HELIX
Environmental Planning

Sharp Metropolitan Medical Campus Modernization Project

Acoustical Analysis Report

August 2021 | 02450.00001.001

Prepared for:

Sharp HealthCare
7901 Frost Street
San Diego, CA 92123

Prepared by:

HELIX Environmental Planning, Inc.
7578 El Cajon Boulevard
La Mesa, CA 91942

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ACRONYMS AND ABBREVIATIONS

ADT	average daily trips
ALUCP	Airport Land Use Compatibility Plan
ANSI	American National Standards Institute
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
City	City of San Diego
CNEL	Community Noise Equivalent Level
CY	cubic yards
dB	decibel
dBA	A-weighted decibel
FTA	Federal Transit Administration
HVAC	heating, ventilation, and air conditioning
Hz	Hertz
kHz	kilohertz
L_{DN}	Day-Night sound level
L_{EQ}	time-averaged noise level
mPa	micro Pascal
mph	miles per hour
NSLU	noise sensitive land use
PDP	Planned Development Permit
PPV	peak particle velocity
RCNM	Roadway Construction Noise Model
SF	square feet/foot
SPL	sound pressure level
SR 163	State Route 163
S_{WL}	Sound Power Level
USDOT	U.S. Department of Transportation
VdB	vibration decibel

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EXECUTIVE SUMMARY

This report assesses potential construction and operational noise impacts associated with the Sharp Metropolitan Medical Campus Modernization Project (project) located in the city of San Diego, California. The project proposes involves a Conditional Use Permit (CUP) and Planned Development Permit (PDP) for upgrades to the existing SMMC. Upgrades would include the demolition and replacement of old structures, construction of a new hospital tower, and renovations to existing facilities.

Project construction would involve demolition, site preparation (e.g., clearing and grubbing), grading/excavation, building construction, and paving. Project construction noise would not result in noise levels above the San Diego Noise Ordinance construction noise threshold of 75 A-weighted decibel (dBA L_{EQ}; 12-hour) measured at the nearest off-site noise sensitive land uses (NSLUs). Groundborne vibration impacts from construction would not exceed thresholds for annoyance of nearby building occupants or exceed thresholds for structural damage to nearby buildings.

Long-term on-site operational noise from the project's operational equipment would not exceed the City Noise Ordinance thresholds at nearby land uses. The project would not increase traffic as compared to existing conditions, so the project's traffic noise contribution would be less than significant.

The project site would be located in areas that would exceed 65 Community Noise Equivalent Level (CNEL), which would be above what is considered "conditionally compatible" for Institutional hospital land uses as defined in the City General Plan Noise Element. However, the project does not propose exterior use areas that would be subject to these standards. Interior noise levels would be attenuated by the project's construction materials, which are anticipated to attenuate exterior noise levels by up to 30 CNEL. This would reduce interior noise levels to below the 45 CNEL requirements. No mitigation measures or land use noise compliance measures would be required.

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1.0 INTRODUCTION

1.1 PURPOSE OF THE REPORT

This report analyzes potential noise and vibration impacts associated with the proposed Sharp Metropolitan Medical Campus Modernization Project (Project) and includes an evaluation of existing conditions in the Project vicinity and assessment of potential impacts associated with Project construction and operations.

1.2 PROJECT LOCATION

The Project would occur at the existing Sharp Metropolitan Medical Campus (SMMC), which is located on a 41-acre site at 7901 Frost Street in the Serra Mesa community of the City of San Diego (City), in western San Diego County (see Figure 1, *Regional Location*, and Figure 2, *Project Vicinity (Aerial Photograph)*). The site is located on the southern side of Frost Street, between State Route 163 (SR 163) and Interstate 805 (I-805). The site is zoned CO-1-2 and has a General Plan land use designation of Institutional and Public and Semi-Public Facilities and a Community Plan land use designation of Institutional.

1.3 PROJECT DESCRIPTION

The proposed Project involves a Conditional Use Permit (CUP) and Planned Development Permit (PDP) for upgrades to the existing SMMC. Sharp Memorial Hospital opened in 1955, a CUP was issued in 1988, and a phased modernization program was approved by the City in 2004. Additional upgrades are necessary to further modernize the facility and comply with current seismic requirements.

The proposed upgrades would include the following (see Figure 3, *Overall Site Plan*):

- Demolition of the existing plumbing shop.
- Partial demolition of the existing Central Energy Plant (CEP) and remodel of engineering offices.
- Construction of a six-level, 86,000-square foot (SF) expansion of the existing Mary Birch building and construction of a new waste dock. The Mary Birch expansion would occur on the eastern side of the existing Mary Birch building and would accommodate a materials loading dock and materials management area, a relocated sterile processing department and laboratory, and three levels of patient care units.
- Construction of a new seven-level, 207,000-SF hospital tower just north of the Mary Birch expansion, replacement of the existing Rady Bridge, and demolition of the existing dietary building and service building. The new hospital tower would include a dietary department, public spaces, a conference center, an interventional level with a preoperative expansion, diagnostic imaging and intensive care unit (ICU), and four levels of patient care units.
- Construction of a new concourse entry for the new hospital tower.

- Replacement of approximately 40,000 SF of the existing Knollwood Building with 120,000 SF of new administrative office building.

- Partial demolition of the existing eight-level central and south hospital towers down to their existing second level podium bases (which would remain).

The Project would result in a 77-hospital bed decrease, which consists of:

- A 27-bed expansion of Mary Birch;
- A new 152-bed hospital tower shell; and
- The 256-bed demolition of a portion of the south and central towers.

A Long Range Plan for Expansion and Improvement (LRPEI) was prepared by Children's Hospital and Health Center, Sharp Memorial Hospital, and San Diego Medical Center in 1995. Its primary focus was to identify the circulation improvements necessary to accommodate future development of the medical campus. With this CUP/PDP amendment and its implementation, the Project would result in a reduction in beds and traffic, the development will remain within Stage 1. No Stage 2 circulation improvements would be required.

2.0 ENVIRONMENTAL SETTING

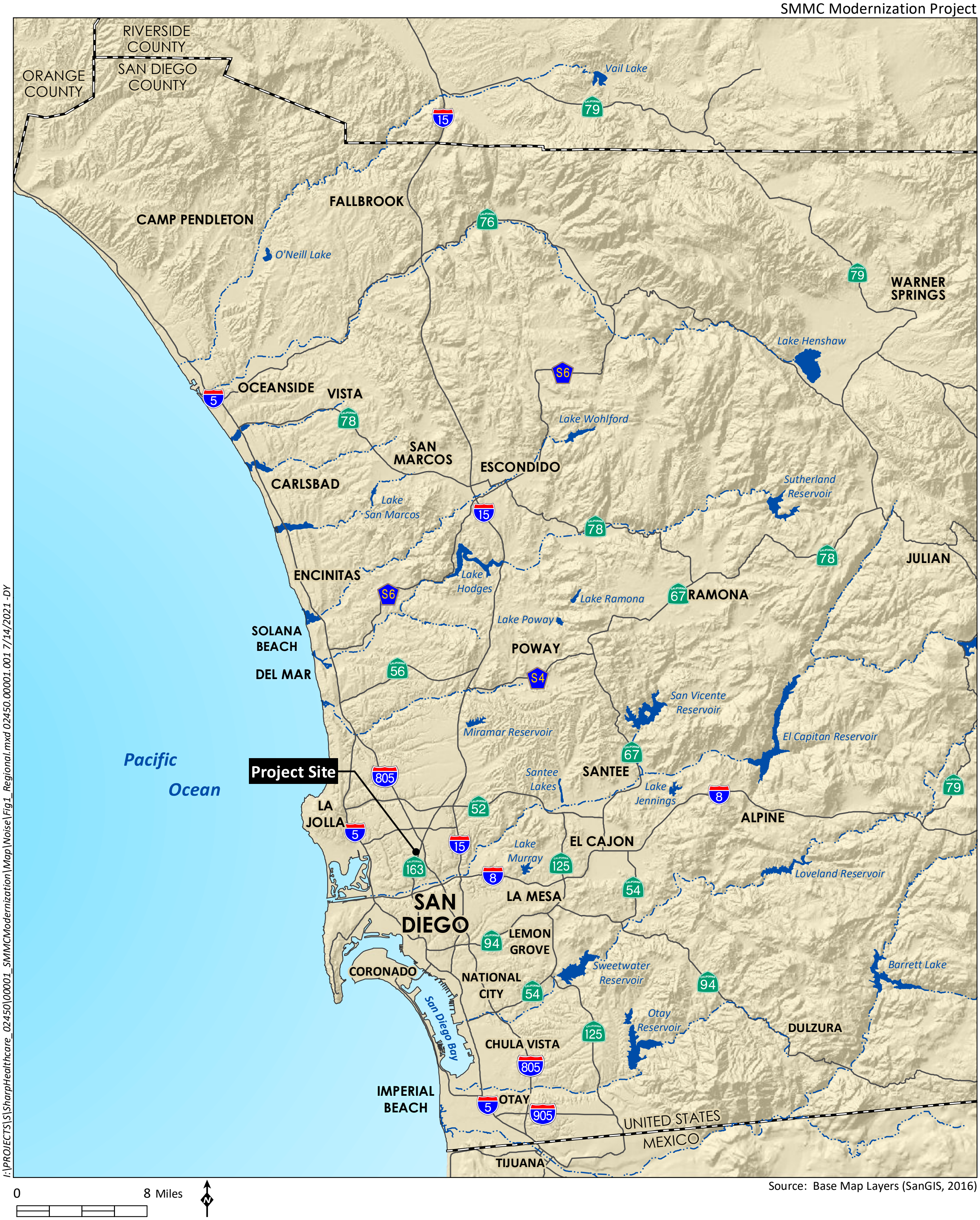
2.1 NOISE AND SOUND LEVEL DESCRIPTORS AND TERMINOLOGY

All noise level or sound level values presented herein are expressed in terms of decibels (dB), with A-weighting (dBA) to approximate the hearing sensitivity of humans. Time-averaged noise levels are expressed by the symbol L_{EQ}, with a specified duration. The Community Noise Equivalent Level (CNEL) is a 24-hour average, where noise levels during the evening hours of 7:00 p.m. to 10:00 p.m. have an added 5 dBA weighting, and sound levels during the nighttime hours of 10:00 p.m. to 7:00 a.m. have an added 10 dBA weighting. This is similar to the Day Night sound level (L_{DN}), which is a 24-hour average with an added 10 dBA weighting on the same nighttime hours but no added weighting on the evening hours. Sound levels expressed in CNEL are always based on dBA. These metrics are used to express noise levels for both measurement and municipal regulations, as well as for land use guidelines and enforcement of noise ordinances.

Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air) to a hearing organ, such as a human ear. Noise is defined as loud, unexpected, or annoying sound.

In the science of acoustics, the fundamental model consists of a sound (or noise) source, a receiver, and the propagation path between the two. The loudness of the noise source and obstructions or atmospheric factors affecting the propagation path to the receiver contribute to the sound level and characteristics of the noise perceived by the receiver. The field of acoustics deals primarily with the propagation and control of sound.

Continuous sound can be described by frequency (pitch) and amplitude (loudness). A low frequency sound is perceived as low in pitch. Frequency is expressed in terms of cycles per second, or Hertz (Hz) (e.g., a frequency of 250 cycles per second is referred to as 250 Hz). High frequencies are sometimes



Source: Base Map Layers (SanGIS, 2016)

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Regional Location

Figure 1

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Source: Aerial (SanGIS, 2020)

0 400 Feet

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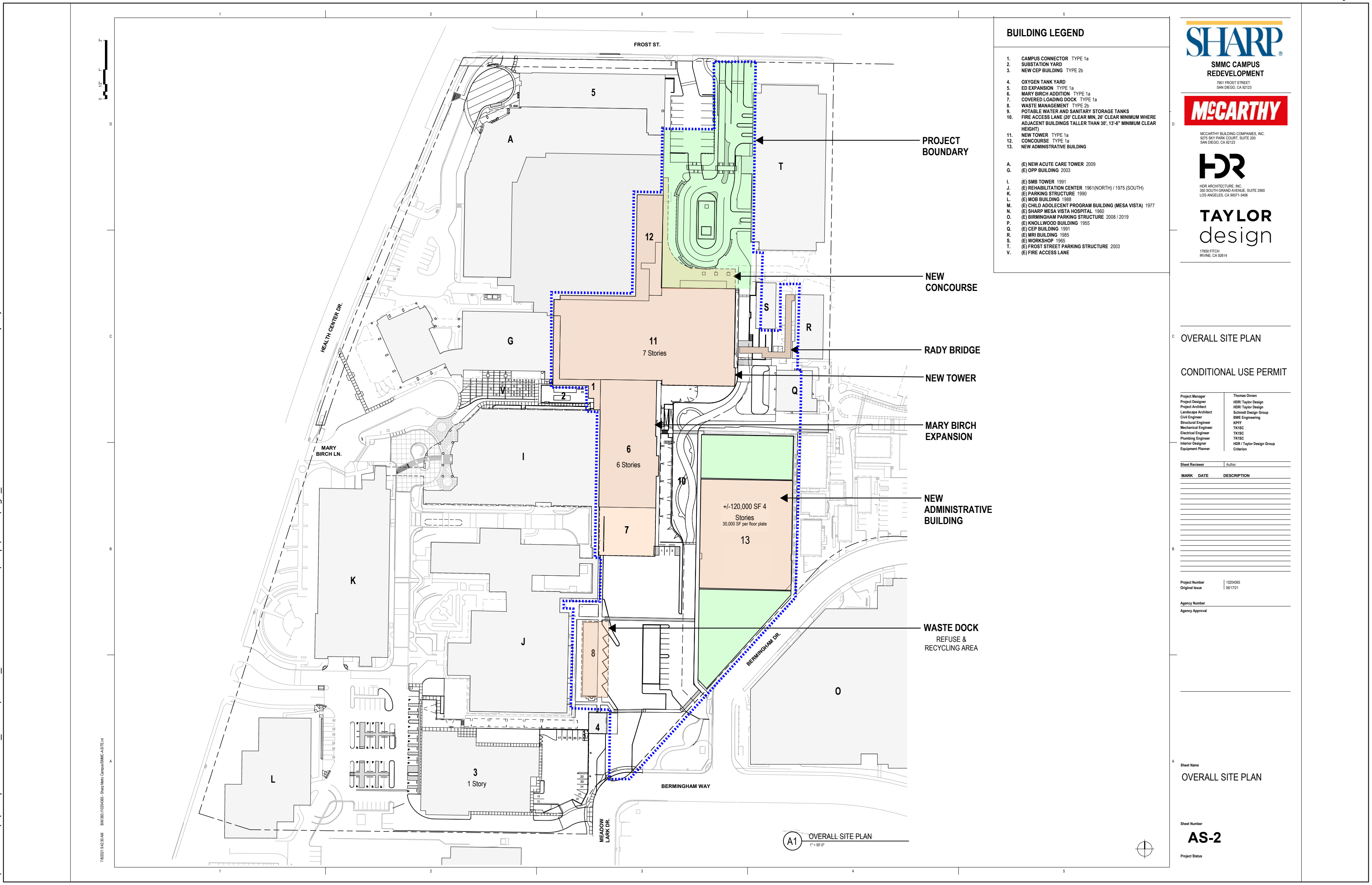
Project Vicinity (Aerial Photograph)

Figure 2



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Source: Sharp Healthcare, 2021

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Overall Site Plan

Figure 3

more conveniently expressed in kilohertz (kHz), or thousands of Hertz. The audible frequency range for humans is generally between 20 Hz and 20,000 Hz.

The amplitude of pressure waves generated by a sound source determines the loudness of that source. A logarithmic scale is used to describe sound pressure level (SPL) in terms of dBA units. The threshold of hearing for the human ear is about 0 dBA, which corresponds to 20 micro Pascals (mPa).

Because decibels are logarithmic units, SPL cannot be added or subtracted through ordinary arithmetic. Under the decibel scale, a doubling of sound energy corresponds to a 3 dBA increase. In other words, when two identical sources are each producing sound of the same loudness, the resulting sound level at a given distance would be 3 dBA higher than one source under the same conditions.

2.2 GROUNDBORNE VIBRATION DESCRIPTORS AND TERMINOLOGY

Groundborne vibration consists of rapidly fluctuating motions or waves transmitted through the ground with an average motion of zero. Sources of groundborne vibrations include natural phenomena and anthropogenic causes (e.g., explosions, machinery, traffic, trains, construction equipment). Vibration sources may be continuous (e.g., factory machinery) or transient (e.g., explosions). Several different methods are typically used to quantify vibration amplitude. One is the peak particle velocity (PPV); another is the RMS velocity. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. For the purposes of this analysis, a PPV descriptor with units of inches per second (in/sec) is used to evaluate construction-generated vibration for building damage and human complaints. Generally, a PPV of less than 0.08 in/sec does not produce perceptible vibration. At 0.12 PPV in/sec is the level at which there is a risk of architectural damage (e.g., cracking of plaster) to historical buildings and other vibration-sensitive structures and the level at which continuous vibration may become noticeable to building occupants. A level of 0.20 PPV in/sec is commonly used as a threshold for risk of architectural damage to non-engineered timber and masonry buildings (California Department of Transportation [Caltrans] 2020).

2.3 NOISE AND VIBRATION SENSITIVE LAND USES

Noise-sensitive land uses (NSLUs) are land uses that may be subject to stress and/or interference from excessive noise, such as residential dwellings, schools, transient lodging (hotels), hospitals, educational facilities, and libraries. Industrial and commercial land uses are generally not considered sensitive to noise. Noise receptors are individual locations that may be affected by noise. The nearest NSLUs in the project vicinity is the Rady Children's Hospital to the north and east.

Land uses in which ground-borne vibration could potentially interfere with operations or equipment, such as research, hospitals, and university research operations (Caltrans 2020) are considered "vibration-sensitive." The degree of sensitivity depends on the specific equipment that would be affected by the ground-borne vibration. In addition, excessive levels of ground-borne vibration of either a regular or an intermittent nature can result in annoyance to residential uses, schools, or transient lodging. Land uses in the project area that are subject to annoyance from vibration include the hospitals to the north and east, as mentioned above.

2.4 REGULATORY FRAMEWORK

Applicable noise standards for the project are codified in the following City regulations:

2.4.1 City of San Diego Municipal Code, Chapter 5, Article 9.5, Division 4, §59.5.0404 Construction Noise

(a) It shall be unlawful for any person, between the hours of 7:00 p.m. of any day and 7:00 a.m. of the following day, or on legal holidays as specified in Section 21.04 of the San Diego Municipal Code, with exception of Columbus Day and Washington's Birthday, or on Sundays, to erect, construct, demolish, excavate for, alter or repair any building or structure in such a manner as to create disturbing, excessive or offensive noise unless a permit has been applied for and granted beforehand by the Noise Abatement and Control Administrator. In granting such permit, the Administrator shall consider whether the construction noise in the vicinity of the proposed work site would be less objectionable at night than during the daytime because of different population densities or different neighboring activities; whether obstruction and interference with traffic particularly on streets of major importance, would be less objectionable at night than during the daytime; whether the type of work to be performed emits noises at such a low level as to not cause significant disturbances in the vicinity of the work site; the character and nature of the neighborhood of the proposed work site; whether great economic hardship would occur if the work were spread over a longer time; whether proposed night work is in the general public interest; and he shall prescribe such conditions, working times, types of construction equipment to be used, and permissible noise levels as he deems to be required in the public interest.

(b) Except as provided in subsection (c) hereof, it shall be unlawful for any person, including the City of San Diego, to conduct any construction activity so as to cause, at or beyond the property lines of any property zoned residential, an average sound level greater than 75 dBA during the 12-hour period from 7:00 a.m. to 7:00 p.m.

(c) The provisions of subsection (b) of this section shall not apply to construction equipment used in connection with emergency work, provided the Administrator is notified within 48 hours after commencement of work.

2.4.2 City of San Diego Municipal Code, Chapter 5, Article 9.5, Division 4, §59.5.0401, Sound Level Limits

(a) It shall be unlawful for any person to cause noise by any means to the extent that the one-hour average sound level exceeds the applicable limit given in the following table [Table 1, *Applicable Noise Limits*], at any location in the City on or beyond the boundaries of the property on which the noise is produced. The noise subject to these limits is that part of the total noise at the specified location that is due solely to the action of said person.

(b) The sound level limit at a location on a boundary between two zoning districts is the arithmetic mean of the respective limits for the two districts. Permissible construction noise level limits shall be governed by Section 59.5.0404 of this article.

Table 1
APPLICABLE NOISE LIMITS

Land Use Zone	Time of Day	One-hour Average Sound Level (dBA)
Single Family Residential	7:00 a.m. to 7:00 p.m.	50
	7:00 p.m. to 10:00 p.m.	45
	10:00 p.m. to 7:00 a.m.	40
Multi-Family Residential (up to a maximum density of 1/2000)	7:00 a.m. to 7:00 p.m.	55
	7:00 p.m. to 10:00 p.m.	50
	10:00 p.m. to 7:00 a.m.	45
All other Residential	7:00 a.m. to 7:00 p.m.	60
	7:00 p.m. to 10:00 p.m.	55
	10:00 p.m. to 7:00 a.m.	50
Commercial	7:00 a.m. to 7:00 p.m.	65
	7:00 p.m. to 10:00 p.m.	60
	10:00 p.m. to 7:00 a.m.	60
Industrial or Agricultural	Anytime	75

Source: City of San Diego Municipal Code, Chapter 5, Article 9.5, Division 4, §59.5.0401, Table K-4 Sound Level Limits

2.4.3 City of San Diego General Plan Noise Element

The City General Plan Noise Element (City 2008, amended in 2015) establishes noise compatibility guidelines for uses affected by traffic noise, as shown in Table 2, *City of San Diego Land Use Noise Compatibility Guidelines*.

Table 2
CITY OF SAN DIEGO LAND USE NOISE COMPATIBILITY GUIDELINES[1]

Land Use Category	Exterior Noise Exposure (dBA CNEL)				
	<60	60-65	65-70	70-75	75+
Parks and Recreational					
Parks, Active and Passive Recreation					
Outdoor Spectator Sports, Golf Courses; Water Recreational Facilities; Indoor Recreation Facilities					
Agricultural					
Crop Raising & Farming; Community Gardens, Aquaculture, Dairies; Horticulture Nurseries & Greenhouses; Animal Raising, Maintain & Keeping; Commercial Stables					
Residential					
Single Dwelling Units; Mobile Homes		45			
Multiple Dwelling Units		45	45		
Institutional					
Hospitals; Nursing Facilities; Intermediate Care Facilities; K-12 Educational Facilities; Libraries; Museums; Child Care Facilities		45			
Other Educational Facilities including Vocational/Trade Schools and Colleges, and Universities)		45	45		
Cemeteries					

Land Use Category	Exterior Noise Exposure (dBA CNEL)				
	<60	60-65	65-70	70-75	75+
Retail Sales					
Building Supplies/Equipment; Groceries; Pets & Pet Supplies; Sundries, Pharmaceutical, & Convenience Sales; Apparel & Accessories			50	50	
Commercial Services					
Building Services; Business Support; Eating & Drinking; Financial Institutions; Maintenance & Repair; Personal Services; Assembly & Entertainment (includes public and religious assembly); Radio & Television Studios; Golf Course Support			50	50	
Visitor Accommodations		45	45	45	
Offices					
Business & Professional; Government; Medical, Dental & Health Practitioner; Regional & Corporate Headquarters			50	50	
Vehicle and Vehicular Equipment Sales and Services Use					
Vehicle Repair & Maintenance; Vehicle Sales & Rentals; Vehicle Equipment & Supplies Sales & Rentals; Vehicle Parking					
Wholesale, Distribution, Storage Use Category					
Equipment & Materials Storage Yards; Moving & Storage Facilities; Warehouse; Wholesale Distribution					
Industrial					
Heavy Manufacturing; Light Manufacturing; Marine Industry; Trucking & Transportation Terminals; Mining & Extractive Industries					
Research & Development				50	

	Compatible	Indoor Uses	Standard construction methods should attenuate exterior noise to an acceptable indoor noise level.
		Outdoor Uses	Activities associated with the land use may be carried out.
45, 50	Conditionally Compatible	Indoor Uses	Building structure must attenuate exterior noise to the indoor noise level indicated by the number (45 or 50) for occupied areas.
		Outdoor Uses	Feasible noise mitigation techniques should be analyzed and incorporated to make the outdoor activities acceptable.
	Incompatible	Indoor Uses	New construction should not be undertaken.
		Outdoor Uses	Severe noise interference makes outdoor activities unacceptable.

Source: City 2008 (as amended in 2015)

[1] Compatible noise levels and land use definitions reflect amendments to the City's General Plan Noise Element approved in 2015.

As shown in Table 2, the project's hospital uses would be compatible if the exterior noise levels are 60 CNEL or less and conditionally compatible if the exterior noise levels are 60 to 65 CNEL. If the exterior noise level is continually compatible, the building structure must attenuate exterior noise to 45 CNEL for occupied areas. The project's office space would be compatible is the exterior noise levels are 65 CNEL or less and conditionally compatible if the exterior noise levels are 65 to 75 CNEL. If the exterior noise level is continually compatible, the building structure must attenuate exterior noise to 50 CNEL for occupied areas (e.g., office space).

2.5 EXISTING CONDITIONS

The existing development includes multiple buildings and a bridge that are proposed to be demolished as part of the project. Such structures include the 19,915 SF CEP/plumbing shop (consisting of 13,034 SF of demolition and 6,881 SF of renovations), 4,629 SF of a connecting corridor, the 1,280 SF shop building, the 20,567 SF dietary building, the 13,707 SF service building, the 2,320 SF Rady Bridge, 47,404 SF of building space for the entrance enhancement, 40,539 SF of the Knollwood Building, 95,036 SF of the central tower, and 113,942 SF of the south tower. In total, 352,458 SF of existing building and bridge space would be demolished. All structures proposed to be demolished are Type I construction, with the exception of the CEP/plumbing shop (Type II-B), the Rady Bridge (Type II-B), and the Knollwood Building (Type V).

Multiple structures would remain and not be altered as part of the project. These include the Stephen Birch Healthcare Center building, Sharp Mary Birch Building, Rehabilitation Center, Sharp Memorial Outpatient Pavilion, and parking structures (see Figure 3).

Surrounding uses include Health Center Drive and SR 163 to the west, Rady Children's Hospital to the north and east, and San Diego Juvenile Hall and Sharp Mesa Vista Hospital to the south (see Figure 2). Montgomery-Gibbs Municipal Airport is located approximately 1 mile northeast of the project site.

3.0 METHODOLOGY, ASSUMPTIONS, AND THRESHOLDS

3.1 METHODOLOGY

3.1.1 Noise Modeling Software

Project construction noise was analyzed using the Roadway Construction Noise Model Version 1.1 (RCNM; USDOT 2008), which utilizes estimates of sound levels from standard construction equipment. The RCNM output is provided in Appendix A, *RCNM Output*, to this report.

3.2 ASSUMPTIONS

3.2.1 Construction

Construction would require demolition, site preparation, grading, installation of underground utilities, and building construction for multiple components of the project. These components include construction of the Mary Birch expansion, new hospital tower, central and south tower demolition, and the Knollwood Building replacement.

Construction equipment estimates are based on assumptions provided by the Project Applicant and model defaults from the project's Air Quality Technical Report (HELIX 2021). Table 3, *Construction Equipment Assumptions*, presents a summary of the assumed equipment that would be required for each project component. Project construction would involve the demolition of existing structures and soil movement (cut and fill) during grading. The export of demolition materials, the export of cut soil, and the import of fill soil would require the use of on-road haul trucks. The demolition and soil movement amounts associated with the various components of Project construction are shown in Table 4, *Demolition and Soil Movement Amounts.*

Table 3
CONSTRUCTION EQUIPMENT ASSUMPTIONS

Construction Equipment	Percent Operating Time
Concrete/Industrial Saw	20
Rubber Tired Loader	20
Tractor/Loader/Backhoe	40
Grader	40
Scraper	40
Crane	40
Forklift	16
Generator Set	50
Welder	40
Paver	50
Paving Equipment	20
Roller	40
Air Compressor	40
Cement Mixer	40

Table 4
DEMOLITION AND SOIL MOVEMENT AMOUNTS

Component	Demolition Amount	Soil Movement Amount Cut	Soil Movement Amount Fill
Mary Birch Expansion/Waste Dock Construction/CEP Renovation	8,650 tons	10,861 CY cut	457 CY fill
Hospital Tower Construction/Rady Bridge Replacement	2,120 tons	3,045 CY cut	2,108 CY fill
Concourse Entry Construction/ Knollwood Building Replacement	7,920 tons	1,829 CY cut	444 CY fill
Central and South Towers Demolition	11,200 tons	10 CY cut	718 CY fill

Source: HELIX 2021
CY = cubic yards

3.2.2 Operation

The proposed operational noise sources include heating, ventilation, and air conditioning (HVAC) systems, on-site generators, fans, noise generated by the CEP, general on-site truck and vehicle noise, and noise associated with the project's vehicular traffic.

3.3 GUIDELINES FOR THE DETERMINATION OF SIGNIFICANCE AND CONDITIONS OF APPROVAL

The following thresholds are based on the City Significance Determination Thresholds and Noise Ordinance, as applicable to the project.

A potentially significant noise impact would occur if the project would:

1. Result in temporary construction noise that exceeds 75 dBA L_{EQ} (12 hour) at the property line of an off-site property zoned residential or other NSLU from 7:00 a.m. to 7:00 p.m. (as identified in Section 59.0404 of the City's Municipal Code) or if non-emergency construction occurs during the 12-hour period from 7:00 p.m. to 7:00 a.m.

2. Result in or create a significant permanent increase in the existing noise levels. For the purposes of this analysis, a significant increase would be greater than a perceptible change (3 dBA) over existing conditions or the generation of noise levels at a common property line that exceed the limits shown in Table 1.

A significant vibration impact would occur of the project would:

3. Subject vibration-sensitive land uses to construction-related ground-borne vibration that exceeds the severe vibration annoyance potential criteria for human receptors, as specified by Caltrans (2020), of 0.4 inches per second PPV, and 0.5 inches per second PPV for damage to structures for continuous/frequent intermittent construction sources (such as impact pile drivers, vibratory pile drivers, and vibratory compaction equipment). Vibration impacts for vibration-sensitive activities, such as laboratory equipment, would be significant vibration levels exceed 72 vibration decibels (VdB) for hospital operating rooms (Federal Transit Administration; FTA 2018).

The following condition of approval would be required for all proposed new uses:

4. Projects shall not expose new development to noise levels at exterior use areas or interior areas in excess of the noise compatibility guidelines established in the City General Plan Noise Element. The compatible noise levels limit for the project's Institutional land use is 65 CNEL. For outdoor uses at a conditionally compatible land use, feasible noise mitigation techniques should be analyzed and incorporated to make the outdoor activities acceptable. For indoor uses at a conditionally compatible land use, exterior noise must be attenuated to 45 CNEL.

4.0 IMPACTS

4.1 ISSUE 1: TEMPORARY INCREASE IN AMBIENT NOISE LEVELS

4.1.1 Construction Equipment

The potential equipment noise from project construction activity was analyzed using the RCNM, as described in Section 3.1, above. Demolition of existing buildings would occur at varying distances from NSLUs. Demolition and construction work required for construction of the new Concourse and Hospital Tower would be located at a distance of approximately 200 feet from Rady Children's Hospital Nelson Pavilion buildings to the east. The loudest construction activity during demolition would be from the potential use of concrete saws and jackhammers to demolish the concrete buildings. A concrete saw would be expected to be used intermittently for approximately 20 percent of the workday. At a distance of 200 feet, a concrete saw would generate a noise level of 70.5 dBA L_{EQ} (12 hour). A jackhammer would generate a noise level of 69.9 dBA L_{EQ} (12 hour). During demolition, a dozer in conjunction with a loader and a dump truck would be used to demolish or grade material and to load debris for removal. A dozer, loader, and dump truck could be used concurrently approximately 40 percent of the workday and would produce a combined 68.3 dBA L_{EQ} (12 hour) at 200 feet. These noise levels do not account for the large amount of attenuation that would be provided by the existing Frost Street Parking Structure. Even without consideration of existing noise-attenuating structures, project construction equipment used during demolition would not be expected to exceed the City Noise Ordinance construction threshold of 75 dBA L_{EQ} (12 hour). See Appendix A, *RCNM Output*, to this report for model outputs.

Similarly, demolition work would need to be conducted for the Knollwood Building at the project's southeastern corner. This site is located adjacent to the project boundary with Rady Children's Hospital. However, the Knollwood Building would be adjacent to an office building within the Rady Children's Hospital complex, which is not considered a NSLU. For the purposes of this analysis, construction noise would be assessed at the Nelson Pavilion to the northeast, approximately 150 feet from the northeast corner of the Knollwood Building. A concrete saw in use at this corner would generate 73.0 dBA L_{EQ} (12 hour) and a jackhammer would generate 72.4 dBA L_{EQ} (12 hour). A dozer, loader, and dump truck would also be used during demolition; however, they would result in lower noise levels and would likely be used at further distances due to the size of the building. Project construction equipment used during demolition would therefore not be expected to exceed the City Noise Ordinance construction threshold of 75 dBA L_{EQ} (12 hour). See Appendix A, *RCNM Output*, to this report for model outputs.

Project construction would occur at varying distances from the nearby Rady Children's Hospital. For the purposes of this analysis, noise levels were modeled at a distance of 200 feet, which is the approximate distance from the Knollwood Building and Hospital Tower to the project boundary with Rady Children's Hospital to the east. Noise levels generated by anticipated construction equipment are shown in Table 5, *Construction Equipment Noise Levels*. As shown in the table, construction equipment is not anticipated to exceed the City Noise Ordinance construction threshold during grading or construction.

Table 5
CONSTRUCTION EQUIPMENT NOISE LEVELS

Unit	Percent Operating Time	dBA L_{MAX} at 200 feet	dBA L_{EQ} at 200 feet
Concrete Saw	20	77.5	70.5
Jackhammer	20	76.8	69.9
Front End Loader	40	67.1	63.1
Tractor	40	72	68
Backhoe	40	65.5	61.5
Scraper	40	71.5	67.6
Crane	16	68.5	60.6
Generator	50	68.6	65.6
Welder/Torch	40	62	58
Paver	50	65.2	62.2
Roller	20	68	61
Compressor (air)	40	65.6	61.6
Concrete Mixer Truck	40	66.8	62.8
Dozer	40	69.6	65.6
Dump Truck	40	64.4	60.4

Source: RCNM; Appendix A
L_{MAX} = maximum noise level; dBA = A-weighted decibel; L_{EQ} = equivalent sound level
Note: Modeling results do not include intervening structures that would attenuate noise levels further.

4.1.2 Construction Traffic

Construction would generate vehicular traffic in the form of worker vehicles and material import and export trucks. Vehicles associated with project-construction would utilize Frost Street and Health Center Drive for project components at the northern portion of the project site and Meadow Lark Drive to Starling Drive for project components at the southern portion of the site.

According to the traffic count data found on SANDAG's TFIC website, Frost Street carries approximately 15,900 average daily trips (ADT) per day, while Health Center Drive carries 20,100 ADT. Meadow Lark Drive carries 12,400 ADT and Starling Drive carries 14,400 ADT. The project would require 10,404 CY of soil export during the construction of the Mary Birch Expansion component. This would be the largest amount of material requiring export from the project site. Assuming truck capacity of 12 CY per vehicle, and assuming two-way trips, approximately 1,734 haul trips would be required. During the grading phase for the Mary Birch Expansion, approximately 42 working days would be required (HELIX 2021). During this period, it is assumed 41 trips would be needed per day.

A general rule of thumb is that a doubling of ADT would cause a doubling in noise (a 3 dBA increase), which would be a noticeable change and considered a significant increase. An additional 41 trucks per day on any of the roadways mentioned above would not double the amount of traffic and therefore increase noise significantly. Trucks, however, generate more noise than an individual automobile. Even if trucks are counted as two automobiles for noise purposes, an additional 82 vehicles per day would not increase noise significantly. Therefore, the increase in traffic from the project's construction would have a less than significant impact on noise levels.

4.2 ISSUE 2: PERMANENT INCREASE IN AMBIENT NOISE LEVELS

4.2.1 On-Site Operational Noise

A Design Development Acoustical Report dated March 1, 2021 was prepared by HDR for the SMMC Campus Redevelopment Project (HDR 2021; Appendix B). This report's scope of work encompasses operational noise generated by the entire SMMC Campus Redevelopment, which includes the project. The report modeled operational noise generated by the project and analyzed how it would affect existing on-site noise receptors such as patients within the SMMC Campus, as well as how those operational noise sources affect off-site receivers in the vicinity of the project. On-site operational noise is generated by primarily stationary sources and include HVAC units, exhaust fans, generators, boilers, chillers, and water pumps. Because the report's scope includes noise sources for the entire SMMC Campus, including the project, operational noise from the project would be less than what was modeled in the HDR report. The report therefore represents a conservative analysis of noise generated by the project.

Noise modeling results indicate that operational noise levels from the combined SMMC Campus Redevelopment Project and the project would not exceed thresholds established by the San Diego Municipal Code. Modeled noise levels from the HDR report are presented for the relevant off-site receivers in Table 6, *Operational Noise Levels*.

Table 6
OPERATIONAL NOISE LEVELS

Off-site Receiver Location	Operational Hourly Noise Levels (dBA L_{EQ})	Municipal Code Limit (dBA L_{EQ})
East District Boundary (Rady Children's Hospital)	56	60
Juvenile Probation Center	54	60
Juvenile Court	45	60
Juvenile Hall	41	52.5
Residences (south of project site)	45	52.5
Residences (west of project site)	50	52.5

Source: HDR 2021; Appendix B
Note: Operational noise levels include all SMMC Campus Redevelopment projects, including the project.

4.2.2 Project-Generated Transportation Noise

4.2.2.1 Off-Site Exterior Noise

A direct significant impact would occur if off-site exterior useable spaces are exposed to noise levels that exceed the "Conditionally Compatible" guidelines discussed in Table 2 if those uses were not exposed to noise levels above the guidelines before the project. If noise levels already exceed the applicable significance thresholds, a significant impact would if the project's contribution would be 3 CNEL or greater.

As a result of the project, the number of beds would be reduced by 77. Because of this, project-generated vehicular traffic would not increase, and ADT generated by the project components would be reduced as compared to existing conditions. Additionally, helicopter and ambulance trips are not anticipated to change from existing conditions. Therefore, while vehicular traffic may increase during construction as described in Section 4.1.2, there would be no permanent increase in traffic due to implementation of the project. Impacts to off-site receivers, including nearby residences, would therefore be less than significant.

4.2.3 Mitigation Measures

Because impacts related to Issue 1 would be less than significant, no mitigation is required.

4.2.4 Significance of Impacts After Mitigation

Impacts would be less than significant without mitigation.

4.3 ISSUE 3: EXCESSIVE GROUND-BORNE VIBRATION

4.3.1 Impact Analysis

4.3.1.1 Construction Vibration

Construction activities known to generate excessive ground-borne vibration, such as pile driving, would not be conducted by the project. The largest source of vibration anticipated during general project construction activities would be a vibratory roller used for pavement compaction. A vibratory roller could be used up to 40 feet from the closest on-site structure (Knollwood Building) to the closest off-site structure (Rady Children's Hospital office building adjacent to the Knollwood Building). A vibratory roller would create approximately 0.210 inch per second PPV at 25 feet (Caltrans 2020). A 0.210 inch per second PPV vibration level would equal 0.13 inch per second PPV at a distance of 40 feet.[1] This would be lower than what is considered a "strongly perceptible" level for humans of 0.1 inch per second PPV, and far lower than the structural damage threshold of 0.5 inches per second PPV for continuous/frequent intermittent construction sources.

Vibration impacts on hospital equipment at nearby land uses, such as those at Rady Children's Hospital Nelson Pavilion, are measured in VdB. At 200 feet, vibration from a vibratory roller would be approximately 68 VdB, which would not exceed the 72 VdB threshold for operating rooms (FTA 2018).

Therefore, although a vibratory roller may be perceptible to nearby human receptors, temporary impacts associated with the roller (and other potential equipment) would be less than significant.

4.3.1.2 Operational Vibration

Land uses that may generate substantial operational vibration include heavy industrial or mining operations that would require the use of vibratory equipment. The proposed project components do not include equipment that would generate substantial vibration. Therefore, operational vibration impacts are less than significant.

4.3.2 Mitigation Measures

Because impacts related to Issue 3 would be less than significant, no mitigation is required.

4.3.3 Significance of Impacts After Mitigation

Impacts would be less than significant without mitigation.

4.4 ISSUE 4: NOISE LEVEL STANDARD COMPLIANCE FOR NEW USES

4.4.1 Exterior Noise Levels

The project's proposed hospital uses would be compatible if exterior noise levels from traffic do not exceed the City's noise element for conditionally compatible exterior standard of 65 CNEL. The new hospital tower building would be less than 1,000 feet from SR 163 and would therefore likely be exposed to noise levels exceeding 65 CNEL from freeway noise (HELIX 2019). The project, however, proposes demolition of existing buildings and construction of new structures. New exterior use areas are not proposed as part of the project. Additionally, noise levels throughout the project site would be attenuated from freeway noise from existing and proposed structures. The project's components would be conditionally compatible with the City's exterior noise standards for institutional land uses.

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[1] Equipment PPV = Reference PPV * $(25/D)^n$ (in/sec), where Reference PPV is PPV at 25 feet, D is distance from equipment to the receiver in feet, and n = 1.1 (the value related to the attenuation rate through the ground); formula from Caltrans 2013b.

4.4.2 Interior Noise Levels

The project's proposed office land use would be compatible if interior noise levels from traffic do not exceed the City's noise element interior standard 45 CNEL for Institutional uses such as hospitals. Current exterior noise levels from SR 163 exceed 65 CNEL at the new hospital building; however, building materials for the project structures within the SMMC Campus are expected to attenuate noise levels by up to 30 CNEL (HDR 2021). Interior noise levels would not exceed the City standard and impacts would be less than significant.

4.4.3 Airport Noise

The closest airport to the project site is Montgomery-Gibbs Municipal Airport, located approximately 1 mile to the northeast. The portion of the site to be developed is not located within the 60 to 65 CNEL contour as shown on the Compatibility Policy Map: Noise Montgomery Field Land Use Compatibility Plan (ALUCP; San Diego County Airport Land Commission 2010). Therefore, the project would not result in the exposure of people working or residing in the project area to excessive noise from airports and the impact would be less than significant.

4.4.4 Mitigation Measures

Because impacts related to Issue 4 would be less than significant, no mitigation is required.

4.4.5 Significance of Impacts After Mitigation

Impacts would be less than significant without mitigation.

5.0 LIST OF PREPARERS

Jason Runyan	Acoustic Analyst
Joanne M. Dramko, AICP	Senior Noise Specialist, Quality Assurance Reviewer
Andrea Bitterling	Project Manager

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Appendix A

RCNM Output

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 7/13/2021
Case Description:

---- Receptor #1 ----

		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
1	Residential	40	40	40

			Equipment			
			Spec	Actual	Receptor	Estimated
	Impact		Lmax	Lmax	Distance	Shielding
Description	Device	Usage(%)	(dBA)	(dBA)	(feet)	(dBA)
Concrete Saw	No	20		89.6	200	0
Jackhammer	Yes	20		88.9	200	0
Front End Loader	No	40		79.1	200	0
Tractor	No	40	84		200	0
Backhoe	No	40		77.6	200	0
Scraper	No	40		83.6	200	0
Crane	No	16		80.6	200	0
Generator	No	50		80.6	200	0
Welder / Torch	No	40		74	200	0
Paver	No	50		77.2	200	0
Paver	No	50		77.2	200	0
Roller	No	20		80	200	0
Compressor (air)	No	40		77.7	200	0
Concrete Mixer Truck	No	40		78.8	200	0
Dozer	No	40		81.7	200	0
Dump Truck	No	40		76.5	200	0

			Results			
	Calculated (dBA)			Noise Limits (dBA)		
			Day		Evening	
Equipment	*Lmax	Leq	Lmax	Leq	Lmax	Leq
Concrete Saw	77.5	70.5	N/A	N/A	N/A	N/A
Jackhammer	76.8	69.9	N/A	N/A	N/A	N/A
Front End Loader	67.1	63.1	N/A	N/A	N/A	N/A
Tractor	72	68	N/A	N/A	N/A	N/A
Backhoe	65.5	61.5	N/A	N/A	N/A	N/A
Scraper	71.5	67.6	N/A	N/A	N/A	N/A
Crane	68.5	60.6	N/A	N/A	N/A	N/A
Generator	68.6	65.6	N/A	N/A	N/A	N/A
Welder / Torch	62	58	N/A	N/A	N/A	N/A
Paver	65.2	62.2	N/A	N/A	N/A	N/A
Paver	65.2	62.2	N/A	N/A	N/A	N/A
Roller	68	61	N/A	N/A	N/A	N/A

Compressor (air)		65.6	61.6	N/A	N/A	N/A	N/A
Concrete Mixer Truck		66.8	62.8	N/A	N/A	N/A	N/A
Dozer		69.6	65.6	N/A	N/A	N/A	N/A
Dump Truck		64.4	60.4	N/A	N/A	N/A	N/A
	Total	77.5	77.4	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report dat(########
Case Description:

---- Receptor #1 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
1	Residential	40	40	40

Equipment

Description	Impact Device	Usage(%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Concrete Saw	No	20		89.6	150	0
Jackhammer	Yes	20		88.9	150	0

Results

	Calculated (dBA)		Noise Limits (dBA)			
			Day		Evening	
Equipment	*Lmax	Leq	Lmax	Leq	Lmax	Leq
Concrete Saw	80	73	N/A	N/A	N/A	N/A
Jackhammer	79.3	72.4	N/A	N/A	N/A	N/A
Total	80	75.7	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 7/13/2021
Case Description:

---- Receptor #1 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
1	Residential	40	40	40

Equipment

Description	Impact Device	Usage(%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Front End Loader	No	40		79.1	200	0
Dozer	No	40		81.7	200	0
Dump Truck	No	40		76.5	200	0

Results

	Calculated (dBA)		Noise Limits (dBA)			
			Day		Evening	
Equipment	*Lmax	Leq	Lmax	Leq	Lmax	Leq
Front End Loader	67.1	63.1	N/A	N/A	N/A	N/A
Dozer	69.6	65.6	N/A	N/A	N/A	N/A
Dump Truck	64.4	60.4	N/A	N/A	N/A	N/A
Total	69.6	68.3	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

Appendix B

Design Development Acoustical Report for the SMMC Campus Redevelopment Project

FACILITY NAME: SHARP METROPOLITAN MEDICAL CENTER

PROJECT NAME: ***SMMC CAMPUS REDEVELOPMENT***

PROJECT NUMBER: ***10204365***

FACILITY NUMBER: ***12744***

DOCUMENT: ***DESIGN DEVELOPMENT ACOUSTICAL REPORT***

DATE: ***MARCH 1, 2021***

TABLE OF CONTENTS

INTRODUCTION

The Sharp Metropolitan Medical Center (SMMC) Campus Redevelopment scope of work includes approximately 367,000 SF of replacement and 193,000 SF of remodel of the existing SMMC facility. The project is extensive and includes work in all of the facility buildings as well as rerouting of existing site utilities, creating a new front entry for the facility, incorporating seismic upgrades to some of the oldest buildings on campus, demolition of two existing eight level patient towers down to the third level podium base, construction of a new Central Energy Plant (CEP), and an on-grade connector that links the buildings together during construction as well as the connection to the neighboring Rady Children's Hospital. The project is spread across seven phases.

A healthcare facility includes numerous acoustically sensitive areas. The SMMC Campus Redevelopment project includes new and renovated patient spaces across the existing Mary Birch building (Packages 1 and 3), the existing Stephen Birch building (Package 4), the existing hospital (Package 6), and the new tower (Package 7). Sound isolation and sound absorptive finishes are key considerations for new and renovated patient spaces. The acoustical scope includes designing architectural systems for adequate sound isolation from mechanical spaces and rooftop equipment. The new CEP (package 5) introduces the potential for noise trespass to neighboring properties and noise intrusion to other buildings on the campus. The acoustical scope also includes controlling noise from the new plant.

DESIGN CRITERIA

The following section summarizes the acoustic design criteria and goals for the campus.

Noise Trespass

Maximum allowable noise levels of building related equipment at site non-Sharp property lines are regulated based on the land use and the time of day. The time of day designations include daytime, evening, and night. The applicable noise limits for each time period and land use are defined by the City of San Diego Noise Ordinance and are shown in the following table.

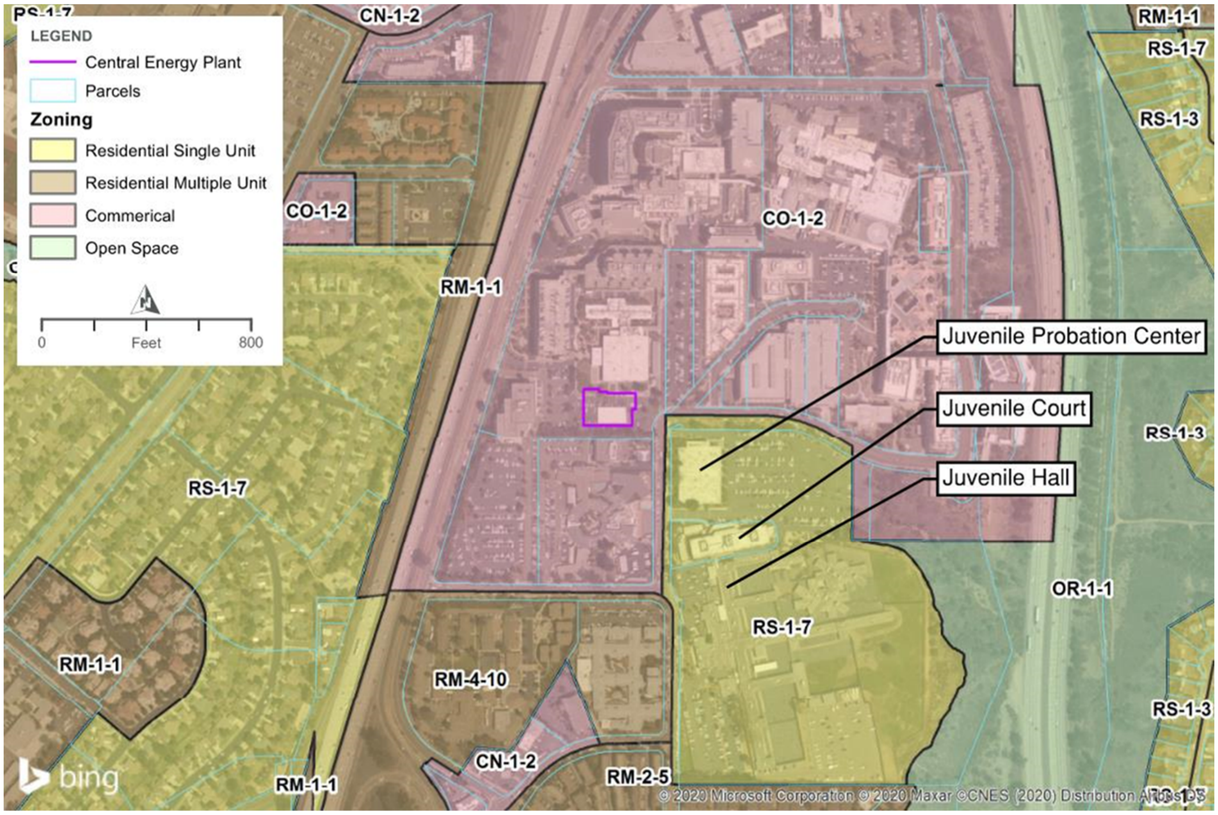
Land Use	Time of Day	One-Hour Average Sound Level, dBA
Single family residential	7 AM to 7 PM	50
	7 PM to 10 PM	45
	10 PM to 7 AM	40
Multi-family residential (up to a maximum density of 1/2000)	7 AM to 7 PM	55
	7 PM to 10 PM	50
	10 PM to 7 AM	45
All other residential	7 AM to 7 PM	60
	7 PM to 10 PM	55
	10 PM to 7 AM	50
Commercial	7 AM to 7 PM	65
	7 PM to 10 PM	60
	10 PM to 7 AM	60
Industrial	Any time	75

Source: City of San Diego Municipal Code Section 59.5.0401

a. Limits apply on or beyond the boundary of the property on which the noise is produced.

b. At the boundary between two zoning districts, the sound level limit is the arithmetic mean of the two limits.

The following figure shows the zoning districts at the SMMC campus.



The Project site is in zoning designation CO-1-2 which is a mix of commercial and residential uses that permits a maximum density of one dwelling unit for each 1,500 square feet of lot area.[1] The adjacent district to the southeast is zoned single family residential. However, the northernmost buildings within that district are a Juvenile Probation Center and Juvenile Court, which are commercial use. The southern portion of that district is a Juvenile Hall, which better aligns with multi-family residential use than the current zoning of single family residential.

The project proposes an exception to the City of San Diego ordinance by following the noise limits that align with the function of the adjacent parcels at the juvenile facility instead of the noise limits that align with the single-family residential zoning. The noise control design for the new CEP is based on these proposed exception noise limits. The commercial-to-commercial noise limits were the design limits for the SMMC campus boundaries with the Juvenile Probation Center and the Juvenile Court. The commercial-to-multi-family-residential noise limits were the design limits for the SMMC campus boundary with the Juvenile Hall.

Site Noise Goals

The new CEP is adjacent to other SMMC buildings that include patient spaces. While there are no regulatory exterior noise requirements for these adjacent buildings, a reasonable noise goal is needed to protect areas where overnight sleep occurs and areas of daytime patient use.

For reference purposes only, section 5.507 of the 2016 California Green Building Standards Code provides building envelope sound isolation requirements when site noise levels exceed a defined threshold. When noise contours are not readily available, that threshold is an equivalent-average sound

[1] Density based on information obtained from https://scoutred.com/zoning

level (Leq) of 65 dBA during any hour of building operations.

Also for reference purposes only, the FGI Guidelines for Design and Construction of Hospitals (2018) describes a site with a day-night average sound level (Ldn) below 65 dBA as a “minimal” exterior site noise exposure category.

HDR has not identified noise contours for the project site, which is located between Interstate 805 and Highway 163 just to the south of the interchange for those two roadways. However, the Kearny Mesa Community Plan Update: Noise Technical Report (December 2019) includes Community Noise Equivalent Level (CNEL) noise contours on the north side of this interchange (see Section A12.C). These noise contours provide a reasonable expectation for existing transportation noise at the project site. The Kearny Mesa Community Plan Update indicates 65 dBA CNEL noise contours extend over 1,000 feet from both Interstate 805 and Highway 163. The new CEP and the adjacent buildings are located less than 1,000 feet from Highway 163.

The site is not a particularly quiet site given the proximity to transportation noise sources. Considering existing site noise and the above reference standards, a noise goal of 65 dBA was adopted for the CEP design. The sound isolation performance of the adjacent building envelopes is unknown; however, for a healthcare building it is reasonable to expect an outdoor to indoor reduction of 20 to 30 dB. Therefore, the 65 dBA outdoor noise goal would be compatible with the project room noise requirement of 45 dBA at patient rooms and public areas.

Interior Sound Isolation

Sound isolation refers to the control of sound transmission to and from a space. Sound Transmission Class (STC) is a single number rating associated with how well a building partition attenuates airborne sound. A partition with a higher STC rating is more efficient at reducing sound transmission. The sound isolation requirements for the project are based on California Building Code (CBC) 2016 requirements. Additional sound isolation goals were established for space types not addressed in the CBC requirements. The following table summarizes the minimum requirements.

Room Type	Partition Sound Isolation Criteria [e]	Floor / Ceiling Sound Isolation Criteria [e]
Patient Room [a]	STC 45 (adjacent to patient room or access corridor) STC 55 (adjacent to public space) STC 65 (adjacent to service area)	STC 40 (adjacent to patient room or public space) STC 45 (adjacent to service area or access corridor)
Exam Room	STC 45 (adjacent to exam room or public space)	N/A
Toilet Room	STC 45 (adjacent to public space)	N/A
Consultation Room	STC 45 (adjacent to patient room or public space)	N/A
Conference Room	STC 45 (adjacent to patient	N/A

	room or public space)	
Staff Lounge	STC 45 (adjacent to patient room)	N/A
MRI Room [c, d]	STC_C 60 [b] (adjacent to patient room or exam room) STC_C 50 (adjacent to public space)	N/A
Operating Room [c, d]	STC_C 50 (adjacent to operating room) STC_C 60 [b] (adjacent to MRI room)	N/A

Source: California Building Code 2016

a. Treatment rooms shall be treated the same as patient rooms.
b. Relaxation of STCC 60 is permitted if room noise level targets are met in adjacent spaces.
c. Criteria based on FGI – values listed are goals, but not required
d. An assembly with a tested or published STC rating as low as 2 points below the stated minimum may be considered acceptable.
e. Renovation of existing spaces where the existing function is not changed are not required to follow these requirements.

The sound isolation requirements of walls and floor/ceiling assemblies vary based space type and adjacency.

Design criteria for interior door sound isolation are based on the targeted speech privacy for a space. Door hardware, sidelights, and interior glazing shall be coordinated to maintain the minimum STC ratings. Calculations of speech privacy are based on ASTM E2638 Speech Privacy Class rating categories for closed plan spaces per FGI. The following table summarizes speech privacy categories associated with ranges of SPC values.

Speech Privacy – Closed Plan	Speech Privacy Class, SPC
Secure	≥ 70
Confidential	60 – 69
Normal	52 – 69

Source: FGI

Defining Standard: ASTM E2638

Sound rated doors are provided for patient care spaces. Sound isolation of doors are based on a target speech privacy of “confidential.” Spaces with a target speech privacy in the confidential category include patient areas such as treatment rooms and exam rooms, and administrative spaces such as conference rooms and private offices. Additionally, sound rated door criteria are provided for MRI and mechanical spaces to control mechanical noise and operational noise in adjacent areas. The following table summarizes the door sound isolation criteria.

Room Type	Door Sound Isolation Criteria
Administrative areas targeting confidential or secure speech privacy	STC 30
Patient areas targeting confidential or secure speech privacy	STC 30
MRI scan room	STC 45
Mechanical room	STC 50

Room Finishes

Reverberation control is a key consideration in occupied spaces, as it affects the buildup of sound and the speech intelligibility within a space. A space with a large volume and hard finishes is associated with more noise buildup and reverberation, while smaller volume spaces with more absorptive finishes tend to have less noise buildup and greater intelligibility.

Noise Reduction Coefficient (NRC) is a value between 0 and 1 describing the ability of a surface to absorb sound. A material with an NRC closer to 1 is more absorptive while a material with an NRC closer to 0 is more reflective. Finishes with higher NRC values help to reduce the overall reverberation within a space.

Per California Building Code 2016, ceiling finishes with a minimum rating of NRC 0.90 are required in NICU sleep areas and NICU staff and family areas. Per the Master Plan Project Requirements, acoustical wall and ceiling treatment is to be included in patient corridors. In addition to these requirements, the following goals are recommended based on FGI for space types not covered by the Master Plan.

Room	Room-Average NRC Goal
Private patient bed	0.15
Multi-bed patient room	0.15
Corridor (patient area)	0.15
Medication safety zone	0.15
Nurse station	0.15
Waiting area (near patient area)	0.25
Atrium	0.10
Office	0.15
Examination room	0.15
Treatment room	0.15
Procedure room	0.15

Class 2 imaging room	0.15
Operating rooms	0.10
Class 3 imaging room	0.10
Source: FGI	

Room Noise

Room noise refers to the level of background noise within a space due to building systems noise as well as noise intrusion from the exterior environment. A variety of metrics can be used to describe room noise including A-weighted decibel (dBA) levels or Noise Criteria (NC). A-weighting is a standard frequency weighting for sound pressure levels where the decibel level is adjusted to account for the sensitivity of human hearing. The Master Plan Project Requirements define maximum room noise levels based on dBA levels. For space types where the Master Plan does not provide room noise limits, room noise goals are based on Noise Criteria values as outlined by FGI and ASHRAE. Maximum room noise criteria are shown in the table below; criteria listed are goals based on FGI unless noted otherwise.

Room Type	Room Noise Limit
Patient rooms	45 dBA [c]
Public areas	45 dBA [c]
NICU sleep area	NC 30 (NC 25 [a])
NICU staff and family areas	NC 35 (NC 30 [a])
Multiple-occupant patient care area	NC 45
Examination / treatment room	NC 40
Procedure room	NC 40
Class 2 imaging room	NC 40
Operating room	NC 50
Class 3 imaging room	NC 50
Medication safety zone	NC 40
Conference room	NC 35
Teleconferencing room	NC 25
Private office	NC 40
Open-plan office	NC 40 [b, d]
Source: FGI a. FGI recommends a target for building mechanical systems and permanent equipment that is	

5 points lower than the room noise criteria.

b. Room noise levels within ±5 of the ASHRAE targets are generally acceptable.

c. Criteria based on Master Plan Project Requirements – required noise limit.

d. Criteria based on ASHRAE – target noise limit.

DESIGN APPROACH

Interior Sound Isolation

Interior sound isolation refers to the design of partition systems including walls, doors, glazing, floors, and ceilings that contribute to the sound isolation, speech privacy, and noise control within the hospital spaces. Sound isolation strategies included in the SMMC design include the use of STC (Sound Transmission Class) rated walls, doors, glazing, and floor/ceiling systems. All sound rated walls are full height and include insulation in the stud cavity. Walls are STC rated according to space type per the sound isolation design criteria outlined in the Design Criteria section. Partitions at adjacencies with higher STC performance targets may include additional layers of gypsum, acoustically enhanced gypsum, double studs, or a combination of these strategies to achieve the targeted STC rating. Column furring walls also implement these strategies as required to maintain the performance of the wall at the column.

Sound rated doors and glazing are utilized to maintain the sound isolation performance and an acceptable level of speech privacy, as applicable, based on the space type requirements. In general, administrative and patient areas requiring confidential or secure speech privacy include a sound rated door.

Additional strategies implemented in the design for maintaining the performance of the sound isolation systems include acoustically treating penetrations in the walls and ceilings. Sound rated walls include sealant at the top and bottom of the wall. Penetrations in sound rated walls and ceilings are treated to maintain the sound isolation performance of the full system. This is achieved using acoustical seal for electric boxes (example product: Kinetics IsoBacker) and sound isolation covers for light fixtures and other ceiling penetrations (example product: Acoustical Solutions PrivacyShield Light Hood).

Sound isolation performance requirements are primarily based on space type and adjacency per the California Building Code. Criteria for the primary spaces and partition types relevant to the project are described below.

- Patient rooms: The interior sound isolation performance at patient rooms varies based on adjacency. Patient rooms adjacent to access corridors or other patient rooms require less sound attenuation than those adjacent to public spaces and service areas. Sound rated doors are not utilized at partitions separating patient rooms from access corridors. Sound rated doors are not utilized at private patient toilets that are only accessible from within the patient room.
- Exam, procedure, and treatment rooms: Sound rated partitions are provided at private exam, procedure, and treatment rooms where adjacent to other similar space types or public spaces. This does not apply for areas where multiple care units are included within the same bay. Sound rated doors and glazing (as applicable) are provided at fully enclosed exam, procedure, and treatment rooms to provide a confidential level of speech privacy.
- Conference and Consultation rooms: The performance of conference and consultation room sound isolation systems is defined by the adjacency. Conference and consult rooms utilize partitions with a higher STC rating where abutting a patient room or public space. Conference and consult rooms within hospital areas not accessible to the public may utilize lower performing sound isolation systems, as the adjacencies are often not as noise sensitive. Sound rated doors and glazing (as applicable) are implemented at conference rooms where confidential or secure speech privacy from adjacent spaces is required.
- On-Call rooms: On-call rooms are designed with sound isolation systems that are considered suitable for sleeping units. Sound isolation strategies are implemented at adjacencies to other on-call spaces and public spaces, where applicable. Sound rated doors are utilized at on-call

rooms.

- Reading and Dictation rooms: Reading and Dictation rooms include sound rated doors and glazing (as applicable).
- Operating rooms: Operating rooms utilize high sound isolation systems, sound rated doors, and sound rated glazing (as applicable). Doors and glazing are selected to maintain the composite STC performance of the partition. Sound isolation systems for Operating rooms include higher performing sound isolation elements than typical procedure rooms.
- MRI and CT Scan rooms: Like Operating rooms, MRI and CT Scan rooms also have specific sound isolation requirements for walls, doors, and glazing (as applicable) beyond those of typical procedure rooms. Doors and glazing are selected to maintain the composite performance of the partition. Refer to the New Tower section for additional information on the room specific interior sound isolation strategies for these space types.
- Toilet rooms: Toilet rooms adjacent to public spaces include sound rated walls.
- Service areas and Equipment rooms: Service area and equipment room sound isolation considerations primarily apply to the new CEP. Sound rated walls and doors are utilized as part of the noise control strategy.
- Floor/Ceiling systems: New floor/ceiling systems provide a minimum sound isolation performance of STC 45 throughout the buildings and adjacencies in the project to comply with CBC requirements for all spaces.

Room Finishes

Room finishes, volume and room geometry impact the acoustics qualities of patient spaces, public areas and administrative functions. Use of hard reflective surfaces can increase noise levels and increase reverberation in a space making communication difficult. While use of high sound absorbing materials can enhance the acoustic environment by limiting reverberation, increasing speech intelligibility, and controlling build-up of reverberant noise.

Acoustic finishes are utilized throughout the campus particularly in acoustically sensitive areas where speech intelligibility and noise control are integral to the function of the space. High sound absorbing surfaces on the project generally included acoustic ceiling tiles, acoustic wall panels and spray applied acoustic treatments. Floor finishes such as carpet and impact isolation rated floorings were also utilized to reduce footfall noise and reverberation.

The performance of acoustic room finishes is described using sound absorption coefficients. A sound absorption of 1.0 indicates that 100% of the sound is absorbed while an absorption of 0.0 means all the sound is reflect and none is absorbed. The Noise Reduction Coefficient (NRC) is a metric used to describe the sound absorption of a material focused on the material performance in the octave band center frequencies of 250 – 2 kHz frequency bands. Design targets for acoustic finishes throughout the project vary from NRC 0.10 to NRC 0.25 based on room function.

HVAC System Best Practices

Background noise levels in interior spaces are typically driven by the building HVAC system. Various noise sources influence room noise levels, including equipment noise transmission from mechanical rooms, duct-borne noise, duct breakout noise, and radiated noise from terminal units and diffusers. HDR recommends the following best practices to help meet the room noise criteria.

- Mechanical equipment
  - Select quietest available equipment.
  - Schedule maximum allowable sound power levels from 63 to 4000 Hz (discharge, inlet, and casing radiated, as applicable).
  - Locate mechanical equipment away from noise-sensitive spaces.
  - Provide vibration isolation for rotating equipment in accordance with the ASHRAE Handbook.
- Ductwork
  - Avoid main duct runs over spaces with room noise criteria of NC 35 or below.
  - Route main duct runs in corridors with discrete takeoffs to rooms with noise criteria.
  - Avoid main duct runs through sound-rated partitions rated STC 50 and above.
  - Design ducts and fittings to minimize turbulence.
  - Avoid low aspect rectangular ductwork.
  - Route high velocity ductwork away from noise-sensitive spaces.
  - Limit duct airflow velocities:
    - Mechanical rooms and shafts: maximum 2000 ft/min
    - Occupied floors: maximum 1500 ft/min
    - See following table

Noise Criteria	Maximum Supply Air Velocity, ft/min Maximum Return Air Velocity, ft/min			
	At DRG	<10 feet from DRG	>10 feet from DRG	>20 feet from DRG
NC 25	350 425	425 500	500 650	700 800
NC 30	425 500	500 600	700 800	850 950
NC 35	500 600	600 700	800 900	1000 1150
NC 40 (45 dBA)	600 725	700 850	900 1075	1150 1380
NC 45	725 875	850 1000	1075 1300	1375 1500
Source: Architectural Acoustics by Marshall Long				

DRG = diffusers / registers / grilles

- Terminal Units
  - Select quietest available units – recommend selecting units rated 5 points below the NC target for the space. NC ratings to be based on assumptions that align with project design (e.g., length of acoustical flex duct, presence of internal duct liner, and applicability of end reflection loss).
  - Minimize pressure drop across terminal units – recommend maximum 0.5 in wg.
  - Schedule maximum allowable sound power levels from 125 to 4000 Hz (discharge and casing radiated) at maximum CFM for each box size.
  - Avoid terminal units over spaces with room noise criteria of NC 35 or below.
- Diffusers / Registers / Grilles (DRG)
  - Select and schedule maximum NC 15 DRG's in spaces with room noise criteria of NC 25 to NC 35.
  - Select and schedule maximum NC 25 DRG's in remaining spaces with room noise criteria.
  - Recommend 3 feet of acoustical flex duct at all DRG's.
- Use the following measures as needed to control duct-borne and duct breakout noise on the supply and return sides of the air distribution system
  - Duct silencers
  - Heavy gauge ducts
  - Wrap ducts with mass-loaded vinyl external lagging over insulation
- Use the following measures as needed to control noise transmission from mechanical spaces
  - Ceiling sound absorption in mechanical spaces (e.g., spray-applied acoustical insulation or direct-attached duct liner board)
  - Sound isolation ceilings in to supplement the floor slab

Electrical System Best Practices

Emergency generators are the primary source of noise amongst the building electrical system. Consider the above room noise criteria and local noise ordinances, as applicable. HDR recommends the following best practices to control electrical system noise.

- Emergency generators
  - Locate away from noise-sensitive spaces.
  - Schedule maximum allowable sound power levels from 63 to 4000 Hz (exhaust, casing radiated, and mechanical intake/outlet).
  - Provide silencers/mufflers for the exhaust.
  - Minimally provide acoustical louvers and consider silencers at mechanical air intakes and outlets.

- Transformers
  - Place on neoprene mounts for vibration isolation.
- Electrical boxes in sound-rated partitions
  - Adhere “putty pads” to back of electrical device, outlet, and service boxes in sound-rated partitions.
  - Stagger electrical device, outlet, and service boxes to avoid back-to-back boxes in the same stud cavity in sound-rated partitions.

Plumbing System Best Practices

This plumbing noise control guidance is not intended as an exhaustive reference. The complexities, variability, and limited available empirical information encompassing plumbing noise make sound level predictions challenging to quantify. Due to these characteristics and the intermittent and random nature of plumbing noise, specific background noise level criteria, such as aforementioned Noise Criteria (NC) levels, are not prescribed for plumbing noise.

Rather, plan to implement the noise control concepts presented below in the best possible manner permitted by the project.

This section provides architectural, plumbing, and mechanical system-based recommendations to control plumbing system noise. Implementation of these concepts will be dependent upon specific project parameters.

Plumbing System Operation

- Quiet Fixture Selection: Because fixtures are the primary sources of noise-generation, select sinks, toilets, and urinals for the quietest operation possible.
- System Water Pressure: To control flow noise in pipe runs and water supply valves, regulate water pressure to 50 psi maximum. Provide pressure-reducing valves as necessary.
- Water-Hammer: To reduce water-hammer, place water-hammer arresters close to quick-acting valves and at the ends of long pipe runs.
- Pipe Transitions: To reduce flow noise radiation from pipe runs, minimize the number of pipe transitions, such as elbows, tees, connections, etc. Limiting use of these elements will decrease opportunities for cavitation and turbulent flow.
- Flush Valves: Select flush valves for quiet operation. Adjust for minimum flow, allowing for proper function. Avoid pressure-assist technology.
- Waste Water Piping: Provide cast iron piping for waste water systems.
- Sink Splash: To control water splash at sinks, limit the velocity of water leaving the spout and the height of the spout above the basin surface. Select the dynamic characteristics of sinks (e.g. density, thickness, shape, size, etc.) to facilitate quiet operation.
- Water Fountains: Avoid water fountains with built-in compressors / condensers. Otherwise, specify a noise level not to exceed 40 dBA at 3ft.

Plumbing System Installation

- Pipe Wrap: Wrap piping within noise-sensitive wall constructions with resilient materials, such as Armaflex (www.armacell.us/home), in accordance with standard practice.
- Rigid Pipe Contact Avoidance: Prohibit pipes from directly contacting surrounding structure, to include the studs and track of walls and floor. Especially avoid rigid contact with large radiating surfaces such as walls, floors, and ceilings. Employ resilient elements such as hangers, supports, and pads for plumbing systems, including at waste water pipelines.
- System Airtightness: Seal the perimeter of all pipes, faucets, and spouts that penetrate through walls with non-hardening, non-shrinking acoustical sealant. To do so, provide approximately a ¼" gap between the penetrating element and surrounding structure, ensuring no contact. Seal airtight.
- Fixture Isolation: Isolate toilets from surrounding structure using neoprene pads or similar, as appropriate and possible. Install sinks with neoprene fasteners. Pack voids with insulation and seal airtight. Support valves, etc. from isolated fixtures, using caution not to bridge structure.

Pump Equipment

- Pump Selection: Follow vibration control guidelines as listed in Chapter 48 – Noise and Vibration Control of the ASHRAE HVAC Applications Handbook for the use of isolator types, base types, static deflections, and other vibration control measures. Select and balance pumps for optimum efficiency.
- Pump Isolation: Provide inertial isolation bases and vibration isolators for pumps. Provide flexible couplings and connectors for all pump equipment. Support initial 50 feet of piping from pumps on isolators having same static deflection as pump equipment.

Exhaust Fans

- Fan Selection: Select exhaust fans for the quietest operation possible.
- Fan Isolation: Provide vibration isolators and bases for exhaust fans. Typically, steel spring isolators with in-series neoprene inserts are selected for 1" minimum static deflection. Provide flexible couplings and connectors for all exhaust fan ductwork and equipment.

MARY BIRCH (PACKAGES 1 AND 3)

Interior Sound Isolation

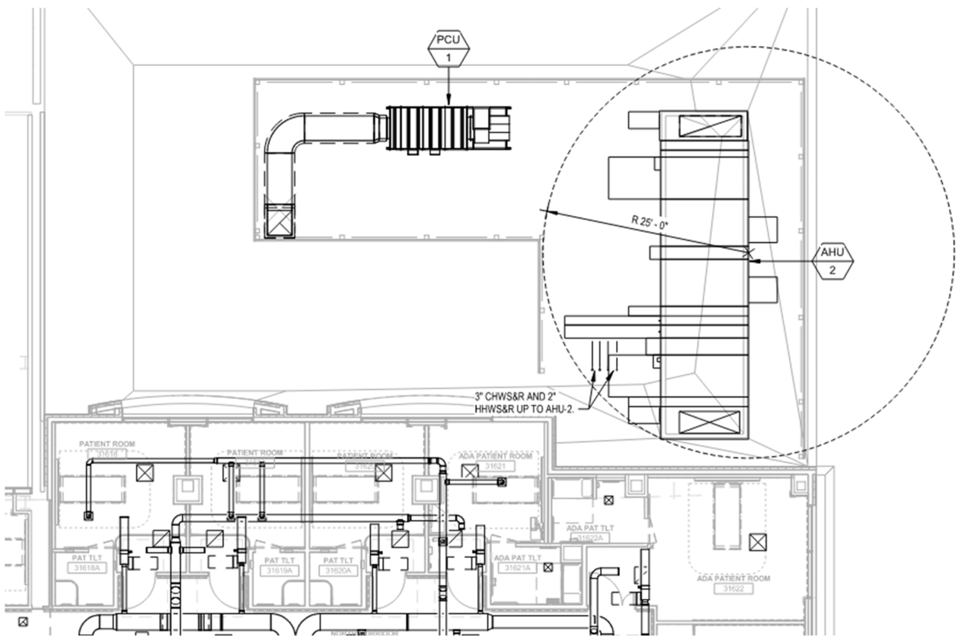
Noise sensitive adjacencies addressed by the sound isolation systems in the Mary Birch expansion include the following:

- New patient rooms (third floor, fourth floor, and fifth floor phase 5 fit-out)
- Conference room (second floor)
- Restrooms adjacent to public corridors (first floor)
- Equipment rooms adjacent to corridors (ground floor)

Equipment rooms adjacent to staff corridors include sound rated doors. Refer to the interior sound isolation subsection of the Design Approach for additional discussion of sound isolation strategies by space type.

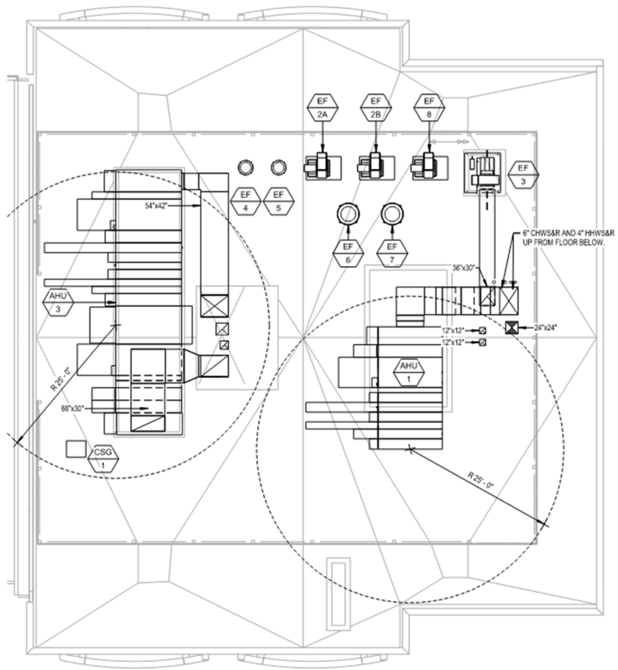
Mechanical Sound Isolation

At Mary Birch, the primary architectural system providing sound isolation from new mechanical units is the building envelope. Rooftop air handlers and exhaust fans are in proximity to patient spaces. The following figure shows a low roof on the third level with air handlers adjacent to patient rooms.



The exterior wall and exterior glazing are designed to maintain the patient room and public area noise criterion of 45 dBA. The exterior wall includes 1" cement plaster, 1-1/2" rigid insulation, and a 6" framed stud wall assembly with batt insulation. The exterior glazing is a 1" insulated assembly.

The following figure shows the roof of the Mary Birch addition, with air handlers and exhaust fans located above planned patient space.



The roof assembly is designed to maintain the patient room and public area noise criterion of 45 dBA. The roof includes 5/8" densdeck, minimum 2-1/2" rigid insulation, and 3" x 20-gauge metal deck with a 4-1/2" normal-weight concrete topper.

Maximum allowable mechanical equipment sound power levels were determined based on these modeled building envelope assemblies. Appendix C contains the maximum allowable mechanical equipment sound power levels.

Room Finishes

Patient rooms and corridors in the Mary Birch include high sound absorption ceiling tiles to reduce reverberation and control the build-up of noise. Acoustical finishes on patient floors of the Mary Birch will match existing patient rooms and corridors

STEPHEN BIRCH (PACKAGE 4)

Interior Sound Isolation

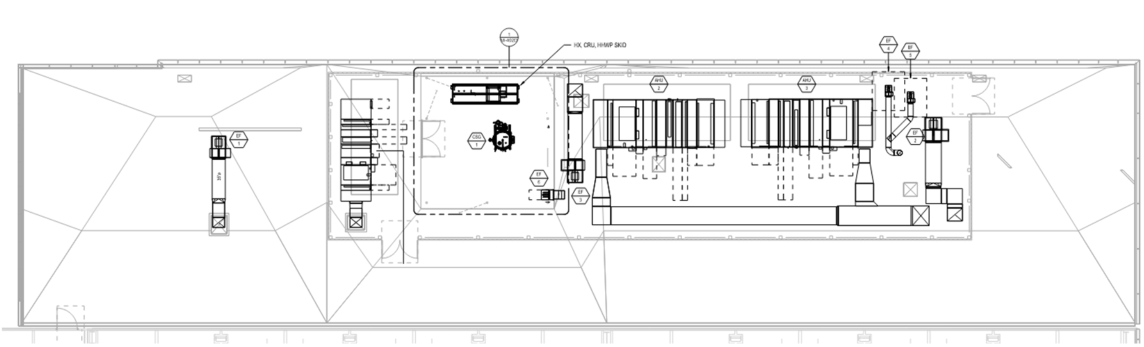
Noise sensitive space types addressed by the sound isolation systems in the Stephen Birch Addition include the following:

- Patient rooms
- Treatment rooms
- Operating rooms
- CT Scan rooms
- Consult rooms
- Conference rooms
- Dictation rooms
- On-call rooms
- Toilet rooms adjacent to public areas

Refer to the interior sound isolation subsection of the Design Approach for additional discussion of sound isolation strategies by space type.

Mechanical Sound Isolation

At Stephen Birch, the primary architectural system providing sound isolation from new mechanical units is the building envelope. Rooftop air handlers and exhaust fans are in proximity to patient spaces. The following figure shows the expansion roof with air handlers and exhaust fans located above operating rooms and staff offices.



The roof assembly is designed to maintain the patient room and public area noise criterion of 45 dBA. The roof includes 5/8” densdeck, minimum 2-1/2” rigid insulation, and 3” x 20-gauge metal deck with a 4-1/2” normal-weight concrete topper.

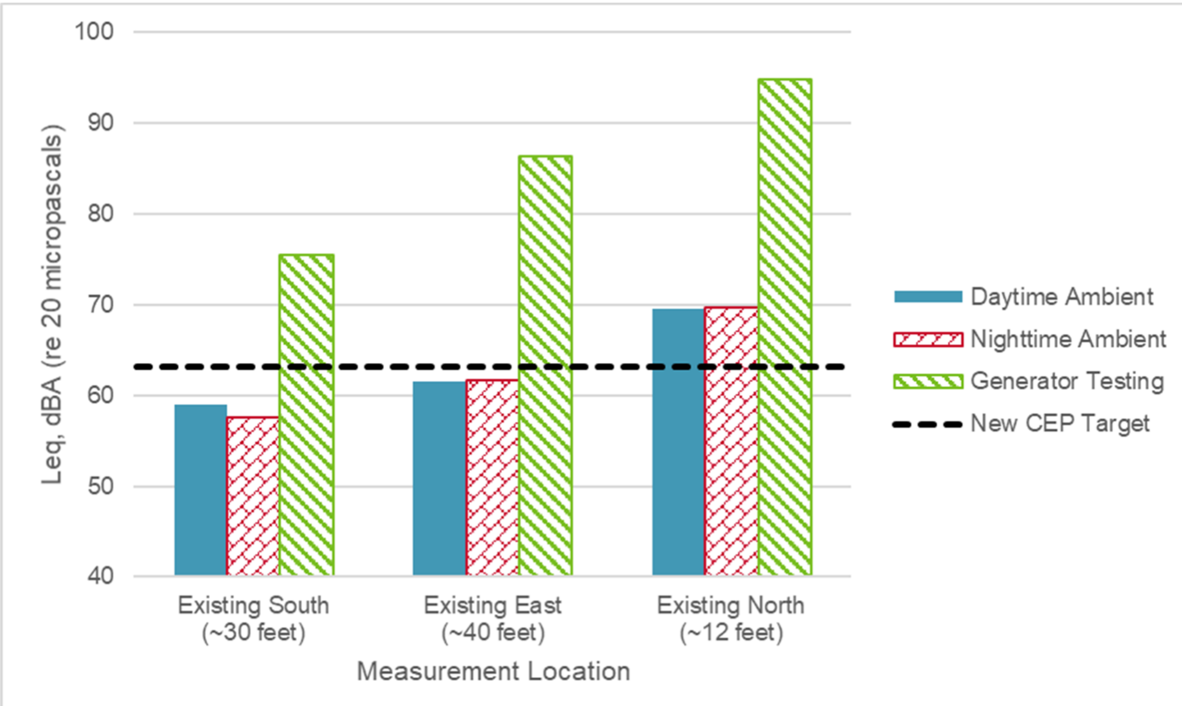
Maximum allowable mechanical equipment sound power levels were determined based on these modeled building envelope assemblies. Appendix C contains the maximum allowable mechanical equipment sound power levels.

NEW CENTRAL ENERGY PLANT (PACKAGE 5)

Noise Monitoring

HDR measured noise levels at the existing CEP and the site of the new CEP. Appendix A describes the noise monitoring in detail. The existing CEP measurements documented ambient daytime noise levels, ambient nighttime noise levels, and noise levels during generator testing. The new CEP measurements documented existing noise levels throughout a 24-hour period.

The following figure compares the existing CEP noise measurement results to the 65 dBA target used for the new CEP design.



The measurement locations represent the south, east, and north sides of the existing CEP, on the east end of the building where the generator room is located. These results demonstrate the area around the existing CEP exceeds 65 dBA during generator testing, and even during typical operations on the north side of the building. Generator testing occurs monthly during the 12:00 AM, and it is unclear if there are any overnight patient spaces near the existing CEP.

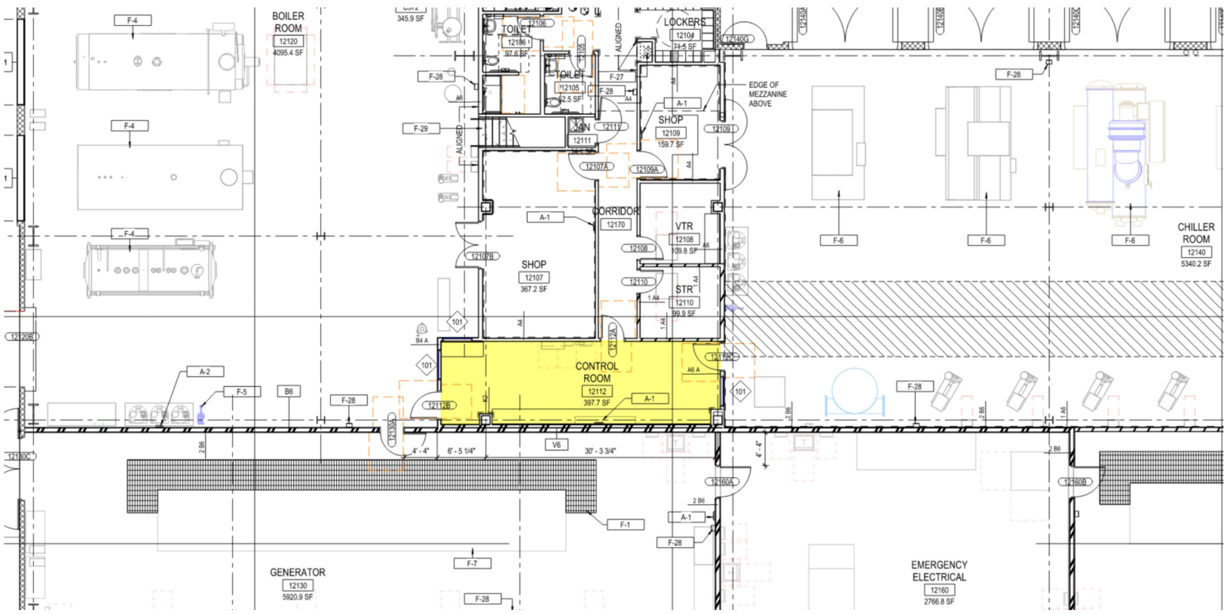
At the site of the new CEP, measured existing noise levels ranged from 53 to 66 dBA Leq. Both the quietest and loudest measured hours occurred at night, which is defined as the period from 10:00 PM to 7:00 AM. The 65 dBA target used for the new CEP design is comparable to existing noise levels at the site. The new CEP site is adjacent to overnight patient spaces located in the Sharp Mesa Vista Hospital to the south. The measured existing noise levels exceeded the City of San Diego commercial-to-single-family-residential noise limits at all measured hours. The measured existing noise levels exceeded the City of San Diego commercial-to-commercial (proposed exception) noise limits at two nighttime hours.

Noise Modeling

HDR modeled project-only noise levels associated with the new CEP. Appendix B describes the noise modeling in detail. HDR designed a range of mechanical, architectural, and interior finish noise control measures for the new CEP. These measures include sound attenuators, mufflers / silencers, acoustical louvers, sound-rated doors, interior sound absorption, and selection of quiet equipment. With these noise control measures, modeled project-only noise levels at the Sharp Rehabilitation Center, Sharp MOB Building, and Sharp Mesa Vista Hospital comply with the 65 dBA on-site noise target. Modeled project-only noise levels also meet the proposed exception noise levels regarding the City of San Diego noise standards.

Control Room

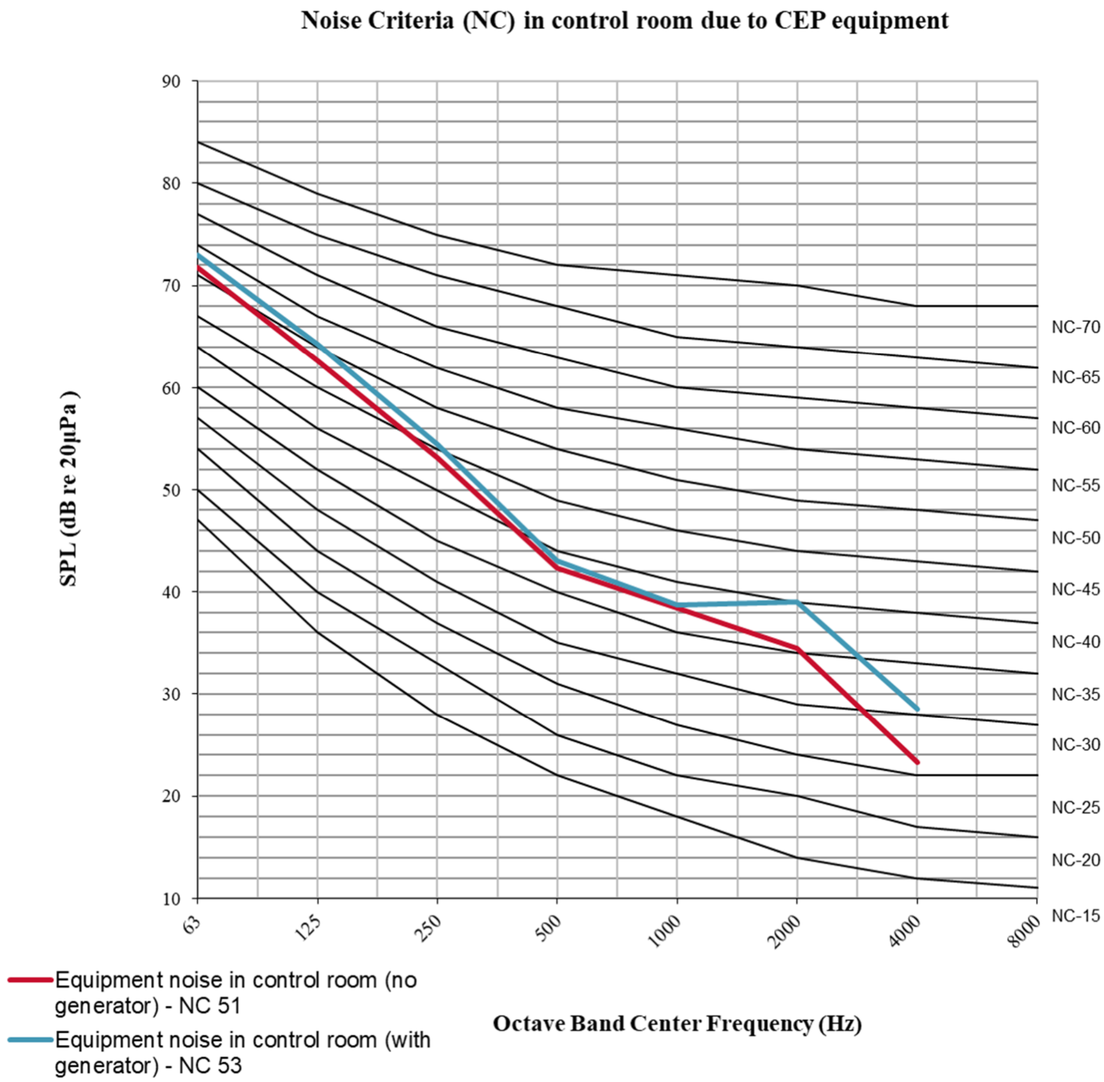
The primary focus for sound isolation in the CEP is the control room. At the control room, sound isolation strategies are implemented at the generator, boiler, and chiller room partitions due to the high level of noise produced by the equipment within these mechanical spaces. A figure showing the location of the control room with respect to the boiler, chiller, and generator rooms is provided below.



Control room sound isolation strategies include the use of sound rated walls, doors, and windows to maintain a suitable noise level within the control room (less than NC 55/ 62 dBA) when the equipment in the boiler, chiller, and generator rooms is running.

Sound rated doors and glazing are utilized at the boiler room and chiller room partitions. The glazing system is comprised of two layers of 1/4" laminated glass with 1 inch of airspace between the two layers of glass to achieve a minimum performance of STC 46. The doors are high-performance steel acoustic doors engineered for sound isolation purposes meeting a minimum sound isolation performance of STC 53 (example product: IAC Acoustics Noise-Lock). Control room partitions at the boiler and chiller room include multiple layers of gypsum as well as acoustically enhanced gypsum. The partition between the control room and the generator room is a double stud wall with two layers of gypsum on each side. Partitions are selected to achieve a sound isolation performance that sufficiently isolates the equipment noise from the control room, particularly for low frequencies. A standard sound rated door is utilized at the entrance to the control room from the main CEP corridor.

Background noise levels in the control room due to the CEP equipment was modeled with the sound isolation systems described above. Modeled results are provided with the boiler running at 75% capacity to represent typical operating conditions for the CEP. Results are also provided with and without the generator component, as the generator is expected to operate infrequently. Background noise in the control room is shown as noise criteria (NC) curves for modeled scenarios with and without the generator in the figure below.



The expected noise criteria ratings for the control room are driven by low frequency equipment noise, as evident in the noise criteria curves.

Background noise in the control room due to the CEP equipment sources presented as both sound pressure levels (dBA) and noise criteria (NC) are provided in the table below.

Modeled Scenario	Background Noise Level	
	Sound Pressure Level (dBA)	Noise Criteria (NC)
Boiler (75%), Chiller, and Generator	53 dBA	NC 53
Boiler (75%) and Chiller *(no Generator)*	51 dBA	NC 51

The modeled background noise levels within the control room based on the equipment noise sources in the adjacent chiller, boiler, and generator rooms fall within the targeted control room background noise criteria and dBA levels with the sound isolation systems described throughout this section.

EXISTING HOSPITAL REMODEL (PACKAGE 6)

Interior Sound Isolation

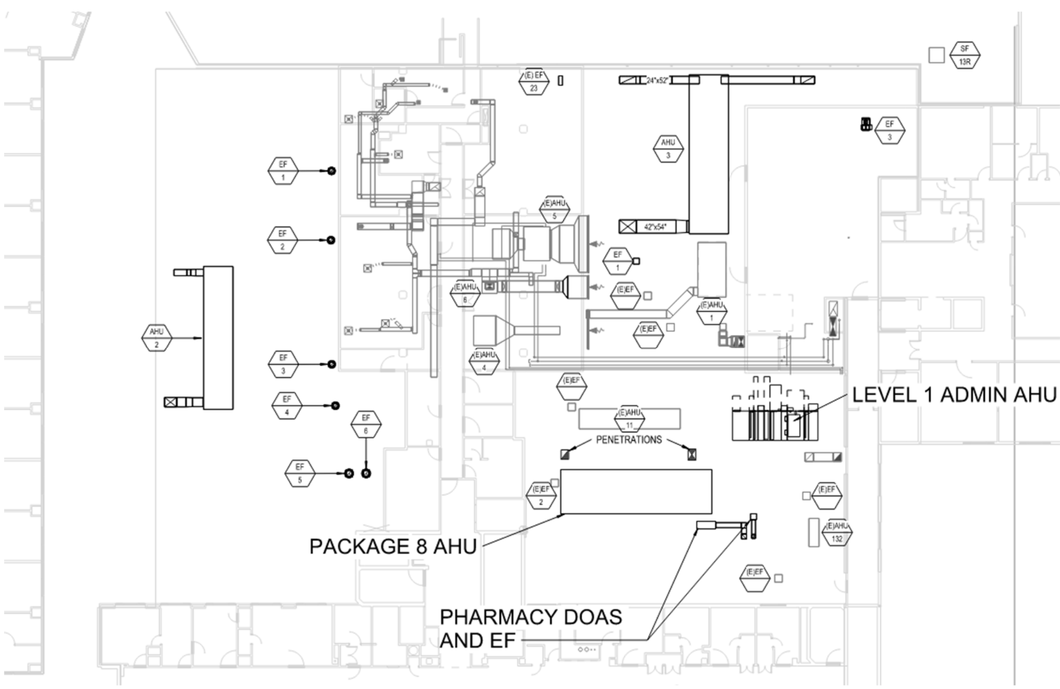
Noise sensitive space types addressed by the sound isolation systems in the Existing Hospital Remodel include the following:

- Patient rooms
- Procedure rooms
- Cath labs
- Isolation PACU
- Conference rooms
- Reading rooms
- Toilet rooms adjacent to public areas

Refer to the interior sound isolation subsection of the Design Approach for additional discussion of sound isolation strategies by space type.

Mechanical Sound Isolation

At the existing hospital remodel, the primary architectural systems providing sound isolation from new mechanical units are the building envelope and an existing floor slab. Rooftop air handlers and exhaust fans are in proximity to patient spaces. The following figure shows air handlers and exhaust fans on the roof above the remodel spaces, which include cath labs and PACU spaces.



The roof assembly is designed to maintain the patient room and public area noise criterion of 45 dBA. The roof includes 1-1/2" metal deck with a 3-1/4" normal-weight concrete topper and is assumed to include minimum 2-1/2” rigid insulation and 5/8” densdeck.

Maximum allowable mechanical equipment sound power levels were determined based on these modeled building envelope assemblies. Appendix C contains the maximum allowable mechanical equipment sound power levels.

The ground level includes mechanical spaces with P-tube blowers, pumps, and heat exchangers. The floor area above these spaces include executive offices and conference spaces. Spring hanger (example product: Kinetics ICC) sound isolation ceilings with two layers of 5/8” type X GWB and batt insulation are provided at these mechanical spaces to supplement the existing floor slab.

NEW TOWER (PACKAGE 7)

Interior Sound Isolation

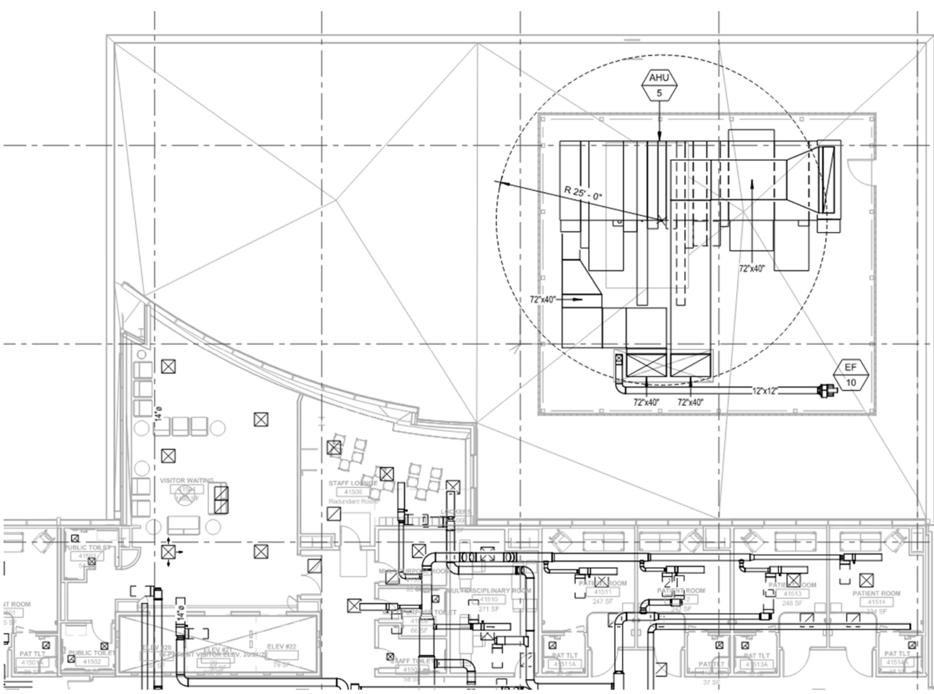
Noise sensitive space types addressed by the sound isolation systems in the New Tower include the following:

- Patient rooms
- Exam rooms
- Conference rooms
- Reading rooms
- Toilet rooms adjacent to public areas

A demountable partition meeting STC 45 is provided in the shared conference space on level two. Refer to the interior sound isolation subsection of the Design Approach for additional discussion of sound isolation strategies by space type.

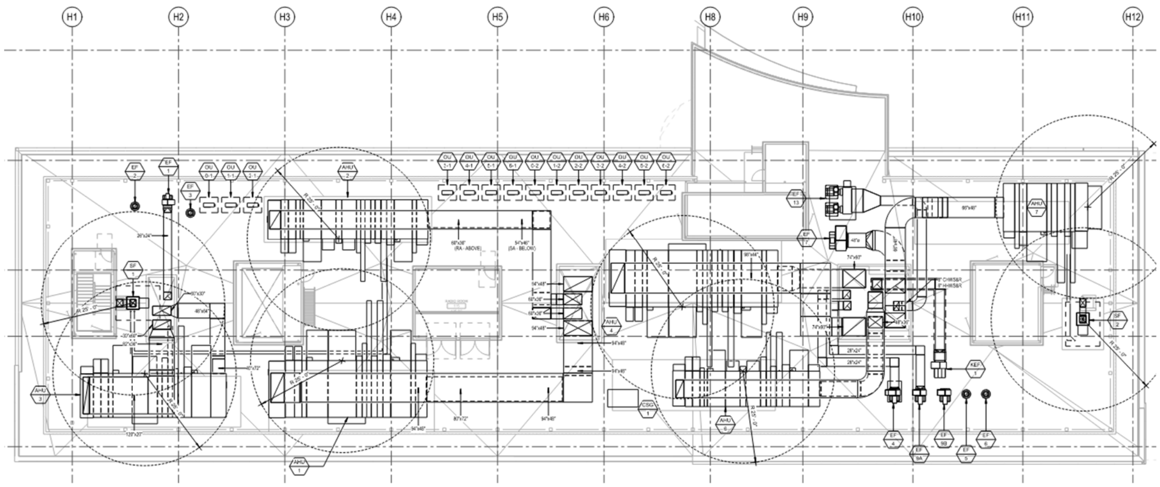
Mechanical Sound Isolation

At the New Tower, the primary architectural system providing sound isolation from new mechanical units is the building envelope. Rooftop air handlers, exhaust fans, and split system condensing units are in proximity to patient spaces. The following figure shows a low roof on the fourth level with an air handler and exhaust fan adjacent to patient rooms and near a visitor waiting area.



The exterior glazing is designed to maintain the patient room and public area noise criterion of 45 dBA. The exterior glazing is a 1" insulated assembly. The addition of equipment associated with the MRI fit out may require a solid noise barrier (example product: IAC Acoustics Noishield Sound Barriers) around the rooftop equipment instead of an architectural visual screen.

The following figure shows the roof of the New Tower, with several air handlers, exhaust fans, and split system condensing units located above a patient room floor.



The roof assembly is designed to maintain the patient room and public area noise criterion of 45 dBA. The roof includes 5/8” densdeck, minimum 2-1/2” rigid insulation, and 3” x 20-gauge metal deck with a 4-1/2” normal-weight concrete topper.

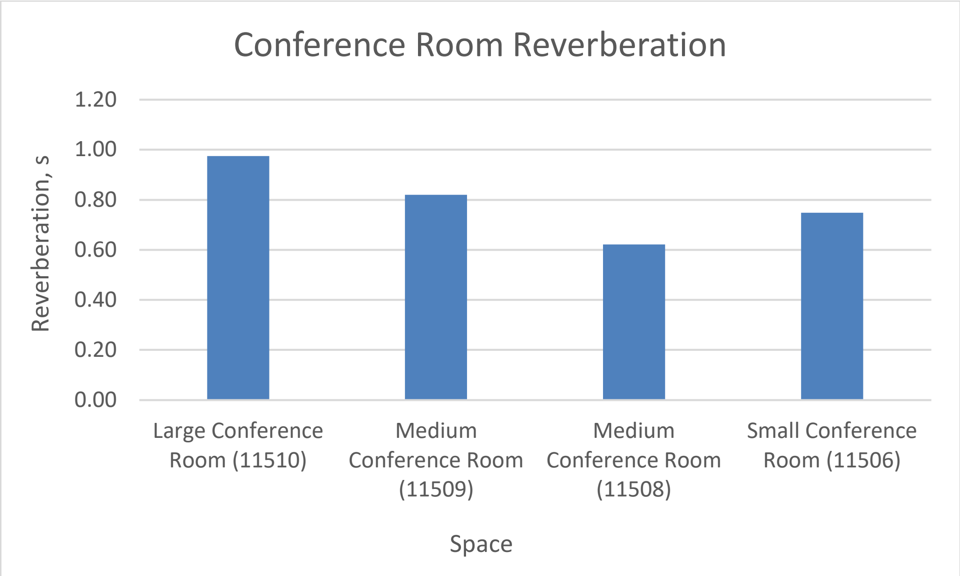
Maximum allowable mechanical equipment sound power levels were determined based on these modeled building envelope assemblies. Appendix C contains the maximum allowable mechanical equipment sound power levels.

Room Finishes

Conference Spaces

The New Tower includes a conference center comprised of small, medium and large sized conference rooms and pre-functional space. Acoustical finishes in the conference area are focused on reducing reverberation and increasing speech intelligibility in meeting spaces. Acoustical treatments include use of carpeted floors and high sound absorption ceilings.

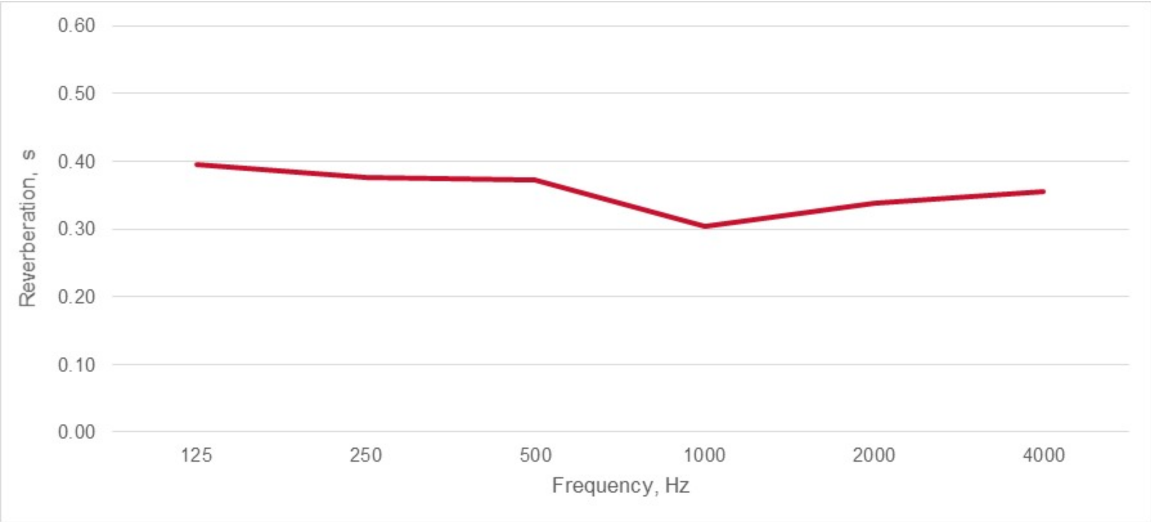
Room reverberation was modeled in four (4) meeting spaces representative of small, medium and large sizes conference rooms. The figure below depicts the average room reverberation in the 500 – 2,000 Hz frequency band for modeled conference spaces. The average room reverberation in the mid-frequencies (500 Hz – 2kHz) is below 1 second for all evaluated spaces.



Patient Corridors

Acoustical wall and ceiling treatments are provided in patient corridors of the New Tower. Acoustically absorptive ceiling materials and wall panels will reduce reverberation and the build-up of noise in patient corridors and nurse stations.

As shown in the figure below the reverberation time in patient corridors is below 0.4 seconds. Additionally, the average noise reduction coefficient, NRC, of the corridor is NRC 0.30, this meets the project design goals for sound absorption in corridors and patient spaces.



Imaging Spaces

MRI machines are proposed within the shelled space on Level 2 of the new SMMC Tower, as shown in pink in the figure below. CT machines are proposed where shown in blue in the figure below.

The MRI and CT suites are located vertically adjacent to noise-sensitive spaces, including Level 1 conference Rooms and Level 3 ICU patient rooms. The CT spaces are also adjacent to offices and exam spaces located on Level 2.

CT Sound Isolation

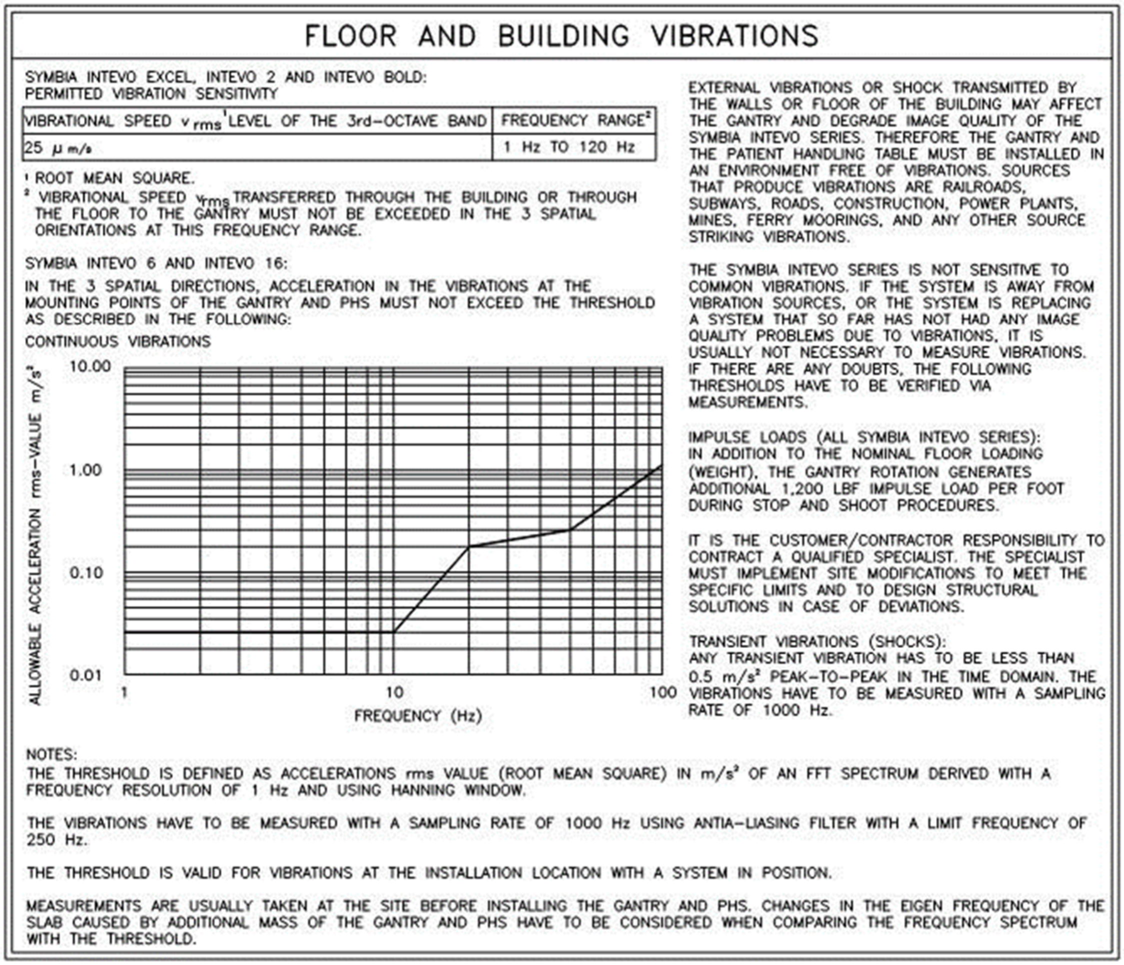
Sound rated ceiling tiles, minimum Ceiling Attenuation Class (CAC) of 35, are provided at Level 1 conference spaces below CT spaces. Gypsum ceilings or minimum CAC 35 ceiling tiles are provided at Level 2 CT spaces. Ceiling tiles at these Level 1 conference spaces and Level 2 CT spaces are suspended from structure using neoprene isolation hangers, and include covers for light fixture penetrations. Ductwork in the ceiling space above these Level 1 conference spaces and Level 2 CT spaces are resiliently supported by 1” static deflection steel spring isolators with in-series neoprene inserts.

Sound-rated partitions and doors are provided at CT spaces. Stud wall isolation strip are provided at the top track of walls at Level 1 conference rooms below the CT spaces and at the bottom and top track of walls at Level 2 CT spaces.

Avoid penetrations through the concrete-filled metal deck (structure below and structure above), sound-isolating GWB ceiling, and wall constructions of CT spaces. If penetrations through these constructions must be made, minimize the extent to which penetrations occur, ensuring that penetrating building elements do not physically contact the structure. Seal the space between the penetrating elements and structure (on the order of 1/4”) airtight with non-hardening, non-shrinking acoustical caulk.

CT Vibration Control

The following figure shows the manufacturer vibration thresholds for the Siemens Symbia Intevo CT scanner equipment.


FLOOR AND BUILDING VIBRATIONS

SYMBIA INTEVO EXCEL, INTEVO 2 AND INTEVO BOLD:
PERMITTED VIBRATION SENSITIVITY

VIBRATIONAL SPEED v_{rms}[1] LEVEL OF THE 3rd-OCTAVE BAND	FREQUENCY RANGE[2]
25 μ m/s	1 Hz TO 120 Hz

[1] ROOT MEAN SQUARE.
[2] VIBRATIONAL SPEED v_{rms} TRANSFERRED THROUGH THE BUILDING OR THROUGH THE FLOOR TO THE GANTRY MUST NOT BE EXCEEDED IN THE 3 SPATIAL ORIENTATIONS AT THIS FREQUENCY RANGE.

SYMBIA INTEVO 6 AND INTEVO 16:
IN THE 3 SPATIAL DIRECTIONS, ACCELERATION IN THE VIBRATIONS AT THE MOUNTING POINTS OF THE GANTRY AND PHS MUST NOT EXCEED THE THRESHOLD AS DESCRIBED IN THE FOLLOWING:
CONTINUOUS VIBRATIONS

EXTERNAL VIBRATIONS OR SHOCK TRANSMITTED BY THE WALLS OR FLOOR OF THE BUILDING MAY AFFECT THE GANTRY AND DEGRADE IMAGE QUALITY OF THE SYMBIA INTEVO SERIES. THEREFORE THE GANTRY AND THE PATIENT HANDLING TABLE MUST BE INSTALLED IN AN ENVIRONMENT FREE OF VIBRATIONS. SOURCES THAT PRODUCE VIBRATIONS ARE RAILROADS, SUBWAYS, ROADS, CONSTRUCTION, POWER PLANTS, MINES, FERRY MOORINGS, AND ANY OTHER SOURCE STRIKING VIBRATIONS.

THE SYMBIA INTEVO SERIES IS NOT SENSITIVE TO COMMON VIBRATIONS. IF THE SYSTEM IS AWAY FROM VIBRATION SOURCES, OR THE SYSTEM IS REPLACING A SYSTEM THAT SO FAR HAS NOT HAD ANY IMAGE QUALITY PROBLEMS DUE TO VIBRATIONS, IT IS USUALLY NOT NECESSARY TO MEASURE VIBRATIONS. IF THERE ARE ANY DOUBTS, THE FOLLOWING THRESHOLDS HAVE TO BE VERIFIED VIA MEASUREMENTS.

IMPULSE LOADS (ALL SYMBIA INTEVO SERIES):
IN ADDITION TO THE NOMINAL FLOOR LOADING (WEIGHT), THE GANTRY ROTATION GENERATES ADDITIONAL 1,200 LBF IMPULSE LOAD PER FOOT DURING STOP AND SHOOT PROCEDURES.

IT IS THE CUSTOMER/CONTRACTOR RESPONSIBILITY TO CONTRACT A QUALIFIED SPECIALIST. THE SPECIALIST MUST IMPLEMENT SITE MODIFICATIONS TO MEET THE SPECIFIC LIMITS AND TO DESIGN STRUCTURAL SOLUTIONS IN CASE OF DEVIATIONS.

TRANSIENT VIBRATIONS (SHOCKS):
ANY TRANSIENT VIBRATION HAS TO BE LESS THAN 0.5 m/s² PEAK-TO-PEAK IN THE TIME DOMAIN. THE VIBRATIONS HAVE TO BE MEASURED WITH A SAMPLING RATE OF 1000 Hz.

NOTES:
THE THRESHOLD IS DEFINED AS ACCELERATIONS rms VALUE (ROOT MEAN SQUARE) IN m/s² OF AN FFT SPECTRUM DERIVED WITH A FREQUENCY RESOLUTION OF 1 Hz AND USING HANNING WINDOW.

THE VIBRATIONS HAVE TO BE MEASURED WITH A SAMPLING RATE OF 1000 Hz USING ANTIA-LIASING FILTER WITH A LIMIT FREQUENCY OF 250 Hz.

THE THRESHOLD IS VALID FOR VIBRATIONS AT THE INSTALLATION LOCATION WITH A SYSTEM IN POSITION.

MEASUREMENTS ARE USUALLY TAKEN AT THE SITE BEFORE INSTALLING THE GANTRY AND PHS. CHANGES IN THE EIGEN FREQUENCY OF THE SLAB CAUSED BY ADDITIONAL MASS OF THE GANTRY AND PHS HAVE TO BE CONSIDERED WHEN COMPARING THE FREQUENCY SPECTRUM WITH THE THRESHOLD.

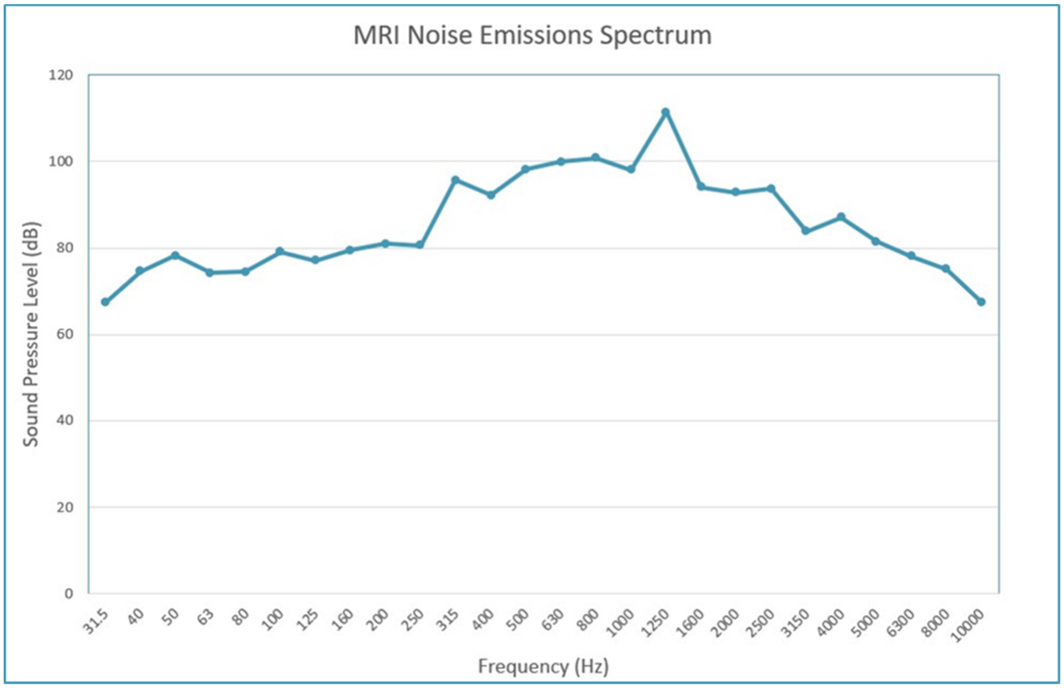
These and other applicable specifications for specific CT scanner equipment should be consulted for vibration control for both equipment operations and transmission to surrounding building spaces. Vibration isolation approaches and measures may include:

- Providing appropriately stiff construction for MRI equipment placement.
- Conducting post-construction vibration measurements of CT Scanning Suites prior to equipment installation.
- Providing spring isolators and elastomeric pads for vibration control.

It is recommended that design and implementation for specific CT Scanning equipment include review of manufacturer's specifications and installation methodologies.

MRI Noise

Manufacturers' sound data for representative MRI equipment were utilized to establish noise levels within MRI spaces. The following figure shows the maximum MRI room sound pressure levels per frequency.



MRI equipment considered includes Philips Insignia Ambition and Elition, GE Signa Pioneer, and units by Canon and Siemens. The sound data presented in the figure above presume the presence of a sound-absorptive ACT ceiling or other comparable acoustical treatments in the MRI space. Otherwise, sound levels in MRI rooms will be higher due to noise build-up in the room.

Sound data presented in the figure above for representative MRI equipment have been utilized for acoustical analysis. The sound isolation performance of wall and floor/ceiling assemblies has been predicted utilizing industry-accepted (INSUL) computer software. These assemblies do not account for lead-lined GWB assemblies, which due to the higher densities involved, would be expected to further enhance sound isolation performance. As previously noted, application of sound-absorptive treatment to reduce noise build-up in MRI spaces should be viewed as an integral noise control measure, supplementing, but not substituting for, partition sound isolation, which is the primary focus for noise control from space to space.

MRI Sound Isolation

At Level 2 MRI rooms, plan for resiliently-suspended GWB ceilings on 1” static deflection steel spring isolators with in-series neoprene insert (e.g. Figure 5, Kinetics ICC Hanger (www.kineticsnoise.com) or equivalent) below the proposed concrete deck. Provide 6” batt insulation above GWB ceilings, having a minimum 18” airspace between the deck and ceiling. Provide 2 layers of 5/8” GWB as the sound-isolating ceiling. With this resiliently-suspended sound-isolating GWB floor/ceiling assembly, noise levels in vertically adjacent noise-sensitive spaces are predicted to be below 45 dBA, appropriate for ICU Patient Rooms.

To avoid excessive noise build-up in MRI spaces acoustical treatments must be introduced into these rooms below the GWB ceiling. The best option to address these issues, as vertical space and other factors allow, is to provide a separate ACT ceiling below the sound-isolating GWB ceiling. The HVAC system ductwork and system elements can then be located in the cavity between the ACT and GWB ceilings, providing HVAC system accessibility, aiding in maintaining airtightness for the sound-isolating GWB ceiling, and enhancing the room acoustics performance of the finish ceiling acoustical treatment.

Plan for full height STC 60 double stud construction between the MRI Suite and Patient Room as follows:

- 2 layers 5/8" Type X GWB
- 3-5/8" or 6" Metal Studs with Batt Insulation
- 1" Airspace (No Rigid Bridging)
- 3-5/8" or 6" Metal Studs with Batt Insulation
- 2 layers 5/8" Type X GWB

With this wall construction, MRI Suite noise is calculated to be reduced to below 45 dBA in horizontally adjacent Patient Rooms.

At Corridor adjacencies, plan for the following wall construction:

- 1 layer 5/8" Type X GWB
- 1 layer 5/8" Enhanced Acoustical GWB
- 3-5/8" or 6" Metal Studs with Batt Insulation
- 1 layer 5/8" Enhanced Acoustical GWB
- 1 layer 5/8" Type X GWB

Depending upon RF requirements, another STC 50 assembly may also be suitable that utilizes lead-lined GWB or other materials.

Plan to utilize resilient partition isolation pads (e.g. Kinetics Wallmat) at the top of the stud tracks, along with a neoprene bushing assembly (e.g. Kinetics KAI) as a resilient anchoring component. Note that no part of the walls should contact or have rigid connections to surrounding structure.

Plan for "sound-isolating" doors at MRI Suites. A sound-isolating door may be comprised of a solid wood core door or insulated metal door sealed airtight with full perimeter seals (e.g. National Guard 103N or equivalent at head and jambs), including automatic door bottom closer (e.g. Zero 360 or equivalent). Seals should be adjustable and properly installed for uniform compression and airtightness. Again, door assemblies subject to RF requirements or other factors. Avoid penetrations through the concrete-filled metal deck, sound-isolating GWB ceiling, and wall constructions. If penetrations through these constructions must be made, minimize the extent to which penetrations occur, ensuring that penetrating building elements do not physically contact the structure. Seal the space between the penetrating elements and structure (on the order of 1/4") airtight with non-hardening, non-shrinking acoustical caulk.

In a similar fashion, the sound-isolating GWB ceiling is also not to physically contact surrounding structure, including at walls. Rather, a gap (on the order of a 1/4") should remain, with the gap being sealed airtight using acoustical caulk.

MRI HVAC System Layout

As discussed above, if conditions permit such that recommended noise control measures featuring a sound-isolating GWB ceiling with an ACT ceiling below are pursued, HDR recommends placing the HVAC system and other above-ceiling building systems components in the space between these two ceilings.

Note that any building systems components, to include HVAC system ductwork, located within MRI Suites which must be attached to the concrete-filled metal deck or other rigid structure, are to be resiliently supported by 1" static deflection steel spring isolators with in-series neoprene inserts. Such a condition may occur if only the sound-isolating GWB ceiling can be installed without placing an ACT ceiling below.

In addition, should the HVAC system be routed above the sound-isolating GWB ceiling, the system must be hard-ducted. Do not use flex duct under these conditions. To compensate for the attenuation loss benefits of the (acoustical) flex duct for duct-borne noise control, plan to internally line the hard ductwork.

MRI Room Finishes

As a reminder, sound-absorptive acoustical treatment should be provided in MRI Suites that require a sound-isolating GWB ceiling. The hard, reflective surface of the GWB ceiling itself is not suitable for room acoustics purposes in these spaces. Ideally, this ceiling acoustical treatment should be in the form of a separate ACT ceiling suspended below the resiliently-suspended sound-isolating GWB ceiling. To control noise build-up and reverberation, generally plan for an NRC 0.70 minimum ACT ceiling for MRI Suites.

MRI Vibration Control

Specifications for specific MRI equipment should be consulted for vibration control for both equipment operations and transmission to surrounding building spaces. Vibration measures may include:

- Providing appropriately stiff construction for MRI equipment placement.
- Conducting post-construction vibration measurements of the MRI Suite prior to equipment installation.
- Providing spring isolators and elastomeric pads for vibration control.

Particularly for MRI applications, it is recommended that design and implementation for specific MRI equipment include review of manufacturer's specifications and installation methodologies. Manufacturers often provide specific requirements to ensure suitable environments for both equipment operation and surrounding spaces.

APPENDIX A – CEP NOISE MONITORING

Noise Measurement Locations

HDR performed short-term, attended noise measurements around the existing Central Energy Plant (CEP). The following figure shows the existing CEP measurement locations.

The following figure shows the sound level meter at the EX North location during generator testing.

To capture daytime conditions, HDR measured ambient noise levels during the 3:00 PM and 4:00 PM hours on February 2nd, 2021. To capture nighttime conditions, HDR measured ambient noise levels during the 11:00 PM hour on February 1st, 2021. Finally, HDR measured noise levels during generator testing, which began at 12:30 AM on February 2nd, 2021, and lasted about 30 minutes.

HDR also performed 24-hour, unattended noise measurements at two locations in the area of the new CEP. The following figure shows the new CEP measurement locations.

24HR North is representative of the north side of the new CEP site and the Sharp Rehabilitation Center. 24 HR South is representative of the south side of the new CEP site, the Sharp Mesa Vista Hospital, and is reasonably representative of the property line to the east along Meadow Lark Drive. The following figure shows the 24HR North noise measurement system.

These 24-hour noise measurements documented existing conditions at the new CEP site.

Noise Measurement Methods

HDR used digital sound level meters with 1/3 octave band filters to perform the noise measurements. HDR used sound level meters and handheld calibrators that meet Class 1/Type 1 precision requirements of American National Standards Institute and International Electrotechnical Commission standards. All instrumentation used by HDR to measure noise levels on this Project is calibrated on a regular basis by an independent accredited calibration laboratory using standards traceable to the National Institute of

Standards and Technology. The instrumentation was calibrated to a reference level traceable to the National Institute of Standards and Technology prior to transportation to the measurement site. Calibration checks were performed in the field prior to and upon completion of each series of measurements.

HDR collected noise measurement data as follows:

- The sound level meters continuously integrated sound pressure level measurements.
- The sound level meters stored the A-weighted Leq (equivalent-average sound pressure level), Lmin (minimum sound pressure level), and Lmax (maximum sound pressure level).
- There was no precipitation during the measurements.
- All microphones were covered by a wind screen during the measurements. Average wind speeds at the San Diego International Airport were below 10 miles per hour except for one hour toward the end of the measurements that increased to 12 miles per hour.
- Extraneous noise events from transportation noise sources and humans were considered typical of the existing noise environment.
- Measurement durations:
    - Daytime ambient: 20 to 30 minutes
    - Nighttime ambient: 10 minutes
    - During generator testing: 3 to 5 minutes
- The microphones were placed about 5 to 6 feet above the ground, and away from reflecting surfaces to the extent site conditions allowed.

The noise measurements were performed during the COVID-19 pandemic, which likely impacted traffic volumes on nearby roadways, including Highway 163 and Interstate 805.

Existing CEP Noise Measurement Results

The following table summarizes the existing CEP noise measurement results.

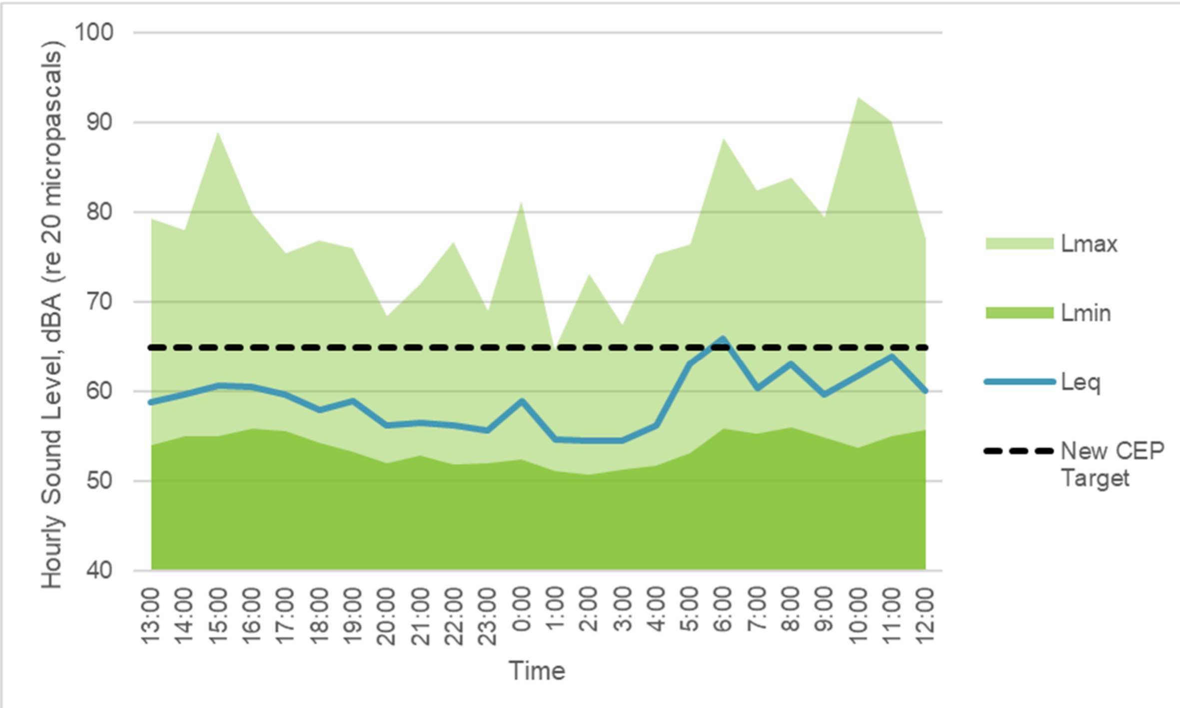
Measurement Location	Measured Daytime / Nighttime Ambient Leq, dBA	Measured Generator Testing Leq, dBA	Distance from Existing CEP Louver Walls, feet
EX South	59 / 58	75	~30
EX East	62 / 62	86	~40
EX North	70 / 70	95	~12
EX Further East	-	75	~200

The south façade of the existing CEP (EX South measurement location) has a louvered door into the generator room. It also has a louvered wall, but it serves an electrical room and not the generator room. The east façade (EX East) has a louvered wall serving the generator room. The north façade (EX North) has a louvered wall serving the generator and a louvered door, which was open during generator testing.

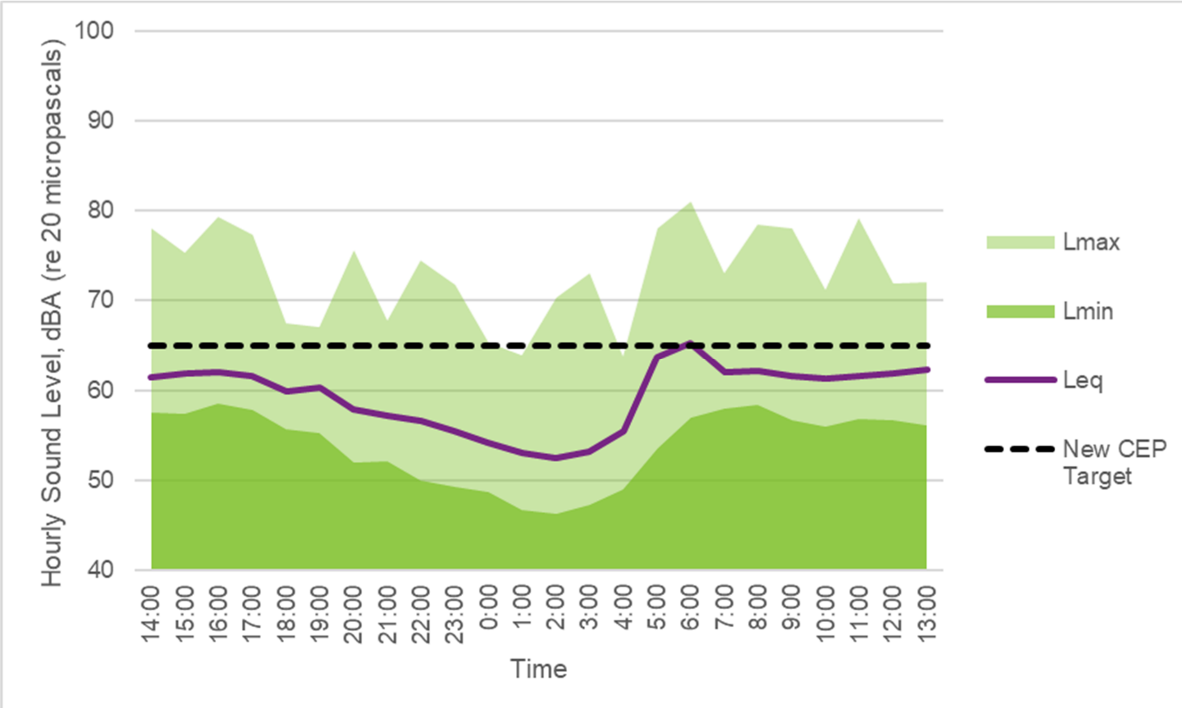
The measured ambient noise levels were consistent between the daytime and nighttime. The measured ambient noise levels at EX North exceeded 65 dBA, which appears to be heavily influenced by cooling tower noise. Generator testing increased the measured noise levels by 17 to 25 dBA. Measured noise levels during generator testing well exceeded 65 dBA, even ~200 feet to the east of the existing CEP.

New CEP Noise Measurement Results

The following figure illustrates the measured hourly noise levels at 24HR South from February 1st to 2nd, 2021.



The following figure shows the measured hourly noise levels at 24HR North from February 1st to 2nd, 2021.



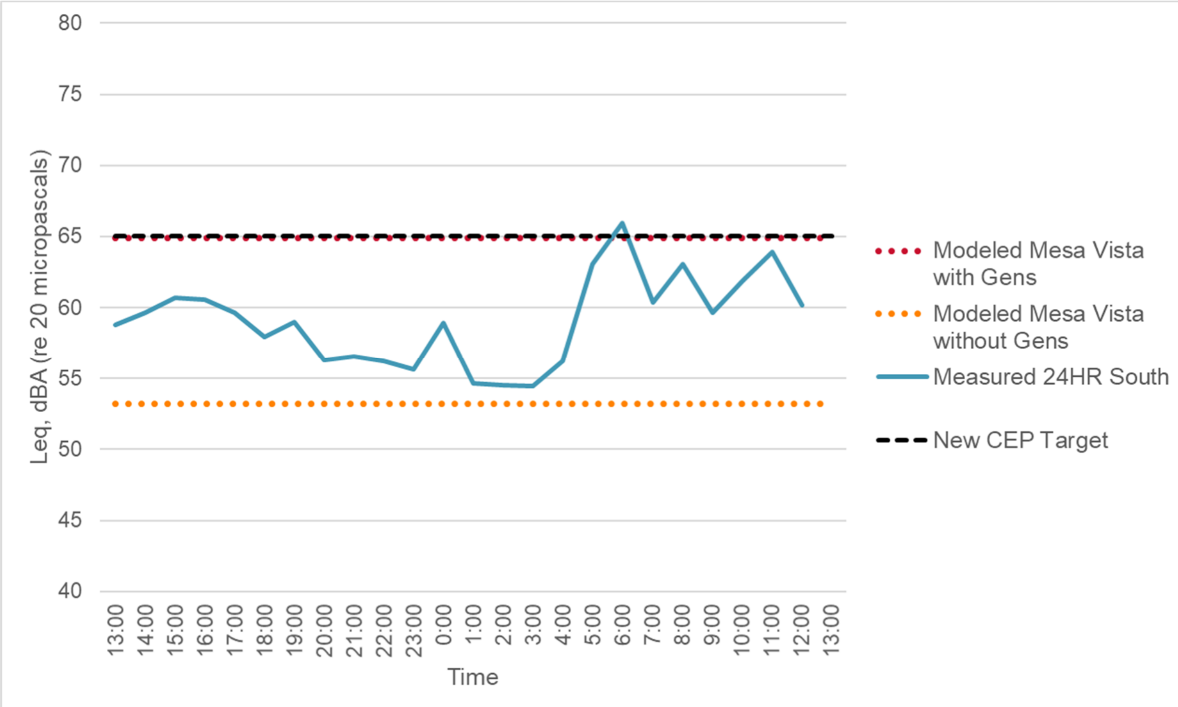
Measured existing noise levels varied through the 24-hour day, with the quietest hours occurring at night. The loudest period at both locations was the 6:00 AM hour, which is considered a nighttime hour. The 65 dBA on-site target used for the new CEP design is within the range of the measured existing noise levels

HDR determined the measured Community Noise Equivalent Levels (CNEL) were 67 dBA CNEL at 24HR South and 66 dBA CNEL at 24HR North. While not applicable to the project, the County of San Diego and CALGREEN call for an evaluation of building envelope acoustical performance at sites with an existing CNEL of 65 dBA or more.

New CEP Comparison of Measured and Modeled Results

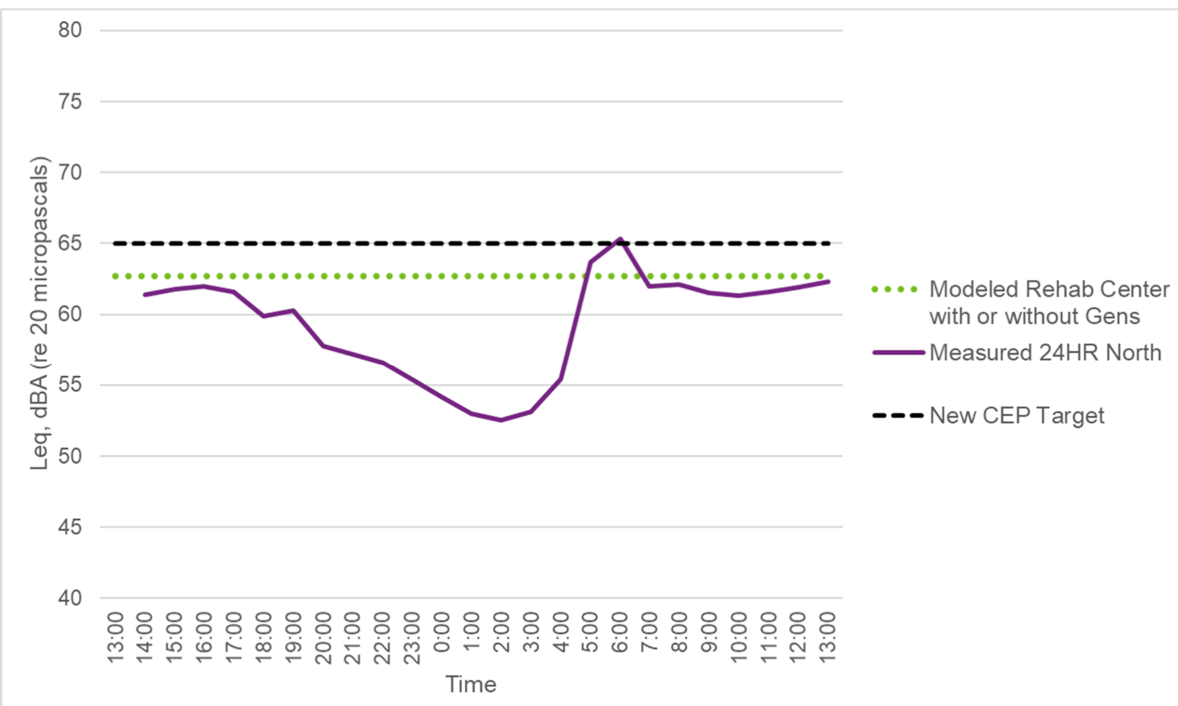
Appendix B describes noise modeling performed for the new CEP. Noise modeling results are presented here for comparison with the noise measurement results.

The following figure compares the 24HR South measurement results, modeled results for the Sharp Mesa Vista Hospital, and the 65 dBA on-site noise target used for the new CEP design.



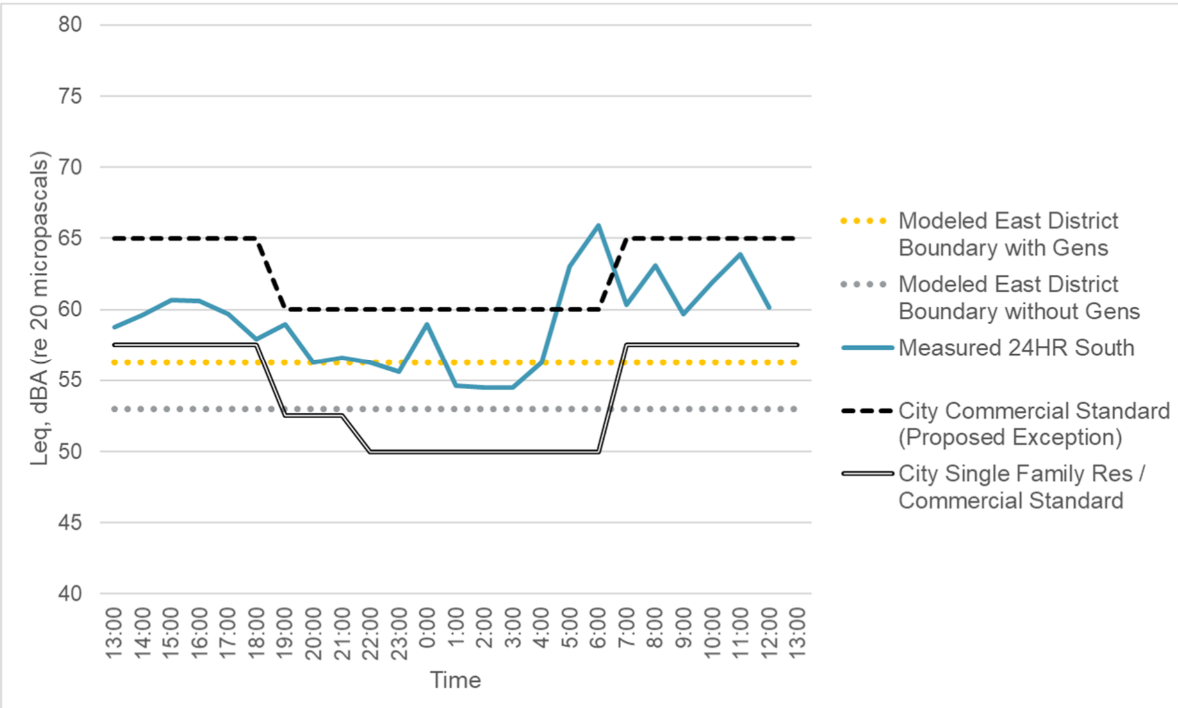
Modeled noise levels at the north façade of Mesa Vista are below the measured hourly Leq. New CEP generator testing would elevate noise levels outside of Mesa Vista, with generator testing anticipated to occur monthly during the 12:00 AM hour. The modeled Mesa Vista noise level with generators included is still comparable to existing noise levels measured at night (the 6:00 AM hour).

The following figure compares the 24HR North measurement results, modeled results for the Sharp Rehabilitation Center, and the 65 dBA on-site noise target used for the new CEP design.



The generators would be located on the south side of the new CEP (opposite from the Rehabilitation Center), so the modeled noise levels at the south façade of the Rehabilitation Center with and without generators are essentially the same. The Rehabilitation Center is primarily a daytime use building. The modeled noise level is comparable to the measured daytime noise levels at 24HR North. However, the summation of the measured and modeled noise levels (to represent a future condition with the new CEP) would result in a net increase in noise levels outside the Rehabilitation Center.

The following figure compares the 24HR South measurement results, modeling results at the property line to the east along Meadow Lark Drive (a zoning district boundary), and City of San Diego noise limits.



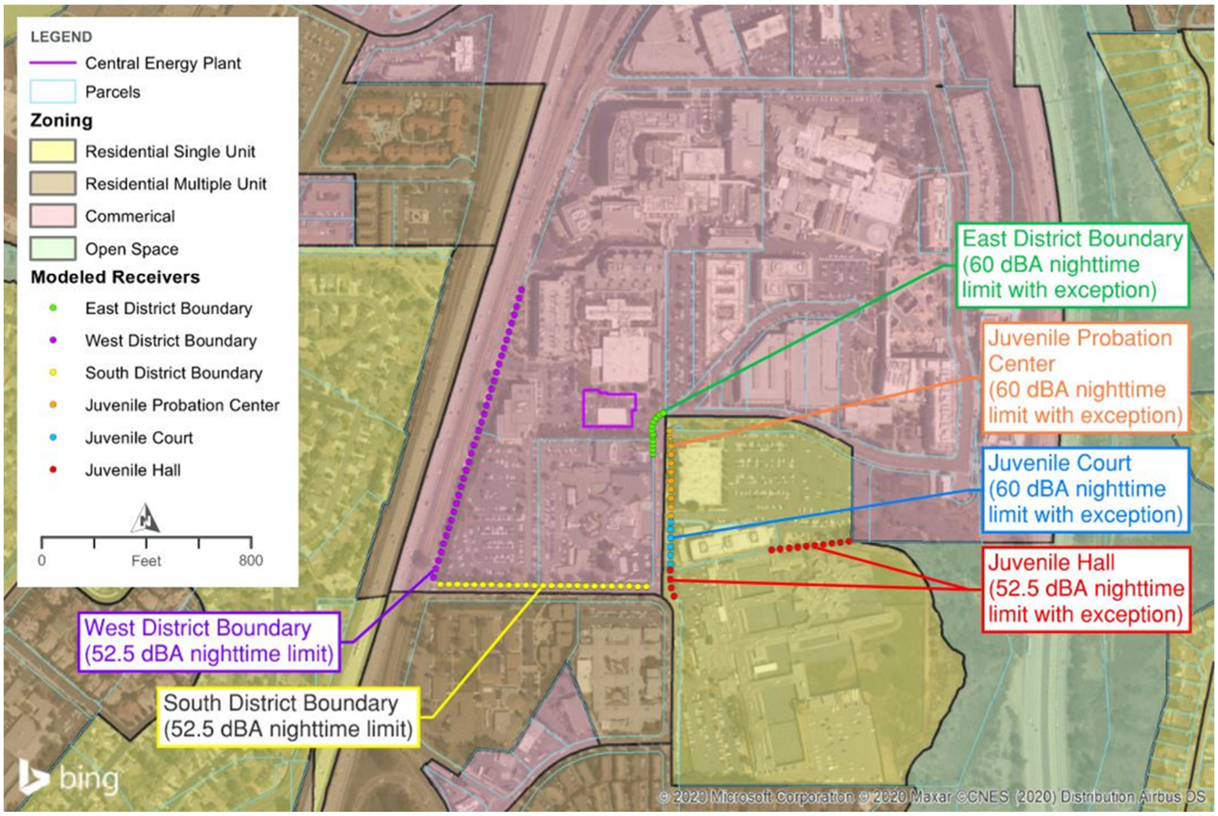
The City of San Diego noise limits vary with the time of day. The commercial-to-single-family-residential noise limits represent current zoning for the Sharp campus and the juvenile facility to the southeast. The commercial-to-commercial noise limits represent the proposed exception noise limits based on the usage of the nearest juvenile facility buildings. These proposed exception noise limits require approval by the City of San Diego. The new CEP noise control design depends on the approval of the proposed exception noise limits.

Measured existing noise levels at 24HR South exceeded the City of San Diego commercial-to-single-family-residential noise limits at all hours. Measured existing noise levels even exceeded the City of San Diego commercial-to-commercial noise limit at two nighttime hours.

APPENDIX B – NEW CEP NOISE MODELING

Noise Modeling Methods

HDR modeled noise emissions from the new Central Energy Plant (CEP) using the three-dimensional environmental noise software CadnaA. CadnaA is based on ISO 9613, "Attenuation of Sound during Propagation Outdoors." Noise levels calculated by CadnaA represent project-only noise levels, and therefore do not include existing noise sources. The following figure shows the new CEP location and the district boundary receivers and off-site receivers where noise levels were calculated.



The new CEP noise control design depends on the approval of the proposed exception noise limits, as indicated at the East District Boundary and juvenile facility to the southeast.

The following figure shows the noise sources included in the noise model and on-site receivers where noise levels were calculated.

The Sharp Rehabilitation Center is located north of the new CEP, the Sharp MOB Building is located to the west, and the Sharp Mesa Vista Hospital is located to the south. The new CEP noise control design is based on a 65 dBA limit at these on-site buildings.

The following table summarizes the noise model parameters.

Parameter	Model Approach
Terrain	Terrain was modeled using publicly available 2-foot elevation contours.
Buildings	Sharp buildings, buildings at the juvenile facility to the southeast, and residential buildings to the south were modeled.
Ground Factor	All ground was modeled as 0% absorptive due to the prevalence of pavement in the area.
Foliage	Foliage was conservatively ignored.
Meteorology	Downwind conditions were conservatively assumed in all directions – at each modeled receiver.
Temperature and Relative Humidity	The modeled temperature of 20 degrees Celsius and relative humidity of 70% generally aligned with publicly available annual averages for the area.

HDR modeled the following noise sources:

- Four generators (BOD: CAT)
- Two boilers (BOD: Cleaver Brooks – noise spectrum based on UFC 3-450-01)

- Four chillers (BOD: Trane)
- Five chilled water pumps (noise estimated using UFC 3-450-01)
- Four cooling tower cells (BOD: BAC with whisper quiet fans)
- Five cold water pumps (noise estimated using UFC 3-450-01)
- Three exhaust fans (BOD: Greenheck)

The generators, boilers, chillers, and chilled water pumps are located inside the new CEP. HDR calculated sound levels at various louvered to estimate noise transmission to the outdoors. The generators only operate during emergency situations. Generator testing is anticipated to occur monthly during the 12:00 AM hour.

Noise Control Measures

HDR modeled the following noise control measures to comply with the 65 dBA on-site noise target and the City of San Diego noise limits with the proposed exception noise limits (waiver):

- 7' long sound attenuators at the generator discharge (BOD: Vibro-Acoustics RD)
- 3' long sound attenuators at the generator intake (BOD: Vibro-Acoustics RD)
- Silencers / mufflers at the generator exhaust (BOD: GT Exhaust Hospital Plus)
- 12" deep acoustical louvers at the boiler room (BOD: IAC Acoustics Slimshield SL-12)
- 12" deep hinged acoustical louvers at the chiller room (BOD: IAC Acoustics Slimshield SL-12)
- Interior sound absorption at the ceiling of the generator room (BOD: K-13)
- STC 35 removable sound-rated panels at the chiller room (BOD: Koch Acoustical Barrier Panel)
- STC 40 sound-rated doors at generator room (BOD: Steelcraft B series)
- STC 30 sound-rated doors at boiler room and chiller room (BOD: Steelcraft CE series / H series honeycomb / L series honeycomb)
- STC 30 sound-rated roll-up doors at boiler room and chiller room (BOD: Alpine Insul-Sound)
- Cooling tower with whisper quiet fans (BOD: BAC)

The follow table summarizes the modeled acoustical performance of the sound attenuators, silencers / mufflers, and acoustical louvers.

	Dynamic Insertion Loss by Octave Band (in Hz), dB Generated Sound Power Level by Octave Band (in Hz), dBL (re 1 picowatt)							
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Generator Discharge	9 62	14 40	29 35	51 34	53 36	55 29	48 22	30 34
Generator Intake South	5 65	11 49	19 49	28 53	35 53	30 48	24 32	20 40

Generator Intake North	5 65	11 49	19 49	28 53	35 53	30 48	24 32	20 40
Generator Intake West	5 66	11 50	19 49	28 54	35 54	30 49	24 32	20 40
Generator Intake East	5 64	11 49	19 48	28 53	35 53	30 48	24 31	20 39
Generator Exhaust	25 -	50 -	47 -	38 -	39 -	40 -	42 -	42 -
Acoustical Louver	6 79	7 79	10 74	12 72	18 64	18 62	14 58	13 50

Noise Modeling Results

The following table summarizes the noise modeling results.

Location	Modeled Project-Only One-Hour Leq w/o Generators, dBA	Modeled Project-Only One-Hour Leq with Generators, dBA	Target, dBA
Sharp Rehabilitation Center	63	63	65
Sharp MOB Building	56	58	65
Sharp Mesa Vista Hospital	53	65	65
East District Boundary	53	56	60
Juvenile Probation Center	51	54	60
Juvenile Court	42	45	60
Juvenile Hall	38	41	52.5
Residential South	43	45	52.5
Residential West	48	50	52.5

With the noise control measures outlined above, the modeled project-only noise levels meet the on-site noise target of 65 dBA at adjacent Sharp buildings. The modeled project-only noise levels also meet the proposed exception noise limits regarding the City of San Diego noise standards.

APPENDIX C – MECHANICAL SOUND ISOLATION DETAILS

Mary Birch (Package 3)

The following table summarizes the maximum allowable mechanical equipment sound power levels calculated for Mary Birch and based on the building envelope assemblies.

Mark	Source	Sound Power Level by Octave Band (in Hz), dBL (re 1 picowatt)						
		63	125	250	500	1000	2000	4000
AHU-1	Radiated	95	96	89	88	84	80	80
AHU-2	Radiated	84	87	82	82	80	75	75
AHU-3	Radiated	93	95	91	86	84	80	80
PCU-1	Radiated	85	80	75	75	75	70	70
EF-2A&2B through EF-8	Radiated / Discharge	90	85	80	80	80	80	75

Stephen Birch (Package 4)

The following table summarizes the maximum allowable mechanical equipment sound power levels calculated for Stephen Birch and based on the building envelope assemblies.

Mark	Source	Sound Power Level by Octave Band (in Hz), dBL (re 1 picowatt)						
		63	125	250	500	1000	2000	4000
AHU-1	Radiated	95	95	90	90	90	85	85
AHU-2	Radiated	95	95	90	87	85	80	80
AHU-3	Radiated	95	95	90	87	85	80	80
EF-1 through EF-6	Radiated / Discharge	95	95	90	85	85	85	80

Existing Hospital Remodel (Package 6)

The following table summarizes the maximum allowable mechanical equipment sound power levels calculated for the Existing Hospital Remodel and based on the building envelope assemblies.

Mark	Source	Sound Power Level by Octave Band (in Hz), dBL (re 1 picowatt)						
		63	125	250	500	1000	2000	4000

AHU Admin	Radiated	94	91	91	86	85	82	80
AHU CATH	Radiated	90	93	88	88	85	80	80
AHU PACU	Radiated	95	92	89	87	90	80	80
AHU Pkg8	Radiated	95	95	90	85	85	85	85
EF-1 through EF-6	Radiated / Discharge	95	90	85	85	85	85	85

New Tower (Package 7)

The following table summarizes the maximum allowable mechanical equipment sound power levels calculated for the New Tower and based on the building envelope assemblies.

Mark	Source	Sound Power Level by Octave Band (in Hz), dBL (re 1 picowatt)						
		63	125	250	500	1000	2000	4000
AHU-1	Radiated	97	94	91	88	87	80	80
AHU-2	Radiated	95	92	89	89	87	80	80
AHU-3	Radiated	94	93	89	90	87	80	80
AHU-4	Radiated	98	92	92	89	88	81	78
AHU-5	Discharge	93	98	98	94	92	92	88
AHU-5	Inlet	92	92	89	82	81	85	78
AHU-5	Radiated	96	95	96	92	89	80	80
AHU-6	Radiated	94	90	90	86	85	80	80
AHU-7	Radiated	93	92	88	91	86	80	80
EF-1 through EF-10, EF-13 KEF-1	Radiated / Discharge	90	85	85	80	80	80	75