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Mr. Steve Kuklin
Senior Project Manager
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Subject: **Market Square Condominiums – Phase 1
Results of Acoustical Testing on 21 April 2006**

Dear Mr. Kuklin:

This report presents the results of sound isolation tests carried out at the Market Square condominiums on Friday, 21 April 2006. Two standardized tests were used - one characterizes the degree to which the party walls and floor/ceiling assemblies isolate airborne sounds (e.g., voices and the sounds from television sets or home entertainment systems) and the other characterizes the degree to which the floor/ceiling assemblies isolate impact sounds (e.g., heel taps on the floor and the scraping of chairs).

Description of Structure and Rooms Tested

The floor/ceiling assembly between living areas and bedrooms in vertically adjoining units comprises carpet or hardwood on 1½" thick lightweight concrete, on a 5/8" thick plywood sub-floor supported on 2" x 10" wood joists, with a layer of 5/8" thick Type 'X' gypsum board supported from the joists via resilient channels, and R-11 cavity insulation. **The hardwood floors were laid on Redupax Engineered Hardwood Underlayment.** The floor/ceiling assembly between bathrooms comprises ceramic tile on 1¼" minimum thickness lightweight concrete, on a layer of Enkasonic Sound Control Matting, on a 5/8" thick plywood sub-floor supported on 2" x 10" wood joists, with a layer of 5/8" thick Type 'X' gypsum board supported from the joists via resilient channels, and R-11 cavity insulation. The perimeters of the resiliently supported ceilings have been caulked with acoustical sealant.

The party walls comprise a double row of 2" x 4" studs at a minimum 1" spacing, with one layer of 5/8" thick Type 'X' gypsum board on each face of the wall and one layer of R-11 cavity insulation. The perimeters of the party walls have also been caulked with acoustical sealant.

The tests were carried out on Levels 5 and 6 of the building, where many of the units have now been completed. Tests were carried out in Units 623, 627, 523, and 525, which all have carpet in

the living rooms and bedrooms, and Unit 625, which has carpet in the bedroom, and a hardwood floor in the living room. All units have hardwood in the kitchens and ceramic tiles in the bathrooms.

Applicable Standards and Test Procedures

Per the California Building Code, Division II, Section 1208 – Sound Transmission Control, the minimum, field-tested sound insulation standard for unoccupied units in a multi-family residential structure is a Normalized Noise Isolation Class (NNIC) of 45. The NNIC value of a given wall or floor/ceiling assembly is determined through a standardized test and rating procedure established in ASTM Standards E-336 and E-413. The test consists of generating an amplified, broadband noise at a level of at least 100 dBA in the lower space (using a Brüel & Kjær Type 4224 or similar sound source), measuring the noise in the upper and lower spaces, and rating the difference by the standardized procedure. Because the units are unoccupied and thus unfurnished, the results are “normalized” or adjusted to a standard amount of acoustical absorption, to compensate for the lack of acoustical absorption in the receiving rooms.

Per the same section of Building Code, the minimum, field-tested impact sound insulation standard is a Field Impact Insulation Class (FIIC) of 45. The test and rating procedures for this acoustical measure are prescribed in ASTM Standards E-1007 and E-989, however, the California Code expressly stipulates that the test procedure deviate from the ASTM methodology by *not* normalizing the sound measurements to a standard amount of absorption in the receiving room. As such the test consists of “tapping” on the floor of the upper unit with a prescribed, standardized tapping machine (a Brüel & Kjær Type 3204 Tapping Machine), measuring the sound in the lower space, and rating the sound spectrum by the standardized procedure.

The sound samples were recorded using a Brüel & Kjær Type 2230 Precision Sound Level Meter fitted with a Brüel & Kjær One-Half-Inch Condenser Microphone Type 4155, in conjunction with a Sony Type M1 Digital Audio Tape Recorder. All instruments were checked for calibration before and after the measurements using a Brüel & Kjær Type 4230 Sound Level Calibrator; the signal generated by this calibrator is checked annually against a reference standard that is traceable to the National Institute of Standards and Technology (NIST) in Maryland. The samples were subsequently analyzed in our laboratory.

Results

The measured Normalized Noise Isolation Class (NNIC) and Field Impact Isolation Class (FIIC) ratings of representative party walls and floor/ceiling assemblies are summarized in Table 1 below. The corresponding one-third-octave spectra are presented in Figures 1 to 16.

The performance of all the party walls and floor/ceiling assemblies tested exceeds the minimum requirements of the California Building Code, Division II, Section 1208 – Sound Transmission Control.

Table 1 Summary of Test Results from Measurements on 4/21/06

Test Description	Measured NNIC	Measured FIIC	Minimum Code Requirement
Floor/ceiling between Unit 523 and 623 Living Rooms (carpet)	60	>74*	45
Floor/ceiling between Unit 525 and 625 Living Rooms (hardwood)	59	57	45
Floor/ceiling between Unit 523 and 623 Bedrooms (carpet)	59	>79*	45
Floor/ceiling between Unit 525 and 625 Bedrooms (carpet)	58	*	45
Floor/ceiling between Unit 523 and 623 Bathrooms (tile)	60	52	45
Floor/ceiling between Unit 525 and 625 Bathrooms (tile)	59	53	45
Wall between Unit 623 and 625 Bathrooms	64	Not Applicable	45
Wall between Unit 525 and 523 Bedrooms	52	Not Applicable	45
Wall between Unit 623 and 625 Bedrooms	56	Not Applicable	45
Wall between Unit 623 Living Room and Unit 621 Bedroom	60	Not Applicable	45
Wall between Unit 625 Living Room and Unit 627 Bedroom	60	Not Applicable	45

*Tapping machine was inaudible in receiving rooms during impact tests on carpeted floors.

The tapping machine was inaudible in the receiving rooms during the first two impact isolation tests carried out on the carpeted floors. Thus, it was not possible to accurately determine the FIIC values of these floors as the measured noise levels were dominated by ambient noise. For this reason, no further tests were carried out on carpeted floors. The FIIC values for the carpeted floors are indicated in Table 1 as being greater than the apparent values obtained from the test results. The actual FIIC values for the carpeted floors tested are likely to be at least 80.

Please let us know if you have any questions on this report, or if need any other units tested.

Very truly yours,

WILSON, IHRIG & ASSOCIATES, INC.



John C. Shearer
Associate Principal