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6555, Cote des Neiges, Bureau 440
Montréal (Québec) *Tél.: (514) 737-9811*
H3S 246 *Fax: (514) 737-9816*

ACOUSTICAL TEST REPORT

Rendered by Manufacturer and Released to:

Acoustical Surfaces Inc.
123 Columbia Court North, Suite 201
Chaska, MN 55318

Impact noise insulation measurement provided by three small floor samples installed at 90 Berlioz in Nun's Island on the concrete slab separating apartments 1805 and 1706

Report No: 793031-1

Date: May 16, 2005
Project No: 793.031

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1.0 INTRODUCTION

The services of MJM ACOUSTICAL CONSULTANTS INC. have been retained by DURO INT'L to perform Field Impact Insulation Class (FIIC) measurements on three types of floorings installed at 90 Belioz located in Nun's Island.

The measurements were performed on September 8 and 9, 2003 by Mr. Jean-François Latour. The aim of the measurements performed on May 8, 2003 was to determine the impact insulation provided by the bare concrete slab separating the rooms of the apartments 1805 and 1706 of 90 Berlioz, whereas the aim of those performed on September 9, 2003 was to determine the impact insulation provided by the concrete slab covered with the sample floorings which were installed immediately after the tests on the bare slab were complete. This report contains a description of the composition of the assemblies under test, the measured FIIC[1] rating for each floor covering tested including the bare 200 to 250 mm thick slab on which they were installed, the 95% confidence limits associated with the measured levels as well as the instrumentation and procedure used.

2.0 METHODOLOGY

In order to determine the impact noise insertion loss provided by the assemblies being tested, the impact insulation was measured for the concrete slab without any covering and with floor covering. Therefore the centre positions of the 4' x 4' floorings to be installed on the floor of the room of apartment 1805 were identified with paint and the Normalized Impact Sound Pressure Levels produced in the apartment below were measured for the bare slab by placing the tapping machine at each of these positions. The floor samples to be tested were then installed on the concrete slab. The dimensions of the floor sample for each test was 4' x 4' with exception to the ceramic floor sample whose dimensions were 4' - 4" x 4' - 4". In each case, impact sound pressure level measurements were performed in apartment 1706, with and without the floor samples, under the same acoustical conditions, using the same instruments and at the same six measurement positions in the receiving room, while the tapping machine was placed at the same two positions on the floor samples and on the bare slab (twelve measurements in each case). The only variable between the tests was the composition of the floor samples being tested.

1 FIIC: Field Impact Insulation Class; single number rating obtained by classifying as per ASTM E 989, the normalized impact sound pressure levels measured in field .conditions as per ASTM E 1007 entitled "Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures".

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3.0 SUMMARY OF RESULTS

The summary of the measurement results expressed in terms of Field Impact Insulation Class, FIIC, as well as the composition of the floor toppings tested is shown in **table "A"** next page.

The third-octave Normalized Impact Sound Pressure Levels (NISPL) measured for the bare slab at each sample position and for each floor covering are plotted on **graphs 1 to 4** attached to this report. The complete results of the measurements as well as the 95% confidence limits are shown in tables 1 to 4 attached to this report. The attached **graph 5** shows the insertion loss provided by the floor coverings tested. **Appendix I** contains a description of the methods and instrumentation used for the impact insulation measurements, their limitations, as well as the site conditions affecting the precision of the results. **Appendix II** contains a description of the acoustical terms used in this report.

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Sample n°	Description	Result	95% confidence limits
1	- 200 to 250 mm thick concrete slab[2]	FFIC 33	FIIC 33 to FIIC 32
2	- STANDARD ceramic 13" x 13" - Keralastic ceramic glue - DURO-ACOUSTIC 3/8" (9 mm) membrane, code: 303 - ACOUSTIC DURO Glue - 200 to 250 mm thick concrete slab[3]	FFIC 58	FIIC 56 to FIIC 60
3	- Engineered floor COLOMBIA 3" x 3/8" - Parquetry glue - DURO-ACOUSTIC 1/4" (6 mm) membrane, code: 302 - ACOUSTIC DURO Glue - 200 to 250 mm thick concrete slab[3]	FFIC 58	FIIC 54 to FIIC 61
4	- Engineered floor COLOMBIA 3" x 3/8" - Parquetry glue - DURO-ACOUSTIC 1/4" (6 mm) membrane, code: 302 - Parquetry glue - MONOFIT 700 gram membrane - ACOUSTIC DURO Glue - 200 to 250 mm thick concrete slab[3]	FFIC 54	FIIC 52 to FIIC 57

Summary or Results
Table "A"

4.0 DISCUSSION

According to a research project carried out by MJM on behalf of the Canada Mortgage and Housing Corporation (CMHC)[3], the Field Impact Insulation Class (FIIC) rating of an 8 to 10 inch thick concrete slab varies considerably from one project to another; the average FIIC rating measured on concrete slabs from 8 to 10 in. thick was FIIC 32 which is one IIC point less than that measured on the 8 to 10 inch thick slab used in the scope of this report; approximately 40% of the ceiling surface of the room in apartment 1706 where the measurements were performed was covered with a gypsum ceiling installed approximately 2-1/2 inches from the concrete slab. Based on the average NISPL levels measured on eight concrete slabs 8 to 10 inches thick and the insertion loss illustrated on **graph 5**, an estimate was made of the average FIIC index which should be obtained by the three floor coverings tested in the scope of this report when installed on an 8 to 10 inch thick concrete slab.

2 Approximately 40% of the ceiling surface under the concrete slab included a gypsum ceiling installed approximately 2-1/2" below the concrete slab.

3 Michel Morin, Jean-Marie Guérin, MJM Conseillers en Acouatiquc Inc.; "Projet de recherche sur la qualification ju degré de confort accoustique procuré par les immeubles multilogements phase II", Montréal, 17 décembre 2002, recherche externe SCHL.

For your information, the average NISPL levels measured on eight concrete slabs extracted from the aforementioned research project[3] have been plotted on **graph 6**. the results of our predictions are presented in **table "B"** below.

Description	Estimated rating
- 200 to 250 mm thick concrete slab[2] (average)	FFIC 32
- STANDARD ceramic 13" x 13" - Keralastic ceramic glue - DURO-ACOUSTIC 1/8" (9 mm) membrane, code: 303 - ACOUSTIC DURO Glue - 200 to 250 mm thick concrete slab[3]	FFIC 55
- Engineered floor COLOMBIA 3" x 3/8" - Parquetry glue - DURO-ACOUSTIC 1/4" (6 mm) membrane, code: 302 - ACOUSTIC DURO Glue - 250 mm thick concrete slab[3]	FFIC 56
- Engineered floor COLOMBIA 3" x 3/8" - Parquetry glue - DURO-ACOUSTIC 1/4" (6 mm) membrane, code: 302 - Parquetry glue - MONOFIT 700 gram membrane - ACOUSTIC DURO Glue - 250 mm thick concrete slab[3]	FFIC 59

Results of our estimates
Table "B"

The FIIC ratings presented in **table "B"** which represent the average ratings that should be obtained on an 8 to 10 inch thick concrete slab, are equal to or superior to FIIC 55, which is today's standard FIIC index used in Quebec's multi-dwelling construction industry. The impact noise insertion loss shown on **graph 5** of this report can be compared to that obtained for other floor samples of comparable size installed on an 8 to 10 inch thick concrete slab so long as the measurement method used is identical to that described herein. According to Mr. Alfred Warnock, Ph.D., the researcher who led the study of the National Research Council of Canada (NRC) on small floor samples mentioned in **Appendix I** of this report, the FIIC ratings measured with 4'-0" x 4'-0" samples should be of the same order or slightly conservative in relation to the ratings that would be measured if the entire surface of the floor was covered with the flooring under test.

If you have any questions concerning the content of this report, please do not hesitate to contact us.

Report submitted on May 16, 2005

MJM ACOUSTICAL CONSULTANTS INC., by

Measured by:

.Jean-François, T.P.
Technologist

Verified by:

Michel Morin, OAQ, ASA
President and principal consultant

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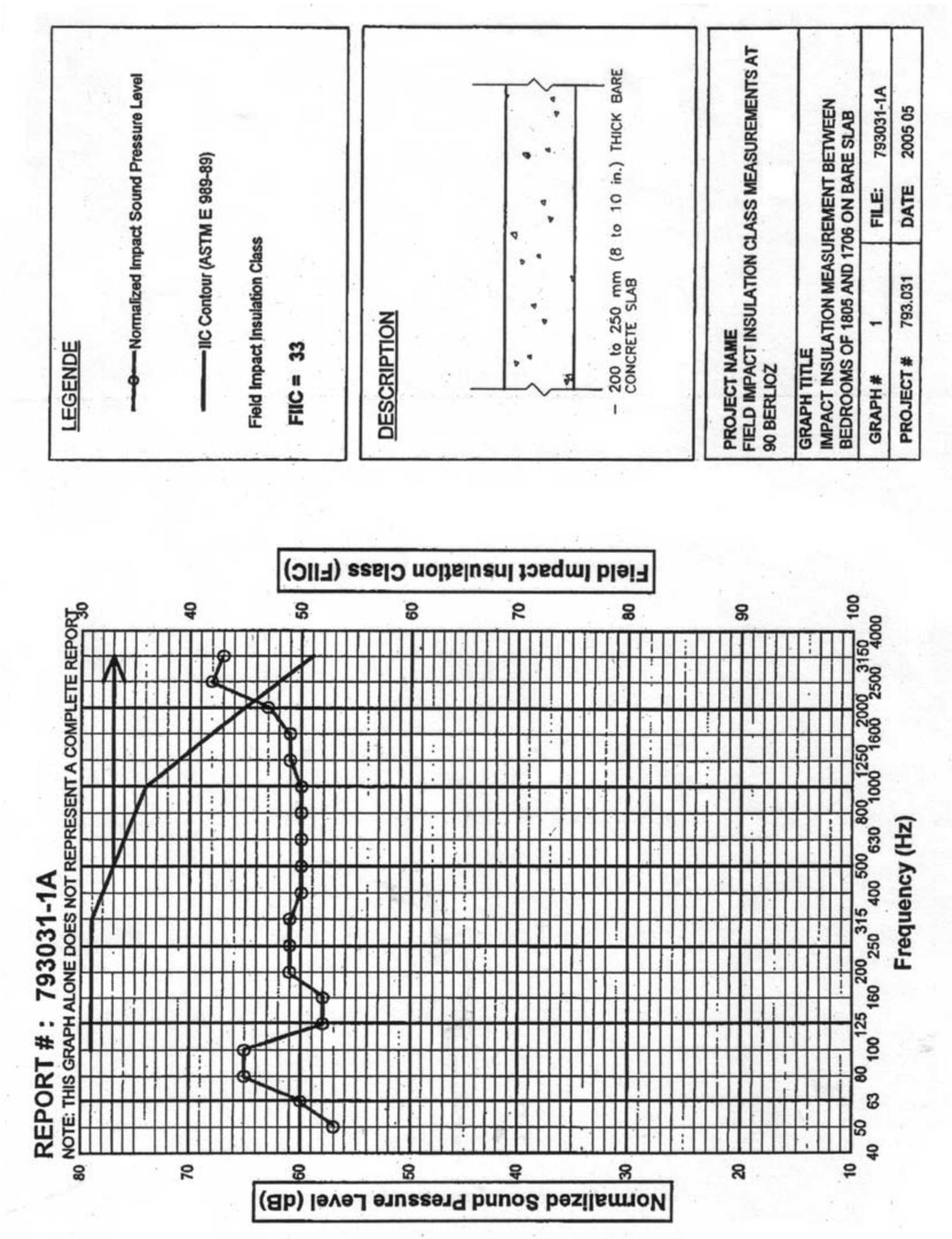

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REPORT NO: 793031-1A

FREQ. Hz	Lbg dB	ISPL dB	A sabins	10log(A/10)	NISPL dB	95% confidence limits	defIIC
50	40	57	10	0	57	± 4.4	n/a
63	39	60	† 11	0	60	± 2.3	n/a
80	39	64	† 12	1	65	± 5.2	n/a
100	35	64	† 13	1	65	± 4.0	0
125	34	58	† 11	0	58	± 2.7	0
160	37	56	† 15	2	58	± 2.6	0
200	30	59	† 14	1	61	± 1.8	0
250	28	59	† 17	2	61	± 2.8	0
315	23	58	† 17	2	61	± 2.2	0
400	21	58	† 18	2	60	± 2.4	0
500	18	58	† 15	2	60	± 1.7	0
630	15	58	† 15	2	60	± 2.5	0
800	12	58	† 14	2	60	± 2.5	0
1000	10	59	† 14	1	60	± 2.7	0
1250	9	59	† 14	1	61	± 2.7	0
1600	8	60	† 13	1	61	± 2.2	0
2000	7	61	† 14	1	63	± 2.2	0
2500	7	67	† 14	1	68	± 1.0	6
3150	7	66	† 14	1	67	± 0.8	8

FIIC =	33	Sum of the deficiences =	14
FIIC MAX =	33	Receiving room volume :	36 m3
FIIC MIN =	32	V^(2/3) = 10.8	

† Frequencies for which the sound absorption exceeds V^(2/3)

FIELD IMPACT INSULATION CLASS MEASUREMENTS AT 90 BERLIOZ
IMPACT INSULATION MEASUREMENT BETWEEN MASTER BEDROOMS OF 1805 AND 1706 ON BARE SLAB

793.031 Table 1 2005 05

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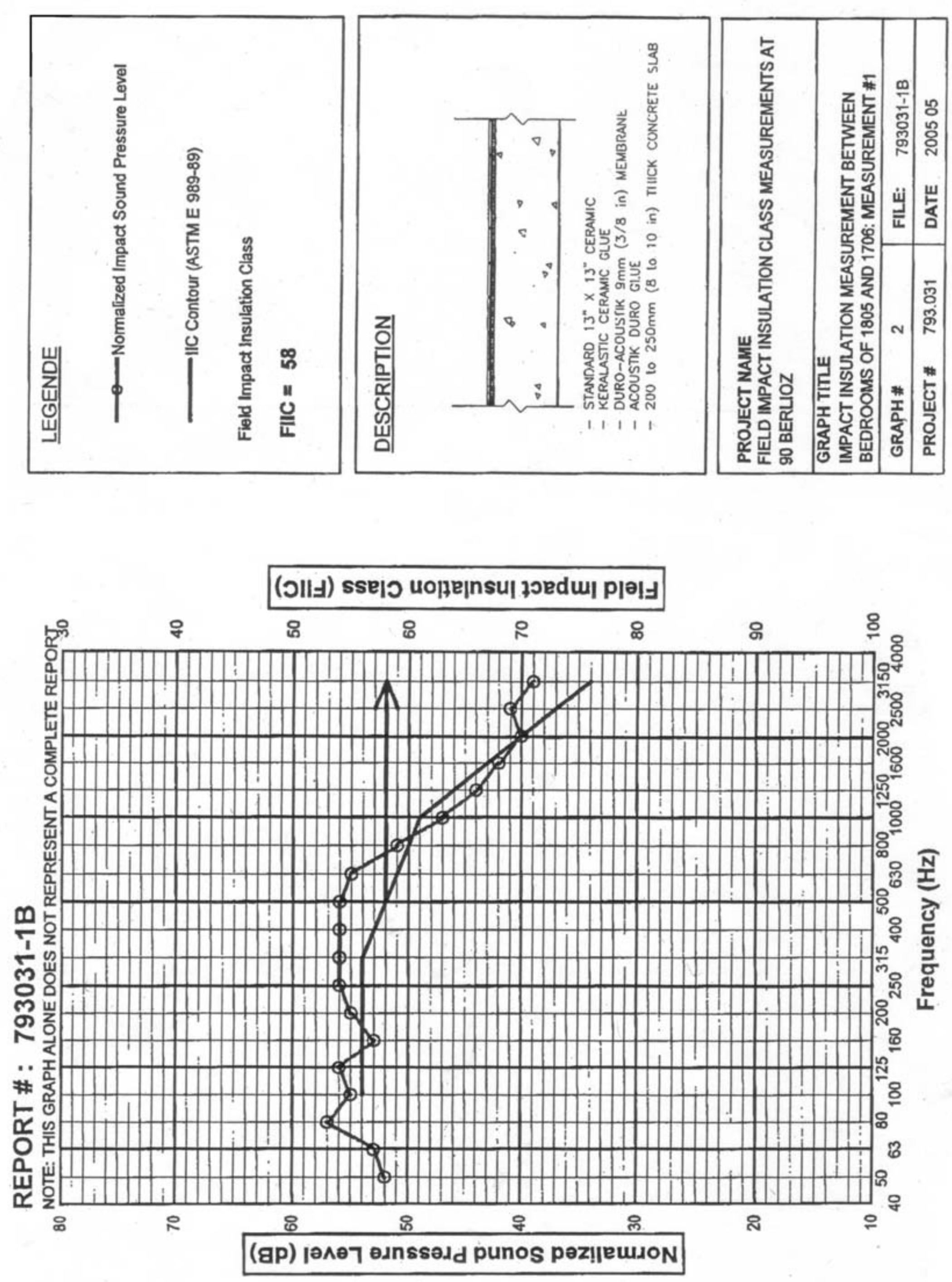

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REPORT NO: 793031-1B

FREQ. Hz	Lbg dB	ISPL dB	A sabins	10log(A/10)	NISPL dB	95% confidence limits	defIIC
50	40	51	† 11	1	52	± 5.8	n/a
63	38	53	† 11	1	53	± 3.5	n/a
80	35	56	† 13	1	57	± 3.5	n/a
100	30	53	† 13	1	55	± 4.1	1
125	32	55	† 12	1	56	± 2.6	2
160	35	52	† 11	0	53	± 1.7	0
200	29	54	† 11	1	55	± 1.8	1
250	28	54	† 15	2	56	± 2.5	2
315	24	54	† 15	2	56	± 1.9	2
400	22	54	† 16	2	56	± 1.8	3
500	18	54	† 16	2	56	± 1.5	4
630	16	53	† 14	2	55	± 1.6	4
800	14	49	† 14	2	51	± 1.4	1
1000	12	46	† 14	1	47	± 2.5	0
1250	10	43	† 12	1	44	± 2.2	0
1600	8	41	† 12	1	42	± 2.1	0
2000	8	39	† 13	1	40	± 2.4	0
2500	8	40	† 12	1	41	± 2.1	4
3150	8	38	† 14	1	39	± 1.1	5

FIIC =	58	Sum of the deficiences =	29
FIIC MAX =	60	Receiving room volume :	36 m3
FIIC MIN =	56	V^(2/3) = 10.8	

† Frequencies for which the sound absorption exceeds V^(2/3)

FIELD IMPACT INSULATION CLASS MEASUREMENTS AT 90 BERLIOZ
IMPACT INSULATION MEASUREMENT BETWEEN MASTER BEDROOMS OF 1805 AND 1706: MEASUREMENT #1

793.031 Table 2 2005 05

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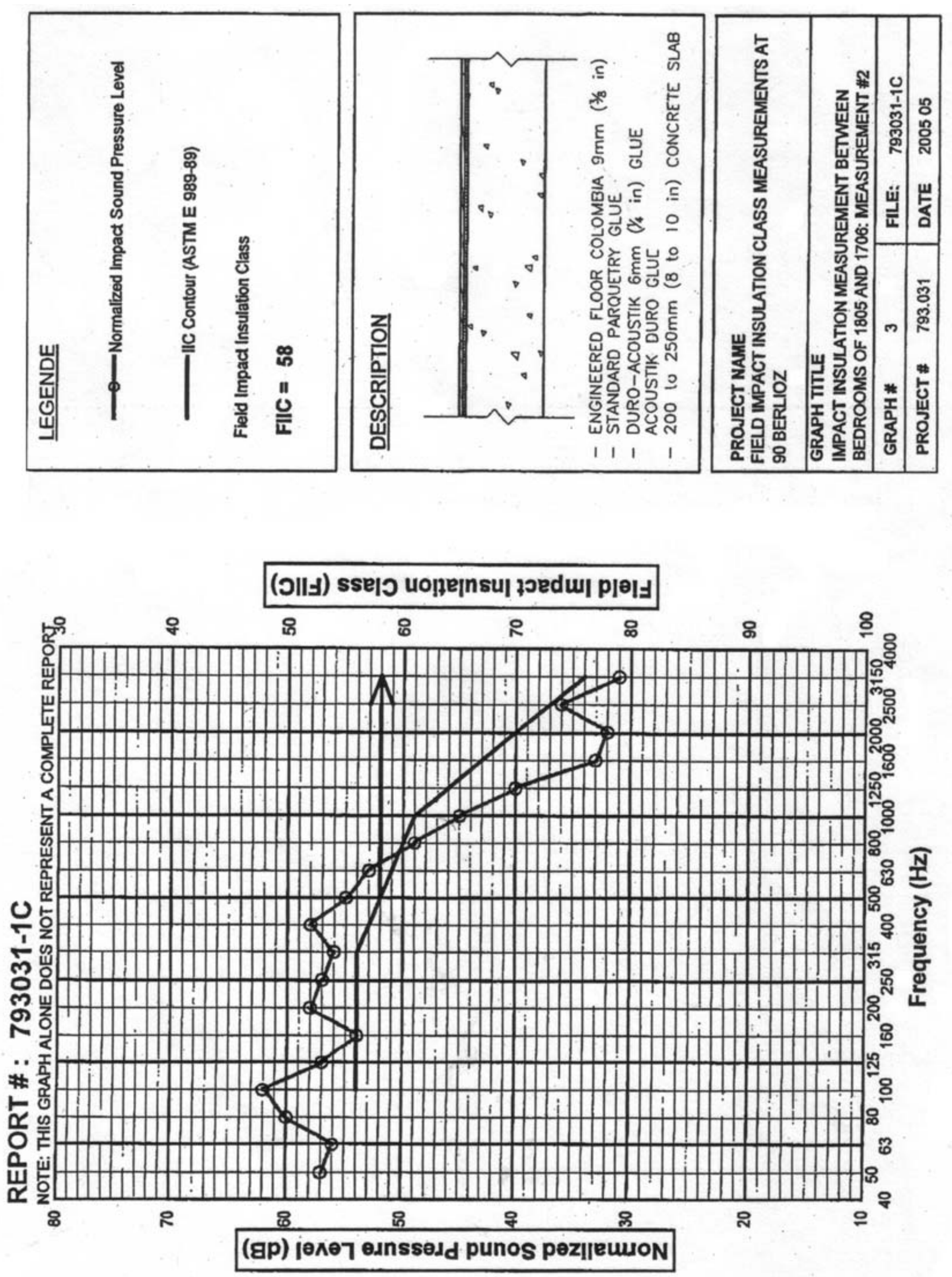

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REPORT NO: 793031-1C

FREQ. Hz	Lbg dB	ISPL dB	A sabins	10log(A/10)	NISPL dB	95% confidence limits	defIIC
50	40	56	† 11	1	57	± 5.4	n/a
63	38	55	† 11	1	56	± 2.1	n/a
80	35	59	† 13	1	60	± 6.0	n/a
100	30	61	† 13	1	62	± 3.9	8
125	32	56	† 12	1	57	± 2.4	3
160	35	53	† 11	0	54	± 2.4	0
200	29	58	† 11	1	58	± 3.0	4
250	28	56	† 15	2	57	± 3.0	3
315	24	54	† 15	2	56	± 2.5	2
400	22	55	† 16	2	58	± 2.5	5
500	18	53	† 16	2	55	± 3.0	3
630	16	52	† 14	2	53	± 2.0	2
800	14	47	† 14	2	49	± 1.6	0
1000	12	44	† 14	1	45	± 2.4	0
1250	10	39	† 12	1	40	± 2.2	0
1600	8	32	† 12	1	33	± 1.9	0
2000	8	31	† 13	1	32	± 2.0	0
2500	8	35	† 12	1	36	± 1.4	0
3150	8	29	† 14	1	31	± 0.4	0

FIIC =	58	Sum of the deficiences =	30
FIIC MAX =	61	Receiving room volume :	36 m3
FIIC MIN =	54	V^(2/3) = 10.8	

† Frequencies for which the sound absorption exceeds Vˆ(2/3)

FIELD IMPACT INSULATION CLASS MEASUREMENTS AT 90 BERLIOZ
IMPACT INSULATION MEASUREMENT BETWEEN MASTER BEDROOMS OF 1805 AND 1706: MEASUREMENT #2

793.031 Table 3 2005 05

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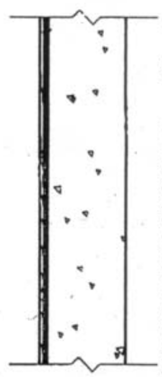
LEGENDE

- Normalized Impact Sound Pressure Level
- IIC Contour (ASTM E 989-89)

Field Impact Insulation Class

FIIC = 54

DESCRIPTION

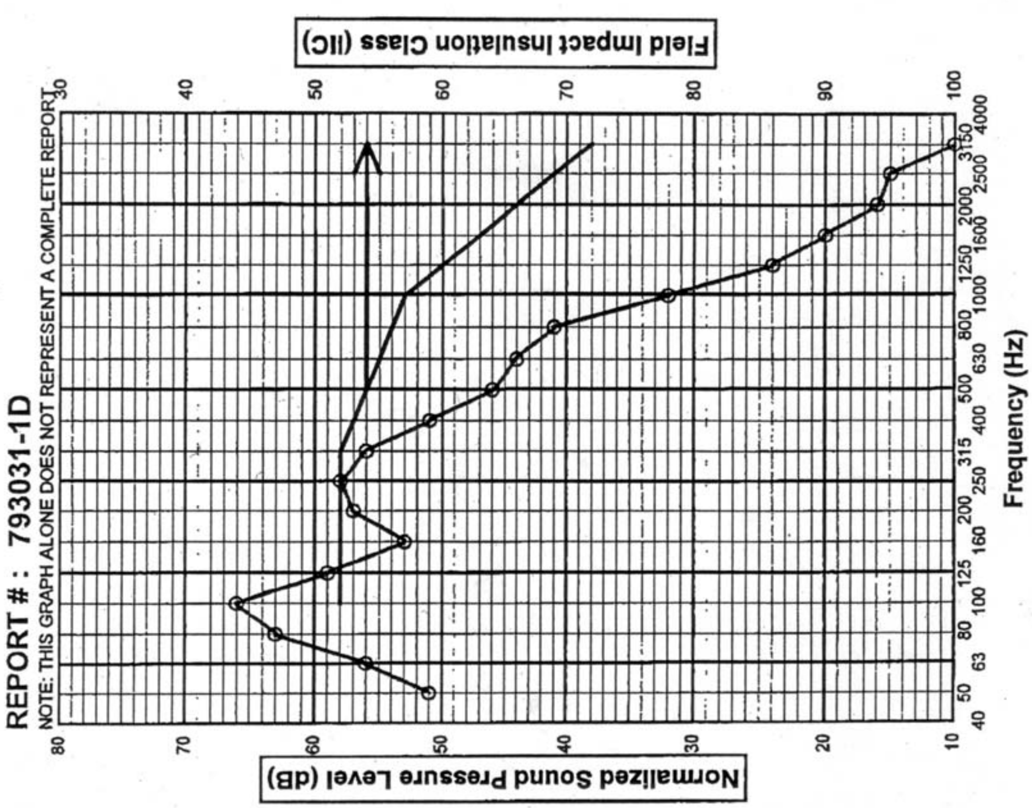


- ENGINEERED FLOOR COLOMBIA 9mm (⅜ in)
- STANDARD PARQUETRY GLUE
- DURO-ACOUSTIK 6mm (¼ in) GLUE
- STANDARD PARQUETRY GLUE
- MONOFIT 700 grams MEMBRANE
- ACOUSTIK DURO GLUE
- 200 to 250mm (8 to 10 in) CONCRETE SLAB

PROJECT NAME FIELD IMPACT INSULATION CLASS MEASUREMENTS AT 90 BERLIOZ			
GRAPH TITLE IMPACT INSULATION MEASUREMENT BETWEEN BEDROOMS OF 1805 AND 1706: MEASUREMENT #3			
GRAPH #	4	FILE:	793031-1D
PROJECT #	793.031	DATE	2005 05

REPORT # : 793031-1D

NOTE: THIS GRAPH ALONE DOES NOT REPRESENT A COMPLETE REPORT



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REPORT NO: 793031-1D

FREQ. Hz	Lbg dB	ISPL dB	A sabins	10log(A/10)	NISPL dB	95% confidence limits	defIIC
50	40	51	† 11	1	51	± 3.3	n/a
63	38	56	† 11	1	56	± 3.9	n/a
80	35	62	† 13	1	63	± 3.0	n/a
100	30	64	† 13	1	66	± 2.8	8
125	32	58	† 12	1	59	± 3.0	1
160	35	53	† 11	0	53	± 2.2	0
200	29	57	† 11	1	57	± 2.1	0
250	28	56	† 15	2	58	± 3.1	0
315	24	54	† 15	2	56	± 2.0	0
400	22	49	† 16	2	51	± 1.8	0
500	18	44	† 16	2	46	± 1.8	0
630	16	42	† 14	2	44	± 2.5	0
800	14	39	† 14	2	41	± 2.3	0
1000	12	30	† 14	1	32	± 2.3	0
1250	10	23	† 12	1	24	± 2.1	0
1600	8	19	† 12	1	20	± 2.2	0
2000	8	* 14	† 13	1	16	± 1.0	0
2500	8	* 14	† 12	1	15	± 1.0	0
3150	8	** 9	† 14	1	10	± 0.7	0

FIIC =	54	Sum of the deficiences =	9
FIIC MAX =	57	Receiving room volume :	36 m3
FIIC MIN =	52	V^(2/3) = 10.8	

* Lbg > (Lpr – 10dB) et Lbg < (Lpr – 5dB)
** Lbg > (Lpr – 5dB)
† Frequencies for which the sound absorption exceeds V^(2/3)

FIELD IMPACT INSULATION CLASS MEASUREMENTS AT 90 BERLIOZ
IMPACT INSULATION MEASUREMENT BETWEEN MASTER BEDROOMS OF 1805 AND 1706: MEASUREMENT #3

793.031 Table 4 2005.05

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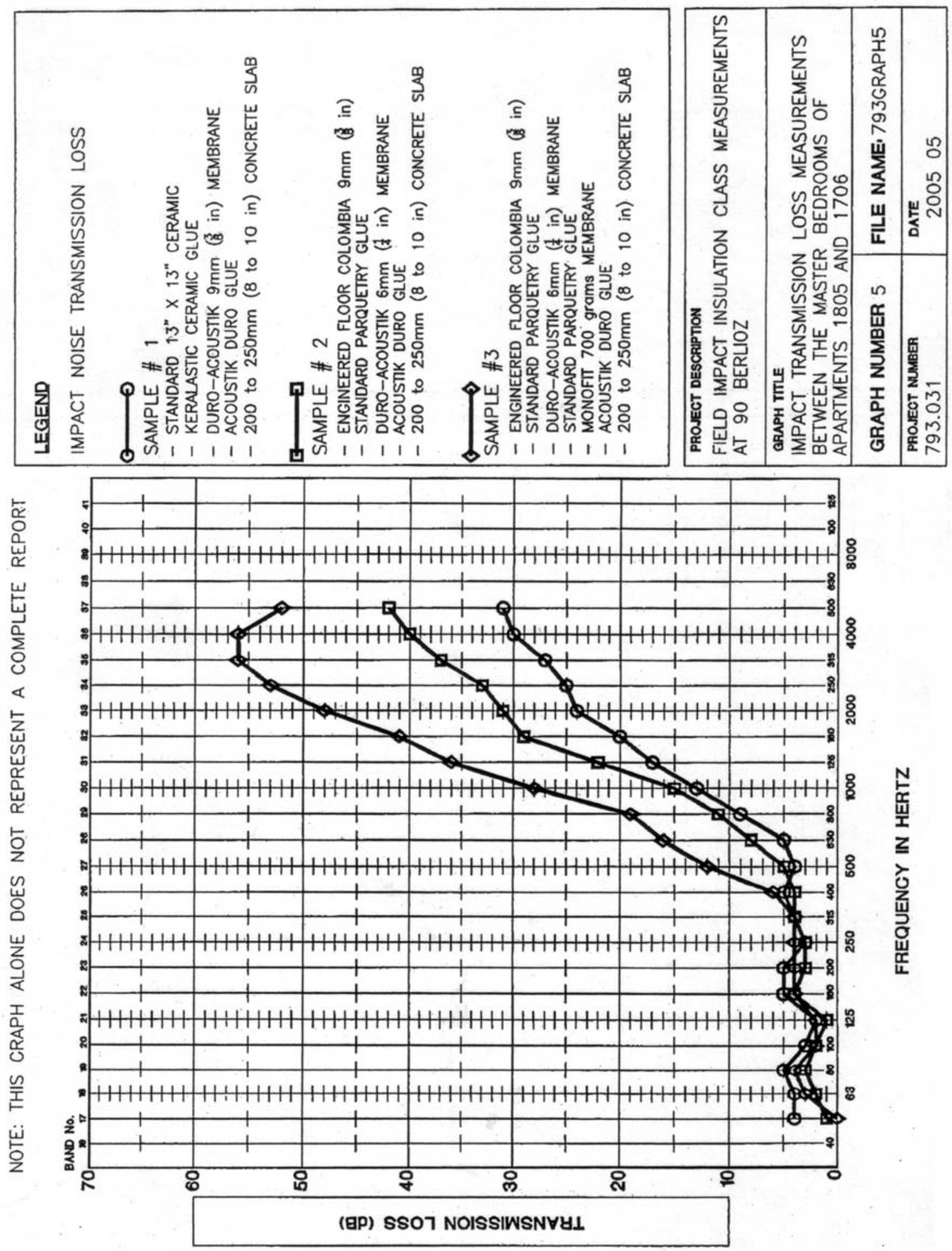

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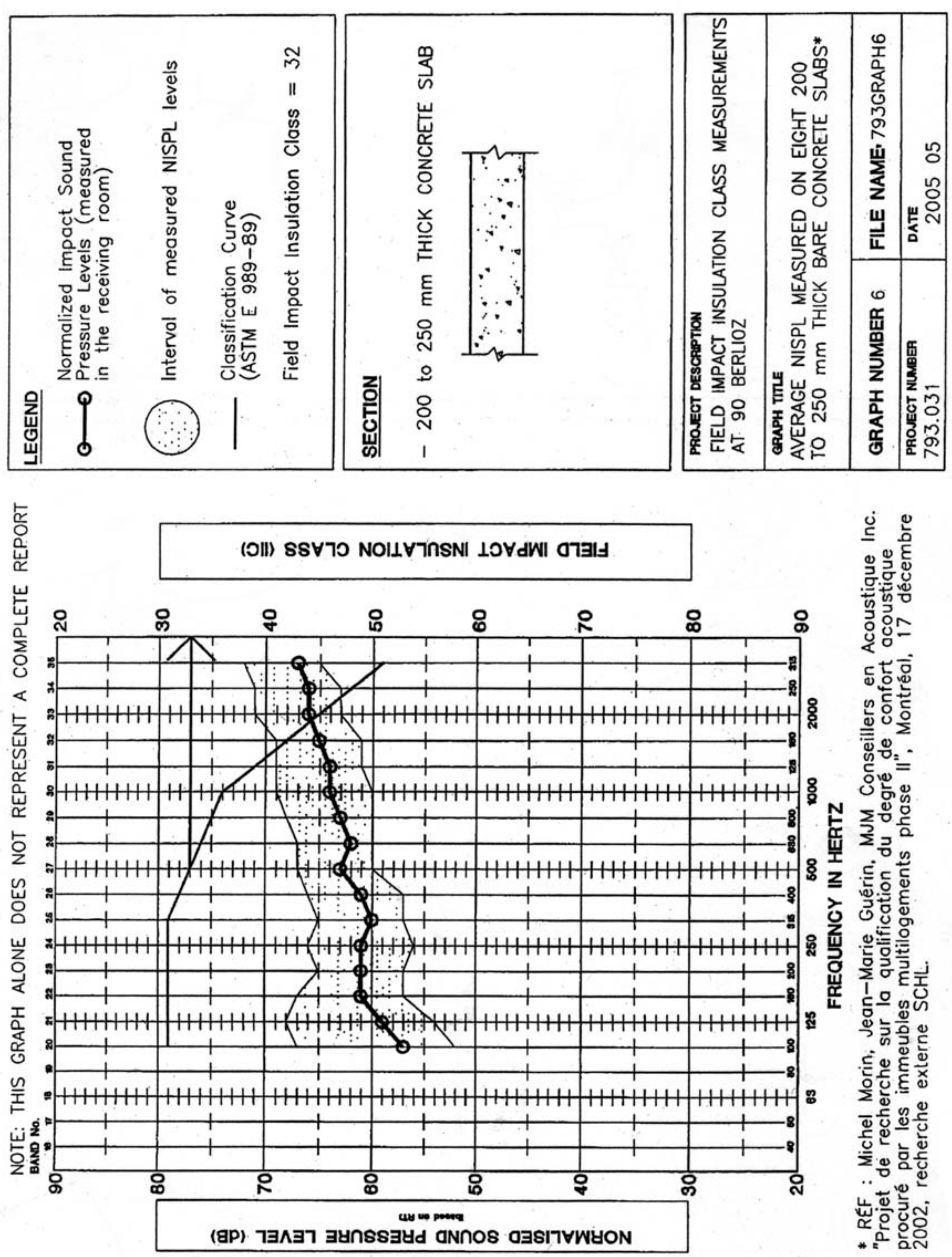

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APPENDIX I

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APPENDIX I

1.0 INSTRUMENTATION

Real-Time analyzer:	Larson-Davis model 2900
Tapping Machine:	Brüel & Kjær model 3204
Calibrator:	Brüel & Kjær model 4231
Sound Source:	Sonotechnique (115 dB re: 1 picowatt)

2.0 METHOD FOR MEASURING AND EVALUATING THE IMPACT SOUND INSULATION CLASS

The objective of the impact sound insulation tests described in this report is to determine the impact sound insulation provided by one or more floor coverings compared to the structure on which they are installed and the Impact Insulation Class (IIC) rating of such floor coverings. Unless otherwise specified, the procedure carried out during the impact noise insulation tests is in accordance to that specified in standards ISO 140/7-1978 and ASTM E 1007-90 entitled respectively *"Mesurage sur place de l'isolation des sols aux bruits de choc" and "Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures"*. The Impact Insulation Class (IIC) was evaluated using the standard ASTM E 989-89 entitled *"Standard Classification for Determination of Impact Insulation Class (IIC)"*. A summary of the procedure used to carryout the measurements documented in this report appears in the following paragraphs:

2.1 The dimensions of the ceramic tile floor covering sample were 4' - 4" by 4 '- 4" and those of the wood slats were 4' - 0" by 4 '- 0" and were installed on the concrete floor of the same room. Prior to testing, the tapping machine was adjusted so that the drop height of the hammers was 40 mm. The sound pressure levels resulting from the operation of the tapping machine and the reverberation times were measured in the receiving room located directly below the room where the floor samples had been installed. The sampled sound pressure levels are one-third octave band equivalent Sound Pressure Levels (Leq) integrated over a period of 20 seconds measured at six positions in the receiving room for two tapping machine positions on the floor covering (at the centre of the sample, at 90 degrees from one another), for a total of twelve impact sound pressure level samples for each flooring tested.

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NOTE: According to the ASTM-E 1007-90 standard, the floor samples tested should have covered the entire surface of the floor and the tapping machine should have been placed in four different positions instead of two. However, the conclusions of a recent research project conducted for the National Research Council of Canada[1], indicate that small 4' - 0" x 4' - 0" samples could be used to compare amongst them different floor coverings and to determine on a preliminary basis the nose reduction provided by a floor covering installed on a structure ("The data do support the hypothesis that small specimens can be used to rank toppings and for development work.").

2.2 The amount of sound absorption present in the receiving room is obtained by measuring the reverberation time within it. To do so, a broadband steady-state pink noise is generated inside the room. The noise is then abruptly cut-off and the resulting sound decay is measured using the LARSON-DAVIS 2900 analyzer for each third-octave band ranging from 50 to 3150 Hz. From the measured reverberation time and the volume of the receiving room, the amount of sound absorption present in the room is determined in metric sabins for each 1/3 octave band using the Sabine formula.

2.3 The ambient noise level when the tapping machine is not operating is also measured in the receiving room at the same positions as mentioned above. If necessary, ambient noise levels may be used to apply a correction to the Impact Sound Pressure Levels measured.

2.4 The Impact Sound Pressure Level values between 100 Hz and 3150 Hz are normalized as a function of 10 metric sabins and classified using the IIC classification curve. The Normalized Impact Sound Pressure Levels (NISPL) and the Field Impact Insulation Class (FIIC) are presented on **graphs 1 to 4 and tables 1 to 4** of this report; the 95% confidence limits associated with these measurements are also shown on the tables.

3.0 MEASUREMENT CONDITIONS AND PRECISION OF RESULTS

3.1 Flanking Paths

There were no obvious flanking paths present during the measurements.

3.2 Room volumes and sound absorption

The sound pressure level measurement procedure described in the ASTM E 1007-97 standard assumes a diffuse sound environment in the receiving room. According to the standard, for a room to constitute a diffuse environment:

a) The sound absorption of the room and V is the volume of the room.

$$A < V^{2/3}$$

where

A is the sound absorption of the room and V is the volume of the room.

1 A.C.C. Warnock, IRC, NRC Canada Internal Report IRC-IR-802 "Impact sound measurements on floors covered with small patches of resilient materials or floating assemblies" January 2000.

b) The volume of the receiving room as a function of the measured frequency must be at least:

100 Hz = Minimum volume of 60 m^3
125 Hz = Minimum volume of 40 m^3
160 Hz = Minimum volume of 25 m^3

- The sound absorption measured in the receiving room was greater than $V^{2/3}$ for the values indicated with a cross in the column ***A sabins* of tables 1 to 4.**
- The volume of the receiving room where the measurements were performed was greater than 25 m^3, but less than 40 m^3**.**

3.3 Ambient Noise

In accordance with the ASTM E 1007-97 standard, the impact noise levels measured in the receiving room for each third-octave band must be at least 10 dB greater than the ambient noise levels for each frequency between 100 Hz and 3150 Hz, which was not the case for measurements 2 to 5. The column ***ISPL* of tables 2 to 4** attached to this report indicated with the use of one or two asterisks the third-octave bands for which this requirement was not met. For these bands the following corrections were applied:

- When the sound pressure level measured in the receiving room is not superior to the ambient noise level by at least 5 dB (levels indicated by two asterisks), the standard requires that 2 dB be subtracted from the measured level in the receiving room**.**
- When sound pressure level measured in the receiving room is between 5 dB and 10 dB above the ambient noise level (levels indicated by one asterisk) a correction is applied according to a calculation specified in the ASTM E 1007 standard**.**

NOTE: These corrected sound pressure levels represent an estimation of the sound levels actually transmitted thought the test assembly into the receiving room.

3.4 Precision of Results

The 95% confidence limits[2] of the measured values are shown in **tables 1 to 4** of this report.

As indicated in **paragraph 3.2** above, the sound environment of the receiving room was not diffuse according to the ASTM E 1007-97 standard.

For one test (measurement number 4) the impact insulation level measurement is limited by the ambient noise level for the frequency bands indicated by an asterisk in column ***ISPL* of table 4.** However, as can be seen in column ***defIIC*** of the same table, the impact insulation class is not controlled by these frequencies; thus, a reduction of the ambient noise in the receiving room would not have allowed to measure a better impact insulation class rating.

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Since the floor coverings tested did not meet the minimum dimension requirements of ASTM E 1007-97 standard, the Field Impact Insulation Class ratings stated in this report could be used to compare the floor coverings tested amongst themselves, however they cannot be stated as FIIC ratings on the same basis as if the floor covering had had the required dimensions.

2 95% confidence limits: The interval for which there is a 95% chance that the transmission loss would fall into if subsequent measurements were to be made using the same procedure and the same measurement equipment at the same positions.

APPENDIX II

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APPENDIX II

GLOSSARY OF ACOUSTICAL TERMS

Airborne noise

Noise that arrives at a point of interest by propagation through the air.

Structure borne noise

Noise that arrives at a point of interest by propagation through a solid structure.

Background noise

Noise from all sources other than a particular sound that is of interest (e.g., other than the sound being measured, the speech or music being listened, etc.).

Ambient noise

All encompassing noise associated with a given environment, being usually a composite of sounds from many sources, near and far. No particular sound is dominant.

SPL Sound Pressure Level

Quantity used to describe the loudness of a sound. The sound pressure level is expressed in decibels and is measured with a sound level meter. For example, a conversation between two people inside and average-size room will produce an average "A" weighted sound pressure level of 50 to 55 dB.

Decibel

Sound Pressure Level (SPL) = $20 \times \log \left(\frac{\text{Pressure}}{20 \text{ micro Pa}} \right)$

Sound Power Level (SWL) = $10 \times \log \left(\frac{\text{Power}}{1 \text{ picowatt}} \right)$

NC: Noise Criteria

These criteria vary from NC 15 to NC 65. They are used to specify the noise levels not to be exceeded by mechanical systems in inhabited spaces in function of the use to which these spaces are destined. For example, the recommended noise level criterion for a television studio is NC 25.

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NR: Noise Reduction

The difference between the sound pressure level generated on one side of a partition and the sound pressure level transmitted through the partition, to the space on the other side of the partition. The nose reduction provided by a partition could be measured for each octave-band, one-third octave-band, or for all frequencies in the form of a single number.

	NR	=	LPs - LPr
where	NR	=	Noise Reduction
	LPs	=	Sound pressure level in the source room
	LPr	=	Sound pressure level in the receiving room (usually adjacent to the source room)

NNR: Normalized Noise Reduction

Noise Reduction normalized as a function of a 0.5 sec reverberation time in the receiving room.

	NNR	=	NR + 10 log (RT/0.5)
where	NNR	=	Normalized Noise Reduction
	NR	=	Noise Reduction
	RT	=	Reverberation time in the receiving room

TL: Sound Transmission Loss

The difference between the sound power level incident on a partition and that transmitted through that partition.

	TL	=	LW incident - LW transmitted
or	TL	=	NR + 10 log S/A
where:	TL	=	Sound Transmission Loss
	LW	=	Sound Power Level
	NR	=	Noise Reduction
	S	=	Surface area of the partition
	A	=	Acoustical absorption present in by the receiving room (in Sabins)

The standards for measuring Sound Transmission Loss are:

Laboratory measurements:	Field measurements:
ASTM E 90	ASTM E 336
ISO 140/1, /2, /3	ISO 140/4, /5

The Sound Transmission Loss (TL) of a partition can be obtained in laboratory conditions by following the guidelines given below, in conformance to the ASTM E 90 standard.

1) For each one-third-octave-band, measure the noise reduction (NR) provided by the partition.

2) Measure the quantity of acoustical absorption in the receiving room (where the sound power levels are transmitted).

3) Transform the values of noise reduction to sound transmission loss, using the correction 10*log (S/A).

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We Identify and S.T.O.P. Your Noise Problems

STC: Sound Transmission Class

A Single-number rating obtained by classifying the measured values of Sound Transmission Loss in accordance with ASTM Standard E 413, "Classification for Sound Rating Insulation", It provides a quick indication of the performance of a partition for certain common sound insulation problems.

To determine the Sound Transmission Class (STC), in conformance to ASTM E 413 (ISO 717/1), one must slide the STC contour along its Y-axis of the graph on which the transmission loss curve is plotted until the following conditions are met:

– The sum of the deviations below the STC contour does not exceed 32 dB.

– The deviations below the STC contour exceeds 8 dB.

Note: The ISO standard excludes this last requirement. One should indicate, however, in the test report, the frequencies at which a difference of 8 dB or more occurs between the noise reduction curve and the STC contour.

When the STC contour is positioned in such a way that these two requirements are satisfied, the sound transmission class can be obtained by reading the transmission loss value at the intersection of the STC contour at the frequency of 500 Hz. This value corresponds to the STC of the partition.

FSTC: Field Sound Transmission Class

A sound transmission rating obtained under "real-life" conditions. The general method to obtain this rating is almost the same as the method used in laboratory conditions. Procedures, however, have been added to take into account the differences between field conditions and laboratory conditions (e.g. flanking paths, absorption, modal distribution, etc.).

NIC: Noise Isolation Class

A rating similar to the Sound Transmission Class (STC), but instead of classifying the results of the transmission loss (TL) measurements, one classifies the results of the noise reduction (NR) measurements, according to the ASTM E 413 classification standards.

NNIC: Normalized Noise Isolation Class

The Normalized Noise Isolation class (NNIC) rating is obtained by applying the ASTM E 413 classification standards to the Normalized Noise Reduction (NNR) value measured on a partition.

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IIC: Impact Isolation Class

The methods to measure the degree of impact noise isolation provided by a floor/ceiling assembly, in laboratory conditions, are described in the ASTM E 492 or ISO 140/6 standards. For field measurements refer to ASTM E 1007 or ISO 140/7. The impacts for these measurements are produced by the "Standard Tapping Machine", an electrically operated mechanism consisting of five 0.5 kg hammers which fall regularly and freely on the floor surface from a 40 mm height at a rate of 10 impacts/sec. The sound pressure levels generated in the room directly below the floor/ceiling assembly undergoing testing are then measured, for each of the 16 third-octave-band between 100 Hz and 3150 Hz, and they are normalized according to:

- and absorption equal to 10 metric Sabins

or - a reverberation time of 0.5 sec (ISO 140/7)

The Normalized Impact Sound Pressure Levels (NISPL) are then plotted on a standard graph.

The IIC rating of the tested floor/ceiling assembly is determined by sliding the classification curve on the graph representing the normalized sound pressure levels, until the following conditions described in the ASTM E 898 (ISO 717/2) standards, are met:

– The sum of the deviations above the normalizing curve should not exceed 32 dB.

– The maximum deviation above the normalizing curve should not exceed 8 dB (see previous note on the classification of the isolation of airborne noise according to the ISO standard).

When the IIC contour is positioned in such a way that that these two requirements are satisfied, the Impact Isolation Class (IIC) can be obtained by reading the normalized impact sound pressure level at the intersection of the IIC contour and the frequency of 500 Hz and by subtracting this value from the number 110.