

RESEARCH PROJECT ON PLUMBING NOISE IN MULTI-DWELLING BUILDINGS

MJM Acoustical Consultants Inc., Montreal, September 1990

Executive Summary

MJM ACOUSTICAL CONSULTANTS INC. has been retained by the CANADA MORTGAGE AND HOUSING CORPORATION to conduct a research project on the noise produced by plumbing installations in multi-dwelling buildings. The main objective of this study was to investigate the acoustical performance of different plumbing installations using materials and techniques readily available in the construction industry. Over two hundred seventy-three (273) tests were conducted in the acoustical laboratories of the NATIONAL RESEARCH COUNCIL OF CANADA (NRCC) in Ottawa under the supervision of Doctor A.C.C. Warnock and under the direction of Mr. Michel Morin.

The conclusions reached during this study are outlined in the paragraphs below.

- Using the ISO noise generator as a source, a variation of water pressure from 40 to 100 psi resulted in increases of 5, 7 and 9 dBA for pipe enclosure constructions of wood stud, metal stud, or studless partition respectively. However, when different faucets and water flows were used to generate plumbing noise, a 40 to 100 psi variation in water pressure resulted in an increase of plumbing noise level reaching 14 dBA. One must therefore conclude that in real installations, the water pressure is an important factor in the production of plumbing noise which should be taken into account during the design of plumbing system destined to multi-dwelling buildings.
- The results of the present study did not allow one to deduce that there would be a clear advantage to using pipes of a certain diameter in order to reduce the transmission of plumbing noise in multi-dwelling buildings.
- The material used to fabricate the pipes has an effect on the noise produced by the water flow. For supply pipes, using plastic instead of copper resulted in an approximate 5 to 10 dBA noise reduction when the pipes were fastened resiliently or rigidly to the wood studs. When considering waste pipes



however, copper and cast iron are preferred to plastic by providing a 5 to 10 dBA additional noise reduction.

- The pipe attachment seems to be the most important single factor which should be considered during the installation of pipes and plumbing enclosures. It was demonstrated that using a resilient material between the pipes and the structure of the enclosure containing them resulted in an attenuation of the plumbing noise which could reach 20 dBA. The technique which appeared to provide the best performance in decoupling the pipes from the pipe enclosure structure was to insert, between the pipes and the studs, a 3" long sleeve of Armaflex 1/2" thick; this material is a preformed closed cell elastomer pipe insulation manufactured by Armstrong. The resilient pipe fasteners manufactured by Ancon Inc. called "Acousto-plumb system" were also tested: the noise isolation performance of these fasteners was revealed to be equal or inferior to that provided by Armaflex sleeves depending on the diameter of the pipe.
- For waste pipes, the absence of contact with the pipe enclosure is also very important: the presence of contact between a pipe and the enclosure could lead to an increase of 6, 9, or 15 dBA depending whether the pipe was made out of cast iron, plastic, or copper.
- The maximum benefit obtained by inserting sound absorption in the plumbing enclosure was approximately 5 dBA. This maximum was reached using cellulose fibre insulation in a wall cavity where pipes were rigidly fastened to wood studs, and by placing batt insulation in the cavity of partitions built with wood or metal studs, with pipes installed resiliently using Armaflex sleeves.
- Doubling the mass of the drywall of a pipe enclosure resulted in an improvement of 3 to 4 dBA regardless of how the pipes were fastened to the studs of the enclosure.
- The use of resilient furrings increased the plumbing noise isolation provided by a wood stud enclosure by approximately 6 to 10 dBA. Furthermore, the resilient furrings seem to provide an additional protection by avoiding direct contact between the pipe and the drywall of the pipe enclosure.
- The presence of domestic low density styrene pipe insulation similar to Armaflex on the entire surface of the pipe, instead of 3" long sleeves at the attachment point, provided a significant noise reduction in the order of 6 to 8



dBa. In the case where the pipes were installed with rigid contacts to the studs, and then covered with insulation, the benefit of covering the pipe was in the order of 1 to 2 dBA, which is not significant.

- At maximum flow, a difference of only 3 dBA was noted between the average noise level generated by the 5 faucets tested; this difference increased to 9 dBA with 1/2 of the flow and to 14 dBA with 1/4 of the flow. The quietest faucets tested were that fabricated by Moen at maximum flow, and that fabricated by Waltec at 1/4 and 1/2 of the flow.
- The faucets measured in the study reacted differently to an increase of water pressure, at a given flow rate. The maximum increase in noise level noted for a variation of pressure between 40 to 100 psi is 14 dBA, ranking the water pressure among the more important parameters influencing the production of plumbing noise. Also worth noting, some of the faucets made more noise at 1/2 flow than at maximum flow.
- Based on the results of this study, it appears that the following partition composition should achieve the best cost versus plumbing noise reduction performance:

Wood stud construction

One layer of drywall mounted on resilient furrings on each side of 2" x 4" wood studs, with batt insulation to fill the stud cavity.

Metal stud partition

Two layers of drywall on each side of metal studs with batt insulation in the stud cavity.

Shaft wall

One layer of 5/8" drywall laminated to 1" core board.