inter•noise 96
25th Anniversary Congress – Liverpool

INCE: 12.1

NOISE REDUCTION USING INLET AND EXIT TREATMENT TO AN EXPANDED-METAL PRESS - A CASE STUDY

D M Eager (1) & H M Williamson (2)

(1) Faculty of Engineering, University of Technology, Sydney, Australia, (2) Acoustics and Vibration Centre, Australian Defence Force Academy, Australia

1. INTRODUCTION

This paper reports some aspects of the continued collaborative research undertaken by the Acoustics and Vibration Centre (AVC) and BHP Building Products (BHPBP). The overall aim of this research was to reduce noise within the sheet metal industry.

The particular research reported herein was to reduce the noise on a 120 tonne Emil Bender press which had been modified to manufacture expanded-metal mesh from flat metal plate feedstock. Previous research by Eager and Williamson [1-3] had reduced the Leq at the operators station by over 15 dB(A) on a similar machine.

2. EXPERIMENTAL PROCEDURE

Sound pressure level measurements were taken before and after the application of noise reduction techniques. A Brüel & Kjær 2231 sound level meter (SLM) was used to measure the sound pressure level. Five separate positions were monitored (see Figure 1), these being:

1. Feed-side (2.5 m rear of cutting-blade, offset to east of press);
2. East-side (1.0 m from edge of concrete foundation);
3. West-side (1.0 m from edge of concrete foundation);
4. Head of press (0.5 m above electric motor casing); and
5. Product-side (6.0 m front of cutting-blade, on centreline of feed).

The AC output of the SLM was connected to a Toshiba T3200SXC personal computer via a Boston Technology PC30DX analog to digital data acquisition card. The sampling rate was set at 15000, giving an upper frequency limit of 7.5 kHz. The sound pressure signal was A-weighted and time-frequency data was processed using Matlab® Version 4.1. All tests were conducted using 1200 mm wide x 3600 mm long x 5 mm thick mild steel feedstock manufacturing 3 x 3000 mm sheets of expanded-metal product. The feed-mechanism for this press was a roller-feed located 300 mm to the rear of the cutting-blade. Three sets of measurements were taken and averaged for each of the five locations.

3. RESULTS AND DISCUSSION

A preliminary noise survey verified that the noise generated by this paired-roller feed-mechanism was not as high as that previously measured on a similar machine with a pinch-grip feed-mechanism. The SPL varied less than 4 dB(A) with feedstock length at the operator station, compared to 8 dB(A) measured at the operator station on the previous expanded-metal press [1]. This was predicted as the roller feed-mechanism constrains the feedstock more rigidly and thus reduces the effects of the feedstock slapping the feedtable and guide-rollers. As a quick and inexpensive exercise, the bank of feedtable rollers adjacent to the cutting blade were covered with 80 duro hardness polyurethane. This had the effect of reducing the measured radiation for a full length sheet by approximately 1 dB(A).

Further improvements were desired, hence the following more extensive modifications were applied to the press and a second set of comprehensive noise measurements were taken:

1. The head of the press was covered and sealed with a removable acoustic enclosure which allowed the electric motor and gear box to breath.
2. All panels and doors were removed and replaced with stiffened doors and panels that had been lined with visco-elastic damping compound. All penetrations were eliminated or sealed.
3. The feed-side and product-side penetrations were sealed with retractable curtains made from heavy-duty clear vinyl sheeting.

Comprehensive sets of noise measurements were taken before and after the application of the above noise reduction modifications to the press. Figures 2-6 show that these modifications achieved reductions of between 1 and 7 dB(A) for various locations around the press and at different stages of the production process. The overall reductions were in the order of 4-6 dB(A) during the production cycle. As might be expected, the noise reduction measures were least effective on the feed-side, Figure 2, where feedstock vibration and feedstock slapping against the guide-rails and support-rollers was a major source of noise. In the other locations, Figures 3-6, the measures were much more effective since they either provided a noise barrier or helped in preventing noise generation from vibrating machinery panels. Comparing the east and west sides of the press it can be seen that the effects were not symmetrical, see Figures 3 and 4. Noise reduction was greater on the west side.

Noise level generally dropped with decreasing length of feedstock, but was noted to rise during the last 300 mm of cutting. This rise was primarily due to reduced constraint as the feedstock was no longer supported/bridged between the feedtable and the pinch rollers. A hit-by-hit analysis revealed that the cutting noise was by far the most dominant noise source, particularly on the feed-side of the press.

4. CONCLUSIONS

Noise reduction measures were applied to a SP250 120 tonne expanded-metal press. The techniques employed were traditional and not of a *high-tech* or innovative nature. They involved the treatment of the inlet, exit, head, all surfaces and penetrations of the press. A noise reduction of between 4-6 dB(A) was achieved under normal production conditions for a standard product. It was noted that additional feedstock constraint has the potential to remove an additional 7 dB(A) at the operator station.

Future work will be directed toward modifying the initial design to incorporate an *operator friendly* mechanism for opening and closing the inlet and exit acoustic doors; and the incorporation of additional feedstock constraint. It was concluded that further work should incorporate a two-way education process between the operators and the design team to ensure the operators get a useable solution and the operator is schooled as to the long-term benefits of a noise reduction policy.

5. ACKNOWLEDGMENTS

The authors would like to acknowledge the financial support of Worksafe Australia, Australian Postgraduate Research (Industry) scheme and BHP Building Products. In particular we would like to thank Max Boyley and Geoff Manzi from BHPBP and Colin Speakman from the AVC who were all involved in this noise reduction project.

6. REFERENCES

1. Eager D.M. and Williamson H.M. Noise reduction measures applied to an expanded-metal press. *IEAust. Mech 94 - International Mechanical Engineering Congress and Exhibition*, 219-223, Perth, Australia, May 1994.
2. Eager D.M., Wang W.Y. and Williamson H.M. The identification of noise sources on an expanded-metal press using time-frequency and time domain techniques. *AAS 1994 Annual Conference*, 95-102, Canberra, Australia, November 1994.
3. Eager D.M. and Williamson H.M. Operational and technical aspects of noise reduction in expanded-metal production processes. National Occupational Health and Safety Commission - Occupational Injury Symposium, Sydney, Australia, February 1996.

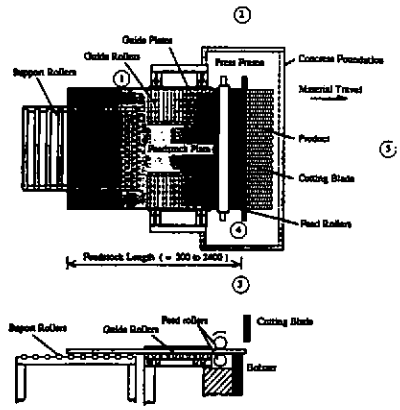

Figure 1: Measurement configuration

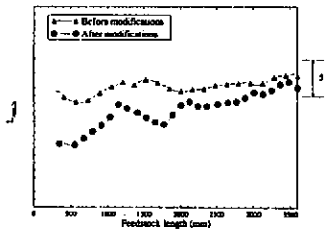

Figure 2: SPL vs Feedstock length
Feed-side (2.5 m rear cutting-blade)

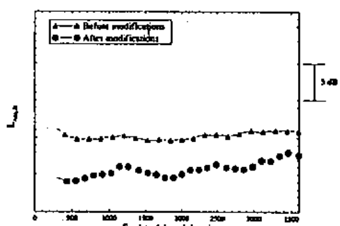

Figure 3: SPL vs Feedstock length
East-side (1.0 m from foundation edge)

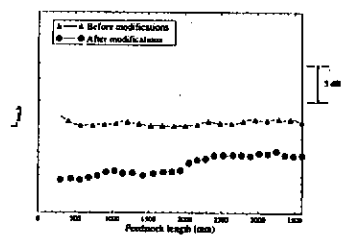

Figure 4: SPL vs Feedstock length
West-side (1.0 from foundation edge)

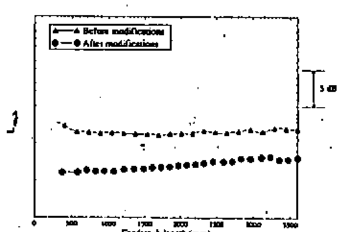

Figure 5: SPL vs Feedstock length
Head of press (0.5 m above motor)

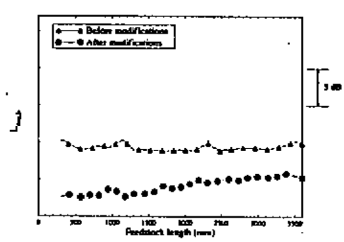

Figure 6: SPL vs Feedstock length
Product-side (6.0 m front cutting-blade)