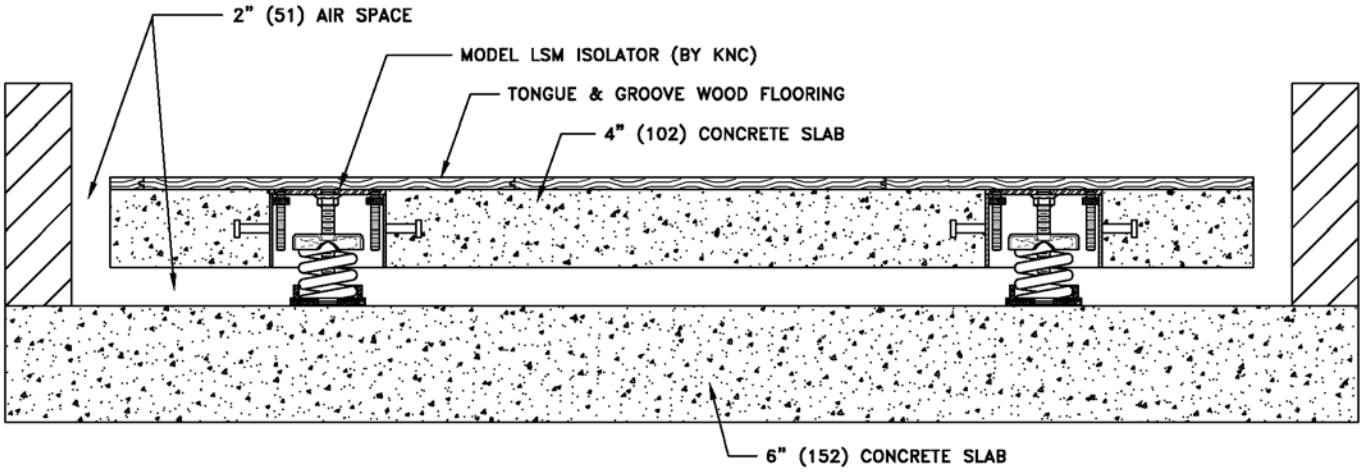
KINETICS NOISE CONTROL TEST REPORT #AT001065

- **KINETICS NOISE CONTROL PRODUCTS:**
  - LSM
- **ACOUSTICAL RATINGS:**
  - FIIC 72
- **TESTING AGENCY & REPORT NUMBER:**
  - BRUCK RICHARDS CHAUDIERE INC.
  - BRC 200-006



KINETICS DRAWING NUMBER: AT001065

KINETICS Noise Control

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BRC acoustics

March 22, 2000

MEMORANDUM

To: **Robert Deering, Mithun Partners**

cc: **Terry Mott, James KM Cheng Architects**
Bruce Tidball, Westbank
Jim Mutrie, Jones Kwong Kishi

From: **William Stewart, BRC Acoustics Inc.**

Re: ***Basketball and Playground Sound and Impact Isolation***
Lincoln Square

This report presents the test results of the acoustic flooring system planned for the basketball courts over theaters 8 and 9. The acoustic performance of a floor can be divided into two components: sound isolation and impact isolation. This memorandum contains information regarding both performance components.

Standardized testing has been established to quantify these components so they can be used in performance specifications. Just as we can specify an insulation factor of "R-19" in the walls, we can specify a floor to achieve a specific Sound Transmission Class (STC) value. Below is a brief explanation of terms related to the acoustic performance of floors:

STC/TL In considering the acoustic performance of a floor, the ability of the system to block the transmission of sound waves is important. The **sound transmission loss (TL)** of a material or building partition is a measure of it's sound isolation ability. Since TL is very frequency dependent, it is generally reported in the third octave frequency bands between, as a minimum, 125 Hz and 4,000 Hz. As a convenience, a single number rating method has been developed which allows a single value to be given to a transmission loss spectrum, which is a set of 16 one-third octave band TL values. This rating is referred to as the **sound transmission class (STC)** rating which has been defined in the American Society for Testing and Materials (ASTM) Standard E413. This standard defines a procedure for determining the STC rating for a TL spectrum by fitting a contour to the one-third octave band TL data.

Creating Sound Environments

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FSTC In order to test the TL properties of a material in the field, ASTM established test methods for a "field" STC or **FSTC.** The measurement technique generally follows the procedures of ASTM designation: E336. Measured TL levels are compared with standard TL contours per ASTM designation: E413. The highest STC contour, which matches the measured TL, equals the Field Sound Transmission Class rating for the test partition.

IIC/FIIC The method established for measuring the impact isolation of a floor assembly is the **impact isolation class (IIC).** This procedure, similar to deriving an STC rating of a material, assigns a single number value to a floor isolation spectrum based on a curve fit. Procedures for deriving an IIC are established under ASTM designation: E1007. The measured sound levels are compared with IIC contours according to ASTM designation: E 989. The highest IIC contour which matches the measured one-third octave band sound level equals the Impact Insulation Class rating for the test floor-ceiling assembly. This rating allows the impact sound transmission from upper-floor units to be identified by a single number. As a field test this procedure is referred to as an **FIIC.**

In addition, running and dribbling a basketball on the assembly was completed to evaluate noise levels generate by this activity within the space below.

Measurement Results

The acoustic performance of the floating floor was excellent for isolating impacts. The assembly achieved an FIIC 72. This performance was limited by the ambient background noise generated by traffic but was consistent with laboratory test performances. The report of this test is attached. Measurements were made to determine the natural frequency of the floating floor assembly. From this information predictions of the spring isolation performance can be made. Our measurements, using the heel-drop method, showed a natural frequency near 18 Hz. Given a rigid supporting structure, less than 3% of the vibration energy would be transferred to the building structure using 1-inch deflection springs.

The floating floor we tested was not ideal for testing sound transmission loss. The assembly was installed leaving a 2-inch gap around the perimeter. Normally this gap would be filled with a border isolation material that allows for deflection of the floor. In this case, because of the baseboard heaters, the floor was not extended to the walls. This reduced the assembly performance to a level consistent with the 6" concrete floor with a suspended gypsum board ceiling 30" below. As assembled the floor achieved an FSTC 61. The report of this test is attached. Assembled to prevent flanking paths along the walls it is predicted the assembly will achieve an STC 67 with a lay-in acoustic panel ceiling.

Measurements were made during running and basketball activity on the floor in the retail spaces below. No sound or vibration from the basketball and running was perceived in the space below. The ceiling height in the space below was 10 feet.

For comparison, measurements were made on the same structural slab without the benefit of the floating floor. In this space measurements made to demonstrate impact isolation achieved an FIIC 46. The report of this test is attached. Basketball dribbling on this assembly could clearly be heard in the space below.

A third area of the sports club was evaluated for impact isolation. In the exercise/weight-lifting area ½" shredded rubber mat was installed over a spring jack-up floating floor. This floor was identical to the wood floor area discussed earlier with the shredded rubber used instead of the ¾" T&G wood flooring. This assembly achieved an FIIC 73. The report of this test is attached. During basketball activity no sound or vibration was perceived in the space below.

Summary

Based on our evaluation, the spring jack-up floor will be sufficient to control noise and vibration to the theaters below. The floating floor should be constructed using a 1-inch deflection spring supporting a 4-inch concrete slab. The structural slab should be 5-inches of concrete on a 3-inch concrete metal decking. If you desire, we can meet and discuss this report in further detail. In any case, please feel free to contact our office with questions.

Sincerely yours,
BRUCK RICHARDS CHAUDIERE INC.

William Stewart

William Stewart
Senior Acoustical Consultant

Encl.: Four test reports

3208 15th Avenue W., Seattle Washington 98119 (206) 270-8910 Fax (206) 270-8690

IMPACT INSULATION CLASS TEST REPORT BRC 2000-006

Report Date: March 22, 2000

Client: Westbank Investments (USA) Inc.
177 West Hastings Street
Vancouver, BC V6E 2K3
Canada

Kinetics Noise Control
6300 Irelan Place
Dublin, Ohio 43017
USA

Product: Kinetics Spring Jack-up
Floating Floor System
Studio 2 (hardwood)

Project: NY Sports Club
Test Date: March 10, 2000

PROCEDURE

This report presents the results of testing completed on the sound impact insulation performance of a Kinetics spring jack-up floating floor system. The procedures used to conduct this test were in accordance with the provisions and requirements of the American Society for Testing and Materials (ASTM) E1007-97 Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures and E989 Classification for Determination of Impact Insulation Class (IIC). Testing was completed at NY Sports Club and the Banana Republic Store in Rockefeller Center, New York City, NY. The test room within the Sports Club was Aerobics Studio 2 constructed to achieve sound and impact isolation to the retail spaces below. Testing was completed after hours to eliminate the impact of retail and sports club activity noise levels on the measurement results. Ambient noise levels generated by external sources of traffic and equipment did impact the overall results of these measurements. All testing was completed within established professional standards and practices.

DESCRIPTION OF TEST SPECIMEN

The test specimen consisted of a 6-inch structural concrete floor with a Kinetics spring jack-up floor assembly providing acoustic isolation. The finish floor was T&G wood flooring. The floating floor included 1-inch deflection springs, type LSM-1, distributed 4 feet on-center in a 4" thick dense concrete slab (150 pcf). The floating slab made no contact with the walls, creating a 2-inch gap around the perimeter. This gap was a flanking path for airborne sound transmission that was identified before testing. No effort was made to block sound from being transmitted

TEST PROCEDURE

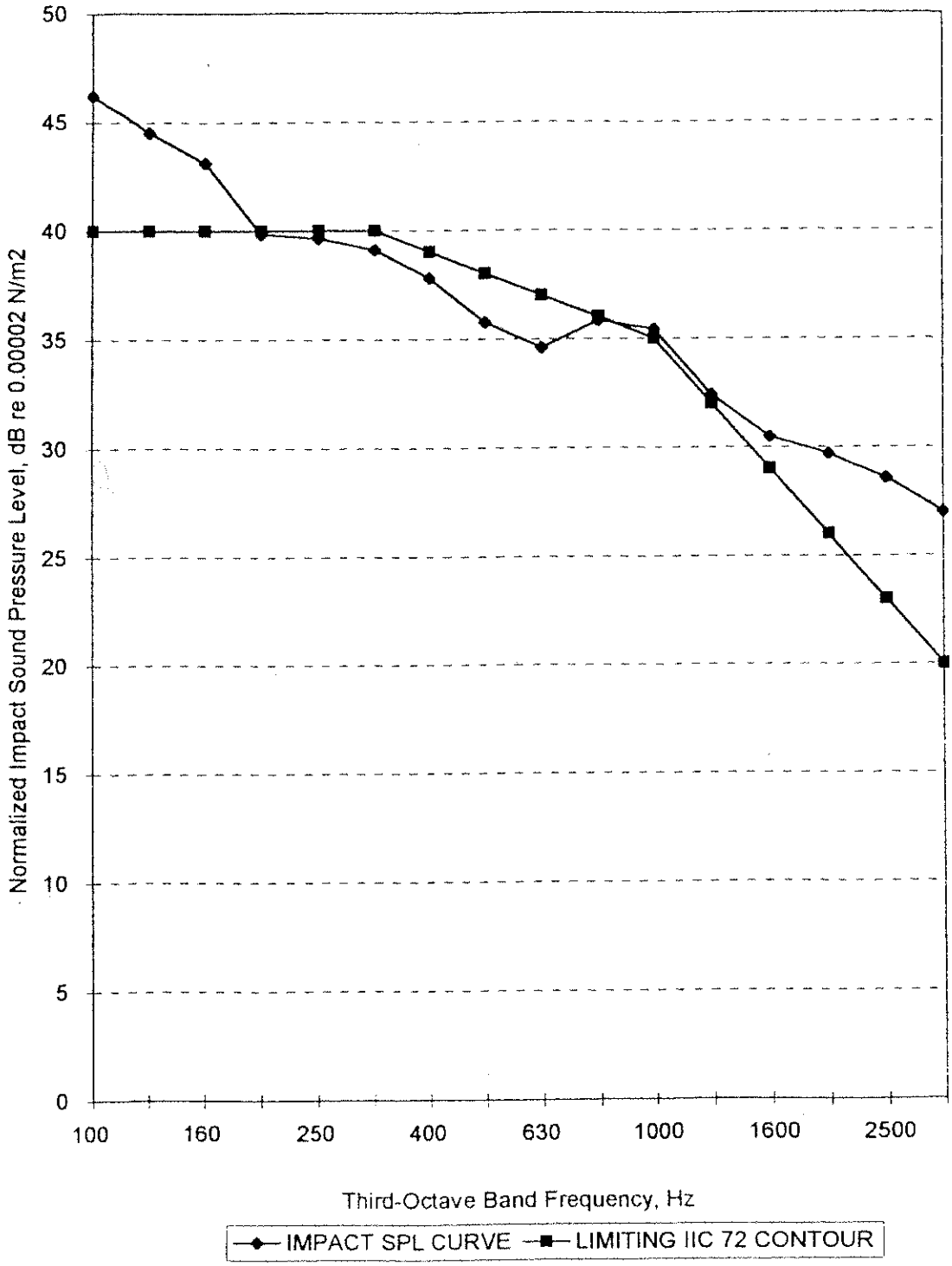
Procedures outlined within ASTM E1007-97 were followed to obtain the transmitted sound pressure level produced by the tapping machine (located in the source room) as measured in the receiver room located beneath the floor being tested. Measurements were normalized to account for sound absorption within the receiver room.

MEASUREMENT RESULTS

To derive a performance rating for Impact Insulation Class, four individual measurements of four different tapping machine positions have been averaged. The averaged values are listed and displayed graphically on the next page. Based on these values the performance of this assembly can be characterized as a Field Impact Insulation Class (FIIC) 72 according to the procedures of ASTM E1007-97.

DISCLAIMER

BRC Acoustics has no financial or managerial interests vested in the clients named in this report nor do the clients have any vested interests in the operation or finances of BRC Acoustics.



The IIC value was determined by applying the Averaged Sound Pressure Levels (SPL) values to the IIC reference contour of ASTM E1007-97, Field Measurement of Tapping

Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures.

Freq (Hz)	SPL Avg. (dB)	IIC Contour	Def (dB)	Freq (Hz)	SPL Avg. (dB)	IIC Contour	Def (dB)
100	46.6	40	6	630	36.5	37	0
125	46.4	40	5	800	37.4	36	0
160	44.7	40	3	1000	37.3	35	0
200	42	40	0	1250	34.3	32	0
250	41.8	40	0	1600	32.6	29	1
315	40.7	40	0	2000	31.9	26	4
400	39.7	39	0	2500	30.8	23	6
500	37.3	38	0	3150	29.2	20	7

NR Averaged Sound Pressure Level (dB)
IIC Contour Limiting IIC Contour
Def Deficiencies, values below IIC contour (dB)

BRUCK RICHARDS CHAUDIERE INC.

William Stewart
Senior Consultant

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SOUND TRANSMISSION LOSS TEST REPORT BRC 2000-007

Report Date: March 22, 2000

Client: Westbank Investments (USA) Inc.
177 West Hastings Street
Vancouver, BC V6E 2K3
Canada

Kinetics Noise Control
6300 Irelan Place
Dublin, Ohio 43017
USA

Product: Kinetics Spring Jack-up
Floating Floor System
Studio 2 (hardwood)

Project: NY Sports Club
Test Date: March 10, 2000

PROCEDURE

This report presents the results of testing completed on the sound transmission loss performance of a Kinetics spring jack-up floating floor system. The procedures used to conduct this test were in accordance with the provisions and requirements of the American Society for Testing and Materials (ASTM) E336-97 Standard Test Method for Measurement of Airborne Sound Insulation in Buildings and E413-87 Classification for Rating Sound Insulation. Testing was completed at NY Sports Club and the Banana Republic Store in Rockefeller Center, New York City, NY. The test room within the Sports Club was Aerobics Studio 2 constructed to achieve sound and impact isolation to the retail spaces below. Testing was completed after hours to eliminate the impact of retail and sports club activity noise levels on the measurement results. Ambient noise levels generated by external sources of traffic and equipment did impact the overall results of these measurements. All testing was completed within established professional standards and practices.

DESCRIPTION OF TEST SPECIMEN

The test specimen consisted of a 6-inch structural concrete floor with a Kinetics spring jack-up floor assembly providing acoustic isolation. The finish floor was T&G wood flooring. The floating floor included 1-inch deflection springs, type LSM-1, distributed 4 feet on-center in a 4" thick dense concrete slab (150 pcf). The floating slab made no contact with the walls, creating a 2-inch gap around the perimeter. This gap was a flanking path for airborne sound transmission that was identified before testing. No effort was made to block sound from being transmitted through this gap.

TEST PROCEDURE

Procedures outlined within ASTM E336-97 were followed to obtain the difference between the average sound pressure levels in each room at specified frequencies in one-third octave bands when one room, the source room, contains a source of noise. Measurements were normalized to account for the room sound absorption within the receiver room.

MEASUREMENT RESULTS

To derive a performance rating for sound transmission loss, individual values for 18 1/3-octave bands centered on standard frequencies were tabulated. These values are listed and displayed graphically on the next page. Based on these values the performance of this assembly can be characterized as a Field Sound Transmission Class (FSTC) 61 according to the procedures of ASTM E413-87.

DISCLAIMER

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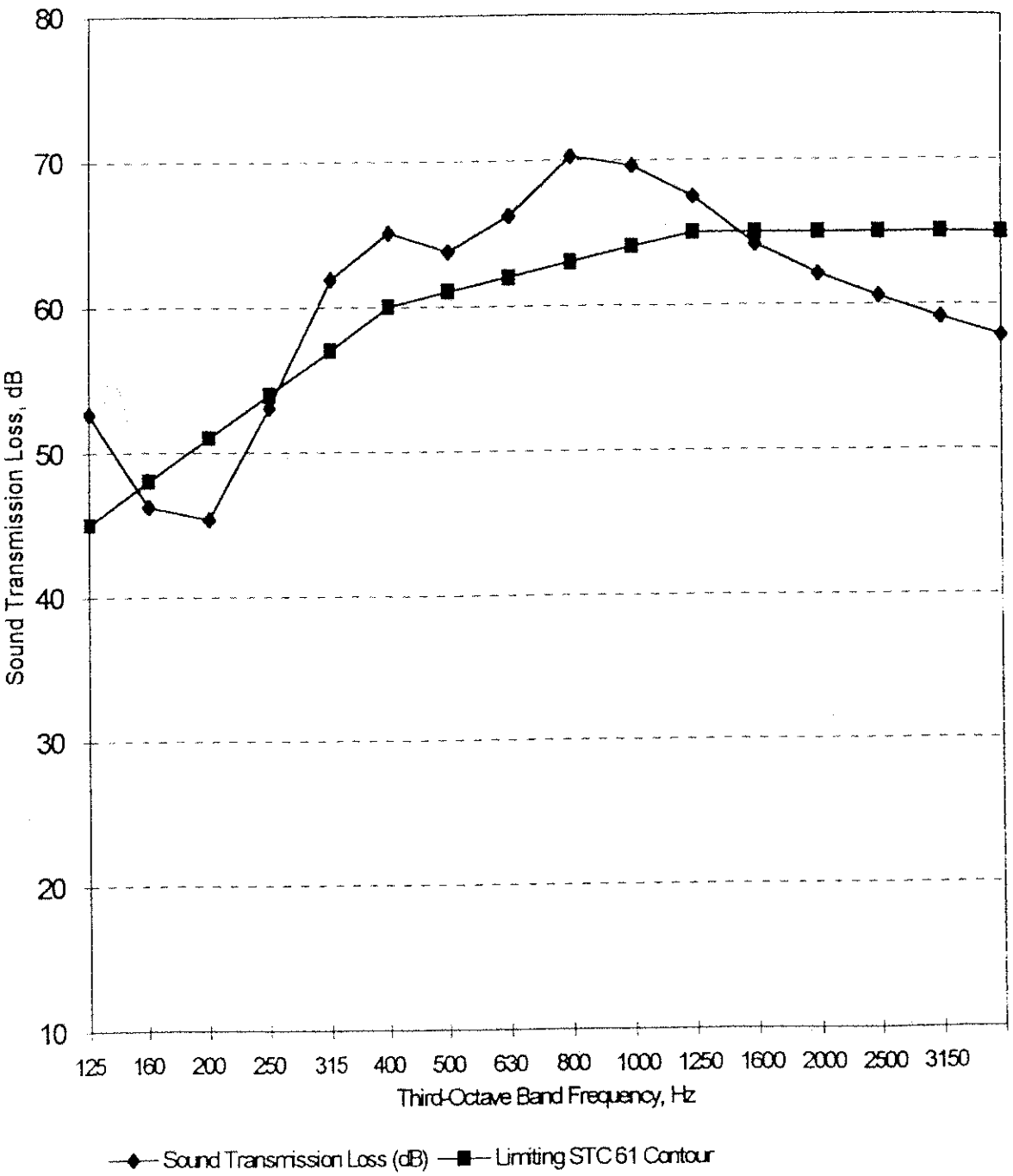
80
70
60
50
40
30
20
10
Sound Transmission Loss, dB
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
Third-Octave Band Frequency, Hz
Sound Transmission Loss (dB)
Limiting STC 61 Contour

The STC value was determined by applying the Transmission Loss (TL) values to the STC reference contour of ASTM E413-87, Determination of Sound Transmission Class.

Freq (Hz)	NR (dB)	TL (dB)	Def (dB)	Freq (Hz)	NR (dB)	TL (dB)	Def (dB)
125	50.9	53	0	800	68.8	70	0
160	44.8	46	2	1000	67.8	70	0
200	43.3	45	6	1250	65.7	67	0
250	51.0	53	1	1600	62.1	64	1
315	60.4	62	0	2000	60.0	62	3
400	63.3	65	0	2500	58.5	61	4
500	62.3	64	0	3150	57.0	59*	6
630	64.4	66	0	4000	55.5	58*	7

NR Noise Reduction (dB)
TL Transmission Loss (dB)
Def Deficiencies, values below STC contour (dB)

*adjusted for ambient levels

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IMPACT INSULATION CLASS TEST REPORT BRC 2000-008

Report Date: March 22, 2000

Client: **Westbank Investments (USA) Inc.**
177 West Hastings Street
Vancouver, BC V6E 2K3
Canada

Kinetics Noise Control
6300 Irelan Place
Dublin, Ohio 43017
USA

Product: **6-inch concrete slab**

Project: **NY Sports Club**
Test Date: **March 10, 2000**

PROCEDURE

This report presents the results of testing completed on the sound impact insulation performance of an 8-inch concrete slab. The procedures used to conduct this test were in accordance with the provisions and requirements of the American Society for Testing and Materials (ASTM) E1007-97 Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures and E989 Classification for Determination of Impact Insulation Class (IIC). Testing was completed at NY Sports Club in Rockefeller Center, New York City, NY. The test room within the Sports Club was a mechanical room above an office and the laundry room. All testing was completed within established professional standards and practices.

DESCRIPTION OF TEST SPECIMEN

The test specimen consisted of a 6-inch structural concrete slab with a vinyl floor on top.

TEST PROCEDURE

Procedures outlined within ASTM E1007-97 were followed to obtain the transmitted sound pressure level produced by the tapping machine (located in the source room) as measured in the receiver room located beneath the floor being tested. Measurements were normalized to account for sound absorption within the receiver room.

MEASUREMENT RESULTS

To derive a performance rating for Impact Insulation Class, 4 individual measurements of 4 different tapping machine positions have been averaged. The averaged values are listed and displayed graphically on the next page. Based on these values the performance of this assembly can be characterized as a Field Impact Insulation Class 46 according to the procedures of ASTM E1007-97.

DISCLAIMER

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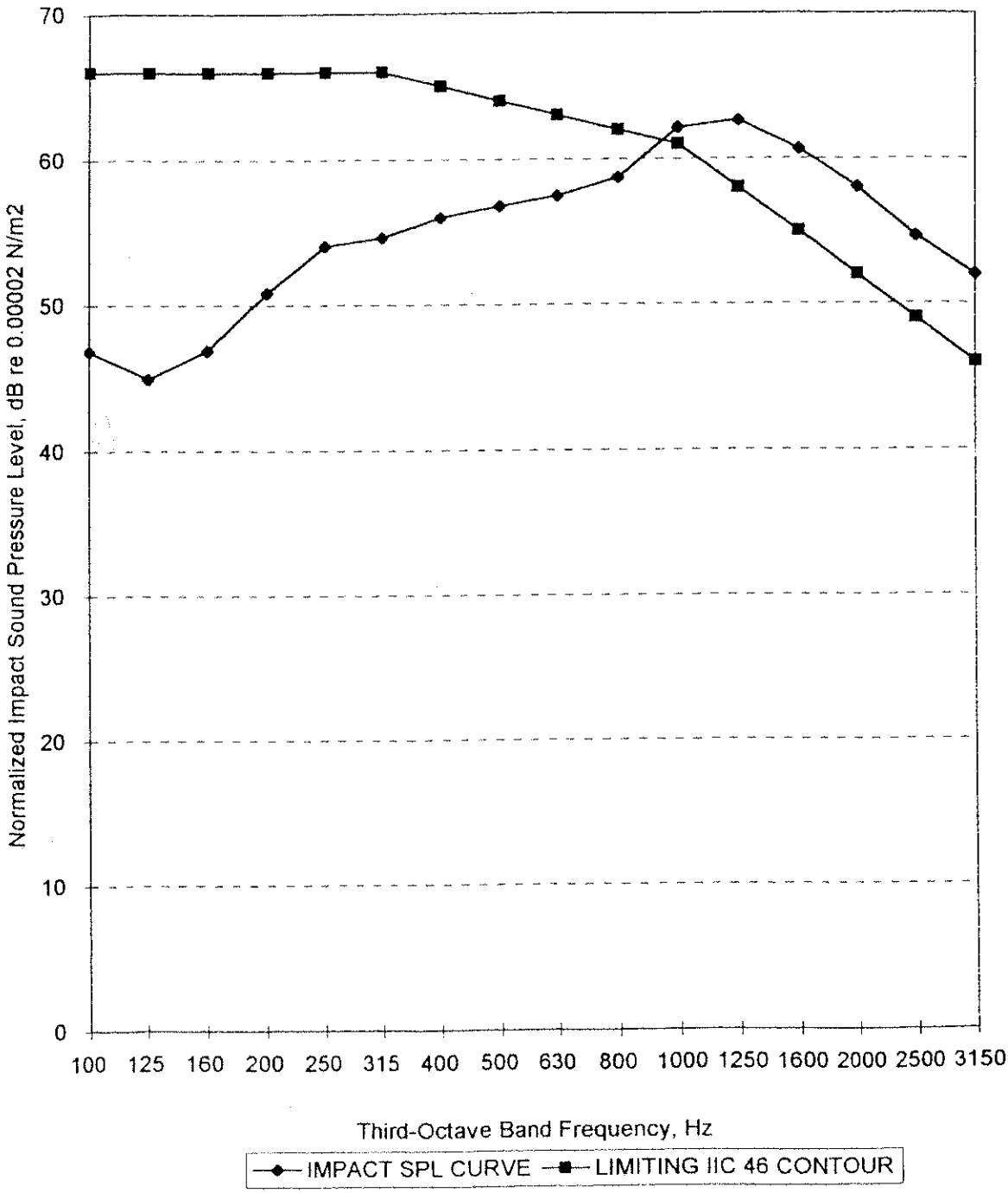

The IIC value was determined by applying the Averaged Sound Pressure Levels (SPL) values to the IIC reference contour of ASTM E1007-97, Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures.

Freq (Hz)	SPL Avg. (dB)	IIC Contour	Def (dB)	Freq (Hz)	SPL Avg. (dB)	IIC Contour	Def (dB)
100	48.2	66	0	630	58.8	63	0
125	46.3	66	0	800	60.1	62	0
160	48.2	66	0	1000	63.5	61	1
200	52.2	66	0	1250	64.0	58	5
250	55.4	66	0	1600	62.0	55	6
315	56.0	66	0	2000	59.4	52	6
400	57.4	65	0	2500	56.0	49	6
500	58.2	64	0	3150	53.4	46	6

NR Averaged Sound Pressure Level (dB)
IIC Contour Limiting IIC Contour
Def Deficiencies, values below IIC contour (dB)

BRUCK RICHARDS CHAUDIERE INC.

William Stewart
Senior Consultant

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IMPACT INSULATION CLASS TEST REPORT BRC 2000-009

Report Date: March 22, 2000

Client: **Westbank Investments (USA) Inc.**
177 West Hastings Street
Vancouver, BC V6E 2K3
Canada

Kinetics Noise Control
6300 Irelan Place
Dublin, Ohio 43017
USA

Product: **Kinetics Spring Jack-up**
Floating Floor System
Gym – shredded rubber

Project: **NY Sports Club**
Test Date: **March 10, 2000**

PROCEDURE

This report presents the results of testing completed on the sound impact insulation performance of a Kinetics spring jack-up floating floor system. The procedures used to conduct this test were in accordance with the provisions and requirements of the American Society for Testing and Materials (ASTM) E1007-97 Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures and E989 Classification for Determination of Impact Insulation Class (IIC). Testing was completed at NY Sports Club and the Banana Republic Store in Rockefeller Center, New York City, NY. The test area within the Sports Club was the open Gym adjacent to the Aerobics Studio 2 and was constructed to achieve sound and impact isolation to the retail spaces below. Testing was completed after hours to eliminate the impact of retail and sports club activity noise levels on the measurement results. Ambient noise levels generated by external sources of traffic and equipment did impact the overall results of these measurements. All testing was completed within established professional standards and practices.

DESCRIPTION OF TEST SPECIMEN

The test specimen consisted of a 6-inch structural concrete floor with a Kinetics spring jack-up floor assembly providing acoustic isolation. The finish floor was shredded rubber. The floating floor included 1-inch deflection springs, type LSM-1, distributed 4 feet on-center in a 4" thick dense concrete slab (150 pcf). The floating slab made no contact with the walls, creating a 2-inch gap around the perimeter. This gap was a flanking path for airborne sound transmission that was identified before testing. No effort was made to block sound from being transmitted through this gap.

TEST PROCEDURE

Procedures outlined within ASTM E1007-97 were followed to obtain the transmitted sound pressure level produced by the tapping machine (located in the source room) as measured in the receiver room located beneath the floor being tested. Measurements were normalized to account for sound absorption within the receiver room.

MEASUREMENT RESULTS

To derive a performance rating for Impact Insulation Class, four individual measurements of four different tapping machine positions have been averaged. The averaged values are listed and displayed graphically on the next page. Based on these values the performance of this assembly can be characterized as a Field Impact Insulation Class 73 according to the procedures of ASTM E1007-97.

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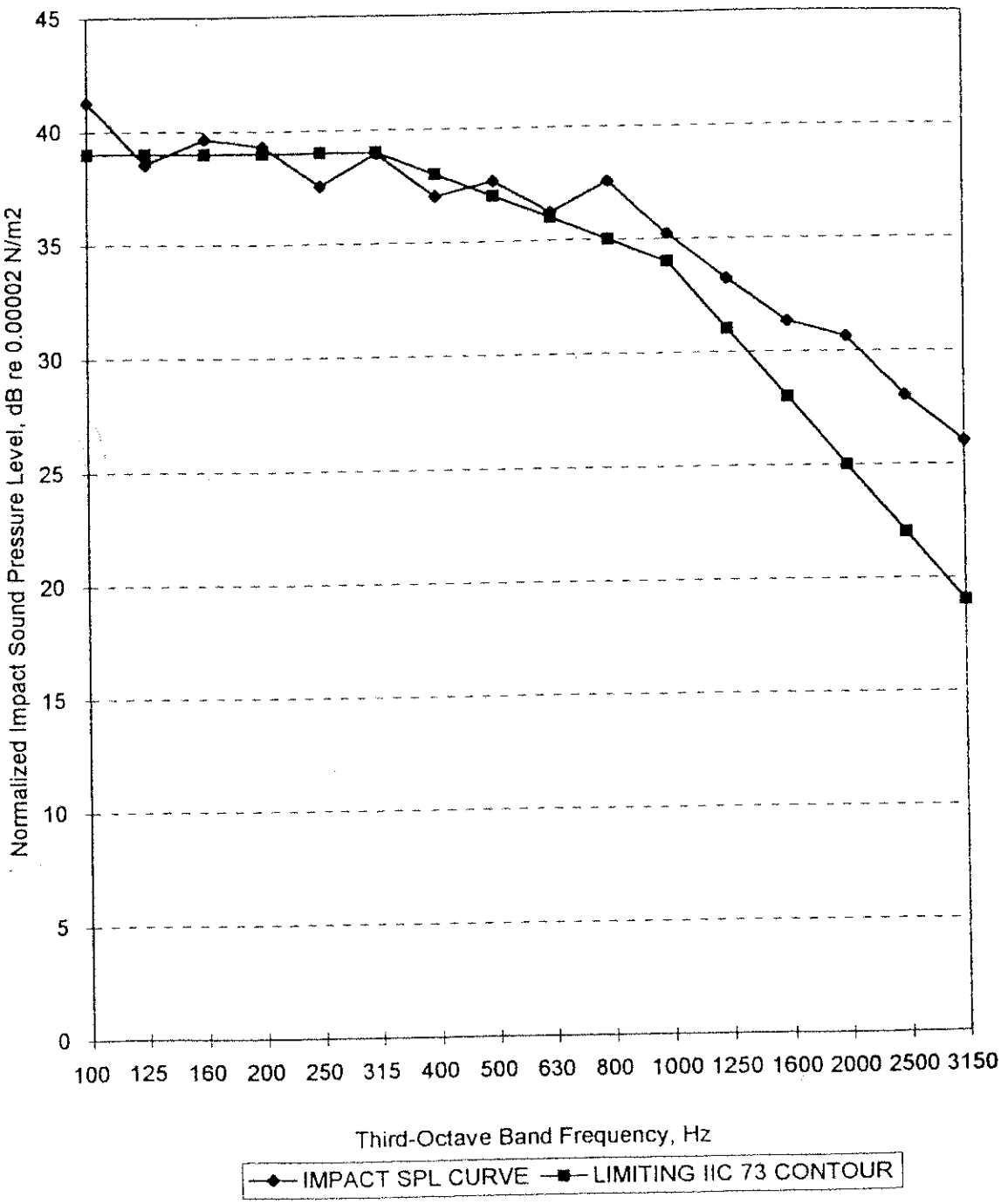

The IIC value was determined by applying the Averaged Sound Pressure Levels (SPL) values to the IIC reference contour of ASTM E1007-97, Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures.

Freq (Hz)	SPL Avg. (dB)	IIC Contour	Def (dB)	Freq (Hz)	SPL Avg. (dB)	IIC Contour	Def (dB)
100	41.7	39	2	630	38.1	36	0
125	40.4	39	0	800	39.1	35	3
160	41.2	39	1	1000	37.1	34	1
200	41.5	39	0	1250	35.1	31	2
250	39.7	39	0	1600	33.5	28	3
315	40.5	39	0	2000	32.8	25	6
400	38.9	38	0	2500	30.2	22	6
500	39.2	37	1	3150	28.2	19	7

NR Averaged Sound Pressure Level (dB)
IIC Contour Limiting IIC Contour
Def Deficiencies, values below IIC contour (dB)

BRUCK RICHARDS CHAUDIERE INC.

William Stewart

William Stewart
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