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The Effectiveness of Back-Up Alarms in Preventing Backing Vehicle-Pedestrian Accidents

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Abstract: This paper provides an update to previous articles on the distribution of pedestrian-backing vehicles using the OSHA Accident database, as well as responses to FOIA requests for additional detail on these accidents. The database contains summaries of fatality & catastrophe investigations conducted by OSHA. Two previous articles (Purswell & Purswell, 2001), (Purswell & Purswell, 2010) summarized and categorized the records that were identified as related to whether the vehicle had a backup alarm or not, and if it did, whether it was operating at the time of the accident. FOIA requests were made for the inspection records where the summaries in the database contained insufficient detail to correctly classify accidents. Records were also classified by the employer NAICS code (business type). There was some difficulty in obtaining the records for this article due to pandemic-related restrictions on regional OSHA offices accessing the requested records. Of the 93 records of accidents, we obtained sufficient detail from the summaries or the Inspection Report obtained through the FOIA to completely classify only 33 of the records.

Keywords*:* Backup alarm effectiveness, Backing up, Audibility.

1. Introduction

Workers continue to be injured or killed in pedestrian-backing vehicle accidents and OSHA is required by law to investigate fatal workplace accidents. As with other fatal workplace accidents, it makes a brief summary of the investigations available on its Fatality and Catastrophe Investigation Search webpage, accessible through it's "Data & Statistics" webpage. In addition, publicly-disclosable information from an investigation can be requested by filing a Freedom of Information Act (FOIA) request with the appropriate regional OSHA office. The Fatality and Catastrophe Investigation Search page permits users to search the database by specifying different characteristics, but also includes an alphabetized grouping of accident types by keyword, among them "backup alarm." Individual records may have and often do have multiple associated keywords.

2. Method

Records entered into the database since the 2010 article with the keyword "backup alarm" were identified. Accident summaries for these (online) records were then downloaded and reviewed. Using the inspection numbers from these records, FOIA requests were made to the appropriate Area Offices of OSHA. For those accidents where sufficient detail was included in the accident summaries, notations were made of when the subject vehicle had an installed backup alarm, whether the alarm, if present were still operable, and whether the alarm could be heard above the ambient noise level.

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In many cases, these details on the backup alarm status were not included in the summary but were available in the materials received from OSHA in response to the FOIA request. As noted above, the Coronavirus pandemic resulted in the investigation files for some of the records being unavailable due to the inability of OSHA Area Offices to access archived records. It bears mentioning that the way in which OSHA accepts and responds to FOIA requests for its investigation files has changed across time. For the 2001 article, OSHA accepted FOIA requests through its national office and apparently did not have a policy in which older investigations were discarded. By 2010, the process had changed so that OSHA accepted FOIA requests only at the Area Office which conducted the investigation and had also initiated a policy of destroying or discarding records older than a certain number of years. The records retention policy appears to remain in effect, as several of the older (5+ years) were no longer available.

3. Results

Table 1 shows the OSHA-assigned Inspection Number, the NAICS code noted for the employer, and then three characteristics relating to backup alarm status: whether the vehicle had a backup alarm installed, whether the backup alarm was still functional, and whether the backup alarm was audible above the ambient noise. The inspection numbers are hyperlinked to the records in the Accident database to facilitate easy access to each record for the reader. As the reader will note, more than two thirds of the records were unclear on these questions regarding the status of the backup alarm, if it was installed. With the two prior articles relating to the status of any installed backup alarm, additional detail provided in the FOIA responses was used to definitively characterize nearly all the records. As noted above, pandemic-related restrictions on accessing the investigation files meant that those details were not available. A number of records were suggestive as to whether or not the vehicle had a still-functioning backup alarm installed, but unless the record was unambiguous, the record was left as a question mark in the table. One of the records coded with the keyword "Backup Alarm"(1268149.015) appears to have been miscoded. The accident summary indicated that a worker fell through a light fixture opening and fractured his back, so this record is not included in Table 1.

The records appear in the OSHA database in reverse order by date (most recent records first). The table below has these records sorted by NAICS code, as the authors thought it was more helpful to see patterns within industries. The Bureau of Labor Statistics has a webpage at https://www.bls.gov/iag/tgs/iag_index_naics.htm that describes the major divisions. As Table 1 below shows, accidents involving pedestrians and backing vehicle occurred most in the following sectors:

Construction (beginning with "23"), Transportation & Warehousing, and Administrative and Support and Waste Management and Remediation Services (beginning with "48" or "49"), and Manufacturing (beginning with "31", "32" or "33").

Table 1. "Backup Alarm"- Coded Accidents with NAICS codes.

Inspection number	NAICS	Installed	Functional	Audible
1234207.015	111219	?	?	?
1220935.015	115115	?	?	?
314792714	115115	?	?	?
952950.015	211111	?	?	?
1450206.015	212321	Y	N	N
1010713.015	213111	?	?	?
314779422	213112	N	N	N
1311118.015	236210	?	?	?
1041522.015	236220	?	?	?

315351999	236220	Y	Y	Y
1507266.015	236220	?	?	?
1470945.015	237110	?	?	?

Table 1. "Backup Alarm"- Coded Accidents with NAICS codes (cont.).

Inspection number	NAICS	Installed	Functional	Audible
1254355.015	237110	Y	Y	Y
1251803.015	237120	?	?	?
1487089.015	237310	Y	N	N
1433468.015	237310	Y	N	N
1404317.015	237310	?	?	?
1317804.015	237310	Y	Y	Y
1244615.015	237310	?	?	?
1149874.015	237310	?	?	?
1127738.015	237310	?	?	?
1086879.015	237310	Y	Y	Y
1069187.015	237310	?	?	?
951712.015	237310	?	?	?
944912.015	237310	?	?	?
109180596	237310	?	?	?
315561324	237310	Y	Y	Y
315364323	237310	?	?	?
315559328	237310	?	?	?
314928094	237310	Y	Y	Y
314314584	237310	?	?	?
314713579	237310	Y	N	N
1257898.015	237310	?	?	?
1144721.015	237990	?	?	?
942901.015	238110	?	?	?
1214962.015	238130	Y	Y	Y

Table 1. "Backup Alarm"- Coded Accidents with NAICS codes (cont).

Inspection Number	NAICS	Installed	Functional	Audible
1132879.015	238210	?	?	?
312559206	238210	Y	Y	Y
1272750.015	238910	Y	N	N
1225205.015	238910	?	?	?
1206463.015	238910	?	?	?
1170895.015	238910	?	?	?
1115178.015	238910	?	?	?
1059664.015	238910	?	?	?
1018470.015	238910	?	?	?
313167983	238910	Y	Y	Y
1059664.015	238910	Y	N	N
1236033.015	238990	?	?	?
315068148	311421	?	?	?
1256371.015	311423	?	?	?
315738245	311612	?	?	?
1034329.015	311812	?	?	?
1252927.015	312111	?	?	?
300873080	327390	Y	Y	N
1102553.015	332722	?	?	?
1085029.015	332999	Y	N	N
1230927.015	333412	?	?	?
1190399.015	337110	?	?	?
1213441.015	337214	?	?	?*
315001909	423930	N	N	N
1306371.015	424130	?	?	?
667099.015	424910	N	N	N
1229118.015	444110	?	?	?
315090928	444110	Y	N	N
315090928	444110	Y	N	N

Table 1. "Backup Alarm"- Coded Accidents with NAICS codes (cont.).

Inspection number	NAICS	Installed	Functional	Audible
1215769.015	444190	Y	N	N
1003479.015	484110	?	?	?
314041146	484110	N	N	N
1003479.015	484110	N	N	N
1215380.015	484121	?	?	?
984978.015	484121	?	?	?
36156.015	484121	N	N	N
1278242.015	484220	?	?	?
1186595.015	484220	?	?	?
1132841.015	484220	?	?	?
1254188.015	484220	?	?	?
1239048.015	493110	?	?	?
315773820	493110	N	N	N
1202447.015	493190	Y	Y	Y
1390372.015	561730	?	?	?
1318380.015	561730	?	?	?
1189579.015	561730	N	N	N
1059185.015	561730	Y	N	N
992546.015	561730	?	?	?
1132825.015	561990	?	?	?
1300395.015	562111	?	?	?
1269107.015	562111	?	?	?
314721481	562219	N	N	N
1011196.015	562998	?	?	?
317011997	921190	Y	Y	Y

4. Discussion

As with the previous two articles discussing the records of accidents where OSHA coded a record as related to backup alarms, the data showed accidents occurring with vehicles which had been sold with a backup alarm, but only six such incidents where an installed backup alarm ceased functioning. There were twelve records for which the summary or the inspection report

indicated that the backup alarm was installed, still functioning, and audible at the time of the accident out of the total thirty-three records for which that information could be identified from the records. This finding that approximately a third of the accidents occurred with a sounding backup alarm is regrettably similar to the ratio reported in the 2001 article. The problem of habituation to the auditory alarm remains a problem. Backup cameras to assist the vehicle operator have improved significantly in quality and availability in the last 20 years, but vehicle vibration causing camera (and image) shake is a continuing problem, especially in construction environments where vehicles may have to traverse rough terrain. The information contained in the OSHA Accident Database does not provide sufficient detail to perform a formal Root Cause Analysis of why each pedestrian-backing vehicle accident occurred, but the reader is referred to the 2001 article below for possible reasons that backup alarms can and do fail to prevent many such incidents, as well as the advantages and disadvantages of other technologies to reduce the incidence of these adverse events.

The use of on-the-ground spotters to direct movements remains a good option, but of course it is critical that the spotter not be assigned other concurrent tasks which distract the spotter. It should be noted that OSHA construction regulations (OSHA, 1998) continue to require either an "audible" backup alarm or on-the-ground spotter. In a 2004 letter of interpretation, OSHA noted that the requirements for backup alarms for vehicles in construction were derived from Army Corps of Engineers standards in 1971. While not explicitly stated, the requirement does not appear to have been based on any empirical studies demonstrating the effectiveness in preventing pedestrian-backing vehicle accidents.

5. References

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