1DOOR4CARE CHEO INTEGRATED TREATEMENT CENTRE

50% CONSTRUCTION DOCUMENTS ACOUSTIC DESIGN REPORT | AUGUST 1, 2024

Thornton Tomasetti

TABLE OF CONTENTS

1Door4Care 50% CONSTRUCTION DOCUMENTS SUBMISSION

INTRODUCTION

Thornton Tomasetti is pleased to present this report summarizing aspects of EDIH's design for the 1DOOR4CARE Integrated Treatment Centre that address the OS requirements for acoustics, noise and vibration control for the Project. The Project Specific Output Specifications (PSOS) requirements and our general recommendations pertaining to areas of environmental noise, background sound levels, speech privacy, room acoustics, and vibration control. Requirements and details related to acoustical performance testing and verification will be addressed later in the project during Construction Administration when these tests are possible. The requirements and recommendations addressed below are provided to support the 50% Construction Document Submission and are based on the 50% CD drawings.

ENVIRONMENTAL NOISE

Environmental noise controls address the impacts of the facility on the surroundings, the surroundings on the facility, and the facility upon itself. Threshold limits are specified by the MECP, and in section 1.4.7.3 of Schedule 15. Sources addressed include two 175-ton cooling tower cells, two 1000 kW emergency generators (one future unit), fresh air and exhaust openings for air handling systems, and existing helipad operations. There are no exterior façade elements on the building that are considered susceptible to wind-induced noise, and therefore this source of exterior noise is not a concern for the facility.

A 3-dimensional noise model was developed using the CadnaA software. Noise controls implemented in the design include the following:

- acoustic louvers on the north and west walls of the cooling towers.
  - Vibro-Acoustics model ALF-MV-4 or similar is specified for the north and west louvers.

- room intake/exhaust silencers and hospital grade combustion exhaust muffler on the generator.
  - Custom elbow silencers are provided for the emergency generator room, having the following minimum insertion losses:

Table 1: Minimum generator room exhaust and intake sound attenuator requirements.

Path	Minimum Required Insertion Loss (dB)							
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Intake	13	22	47	55	52	49	37	23
Exhaust	15	22	45	58	55	58	46	32

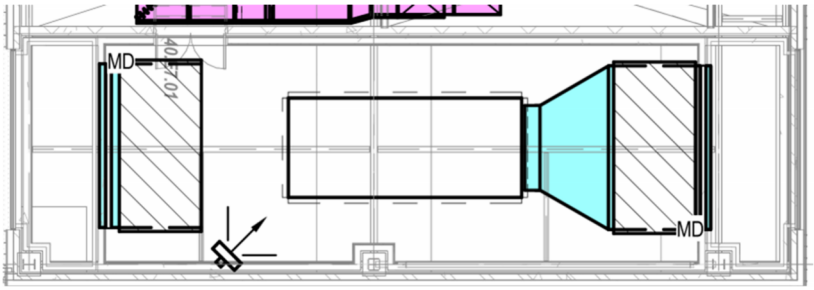

Figure 1: Generator room intake and exhaust silencers indicated on drawings.

- The team is currently evaluating options for control of EA and OA noise from the penthouse. This will include either acoustic louvers on the EA and OA intake plenums OR silencers in the EA and OA ducts prior to connection to the plena. The required insertion losses for both options are listed below.

Table 2: Minimum insertion losses for EA and OA acoustic louvers.

Louver	Minimum Insertion Loss Required (dB)								Louver Depth (mm)
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Intake	8	8	11	15	17	18	18	17	300
Exhaust	9	10	11	11	18	19	17	17	300

Table 3: Minimum insertion losses for EA and OA duct sound attenuators.

System Path	Minimum Insertion Loss Required (dB)								Silencer Length (mm)
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
AHU-01 OA	8	8	11	16	21	29	25	21	2100
AHU-01 EA	10	10	12	12	20	20	18	19	2100
AHU-02 OA	8	8	11	16	21	29	25	21	2100
AHU-02 EA	9	10	12	12	20	20	18	19	2100
AHU-04 OA	*Sound attenuator not required*								-
AHU-04 EA	7	-	-	4	12	15	15	15	1500
AHU-05 OA	8	8	11	16	20	24	22	21	2100
AHU-05 EA	7	-	-	4	12	14	14	15	1500
DOAS-01 OA	9	9	12	16	20	24	22	21	2100
DOAS-01 EA	10	11	12	12	20	20	18	19	2100
ERV-02 OA	8	8	11	16	21	29	25	21	2100
ERV-02 EA	9	11	12	12	20	20	18	19	2100

- building envelope elements that limit noise ingress from helipad operations to a max of 75 dBA.
  - ➢ Exterior glazing and wall construction to provide a minimum STC 35 / OITC 30 to address exterior helipad noise levels of ~88dBA. Refer to Exterior Glazing and Film Schedule in Specification 08 80 00 for exterior glazing types. Note that these glazing types also comply with the minim OBC requirement stipulated in the Noise and Vibration Impact Study produced by RWDI for the development.

Noise levels at all exterior terraces are limited to an Leq,1hr of 50 dBA during normal facility operations, and noise ingress through the façade is limited to a Leq,1hr = 40 dBA. By performing routine testing and maintenance of the generator outside of the operating hours of the Facility, it is expected that noise impacts to the outdoor amenity areas and building entrances can be avoided.

Model images showing the mitigated noise exposure levels and helicopter façade levels are shown below.

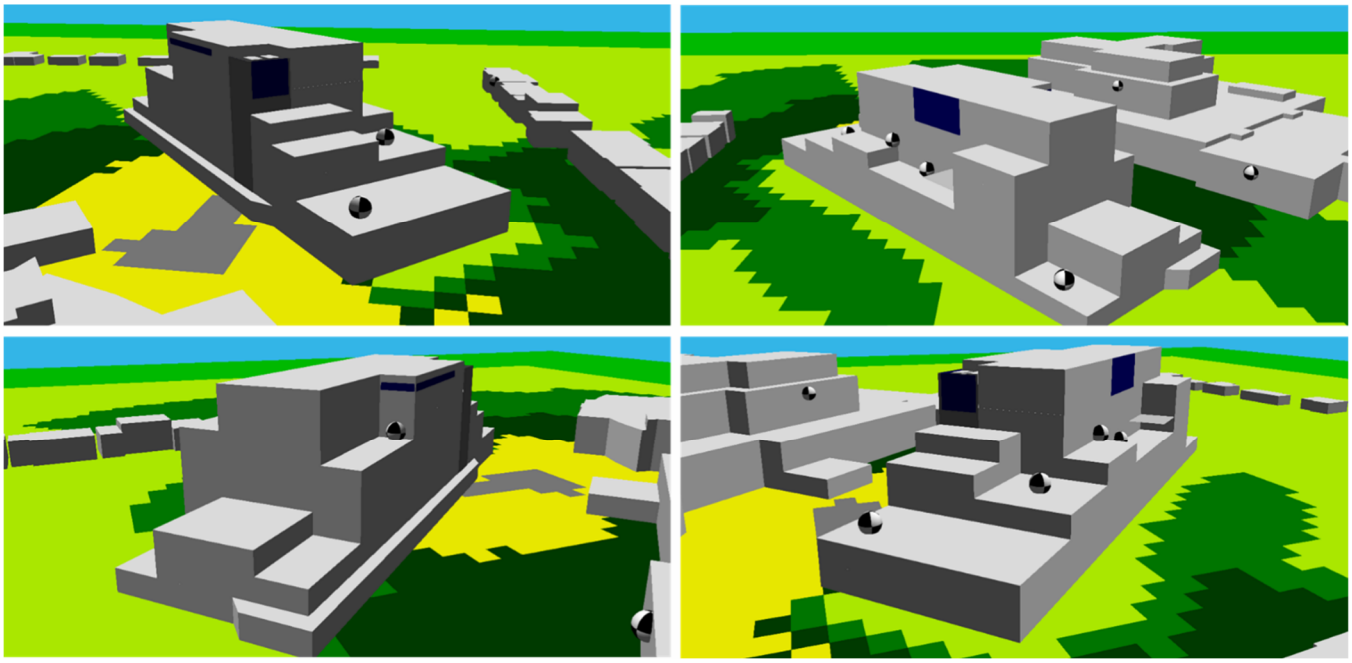

Figure 2: Images of the 3D noise model of the facility.

Figure 3: Noise modelling results, with mitigation measures as described in this report.

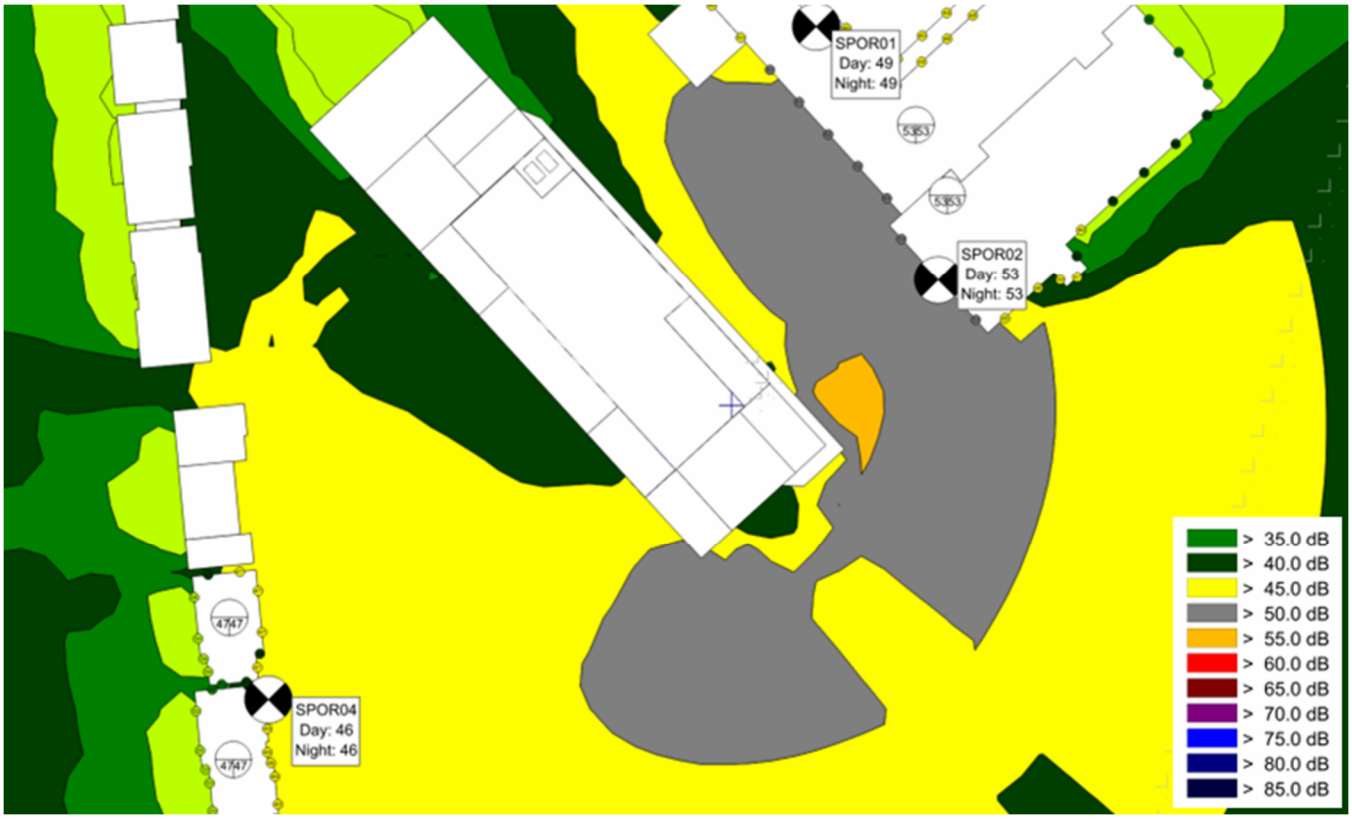

Figure 4: Noise modelling results, emergency generator operation (with mitigation).

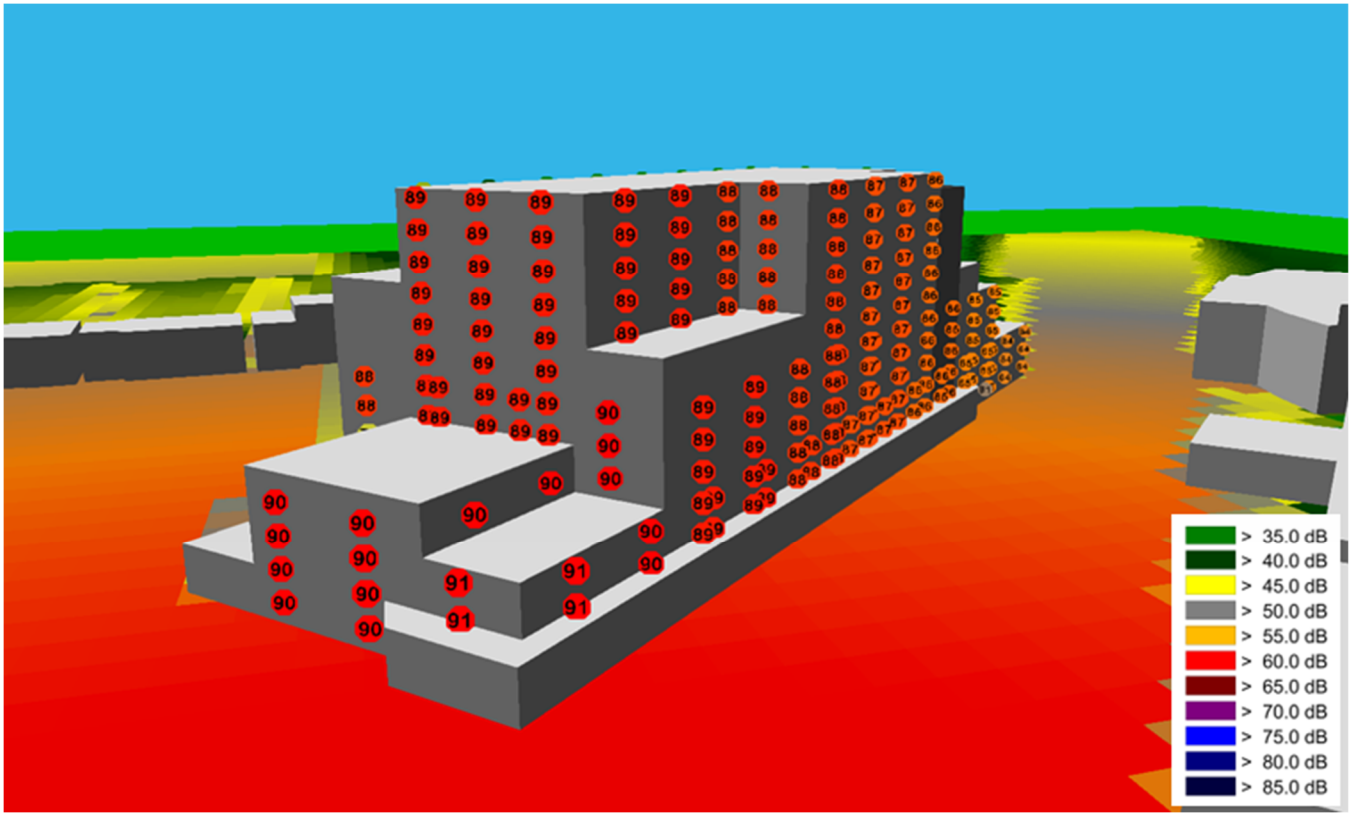

Figure 5: Noise modelling results, helipad exposure levels.

BACKGROUND SOUND LEVELS

Noise sources associated with building services within the Facility are controlled to meet the specified background sound level criteria listed in Table 1.4.7.1 of Schedule 15 Part 1.4.

The design approaches employed to achieve the required noise controls include:

- a 290 mm thick concrete penthouse floor + ceiling below, providing effective attenuation of low-frequency airborne noise;
- Floating floors throughout the extents of the chiller room and generator room, consisting of a minimum 100 mm concrete topping slab atop 50 mm thick isolation pucks with batts and air separation from base slab (refer to detail CS19 on drawing S0012);
- Vibration isolation of equipment and connected piping per the requirements below:

Table 4: General vibration isolation requirements.

Item Number	Equipment	Isolator Type	Minimum Static Deflection
V-1.1	AHUs/DOAS	Spring mount (internal) Isolation pad (casing)	25 mm 3 mm
V-1.2	Centrifugal Fans (constant speed)	Spring Mount or Hanger	25 mm
V-1.3	Centrifugal Fans (variable speed)	Spring Mount	50 mm
V-1.4	Base mounted Pump	Spring Hanger	50 mm
V-1.5	Floor mounted Vertical Inline Pumps	Isolation pad	8 mm
V-1.6	Ceiling mounted Vertical Inline Pumps	Spring hanger	25 mm
V-1.7	Ceiling mounted Fan Coil Units or Heat Pumps	Spring hanger	25 mm
V-1.8	Boilers	Isolation pad	8 mm
V-1.9	Chiller	Neoprene Pad	75 mm
V-1.10	Cooling Towers	Spring Mount	75 mm

- Selection of quiet fans and installation of duct silencers to attenuate duct-borne noise from large air handling equipment;
- Sufficiently slow airflow speeds in ductwork to limit regenerated and breakout noise; and,
- Sufficiently thick wall partition construction on MEP spaces to provide a high level of sound isolation.

Based on modelling of duct-borne noise considering the most current AHU and DOAS basis of design sound emissions, compliance with OS background noise criteria is achieved by inclusion of 25 mm internal acoustic lining at the locations shown in Figure 6.

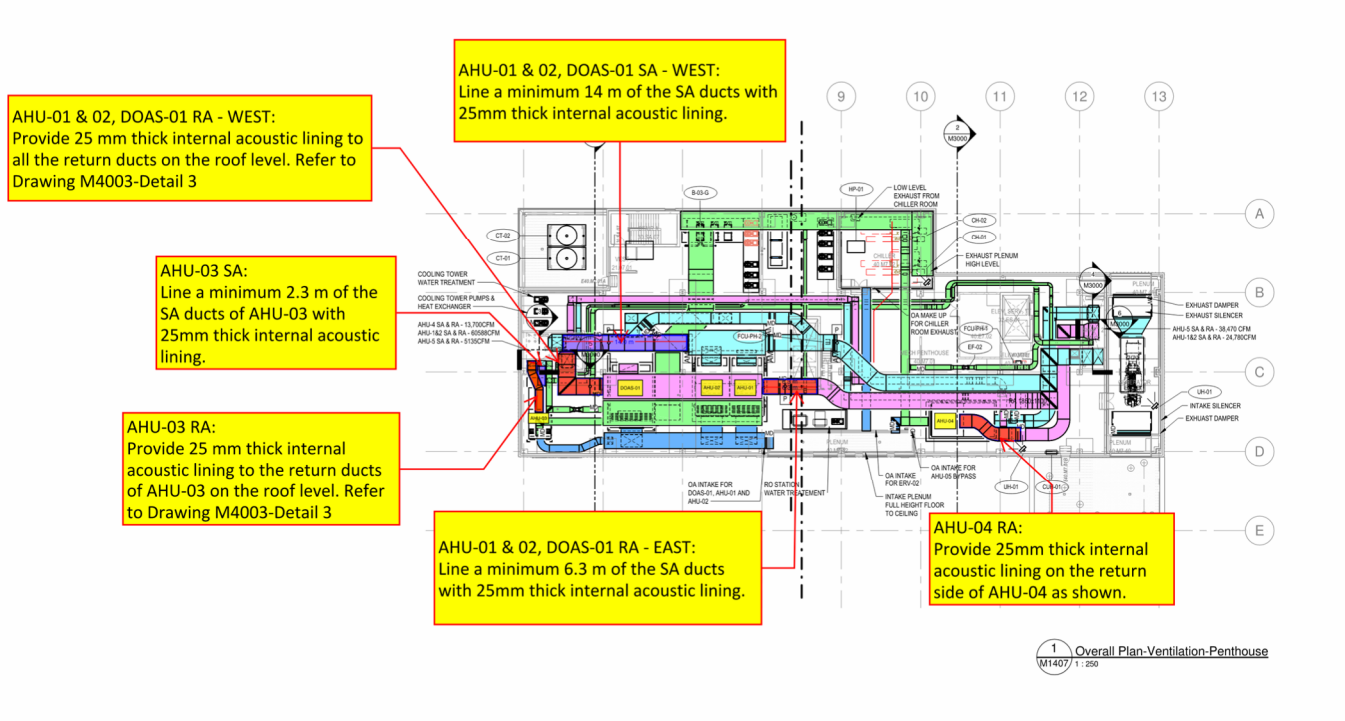

Figure 6: Extents of internal acoustic duct lining on penthouse primary ductwork.

In addition to required sound attenuators on discharge and return ducts connected to the air handlers, VAVs will be supplied with internal sound attenuators in areas where required for compliance with background sound levels. In many areas compliance is achieved by inclusion of 25 mm internal acoustic lining downstream of the VAVs. Units supplied with internal attenuators are as follows:

- VAV 1-8, VAV 1-18, VAV 1-44
- VAV 2-1, VAV 2-23, VAV 2-34
- VAV 3-4, VAV 3-6, VAV 3-7
- VAV 4-3, VAV 4-20, VAV 4-22
- VAV 5-7, VAV 5-8, VAV 5-22, VAV 5-24, VAV 5-29
- VAV 6-14

Plumbing Noise Control

The following approaches shall be used for control of noise from domestic water, waste lines, and roof drains.

- Plumbing supply, return and waste lines near occupied spaces are to be attached using resilient mounts.
- Pipe riser supports to be isolated from building structure using neoprene pads.
- Provision of a minimum 25mm gap between the outside of any pipe and a building element to avoid transfer of structure-borne noise.
- Pipes are sized to limit flow speeds to less than 2.1 m/s when near occupied spaces.
- Limiting pressure at fixtures to 400 kPa to reduce noise generation.

SOUND INSULATION

The sound insulation design addresses airborne and impact sound transmission through demising assemblies. Requirements for airborne noise transmission control are specified in Table 1.4.7.1 of Schedule 15 as composite sound transmission class ratings (STCc), and impact noise control requirements are specified as impact insulation class (IIC) ratings for specific areas of the building.

Impact Sound Insulation

The project features 240 mm thick monolithic floor slabs with floor finishes varying by location. The floor finishes include linoleum and epoxy terrazzo coupled with a 5 mm resilient underlayment. Ceiling finishes in occupied spaces consist of acoustic ceiling tile and drywall. These assemblies will provide a minimum IIC-45 rating as required by Schedule 15.

Control of impact noise from gym activities will be possible with the installation of a 10 mm thick specialty impact Mondo sports flooring system.

Additionally, control of wall impacts and noise transfer to spaces adjacent to the Gym is provided by CMU walls plus an isolated furring assembly with integrated isolation braces to absorb impacts. Together these systems are expected to limit impact sound transmission to occupied spaces to 35 dBA or less.

Wall Partitions

A vertical folding partition is planned for the EDU Training space on Level 1. This partition shall be selected to have a minimum performance rating of STC 60 for compliance with the OS and shall be detailed such that field performance is no less than 10 dB below the required STCc rating for the adjacency.

The project will employ Bailey B18 Hardboard studs for drywall partition assemblies. These systems provide a high level of stiffness, whilst maintaining the acoustic performance ratings of a 25-gauge stud assembly. Although test data are not currently available for 150 mm B18 Hardboard assemblies, we have consulted with Bailey to confirm that the 150 mm systems also perform equivalent to a 25-gauge 150 mm stud assembly.

Wall partitions proposed for the project are listed in the partition schedule on drawing A0211, together with their associated STC ratings. Partition tags are shown on the A140 series architectural plans.

Door and Frame Assemblies

Door assemblies are designed to satisfy the requirements listed in Section 5.2 of OS Section 1.4.7 and are detailed on drawing A6121 in the architectural drawing set.

Interior Screens and Glazed Fronts

EDIH is planning to use the PC350 wall systems where glazed fronts are planned. Glazing shall be specified to comply with SPC and STCc requirements listed in Schedule 15. Double (insulated) glazing will be necessary in some locations to meet the acoustic requirements.

The EDIH team is continuing to develop interior glazing assemblies to address higher ratings required in areas where an STCc 50 rating is required. It is anticipated that in Observation/Viewing Rooms, which have extensive glazing and an STCc50 requirement, a combined STC 55 wall and ~STC 47 glazing assembly will be required for compliance. These design details are still in development and will be finalized for the 100%CD submission.

SPEECH PRIVACY

Privacy and confidentiality are essential to many areas of the facility including Treatment, Consultation, Meeting Rooms, Private Offices and open workspaces. Speech Privacy Class ratings of 70 and 75 are specified to address normal and confidential levels of privacy.

The speech privacy requirements are attained through a combination of sound transmission loss of a demising assembly, and background sound levels. As it is not possible to predict/specify background sound levels in all spaces in the finished building, sound masking, together with sound insulating partitions, will be used as a means of achieving the SPC requirements. To avoid impacts on comfort and functionality, sound masking levels shall not exceed 48 dBA in any occupied spaces.

Layout of masking systems is in accordance with clause 6.5.3 in section 1.4.7 of Part 1.4 of Schedule 15. Currently planned locations are indicated in the AV120 series of the 50% CD Audio Visual drawings. Requirements of the sound masking system will be included as a specification and shall be demonstrated during the submittal phase.

As it is not possible to compute the SPC during design, the Speech Privacy Potential has been used as a basis for partition selection. This metric is approximately equal to the sum of the NC rating of the receiver space and the STC rating of the demising assembly. In areas where sound masking is provided, the NC rating assigned to the sound masking spectrum specified in the OS is approximately NC 40. It is not possible to predict background sound in areas without sound masking to a high degree of accuracy, so a "design rating" of NC 25 has been assumed in these areas as conservatism. Additionally, an allowance of 5 SPC points has been made for assessment of compliance, per the OS.

Based on these assumptions the following *approximate minimum* STC/ASTC ratings are required in areas where speech privacy requirements are specified in the OS:

Confidential Privacy: SPC-75 (~SPP 75)

- No sound masking: STCc 50 / ASTC 45
- With sound masking: STCc 32 / ASTC 27

Normal Privacy: SPC-70 (~SPP 70)

- No sound masking: STCc 45 / ASTC 40
- With sound masking: STCc 27 / ASTC 22

The composite requirements listed above include the effects of interior screens and doors. Interior screen specifications are in the final stages of development and will be detailed in the 100% IFC drawings submission.

It is expected that the articulation index limit of 0.3 will be met provided sound absorptive surfaces are included in the open office furniture, which is the responsibility of the FF&E contractor.

ROOM ACOUSTICS AND ACOUSTICAL FINISHES

Interior finishes are detailed in the A160 drawing series, and in the Room Finish Schedules A6110 and A6111. Acoustic finishes consist of acoustic ceiling tile and acoustic wall panels, where required, for compliance with the average NRC values in the OS.

While most spaces have been verified as compliant with the average NRC requirements, there are several spaces where competing requirements for millwork space, and non-acoustic clinical function, make this a challenge in some areas. EDIH is currently working with the CA to resolve these challenges. Currently specified finishes, including ACT and acoustic wall panels where required to satisfy the average NRC requirements, are listed in finish schedules A610, A611, and A612. Final requirements will be included in the 100% IFC submission.

In open space Staff areas, CA is to ensure Cubicles and workstations selection have acoustical padding to compensate for the removal of the carpet tile and to comply with the OS.

VIBRATION CONTROL

Occupant-induced floor vibrations (footfalls, gym activity) are controlled by the mass, stiffness, and damping supplied by the 240 mm structural slab + superimposed loads from non-structural elements. Based on our experience, and according to guidance published in design guides such as AISC DG 11 and SCI P354, damping is anticipated to be a minimum of 5% of critical for all floor vibration modes of concern (i.e., those susceptible to excitation by human-structure interaction).

Predicted responses for mid-span walking in enclosed spaces of a typical floor are shown in Figure 7 below. As indicated, floor vibration levels due to occupant activity are expected to be less than 100e-6 m/s RMS.

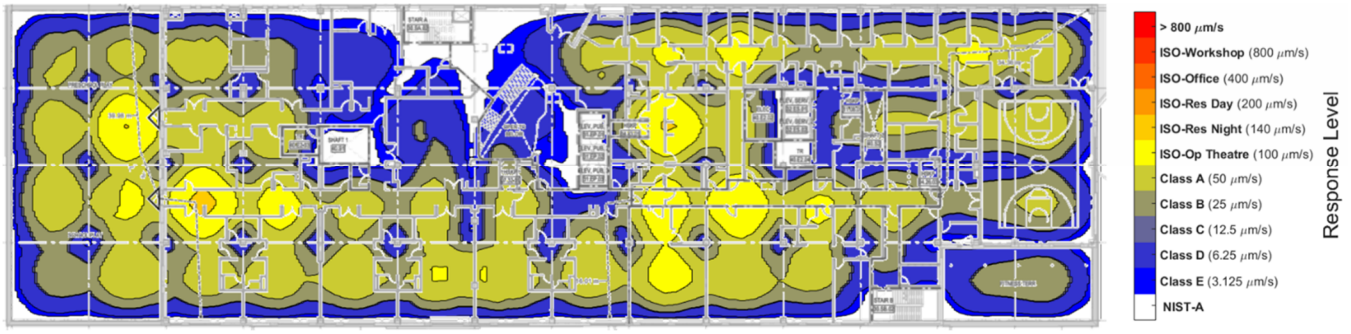

Figure 7: Floor response map for footfalls in enclosed spaces.

Analysis of floor vibration levels due to gym activity was also completed to confirm that vibrations will be less than 5%g within the space. These results are shown in Figure 8.

Figure 8: Floor response map for gym activity (35 persons engaged in rhythmic activity).

CONCLUSION

This concludes the 50% Construction Documents Acoustic Report. Additional details related to compliance of the design with the output specifications will be included in the next design submission.

Sincerely,

Brad Pridham, Ph.D., P.Eng.
Vice President
August 1, 2024