 30.00	\$ 120.00	\$ 150.00	
23	\$ -	\$ 30.00	\$ 30.00	
24	\$ -	\$ 60.00	\$ 60.00	
25	\$ -	\$ -	\$ -	Owner to remove
Subtotals	\$ 14,650.00	\$ 34,070.00	\$ 48,720.00	
			\$ 6,000.00	Management, Lifts/Access, Disposal, Documentation
			Hard Cost Total: \$ 54,720.00	
			35% Soft Costs: \$ 19,152.00	Includes Post-Repair Inspection
			Grand Total: \$ 73,872.00	

NEWMAN ES - SAC2								
Item	Material	Qty	Material	Hours	Rate	Labor	Extended	Notes
1	\$ 100.00	1	\$ 100.00	16	\$ 120.00	\$ 1,920.00	\$ 2,020.00	
2	\$ -		\$ -	2	\$ 120.00	\$ 240.00	\$ 240.00	
3	\$ -		\$ -	2	\$ 120.00	\$ 240.00	\$ 240.00	
4	\$ 50.00	1	\$ 50.00	16	\$ 120.00	\$ 1,920.00	\$ 1,970.00	
5	\$ 400.00	2	\$ 800.00	48	\$ 120.00	\$ 5,760.00	\$ 6,560.00	
6	\$ 500.00	3	\$ 1,500.00	32	\$ 120.00	\$ 3,840.00	\$ 5,340.00	
7	\$ 250.00	1	\$ 250.00	6	\$ 120.00	\$ 720.00	\$ 970.00	
8	\$ -		\$ -	0.25	\$ 120.00	\$ 30.00	\$ 30.00	
9	\$ -		\$ -	4	\$ 120.00	\$ 480.00	\$ 480.00	
10	\$ 75.00	1	\$ 75.00	1	\$ 120.00	\$ 120.00	\$ 195.00	
11	\$ 500.00	1	\$ 500.00	60	\$ 150.00	\$ 9,000.00	\$ 9,500.00	
12	\$ -		\$ -	4	\$ 120.00	\$ 480.00	\$ 480.00	
13	\$ -		\$ -		\$ -	\$ -	\$ -	Owner to remove
14	\$ -		\$ -	2	\$ 120.00	\$ 240.00	\$ 240.00	
15	\$ 500.00	1	\$ 500.00	8	\$ 150.00	\$ 1,200.00	\$ 1,700.00	Electrician
Subtotals			\$ 3,775.00			\$ 26,190.00	\$ 29,965.00	
							\$ 6,000.00	Management, Lifts/Access, Disposal, Documentation
						Hard Cost Total:	\$ 35,965.00	
						35% Soft Costs:	\$ 12,587.75	Includes Post-Repair Inspection
						Grand Total:	\$ 48,552.75	

NEWMAN ES - TSU1								
Category	Material	Qty	Equipment	Hours	Rate	Labor	Extended	Notes
Audio	\$ 5,000.00	1	\$ 5,000.00	16	\$ 140.00	\$ 2,240.00	\$ 7,240.00	Repair 3rd Party Control System
Audio	\$ -		\$ -	4	\$ 120.00	\$ 480.00	\$ 480.00	Energize assistive listening system
Audio	\$ 1,500.00	4	\$ 6,000.00	12	\$ 120.00	\$ 1,440.00	\$ 7,440.00	Replace wireless microphone system
Audio	\$ 800.00	6	\$ 4,800.00	12	\$ 120.00	\$ 1,440.00	\$ 6,240.00	Wired intercom beltacks, headsets, and cables
			\$ 15,800.00			\$ 5,600.00	\$ 21,400.00	AUDIO SUBTOTAL
Video	\$ -		\$ -		\$ -	\$ -	\$ -	
			\$ -			\$ -	\$ -	VIDEO SUBTOTAL
Lighting	\$ 10,000.00	1	\$ 10,000.00	32	\$ 120.00	\$ 3,840.00	\$ 13,840.00	
			\$ 10,000.00			\$ 3,840.00	\$ 13,840.00	LIGHTING SUBTOTAL
Ltg Controls	\$ -		\$ -	4	\$ 120.00	\$ 480.00	\$ 480.00	
			\$ -			\$ 480.00	\$ 480.00	LIGHTING CONTROLS SUBTOTAL
Rigging	\$ 300.00	2	\$ 600.00	12	\$ 120.00	\$ 1,440.00	\$ 2,040.00	Safety signage
Rigging	\$ 3.00	50	\$ 150.00	16	\$ 120.00	\$ 1,920.00	\$ 2,070.00	Batten caps
Rigging	\$ 6,000.00	1	\$ 6,000.00	32	\$ 120.00	\$ 3,840.00	\$ 9,840.00	Replace upstage traveler track
			\$ 6,750.00			\$ 7,200.00	\$ 13,950.00	RIGGING SUBTOTAL
							\$ 49,670.00	TSU1 TOTAL (hard costs only)

NEWMAN ES - TSU2								
Category	Material	Qty	Equipment	Hours	Rate	Labor	Extended	Notes
Audio	\$ 3,000.00	1	\$ 3,000.00	60	\$ 150.00	\$ 9,000.00	\$ 12,000.00	Repair of IG power system
Audio	\$ 20,000.00	1	\$ 20,000.00	20	\$ 120.00	\$ 2,400.00	\$ 22,400.00	Digital mixing system
Audio	\$ 1,500.00	12	\$ 18,000.00	12	\$ 120.00	\$ 1,440.00	\$ 19,440.00	Add'l wireless microphone systems
Audio	\$ 650.00	2	\$ 1,300.00	6	\$ 120.00	\$ 720.00	\$ 2,020.00	Replace wireless microphone antennae
Audio	\$ 2,500.00	7	\$ 17,500.00	32	\$ 120.00	\$ 3,840.00	\$ 21,340.00	Wireless intercom stations
Audio	\$ 7,500.00	1	\$ 7,500.00	4	\$ 120.00	\$ 480.00	\$ 7,980.00	Stock of mics, cables, stands, etc.
Audio	\$ 4,000.00	1	\$ 4,000.00	32	\$ 120.00	\$ 3,840.00	\$ 7,840.00	Add inputs to stage front for orch. pit use
			\$ 71,300.00			\$ 21,720.00	\$ 93,020.00	AUDIO SUBTOTAL
Video	\$ 3,000.00	1	\$ 3,000.00	16	\$ 140.00	\$ 2,240.00	\$ 5,240.00	Scaler & programming for close viewing
			\$ 3,000.00			\$ 2,240.00	\$ 5,240.00	VIDEO SUBTOTAL
Lighting	\$ 2,250.00	48	\$ 108,000.00	64	\$ 120.00	\$ 7,680.00	\$ 115,680.00	LED color-changing fixtures, rep plot
			\$ 108,000.00			\$ 7,680.00	\$ 115,680.00	LIGHTING SUBTOTAL
Ltg Controls	\$ 500.00	3	\$ 1,500.00	4	\$ 120.00	\$ 480.00	\$ 1,980.00	Access point, monitors
Ltg Controls	\$ 7,500.00	1	\$ 7,500.00	16	\$ 120.00	\$ 1,920.00	\$ 9,420.00	Replacement desk
Ltg Controls	\$ 1,000.00	1	\$ 1,000.00	24	\$ 120.00	\$ 2,880.00	\$ 3,880.00	Integrate sconces
Ltg Controls	\$ 16,000.00	1	\$ 16,000.00	8	\$ 120.00	\$ 960.00	\$ 16,960.00	Upgrade dimming system for LED use
			\$ 26,000.00			\$ 6,240.00	\$ 32,240.00	LIGHTING CONTROLS SUBTOTAL

Rigging	\$ 40,000.00	1	\$ 40,000.00	100	\$ 120.00	\$ 12,000.00	\$ 52,000.00	Curtain replacement
Rigging	\$ 1,000.00	3	\$ 3,000.00	80	\$ 120.00	\$ 9,600.00	\$ 12,600.00	Spare pipe battens
			\$ 43,000.00			\$ 21,600.00	\$ 64,600.00	RIGGING SUBTOTAL
							\$ 310,780.00	TSU2 TOTAL (hard costs only)

NEWMAN ES - TSU3								
Category	Material	Qty	Equipment	Hours	Rate	Labor	Extended	Notes
Audio	\$ 3,000.00	1	\$ 3,000.00	24	\$ 150.00	\$ 3,600.00	\$ 6,600.00	Digital signal processor
Audio	\$ -		\$ -	16	\$ 120.00	\$ 1,920.00	\$ 1,920.00	Remove delay loudspeakers
Audio	\$ 6,000.00	3	\$ 18,000.00	64	\$ 120.00	\$ 7,680.00	\$ 25,680.00	Replace & relocate main loudspeakers
Audio	\$ 6,000.00	2	\$ 12,000.00	24	\$ 120.00	\$ 2,880.00	\$ 14,880.00	Add subwoofers
Audio	\$ 5,000.00	3	\$ 15,000.00	24	\$ 120.00	\$ 2,880.00	\$ 17,880.00	Replace amplifiers
Audio	\$ 12,000.00	1	\$ 12,000.00	60	\$ 150.00	\$ 9,000.00	\$ 21,000.00	Replace 3rd party control system (shared w/ video)
Audio	\$ 6,000.00	1	\$ 6,000.00	24	\$ 120.00	\$ 2,880.00	\$ 8,880.00	Replace network (shared w/ video/ltg)
Audio	\$ 3,000.00	8	\$ 24,000.00	24	\$ 120.00	\$ 2,880.00	\$ 26,880.00	Portable acoustical shell
Audio	\$ 8,000.00	1	\$ 8,000.00	48	\$ 120.00	\$ 5,760.00	\$ 13,760.00	Ambient mics, replace/relabel plates, recorder
			\$ 98,000.00			\$ 39,480.00	\$ 137,480.00	AUDIO SUBTOTAL
Video	\$ 6,000.00	1	\$ 6,000.00	24	\$ 140.00	\$ 3,360.00	\$ 9,360.00	Replace 3rd party control system (shared w/ audio)
Video	\$ 750.00	1	\$ 750.00	4	\$ 140.00	\$ 560.00	\$ 1,310.00	Blu-ray player
Video	\$ 6,000.00	1	\$ 6,000.00	16	\$ 120.00	\$ 1,920.00	\$ 7,920.00	Replace network (shared w/ audio/ltg)
Video	\$ 10,000.00	1	\$ 10,000.00	24	\$ 120.00	\$ 2,880.00	\$ 12,880.00	Streaming system (camera, recorder)
			\$ 22,750.00			\$ 8,720.00	\$ 31,470.00	VIDEO SUBTOTAL
Lighting	\$ 1,000.00	6	\$ 6,000.00	80	\$ 150.00	\$ 12,000.00	\$ 18,000.00	Add lighting positions (rigging & electrical)
Lighting	\$ 2,250.00	32	\$ 72,000.00	40	\$ 120.00	\$ 4,800.00	\$ 76,800.00	LED color-changing fixtures
Lighting	\$ 7,500.00	4	\$ 30,000.00	16	\$ 120.00	\$ 1,920.00	\$ 31,920.00	Minimal quantity of moving lights
			\$ 108,000.00			\$ 18,720.00	\$ 126,720.00	LIGHTING SUBTOTAL
Ltg Controls	\$ 4,000.00	6	\$ 24,000.00	240	\$ 120.00	\$ 28,800.00	\$ 52,800.00	Replace connector strips
Ltg Controls	\$ 1,200.00	8	\$ 9,600.00	100	\$ 120.00	\$ 12,000.00	\$ 21,600.00	Add DMX (control) to existing receptacles
Ltg Controls	\$ 1,000.00	1	\$ 1,000.00	24	\$ 120.00	\$ 2,880.00	\$ 3,880.00	Replace lighting board
Ltg Controls	\$ 6,000.00	1	\$ 6,000.00	24	\$ 120.00	\$ 2,880.00	\$ 8,880.00	Integrate lighting control w/ 3rd party system
Ltg Controls	\$ 6,000.00	1	\$ 6,000.00	16	\$ 120.00	\$ 1,920.00	\$ 7,920.00	Replace network (shared w/ audio/video)
			\$ 46,600.00			\$ 48,480.00	\$ 95,080.00	LIGHTING CONTROLS SUBTOTAL
Rigging	\$ 15,000.00	2	\$ 30,000.00	300	\$ 120.00	\$ 36,000.00	\$ 66,000.00	Fall arrest system (catwalks)
			\$ 30,000.00			\$ 36,000.00	\$ 66,000.00	RIGGING SUBTOTAL
							\$ 456,750.00	TSU3 TOTAL (hard costs only)

NEWMAN ES - TSU4								
Category	Material	Qty	Equipment	Hours	Rate	Labor	Extended	Notes
Audio	\$ -		\$ -		\$ -	\$ -	\$ -	
			\$ -			\$ -	\$ -	AUDIO SUBTOTAL
Video	\$ 100,000.00	1	\$ 100,000.00	120	\$ 150.00	\$ 18,000.00	\$ 118,000.00	Scenic projection system
			\$ 100,000.00			\$ 18,000.00	\$ 118,000.00	VIDEO SUBTOTAL
Lighting	\$ 7,500.00	6	\$ 45,000.00	20	\$ 120.00	\$ 2,400.00	\$ 47,400.00	Add'l moving lights
			\$ 45,000.00			\$ 2,400.00	\$ 47,400.00	LIGHTING SUBTOTAL
Ltg Controls	\$ -		\$ -		\$ -	\$ -	\$ -	
			\$ -			\$ -	\$ -	LIGHTING CONTROLS SUBTOTAL
Rigging	\$ 40,000.00	3	\$ 120,000.00	300	\$ 120.00	\$ 36,000.00	\$ 156,000.00	Motorize lighting pipes
Rigging	\$ 40,000.00	3	\$ 120,000.00	240	\$ 120.00	\$ 28,800.00	\$ 148,800.00	Motorize valance pipes
			\$ 240,000.00			\$ 64,800.00	\$ 304,800.00	RIGGING SUBTOTAL
							\$ 470,200.00	TSU4 TOTAL (hard costs only)

NEWMAN ES - AL1								
Category	Material	Qty	Equipment	Hours	Rate	Labor	Extended	Notes
Lighting	\$ 2,500.00	76	\$ 190,000.00	260	\$ 150.00	\$ 39,000.00	\$ 229,000.00	Architectural lighting replacement
			\$ 190,000.00			\$ 39,000.00	\$ 229,000.00	LIGHTING SUBTOTAL
							\$ 229,000.00	AL1 TOTAL (hard costs only)

Cost Estimate for Pollard Middle School
 Deficiencies Requiring Immediate Action per Rigging and Safety Inspection Report (dated 2/17/2023)

POLLARD MS				
Item	Material	Labor	Extended	Notes
1	\$ -	\$ 120.00	\$ 120.00	
2	\$ -	\$ -	\$ -	Owner to remove
3	\$ 8,000.00	\$ 8,640.00	\$ 16,640.00	
4	\$ -	\$ 120.00	\$ 120.00	
5	\$ 15,000.00	\$ 1,440.00	\$ 16,440.00	Replacement
6	\$ -	\$ -	\$ -	Included in #3
7	\$ 100.00	\$ 360.00	\$ 460.00	
8	\$ -	\$ 60.00	\$ 60.00	
9	\$ 150.00	\$ 480.00	\$ 630.00	
10	\$ 2,500.00	\$ 360.00	\$ 2,860.00	Owner to reduce & dispose of unneeded paint
11	\$ -	\$ -	\$ -	Owner to remove
12	\$ -	\$ -	\$ -	Owner to rectify
13	\$ 2,500.00	\$ 6,000.00	\$ 8,500.00	
14	\$ 500.00	\$ 2,400.00	\$ 2,900.00	
Subtotals	\$ 28,750.00	\$ 19,980.00	\$ 48,730.00	
			\$ 4,000.00	Management, Lifts/Access, Disposal, Documentation
			Hard Cost Total: \$ 52,730.00	
			35% Soft Costs: \$ 18,455.50	Includes Post-Repair Inspection
			Grand Total: \$ 71,185.50	

POLLARD MS - SAC2								
Item	Material	Qty	Material	Hours	Rate	Labor	Extended	Notes
1	\$ 400.00	1	\$ 400.00	24	\$ 120.00	\$ 2,880.00	\$ 3,280.00	Install proper pipe batten
2	\$ -		\$ -		\$ -	\$ -	\$ -	Owner to remove fixtures
3	\$ 250.00	2	\$ 500.00	16	\$ 120.00	\$ 1,920.00	\$ 2,420.00	
4	\$ -		\$ -	8	\$ 120.00	\$ 960.00	\$ 960.00	
5	\$ 750.00	1	\$ 750.00	32	\$ 120.00	\$ 3,840.00	\$ 4,590.00	
6	\$ 50.00	1	\$ 50.00	8	\$ 120.00	\$ 960.00	\$ 1,010.00	
7	\$ -		\$ -		\$ -	\$ -	\$ -	Owner to rectify
8	\$ 10.00	1	\$ 10.00	1	\$ 150.00	\$ 150.00	\$ 160.00	
9	\$ -		\$ -		\$ -	\$ -	\$ -	Owner to rectify
10	\$ 250.00	1	\$ 250.00	8	\$ 150.00	\$ 1,200.00	\$ 1,450.00	
Subtotals			\$ 1,960.00			\$ 11,910.00	\$ 13,870.00	
							\$ 2,000.00	Management, Lifts/Access, Disposal, Documentation
						Hard Cost Total:	\$ 15,870.00	
						35% Soft Costs:	\$ 5,554.50	Includes Post-Repair Inspection
						Grand Total:	\$ 21,424.50	

POLLARD MS - TSU1								
Category	Material	Qty	Equipment	Hours	Rate	Labor	Extended	Notes
Audio	\$ 1,500.00	1	\$ 1,500.00	32	\$ 120.00	\$ 3,840.00	\$ 5,340.00	Repair microphone inputs
Audio	\$ 6,000.00	1	\$ 6,000.00	24	\$ 120.00	\$ 2,880.00	\$ 8,880.00	Add assistive listening system
			\$ 7,500.00			\$ 6,720.00	\$ 14,220.00	AUDIO SUBTOTAL
Video	\$ -		\$ -	4	\$ 120.00	\$ 480.00	\$ 480.00	Set limit on projection screen
			\$ -			\$ 480.00	\$ 480.00	VIDEO SUBTOTAL
Lighting	\$ 2,500.00	20	\$ 50,000.00	64	\$ 120.00	\$ 7,680.00	\$ 57,680.00	LED color-changing lighting fixtures
Lighting	\$ 4,000.00	2	\$ 8,000.00	8	\$ 120.00	\$ 960.00	\$ 8,960.00	LED follow spots
Lighting	\$ 400.00	8	\$ 3,200.00	8	\$ 120.00	\$ 960.00	\$ 4,160.00	Wireless control
			\$ 61,200.00			\$ 9,600.00	\$ 70,800.00	LIGHTING SUBTOTAL
Rigging	\$ 300.00	2	\$ 600.00	12	\$ 120.00	\$ 1,440.00	\$ 2,040.00	Safety signage
Rigging	\$ 24,000.00	1	\$ 24,000.00	32	\$ 120.00	\$ 3,840.00	\$ 27,840.00	Replace curtains
Rigging	\$ 1,000.00	4	\$ 4,000.00	64	\$ 120.00	\$ 7,680.00	\$ 11,680.00	Pipe battens
			\$ 28,600.00			\$ 12,960.00	\$ 41,560.00	RIGGING SUBTOTAL
							\$ 127,060.00	TSU1 TOTAL (hard costs only)

POLLARD MS - TSU2								
Category	Material	Qty	Equipment	Hours	Rate	Labor	Extended	Notes
Audio	\$ 3,000.00	3	\$ 9,000.00	64	\$ 120.00	\$ 7,680.00	\$ 16,680.00	Replace and relocate loudspeakers
Audio	\$ 4,000.00	1	\$ 4,000.00	8	\$ 120.00	\$ 960.00	\$ 4,960.00	Rack mount mixer
Audio	\$ 3,500.00	1	\$ 3,500.00	16	\$ 120.00	\$ 1,920.00	\$ 5,420.00	Digital signal processor
Audio	\$ 650.00	2	\$ 1,300.00	8	\$ 120.00	\$ 960.00	\$ 2,260.00	Replace wireless microphone antennae
Audio	\$ 2,500.00	1	\$ 2,500.00	12	\$ 120.00	\$ 1,440.00	\$ 3,940.00	Sequencer, rack door
			\$ 20,300.00			\$ 12,960.00	\$ 33,260.00	AUDIO SUBTOTAL
Video			\$ -		\$ -	\$ -	\$ -	
			\$ -			\$ -	\$ -	VIDEO SUBTOTAL
Lighting	\$ 2,250.00	20	\$ 45,000.00	64	\$ 120.00	\$ 7,680.00	\$ 52,680.00	LED color-changing fixtures, rep plot
			\$ 45,000.00			\$ 7,680.00	\$ 52,680.00	LIGHTING SUBTOTAL
Rigging	\$ 25,000.00	1	\$ 25,000.00	120	\$ 120.00	\$ 14,400.00	\$ 39,400.00	Add'l masking curtains, tracks, & cyclorama
Rigging	\$ 1,000.00	4	\$ 4,000.00	120	\$ 120.00	\$ 14,400.00	\$ 18,400.00	Add'l pipe battens
Rigging	\$ 3.00	24	\$ 72.00	8	\$ 120.00	\$ 960.00	\$ 1,032.00	Batten caps
			\$ 29,072.00			\$ 29,760.00	\$ 58,832.00	RIGGING SUBTOTAL
							\$ 144,772.00	TSU2 TOTAL (hard costs only)

POLLARD MS - TSU3								
Category	Material	Qty	Equipment	Hours	Rate	Labor	Extended	Notes
Audio	\$ 12,000.00	1	\$ 12,000.00	80	\$ 150.00	\$ 12,000.00	\$ 24,000.00	Mix position
Audio	\$ 5,000.00	1	\$ 5,000.00	24	\$ 120.00	\$ 2,880.00	\$ 7,880.00	Equipment rack
Audio	\$ 10,000.00	1	\$ 10,000.00	24	\$ 120.00	\$ 2,880.00	\$ 12,880.00	New mixer and stage box
Audio	\$ 3,500.00	2	\$ 7,000.00	24	\$ 120.00	\$ 2,880.00	\$ 9,880.00	Add subwoofers
Audio	\$ 5,000.00	2	\$ 10,000.00	24	\$ 120.00	\$ 2,880.00	\$ 12,880.00	Replace amplifiers
Audio	\$ 800.00	6	\$ 4,800.00	12	\$ 120.00	\$ 1,440.00	\$ 6,240.00	Wired intercom belt packs, headsets, cables
Audio	\$ 2,500.00	5	\$ 12,500.00	32	\$ 120.00	\$ 3,840.00	\$ 16,340.00	Wireless intercom system
Audio	\$ 12,000.00	1	\$ 12,000.00	60	\$ 150.00	\$ 9,000.00	\$ 21,000.00	Replace 3rd party control system (shared w/ video)

Audio	\$ 6,000.00	1	\$ 6,000.00	24	\$ 120.00	\$ 2,880.00	\$ 8,880.00	Install network (shared w/ video/lgt)
Audio	\$ 3,000.00	8	\$ 24,000.00	24	\$ 120.00	\$ 2,880.00	\$ 26,880.00	Portable acoustical shell
Audio	\$ 6,000.00	1	\$ 6,000.00	40	\$ 120.00	\$ 4,800.00	\$ 10,800.00	Ambient mics, replace/relabel plates, recorder
Audio	\$ 20,000.00	1	\$ 20,000.00	80	\$ 120.00	\$ 9,600.00	\$ 29,600.00	Acoustical wall panels
Audio	\$ 4,000.00	1	\$ 4,000.00	80	\$ 150.00	\$ 12,000.00	\$ 16,000.00	Power receptacles
			\$ 133,300.00			\$ 69,960.00	\$ 203,260.00	AUDIO SUBTOTAL
Video	\$ 45,000.00	1	\$ 45,000.00	64	\$ 120.00	\$ 7,680.00	\$ 52,680.00	Projector and projection screen, processing/control
Video	\$ 6,000.00	1	\$ 6,000.00	24	\$ 140.00	\$ 3,360.00	\$ 9,360.00	Replace 3rd party control system (shared w/ audio)
Video	\$ 6,000.00	1	\$ 6,000.00	16	\$ 120.00	\$ 1,920.00	\$ 7,920.00	Install network (shared w/ audio/lgt)
Video	\$ 4,000.00	1	\$ 4,000.00	80	\$ 150.00	\$ 12,000.00	\$ 16,000.00	Power receptacles
Video	\$ 10,000.00	1	\$ 10,000.00	24	\$ 120.00	\$ 2,880.00	\$ 12,880.00	Streaming system (camera, recorder)
			\$ 26,000.00			\$ 20,160.00	\$ 46,160.00	VIDEO SUBTOTAL
Lighting	\$ 1,000.00	6	\$ 6,000.00	80	\$ 150.00	\$ 12,000.00	\$ 18,000.00	Add lighting positions (rigging & electrical)
Lighting	\$ 2,250.00	32	\$ 72,000.00	40	\$ 120.00	\$ 4,800.00	\$ 76,800.00	LED color-changing fixtures
Lighting	\$ 7,500.00	4	\$ 30,000.00	16	\$ 120.00	\$ 1,920.00	\$ 31,920.00	Minimal quantity of moving lights
Lighting	\$ 50,000.00	1	\$ 50,000.00	240	\$ 150.00	\$ 36,000.00	\$ 86,000.00	Power & control system, plug boxes
Lighting	\$ 6,000.00	1	\$ 6,000.00	24	\$ 120.00	\$ 2,880.00	\$ 8,880.00	Install network (shared w/ audio/video)
Lighting	\$ 18,000.00	1	\$ 18,000.00	160	\$ 150.00	\$ 24,000.00	\$ 42,000.00	Architectural lighting controls
			\$ 164,000.00			\$ 81,600.00	\$ 263,600.00	LIGHTING SUBTOTAL
Rigging	\$ -		\$ -		\$ -	\$ -	\$ -	
			\$ -			\$ -	\$ -	RIGGING SUBTOTAL
							\$ 513,020.00	TSU3 TOTAL (hard costs only)

POLLARD MS - TSU4								
Category	Material	Qty	Equipment	Hours	Rate	Labor	Extended	Notes
Audio	\$ -		\$ -		\$ -	\$ -	\$ -	
			\$ -			\$ -	\$ -	AUDIO SUBTOTAL
Video	\$ 100,000.00	1	\$ 100,000.00	120	\$ 150.00	\$ 18,000.00	\$ 118,000.00	Scenic projection system
			\$ 100,000.00			\$ 18,000.00	\$ 118,000.00	VIDEO SUBTOTAL
Lighting	\$ 7,500.00	6	\$ 45,000.00	20	\$ 120.00	\$ 2,400.00	\$ 47,400.00	Add'l moving lights
			\$ 45,000.00			\$ 2,400.00	\$ 47,400.00	LIGHTING SUBTOTAL
Rigging	\$ 10,000.00	1	\$ 10,000.00	600	\$ 150.00	\$ 90,000.00	\$ 100,000.00	Remove stage ceiling and raise rigging
			\$ 10,000.00			\$ 90,000.00	\$ 100,000.00	RIGGING SUBTOTAL
							\$ 265,400.00	TSU4 TOTAL (hard costs only)

POLLARD MS - AL1								
Category	Material	Qty	Equipment	Hours	Rate	Labor	Extended	Notes
Lighting	\$ 2,500.00	50	\$ 125,000.00	260	\$ 150.00	\$ 39,000.00	\$ 164,000.00	Architectural lighting replacement
			\$ 125,000.00			\$ 39,000.00	\$ 164,000.00	LIGHTING SUBTOTAL
							\$ 164,000.00	AL1 TOTAL (hard costs only)

Cost Estimate for Needham High School

Deficiencies Requiring Immediate Action per Rigging and Safety Inspection Report (dated 2/17/2023)

NEEDHAM HS				
Item	Material	Labor	Extended	Notes
1	\$ 5,250.00	\$ 24,000.00	\$ 29,250.00	Includes support structure in attic
2	\$ 720.00	\$ 960.00	\$ 1,680.00	
3	\$ 150.00	\$ 1,440.00	\$ 1,590.00	
4	\$ 400.00	\$ 2,400.00	\$ 2,800.00	
5	\$ -	\$ 240.00	\$ 240.00	
6	\$ -	\$ 960.00	\$ 960.00	
7	\$ 75.00	\$ 720.00	\$ 795.00	
8	\$ -	\$ 7,680.00	\$ 7,680.00	Remove fire curtain system, pending AHJ approval
9	\$ 300.00	\$ 960.00	\$ 1,260.00	
10	\$ 1,000.00	\$ 2,000.00	\$ 3,000.00	In-situ retreatment
11	\$ -	\$ -	\$ -	In-situ retreatment (included in #10)
12	\$ 1,400.00	\$ 480.00	\$ 1,880.00	
13	\$ 500.00	\$ 960.00	\$ 1,460.00	Owner to repair
14	\$ -	\$ -	\$ -	Owner to rectify
15	\$ -	\$ -	\$ -	Owner to rectify
16	\$ -	\$ -	\$ -	Owner to rectify
17	\$ 2,500.00	\$ 360.00	\$ 2,860.00	Owner to reduce & dispose of unneeded paint
Subtotals	\$ 12,295.00	\$ 43,160.00	\$ 55,455.00	
			\$ 7,500.00	Management, Lifts/Access, Disposal, Documentation
			Hard Cost Total: \$ 62,955.00	
			35% Soft Costs: \$ 22,034.25	Includes Post-Repair Inspection
			Grand Total: \$ 84,989.25	

NEEDHAM HS - SAC2								
Item	Material	Qty	Material	Hours	Rate	Labor	Extended	Notes
1	\$ 10.00	12	\$ 120.00	12	\$ 120.00	\$ 1,440.00	\$ 1,560.00	
2	\$ 75.00	12	\$ 900.00	32	\$ 120.00	\$ 3,840.00	\$ 4,740.00	
3	\$ 35.00	80	\$ 2,800.00	80	\$ 120.00	\$ 9,600.00	\$ 12,400.00	
4	\$ 50.00	1	\$ 50.00	2	\$ 120.00	\$ 240.00	\$ 290.00	
5	\$ 200.00	1	\$ 200.00	24	\$ 120.00	\$ 2,880.00	\$ 3,080.00	
6	\$ 200.00	1	\$ 200.00	8	\$ 120.00	\$ 960.00	\$ 1,160.00	
7	\$ 50.00	16	\$ 800.00	16	\$ 140.00	\$ 2,240.00	\$ 3,040.00	
Subtotals			\$ 5,070.00			\$ 21,200.00	\$ 26,270.00	
							\$ 2,000.00	Management, Lifts/Access, Disposal, Documentation
						Hard Cost Total:	\$ 28,270.00	
						35% Soft Costs:	\$ 9,894.50	Includes Post-Repair Inspection
						Grand Total:	\$ 38,164.50	

NEEDHAM HS - TSU1								
Category	Material	Qty	Equipment	Hours	Rate	Labor	Extended	Notes
Audio	\$ 1,500.00	1	\$ 1,500.00	24	\$ 120.00	\$ 2,880.00	\$ 4,380.00	Test/repair loudspeakers
Audio	\$ 4,000.00	1	\$ 4,000.00	8	\$ 120.00	\$ 960.00	\$ 4,960.00	Digital mixer & stage box
Audio	\$ 2,500.00	1	\$ 2,500.00	40	\$ 120.00	\$ 4,800.00	\$ 7,300.00	Cabling infrastructure
Audio	\$ 1,500.00	4	\$ 6,000.00	12	\$ 120.00	\$ 1,440.00	\$ 7,440.00	Minimal quantity of wireless microphone system
Audio	\$ 6,000.00	1	\$ 6,000.00	24	\$ 120.00	\$ 2,880.00	\$ 8,880.00	Add assistive listening system
			\$ 20,000.00			\$ 12,960.00	\$ 32,960.00	AUDIO SUBTOTAL
Video	\$ 20,000.00	1	\$ 20,000.00	4	\$ 120.00	\$ 480.00	\$ 20,480.00	Portable projector w/ lens
			\$ 20,000.00			\$ 480.00	\$ 20,480.00	VIDEO SUBTOTAL
Lighting	\$ 5,000.00	1	\$ 5,000.00	32	\$ 120.00	\$ 3,840.00	\$ 8,840.00	Dimming & control system repair
Lighting	\$ 12,000.00	1	\$ 12,000.00	8	\$ 120.00	\$ 960.00	\$ 12,960.00	Lighting board w/ monitors
			\$ 17,000.00			\$ 4,800.00	\$ 21,800.00	LIGHTING SUBTOTAL
Rigging	\$ 300.00	2	\$ 600.00	12	\$ 120.00	\$ 1,440.00	\$ 2,040.00	Safety signage
Rigging	\$ 24,000.00	1	\$ 24,000.00	32	\$ 120.00	\$ 3,840.00	\$ 27,840.00	Replace curtains
Rigging	\$ 1,000.00	4	\$ 4,000.00	64	\$ 120.00	\$ 7,680.00	\$ 11,680.00	Pipe battens
			\$ 28,600.00			\$ 12,960.00	\$ 41,560.00	RIGGING SUBTOTAL
							\$ 116,800.00	TSU1 TOTAL (hard costs only)

NEEDHAM HS - TSU2								
Category	Material	Qty	Equipment	Hours	Rate	Labor	Extended	Notes
Audio	\$ 750.00	1	\$ 750.00	24	\$ 120.00	\$ 2,880.00	\$ 3,630.00	Test/repair wired microphone inputs
Audio	\$ 1,500.00	1	\$ 1,500.00	16	\$ 120.00	\$ 1,920.00	\$ 3,420.00	Replace/relabel plates
Audio	\$ 1,000.00	5	\$ 5,000.00	8	\$ 120.00	\$ 960.00	\$ 5,960.00	Portable stage monitors, recorder
Audio	\$ 2,500.00	5	\$ 12,500.00	32	\$ 120.00	\$ 3,840.00	\$ 16,340.00	Wireless intercom system
			\$ 19,750.00			\$ 9,600.00	\$ 29,350.00	AUDIO SUBTOTAL
Video	\$ 200.00	1	\$ 200.00	8	\$ 150.00	\$ 1,200.00	\$ 1,400.00	Electrician to relocate existing screen controls
			\$ 200.00			\$ 1,200.00	\$ 1,400.00	VIDEO SUBTOTAL
Lighting	\$ 2,000.00	1	\$ 2,000.00	64	\$ 120.00	\$ 7,680.00	\$ 9,680.00	Test system, replace lamps
Lighting	\$ 4,000.00	1	\$ 4,000.00	8	\$ 120.00	\$ 960.00	\$ 4,960.00	LED follow spot
			\$ 2,000.00			\$ 7,680.00	\$ 9,680.00	LIGHTING SUBTOTAL
Rigging	\$ 25,000.00	1	\$ 25,000.00	120	\$ 120.00	\$ 14,400.00	\$ 39,400.00	Add'l masking curtains, tracks, & cyclorama
Rigging	\$ 1,000.00	4	\$ 4,000.00	120	\$ 120.00	\$ 14,400.00	\$ 18,400.00	Add'l pipe battens
Rigging	\$ 3.00	24	\$ 72.00	8	\$ 120.00	\$ 960.00	\$ 1,032.00	Batten caps
			\$ 29,072.00			\$ 29,760.00	\$ 58,832.00	RIGGING SUBTOTAL
							\$ 99,262.00	TSU2 TOTAL (hard costs only)

NEEDHAM HS - TSU3								
Category	Material	Qty	Equipment	Hours	Rate	Labor	Extended	Notes
Audio	\$ 12,000.00	1	\$ 12,000.00	80	\$ 150.00	\$ 12,000.00	\$ 24,000.00	Mix position
Audio	\$ 5,000.00	1	\$ 5,000.00	24	\$ 120.00	\$ 2,880.00	\$ 7,880.00	Equipment rack
Audio	\$ 10,000.00	1	\$ 10,000.00	24	\$ 120.00	\$ 2,880.00	\$ 12,880.00	New mixer and stage box
Audio	\$ 3,000.00	1	\$ 3,000.00	24	\$ 120.00	\$ 2,880.00	\$ 5,880.00	Digital signal processor
Audio	\$ 1,500.00	16	\$ 24,000.00	12	\$ 120.00	\$ 1,440.00	\$ 25,440.00	Wireless microphones
Audio	\$ 1,000.00	1	\$ 1,000.00	32	\$ 120.00	\$ 3,840.00	\$ 4,840.00	Relocate wireless mic antennae to ceiling
Audio	\$ 7,500.00	1	\$ 7,500.00	4	\$ 120.00	\$ 480.00	\$ 7,980.00	Stock of mics, cables, stands, etc.
Audio	\$ 3,500.00	2	\$ 7,000.00	24	\$ 120.00	\$ 2,880.00	\$ 9,880.00	Add subwoofers
Audio	\$ 1,000.00	6	\$ 6,000.00	64	\$ 120.00	\$ 7,680.00	\$ 13,680.00	Delay loudspeakers

Audio	\$ 5,000.00	2	\$ 10,000.00	24	\$ 120.00	\$ 2,880.00	\$ 12,880.00	Replace amplifiers
Audio	\$ 7,500.00	1	\$ 7,500.00	80	\$ 120.00	\$ 9,600.00	\$ 17,100.00	Wired intercom infrastructure, belt packs, headsets
Audio	\$ 2,500.00	5	\$ 12,500.00	32	\$ 120.00	\$ 3,840.00	\$ 16,340.00	Wireless intercom system
Audio	\$ 12,000.00	1	\$ 12,000.00	60	\$ 150.00	\$ 9,000.00	\$ 21,000.00	Replace 3rd party control system (shared w/ video)
Audio	\$ 6,000.00	1	\$ 6,000.00	24	\$ 120.00	\$ 2,880.00	\$ 8,880.00	Install network (shared w/ video/lgt)
Audio	\$ 3,000.00	8	\$ 24,000.00	24	\$ 120.00	\$ 2,880.00	\$ 26,880.00	Portable acoustical shell
Audio	\$ 6,000.00	1	\$ 6,000.00	40	\$ 120.00	\$ 4,800.00	\$ 10,800.00	Ambient mics, replace/relabel plates, recorder
Audio	\$ 20,000.00	1	\$ 20,000.00	80	\$ 120.00	\$ 9,600.00	\$ 29,600.00	Acoustical wall panels
Audio	\$ 16,000.00	1	\$ 16,000.00	100	\$ 150.00	\$ 15,000.00	\$ 31,000.00	IG power/control system & receptacles
			\$ 189,500.00			\$ 97,440.00	\$ 286,940.00	AUDIO SUBTOTAL
Video	\$ 23,000.00	1	\$ 23,000.00	64	\$ 120.00	\$ 7,680.00	\$ 30,680.00	Replace projection screen, add processing/control
Video	\$ 1,500.00	1	\$ 1,500.00	16	\$ 120.00	\$ 1,920.00	\$ 3,420.00	Install projector
Video	\$ 6,000.00	1	\$ 6,000.00	24	\$ 140.00	\$ 3,360.00	\$ 9,360.00	Replace 3rd party control system (shared w/ audio)
Video	\$ 6,000.00	1	\$ 6,000.00	16	\$ 120.00	\$ 1,920.00	\$ 7,920.00	Install network (shared w/ audio/lgt)
Video	\$ 6,000.00	1	\$ 6,000.00	80	\$ 150.00	\$ 12,000.00	\$ 18,000.00	IG power/control system & receptacles
Video	\$ 10,000.00	1	\$ 10,000.00	24	\$ 120.00	\$ 2,880.00	\$ 12,880.00	Streaming system (camera, recorder)
			\$ 28,000.00			\$ 20,160.00	\$ 48,160.00	VIDEO SUBTOTAL
Lighting	\$ 2,250.00	60	\$ 135,000.00	120	\$ 120.00	\$ 14,400.00	\$ 149,400.00	LED color-changing fixtures, rep plot
Lighting	\$ 7,500.00	4	\$ 30,000.00	16	\$ 120.00	\$ 1,920.00	\$ 31,920.00	Minimal quantity of moving lights
Lighting	\$ 5,000.00	1	\$ 5,000.00	16	\$ 120.00	\$ 1,920.00	\$ 6,920.00	3rd party control system (shared w/ audio/video)
Lighting	\$ 12,000.00	1	\$ 12,000.00	80	\$ 150.00	\$ 12,000.00	\$ 24,000.00	Lighting booth/desk
Lighting	\$ 80,000.00	1	\$ 80,000.00	360	\$ 150.00	\$ 54,000.00	\$ 134,000.00	Power & control system, connector strips, plug boxes
Lighting	\$ 6,000.00	1	\$ 6,000.00	24	\$ 120.00	\$ 2,880.00	\$ 8,880.00	Install network (shared w/ audio/video)
			\$ 268,000.00			\$ 87,120.00	\$ 355,120.00	LIGHTING SUBTOTAL
Rigging	\$ -		\$ -		\$ -	\$ -	\$ -	
			\$ -			\$ -	\$ -	RIGGING SUBTOTAL
							\$ 690,220.00	TSU3 TOTAL (hard costs only)

NEEDHAM HS - TSU4								
Category	Material	Qty	Equipment	Hours	Rate	Labor	Extended	Notes
Audio	\$ -		\$ -		\$ -	\$ -	\$ -	
			\$ -			\$ -	\$ -	AUDIO SUBTOTAL
Video	\$ -		\$ -		\$ -	\$ -	\$ -	
			\$ -			\$ -	\$ -	VIDEO SUBTOTAL
Lighting	\$ 7,500.00	6	\$ 45,000.00	20	\$ 120.00	\$ 2,400.00	\$ 47,400.00	Add'l moving lights
			\$ 45,000.00			\$ 2,400.00	\$ 47,400.00	LIGHTING SUBTOTAL
Rigging	\$ 10,000.00	1	\$ 10,000.00	600	\$ 150.00	\$ 90,000.00	\$ 100,000.00	Remove stage ceiling and raise rigging
Rigging	\$ 40,000.00	4	\$ 160,000.00	300	\$ 120.00	\$ 36,000.00	\$ 196,000.00	Motorize lighting pipes
Rigging	\$ 40,000.00	3	\$ 120,000.00	240	\$ 120.00	\$ 28,800.00	\$ 148,800.00	Motorize valance pipes
			\$ 290,000.00			\$ 154,800.00	\$ 444,800.00	RIGGING SUBTOTAL
							\$ 492,200.00	TSU4 TOTAL (hard costs only)

NEEDHAM HS - AL1								
Category	Material	Qty	Equipment	Hours	Rate	Labor	Extended	Notes
Lighting	\$ 2,500.00	40	\$ 100,000.00	320	\$ 150.00	\$ 48,000.00	\$ 148,000.00	Architectural lighting replacement
Lighting	\$ 10,000.00	1	\$ 10,000.00	160	\$ 150.00	\$ 24,000.00	\$ 34,000.00	Architectural lighting controls
			\$ 110,000.00			\$ 72,000.00	\$ 182,000.00	LIGHTING SUBTOTAL
							\$ 182,000.00	AL1 TOTAL (hard costs only)

Needham PS

Theater Sound & Light Study

Committee Meeting 12/09/2022 (Minutes)

Organized Feedback

Room Use	Newman ES	Pollard MS	Needham HS
Classroom	X	X	X
Physical Education	X		
Dance	X	X	
Rentals	X	X	X
Turn around time between uses	X		X
Theatrical Plays/Musicals	X	X	X
Theater Class		X	X
Band Concerts	X	X	X
Band Practice / Class / Lessons	X	X	X
Choral Concerts	X	X	X
Choral Practice / Class	X	X	X
Poetry / Public Speaking		X	
Assemblies	X	X	X
Small Group Meetings	X	X	
Community Meetings	X	X	X

Needs: Generic	Newman ES	Pollard MS	Needham HS
Similar user experience between all 3 spaces (i.e. same control surfaces/systems)	X	X	X
Easy to use systems/technology	X	X	X
Ability to operate systems without numerous technicians	X	X	X
Reliable Equipment & Systems	X	X	X
Continuing Education / Training	X	X	X
Plan to update/replace equipment (before it reaches end of life / stops working)	X	X	X
Current Technology	X	X	X
Routine Maintenance	X	X	X
Technology that requires less maintenance	X	X	X
Safe Systems	X	X	X
Eliminate need for rental sound & light systems	X	X	X



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Needs: Sound	Newman ES	Pollard MS	Needham HS
Operational (permanently installed) system	X	X	X
Audio connectivity (in optimal locations)	X	X	X
Digital Mixer	X	X	X
More microphones (wired, wireless: lavs/handhelds, floor)	X	X	X
Sound system free from interference	X	X	X
Ability to stream/record	X	X	X
Built-in control desk/position		X	X
Improved room acoustics		X	X
Ability to have mic'd & non-mic'd performers	X	X	X
Better sound system	X	X	X
Acoustical shell	X	X	X
Alternate location for projection screen controls		X	X
More power		X	X
Connectivity for guitar amps (and other instruments)	X	X	X
Stage monitors	X	X	X
Ability for presets	X	X	X
Define/document what the normal/standard state is	X	X	X
Classroom setup	X	X	X
Production intercom	X	X	X
Green Room Audio	X	X	X

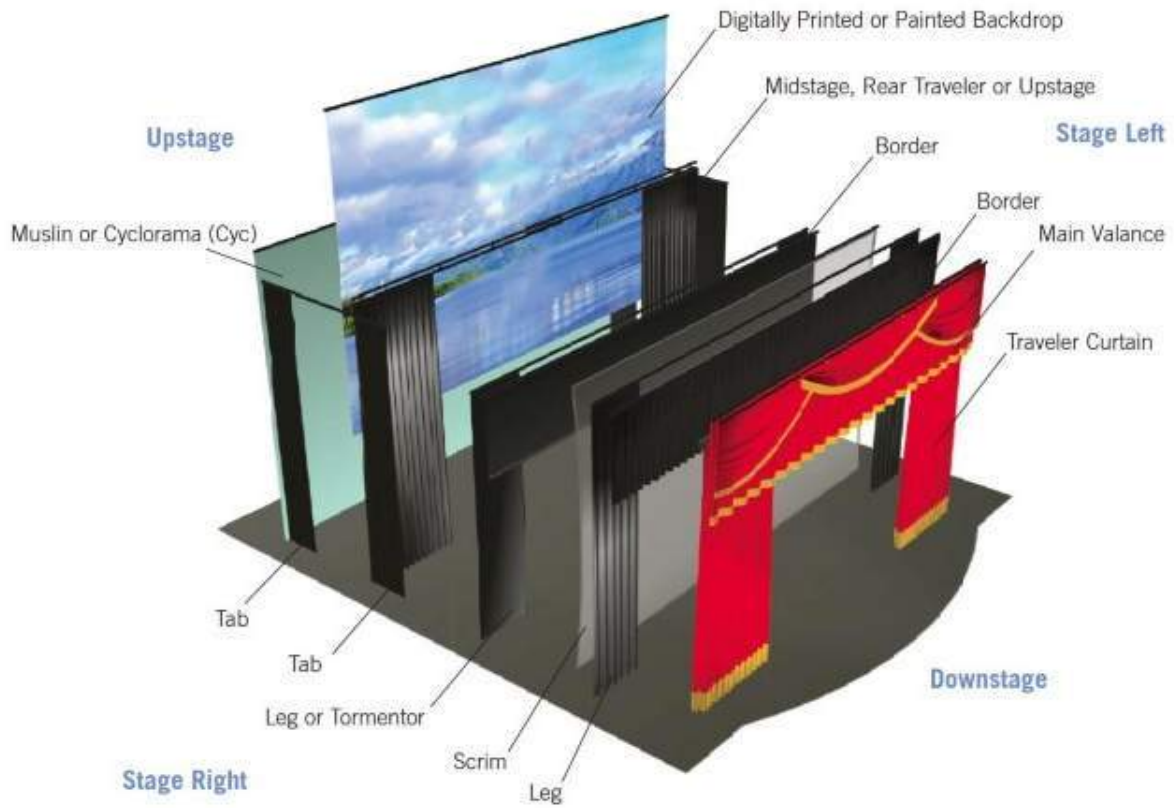
Needs: Lighting	Newman ES	Pollard MS	Needham HS
Brighter Stage (work) Lights	X	X	X
Stage lighting for band/choral	X	X	X
More theatrical lighting	X	X	X
Color-changing lighting	X	X	X
More power		X	X
Built-in control desk/position	Existing	X	X
Additional lighting positions (onstage, front, side, etc.)	X	X	X
Installed lighting controls	Existing	X	X
Lighting board	Existing	Existing	X
Architectural controls that are operational (and integrated w/ control board)	Existing	X	X
New followspots		X	X
Ability for presets (predefined and suitable for all uses)	X	X	X
Define/document what the normal/standard state is	X	X	X



Needs: Other (baed on current room use scenarios)	Newman ES	Pollard MS	Needham HS	Out of Scope
Installed video system	X	X	X	TBD
Scenic Projection	X	x		TBD
Relocate projection screen			X	TBD
Movable Rigging	X	X	X	TBD
Accessible Rigging	X	X	X	TBD
Ability to rig (can't due to hard ceilling)		X	X	TBD
Routine rigging inspections	X	X	X	TBD
Fire curtain routine inspections/testings	n/a	n/a	X	TBD
New curtain(s)		X	x	TBD
Fix stage floor, suitable floor for dance	X	X	X	X
Place to build sets (scene shop)	X	X	X	X
Build hard proscenium		X		X
Operational (repair/fix) motorized shades	n/a	n/a	X	X
Ability to load-in/out equipment / sets	X	X	X	X
Storage	X	X	X	X
Fix/repair rear wall (paint?)			X	X
Railing for choral risers	X	X		X
Labor & responsibility for restoring rooms/systems to standard state	X	X	X	X
Labor beyond student/volunteer	X	X	X	X
Not enough seating	X	X	X	X
Better wifi			X	X
Budget	X	X	X	X
Night/weekend support	X	X	X	X
Study is longer term, what about fixes now	X	X	X	
Theater Manager*	X	X	X	X
<i>*Who is responsbile for maintenance, repairs, inspections, upgrades, prepping/restoring for next use?</i>				
Booking & Use Policy**	X	X	X	X
<i>**Who is authorized to use systems? Can they move/change/reconfigure systems? How does anyone know if anything is damaged?</i>				
<i>***How does information get communicated to others? Perf arts, teachers, IT, and community, users not based in that school?</i>				
Notes:				
1. Dance lighting for all schools.				
2. Review power for all schools (i.e. for rental systems, add'l/augmented equipment)				
3. Moving lights for all would be beneficial.				
4. Consider how/when to upgrade systems. For example, should Newman ES be upgraded to it is current and then move on to the next?				
One comment: Newman is so heavily used, it would be best to get another theater online and usable to alleviate some of the pressure with use at Newman.				



Curtain Types



**Image courtesy of Rose Brand*



Rigging Terminology

Arbor Pit: Opening in the stage floor under the arbors that allows counterweight arbors to travel below stage level.

Synonym: Arbor Well, Counterweight Pit, Well

Arbor Rod: Vertical, round metal members of a Counterweight arbor.

Balance: When counterweight arbor load equally compensates the suspended load.

Synonym: In Balance

Batten: Horizontal pipe, tube, or other structural shape 1) for hanging scenery, lighting, curtains, etc.; 2) in a pocket of or attached to a fire safety curtain.

Synonym: Pipe

Batten Heavy: See “Out of Balance.”

Block: An assembly of one or more sheaves in a housing designed to support one or more lines.

Body Harness: Component of a personal fall arrest system consisting of straps that adjust to fasten around the body; use requires training.

Synonym: Harness, Safety Harness

Bowline: Popular knot that is used extensively because it is secure and easy to undo.

Box Truss: Truss consisting of 4 linear members.

Breaking Strength: The load at which failure will occur in a component.

Breasting: Laterally moving a suspended object.

Bridle: Two or more support lines running from multiple points to a single point.

Bull Line: Line used to lift or control an out of balance line set.

Carabiner: Hardware clip used for quick connections; may be load rated.

Synonyms: Biner, Crab, Krab

Chain Hoist: Manual or electric geared mechanical device that uses chain for lifting.

Synonyms: Chain Motor, Chain Fall, Hoist

Compression Fitting: Swage fitting used to terminate wire rope by means of crimping the fitting onto the rope.

Synonyms: Crimp, Nicopress[®] Sleeve, Oval Sleeve, Swage, Wire Rope Sleeve

Counterweight: A weight used to balance the load on a line that is being raised, lowered, or held in position.

Synonym: Brick, Pig, Stage Weight, Weight

Counterweight Arbor: A guided, movable rigid carriage assembly used to hold counterweights and to counterbalance a load.

Synonym: Counterweight Carriage

Counterweight Loader: Person who loads and unloads counterweight arbors.

Synonym: Loader

Dead End: End of a rope or part of a device that is not active or load carrying.

Synonym: Bitter End

Dead Hung: Suspension of an object in a fixed, nonadjustable position.

Design Factor: A ratio of the design load to the breaking strength of a material or component.

End Stop: 1) Position at the end of a traveling device; 2) Mechanical device that physically limits travel.

Fire Safety Curtain: Fire resistant barrier which closes off the proscenium opening in case of fire.

Synonyms: Asbestos (obsolete term), Fire Curtain, Proscenium Fire Safety Curtain, Safety Curtain



Fly Loft: The space between the roof and the performance area that is not visible to the audience.

Synonyms: Flies, Fly House, Fly Tower

Fly Rail: Operating position for a theatrical counterweight fly system.

Synonym: Rail

Go No-go Gauge: Piece of metal with slots that measures the accuracy of: 1) a crimp; 2) the spacing of chain links.

Gridiron: Over stage support structure consisting of regularly spaced members permanently affixed to the venue to support equipment.

Synonym: Grid

Guide Shoe: A component of a counterweight arbor assembly that engages the guide rails in order to maintain vertical alignment over the length of the arbor travel.

Head Block: The stationary block assembly above and closest to the counterweight arbor or pin rail. The head block permits lift lines to change direction. In some counterweight systems, the head block is also grooved to allow the operating line to change direction by 180 degrees.

Hemp House: Venue that uses ropes and sandbags primary rigging components.

Lanyard: Component of a personal fall arrest system that connects the safety harness to the anchorage point; use requires training.

Lift Line: Any fiber or wire rope reeved through block(s) and attached to a load. Lift lines operate singly, as spot lines, or in "sets" of several lift lines working together to support a load.

Line Set: A system of multiple lift lines, operated together to raise, lower, or suspend a load; all of the mechanical, component

subsystems required for supporting, positioning, and operating those lift lines as a system.

Loading Bridge: A load-bearing, elevated personnel access and work area, located to permit counterweight loading and unloading at the arbor.

Synonym: Loading Gallery

Locking Collar: A device placed on a counterweight arbor rod to reduce unintended vertical movement of counterweights on the arbor.

Locking Rail: A structural railing that supports the rope locks.

Loft Block: An overhead block through which one or more lift lines pass before being attached to the batten. A loft block typically permits the change of lift line direction in the vertical plane.

Operating Line: The line that an operator pulls to move, position or hold a counterbalanced load.

Synonyms: Hand Line, Purchase Line

Personal Fall Arrest System: System used to prevent an individual from falling from a working level; use requires training.

Rigging: General term for arrangements of hardware and systems for the raising, lowering, and suspending of scenery, properties, lighting, and similar loads.

Rope Lock: A positioning device, located on the locking rail that holds an operating line of a balanced counterweight set and prevents unintended movement.

Shackle: U shaped fastening device secured by a bolt or a pin through holes in the ends of the two arms.

Synonyms: Round Pin Shackle, Screw Pin Anchor Shackle; Pin Anchor Shackle, Bolt-Type Shackle



Single Purchase: A system of rigging employing weights, blocks and lines to hold or move a load of similar weight, using a 1:1 mechanical advantage for counterweight and batten load.
Synonym: Single Reeve

Spreader Plate: Plate that is installed between counterweight arbor rods to keep the rods from spreading during rapid travel or impact, preventing counterweights from falling out of the arbor.

Spike: Act of inserting a spike ribbon through an operating line, see “Spike Ribbon.”
Synonym: Stab

Swaging Tool: Manual or hydraulic tool for crimping compression fittings.
Synonym: Nicopress[®] Tool

Tension Wire Grid: System of interwoven wire rope that serves as a working platform.
Synonyms: Cable Grid, Izenour Grid, Sky Deck[®], Tension Grid, Wire Grid

Thimble: A grooved fitting around which a rope is bent to form an eye. It supports and protects the rope to prevent kinking and wear.

Toe Rail: Metal plate at the bottom edge that prevents objects from sliding through the opening.

Trim Chain: A length of chain and fittings used to connect a lift line to a batten (or other load) and adjust its level relative to the other lift lines along the batten.

Trim: To bring a rigging element to a defined height.
Synonym: Trim Height

Wire Rope Clip: Mechanical device used for terminating wire rope by means of a saddle, a U bolt and two nuts.
Synonym: Crosby

Working load limit (WLL): The maximum rated capacity of a component or system during normal operating conditions, as determined by the component manufacturer, or as determined by a qualified person for a specific application.

**Terminology derived from eSET Counterweight Rigging Lexicon and ANSI E1. 4 (2016): Entertainment Technology - Manual Counterweight Rigging Systems www.esta.org*



RIGGING AND SAFETY INSPECTION REPORT

for

Needham Public Schools

1330 Highland Avenue
Needham, MA 02492

at

Newman Elementary School

1155 Central Ave
Needham, MA 02492

Inspection Date: February 9, 2023

Report Date: February 17, 2023

Inspector: Brandon Creel

ETCP CR-T #948, ETCP CEE #1147, CTS #1336826, CTS-D #2338402



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Relevant Standards/Codes:

- ANSI E1.4-1 – 2016 Entertainment Technology - Manual Counterweight Rigging Systems
- ANSI E1.4.2 – 2021 Entertainment Technology – Statically Suspended Rigging Systems
- ANSI E1.8 – 2018 Entertainment Technology – Loudspeaker Enclosures Intended for Overhead Suspension
- ANSI E1.32 – 2012 (R2017) Guide for the Inspection of Entertainment Industry Incandescent Lamp Luminaires
- ANSI E1.46 – 2018 Standard for the Prevention of Falls from Theatrical Stages and Raised Performance Platforms
- ANSI E1.47 – 2020 Entertainment Technology - Recommended Guidelines for Entertainment Rigging System Inspections
- ANSI E1.53 – 2019 Overhead mounting of luminaires, lighting accessories, and other portable devices: specification and practice
- ANSI E1.56-2018 Entertainment Technology – Rigging Support Points
- ANSI/ASSP Z359 Fall Protection Code
- Americans with Disabilities (ADA)
- OSHA Standards for General Industry 29 CFR Part 1910 and 1919
- National Fire Protection Association (NFPA)
- NFPA 70: National Electrical Code (NEC)
- NFPA 204: Standard for Smoke and Heat Venting
- International Building Code (IBC)
- Uniform Commercial Code (UCC)

Introduction:

This rigging system inspection serves many purposes. First, it keeps the school district and venue in conformance to ANSI and OSHA standards with respect to inspections. It also identifies and documents any safety concerns and deficiencies in the system.

Received Documents:

Y/N:	Item:	Y/N:	Item:
N	As-built drawings	N	Maintenance logs
N	Operation manuals	N	Previous inspection reports
N	Known modifications	N	Curtain flame certificates
N	Reports of known issues or incidents	N	Records of user training

General Description:

The theater consists of a proscenium stage, one-level sloped seating area, two catwalks, stage curtains, lighting system, audio system, video system, and control booth. The stage measures 73'-10" x 25'-6" x 2'-



6" (WxLxH) and the proscenium arch, 37'-10" x 17'-0" (WxH). The bottom of the rigging steel is 26'-7 1/2" above the stage floor and the roof is 27'-10" high. The rigging system consists of dead hung linesets. There is a modular and removable stage thrust. On stage right is the lighting equipment rack. On stage left is a company switch.

The system was installed in approximately 2012, aging the system at 11 years. No manufacturer was identified for the stage rigging system, most of which is steel pipe, chain, and hardware. The curtain tracks were manufactured by H&H Specialties, majority of curtains by Walker Specialties Inc, loudspeakers by Fulcrum Acoustic with rigging by Polar Focus and ATM Fly-ware. The projector is by Digital Projection, screen by Draper, and lighting controls and distribution by ETC. Lighting fixtures are largely by ETC. The modular stage thrust is by Staging Concepts with skirting by Snap Drape. The ceiling structure consists of open web steel joists supported by perpendicular open web steel trusses.

Lineset Schedule:

- H. Projector
- G. Loudspeakers (delays)
- F. FOH 2 electric (catwalk)
- E. Tormentors
- D. Loudspeakers (left, center, right)
- C. FOH 1 electric (catwalk)
- B. Apron side pipes
- A. Apron electric
- 0. Datum
- 1. Projection screen
- 2. Main traveler (280 series track)
- 3. 1st electric
- 4. Legs (rotodrapers)
- 5. Valance
- 6. Midstage traveler (280 series track)
- 7. 2nd electric
- 8. Valance
- 9. Scenic track (280 series track)
- 10. Legs
- 11. 3rd electric
- 12. Valance
- 13. Upstage traveler (170 series track)
- 14. Cyclorama



Deficiencies Requiring Immediate Action:

1. Linesets are suspended with proof coil chain (grade 30) that wraps the joists and structural steel. Proof coil chain is not designed or permitted to wrap sharp corners which side loads the links. (9,10,11,19,23,24,34,40)
 - a. Install beam clamps and/or shouldered, forged, plated, and load rated eyebolts. Connect chain to eyebolts with bolt-type shackles.
2. A turnbuckle suspending the center loudspeaker cluster uses a piece of electrical wire in lieu of a cotter pin. (6)
 - a. Remove the wire and install a cotter pin to secure the pin.
3. Both catwalks have railings that are too high, distance between horizontal members is too large, and do not comply with building codes. (8)
 - a. Provide additional horizontal railings between the catwalk and each horizontal member. Consider providing a personal fall arrest system as users need to reach out beyond the railings to adjust and accessorize the fixtures.
4. In the catwalk are followspots on wheels which is extremely dangerous as they could tip over and fall onto the seating area below. (8)
 - a. Discontinue use of the wheels/dollies and bolt/clamp the followspot column onto the catwalk railing. Install a safety cable. Remove the folding chairs.
5. Lineset B is sloped and the chain is connected to the pipe at the end, which is dangerous as it may slide off. (10)
 - a. Remove the chain assembly and install an engineered solution that uses batten clamps.
6. The mirror ball is suspended with chain that is taped at the termination point. (11)
 - a. Remove the mirror ball assembly in its entirety or properly install it.
7. The projector mount is anchored in the rear wall which contains unused holes. (12)
 - a. The projector weighs 115 lbs and with an abundance of caution, investigate the mount's weight capacity and attachment method and wall's capacity. It is suggested to suspend the projector from the structure above.
8. The modular removable stage thrust is not installed according to the manufacturer's instructions. The leg clamps must be installed on the lower half of the legs. The diagonal braces must be installed. Rope is not an acceptable connection method. (14,15,16)
 - a. Install all legs, clamps, and braces per the manufacturer's instructions. Replace any damaged or missing parts.
9. The stage thrust skirting contains a tag which reads, "Flame Retardant," with no mention if it is inherently flame retardant or treated with a flame retardant agent. (16)
 - a. Perform flame test and retreat as needed or replace skirting with inherently flame retardant fabric.
10. The main traveler, main valance, and black masking curtains all contain a tag stating the fabric has been treated to be flame resistant and annual testing is recommended. (17)
 - a. Perform flame test and retreat as needed or replace curtains with inherently flame retardant fabric.



11. The cyclorama has a homemade tag which contains the letters “IFR” which likely stands for inherently flame retardant. But there is no manufacturer or date of fabrication which makes traceability difficult. (18)
 - a. Perform flame test and retreat as needed or replace cyclorama with inherently flame retardant fabric.
12. The upstage traveler curtain does not have a tag stating the flammability.
 - a. Perform flame test and retreat as needed or replace the traveler with inherently flame retardant fabric.
13. In the house are ceiling clouds which are suspended from pipes spanning roof joists. Adjacent to the proscenium, the pipe is connected to the joists with chain, which is not designed or permitted to wrap sharp corners due to side loading the links. (19,20)
 - a. Install B-Line B422 beam clamps and remove the chain.
14. One suspension point on Lineset A is terminated with a quick-link that is not fully closed. (21)
 - a. Tighten the quick-link nut.
15. Lineset 3 contains suspension points that use jack chain which is not rated for overhead use and has a low load rating, if any. (22)
 - a. Replace chain with welded link chain and terminate with bolt-type shackles. All hardware to be plated or painted to prevent rust and corrosion. Install an engineered solution to trapeze around the duct.
16. Two suspension points use cantilevered strut channel and the chain goes through the slots which contain sharp edges. (23)
 - a. Remove cantilevered strut channel and install strut channels that span two joists. Install shouldered, forged, plated, and load rated eyebolts and attach chain with a bolt-type shackle.
17. In addition to item 1 above, lineset 14 is suspended with chain that wraps the bottom chord of the joists beyond the diagonal web members. That is, the chain could easily slide off the end of the joists. There is a wood batten through the joist web. (24)
 - a. Install beam clamps and/or shouldered, forged, plated, and load rated eyebolts. Connect chain to eyebolts with bolt-type shackles. Remove the wood batten which is not in use.
18. In two locations, the suspension point is no longer connected which doubles the span. In the case of the midstage traveler, it is cantilevered. (25,27,28)
 - a. Reconnect the rigging points.
19. The pipe splice on a valance lineset contains through bolts which are not long enough to fully penetrate the nylon part of the locknut. (30)
 - a. Replace with longer bolts so the threads fully engage the nylon locknut.
20. The pipe battens on the stage electrics are not spliced. While they have an insert, it is not mechanically secured in place. (31)
 - a. Install (4) through bolts to create a proper splice.
21. The projection screen is suspended with eyebolts which are not oriented correctly. Also, the mounting plates are bent. (32)
 - a. Replace the mounting plates with new and turn the eyebolts 90° so they are in line with the load path.



22. Lineset 5 is suspended with chain that wraps the pipe at the end, which is dangerous as it may slide off. The shackle has a bolt installed in lieu of the pin. (37)
 - a. Install a batten clamp and connect to the chain with a bolt-type shackle. Replace the shackle with new.
23. A round pin shackle has its cotter pin improperly installed. (38)
 - a. Install both ends of the cotter pin through the round pin and secure per the manufacturer's instructions.
24. A fluorescent stage work light louvre assembly is hanging down. (44)
 - a. Reinstall and secure the louvre.
25. A fixture's whip is likely to contain asbestos. (46)
 - a. Remove and dispose of fixtures as required.

Deficiencies Requiring Attention Within 1-Year:

1. Screw pin anchor shackles and turnbuckles require a secondary means to prevent pin/body rotation (loosening). (1,2,3,4,5,6)
 - a. Install a nylon tie wrap on each shackle and turnbuckle such that the pin/body cannot rotate or loosen.
2. On several loudspeakers, the rear wire rope is terminated with a eye glider which requires the rear nut to be tightened for proper holding. However, the nut is not installed. (2,3,5)
 - a. Install the glider nut and tension it.
3. The eyebolts in the loudspeaker are not oriented in line of the load path. (3,4,5)
 - a. Rotate the eyebolts 90°.
4. Spot lighting fixtures have safety cables installed around the yoke. All fixtures should have safety cables installed according to the manufacturer's instructions. (7)
 - a. Install the safety cable through the dedicated safety point on the fixture's body.
5. The tormentor pipe assemblies contain threaded couplers. ANSI standards do not permit threaded couplers/connections to be used in stage rigging applications as the pipe battens can rotate causing the connection to come undone. (13)
 - a. Replace with welded pipe assembly.
6. The onstage electrics are suspended from threaded rod with eye socket rod hanger adapters, which are not intended for stage use and have a low load rating. The span exceeds the allowable span of 5'-0". (26,45)
 - a. Replace eye socket rod hanger adapters with eye nuts and connect to the connector strip brackets with bolt-type shackles (or clevis/yoke end). Install additional points (or brackets) so the connector strip is supported every 5'-0" maximum.
7. One suspension point is formed with chain to create a bridle. The angle is steep and chain is not intended to be used in this manner. (34)
 - a. Remove chain bridle and install strut channel to provide plumb suspension point.
8. On lineset 9, the track's operating line is not in the live end pulley, making it difficult to operate. (39)
 - a. Adjust the operating line so it is routed through the pulley.
9. There are unused pieces of hardware in the system. (42,43)



- a. Remove unused hardware from the rigging system.
10. A homemade power adapter was found in the catwalk for the mirror ball motor. It utilizes a light-duty orange power cord and an old style stage pin plug. (47)
 - a. Dispose of the adapter and purchase a premade adapter.
11. Some seats at the aisles have integrated lights, which are powered from the aisle thresholds. The whips are too long and protrude into the aisle where people are walking. And most were damaged and have exposed conductors. (50)
 - a. Contact an electrician to shorten the whips and reconnect them securely into the thresholds.
12. On stage left are two locations of cleats which are typically used with hemp rigging system, which the school does not have. There is no load rating posted. (53)
 - a. Remove the cleats, wood blocking, and anchors.
13. The backstage crossover has excess number of wood set pieces. Excess storage of combustible materials is not advised. (55)
 - a. Remove all items that are no longer needed and properly stow the remaining items.
14. On top of the ceiling clouds were two pieces of wood. Ceiling clouds are not intended for storage of anything. (56)
 - a. Remove the wood and any other debris, trash, and items.
15. Multiple fluorescent work lights were not operational or flickering.
 - a. Replace lamps and test.

Deficiencies Requiring Action When Time and Funding Allows:

1. The rear point on the loudspeaker hanging bracket is not under tension. (2)
 - a. Remove one link in the load path or shorten the chain and install a turnbuckle to adjust tension.
2. Center stage, where the biparting traveler track overlaps, it is suspended from a single point which uses 3 links of chain to create a bridle. Chain is not to be used in this manner. (29)
 - a. Install a pear ring with shackles to form a proper bridle.
3. A nut on the connector strip bracket is a hex nut and not a lock nut. (33)
 - a. Replace with a nylon lock nut.
4. One floor pulley is taped to the stage and another is floating. Floor pulleys should be screwed to the stage floor. (35,36)
 - a. Remove tape, screw pulleys to the floor, and retention the operating line.
5. Upstage of the 3rd electric, there are suspension points (chains), which aren't attached to anything. (40)
 - a. Remove the unused suspension points in their entirety.
6. A lighting control keypad had a broken cover. The keypad is still operational but not secure from unauthorized use. (48)
 - a. Contact the manufacturer for a replacement cover.
7. Two house left wall sconces were not operational. (49)
 - a. Contact an electrician to troubleshoot and repair as needed.
8. On lineset 11 on stage left, a cyclorama fixture is missing two filters and one fan cover (grille). (51)



- a. Contact the manufacturer for replacement parts.
9. The tambour on the lighting control desk is damaged. (52)
 - a. Contact the manufacturer to determine if it is repairable or needs to be replaced.
10. There is no rigging safety signage posted.
 - a. Contact a rigging contractor to provide safety signage which must state the allowable load ratings of the system. Require the rigging contractor to engage a structural engineer in determining the load ratings.

Other Notes and Recommendations:

1. It is suggested to paint all fall or trip hazards caution yellow.
2. All pipe battens should have yellow safety caps with load rating and line set information clearly marked. (41)
3. ANSI and OSHA require documented rigging inspections at least annually.
4. The following systems were not inspected:
 - a. Portable ladders
 - b. Fire alarm system
 - c. Emergency lighting system
5. National Electrical Code (NEC) requires 36" minimum clearance in front of all electrical panels. (54)

Final Conclusion:

Below (see Appendix A) are a few photos which capture several of the issues mentioned in this report, however not all problems are easily identifiable to an untrained reader. After inspecting the system, Hewshott advises that all the items enumerated in the "Deficiencies Requiring Immediate Action" section are addressed. In addition, prior to the next annual inspection, all items in "Deficiencies Requiring Attention Within 1-Year" should be addressed. The other items listed in this report are not as critical and can be budgeted and addressed as time and funding allows. High resolution photos are available by request.

Some items are simple housekeeping items and can be addressed by the School's staff while others are specialized and should be performed by a professional, reputable, and ETCP certified rigging contractor.

A Maintenance and Inspection Log is attached. Please post on a stage wall in clear view.

If you have any questions or concerns about any items detailed in this report, please contact us. Thank you.



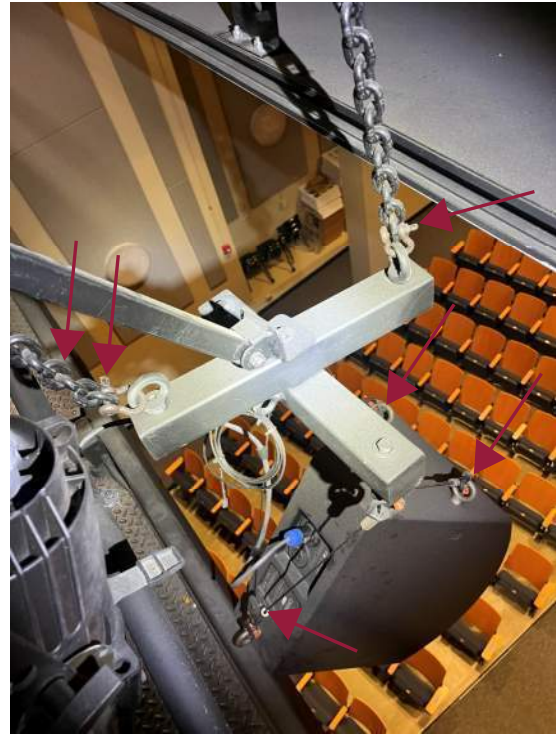
Regards,

A handwritten signature in blue ink, appearing to read "Be 8 cl". The signature is written in a cursive, somewhat stylized font.

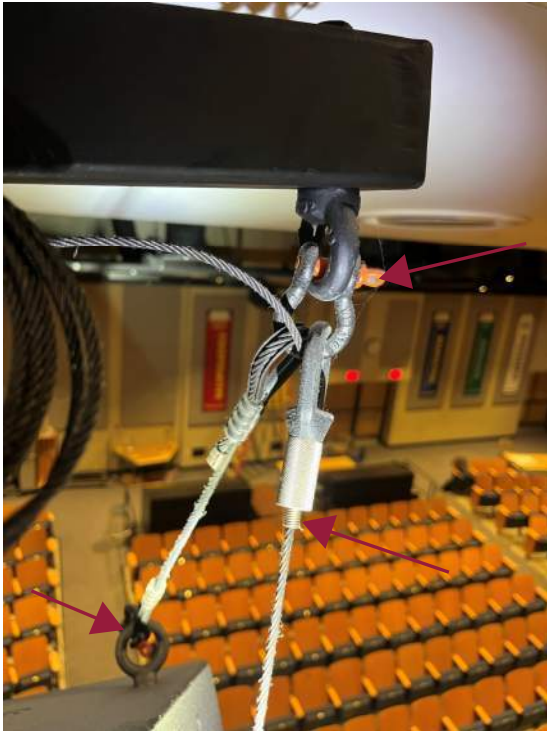
Brandon Creel, ETCP CR-T #948, ETCP CEE#114, CTS #1336826, CTS-D #2338402



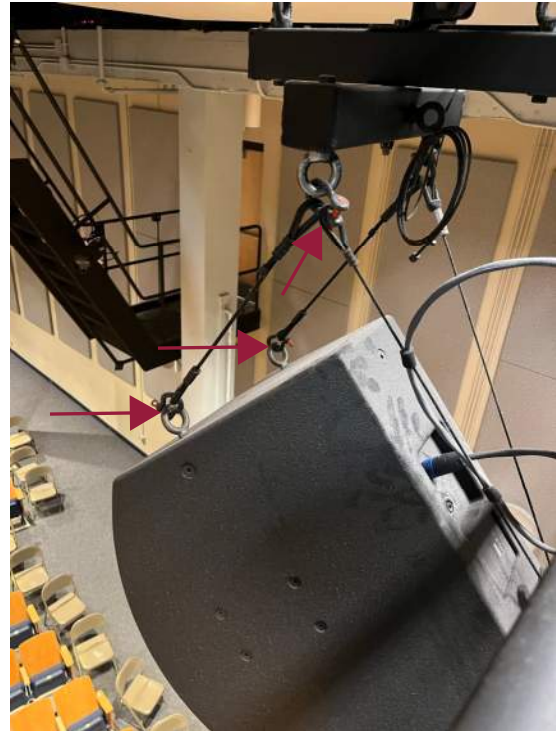
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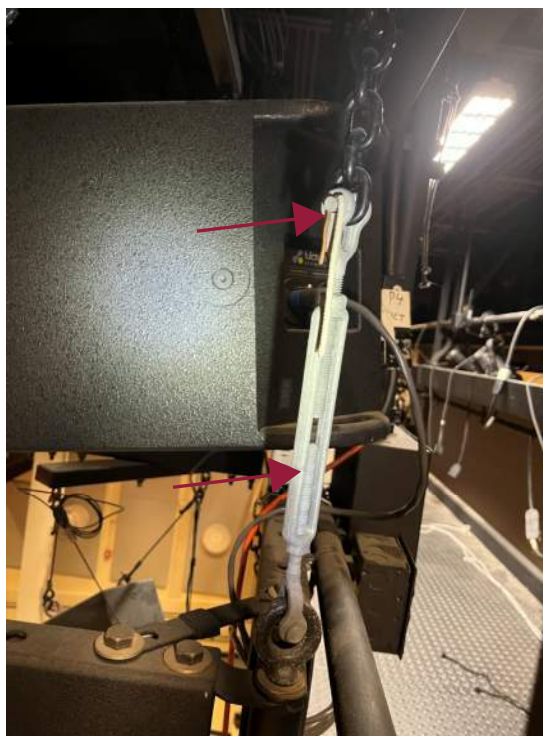
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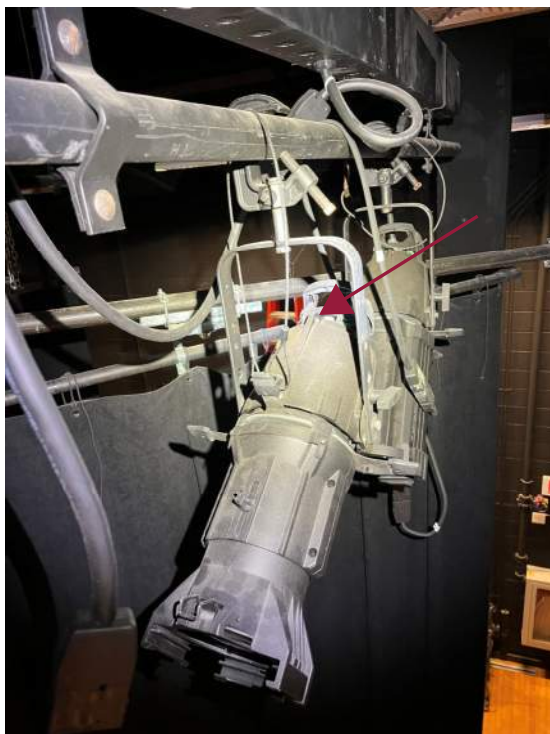
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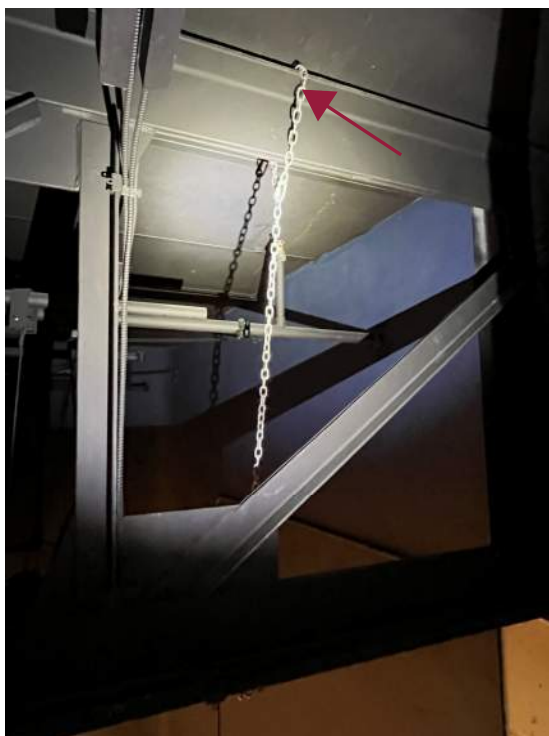
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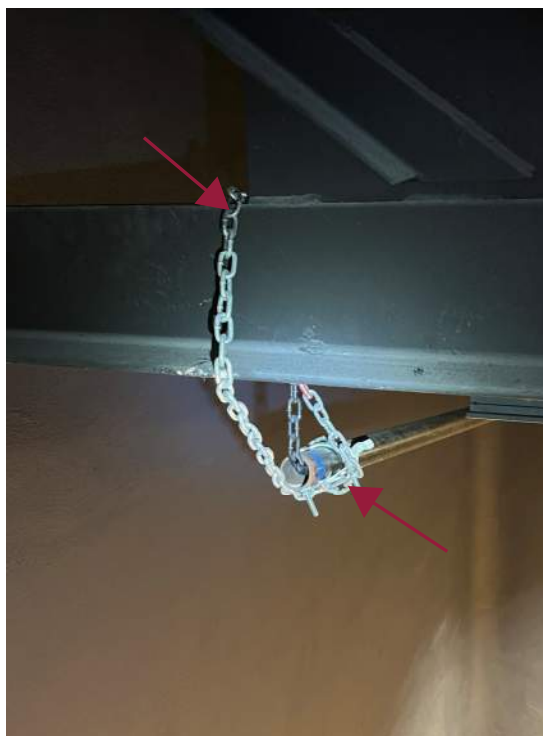
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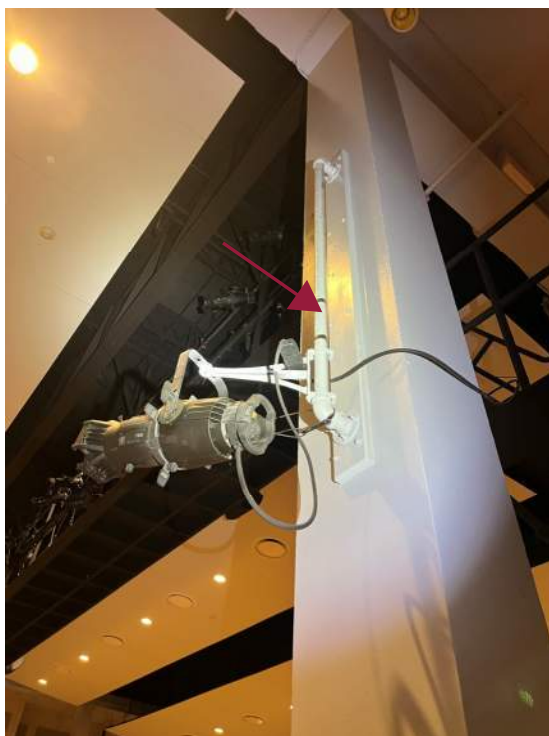
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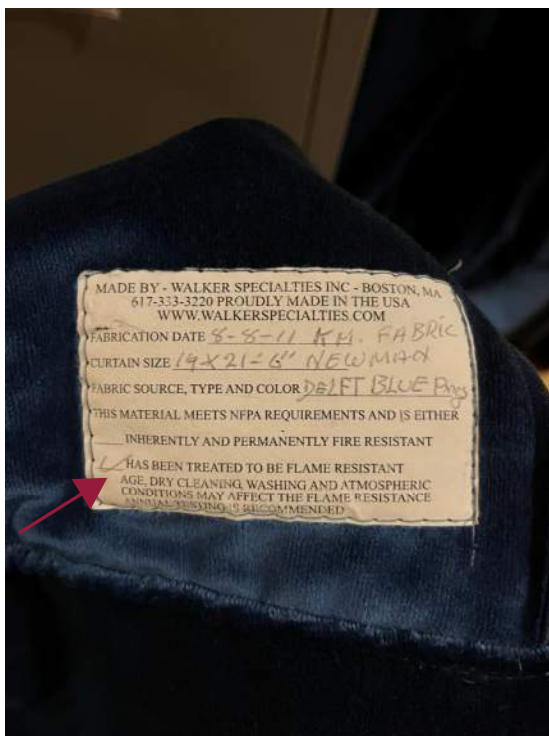
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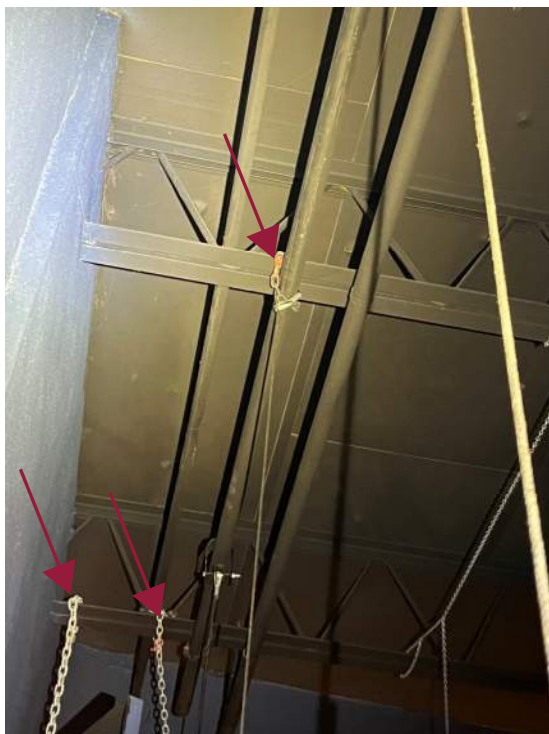
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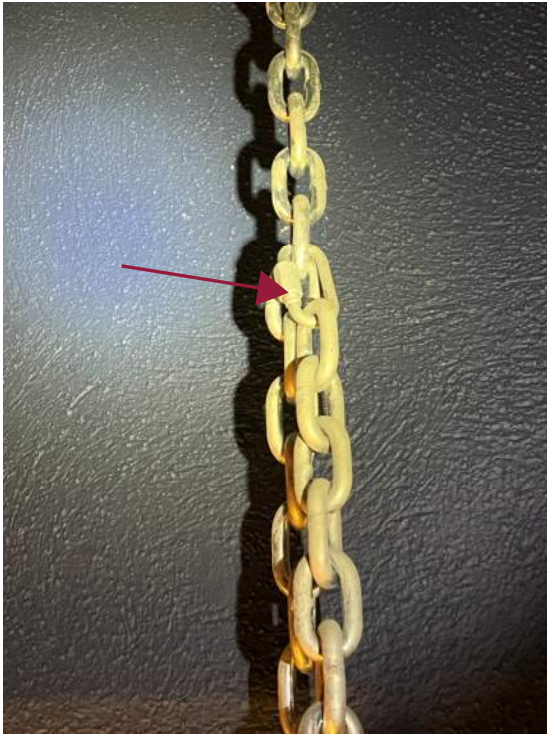
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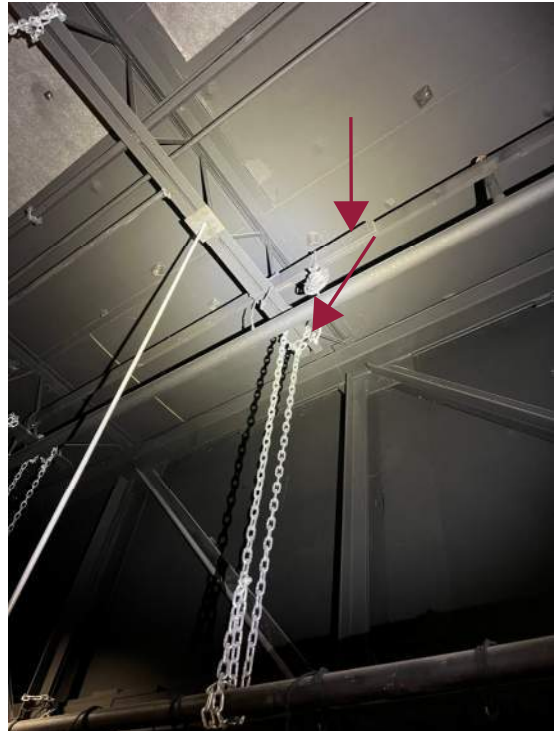
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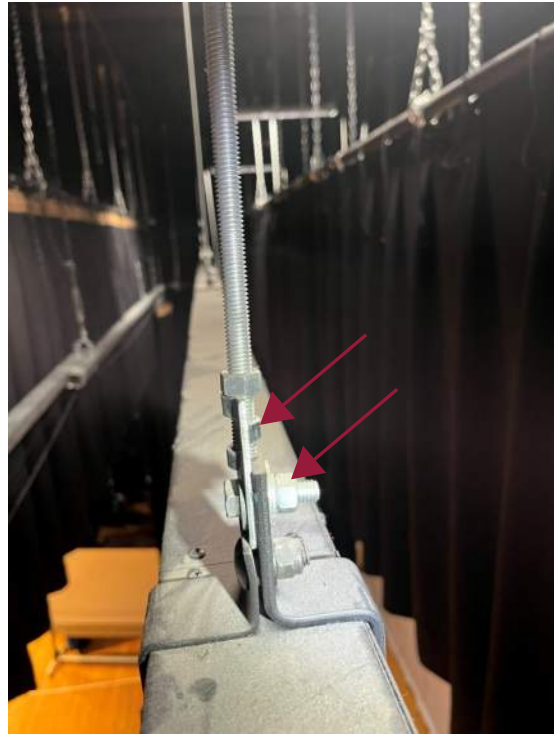
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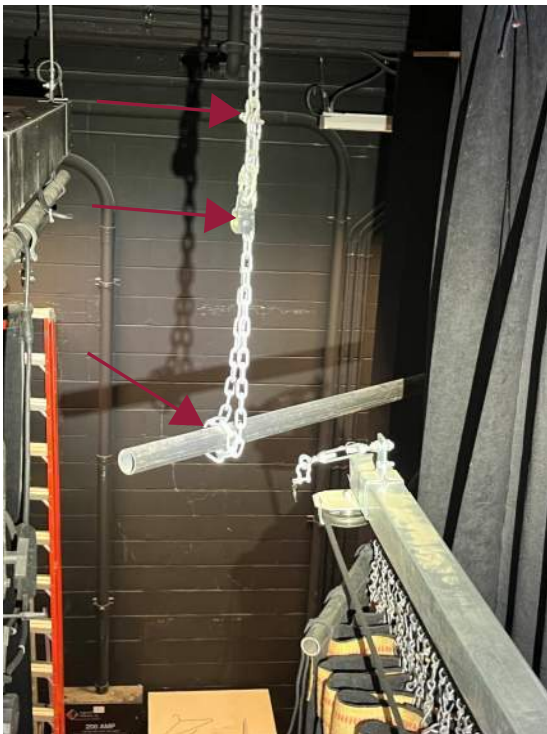
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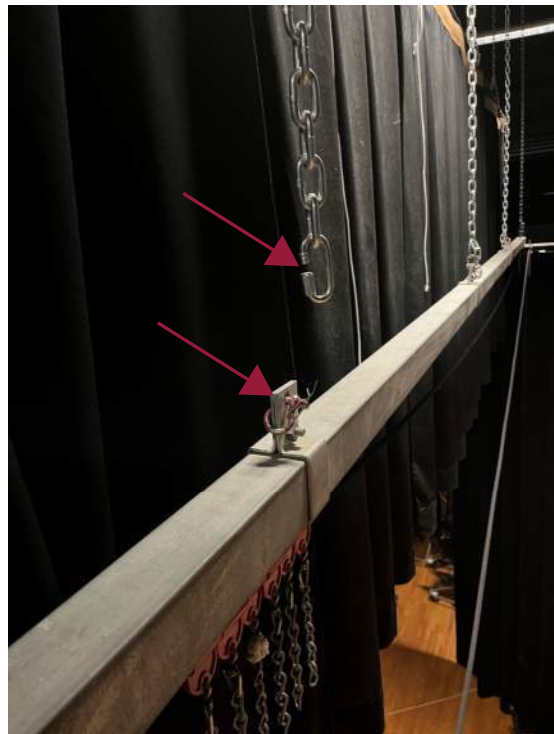
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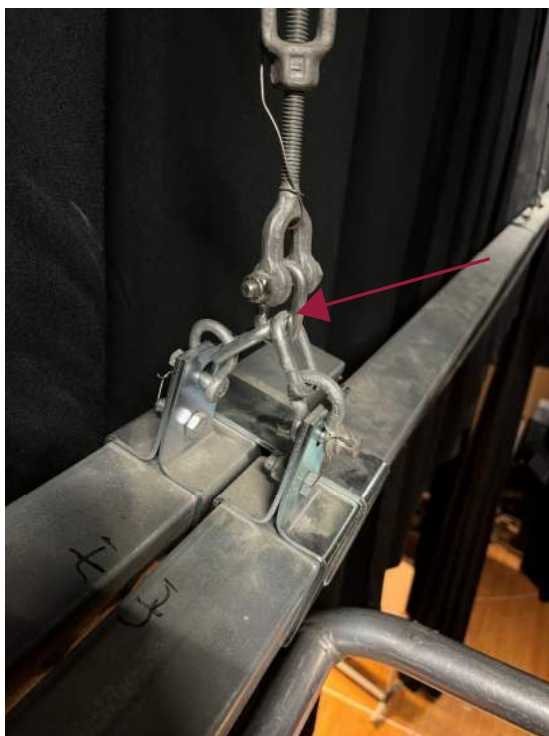
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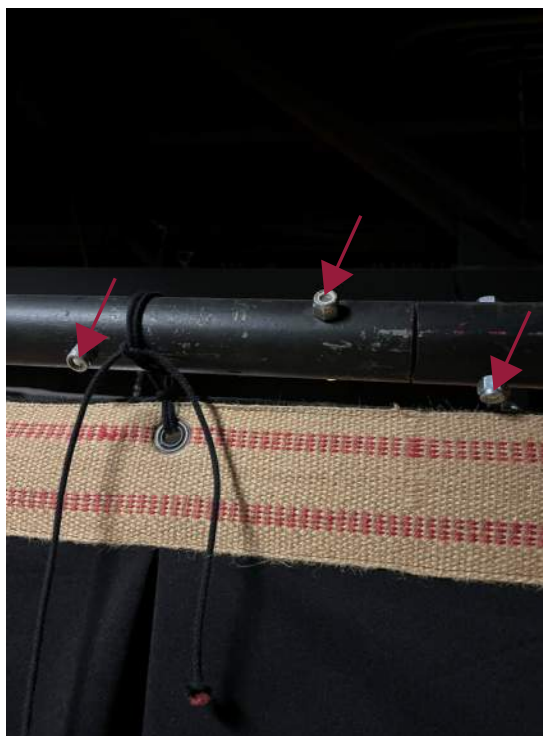
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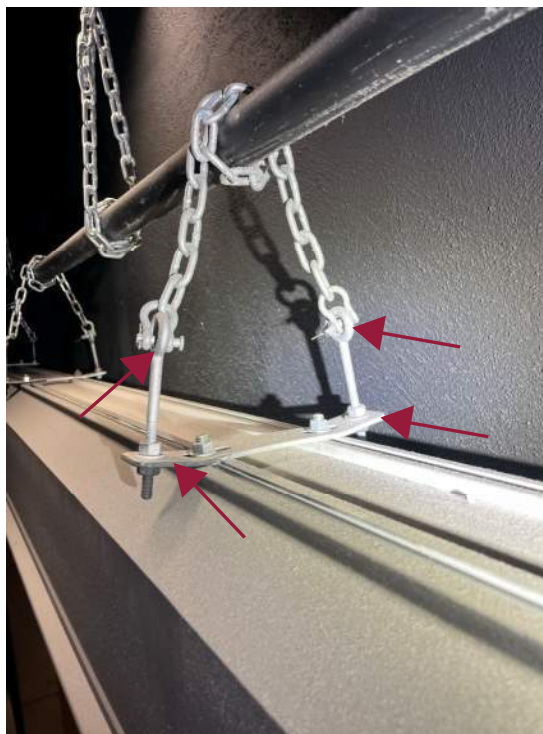
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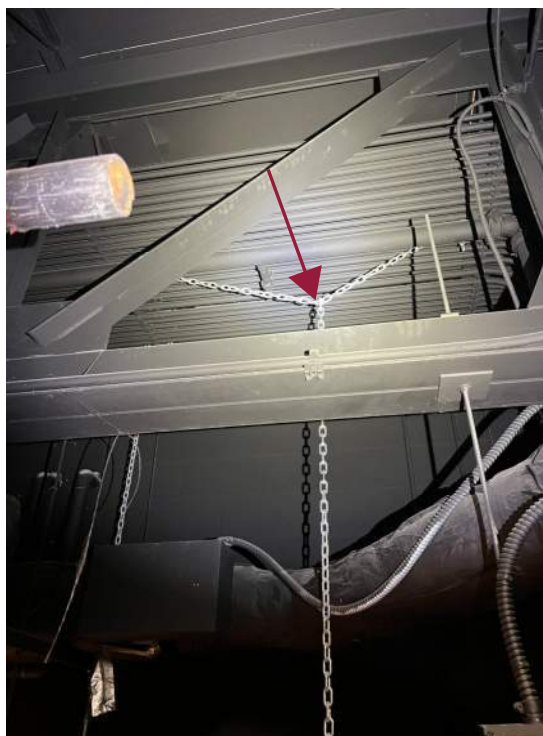
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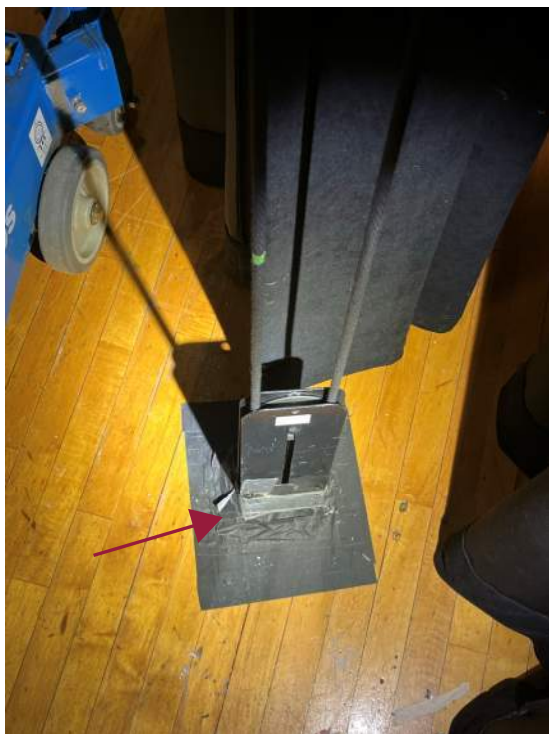
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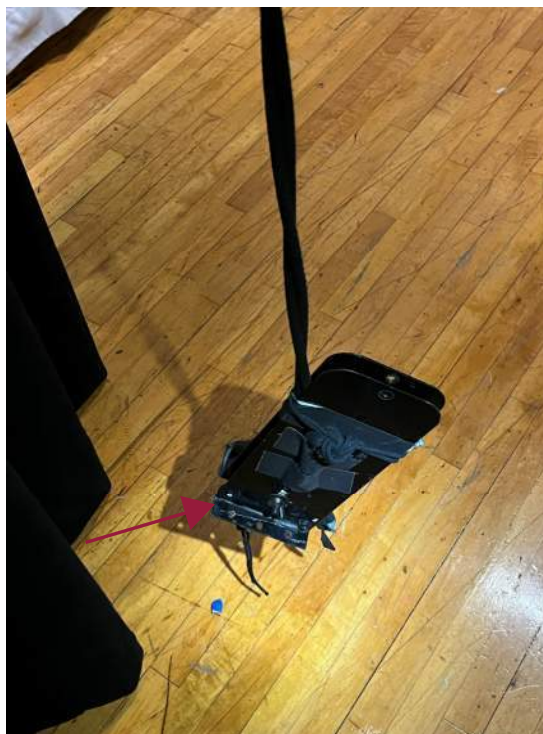
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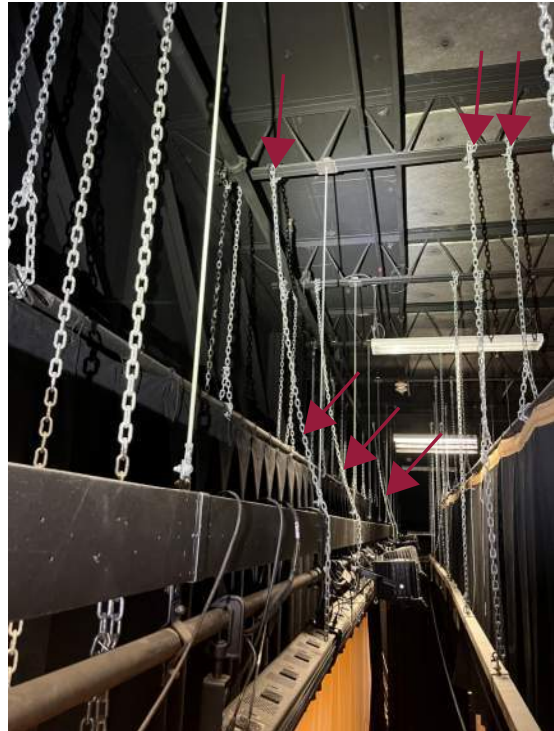
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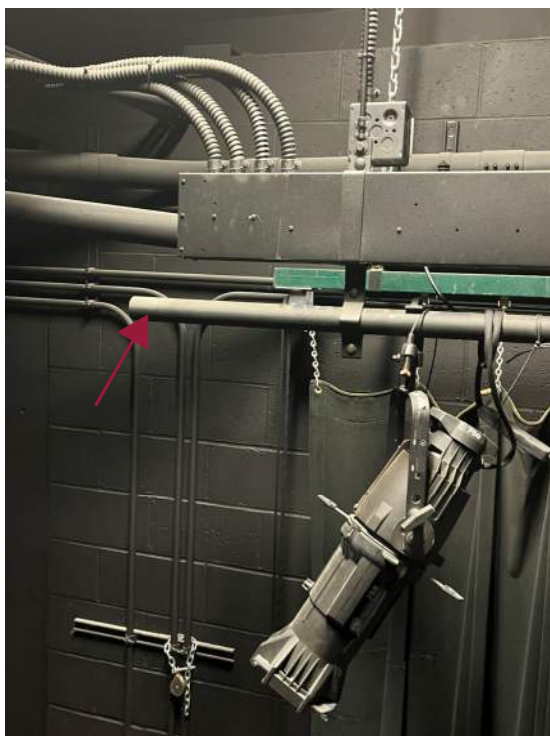
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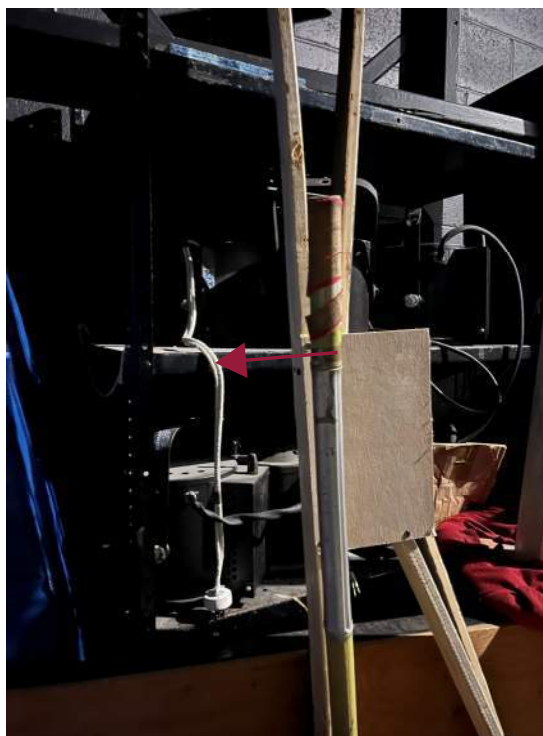
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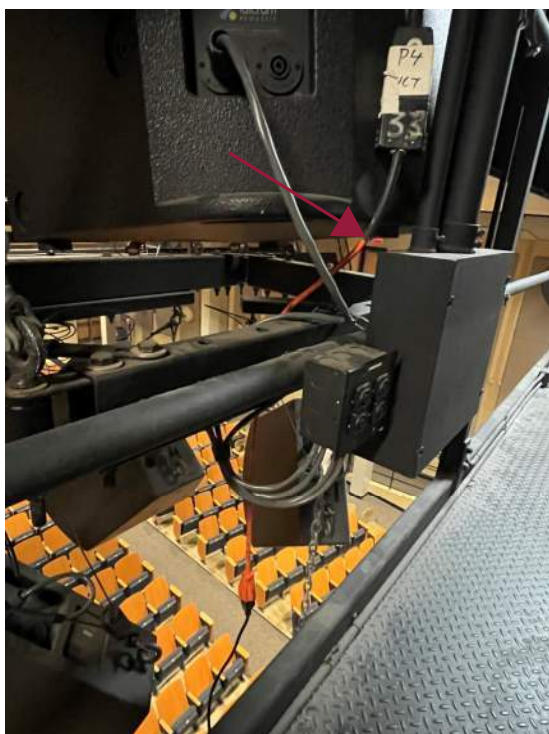
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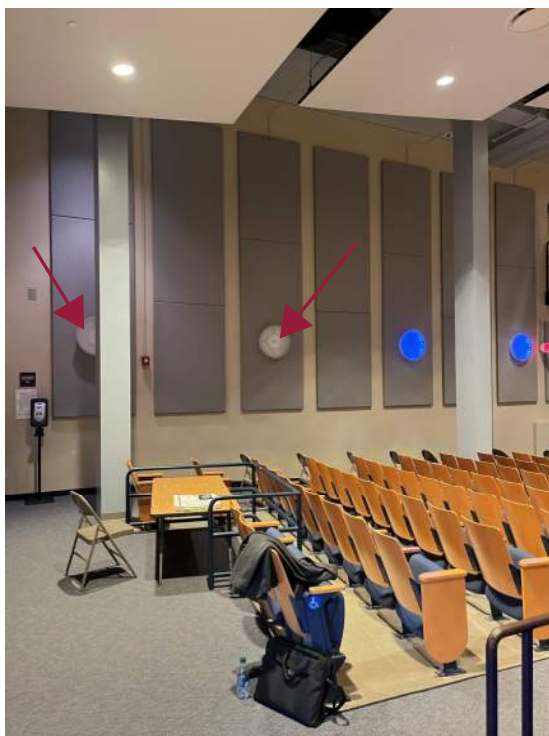
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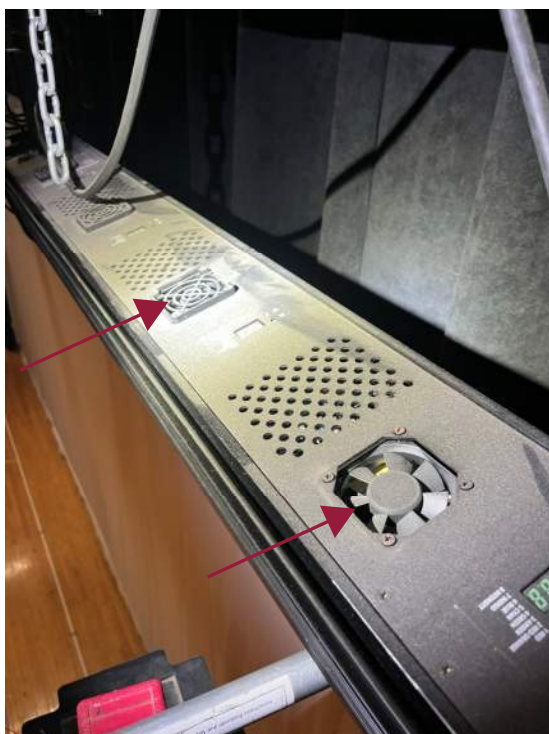
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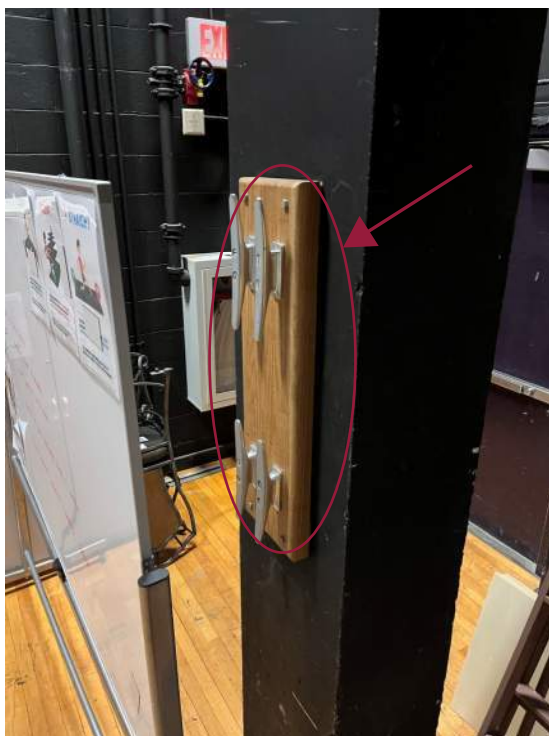
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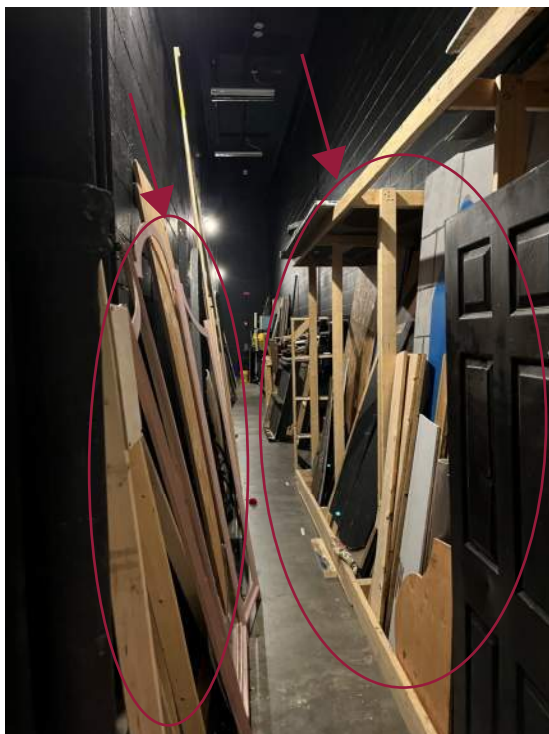
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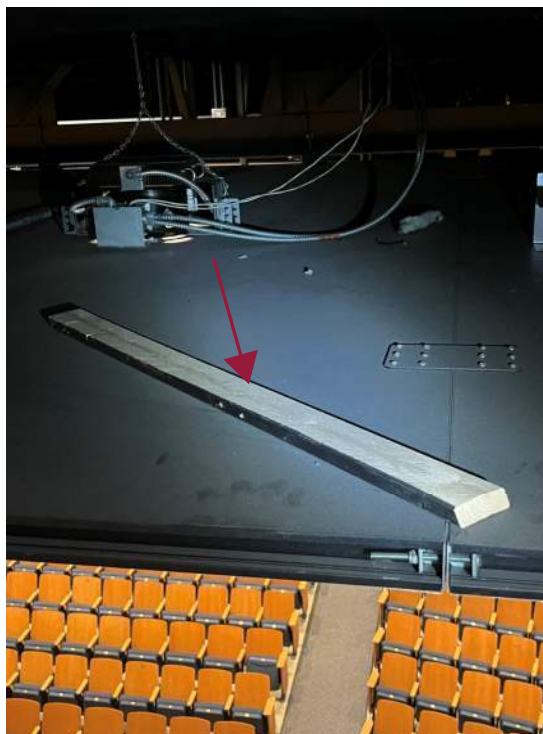
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RIGGING AND SAFETY INSPECTION REPORT

for

Needham Public Schools

1330 Highland Avenue
Needham, MA 02492

at

Pollard Middle School

200 Harris Ave
Needham, MA 02492

Inspection Date: February 8, 2023

Report Date: February 17, 2023

Inspector: Brandon Creel

ETCP CR-T #948, ETCP CEE #1147, CTS #1336826, CTS-D #2338402



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Relevant Standards/Codes:

- ANSI E1.4-1 – 2016 Entertainment Technology - Manual Counterweight Rigging Systems
- ANSI E1.4.2 – 2021 Entertainment Technology – Statically Suspended Rigging Systems
- ANSI E1.8 – 2018 Entertainment Technology – Loudspeaker Enclosures Intended for Overhead Suspension
- ANSI E1.32 – 2012 (R2017) Guide for the Inspection of Entertainment Industry Incandescent Lamp Luminaires
- ANSI E1.46 – 2018 Standard for the Prevention of Falls from Theatrical Stages and Raised Performance Platforms
- ANSI E1.47 – 2020 Entertainment Technology - Recommended Guidelines for Entertainment Rigging System Inspections
- ANSI E1.53 – 2019 Overhead mounting of luminaires, lighting accessories, and other portable devices: specification and practice
- ANSI E1.56-2018 Entertainment Technology – Rigging Support Points
- ANSI/ASSP Z359 Fall Protection Code
- Americans with Disabilities (ADA)
- OSHA Standards for General Industry 29 CFR Part 1910 and 1919
- National Fire Protection Association (NFPA)
- NFPA 70: National Electrical Code (NEC)
- NFPA 204: Standard for Smoke and Heat Venting
- International Building Code (IBC)
- Uniform Commercial Code (UCC)

Introduction:

This rigging system inspection serves many purposes. First, it keeps the school district and venue in conformance to ANSI and OSHA standards with respect to inspections. It also identifies and documents any safety concerns and deficiencies in the system.

Received Documents:

Y/N:	Item:	Y/N:	Item:
N	As-built drawings	N	Maintenance logs
N	Operation manuals	N	Previous inspection reports
N	Known modifications	N	Curtain flame certificates
N	Reports of known issues or incidents	N	Records of user training

General Description:

The theater consists of a proscenium stage, one-level sloped seating area, stage curtains, lighting system, audio system, video system, and a lighting control booth. The stage measures 64'-6" x 27'-10" x 2'-3"



(WxLxH). The stage has a hard ceiling at 11'-1" above the stage floor. The rigging system consists of dead-hung linesets. On stage right is the audio equipment rack, electrical panel, and portable dimmers.

The age of the system is unknown. The curtains were replaced in 2010, aging them at 13 years. No manufacturer was identified for the stage rigging system, most of which is steel pipe, chain, and hardware. The curtain tracks were manufactured by Automatic Devices Company and most curtains by Limelight. The loudspeakers are by JBL. The ceiling structure consists of open web steel joists.

Lineset Schedule:

- D. FOH 2 electric
- C. Projector
- B. FOH 1 electric
- A. Side lighting position (house right only)
0. Datum
1. Main valance
2. Projection screen
3. Main traveler (280 series track)
4. 1st electric
5. Valance
6. Traveler (280 series track)
7. 2nd electric (via 2 ceiling ports) / recessed down lights
8. Work lights
9. Recessed down lights
10. Valance
11. Upstage traveler (280 series track) (angled panels are 170 series track)

Deficiencies Requiring Immediate Action:

1. The fixture's whip has exposed conductors due to the overall sheathing coming out of the plug. (2,22)
 - a. Reterminate the plug such that the sheathing is secured properly.
2. Several fixture's whips are likely to contain asbestos. (3,24)
 - a. Remove and dispose of fixtures as required.
3. Linesets are suspended with bent eyebolts, hook turnbuckles, jack chain, double loop chain, lock link chain, connecting links, and/or S-hooks. All of which are not rated for overhead use and have a low load rating, if any. (7,9,10,12,17,19,20,23,29,40)
 - a. Replace hardware with load rated beam clamps, welded link chain, bolt-type shackles and batten clamps. All hardware to be plated or painted to prevent rust and corrosion. Eyebolts must be shouldered, forged, plated, load rated and go to structure.
4. Above the main traveler, is a piece of conduit taped to the joists. Conduit is not to be used as support for rigging and tape is not an appropriate method to attach anything to the structure. (7)
 - a. Remove conduit and tape.



5. The main traveler and valance curtains have tags with incomplete information. The only information provided is the "Date of flameproofing: 8/9/10," implying the fabric is not inherently flame retardant. Additionally, the main traveler is in poor condition with multiple locations of damage including rips, holes, and tears. (13,14,15,16)
 - a. Curtains which are not inherently flame retardant require annual testing and retreating as needed to maintain flame retardancy. Test the curtains and retreat as needed. Update tags and documentation with new date of testing. Based on the poor condition, it is suggested to replace the curtains with new made from inherently flame retardant fabric. Attach it to every carrier to avoid over stressing adjacent grommets.
6. One suspension point on the main traveler has come undone. The S-hook has come out of the chain, which doubles the span. (19)
 - a. Replace the hardware as detailed in item 3.
7. One suspension point wraps an object that is laying on the bottom chord of the joists without any attachment. (20)
 - a. Remove object and replace with strut channel sized to support the load.
8. On lineset 6, a piece of hardware (end stop) came out of the track and is captive on the operating rope. (24)
 - a. Reinstall the end stop and apply medium strength thread locker.
9. On stage left angled track, the operating rope is not of the correct size and construction and thus is difficult to use. Further, it is not routed through the floor pulley and has no tension on it. (25,26)
 - a. Replace the rope with the correct size and type.
10. Paint is stored in a closet, which is a fire hazard. (28)
 - a. Store paint and all combustible solvents, cleaners, etc. in a self-closing flammable storage cabinet.
11. In the rear of the theatre is a makeshift platform, which is not code compliant. (30)
 - a. Remove and dispose of the platform in its entirety.
12. In several locations, items are preventing clear access to fire extinguishers. (31,32)
 - a. Remove or relocate items to allow unrestricted access to all fire extinguishers.
13. Numerous non-grounding type receptacles (twist-lock, and stage pin) and plugs were observed. (35)
 - a. Contact a licensed electrician to replace receptacles with grounding type (or remove if they are not in use or needed). Replace fixtures containing non-grounding type plugs with new.
14. On stage right, water bottles are stored on an electrical wiring trough. Exposed conductors are present in the stage pin whips and several receptacles have tape covering the outlet. (36)
 - a. Remove the water bottles and do not store anything on the trough. Remove or replace the whips. Test all receptacles and troubleshoot/repair as needed to restore full operation.

Deficiencies Requiring Attention Within 1-Year:

1. Lineset B is attached to structure with nylon round slings and fibrous rope. Nylon round slings are intended for temporary rigging and not permitted to wrap building steel as the sharp corners could cut the nylon. Similarly for the rope. (1)
 - a. Remove the lineset or reinstall with proper hardware and methods.



2. On house right, two fixtures are clamped onto a joist. The clamp is intended to mount the fixture onto a (round) pipe batten only. (4)
 - a. Remove fixtures from the joist.
3. The loudspeakers are attached to strut channel which is clamped onto the joists. The clamps are improperly installed. The safety cable attached to the loudspeaker is attached to the strut, specifically through the slots which have sharp edges. (5)
 - a. Install the clamps per the manufacturer's instructions. Reroute the safety cable to the joist avoiding all sharp edges.
4. The stage left track is attached to the ceiling with toggle bolts. There are two holes where it appears the toggle bolts pulled through. Rigging must be supported by structure with sufficient capacity to support the load. (8)
 - a. Because no curtains are attached to the track, remove it from the system and patch the holes.
5. The valance is attached to 1x4 wood batten which is cantilevered from the main traveler track. This eccentric load is rotating the track, creating a poor condition for the carriers. Additionally, the projection screen is supported from the track and valance assembly. (9,10,12)
 - a. Remove the wood batten and cantilevered brackets. Install an 1-1/2" schedule 40 pipe batten properly spliced and attached to the structure. Independently suspend the screen from the structure with proper load rated hardware.
6. The pipe batten on lineset 4 contains threaded couplers. ANSI standards do not permit threaded couplers/connections to be used in stage rigging applications as the pipe battens can rotate causing the connection to come undone. (18)
 - a. Replace all threaded connections with internal splices.
7. The storage room contains numerous wood set pieces which could fall or tip over. Further, storage of excess combustible materials is not advised. (27)
 - a. Remove all items that are no longer needed and properly stow the remaining items.
8. A junction box supporting a lighting fixture does not have a cover plate and conductors are exposed. (34)
 - a. Install cover plate per NEC.
9. There is no clear access to the electrical panels on stage right. (38)
 - a. Remove or relocate the fixtures, cables, and items preventing the access as the National Electrical Code (NEC) requires 36" minimum clearance in front of all electrical panels.
10. The power cord to the projection screen is installed through the stage ceiling, which NEC prohibits. (40)
 - a. Contact a licensed electrical contractor to repair.

Deficiencies Requiring Action When Time and Funding Allows:

1. The wall mounted loudspeakers are not in use. (6)
 - a. Remove and dispose of the loudspeakers and associated hardware/brackets.
2. Between linesets 5 & 6 are several open eye hooks screwed into the wood member. Open eye hooks are not permitted for stage rigging use. (21)
 - a. Remove all hooks and unused hardware from the system.



3. Portable cabling is supported by nylon tie wraps which is a poor choice of support. (33)
 - a. Remove tie wraps and support cables with tie line, round slings, or cable grips.
4. The stage lighting system utilizes portable dimming packs which are installed on a wood rack. (39)
 - a. Replace portable system with installed system.
5. The acoustical panel assembly on house right has a sheared support member where the steel bracket enters the CMU wall. (41)
 - a. Contact a handyman to review and repair as needed.
6. There is no rigging safety signage posted.
 - a. Contact a rigging contractor to provide safety signage which must state the allowable load ratings of the system. Require the rigging contractor to engage a structural engineer in determining the load ratings.
7. The traveler tracks are noisy when operated which is not desirable.
 - a. Replace the carriers and pulleys with new.

Other Notes and Recommendations:

1. It is suggested to paint all fall or trip hazards caution yellow.
2. All pipe battens should have yellow safety caps with load rating and line set information clearly marked.
3. All fixtures should have safety cables installed according to the manufacturer's instructions. (3)
4. ANSI and OSHA require documented rigging inspections at least annually.
5. The following systems were not inspected:
 - a. Portable ladders
 - b. Fire alarm system
 - c. Emergency lighting system

Final Conclusion:

Below (see Appendix A) are a few photos which capture several of the issues mentioned in this report, however not all problems are easily identifiable to an untrained reader. After inspecting the system, Hewshott advises that all the items enumerated in the "Deficiencies Requiring Immediate Action" section are addressed. In addition, prior to the next annual inspection, all items in "Deficiencies Requiring Attention Within 1-Year" should be addressed. The other items listed in this report are not as critical and can be budgeted and addressed as time and funding allows. High resolution photos are available by request.

Some items are simple housekeeping items and can be addressed by the School's staff while others are specialized and should be performed by a professional, reputable, and ETCP certified rigging contractor.

A Maintenance and Inspection Log is attached. Please post on a stage wall in clear view.

If you have any questions or concerns about any items detailed in this report, please contact us. Thank you.



Regards,

A handwritten signature in blue ink, appearing to read "Be 8 cl". The signature is written in a cursive, somewhat stylized font. The letters are connected, with the "8" being a simple loop and the "cl" being a continuous stroke.

Brandon Creel, ETCP CR-T #948, ETCP CEE#114, CTS #1336826, CTS-D #2338402



1



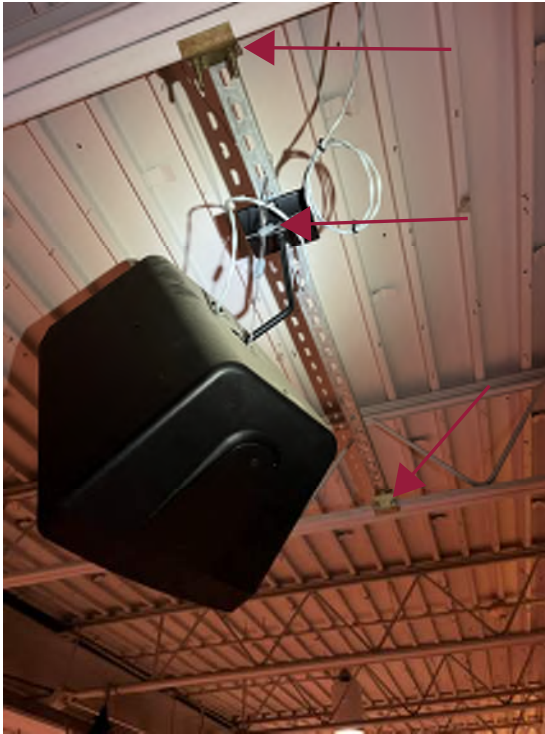
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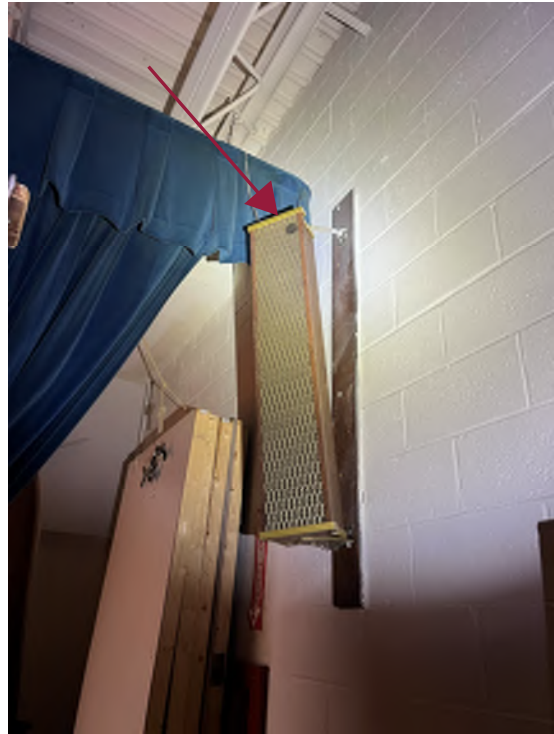
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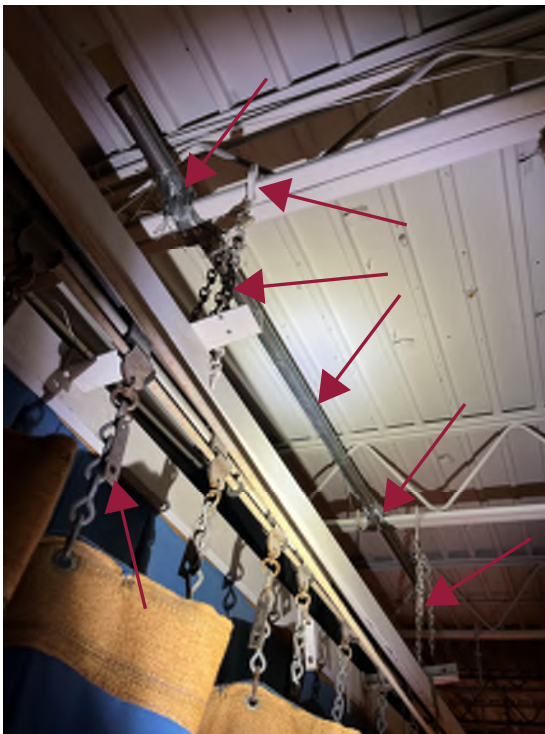
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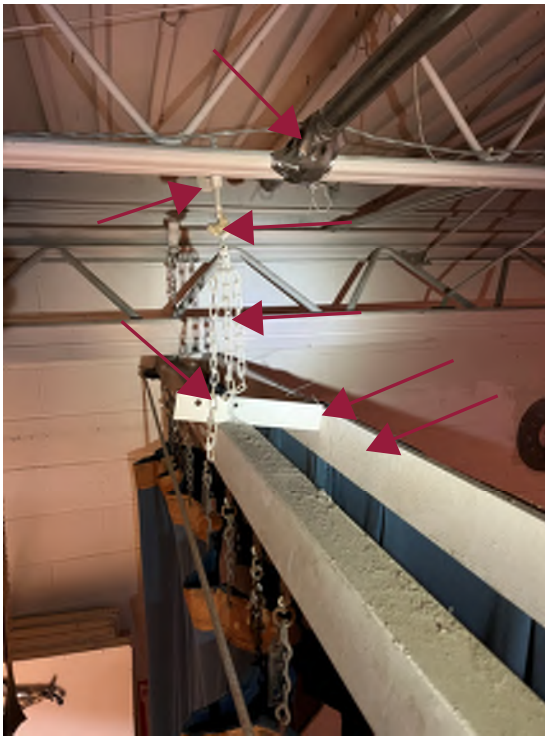
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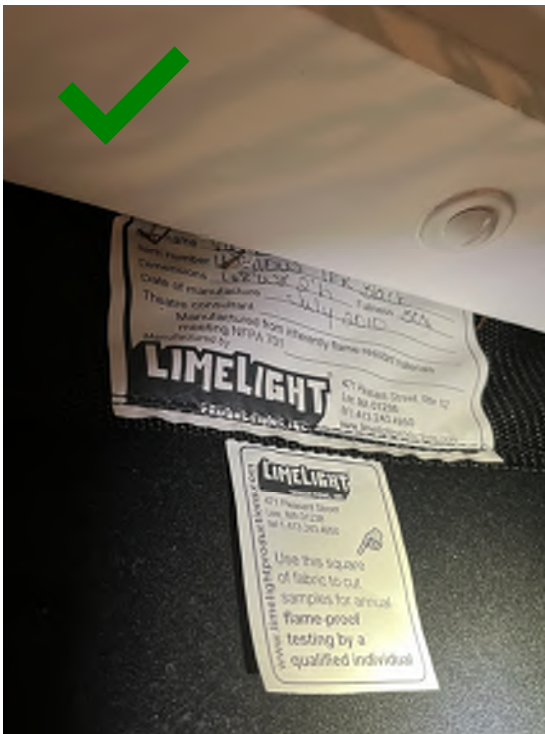
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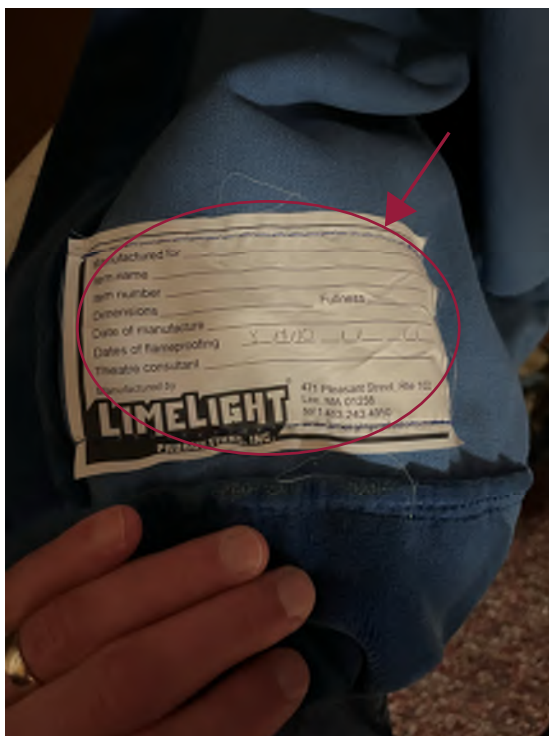
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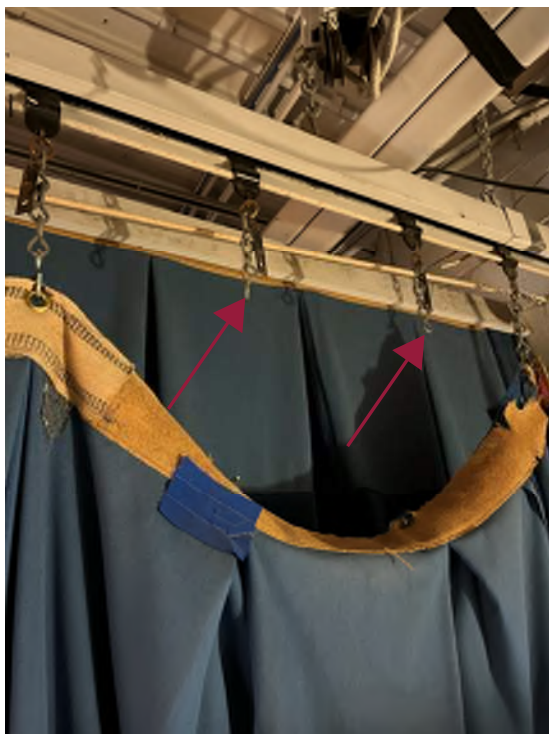
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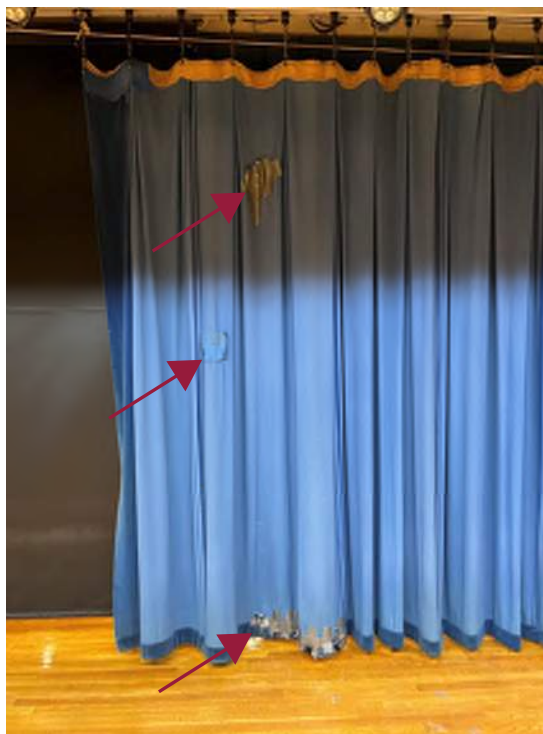
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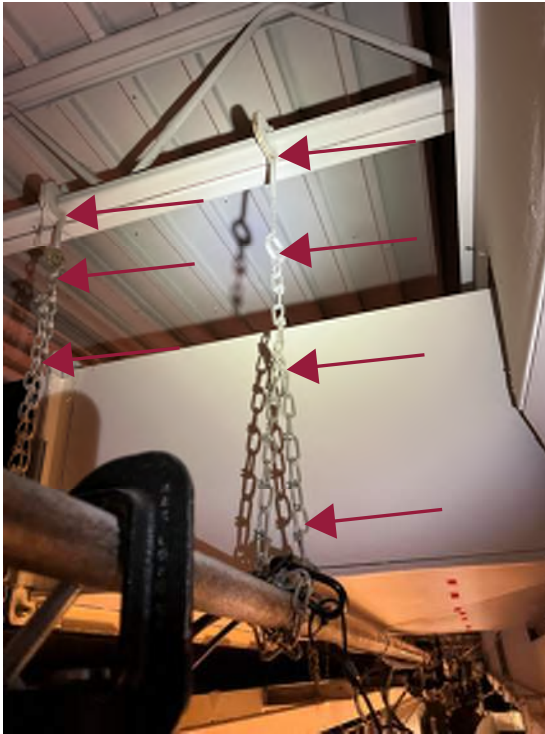
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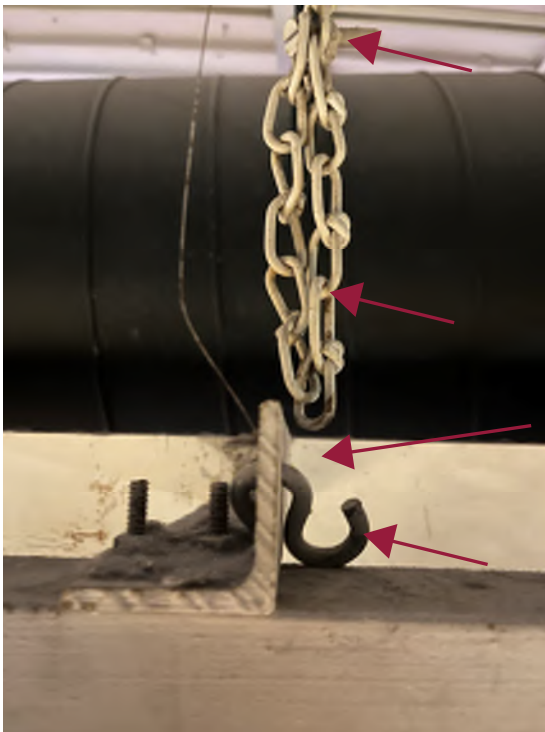
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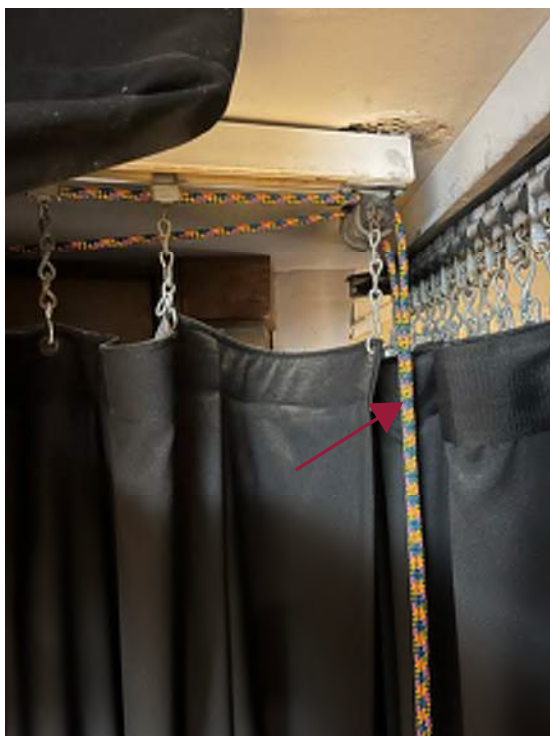
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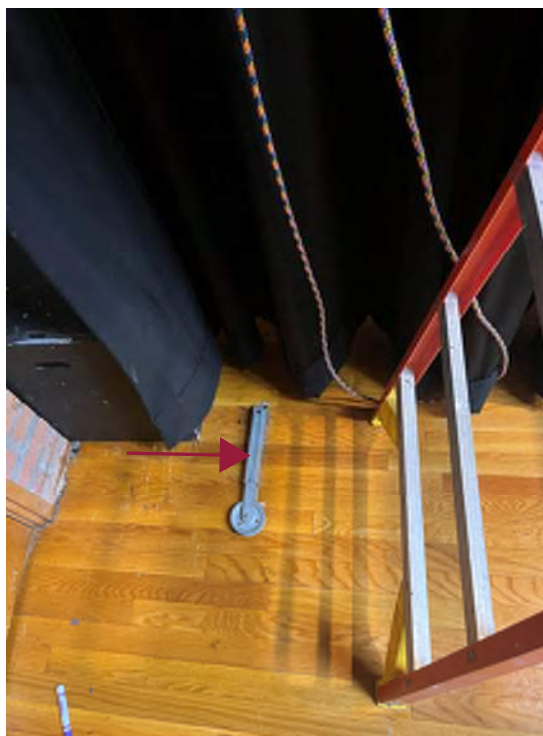
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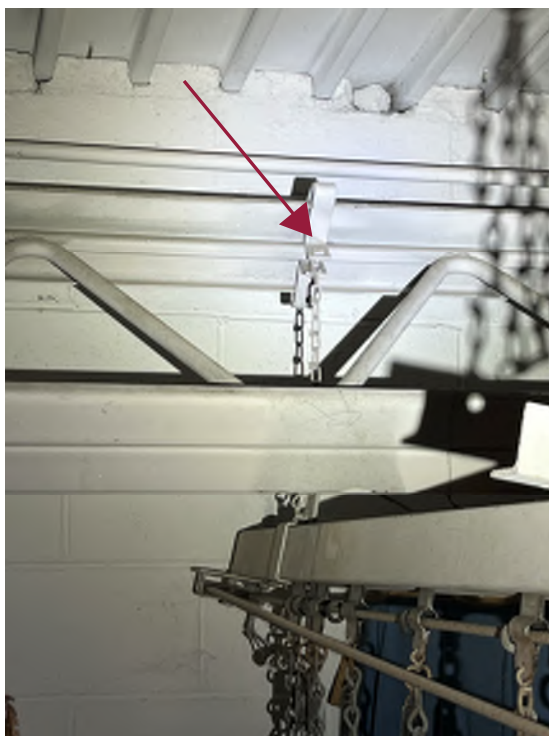
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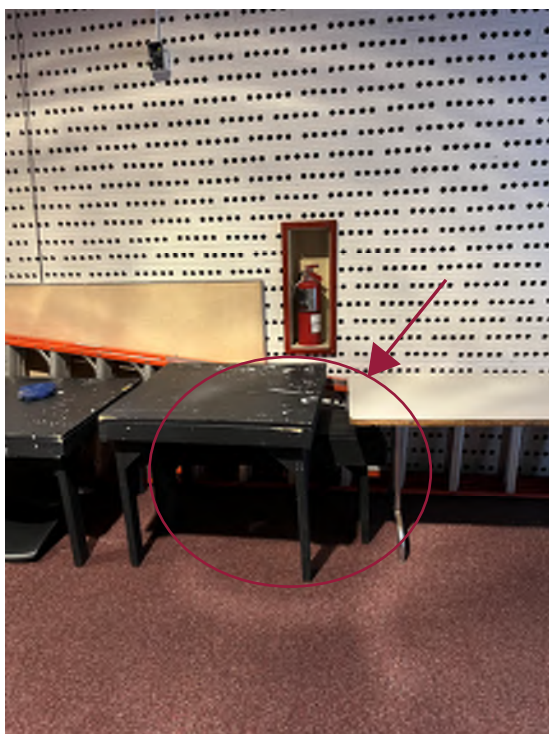
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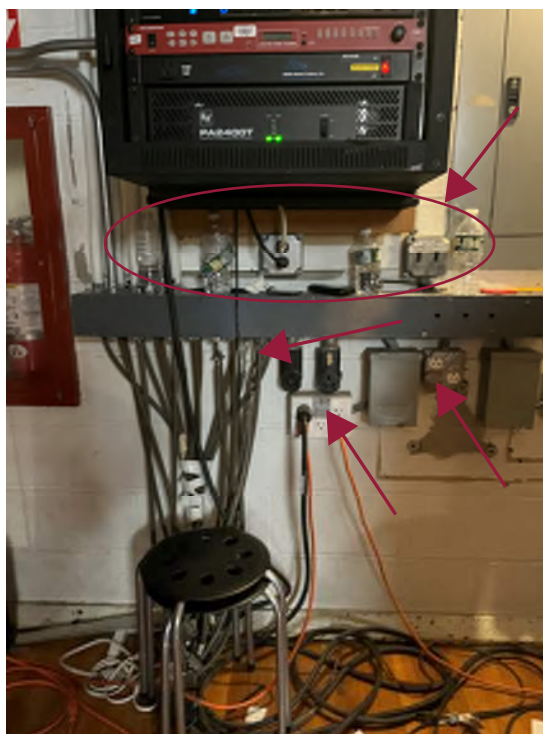
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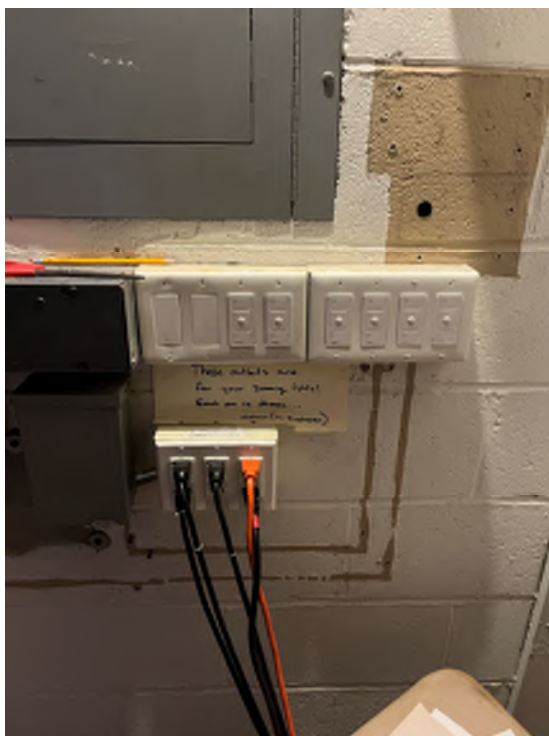
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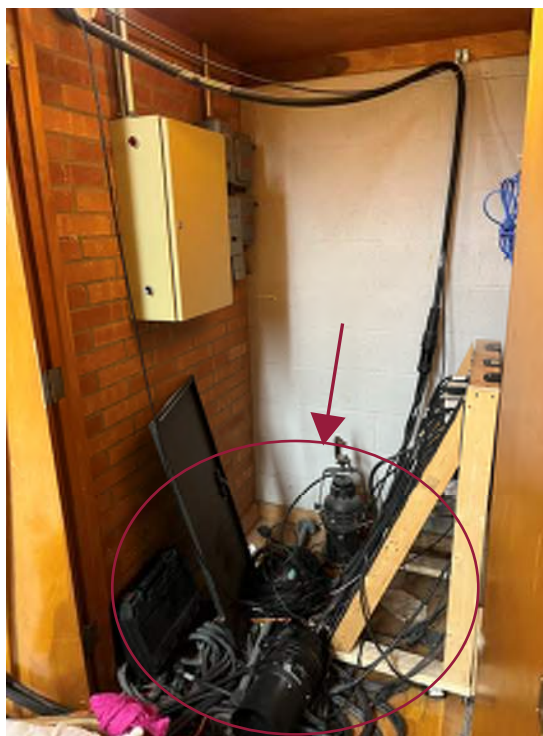
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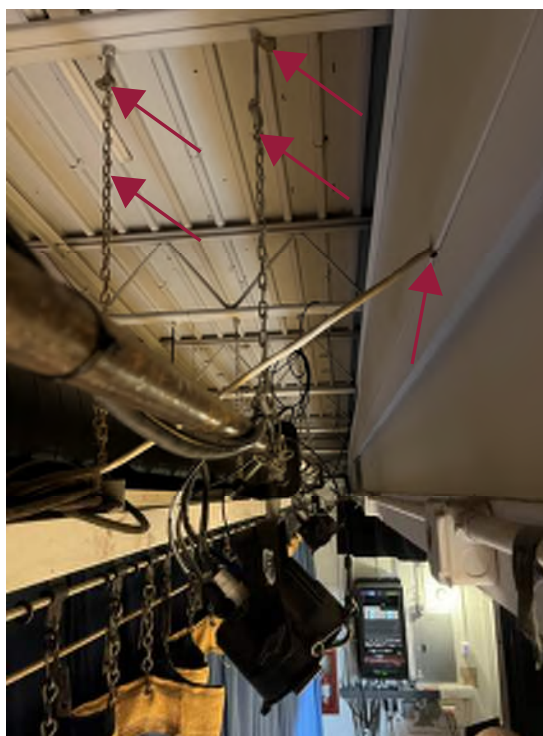
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RIGGING AND SAFETY INSPECTION REPORT

for

Needham Public Schools

1330 Highland Avenue
Needham, MA 02492

at

Needham High School

609 Webster St
Needham, MA 02494

Inspection Date: February 8, 2023

Report Date: February 17, 2023

Inspector: Brandon Creel

ETCP CR-T #948, ETCP CEE #1147, CTS #1336826, CTS-D #2338402



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Relevant Standards/Codes:

- ANSI E1.4-1 – 2016 Entertainment Technology - Manual Counterweight Rigging Systems
- ANSI E1.4.2 – 2021 Entertainment Technology – Statically Suspended Rigging Systems
- ANSI E1.8 – 2018 Entertainment Technology – Loudspeaker Enclosures Intended for Overhead Suspension
- ANSI E1.11 – 2008 (R2018) Entertainment Technology – USITT DMX512-A, Asynchronous Serial Digital Data Transmission Standard for Controlling Lighting Equipment and Accessories
- ANSI E1.22 - 2016 Entertainment Technology - Fire Safety Curtain Systems
- ANSI E1.32 – 2012 (R2017) Guide for the Inspection of Entertainment Industry Incandescent Lamp Luminaires
- ANSI E1.46 – 2018 Standard for the Prevention of Falls from Theatrical Stages and Raised Performance Platforms
- ANSI E1.47 – 2020 Entertainment Technology - Recommended Guidelines for Entertainment Rigging System Inspections
- ANSI E1.53 – 2019 Overhead mounting of luminaires, lighting accessories, and other portable devices: specification and practice
- ANSI E1.56-2018 Entertainment Technology – Rigging Support Points
- ANSI/ASSP Z359 Fall Protection Code
- Americans with Disabilities (ADA)
- OSHA Standards for General Industry 29 CFR Part 1910 and 1919
- National Fire Protection Association (NFPA)
- NFPA 70: National Electrical Code (NEC)
- NFPA 204: Standard for Smoke and Heat Venting
- International Building Code (IBC)
- Uniform Commercial Code (UCC)

Introduction:

This rigging system inspection serves many purposes. First, it keeps the school district and venue in conformance to ANSI and OSHA standards with respect to inspections. It also identifies and documents any safety concerns and deficiencies in the system.

Received Documents:

Y/N:	Item:	Y/N:	Item:
N	As-built drawings	N	Maintenance logs
N	Operation manuals	N	Previous inspection reports
N	Known modifications	N	Curtain flame certificates
N	Reports of known issues or incidents	N	Records of user training



General Description:

The theater consists of a proscenium stage, sloped seating area with balcony, stage curtains, lighting system, audio system, video system, and control room. The stage measures 62'-0" x 16'-9" x 2'-11" (WxLxH) and the proscenium arch, 32'-10" x 15'-10" (WxH). The stage ceiling is 19'-5" above the floor. The rigging system consists of dead hung linesets and a manual brail winch fire curtain. On stage left is the audio equipment rack and in a closet is the house light dimming panel. On stage right is an electrical closet with the stage lighting dimming panel.

The age of the system is unknown. Most curtains were replaced in 2010, aging them at 13 years. No manufacturer was identified for the stage rigging system, most of which is steel pipe, chain, and hardware. The curtain tracks were manufactured by Automatic Devices Company and most curtains by Rose Brand. The loudspeakers are by Renkus-Heinz supported from Polar Focus Z-Beams. The projection screen is by Da-Lite. The fire curtain system is by JR Clancy. The ceiling structure consists of wood ceiling joists, attic, and wood roof joists. The joists are supported by perpendicular steel beams and exterior wall.

Lineset Schedule:

- B. FOH electric
- A. Loudspeakers (left,center,right)
0. Datum
1. Main valance
2. Fire curtain (brail winch)
3. Main traveler (170 series track)
4. 1st electric
5. Work lights
6. Legs (rotodrapers on 170 series track) – no curtains
7. Projection screen
8. Valance
9. 2nd electric
10. Legs (rotodrapers on 170 series track) / duct
11. Valance
12. 3rd electric
13. Work lights
14. Upstage traveler (170 series track)

Deficiencies Requiring Immediate Action:

1. Linesets are suspended with bent eyebolts, hook turnbuckles, jack chain, double loop chain, lock link chain, connecting links, and/or S-hooks. All of which are not rated for overhead use and have a low load rating, if any. (4,5,6,7,10,12,15,23)
 - a. Replace hardware with load rated beam clamps, welded link chain, bolt-type shackles and batten clamps. All hardware to be plated or painted to prevent rust and corrosion. Eyebolts must be shouldered, forged, plated, load rated and go to structure.



2. The stage electrics are suspended with threaded rod terminated to conduit clamps, which are not for stage rigging use. (4,5,28)
 - a. Replace conduit clamps with load rated batten clamps or other approved attachment method.
3. Suspension points should be plumb and not installed at an angle. (5)
 - a. Replace and relocate suspension points so they are plumb.
4. A valance is suspended from a 3/4" pipe which is undersized and contains rust. (6)
 - a. Replace with 1-1/2" schedule 40 pipe batten that is primed and painted and properly spliced.
5. In several locations, shackles were rotated and not in line with the load path. (7,10)
 - a. Rotate shackles to the proper orientation.
6. Several unused pieces of hardware or suspension points were observed. (13,14)
 - a. Remove all unused hardware and suspension points from the system.
7. The leg pipe (attached to the rotodrapery) is wedged between adjacent linesets and is no longer horizontal. A clamp is used as an end stop, which per the manufacturer, must be a through-bolt. (16)
 - a. Remove clamp, install through-bolt end stop, and adjust rotodrapery pipe to proper orientation.
8. The fire curtain release system is not operational. The electro-magnetic release, "Sure-Guard," is not holding the hook. The release line is fibrous rope and not under tension. The brail winch handle was installed and is resting on an enclosure bolt. There is register in the smoke pocket. The fire curtain was cut, or ripped, at the suspension chains. Adjacent to the loft block, the lift line is rubbing on the top of the curtain and has ripped it. The lift lines are terminated to the clew with wire rope clips. The pull line is terminated with two different sizes of wire rope clips. The turnbuckles used as part of the clew guide wires do not have a secondary means to prevent body rotation (loosening). A lift line goes through a "light-duty" block which exceeds its working load limit. (17,18,19,20,21,22,23,24,25,26,27)
 - a. Replace the release line with 1/8" 7x19 wire rope and fusible links in accordance with ANSI E1.22. Troubleshoot the electro-magnetic release and repair or replace as required. After the release line is installed, remove the handle from the winch and test the system, adjusting the lowering rate to be within specifications. Remove the register and all items from the smoke pocket. While wire rope clips may be acceptable if they were installed with a torque wrench, it is unknown how if the nuts are at the correct tightness. An incorrect size wire rope clip was used on the pull line. Install tie wraps on the guide wire turnbuckles. Replace the light duty block with an appropriate mule/loft block. Contact the authority having jurisdiction to review the fire curtain and determine if it can be removed in its entirety.
9. In the center of the stage, biparting tracks are connected with lap clamps. On lineset 14, the lap clamp has no nut and washer. The span on the track exceeds the manufacturer's allowable span. (29)
 - a. Order replacement parts from the manufacturer and install on the lap clamp. Hangers must be spaced in accordance with the manufacturer's instructions. Add hangers as needed.



10. The curtains on lineset 14 have a generic tag which reads, "Fabric in these curtains [are] Flame Retardant in compliance with state laws," with no mention of which state, and if it is inherently flame retardant or treated with a flame retardant. (30)
 - a. Perform flame test and retreat as needed or replace curtains with inherently flame retardant fabric.
11. The remaining curtains have detailed tags which state the fabric was treated and should be tested annually. Date of manufacturing is 7/12/2010. (31,32)
 - a. Perform flame test and retreat as needed or replace curtains with inherently flame retardant fabric.
12. Multiple floor pocket covers were broken and create a tripping hazard. (34)
 - a. Replace the covers with new.
13. The railing adjacent to the handicap lift is loose and unlikely to support the code required load (50 plf or 200 lb point load). (36)
 - a. Repair, reinforce, or replace as needed.
14. On stage left, items are preventing clear access to the fire extinguisher. (37)
 - a. Remove or relocate items to allow unrestricted access to all fire extinguishers.
15. On stage right, there are items on top of the hose cabinet. (38)
 - a. Remove all items from the hose cabinet.
16. On both sides of the stage are egress stairs. Both of which had items located in them restricting the path of egress. (39)
 - a. Remove all items from the paths of egress and educate users so they discontinue storage in the stairs.
17. Paint is stored in a closet, which is a fire hazard. And items are preventing access to the dimming panel. (40)
 - a. Store paint and all combustible solvents, cleaners, etc. in a self-closing flammable storage cabinet. National Electrical Code (NEC) requires 36" minimum clearance in front of all electrical panels.

Deficiencies Requiring Attention Within 1-Year:

1. Loudspeaker rigging uses unplated eyebolts which are rusted. Some of the shackles do not have a secondary means to prevent pin loosening. (1)
 - a. Replace eyebolts with zinc plated to prevent future rust and install nylon tie wraps around the pin and bow of the shackles (or replace with bolt-type shackles).
2. Pipe battens contain threaded couplers. ANSI standards do not permit threaded couplers/connections to be used in stage rigging applications as the pipe battens can rotate causing the connection to come undone. The FOH Electric is attached to cantilevered strut channel and the clamps are at the open end of the channel, which are held in place by friction. (2,3,8)
 - a. Replace all threaded connections with internal splices. Provide secondary means to prevent clamp from coming out of the strut channel.
3. Welded link chain is terminated by through-bolting, which is not an approved termination method. (5,7,9,11,15,16,19)
 - a. Remove bolt assembly and replace with bolt-type shackles or turnbuckle.



4. The connector strip on the 1st electric has knockouts missing exposing the internal conductors. (8)
 - a. Install knock out covers.
5. Most of the shackles do not have a secondary means to prevent pin loosening. (10,12,15)
 - a. Install nylon tie wraps around the pin and bow of the shackles (or replace with bolt-type shackles).
6. In one location, a pipe batten is supported from strut channel supporting a duct. Rigging must be supported by structure with sufficient capacity for the loads. (28)
 - a. Review the strut and attachment methods to determine if it has the capacity to support the pipe.
7. Multiple lamps in the stage work lights were not operational. (33)
 - a. Replace lamps and test.

Deficiencies Requiring Action When Time and Funding Allows:

1. The main traveler is attached to the carriers with tieline. (8)
 - a. Replace tieline with hardware (e.g. elephant ears) to connect grommets to carriers.
2. The upstage (rear) wall is damaged. (35)
 - a. Investigate cause of damage and repair as needed.
3. There is no rigging safety signage posted.
 - a. Contact a rigging contractor to provide safety signage which must state the allowable load ratings of the system. Require the rigging contractor to engage a structural engineer in determining the load ratings.
4. The main traveler is operational but difficult. The upstage traveler was noisy when operated which is not desirable.
 - a. Replace the carriers and pulleys with new.

Other Notes and Recommendations:

1. It is suggested to paint all fall or trip hazards caution yellow.
2. All pipe battens should have yellow safety caps with load rating and line set information clearly marked.
3. All fixtures should have safety cables installed according to the manufacturer's instructions.
4. ANSI and OSHA require documented rigging inspections at least annually.
5. ANSI requires quarterly testing of the fire curtain and inspection at least annually.
6. The following systems were not inspected:
 - a. Portable ladders
 - b. Fire alarm system
 - c. Emergency lighting system
 - d. Above ceiling rigging
7. National Electrical Code (NEC) requires 36" minimum clearance in front of all electrical panels.



Final Conclusion:

Below (see Appendix A) are a few photos which capture several of the issues mentioned in this report, however not all problems are easily identifiable to an untrained reader. After inspecting the system, Hewshott advises that all the items enumerated in the “Deficiencies Requiring Immediate Action” section are addressed. In addition, prior to the next annual inspection, all items in “Deficiencies Requiring Attention Within 1-Year” should be addressed. The other items listed in this report are not as critical and can be budgeted and addressed as time and funding allows. High resolution photos are available by request.

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If you have any questions or concerns about any items detailed in this report, please contact us. Thank you.

Regards,

Brandon Creel, ETCP CR-T #948, ETCP CEE#114, CTS #1336826, CTS-D #2338402



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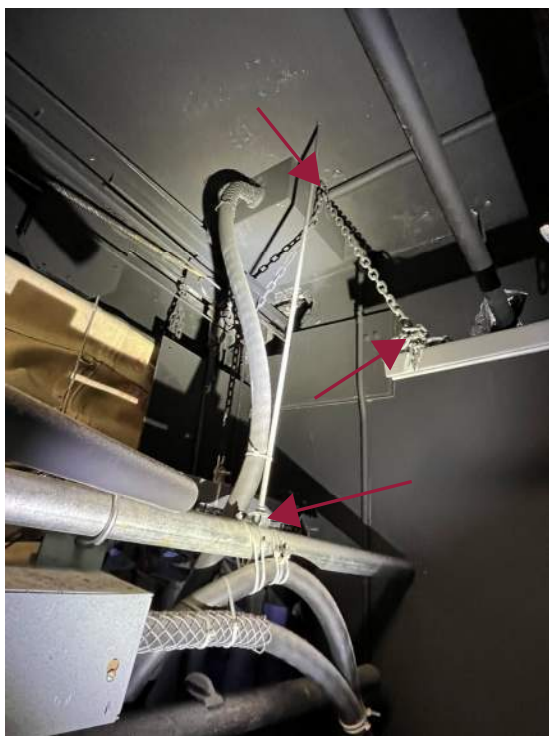
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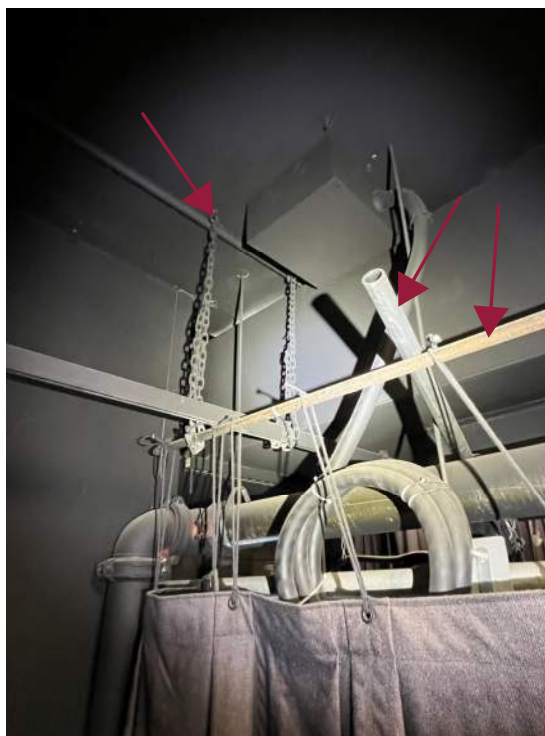
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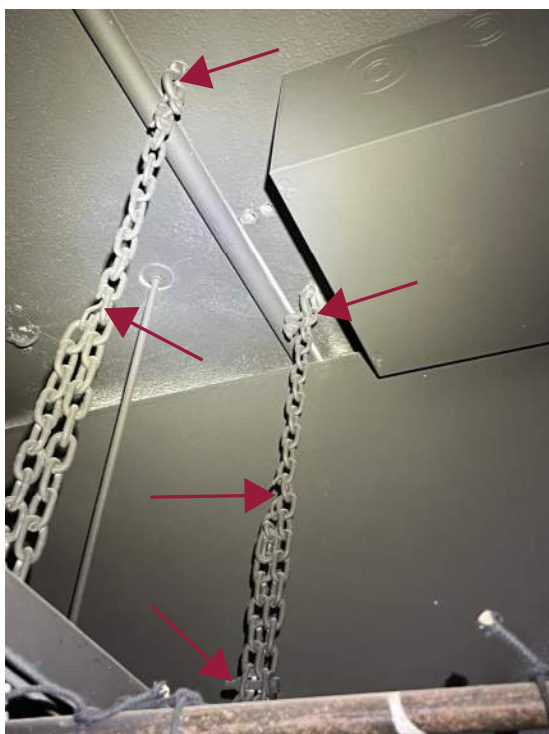
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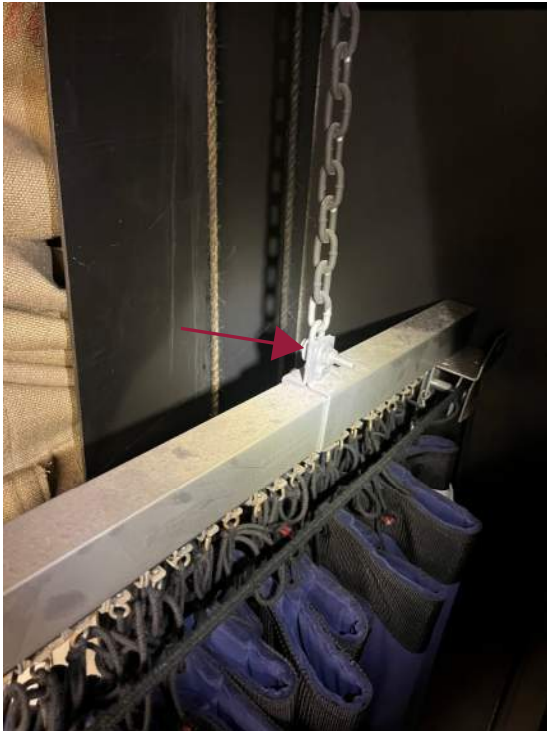
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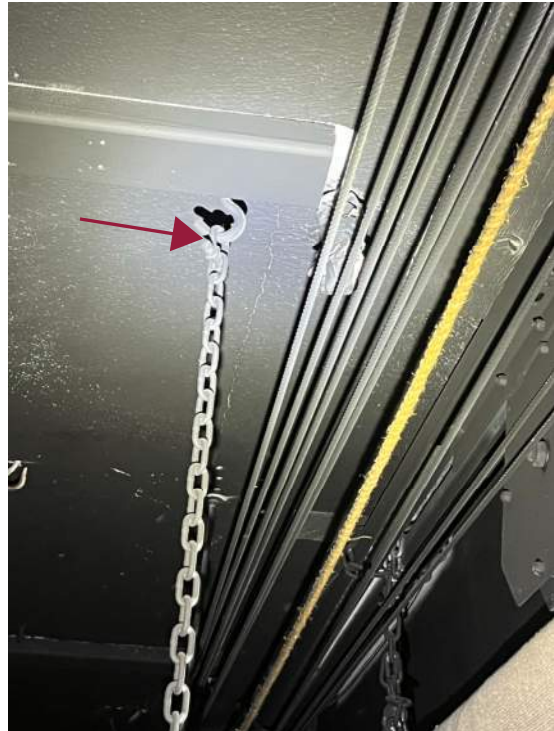
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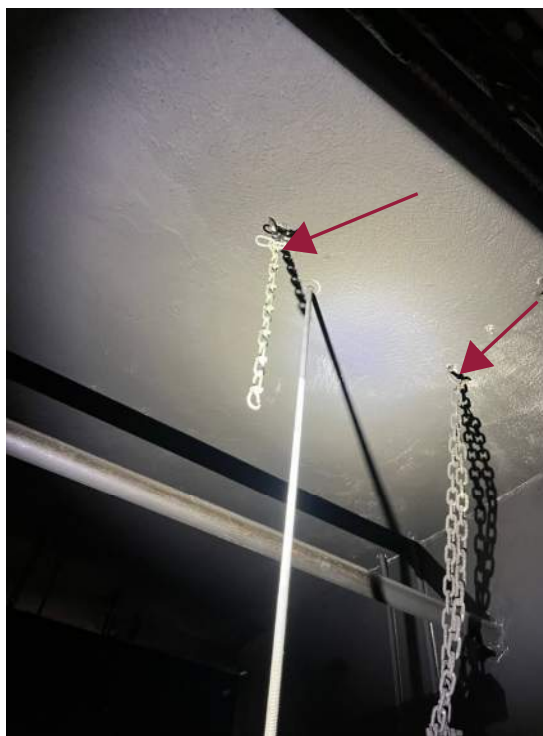
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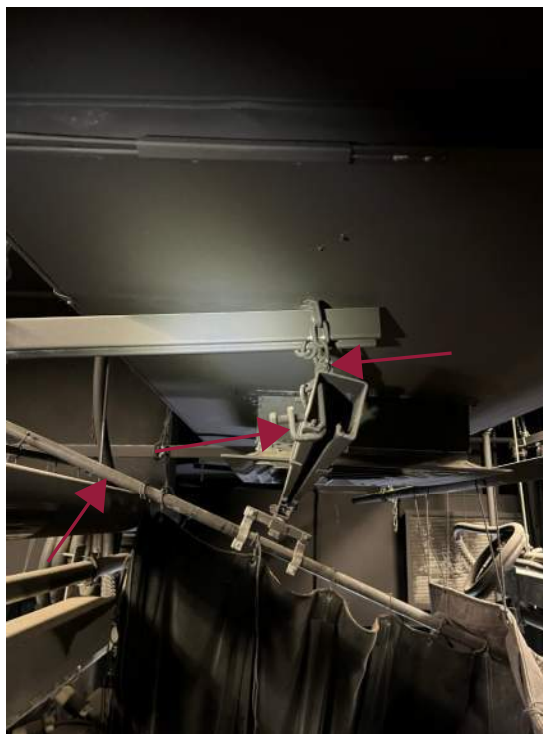
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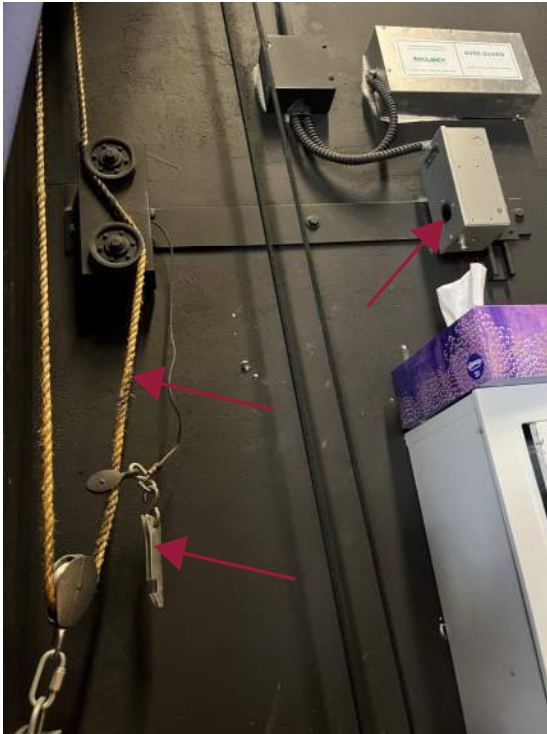
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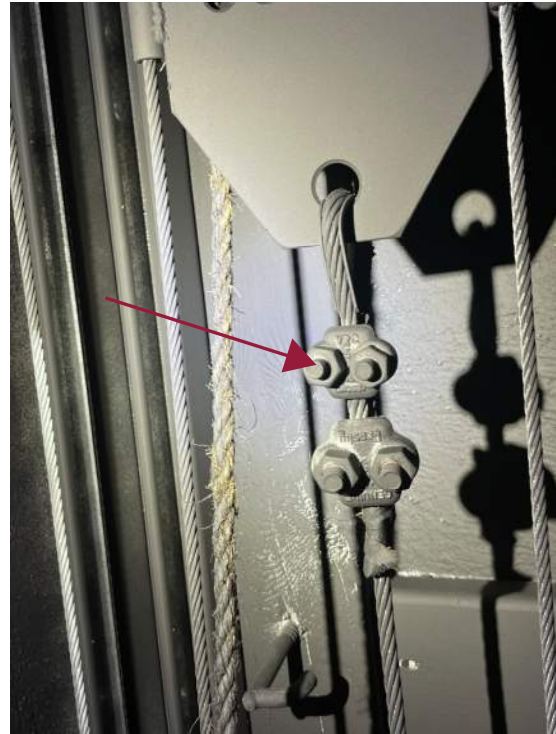
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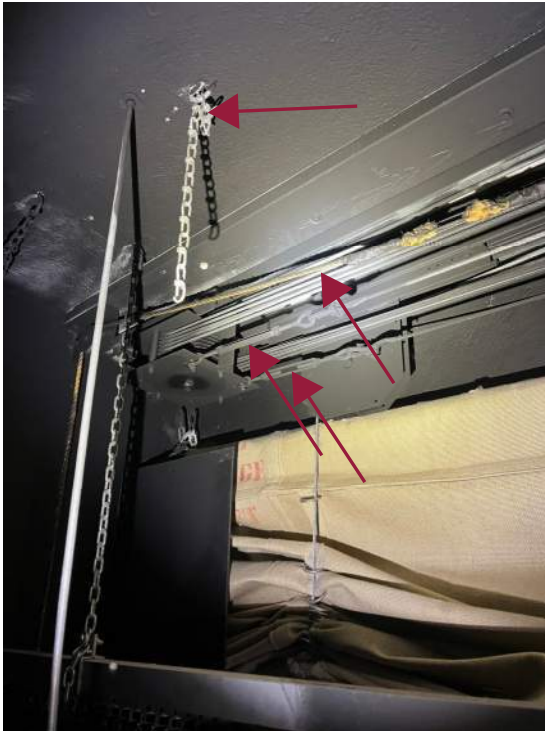
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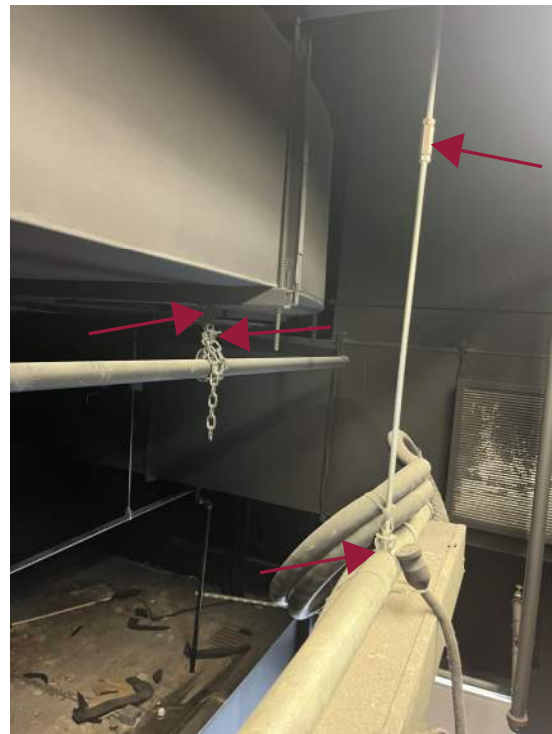
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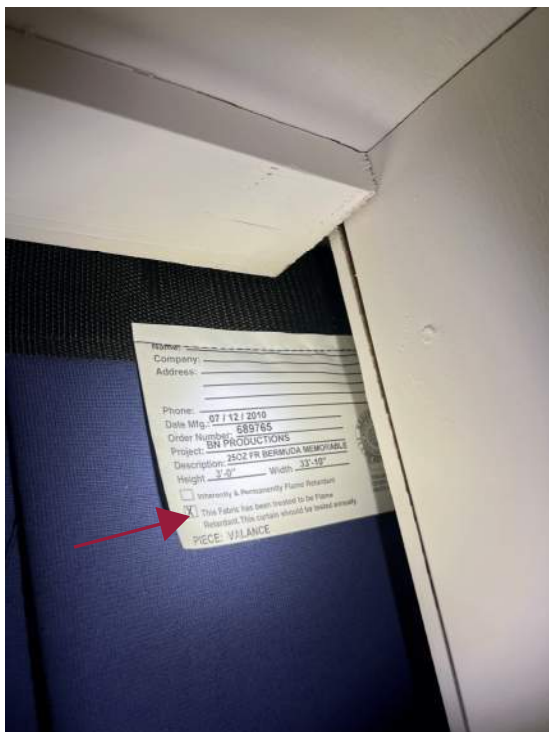
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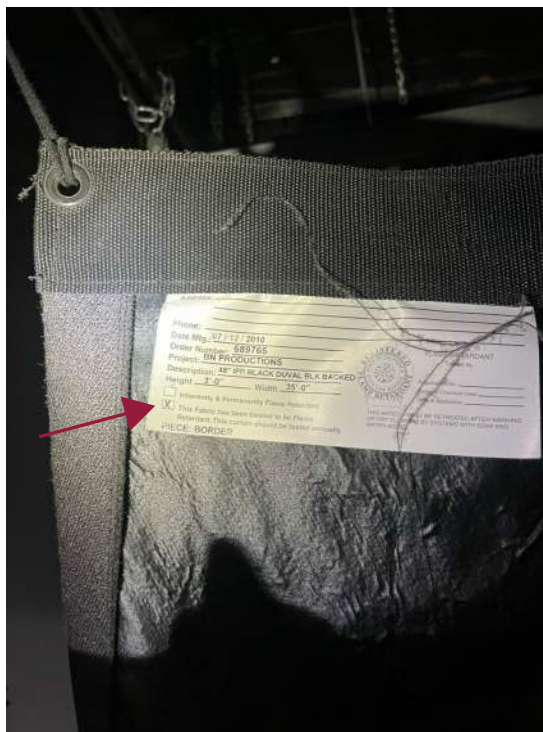
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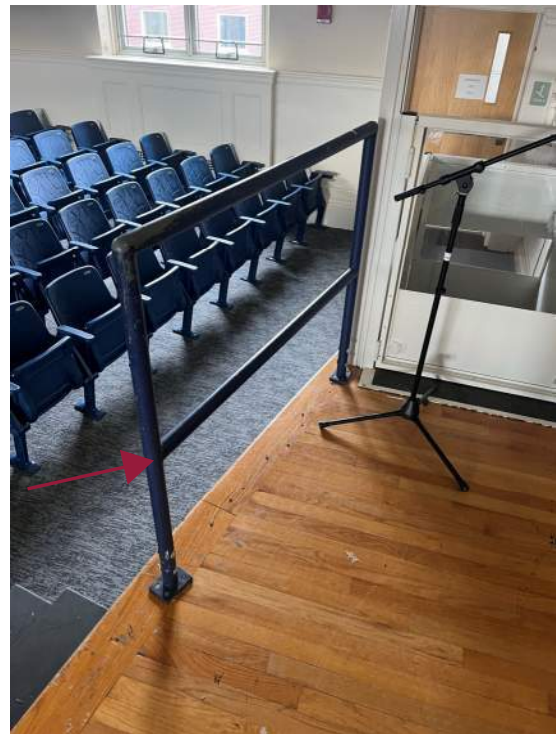
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