

**Date:** June 6 2018

**To:** Header Merza, Ministry of the Environment and Climate Change header.merza@ontario.ca

**CC:** Kyle Bittman, Coletara Development kbittman@coletara.com

**Re:** 17 Ewen (Hamilton) Inc. - 17 Ewen Road Development  
Suggested Revisions to Enclosed Noise Buffer Window Design  
Novus File No. 15-0007

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## 1.0 Introduction

Header,

As you know, Novus Environmental Inc. (Novus) was retained by 17 Ewen (Hamilton) Inc. to conduct a noise impact assessment for a 10-storey student residence to be located at 17 Ewen Road, in Hamilton, Ontario.

A key part of the mitigation design involves the use of enclosed noise buffer windows (“ENB windows” on certain facades, to control stationary noise from Mondelez Cadbury operations, who operate a facility immediately to the south of the development.

A design of the ENB windows was previously sent to you for review in March of 2017. Subsequent to that memo, mock-ups of the window have been constructed and sent for STC performance testing. The purpose of this memo is to provide the test results and final design, for your review.

## 2.0 Description of the Current Site Plan

Excerpts from the current site plan and elevation views are shown in **Figures 1 and 2**, attached. The development remains a 10-storey student residence, set back 3.0 m from the southern property line. The site plan has not changed since our previous memo.

There are no Outdoor Living Areas or common outdoor amenity areas, including balconies or rooftop outdoor amenity areas. The only points of reception are the façade windows connected to noise sensitive spaces such as bedrooms and living rooms.

### 3.0 Noise Requirements

The City of Hamilton has provided a Class 4 designation for the 17 Ewen Road property. As such, the following limits apply:

- Continuous Noise:
  - Daytime: 60 dBA  $L_{eq}$  (1-hr) dBA, in the plane of noise-sensitive windows;
  - Night-time: 55 dBA  $L_{eq}$  (1-hr) dBA, in the plane of noise-sensitive windows;
- Impulsive Noise:
  - Daytime: 60 dBA  $L_{LM}$  dBAI, for frequent impulses in the plane of noise-sensitive windows;

During unloading of tanker trucks, there are frequent impulsive noises (more than 9 per hour) from mallet hammer hits on the side of the tanker cars, meant to dislodge flour and other powders inside the tanks. Unloading only takes place once per day during daytime hours.

### 4.0 Predicted Sound Levels

Predicted impulsive and non-impulsive sound levels are shown in **Figures 3a and 3b**. Worst-case maximum sound levels at the exterior façade are summarized in **Table 1** below:

**Table 1: Worst-Case Unmitigated Façade Levels**

Type of Noise	Location	1/1-Octave Band Levels (dB)								Overall	
		63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	dBZ	dBA
Impulsive Noise	South Façade	63.3	64.8	71.8	76.5	67.0	64.5	56.8	47.2	78.7	75.2
	East Façade	62.8	63.6	70.6	75.3	65.7	63.1	55.4	45.7	77.5	73.9
	North Façade	57.4	57.2	62.6	65.3	53.2	47.9	37.5	24.2	68.2	63.4
Non-Impulsive Noise	South Façade	66.3	61.8	60.0	59.7	56.4	51.3	44.1	30.0	69.2	61.1
	East Façade	64.9	59.0	58.1	58.4	55.0	49.7	42.2	26.0	67.5	59.6
	North Façade	59.7	53.4	50.0	47.5	42.0	34.2	24.2	5.8	61.2	48.3

The impulsive noise from tanker unloading is the dominant noise source on-site and drives the mitigation requirements.

### 5.0 Proposed ENB Window Design

The ENB window design consists of an external 2-pane sealed (inoperable) insulated glass unit window, which acts as the buffer window. The interior window will consist of a single 1/4"

(6.3 mm) interior lite mounted in an aluminum sash. This sash will be attached to the main frame using specialty fasteners which will not be removable by the student occupants and which will require a maintenance key. The space between the inner-most pane of the exterior buffer window and the sash is approximately 3-3/8 inch. The sash will also be sealed to the frame using rubber gaskets. The sash window (glazing and frame) provides a minimum noise reduction of STC 29, which is equivalent to the STC rating of a regular exterior window meeting minimum Ontario Building Code thermal requirements. A diagram showing the ENB window design is provided in **Figures 4a and 4b**. A copy of the final window design drawing is provided in **Attachment A**.

The sash will only be removed by maintenance staff for inspection, cleaning, and repair, as required. This requirement will be enshrined within revised Minutes of Settlement with Mondelez Cadbury to ensure its continued use and legal enforceability. Similar window designs exist, and have been used at multiple noise sensitive buildings in and around the GTA. An example would be at some existing medical facilities.

Two different exterior buffer windows will be used: An STC 32 window type, and STC 35 window type. The location where these windows will be used are shown in in **Figures 2a through 2c**.

## 6.0 ENB Window Performance

### Window STC Ratings

**Attachment A** provides copies of the ASTM-E 90 sound transmission test results for two window designs.

### South Side (Figure 2a)

All exterior windows on the south side of the building are to have a minimum sound transmission requirement of STC 32.

The actual transmission loss data was used to determine the resulting sound level on the inside of the enclosed buffer windows. Calculations are provided in **Attachment B**. Results are tabulated for the south façade below:

**Table 2: Modelled Worst-Case Noise Levels Inside Buffer Windows – South Side**

Noise Type and Window Location	Window Type	Maximum Sound Level at Exterior of Buffer Window	Sound Level at Exterior of Sull Sash Window	Applicable MOECC Class 4 Guideline Limit	Meets MOECC Guideline Limit?	Difference
Impulsive Noise, South Façade	STC32	75.2 dBAI	55.8 dBAI	60.0 dBAI	Yes	-4.2 dB
Non-Impulsive Noise, South Façade	STC32	61.1 dBA	42.7 dBA	55.0 dBA	Yes	-12.3 dB

As can be seen from the chart above, the applicable MOECC noise guidelines are met at the exterior of the sull sash window.

**North Side (Figure 2b)**

Windows identified at the east end of the building between the 6<sup>th</sup> and 10<sup>th</sup> floors on the north side of the building are to have a minimum sound transmission requirement of STC 32.

As was the case for the south side, the actual transmission loss data was used to determine the resulting sound level on the inside of the enclosed buffer window. Calculations are provided in **Attachment B**. Results are tabulated for the north façade below:

**Table 3: Modelled Worst-Case Noise Levels Inside Buffer Windows – North Side**

Noise Type and Window Location	Window Type	Maximum Sound Level at Exterior of Buffer Window	Sound Level at Exterior of Sull Sash Window	Applicable MOECC Class 4 Guideline Limit	Meets MOECC Guideline Limit?	Difference
Impulsive Noise, North Façade	STC32	63.4 dBAI	47.9 dBAI	60.0 dBAI	Yes	-12.1 dB
Non-Impulsive Noise, North Façade	STC32	48.3 dBA	34.9 dBA	55.0 dBA	Yes	-20.1

As can be seen from the above, the applicable MOECC noise guidelines are met at the exterior of the sull sash window.

**East Side (Figure 2c)**

Exterior ENB windows on the east side of the building will have the following STC ratings (see **Figure 2c** for window locations):

- Windows between the 1<sup>st</sup> and 5<sup>th</sup> floor are to have a minimum sound transmission requirement of STC 32.
- Windows between the 6<sup>th</sup> through 10<sup>th</sup> floor must have a minimum rating of STC 35.

The actual transmission loss data was used to determine the resulting sound level on the inside of the enclosed buffer window. Calculations are provided in **Attachment B**. Results are tabulated for the east façade below:

**Table 4: Modelled Worst-Case Noise Levels Inside Buffer Windows – East Side**

Noise Type and Window Location	Window Type	Maximum Sound Level at Exterior of Buffer Window	Sound Level at Exterior of Sull Sash Window	Applicable MOECC Class 4 Guideline Limit	Meets MOECC Guideline Limit?	Difference
Impulsive Noise, East Façade (5 <sup>th</sup> Floor)	STC32	70.1 dBAI	50.8 dBAI	60.0 dBAI	Yes	-9.2 dB
Non-Impulsive Noise, East Façade (5 <sup>th</sup> Floor)	STC32	55.1 dBA	37.6 dBA	55.0 dBA	Yes	-17.4 dB
Impulsive Noise, East Façade (9 <sup>th</sup> Floor)	STC35	73.9 dBAI	54.3 dBAI	60.0 dBAI	Yes	-5.7 dB
Non-Impulsive Noise, East Façade (9 <sup>th</sup> Floor)	STC35	59.6 dBA	41.6 dBA	55.0 dBA	Yes	-13.4 dB

As can be seen from the above, the applicable MOECC noise guidelines are met at the exterior of the sull sash window.

## 7.0 Closing

Based on our review, we believe the proposed window designs will meet the MOECC’s requirements for an enclosed noise buffer under NPC-300, and will provide an adequate indoor environment for the student residence. We hope that you can confirm as such with a response letter. Should you have any questions or comments, please feel free to contact us.

Sincerely,

**Novus Environmental Inc.**



R. L. Scott Penton, P.Eng.  
 Principal.

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# Figures

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for 2-sided printing purposes

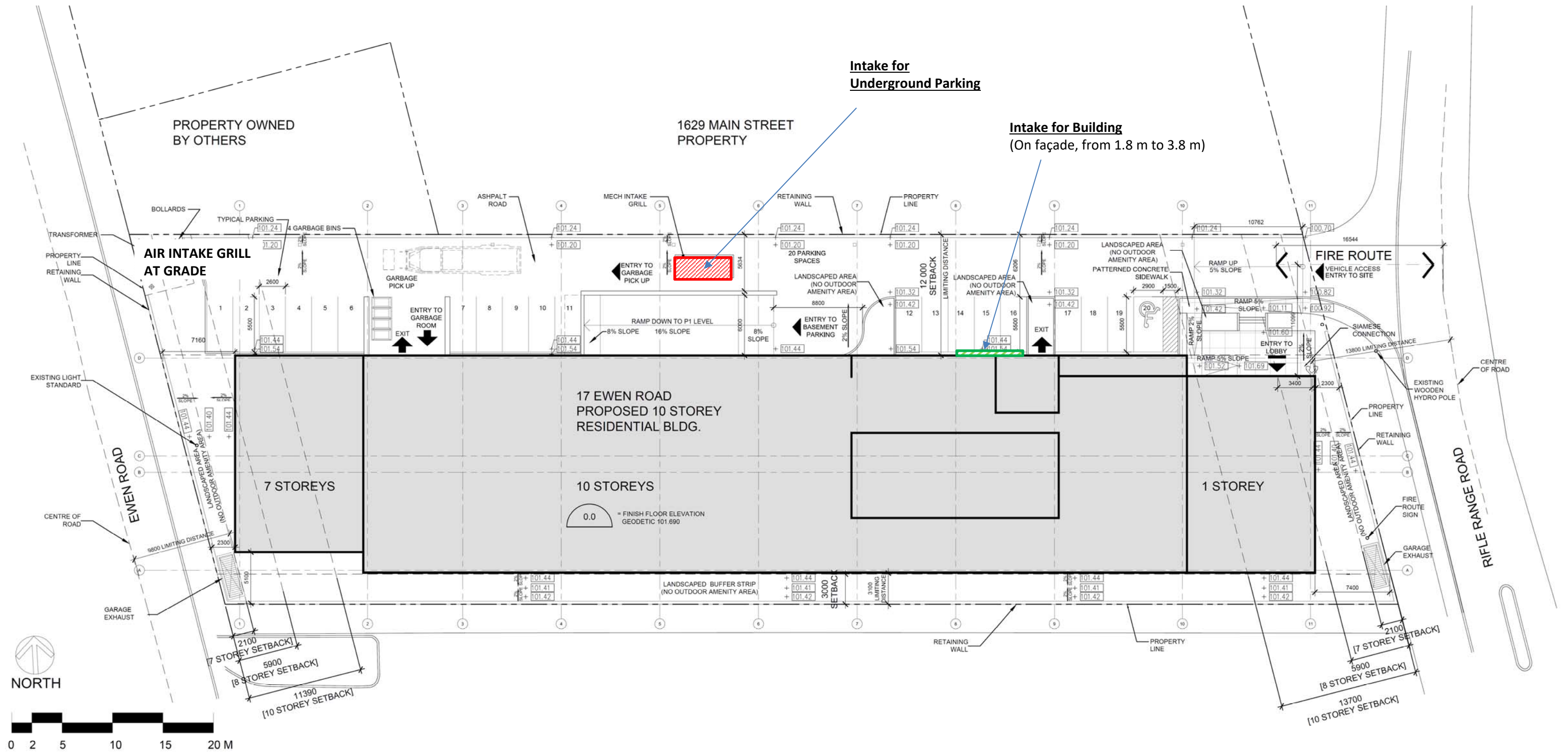


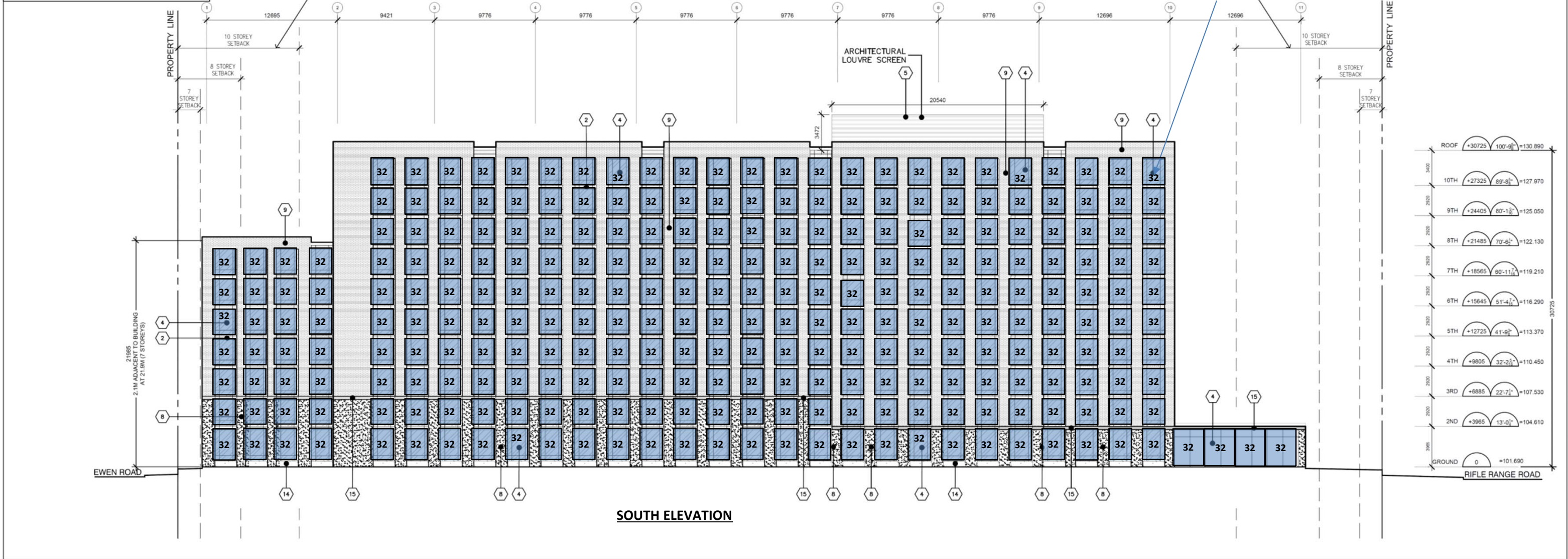
Figure No. 1  
**Excerpts From Site Plan A-101 May 2017**

Scale: See inset  
 Date: 18/01/23  
 File No.: 15-0007  
 Drawn By: SLP





NOTE:  
ALL WINDOWS ON THE SOUTH ELEVATION ARE NOISE BUFFER WINDOWS WITH MINIMUM STC 37 EXTERIOR PANES.



**SOUTH ELEVATION**

**MATERIAL LEGEND**

- |  |                                  |
|--|----------------------------------|
| ② GLASS SPANDREL PANEL                           | ⑨ PRECAST BRICKS (BLACK)         |
| ③ RESERVED                                       | ⑩                                |
| ④ NON-OPERABLE NOISE BUFFER WINDOW <b>STC 32</b> | ⑪ RESERVED                       |
| ⑤ MECHANICAL PENTHOUSE ARCHITECTURAL LOUVRES     | ⑫ WOOD EFFECT PANELS             |
| ⑥ NON-OPERABLE WINDOW                            | ⑬ METAL DOOR                     |
| ⑦ CANTILEVERED METAL CLAD CANOPY                 | ⑭ ARCHITECTURAL EXPOSED CONCRETE |
| ⑧ GRANITE (BLACK LEATHERED)                      | ⑮ STAINLESS STEEL FASCIA         |

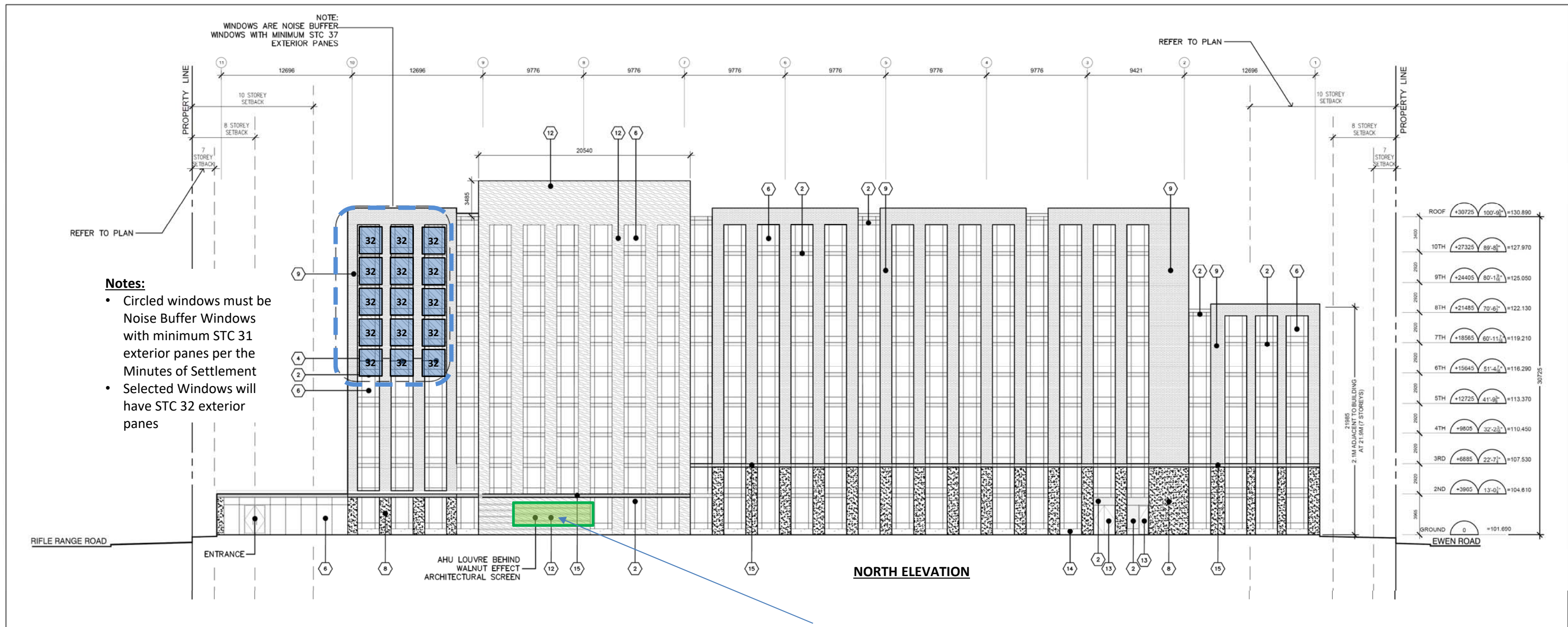
**Notes:**

- All windows on the Southern Façade must be Noise Buffer Windows with minimum STC 31 exterior panes per Minutes of Settlement.
- STC 32 windows have been selected in the design, meeting the requirement.

Figure No. **2a**  
**Building Elevations Showing Locations of Buffer Windows – South Elevation**

Scale: Approx 1: 300  
Date: 18/01/23  
File No.: 15-0007  
Drawn By: SLP





- Notes:**
- Circled windows must be Noise Buffer Windows with minimum STC 31 exterior panes per the Minutes of Settlement
  - Selected Windows will have STC 32 exterior panes

- Notes:**
- Location of Building Air Intake
  - From 1.8 m to 3.8 m high

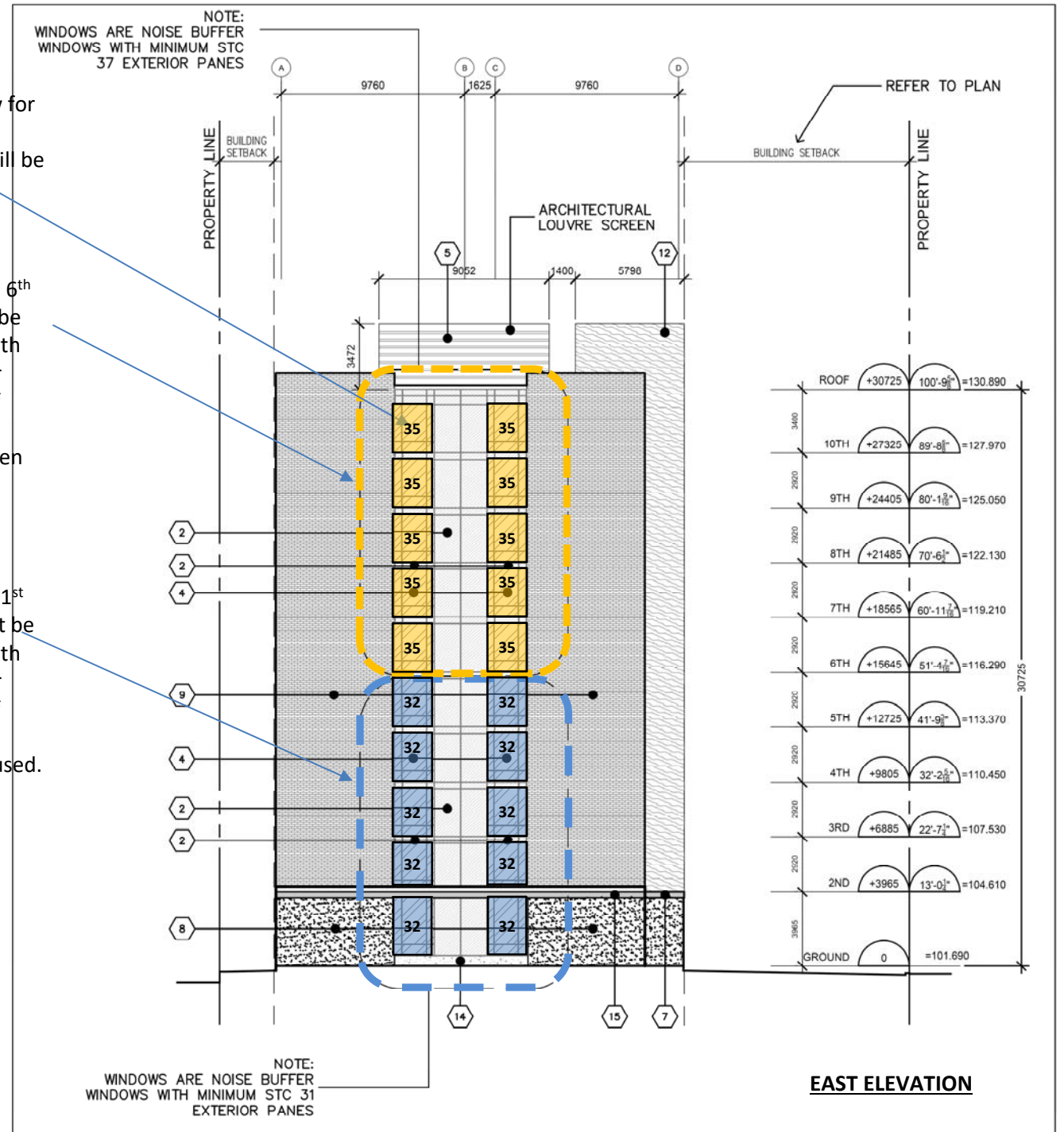
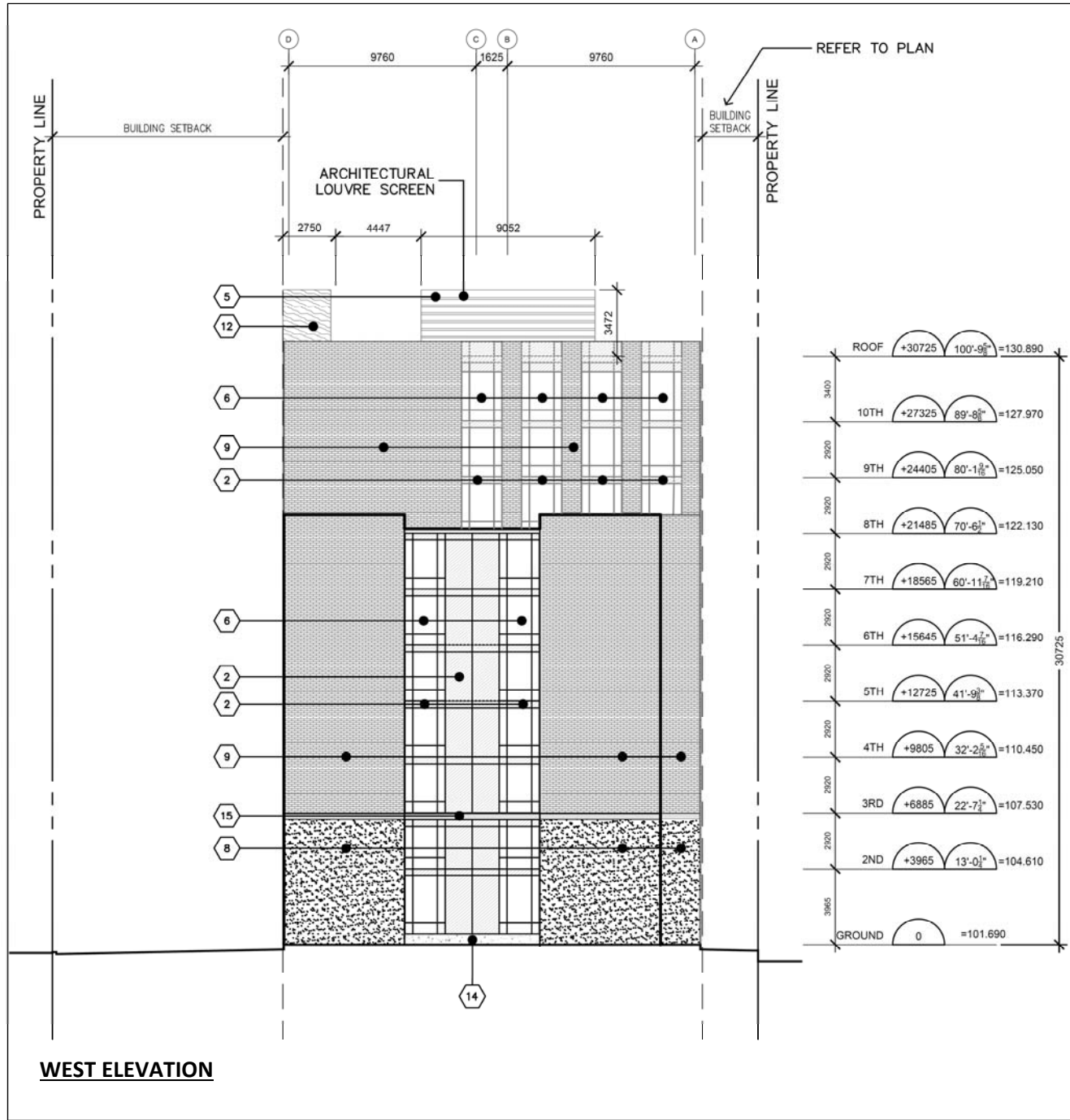
**MATERIAL LEGEND**

- |  |                                  |
|--|----------------------------------|
| ② GLASS SPANDREL PANEL                           | ⑨ PRECAST BRICKS (BLACK)         |
| ③ RESERVED                                       | ⑩                                |
| ④ NON-OPERABLE NOISE BUFFER WINDOW <b>STC 32</b> | ⑪ RESERVED                       |
| ⑤ MECHANICAL PENTHOUSE ARCHITECTURAL LOUVRES     | ⑫ WOOD EFFECT PANELS             |
| ⑥ NON-OPERABLE WINDOW                            | ⑬ METAL DOOR                     |
| ⑦ CANTILEVERED METAL CLAD CANOPY                 | ⑭ ARCHITECTURAL EXPOSED CONCRETE |
| ⑧ GRANITE (BLACK LEATHERED)                      | ⑮ STAINLESS STEEL FASCIA         |

Figure No. **2b**  
**Building Elevations Showing Locations of Buffer Windows – North Elevation**

Scale: Approx 1: 300  
 Date: 18/01/23  
 File No.: 15-0007  
 Drawn By: SLP





- Notes:**
- Selected Buffer Window for Acoustic Audit
  - Interior Window Only will be operable
- Notes:**
- Circled windows here on 6<sup>th</sup> through 10<sup>th</sup> floors must be Noise Buffer Windows with minimum STC 36 exterior panes per the Minutes of Settlement
  - STC 35 Windows have been chosen
  - Circled windows here on 1<sup>st</sup> through to 5<sup>th</sup> floors must be Noise Buffer Windows with minimum STC 31 exterior panes per the Minutes of Settlement
  - STC 32 Windows will be used.

**MATERIAL LEGEND**

- |   |  |    |                                |
|---|--|----|--------------------------------|
| 2 | GLASS SPANDREL PANEL   | 9  | PRECAST BRICKS (BLACK)         |
| 3 | RESERVED   | 10 |                                |
| 4 | NON-OPERABLE NOISE BUFFER WINDOW <span style="background-color: #ccccff; padding: 2px;">STC 32</span> <span style="background-color: #ffffcc; padding: 2px;">STC 35</span> | 11 | RESERVED                       |
| 5 | MECHANICAL PENTHOUSE ARCHITECTURAL LOUVRES   | 12 | WOOD EFFECT PANELS             |
| 6 | NON-OPERABLE WINDOW  | 13 | METAL DOOR                     |
| 7 | CANTILEVERED METAL CLAD CANOPY   | 14 | ARCHITECTURAL EXPOSED CONCRETE |
| 8 | GRANITE (BLACK LEATHERED)  | 15 | STAINLESS STEEL FASCIA         |

Figure No. 2c

**Building Elevations Showing Locations of Buffer Windows – West and East Elevations**

Scale: Approx 1: 300

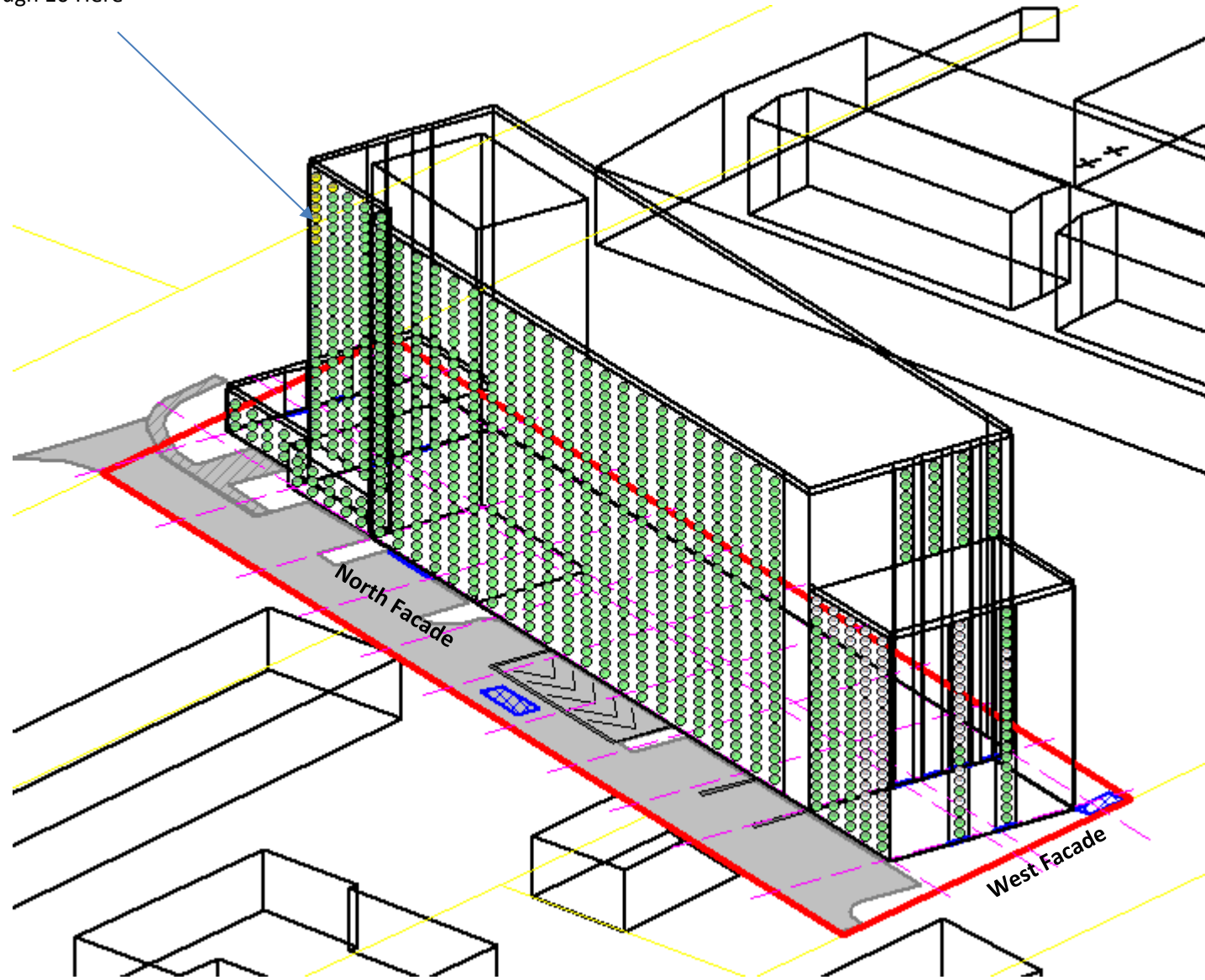
Date: 18/01/23

File No.: 15-0007

Drawn By: SLP



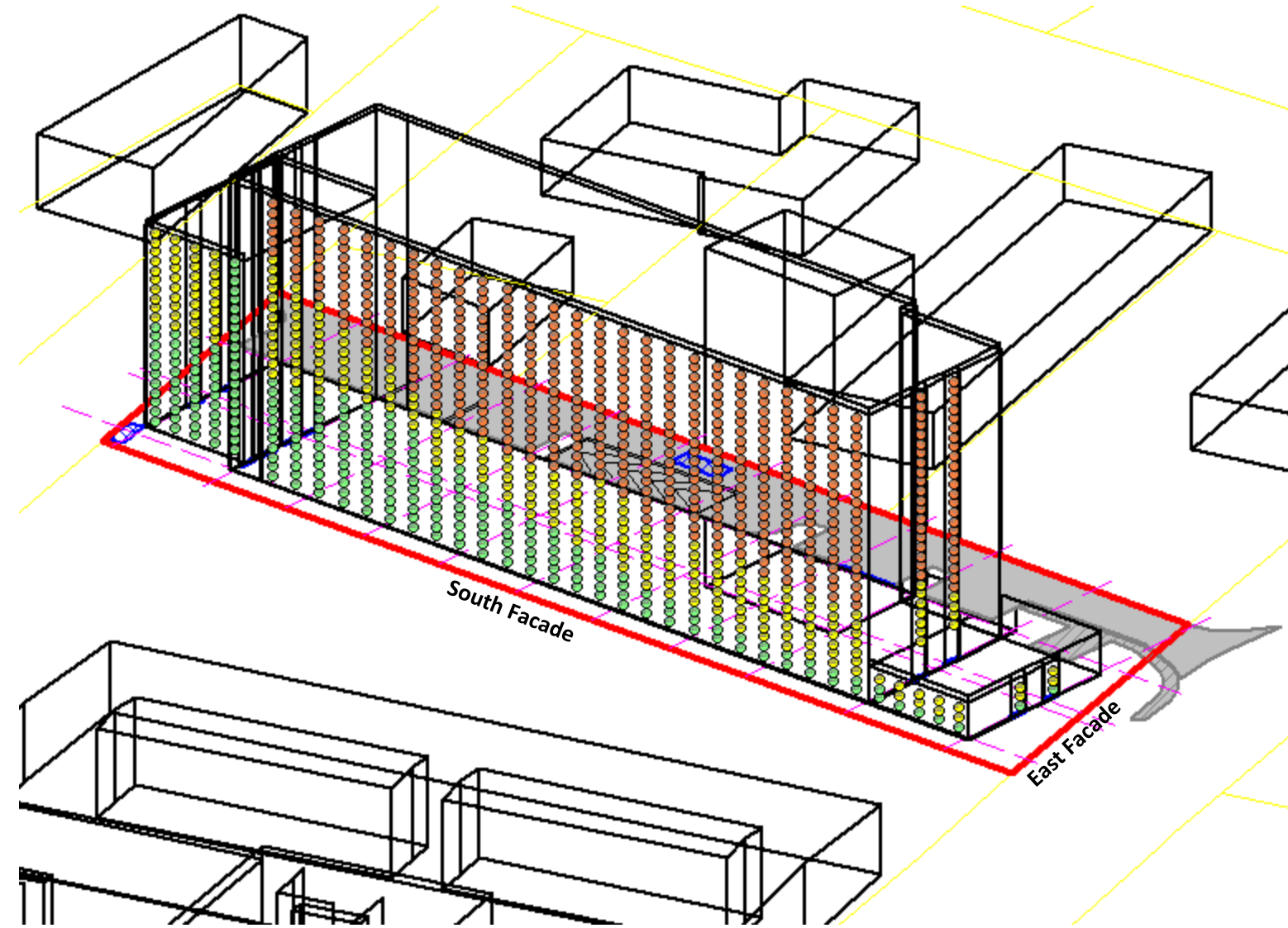
Noise Buffer Windows  
Required For Floors 6  
through 10 Here



View From Northwest

**LEGEND**

- >= 45
- >= 55
- >= 60



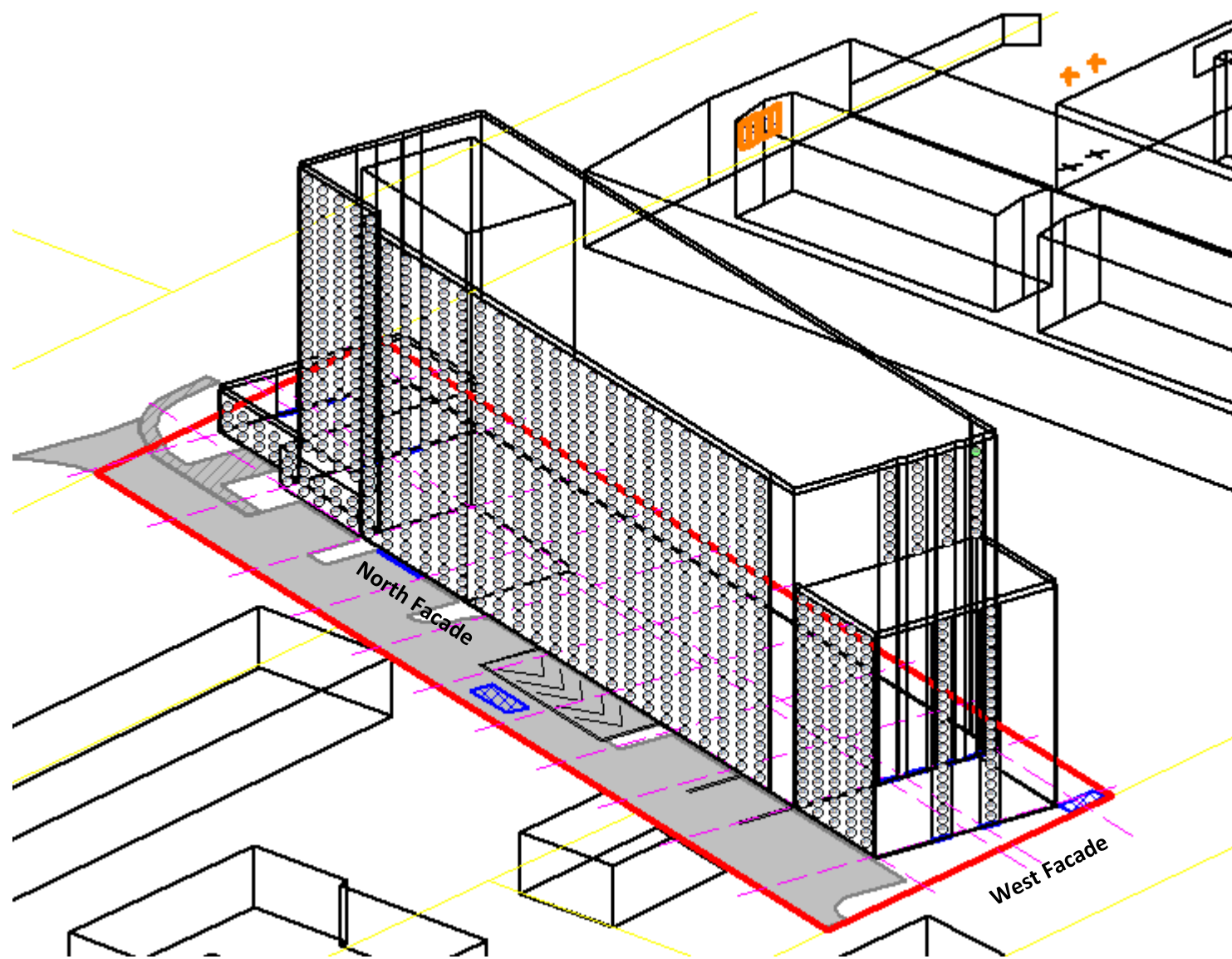
View From Southeast

Noise Buffer Windows Required For  
All Windows On The Southern  
And Eastern Facades Per Minutes of  
Settlement

Figure No. **3a**  
**Updated Noise Modelling Results – Impulsive Noise**

Scale: n/a  
Date: 18/01/23  
File No.: 15-0007  
Drawn By: SLP

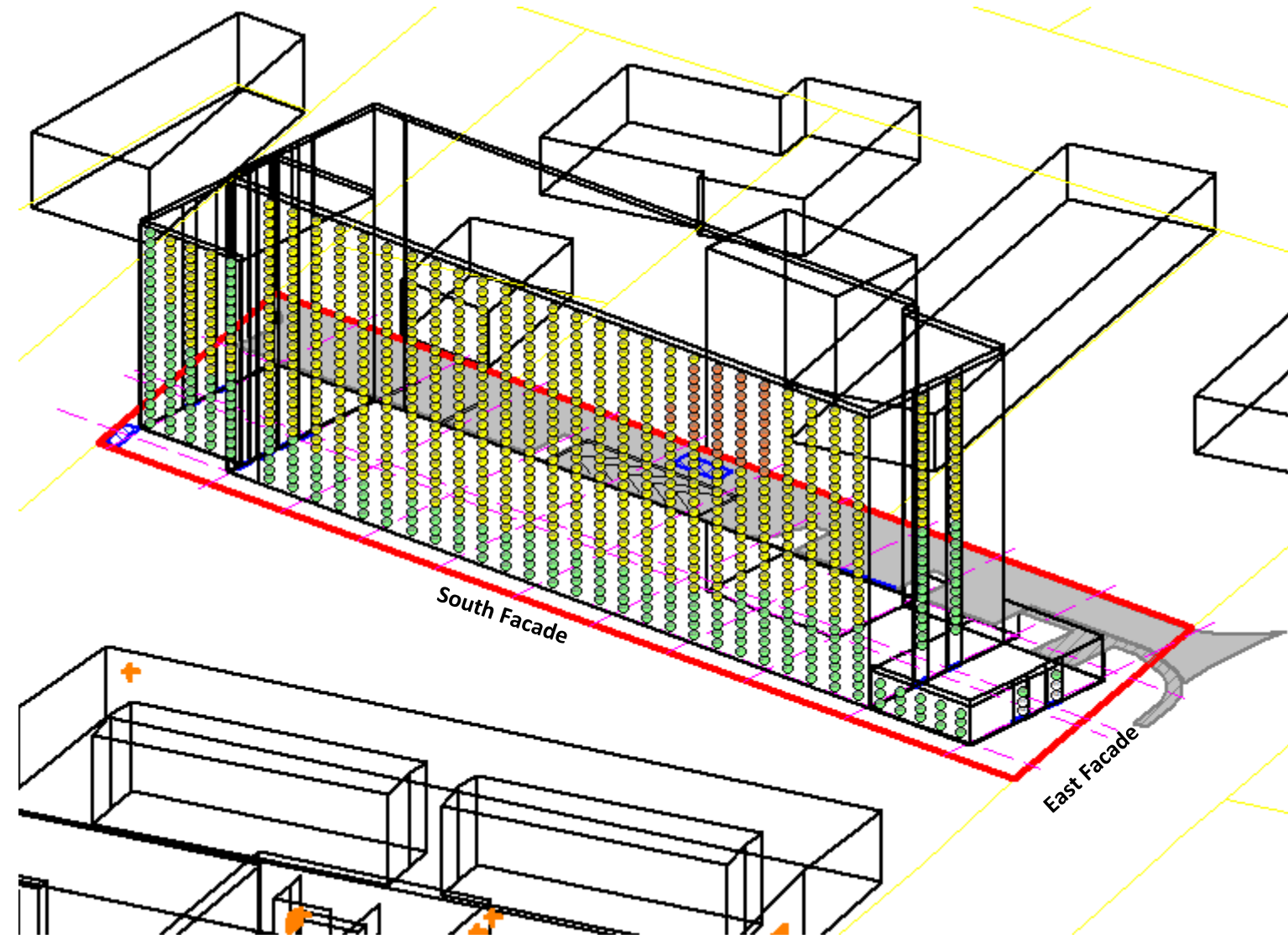




**View From Northwest**

**LEGEND**

- >= 45
- >= 55
- >= 60



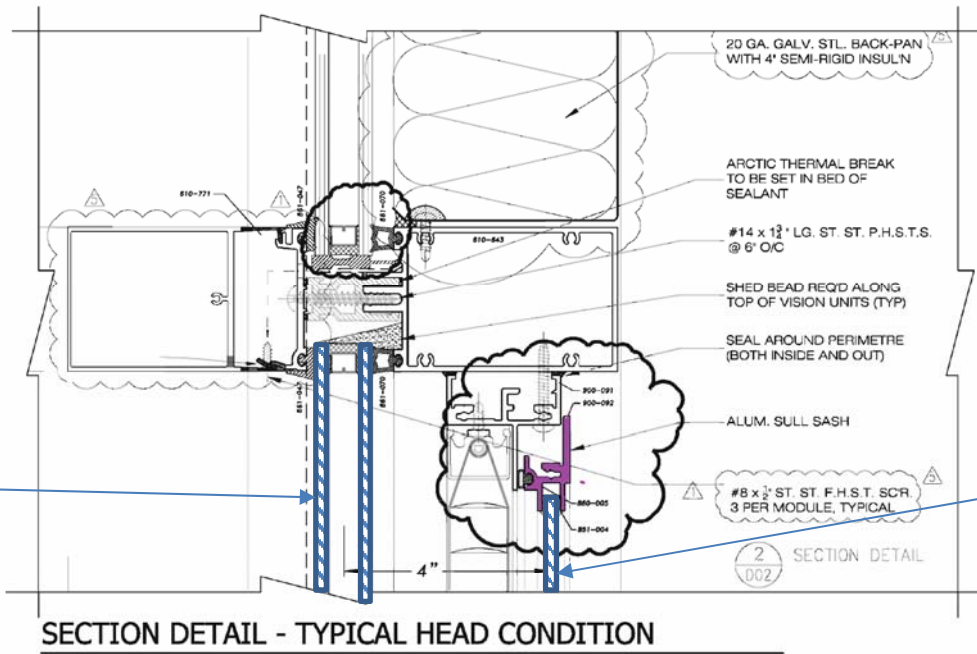
**View From Southeast**

Noise Buffer Windows Required For All Windows On The Southern And Eastern Facades Per Minutes of Settlement

Figure No. **3b**  
**Updated Noise Modelling Results – Non-Impulsive Noise**

Scale: n/a  
 Date: 18/01/23  
 File No.: 15-0007  
 Drawn By: SLP



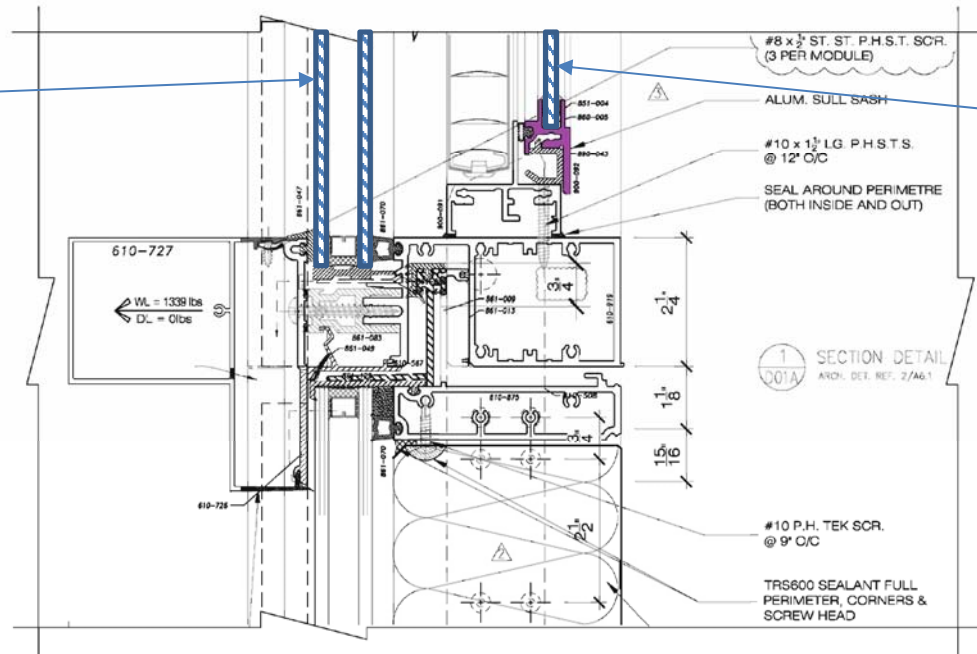


Double-Pane  
Exterior  
Buffer  
Window

Single Pane  
Interior Sull  
Sash Window

SECTION DETAIL - TYPICAL HEAD CONDITION

Scale: N.T.S.



Double-Pane  
Exterior  
Buffer  
Window

Single Pane  
Interior Sull  
Sash Window

SECTION DETAIL - TYPICAL SILL CONDITION

Scale: N.T.S.

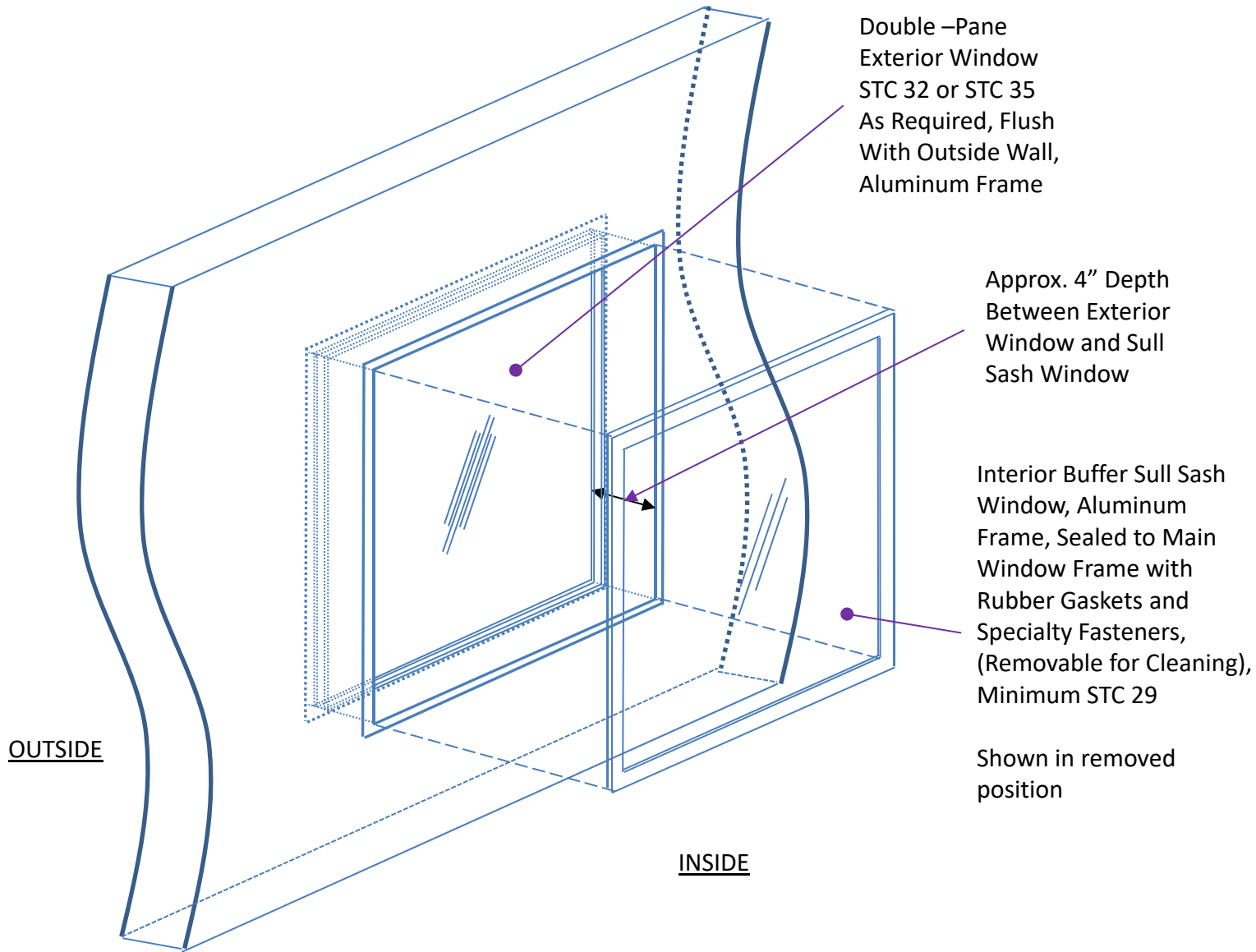


Scale: n/a  
 Date: 17/03/13  
 File No.: 15-0007  
 Drawn By: SLP

Figure No. 4a

**Revised Enclosed  
Noise Buffer  
Window Design**

Coletara Developments –  
17 Ewen Road



Scale: n/a  
 Date: 18/06/06  
 File No.: 15-0007  
 Drawn By: SLP

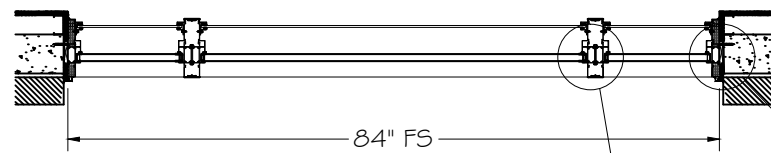
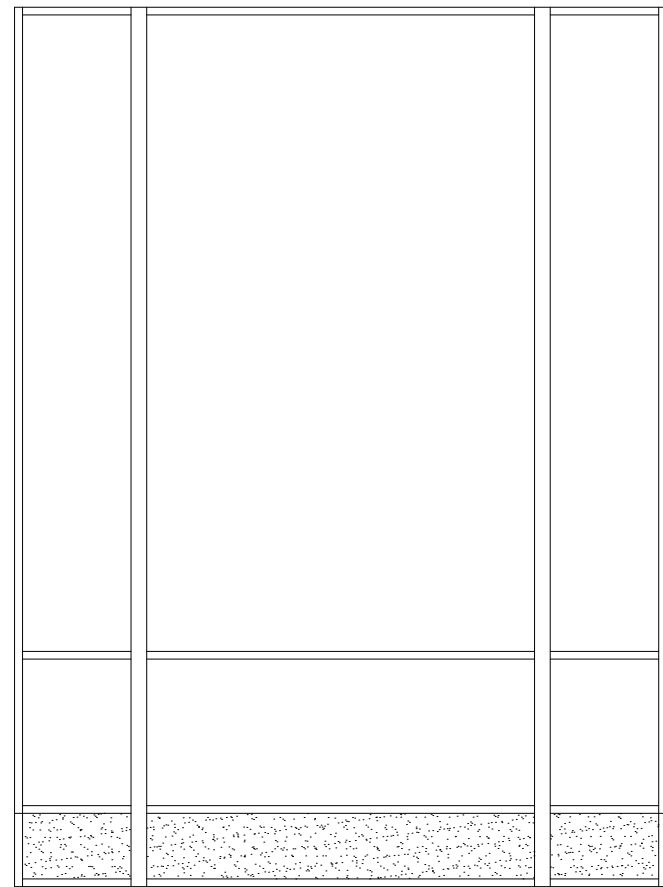
Figure No. **4b**  
**Revised Enclosed  
 Noise Buffer  
 Window Design**

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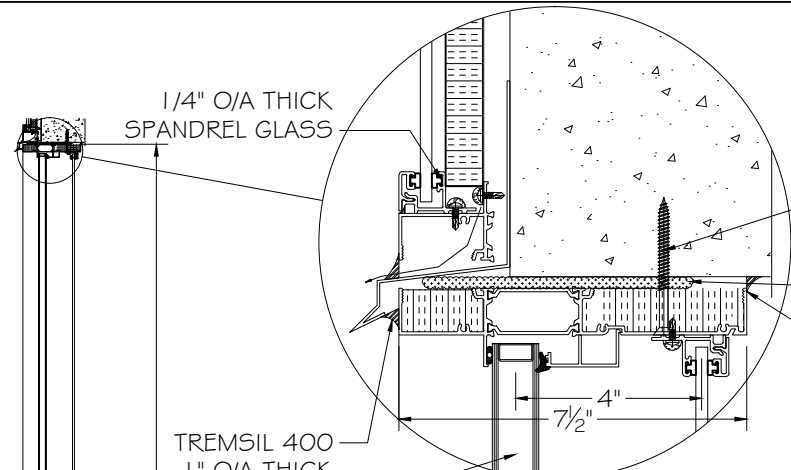
## **Attachment A**

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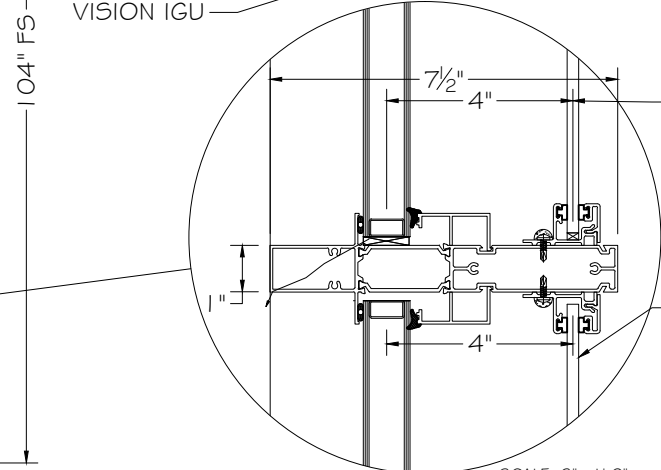
1 TYPICAL WINDOW ELEVATION (5875 SERIES)  
SCALE: 1/2"=1'-0"



HEAD FIXED TO U/S OF CONCRETE w/ 1/4" TAPCONS 30" O/C MAX  
ADFOAM 1885-02 SPRAY-IN FOAM INSULATION  
TREMIFLEX 834

TREMSIL 400 1" O/A THICK VISION IGU

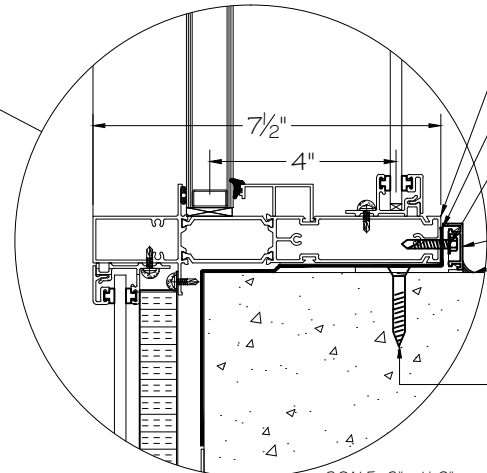
SCALE: 3"=1'-0"



CL OF GLASS TO CL OF GLASS(TYP)

1/4" O/A THICK VISION GLASS

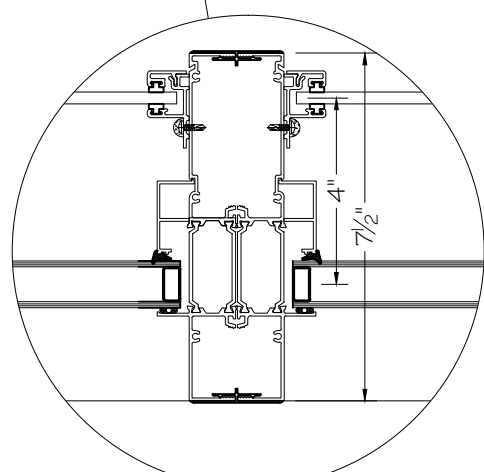
SCALE: 3"=1'-0"



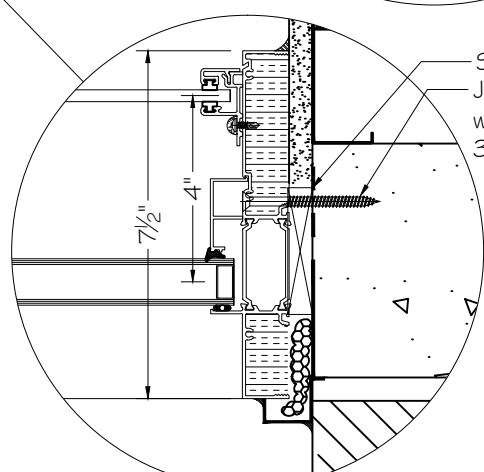
1/16" THICK BUTYL TAPE  
CONTS. BLUESKIN  
LAPPED UP ANGLE  
CONTS. 1/8" THICK ALUM ANGLE  
FIXED TO SILL w/ #10x1 TEK SCREWS  
30" O/C (MAX) PAINTED TO MATCH WINDOW  
SNAP CAP  
TREMIFLEX 834

1/4" x 1 3/4" TAPCON EMBED INTO CONCRETE

SCALE: 3"=1'-0"



SCALE: 3"=1'-0"



SHIM AS REQUIRED  
JAMB FIXED TO CONCRETE w/ 1/4" TAPCONS 30" O/C MAX

SCALE: 3"=1'-0"

REV	DATE	ISSUE OR REVISION

ENGINEER SEAL

**NORSTAR**  
WINDOWS & DOORS LTD.  
17 EWEN ROAD  
HAMILTON, ON.

BYPASS SPANDREL and SULL  
SASH DETAILS (option A)

ARCHITECT		CONTRACTOR		
		COLETARA		
BY	JOB #	DATE	SCALE	DWG No
EB		4.25 2017	AS SHOWN	WS1

# TEST REPORT

For

**Norstar Windows & Doors Ltd.**

944 South Service Rd.

Stoney Creek, ONT L8E 6A2

John Vacca / 905-643-9333

**Sound Transmission Loss Test**

ASTM E 90 – 09 / E 413 – 10 / E 1332-10a

On

Norstar Series 725 Window

Report Number: NGC 2017143

Assignment Number: G-1433

Test Date: 09/07/2017

Report Approval Date: 09/14/2017

Submitted by:

  
Anthony J. Rivers  
Test Technician

Reviewed by:

  
Robert J. Menchetti  
Director

The results reported above apply to specific samples submitted for measurement. No responsibility is assumed for performance of any other specimen. The laboratory's accreditation or any of its test reports in no way constitute or imply product certification, approval, or endorsement by NVLAP, NIST or any agency of the Federal Government. This report may not be reproduced except in full, without written approval of the laboratory.

**Revision Summary:**

<b>Date</b>	<b>SUMMARY</b>
Approval Date: 09/14/2017	Original issue date: 09/14/2017 Original NGCTS report #: NGC 2017143

The results reported above apply to specific samples submitted for measurement. No responsibility is assumed for performance of any other specimen. The laboratory's accreditation or any of its test reports in no way constitute or imply product certification, approval, or endorsement by NVLAP, NIST or any agency of the Federal Government. This report may not be reproduced except in full, without written approval of the laboratory.



Report Number:	NGC 2017143	Page 3 of 5
Test Method:	This test method conforms explicitly with the American Society for Testing and Materials Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements - Designation: E 90 - 09 / E 413 - 10 and explicitly to the American Society for Testing and Materials Standard Test Method for Standard Classification for Rating Outdoor-Indoor Sound Attenuation - Designation E 1332-10a.	
Specimen Description:	The test specimen was a window, identified by the client as: Norstar Series 725 Window  Standard direction of sound from Source Room (Room 1) to Receiving Room (Room 2).  The wall system was constructed in the test opening and was observed to consist of. All measured weights and dimensions are averaged:  From Room 1 to Room 2. <ul style="list-style-type: none"><li>- Filler wall. This Filler wall had a measured STC of 60</li><li>- The window was identified by the client as: Norstar Series 725 Window</li><li>- The window and frame was measured to be: 2133.6 mm x 2641.6 mm x 177.8 mm (84 in. x 104 in. x 7 in). Total weight was 26.72 kg/m<sup>2</sup> (5.47 PSF).</li><li>- The frame of the window was sealed with caulk into the 2146.3 mm x 2654.3 mm (84-1/2 in. x 104-1/2 in) rough opening in the Filler wall.</li></ul> Total weight of the door/frame test unit was 37.81 kg/m <sup>2</sup> (7.75 PSF).  The perimeter of the test assembly was sealed with acoustical caulk and exposed wallboard joints were taped.	
Specimen size:	Filler wall: 3657 mm x 2743.2 mm (12 ft. x 9 ft.) with rough opening cut for the window and frame.  Area of the window and frame: 5.64 m <sup>2</sup> (60.83 ft <sup>2</sup> )	
Conditioning:	The window and frame were tested with as received.	
Test Results:	The results of the tests are given on pages 4 and 5 of the report.	

The results reported above apply to specific samples submitted for measurement. No responsibility is assumed for performance of any other specimen. The laboratory's accreditation or any of its test reports in no way constitute or imply product certification, approval, or endorsement by NVLAP, NIST or any agency of the Federal Government. This report may not be reproduced except in full, without written approval of the laboratory.

<b>Sound Transmission Loss Test Data</b>							
<b>Test: ASTM E 90 - 09 / ASTM E 413 - 10 / ASTM E 1332 - 10a</b>							
Test Report: NGC 2017143						Date: 9/7/2017	
Specimen Size [m <sup>2</sup> ]: 5.6						Page 4 of 5	
<b>Source room</b>				<b>Receiving room</b>			
Volume [m <sup>3</sup> ]: 90.44				Volume [m <sup>3</sup> ]: 98.61			
Rm Temp [°C]: 25				Rm Temp [°C]: 25			
Humidity [%]: 65				Humidity [%]: 65			
<b>Sound Transmission Class STC [dB]: 32</b>							
<b>Outdoor-Indoor Transmission Class OITC [dB]: 26</b>							
Sum of Unfavorable Deviations [dB]: 31							
Max. Unfavorable Deviation [dB]: 5				at 250 Hz			
Frequency [Hz]	STL [dB]	L1 [dB]	L2 [dB]	d [dB/s]	Corr. [dB]	u.Dev. [dB]	ΔSTL
80	25	101.8	76.7	21.6	-0.1		2.1
100	26	105.0	80.4	16.6	1.4		2.1
125	23	104.6	82.8	15.6	1.2		1.9
160	17	103.8	89.1	13.8	2.3	2	0.4
200	19	102.0	85.9	12.9	2.9	3	0.6
250	20	102.0	83.9	12.3	1.9	5	0.3
315	24	100.7	78.7	13.1	2.0	4	0.2
400	29	100.6	73.9	13.1	2.3	2	0.1
500	30	102.9	74.7	12.8	1.8	2	0.2
630	32	103.4	73.8	12.7	2.4	1	0.1
800	33	103.3	71.7	14.0	1.4	1	0.1
1000	34	102.6	70.0	14.8	1.4	1	0.0
1250	34	100.4	68.1	16.2	1.7	2	0.1
1600	34	97.7	64.5	18.9	0.8	2	0.0
2000	33	96.8	63.8	22.5	0.0	3	0.0
2500	33	97.1	63.6	25.5	-0.5	3	0.0
3150	39	96.2	56.5	27.6	-0.7		0.0
4000	44	94.8	49.2	30.2	-1.6		0.0
5000	48	94.0	43.5	34.4	-2.5		0.0

STL = Sound Transmission Loss, dB  
 L1 = Source Room Level, dB  
 L2 = Receiving Room Level, dB  
 d = Decay Time, dB/second  
 Δ STL = Uncertainty for 95% Confidence Level

The results reported above apply to specific samples submitted for measurement. No responsibility is assumed for performance of any other specimen. The laboratory's accreditation or any of its test reports in no way constitute or imply product certification, approval, or endorsement by NVLAP, NIST or any agency of the Federal Government. This report may not be reproduced except in full, without written approval of the laboratory.

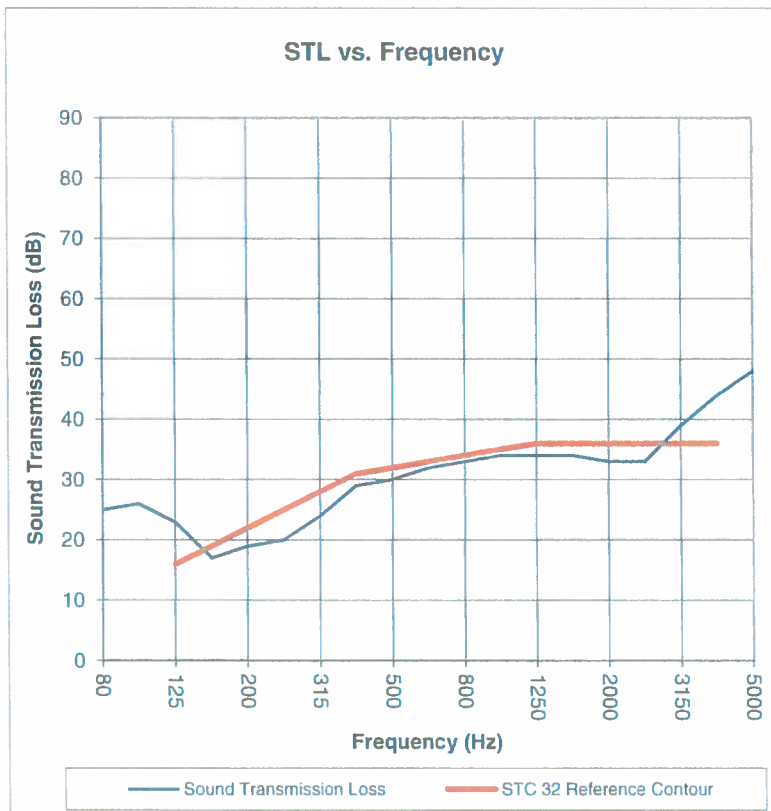
**Sound Transmission Loss Test Data**

Test: ASTM E 90 - 09 / ASTM E 413 - 10 / ASTM E 1332 - 10a

Test Report: NGC 2017143  
 Test Date: 9/7/2017  
 Specimen Size [m<sup>2</sup>]: 5.64

**Sound Transmission Class STC [dB]: 32 dB**  
**Outdoor-Indoor Transmission Class OITC [dB]: 26 dB**

Frequency [Hz]	STL [dB]	ΔSTL
80	25	2.1
100	26	2.1
125	23	1.9
160	17	0.4
200	19	0.6
250	20	0.3
315	24	0.2
400	29	0.1
500	30	0.2
630	32	0.1
800	33	0.1
1000	34	0.0
1250	34	0.1
1600	34	0.0
2000	33	0.0
2500	33	0.0
3150	39	0.0
4000	44	0.0
5000	48	0.0



\* Due to high insulating value of specimen, background levels limit results at these frequencies.

STL = Sound Transmission Loss, dB  
 Δ STL = Uncertainty for 95% Confidence Level

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## TEST REPORT

For

**Norstar Windows & Doors Ltd.**

944 South Service Rd.  
Stoney Creek, ONT L8E 6A2  
John Vacca / 905-643-9333

**Sound Transmission Loss Test**

ASTM E 90 – 09 / E 413 – 10 / E 1332-10a

On

Norstar Series 725 Window with Double Pane Thermal Glass

Report Number: NGC 2017201

Assignment Number: G-1478

Test Date: 11/27/2017

Report Approval Date: 12/07/2017

Submitted by: \_\_\_\_\_

Anthony J. Rivers  
Test Technician

Reviewed by: \_\_\_\_\_

Robert J. Menchetti  
Director

The results reported above apply to specific samples submitted for measurement. No responsibility is assumed for performance of any other specimen. The laboratory's accreditation or any of its test reports in no way constitute or imply product certification, approval, or endorsement by NVLAP, NIST or any agency of the Federal Government. This report may not be reproduced except in full, without written approval of the laboratory.

**Revision Summary:**

Date	SUMMARY
Approval Date: 12/07/2017	Original issue date: 12/07/2017 Original NGCTS report #: NGC 2017201

The results reported above apply to specific samples submitted for measurement. No responsibility is assumed for performance of any other specimen. The laboratory's accreditation or any of its test reports in no way constitute or imply product certification, approval, or endorsement by NVLAP, NIST or any agency of the Federal Government. This report may not be reproduced except in full, without written approval of the laboratory.





Report Number:	NGC 2017201	Page 3 of 5
Test Method:	This test method conforms explicitly with the American Society for Testing and Materials Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements - Designation: E 90 - 09 / E 413 - 10 and explicitly to the American Society for Testing and Materials Standard Test Method for Standard Classification for Rating Outdoor-Indoor Sound Attenuation - Designation E 1332-10a.	
Specimen Description:	The test specimen was a window, identified by the client as: Norstar Series 725 Window with Double Pane Thermal Glass	
	Standard direction of sound from Source Room (Room 1) to Receiving Room (Room 2).	
	The wall system was constructed in the test opening and was observed to consist of. All measured weights and dimensions are averaged:	
	From Room 1 to Room 2.	
	<ul style="list-style-type: none"><li>- Filler wall. This Filler wall had a measured STC of 60</li><li>- The window was identified by the client as: Norstar Series 725 Window with Double Pane Thermal Glass</li><li>- The window and frame was measured to be: 2133.6 mm x 2641.6 mm x 177.8 mm (84 in. x 104 in. x 7 in).</li><li>- The frame of the window was sealed with caulk into the 2146.3 mm x 2654.3 mm (84-1/2 in. x 104-1/2 in) rough opening in the Filler wall.</li></ul>	
	Total weight of the door/frame test unit was 39.30 kg/m <sup>2</sup> (8.05 PSF).	
	The perimeter of the test assembly was sealed with acoustical caulk and exposed wallboard joints were taped.	
Specimen size:	Filler wall: 3657 mm x 2743.2 mm (12 ft. x 9 ft.) with rough opening cut for the window and frame. Area of the window and frame: 5.64 m <sup>2</sup> (60.83 ft <sup>2</sup> )	
Conditioning:	The window and frame were tested with as received.	
Test Results:	The results of the tests are given on pages 4 and 5 of the report.	

The results reported above apply to specific samples submitted for measurement. No responsibility is assumed for performance of any other specimen. The laboratory's accreditation or any of its test reports in no way constitute or imply product certification, approval, or endorsement by NVLAP, NIST or any agency of the Federal Government. This report may not be reproduced except in full, without written approval of the laboratory.

**Sound Transmission Loss Test Data**

Test: ASTM E 90 - 09 / ASTM E 413 - 10 / ASTM E 1332 - 10a

Page 4 of 5

Test Report: NGC 2017201

Date: 11/27/2017

Specimen Size [m<sup>2</sup>]: 5.7

**Source room**

Volume [m<sup>3</sup>]: 90.44

Rm Temp [°C]: 25

Humidity [%]: 60

**Receiving room**

Volume [m<sup>3</sup>]: 98.61

Rm Temp [°C]: 25

Humidity [%]: 60

**Sound Transmission Class STC [dB]: 35**

**Outdoor-Indoor Transmission Class OITC [dB]: 29**

Sum of Unfavorable Deviations [dB]: 24

Max. Unfavorable Deviation [dB]: 5 at 200 Hz

Frequency	STL	L1	L2	d	Corr.	u.Dev.	ΔSTL
[Hz]	[dB]	[dB]	[dB]	[dB/s]	[dB]	[dB]	
80	22	99.6	77.4	23.6	-0.2		0.8
100	26	105.9	81.0	17.0	1.1		1.1
125	24	104.9	82.2	16.4	1.3		1.3
160	21	104.9	85.7	14.1	1.8	1	0.3
200	20	103.0	84.9	13.0	1.9	5	0.3
250	24	101.6	79.3	13.5	1.7	4	0.4
315	28	101.3	75.1	13.1	1.8	3	0.2
400	32	100.9	71.4	13.5	2.5	2	0.1
500	35	103.8	70.7	12.6	1.9		0.1
630	37	104.1	69.7	12.5	2.6		0.1
800	37	102.2	67.4	13.5	2.2		0.0
1000	38	103.4	67.2	14.3	1.8		0.0
1250	37	100.8	65.4	16.1	1.6	2	0.0
1600	37	97.4	60.6	19.0	0.2	2	0.0
2000	36	97.2	60.8	22.2	-0.4	3	0.0
2500	37	97.5	59.4	26.1	-1.1	2	0.0
3150	42	96.4	53.5	28.4	-0.9		0.0
4000	48	95.2	45.8	32.5	-1.4		0.0
5000	53	94.0	39.2	37.4	-1.8		0.0

STL = Sound Transmission Loss, dB  
 L1 = Source Room Level, dB  
 L2 = Receiving Room Level, dB  
 d = Decay Time, dB/second  
 Δ STL = Uncertainty for 95% Confidence Level

The results reported above apply to specific samples submitted for measurement. No responsibility is assumed for performance of any other specimen. The laboratory's accreditation or any of its test reports in no way constitute or imply product certification, approval, or endorsement by NVLAP, NIST or any agency of the Federal Government. This report may not be reproduced except in full, without written approval of the laboratory.

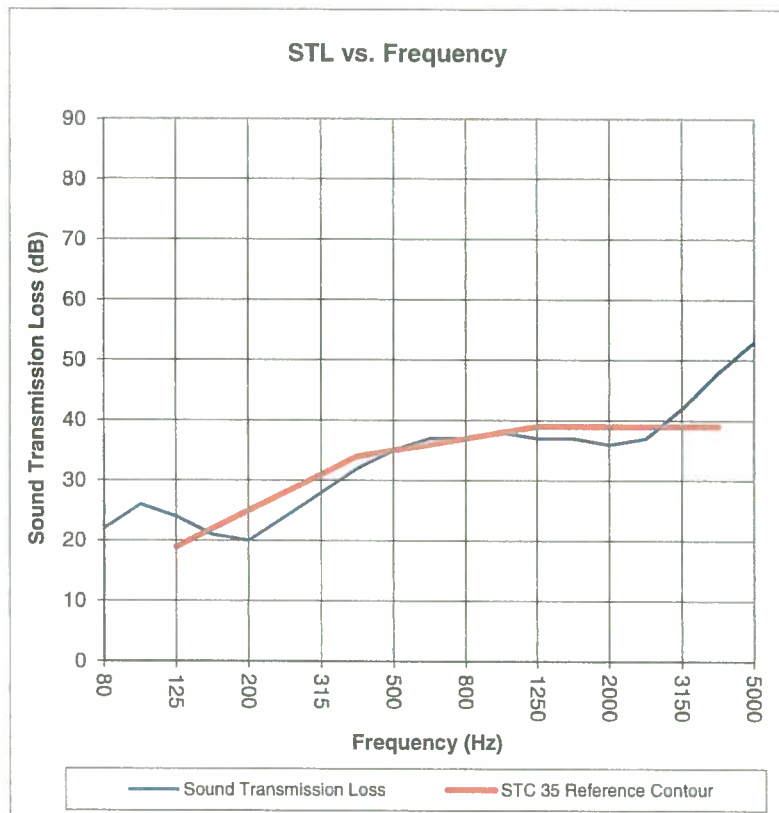
**Sound Transmission Loss Test Data**

Test: ASTM E 90 - 09 / ASTM E 413 - 10 / ASTM E 1332 - 10a

Test Report: NGC 2017201  
 Test Date: 11/27/2017  
 Specimen Size [m<sup>2</sup>]: 5.70

**Sound Transmission Class STC [dB]: 35 dB**  
**Outdoor-Indoor Transmission Class OITC [dB]: 29 dB**

Frequency [Hz]	STL [dB]	ΔSTL
80	22	0.8
100	26	1.1
125	24	1.3
160	21	0.3
200	20	0.3
250	24	0.4
315	28	0.2
400	32	0.1
500	35	0.1
630	37	0.1
800	37	0.0
1000	38	0.0
1250	37	0.0
1600	37	0.0
2000	36	0.0
2500	37	0.0
3150	42	0.0
4000	48	0.0
5000	53	0.0



\* Due to high insulating value of specimen, background levels limit results at these frequencies.

STL = Sound Transmission Loss, dB  
 Δ STL = Uncertainty for 95% Confidence Level

The results reported above apply to specific samples submitted for measurement. No responsibility is assumed for performance of any other specimen. The laboratory's accreditation or any of its test reports in no way constitute or imply product certification, approval, or endorsement by NVLAP, NIST or any agency of the Federal Government. This report may not be reproduced except in full, without written approval of the laboratory.

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## **Attachment B**

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# South Facade, Worst-Case Impulsive Noise, STC 32 Window

## Calculation

Composite? N Use Outdoor Sound Level Scenario: 1 **W-C Impulsive South Façade C21**

TL	Material 1	Material 2	Material 3	Material 4	Remaining	Area	STC
656	Select: AWD STC 37 Lam Outer Pan Fixed				0	2.0	36
	Disabled						
	Disabled						
	Disabled						

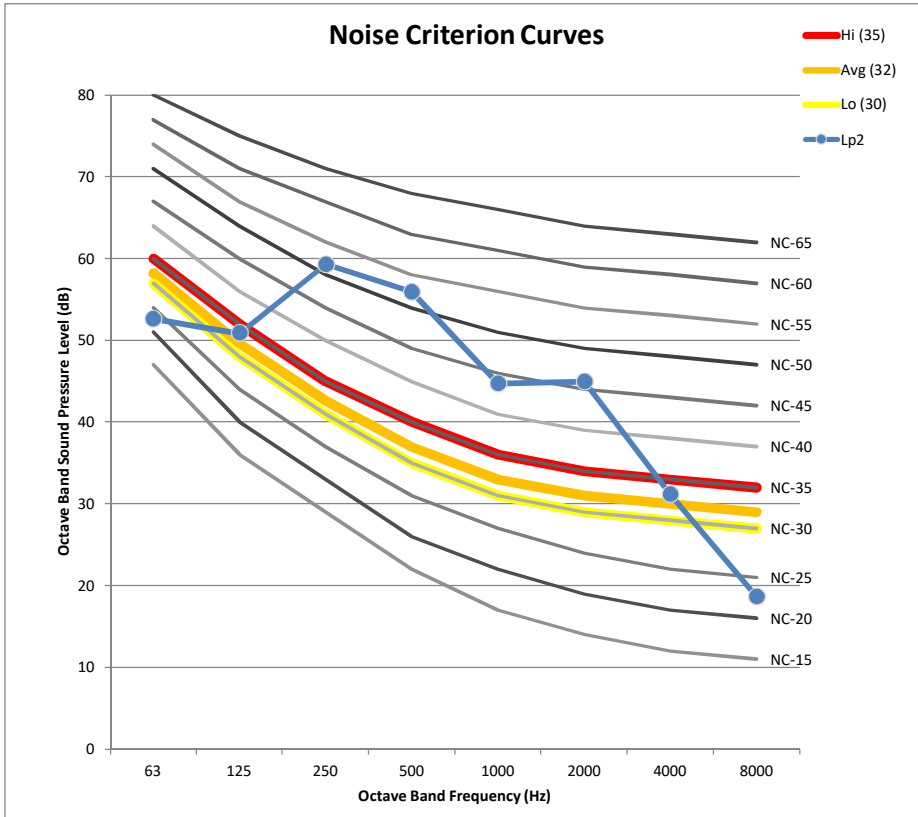
	Transmission Loss (dB)								<< STC32 window
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Material 1	19	20	21	30	34	33	42	45	
Disabled									
Disabled									
Disabled									

Summary	Sound Pressure Level (dB)								dB	dBA	
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz			
	63.3	64.8	71.8	76.5	67	64.5	56.8	47.2	78.7	75.2	<----- Free Field Sound Level at window
	3	3	3	3	3	3	3	3			<----- Façade Correction (per BPN-56)
	0	0	0	0	0	0	0	0			<----- Angle of incidence correction per BPN-!
Lp1	66.3	67.8	74.8	79.5	70.0	67.5	59.8	50.2	81.7	78.2	<----- Resulting sound level at façade
TL	19.0	20.4	20.5	30.2	33.6	33.3	42.2	45.2			

Lp2	52.6	50.9	59.3	55.9	44.7	44.9	31.2	18.6	62.1	55.8	<----- Resulting sound level at Enclosed Winc
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NC	23	34	52	53	44	46	34	23			<----- NC Level met in each octave band Highlighted level is NC rating of noise
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Target	105. Motel/Motel Individual rooms or suites							
Lo (30)	57	48	41	35	31	29	28	27
Avg (32)	58	50	43	37	33	31	30	29
Hi (35)	60	52	45	40	36	34	33	32



# South Façade, Worst-Case Non-Impulsive Noise, STC 32 Window

## Calculation

Composite?  
N

Use Outdoor Sound Level Scenario: 5

**W-C Cont South Façade C21**

TL	Material 1	Material 2	Material 3	Material 4	Remaining	Area	STC
656	Select: AWD STC 37 Lam Outer Pan Fixed				0	2.0	36
	Disabled						
	Disabled						
	Disabled						

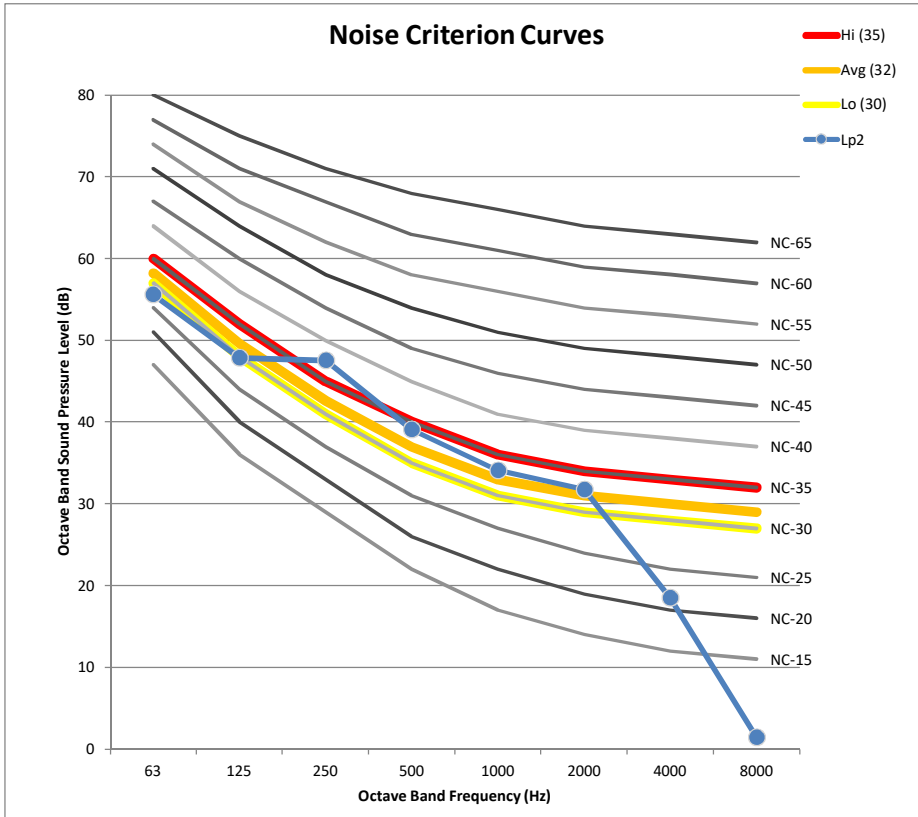
	Transmission Loss (dB)								<< STC32 window
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Material 1	19	20	21	30	34	33	42	45	
Disabled									
Disabled									
Disabled									

Summary	Sound Pressure Level (dB)								dB	dBA	
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz			
	66.3	61.8	60	59.7	56.4	51.3	44.1	30	69.2	61.1	<----- Free Field Sound Level at window
	3	3	3	3	3	3	3	3			<----- Façade Correction (per BPN-56)
	0	0	0	0	0	0	0	0			<----- Angle of incidence correction per BPN-!
Lp1	69.3	64.8	63.0	62.7	59.4	54.3	47.1	33.0	72.2	64.1	<----- Resulting sound level at façade
TL	19.0	20.4	20.5	30.2	33.6	33.3	42.2	45.2			

Lp2	55.6	47.9	47.5	39.1	34.1	31.7	18.5	1.4	56.9	42.7	<----- Resulting sound level at Enclosed Winc
-----	------	------	------	------	------	------	------	-----	------	------	---

NC	28	30	38	35	34	33	22	< 15			<----- NC Level met in each octave band Highlighted level is NC rating of noise
----	----	----	----	----	----	----	----	------	--	--	--

Target	105. Motel/Motel Individual rooms or suites							
Lo (30)	57	48	41	35	31	29	28	27
Avg (32)	58	50	43	37	33	31	30	29
Hi (35)	60	52	45	40	36	34	33	32



# North Façade, Worst-Case Impulsive Noise, STC 32 Window

## Calculation

Composite? N      Use Outdoor Sound Level Scenario: 3      **W-C Impulsive North Façade C9**

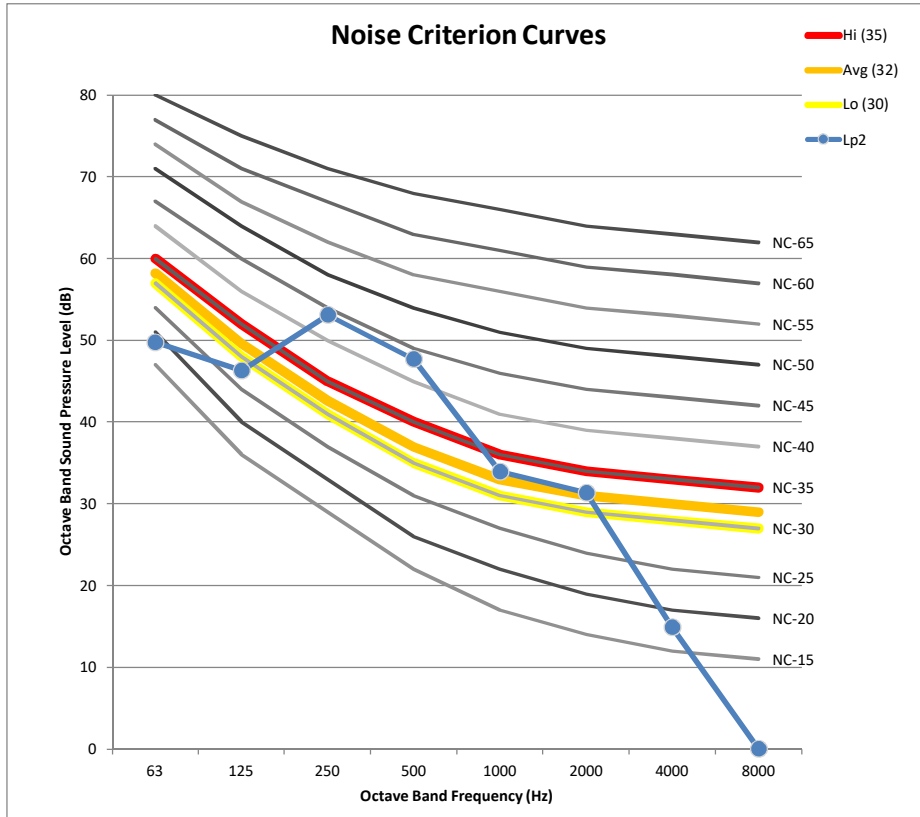
TL	Material 1	Material 2	Material 3	Material 4	Remaining	Area	STC
	654	Select: AWD STC 32 Fixed			0	2.0	32
		Disabled					
		Disabled					
		Disabled					

	Transmission Loss (dB)								
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Material 1	19	20	21	30	34	33	42	45	<< STC32 window
Disabled									
Disabled									
Disabled									

Summary	Sound Pressure Level (dB)								dB	dBA	
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz			
	57.4	57.2	62.6	65.3	53.2	47.9	37.5	24.2	68.2	63.4	<----- Free Field Sound Level at window
	3	3	3	3	3	3	3	3			<----- Façade Correction (per BPN-56)
	3	3	3	3	3	3	3	3			<----- Angle of incidence correction per BPN-!
Lp1	63.4	63.2	68.6	71.3	59.2	53.9	43.5	30.2	74.2	69.4	<----- Resulting sound level at façade
TL	19.0	20.4	20.5	30.2	33.6	33.3	42.2	45.2			
Lp2	49.7	46.3	53.1	47.7	33.9	31.3	14.9	0.0	56.1	47.9	<----- Resulting sound level at Enclosed Winc

NC	19	28	44	43	33	33	18	<15	<----- NC Level met in each octave band Highlighted level is NC rating of noise
----	----	----	----	----	----	----	----	-----	--

Target	105. Motel/Motel Individual rooms or suites							
Lo (30)	57	48	41	35	31	29	28	27
Avg (32)	58	50	43	37	33	31	30	29
Hi (35)	60	52	45	40	36	34	33	32



# North Facade, Worst-Case Non-Impulsive Noise, STC 32 Window

## Calculation

	Composite? <b>N</b>	Use Outdoor Sound Level Scenario: <b>7</b>	<b>W-C Cont North Façade C9</b>
<b>TL</b>			Area    STC
Material 1	654	Select: AWD STC 32 Fixed	Remaining    2.0    32
Material 2	Disabled		0
Material 3	Disabled		
Material 4	Disabled		

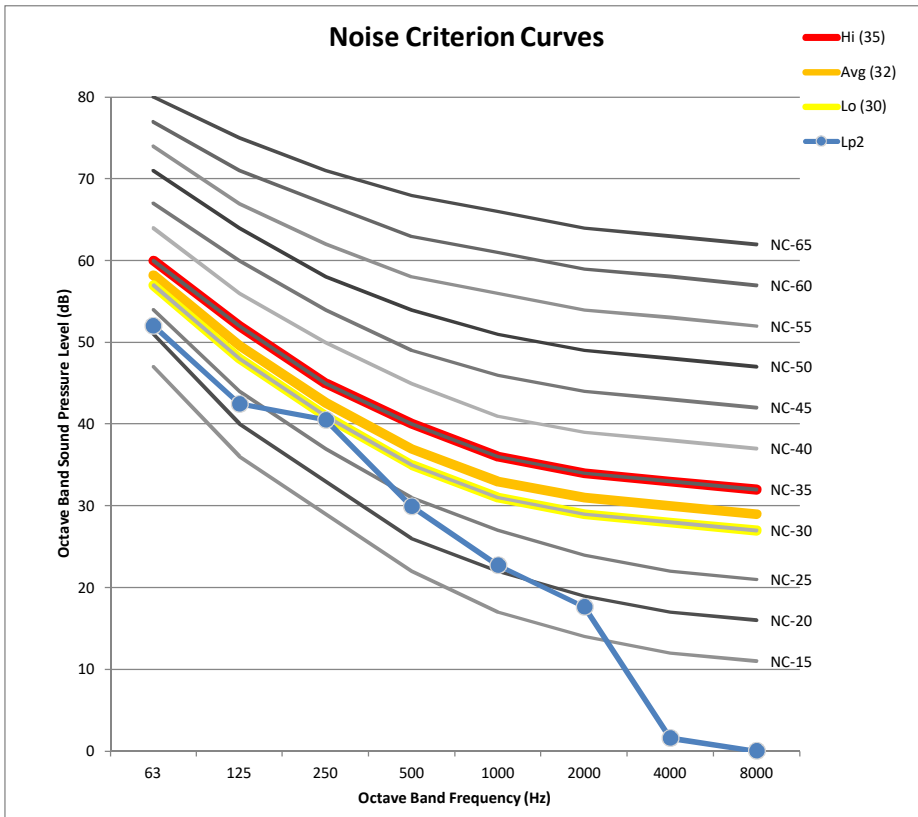
	Transmission Loss (dB)								
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Material 1	19	20	21	30	34	33	42	45	<< STC32 window
Disabled									
Disabled									
Disabled									

	Sound Pressure Level (dB)								dB	dBA	
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz			
Summary	59.7	53.4	50	47.5	42	34.2	24.2	5.8	61.2	48.3	<----- Free Field Sound Level at window
	3	3	3	3	3	3	3	3			<----- Façade Correction (per BPN-56)
	3	3	3	3	3	3	3	3			<----- Angle of incidence correction per BPN-!
Lp1	65.7	59.4	56.0	53.5	48.0	40.2	30.2	11.8	67.2	54.3	<----- Resulting sound level at façade
TL	19.0	20.4	20.5	30.2	33.6	33.3	42.2	45.2			

Lp2	52.0	42.5	40.5	29.9	22.7	17.6	1.6	0.0	52.8	<b>34.9</b>	<----- Resulting sound level at Enclosed Winc
-----	------	------	------	------	------	------	-----	-----	------	-------------	---

NC	22	24	30	24	21	19	< 15	< 15	<----- NC Level met in each octave band Highlighted level is NC rating of noise
----	----	----	----	----	----	----	------	------	--

<b>Target</b>	105. Motel/Motel Individual rooms or suites							
Lo (30)	57	48	41	35	31	29	28	27
Avg (32)	58	50	43	37	33	31	30	29
Hi (35)	60	52	45	40	36	34	33	32





# East Facade, 5th Floor Worst-Case Impulsive Noise, STC 32 Window

## Calculation

Composite? N      Use Outdoor Sound Level Scenario: 4      **W-C Impulsive East façade 5th floor**

TL	0	Select:	Remaining	Area	STC
Material 1	0	Disabled	0	2.0	
Material 2		Disabled			
Material 3		Disabled			
Material 4		Disabled			

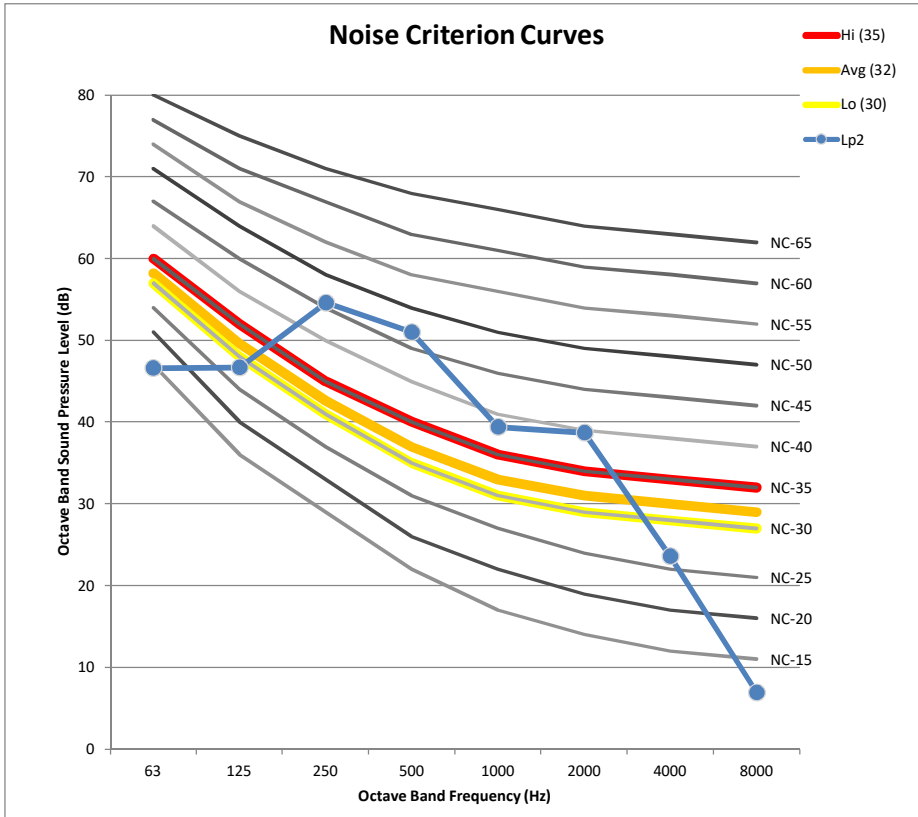
	Transmission Loss (dB)								
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Material 1	19	20	21	30	34	33	42	45	<< STC32 window
Disabled									
Disabled									
Disabled									
Disabled									

	Sound Pressure Level (dB)								dB	dBA	
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz			
Summary	57.3	60.6	67.1	71.6	61.7	58.3	49.2	35.5	73.7	70.1	Free Field Sound Level at window
	3	3	3	3	3	3	3	3			Façade Correction (per BPN-56)
											Angle of incidence correction per BPN-!
Lp1	60.3	63.6	70.1	74.6	64.7	61.3	52.2	38.5	76.7	73.1	Resulting sound level at façade
TL	19.0	20.4	20.5	30.2	33.6	33.3	42.2	45.2			

Lp2	46.6	46.7	54.6	51.0	39.4	38.7	23.6	6.9	57.2	50.8	Resulting sound level at Enclosed Winc
-----	------	------	------	------	------	------	------	-----	------	------	--

NC	< 15	29	46	48	39	40	27	< 15	NC Level met in each octave band Highlighted level is NC rating of noise
----	------	----	----	----	----	----	----	------	---

Target	105. Motel/Motel Individual rooms or suites							
Lo (30)	57	48	41	35	31	29	28	27
Avg (32)	58	50	43	37	33	31	30	29
Hi (35)	60	52	45	40	36	34	33	32



# East Facade, 5th Floor Worst-Case Non-Impulsive Noise, STC 32 Window

## Calculation

Composite? N      Use Outdoor Sound Level Scenario: 8      **W-C Cont East Façade 5th Floor**

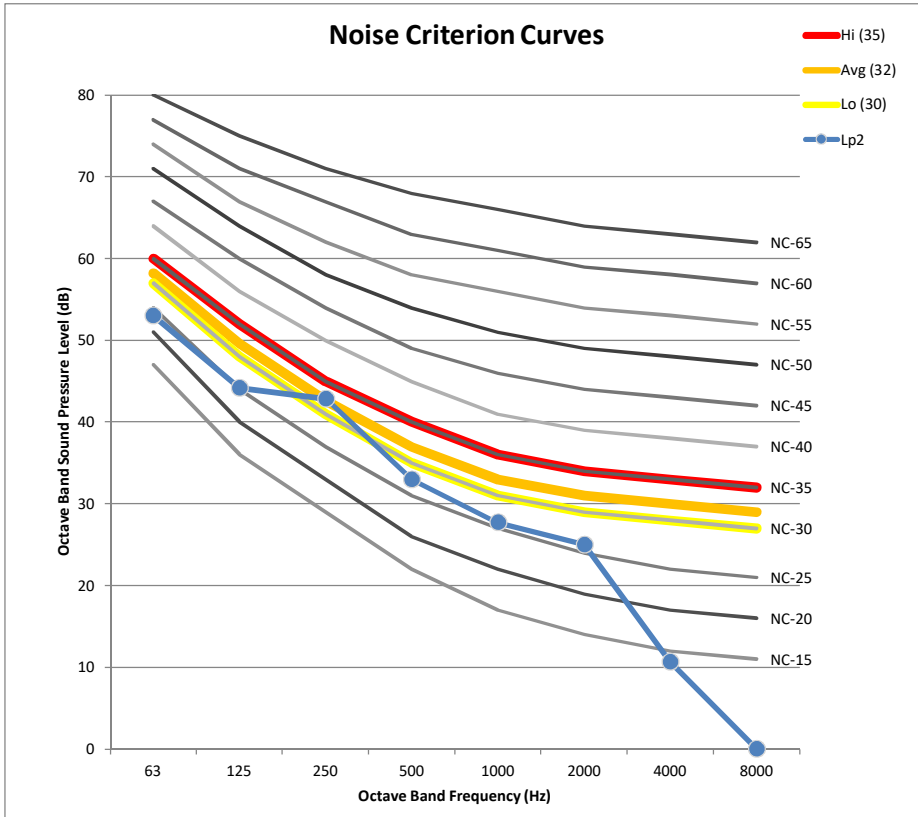
TL	0	Select:	Remaining	Area	STC
Material 1	0	Disabled	0	2.0	
Material 2		Disabled			
Material 3		Disabled			
Material 4		Disabled			

	Transmission Loss (dB)								
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Material 1	19	20	21	30	34	33	42	45	<< STC32 window
Disabled									
Disabled									
Disabled									

	Sound Pressure Level (dB)								dB	dBA	
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz			
Summary	63.7	58.1	55.3	53.6	50	44.6	36.3	20.2	65.7	55.1	Free Field Sound Level at window
	3	3	3	3	3	3	3	3			Façade Correction (per BPN-56)
											Angle of incidence correction per BPN-!
Lp1	66.7	61.1	58.3	56.6	53.0	47.6	39.3	23.2	68.7	58.1	Resulting sound level at façade
TL	19.0	20.4	20.5	30.2	33.6	33.3	42.2	45.2			
Lp2	53.0	44.2	42.8	33.0	27.7	25.0	10.7	0.0	54.0	37.6	Resulting sound level at Enclosed Winc

NC	24	26	33	28	26	27	< 15	< 15	
									NC Level met in each octave band Highlighted level is NC rating of noise

Target	105. Motel/Motel Individual rooms or suites							
Lo (30)	57	48	41	35	31	29	28	27
Avg (32)	58	50	43	37	33	31	30	29
Hi (35)	60	52	45	40	36	34	33	32



# East Facade, 9th Floor Worst-Case Impulsive Noise, STC 35 Window

## Calculation

Composite? N      Use Outdoor Sound Level Scenario: 2      **W-C Impulsive East Façade A21**

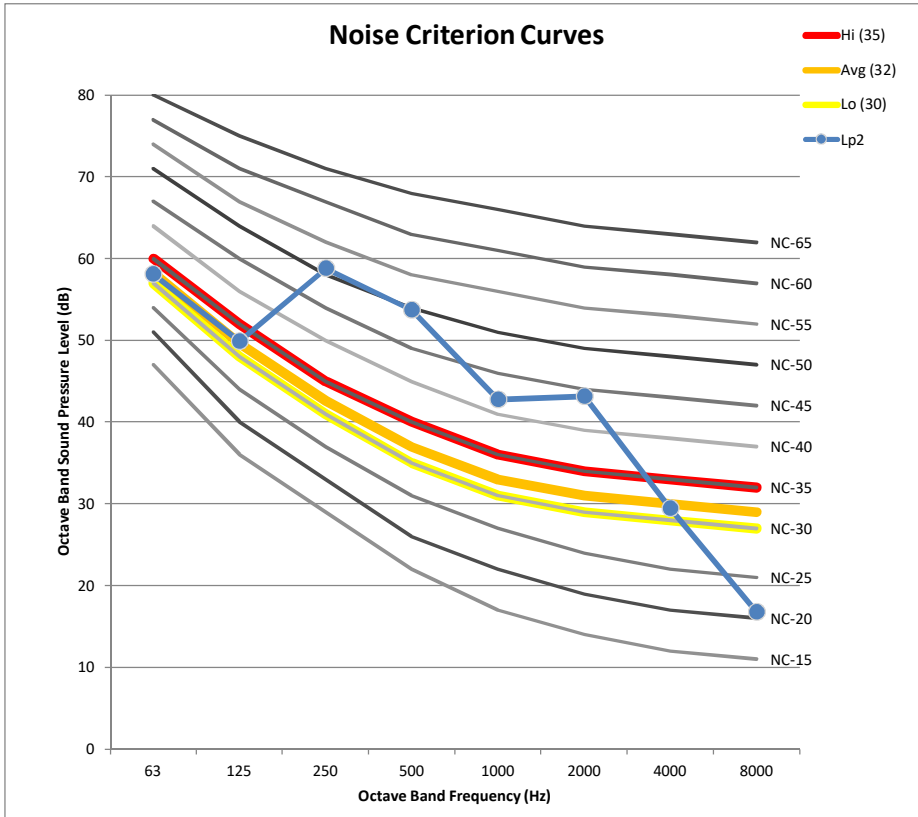
TL	Material 1	Material 2	Material 3	Material 4	Remaining	Area	STC
	656	Select: AWD STC 37 Lam Outer Pan Fixed			0	2.0	36
		Disabled					
		Disabled					
		Disabled					

	Transmission Loss (dB)								
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Material 1	16	23	23	34	37	37	46	49	<< Lam STC35 window
Disabled									
Disabled									
Disabled									
Disabled									

	Sound Pressure Level (dB)								dB	dBA	
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz			
Summary	62.8	63.6	70.6	75.3	65.7	63.1	55.4	45.7	77.5	73.9	<----- Free Field Sound Level at window
	3	3	3	3	3	3	3	3			<----- Façade Correction (per BPN-56)
	3	3	3	3	3	3	3	3			<----- Angle of incidence correction per BPN-!
Lp1	68.8	69.6	76.6	81.3	71.7	69.1	61.4	51.7	83.5	79.9	<----- Resulting sound level at façade
TL	16.0	23.2	22.8	34.2	37.3	36.6	45.5	48.5			
Lp2	58.1	49.9	58.8	53.7	42.7	43.2	29.4	16.8	62.5	54.3	<----- Resulting sound level at Enclosed Winc

NC	32	33	51	50	42	45	32	21	
Target	105. Motel/Motel Individual rooms or suites								
Lo (30)	57	48	41	35	31	29	28	27	
Avg (32)	58	50	43	37	33	31	30	29	
Hi (35)	60	52	45	40	36	34	33	32	

<----- NC Level met in each octave band  
Highlighted level is NC rating of noise



# East Facade, 9th Floor Worst-Case Non-Impulsive Noise, STC 35 Window

## Calculation

	Composite? <b>N</b>	Use Outdoor Sound Level Scenario: <b>6</b>	<b>W-C Cont East Façade A21</b>
<b>TL</b>	<b>656</b>	Select: AWD STC 37 Lam Outer Pan Fixed	Area: <b>2.0</b> STC: <b>36</b>
Material 1	Disabled		Remaining: <b>0</b>
Material 2	Disabled		
Material 3	Disabled		
Material 4	Disabled		

	Transmission Loss (dB)								
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Material 1	<b>16</b>	<b>23</b>	<b>23</b>	<b>34</b>	<b>37</b>	<b>37</b>	<b>46</b>	<b>49</b>	<< Lam STC35 window
Disabled									
Disabled									
Disabled									

	Sound Pressure Level (dB)								dB	dBA	
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz			
Summary	64.9	59	58.1	58.4	55	49.7	42.2	26	67.5	59.6	<----- Free Field Sound Level at window
	3	3	3	3	3	3	3	3			<----- Façade Correction (per BPN-56)
	3	3	3	3	3	3	3	3			<----- Angle of incidence correction per BPN-!
Lp1	70.9	65.0	64.1	64.4	61.0	55.7	48.2	32.0	73.5	65.6	<----- Resulting sound level at façade
TL	16.0	23.2	22.8	34.2	37.3	36.6	45.5	48.5			
Lp2	60.2	45.3	46.3	36.8	32.0	29.8	16.2	0.0	60.5	<b>41.6</b>	<----- Resulting sound level at Enclosed Winc

NC	36	27	<b>37</b>	32	32	31	20	<15		<----- NC Level met in each octave band Highlighted level is NC rating of noise
Target	105. Motel/Motel Individual rooms or suites									
Lo (30)	57	48	41	35	31	29	28	27		
Avg (32)	58	50	43	37	33	31	30	29		
Hi (35)	60	52	45	40	36	34	33	32		

