

Notes and comments

The economic valuation of train horn noise: A US case study

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Abstract

This paper provides a property value-based estimate of the dollar cost of train horn noise in a residential neighborhood in a small town, Wormleysburg, Pennsylvania, US. Residential property values are found to decrease by about \$4800, or 4.1%, per 10 db of added noise exposure, for an aggregate total of \$4,088,799 in 2004 dollars. The primary study was supplemented with information from a neighborhood survey. Dollar value estimates of train horn costs could prove useful in facilitating balanced benefit-cost analyses of horn noise abatement policies such as quiet zones, wayside horns, underpasses, or street closures.

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1. Introduction

The elimination of train horn noise is the primary benefit to be derived from the establishment of quiet zones for railroads. While the long period of experimentation with quiet zones led to a great deal of information about their effects on safety (Federal Railroad Administration, 1995, 2000; Zador, 2003), the benefits of the elimination of train horn noise have received very little attention beyond studies of residents' annoyance levels (Gent et al., 1998). Therefore this paper may begin to fill a need in the analysis of train horn noise and quiet zone policy decisions.

This paper is derived from a more general benefit-cost analysis of a proposed highway-rail underpass in a residential neighborhood in Wormleysburg, Pennsylvania, a small town directly across the Susquehanna River from Harrisburg. Wormleysburg is divided into a narrow 100 year flood plain near the river and a more elevated section to the west, and into northern and southern sections by a local limited access highway. The rail tracks are somewhat elevated relative to the riverfront neighborhood but are well below the crest of the bluff that leads to the western side of the town. Based on a survey of Wormleysburg residents, the riverfront area is highly impacted by train horn and other noise, while most of the higher elevation area is not.

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2. Resident survey

While the primary estimate of the dollar cost of train horns is based on an analysis of property values presented later, the study also benefits from the findings of a survey distributed to Wormleysburg residents in the summer of 2005. This survey asked about perceived loudness and annoyance levels from train horns and train movement, the impact of horn noise on daily activities such as sleep and outdoor activity, and a hypothetical question regarding residents' willingness to pay to eliminate train horn noise. Identifying variables included location, household size, and tenure. Just over 100 questionnaires were returned, the majority of which were from the northern riverfront and uphill neighborhoods in Wormleysburg closest to the rail crossing. The results are consistent with expectations. Annoyance is closely related to perceived train horn volume. Annoyance levels are far higher in the riverfront north area nearest to the rail crossing, higher for train horns than for train movement, higher for those with fewer years of residence, and higher at night than during the day.

The Wormleysburg resident survey also included the following:

“This question is not about a real person or a real situation and does not mean you will actually have to pay to stop horn noise. Your best guess will be perfectly acceptable. If you could pay some person or group to stop all train horns, what is the most you would be willing to pay per month?”

While the question seems to invite high responses, response biases existed in both directions. At least half a dozen respondents with high or extremely high levels of annoyance offered a zero payment response. The majority of these few respondents added notes saying that while they were annoyed by horns, someone else should pay for their elimination. On the other hand, two respondents offered dubiously high valuations of \$500 and \$1000 per month, possibly in an attempt to influence the results. Eliminating both groups reduced the average monthly willingness to pay from \$30.18 to \$13.06 per household, a more reliable figure. Because statistical tests found no correlation between family size and respondents' willingness to pay, these responses were interpreted as individual valuations. Therefore, household values were calculated by multiplying the willingness to pay by the number of adults in the household.

Selected annoyance values and monthly willingness to pay by location are presented in Table 1. The positive relationship between respondents' willingness to pay and train horn annoyance levels, measured on a 5 point scale, is clear. The correlations between willingness to pay and annoyance were 0.612 for daytime annoyance levels, 0.637 for evening and nighttime annoyance levels, and 0.671 for frequency of sleep loss. Correlations between willingness to pay and loudness were 0.590 for daytime and 0.600 for night time. All were highly significant. Average monthly household willingness to pay varied from \$66.75 for those with at least one annoyance level of 5 (extremely annoying) to \$0 for those households with a highest annoyance level of 1 (not annoying).

Because of the possible upward bias in the survey results, no aggregate dollar value is reported here. The important finding from the survey is the strong correlation between perceived noise volume, annoyance, willingness to pay, and proximity to the Wormleysburg railroad crossing. This information helps to support the indirect sound figures used in the following property value estimate of horn noise costs.

Table 1
Monthly willingness to pay to eliminate train horns

Area	Number of responses	Average night noise rating (5 point scale)	Average night time annoyance rating (5 point scale)	Household willingness to pay
Riverfront north	17	4.00	4.06	\$55.29
Riverfront south	8	2.94	3.00	21.25
Uphill north	29	2.56	2.23	5.21
Uphill south	9	3.50	3.58	30.00
Total	63	3.21	3.12	\$24.30

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