



June 20, 2012

Central Area Planning
City Of Vancouver

Attention: Mayor and Council

Re: Rogers Arena rezoning, acoustic requirements.

With reference to the clarification requested in Council on 12 June 2012 regarding the 82 dBC noise level exemption for the proposed rezoning at Rogers Arena, please find the following information.

In the Development and Building Policy Report, dated 5 June 2012, it states:

"An additional change to the Noise Control By-law is recommended in Appendix C. Similar to the process used for noise generated from BC Place, an exemption for noise is being provided for Rogers Arena. While most of the noise in the event zone is restricted to 70 dBC (up to 11 p.m.), a special exemption is being given for the Rezoning Site to provide for 82 dBC at the point of reception from the roof (where the noise from the arena hits the residential buildings). A level of 82 dBC more accurately reflects the noise level for the loudest 15 minutes on a concert (as measured by the applicant during concerts by Bryan Adams, Rihanna, Bruno Mars, and Supertramp), and is also the threshold that the applicant used as a benchmark for noise mitigation for the tower design. This also provides clarity to the users of Rogers Arena and any new residents about the guidelines for noise from the arena."

The area of concern is that potentially excessive event based noise levels may be experienced in the surrounding public area and inside the proposed new residential units. This is specifically applicable to units that are above the roofline of the Arena and directly facing the Arena roof.

The 82 dBC noise limit is measured at the roof membrane, which provides the least amount of acoustic mitigation within the Arena structure. Due to the heavy masonry structure of the Arena walls, the noise limit of 82 dBC for event based noise will never be reached in public exterior spaces at grade. A level of 82 dBC would only be experienced by individuals at the point of reception on the roof membrane of the Arena, a situation permitted for only qualified personnel with the necessary safety equipment.

The parameter of 82 dBC used in the report is a realistic reflection of current "MAXIMUM" noise levels that can be expected on the roof membrane surface of the Arena during events. Appendix A contains a list of actual measurements taken during recent events. The average noise levels at the publically inaccessible roof membrane, as opposed to maximum, are in fact "SIGNIFICANTLY" lower than the design levels of 82 dBC.



The residential units facing the arena were, therefore, designed to mitigate the allowable maximum level of deep bass noise of 82 dBC, as experienced over a fifteen minute period. The proposed residential towers have mitigated the exterior noise to less than 50dBC when measured inside the new residential units.

The design utilizes enclosed balconies between bedrooms and the exterior of the building, constructed with reduced areas of glass. The windows at the bedroom and exterior face of the enclosed balconies are double glazed. The combination of the two design features brings the event based noise level inside the bedrooms during the 15 minutes of peak noise to 46 dBC. This level of noise is well within the current requirements for the City of Vancouver.

The design further utilizes "stacking double glazed sliding shutters" at open balconies in front of living spaces, which reduces the noise level heard inside the living spaces during the 15 minutes of peak noise to 50 dBC. Once again the level of noise is within the current requirements of the City of Vancouver.

Appendix B contains an acoustic report to that effect prepared by Brown Strachan indicating the design levels as set out above. This report was reviewed by the City of Vancouver's staff and was accepted.

Appendix C contains concept suite plans prepared by Walter Francl Architecture Inc., which indicates the design principles employed to achieve the values set out above.

Consequently, residents in the new proposed development will experience deep base noise levels of no more than 50 dBC during the most extreme 15 minutes of any event, based on noise measured at the acoustically weakest point in the Arena.

Aquilini Development and Construction reviewed the acoustic requirements thoroughly, as we feel that it is extremely important that we achieved dBC levels that are within the current requirements of the City of Vancouver. Our consultants created a unique design that has addressed the concerns forwarded to us by the City of Vancouver's Planning Department and we are confident that these requirements have been met.

Yours sincerely,



Riaan de Beer
Development Manager

Cc: David Negrin, President

APPENDIX A:
ROGERS ARENA ACOUSITC MEASUREMENTS

Rogers Arena

Rooftop Acoustic Measurements

June 2, 2011 - Supertramp

June 3, 2011 - Bruno Mars

East Roof (Best Buy Club)				
Date/Time		db Avg	db Min	db Max
June 2nd 19:00		57.7	54.7	66.1
June 2nd 21:00		60.0	55.7	66.0
June 2nd 21:58		60.6	55.3	69.7
June 3rd 18:35		60.4	57.6	71.9
June 3rd 19:30		61.2	57.9	67.9
June 3rd 20:44		63.0	58.6	70.6

West Roof (Loading Bay)				
Date/Time		db Avg	db Min	db Max
June 2nd 19:30		59.5	56.3	66.8
June 2nd 19:58		57.2	52.1	64.7
June 2nd 21:58		61.2	57.6	65.3
June 3rd 19:03		57.8	55.6	82.1
June 3rd 20:20		62.7	56.4	69.5
June 3rd 21:40		65.9	57.0	74.7

Notes:

Baseline readings were taken to determine ambient noise in the area when there was no sound activity in the Arena. Sample durations are 20 min.

Sample rate 1 per second A weight at 15' from the roof surface.

Test Meter: Reed 322

Meter Accuracy +/- 1.5dB Unit conforms to IEC651 Type 2 , Ansi S1.4 Type 2 Sound Level Meter.

Rogers Arena

Rooftop Acoustic Measurements

June 24, 2011 - Rihanna

East Roof (Best Buy Club)				
Time		db Avg	db Min	db Max
18:40		57.4	54.9	68.7
19:30		60.5	54.5	69.6
20:16		65.1	55.6	74.2
21:20		57.4	55.1	66.3

West Roof (Loading Bay)				
Time		db Avg	db Min	db Max
19:05		59.2	57.6	70.9
19:53		60.5	57.7	68.3
20:39		65.0	57.1	73.1
21:40		66.2	57.5	74.5

Notes:

Baseline readings were taken to determine ambient noise in the area when there was no sound activity in the Arena. Sample durations are 20 min.

Sample rate 1 per second A weight at 15' from the roof surface.

Test Meter: Reed 322

Meter Accuracy +/- 1.5dB Unit conforms to IEC651 Type 2 , Ansi S1.4 Type 2 Sound Level Meter.

Rogers Arena

Rooftop Acoustic Measurements

July 9, 2011 - New Kids on the Block

East Roof (Best Buy Club)				
Time		db Avg	db Min	db Max
18:44		59.6	57.4	67.3
19:55		64.9	58.4	70.5
21:15		62.8	58.1	73.1
22:12		62.8	58.1	71.1

West Roof (Loading Bay)				
Time		db Avg	db Min	db Max
18:20		57.1	54.1	70.8
19:18		62.4	53.8	72.8
20:46		65.7	57.4	86.9
21:43		64.6	56.4	70.1
22:40		61.9	55.7	70.4

Notes:

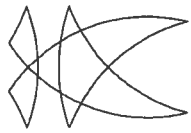
Baseline readings were taken to determine ambient noise in the area when there was no sound activity in the Arena. Sample durations are 20 min.

Sample rate 1 per second A weight at 15' from the roof surface.

Test Meter: Reed 322

Meter Accuracy +/- 1.5dB Unit conforms to IEC651 Type 2 , Ansi S1.4 Type 2 Sound Level Meter.

APPENDIX B:
BROWN STRACHAN ACOUSTIC REPORT



Brown Strachan Associates
Consulting Engineers in Acoustics

PROJECT: C37.101

June 15, 2012

Aquilini Investment Group
200 - 510 West Hastings Street
Vancouver, BC V6B 1L8

Attention: Mr. Mark Mazzone

Dear Mr. Mazzone:

Re: Rogers Arena Towers

Further to your telephone request of 14 June 2012, the following confirms our analysis of Rogers Arena noise at your proposed residential towers (BSA report of 13 December 2011, appended).

With enclosed balconies, bedrooms and living rooms at the nearest facades facing the Rogers Arena roof meet the City's 50 dBC interior noise design criterion. The method of evaluation has been agreed with BKL (the City's acoustical consultant), including the 82 dBC exterior design level, sound isolation provided by enclosed balconies, etc.

For reference, in recently constructed residential buildings downtown, background noise levels measured within suites exceed 50 dBC (typical traffic, etc.). For event/concert noise, we understand the intent of the 50 dBC criterion is to minimize the potential for annoyance associated with the intermittent nature of music.

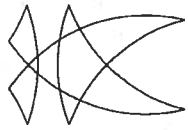
Please call if you have any questions.

Yours very truly,

BROWN STRACHAN ASSOCIATES

Aaron Peterson, B.A.Sc., EIT

AP/cm/12Junc/Aquilini.let



Brown Strachan Associates
Consulting Engineers in Acoustics

PROJECT: C37.101

December 13, 2011

Walter Franci Architecture Inc.
1684 West 2nd Avenue
Vancouver, BC V6J 1H4

Attention: Mr. Walter Franci

Dear Mr. Franci:

Re: Rogers Arena Towers

Further to your email of 8 September 2011, and our telephone discussions, appended is our evaluation of a typical suite proposed for the Rogers Arena sites to estimate inside noise levels with respect to the Design Target of 40-50 dBC.

Our evaluation indicates the following:

Bedrooms and living rooms behind enclosed balconies with regular thermal glazing meet the 50 dBC indoor criterion. Our evaluation is based on an exterior design noise level of 82 dBC, which we understand represents the design 15 min Leq recommended by BKL for suites with a view to Rogers Arena. The effect of enclosed balconies is based on the method agreed with BKL (standard S/A calculation). The noise spectra remain the same as our previous calculations (Graph: Src, appended).

There is no significant improvement from reducing your proposed punched window area, e.g. from 57% to 33% of the facade area (-2 dB), or using concrete vs. a typical facade (+2 dBC).

The BKL method of calculation (INSUL) using a standard room, which has been used in the evaluation of all sites in NEFC, gives results in close agreement with your typical suite design (+/-2 dBC), i.e. detailed evaluation of individual buildings is unnecessary.

Please call if you have any questions.

Yours very truly,

BROWN STRACHAN ASSOCIATES

Aaron Peterson, B.A.Sc., EIT

AP/tr/11Dec/Franc12.let

CALC. BEDROOM NOISE LEVELS WITH VARIOUS FACADES (L/R where indicated), dBC

<u>Facade</u>	<u>BKL Ref. Room</u> (Curtain Wall)	<u>Arch. Design</u> (Punched Window)
6-13-6 (B/R)	63	62
L/R	(82-17TL-2S/A)	62
6Lam-13-6Lam	63	66
6-25-6 + 200+13 (BKL)	60	59
<u>Glazed Balcony</u>		
6-13-6 + 1200+6 (1)	53	49 (4.2m ² balc. gl.)
L/R w/balc. glazing to 6' height only (full height 8'6", see note 2)		57
6-13-6 + 1200 + 6-13-6 (1)	50	46 (4.2m ² balc. gl.)
L/R w/openable balc. glazing (3)		50 (full balc. gl.)
6-13-6 + 1200 + 6-13-6 (1) (glazed area reduced 50%)	47 (5.4m ² window)	43 (2.25m ² window)
<u>Concrete Structure (with punched windows)</u>		
8" conc. + 33% 6-13-6 (2)	58 (3.6m ² window)	60 (2.6m ² window)
8" conc. + 0.3m ² 6-13-6 (2)	48 (0.3m ² window)	50 (0.3m ² window)
Full 8" conc. no windows.	41 (10.8m ² facade)	42 (7.9m ² facade)

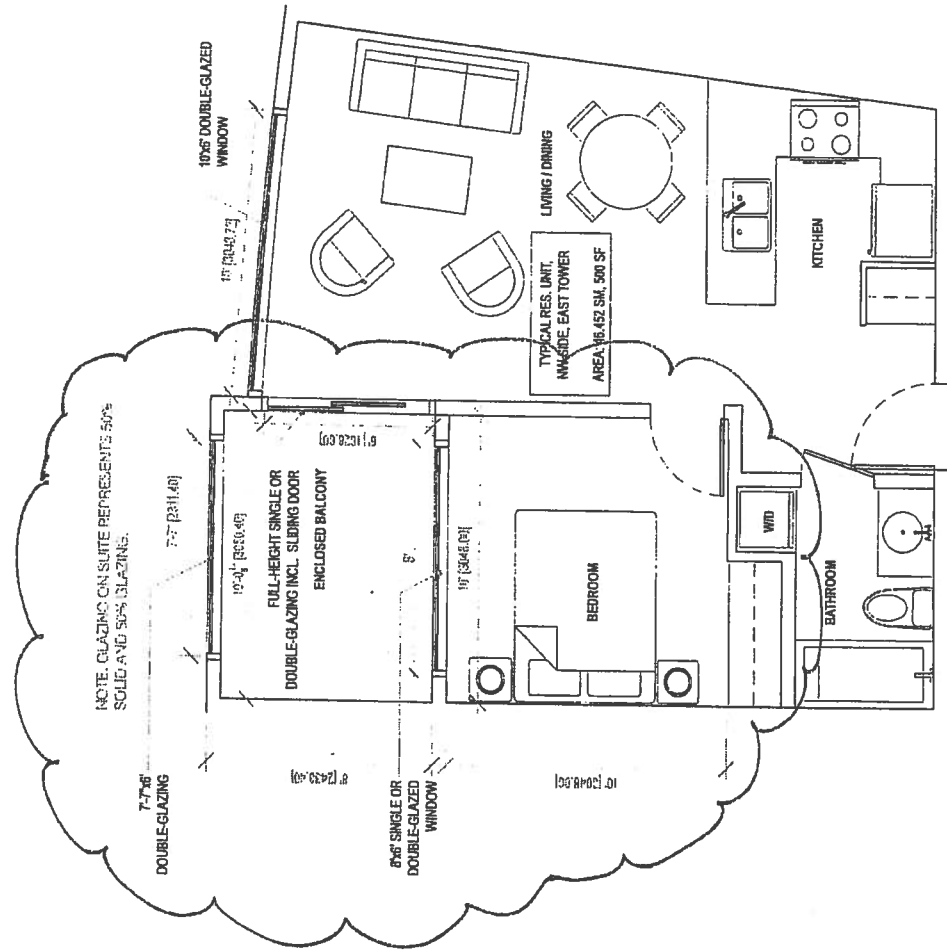
Notes:

Design outside noise 82 dBC (BKL Rogers Arena spectrum, loudest 15 min Leq).
Other 82 dBC noise spectra may change inside levels (appended).

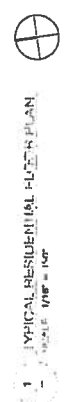
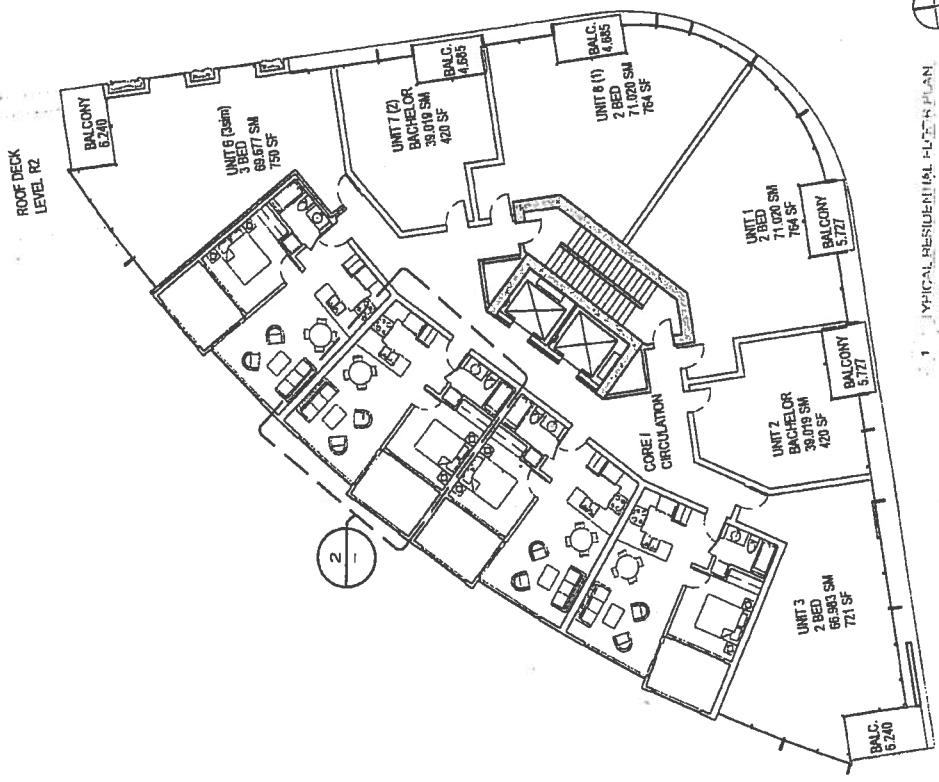
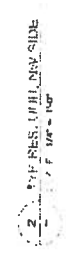
BKL ref. room: A=16m² (full floor area), S=10.8m² (full facade area). S/A= -2.
Arch. design, bedroom: A=9.3m² (full floor area), S=4.5m², full facade=7.9m². S/A= -3.
Arch. L/R: A=10.7m², S=5.6m², full facade=10.7m². S/A= -3.

- (1) Depends on absorption within enclosed balcony.
Balc. atten. = -TL₁ (gl.) + 4 dB (balc. reverb. effect) - TL₂ (gl.), full balc./facade glazing.
Reduced balc./facade glazed area corrected for S.
- (2) Estimate based on 10 Log open area or glazed area ratio.
- (3) Includes +1 dB contribution through sliding glass door to bedroom balcony.

Ceiling height = 8'-6"



NOTE: STORAGE NOT INCLUDED IN UNIT.



PWL Partnership Landscape Architects Inc
 Consultants

ROGERS ARENA TOWERS
 AQUILINI DEVELOPMENT
 Project 2830

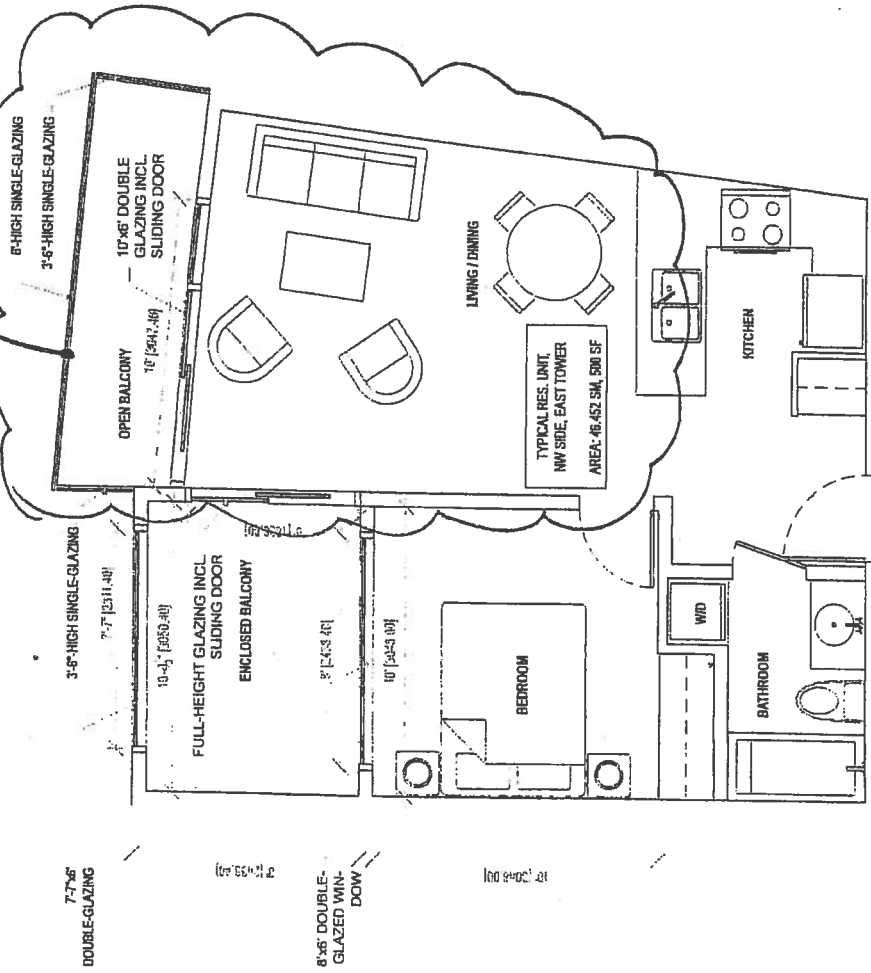
Title East Tower
 TYPICAL RESIDENTIAL FLOOR PLAN
 Scale Varies Date 2011.09.08

Sheet No

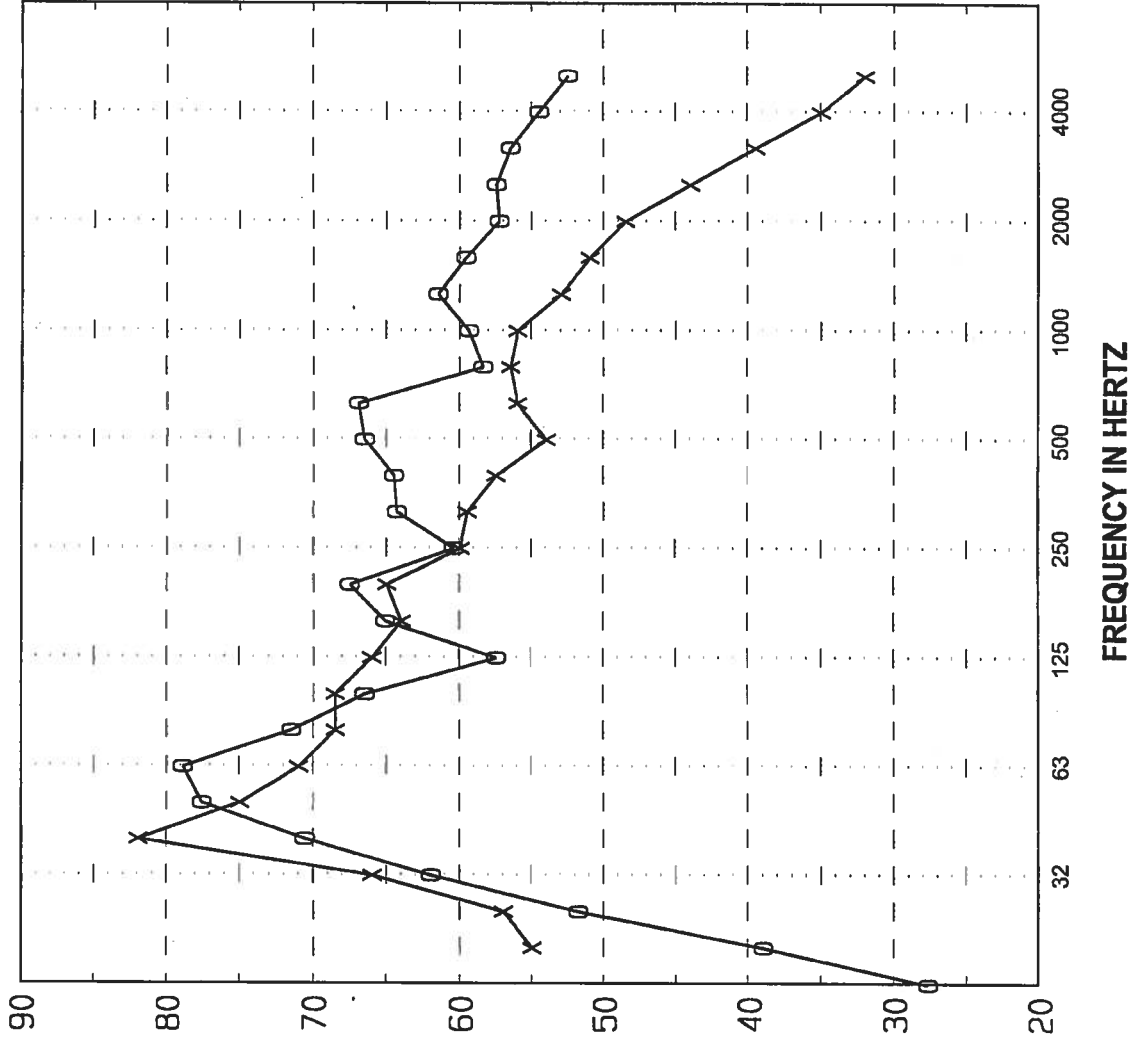
Option:
Encl. Balcony with
Operable glazing.

EAST TOWER, TYPICAL UNIT: WITH ENCLOSED AND OPEN BALCONY

CALCULATED INSIDE NOISE LEVELS WITH VARIOUS FACADES (dBC)



Third Octave Band Sound Pressure Levels (dB re 20 uPa)



LEGEND

- x—x Outdoor noise level meas. on roof of Rogers Arena during concert (loudest 15 min Leq, BKL data). 65 dBA, 82 dBC.
- o—o BKL meas. music level at Deer Lake Park concert, normalized to 82 dBC. 72 dBA, 82 dBC.

PROJECT

ROGERS ARENA TOWERS

GRAPH TITLE

Evaluation of event noise at Rogers Arena.

GRAPH NUMBER

Src

FILE: BKL-82

PROJECT NUMBER

C37.101

DATE

12-DEC-11

Sound Insulation Prediction (v6.3)

Program copyright Marshall Day Acoustics 2009



Margin of error is generally within +/- 3STC

Job Name: Rogers Arena Towers

Notes:

Job No.: C37.101

Page No.:

6-13-6 glazing, 54 sq.ft. pane size.

Date: 10 Mar 11

Initials: AMP

File Name: Insul

COPY



STC 35
OITC 28

System description

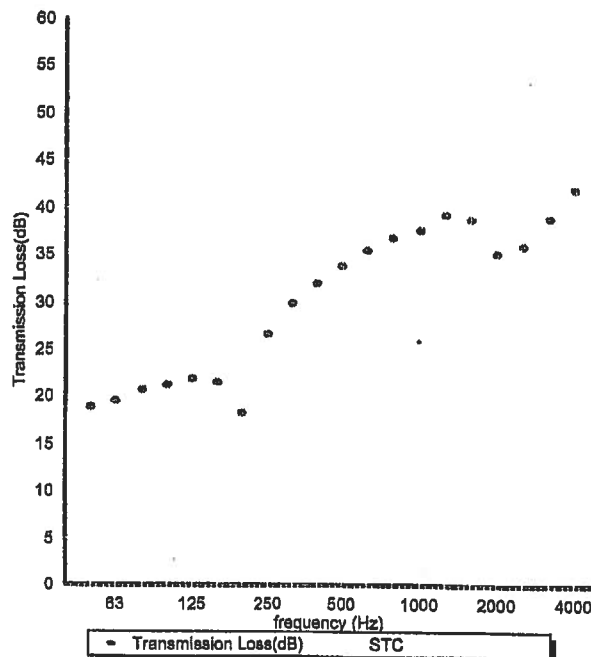
First pane: 1 x 6.0 mm Glass (m=15.0 kg/m², fc=2200 Hz, damping=0.02)

Second pane: 1 x 6.0 mm Glass (m=15.0 kg/m², fc=2200 Hz, damping=0.02)

Panel Size 2.7x2 m

frequency (Hz)	TL (dB)	TL (dB)
40	17	
50	19	
63	20	20
80	21	
100	21	
125	22	21
160	21	
200	18	
250	27	22
315	30	
400	32	
500	34	34
630	35	
800	37	
1000	38	38
1250	39	
1600	39	
2000	35	36
2500	36	
3150	39	
4000	42	41
5000	45	

Data est. @ 40 Hz.



Sound Insulation Prediction (v6.3)

Program copyright Marshall Day Acoustics 2009



Margin of error is generally within +/- 3STC

Job Name: Rogers Arena Towers

Notes:

Job No.: C37.101

Page No.:

Date: 13 Dec 11

Initials: AMP

File Name: insul



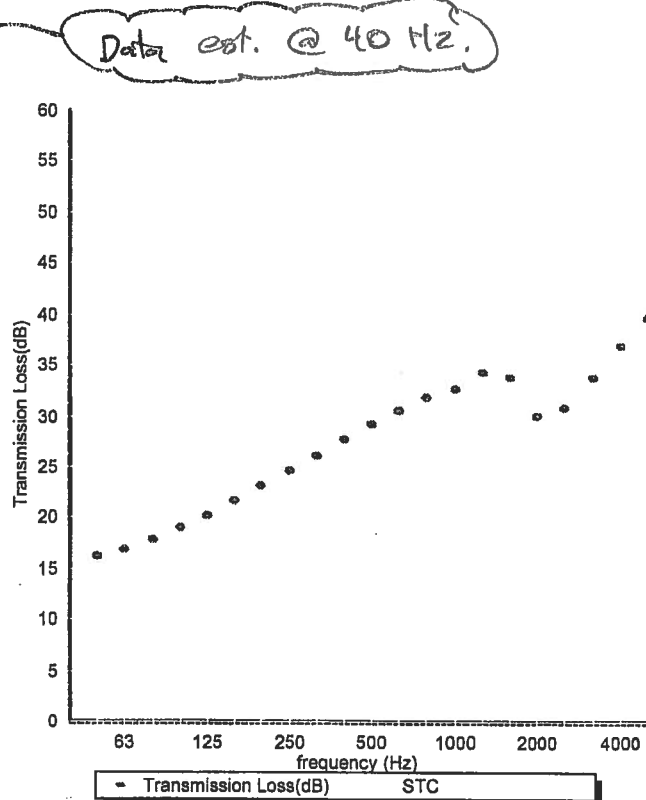
STC 32
OITC 27

System description

Panel 1 Outer layer: 1 x 6.0 mm Glass (m=15.0 kg/m², fc=2200 Hz, damping=0.02)

Panel Size 2.7x2 m

frequency (Hz)	TL (dB)	TL (dB)
40	14	
50	16	
63	17	17
80	18	
100	19	
125	20	20
160	22	
200	23	
250	25	25
315	26	
400	28	
500	29	29
630	31	
800	32	
1000	33	33
1250	34	
1600	34	
2000	30	31
2500	31	
3150	34	
4000	37	36
5000	40	



APPENDIX C:
CONCEPT SUITE PLANS
WALTER FRANCL ARCHITECTS

sent to city Dec 15/11

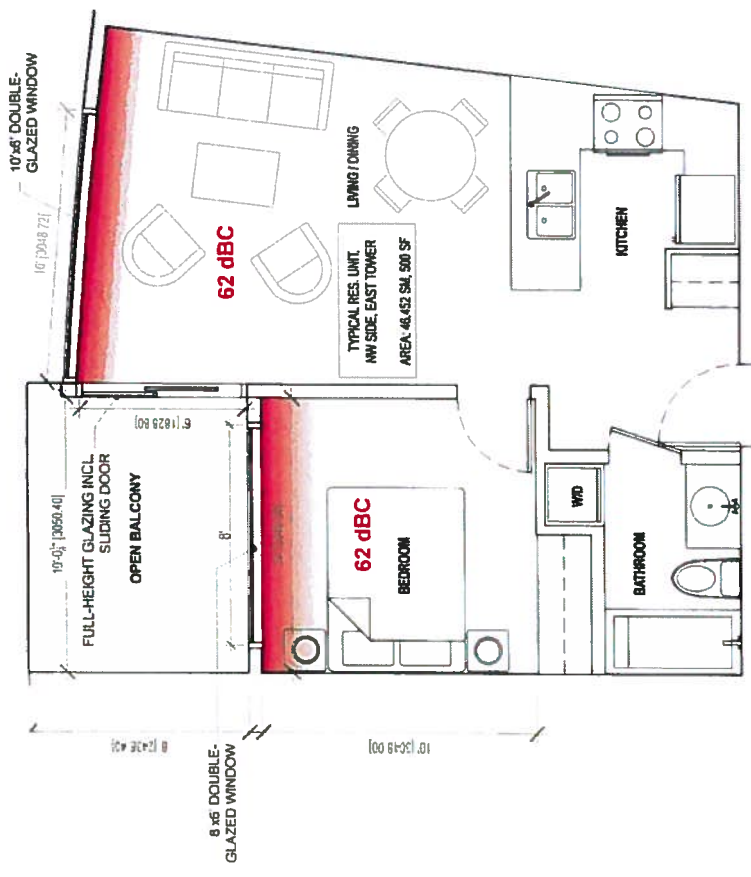
EAST TOWER, TYPICAL UNIT: OPEN BALCONY
 Bedroom and Living/Dining room: 6-13-6 double glazing

FACADE OPTION

NOISE LEVEL INSIDE SUITE (dBC)	
Bedroom	62
Living/Dining Room	62

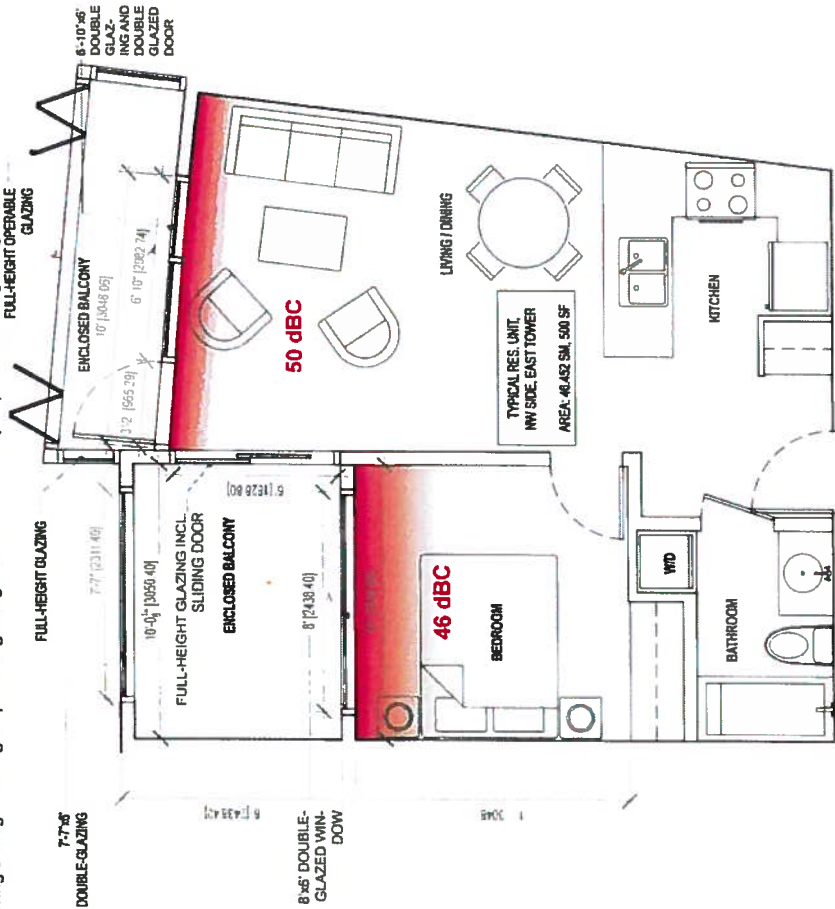
Double-glazing (6-13-6 glass)

refer to Brown Strachan Associates report dated Dec. 13 / 2011 for further information



EAST TOWER, TYPICAL UNIT: WITH ENCLOSED BALCONIES

Bedroom: 6-13-6 double glazing + enclosed balcony depth + 6-13-6 double glazing
 Living/Dining: full-height operable glazing + enclosed balcony depth + double-glazing



NOISE LEVEL INSIDE SUITE (dBC)	
Bedroom	Living/Dining Room
46	--
--	50

FACADE OPTION

- Double glazing at enclosed balcony (6-13-6 glass) & double-glazing at Bedroom (6-13-6 glass)
- Full-height operable glazing at enclosed balcony & double-glazing at Living/Dining room

refer to Brown Strachan Associates report dated Dec 13 / 2011 for further information

WALTER PERAZICH
 ARCHITECTS INC.
 1000 BROADVIEW AVENUE, SUITE 100
 SCARBOROUGH, ONTARIO M1S 1V7
 TEL: (416) 291-1111
 FAX: (416) 291-1112
 WWW.WALTERPERAZICH.COM

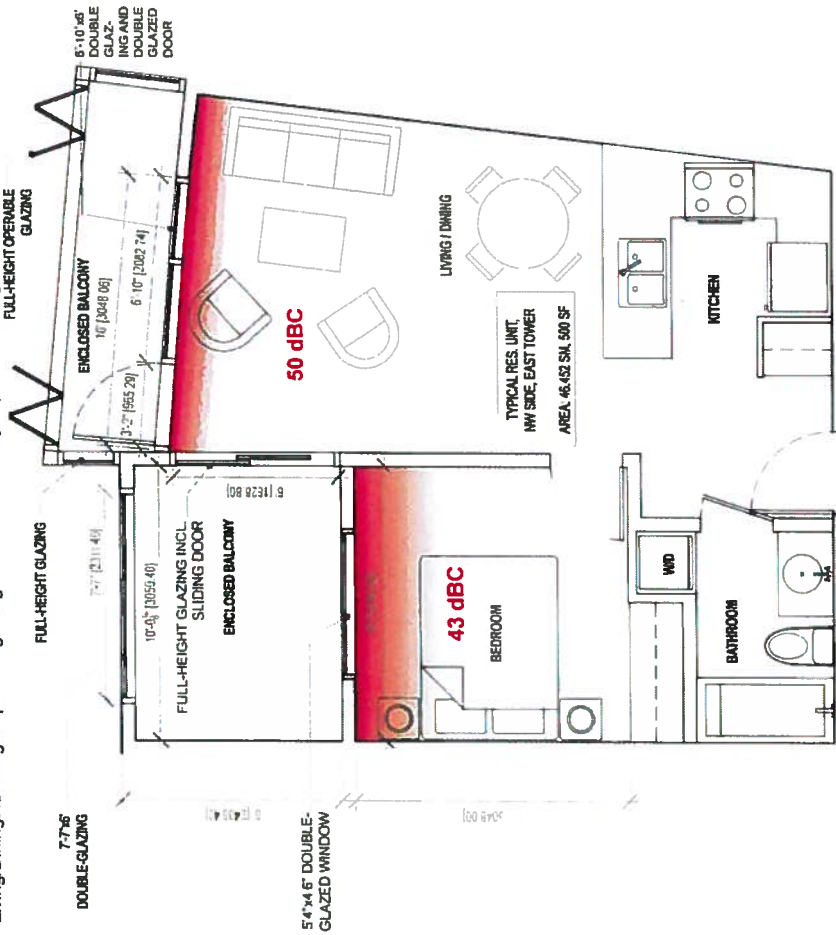
PWL Partnership Landscape Architects Inc
 1000 BROADVIEW AVENUE, SUITE 100
 SCARBOROUGH, ONTARIO M1S 1V7
 TEL: (416) 291-1111
 FAX: (416) 291-1112
 WWW.PWL.COM

ROGERS ARENA TOWERS
 AQUILINI DEVELOPMENT
 Project: 2030
 Consultant

Title: **East Tower**
TYPICAL RESIDENTIAL UNIT
ACOUSTIC STUDY
 Scale: -- Date: 12/15/11
 Sheet No:

EAST TOWER, TYPICAL UNIT: WITH ENCLOSED BALCONIES

Bedroom: 6-13-6 double glazing + enclosed balcony depth + 6-13-6 double glazing
 Living/Dining: full-height operable glazing + enclosed balcony depth + double-glazing



FACADE OPTION

NOISE LEVEL INSIDE SUITE (dBC)
 Bedroom — Living/Dining Room

- 43 — Double glazing at enclosed balcony (6-13-6 glass) & double-glazing at Bedroom (6-13-6 glass) (glazing area reduced by 50%)
- 50 — Full-height operable glazing at enclosed balcony & double-glazing at Living/Dining room

refer to Brown Strachan Associates report dated Dec 13 / 2011 for further information

WAITER FRANK
 ARCHITECTS INC.
 1000 WEST 10TH AVENUE
 SUITE 1000
 DENVER, CO 80202
 TEL: 303.733.8888
 WWW.WAITERFRANK.COM

PVL Partnership Landscape Architects Inc

ROGERS ARENA TOWERS
 ADULINI DEVELOPMENT

Project 2010

Consultants

Title: East Tower
 TYPICAL RESIDENTIAL UNIT
 ACOUSTIC STUDY

Scale: — Date: 12/15/11

Sheet No.

EAST TOWER, TYPICAL UNIT: 8" CONCRETE WALL, 0.15 s.m. GLAZING
 Bedroom and Living/Dining room: 6-13-6 double glazing
 (0.15 s.m. area)

FACADE OPTION

NOISE LEVEL INSIDE SUITE (dBC)	
Bedroom	50
Living/Dining Room	50

8" concrete walls with 0.15m² double glazed window
 (6-13-6 glass) in Bedroom and Living/Dining room

refer to Brown Strachan Associates report dated Dec 13 / 2011 for further information

