

# The Distribution of Pedestrian-Backing Vehicle Accidents by Backup Alarm Status and Vehicle Type

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## ABSTRACT

The purpose of the current study was to update and expand upon an earlier study performed to review and categorize OSHA accident investigation records for pedestrian-backing vehicle accidents according to whether the backing vehicle had a backup alarm and whether the alarm was installed and functioning as intended. The current study includes an analysis of additional records as well as the business type (SIC code) of the employer. Incidents where a backup alarm was installed and operational, but possibly not audible above the background noise were also noted. The backing vehicle was also classified into one of three categories: industrial lift truck (forklift), some type of construction equipment, or a street vehicle such as a tractor trailer or straight truck. As with the previous analysis, OSHA accident investigation records provided the data for this analysis.

**Keywords:** Backup alarms, Backup alarm Effectiveness, Audibility

## INTRODUCTION

OSHA regulations require that OSHA investigate incidents involving a worker fatality and one in which 3 or more employees are hospitalized (29 CFR 1904.39). OSHA regulations *for construction* (29 CFR 1926) require that vehicles with an obstructed rear view which are being backed up to have either an audible automatic alarm or an on the ground spotter directing the movement (29 CFR 1926.601). To date, OSHA has not required industrial lift trucks or over-the-road trucks to have automatic backup alarms. In an earlier study, (Purswell & Purswell, 2001) reviewed the distribution of pedestrian-backing vehicle accidents contained in the OSHA Accident database (<http://www.osha.gov/pls/imis/accidentsearch.html>) identified by several specific search terms. More recently, OSHA has made available accident investigation summaries by keyword, one of which includes “backup alarms.” From a review of these OSHA-categorized backup alarm-related cases, additional records involving pedestrian-backing vehicle accidents were identified and reviewed. In some of these instances, the investigation summary available from the OSHA website contained inadequate detail to discern what the status of the backup alarm (if any) of the backing vehicle was. Consequently, FOIA requests for the investigation files were filed with the particular OSHA offices that conducted the investigations. In some instances, FOIA responses clarified the backup alarm status of a backing vehicle. In a number of cases, the accident files were no longer available. In some cases, the FOIA response was still not determinative. Of the 348 accident files reviewed, 120 of them remained uncategorized as to the backup alarm status of the backing vehicle.

The current study expands upon the earlier study in several ways. First, due to a change in the OSHA website, more records of pedestrian-backing vehicle accidents were identified. In addition, records made available by OSHA since the earlier analysis have been incorporated. Finally, additional information has been extracted from each record reviewed. Specifically, the type of industry and the type of backing vehicle has been noted from the accident summaries. This information has been entered into a spreadsheet that contains a hyperlink to the accident summary, the SIC code, and the vehicle description from the accident summary. In instances involving multiple employers, the SIC code for the employer of the pedestrian was noted.

The records were categorized into five specific accident scenarios, and one additional category if the available records did not have enough information to otherwise classify the accident. The categories were as follows and the number of records corresponding to each category are shown below:

- No automatic audible backup alarm installed on the vehicle, (109).
- Automatic audible backup alarm installed, but no longer functioning, (85).
- Automatic audible backup alarm installed and functioning, (35).

- Automatic audible backup alarm installed and functioning, but (likely) inaudible above the background noise, (6).
- Inadequate information to determine the status of any automatic audible backup alarm, (121).

Due to space constraints, the 120 records of pedestrian-backing vehicle accidents which remained unclassified are not included here, but may be obtained by contacting the authors. The vehicle description used in the OSHA Accident Summary are adopted here. Vehicle descriptions which include a product manufacturer or brand name are included here as well. However, most records did not include such information.

## ACCIDENT CATEGORIES

The following six tables contain the hyperlinked OSHA inspection numbers (so readers may easily access and review the records themselves) grouped by the four categories. The accident summaries may also be accessed by the inspection number at <http://www.osha.gov/pls/imis/InspectionNr.html>.

**Table 1:** No backup alarm installed on vehicle.

<b>Inspection Number</b>	<b>SIC</b>	<b>Vehicle Type</b>
<a href="#">119691715</a>	<a href="#">1711</a>	Truck
<a href="#">113172738</a>	<a href="#">1794</a>	Dump truck
<a href="#">306831793</a>	<a href="#">1611</a>	Dump truck
<a href="#">300782471</a>	<a href="#">2511</a>	tractor trailer
<a href="#">306096785</a>	<a href="#">1731</a>	tractor trailer
<a href="#">300779659</a>	<a href="#">7699</a>	tractor trailer
<a href="#">303688196</a>	<a href="#">1381</a>	winch truck
<a href="#">303647481</a>	<a href="#">1623</a>	aerial lift truck
<a href="#">125561712</a>	<a href="#">0171</a>	truck
<a href="#">119689966</a>	<a href="#">1611</a>	dump truck
<a href="#">303376925</a>	<a href="#">4151</a>	school bus
<a href="#">303933808</a>	<a href="#">1541</a>	telescopic forklift
<a href="#">304266299</a>	<a href="#">4213</a>	tractor trailer
<a href="#">304266216</a>	<a href="#">4213</a>	tractor trailer
<a href="#">304266208</a>	<a href="#">2952</a>	tractor trailer
<a href="#">304413438</a>	<a href="#">1771</a>	asphalt truck
<a href="#">303370944</a>	<a href="#">3069</a>	truck
<a href="#">126138692</a>	<a href="#">4953</a>	pickup truck
<a href="#">301043188</a>	<a href="#">1794</a>	dump truck
<a href="#">302297668</a>	<a href="#">5181</a>	electric forklift
<a href="#">302337977</a>	<a href="#">5712</a>	garbage truck

**Table 1:** No backup alarm installed on vehicle.

<a href="#">126793868</a>	<a href="#">1611</a>	pickup truck
<a href="#">102788908</a>	<a href="#">1611</a>	tractor trailer
<a href="#">301220026</a>	<a href="#">2436</a>	dump truck
<a href="#">122164585</a>	<a href="#">1611</a>	dump truck
<a href="#">126484088</a>	<a href="#">7363</a>	tractor trailer
<a href="#">126636158</a>	<a href="#">3443</a>	truck tractor
<a href="#">109651000</a>	<a href="#">8711</a>	dump truck
<a href="#">109168450</a>	<a href="#">1622</a>	dump truck
<a href="#">119743086</a>	<a href="#">4731</a>	delivery truck
<a href="#">107713133</a>	<a href="#">1781</a>	water truck
<a href="#">109295634</a>	<a href="#">4215</a>	tractor trailer
<a href="#">108801895</a>	<a href="#">1611</a>	bulldozer
<a href="#">123659039</a>	<a href="#">1611</a>	dump truck
<a href="#">103520557</a>	<a href="#">4231</a>	truck tractor
<a href="#">101390169</a>	<a href="#">1611</a>	scraper
<a href="#">102929528</a>	<a href="#">4212</a>	delivery truck
<a href="#">107302838</a>	<a href="#">1611</a>	transfer truck
<a href="#">109820753</a>	<a href="#">1611</a>	dump truck
<a href="#">100976489</a>	<a href="#">1611</a>	dump truck
<a href="#">109820746</a>	<a href="#">1791</a>	dump truck
<a href="#">18347518</a>	<a href="#">1623</a>	bulldozer
<a href="#">112203898</a>	<a href="#">3315</a>	forklift
<a href="#">112216254</a>	<a href="#">7513</a>	moving truck
<a href="#">103239950</a>	<a href="#">1711</a>	roll-off type container truck
<a href="#">111629754</a>	<a href="#">1629</a>	semi-tractor belly-dumping trucks
<a href="#">103299053</a>	<a href="#">1622</a>	backhoe
<a href="#">111822482</a>	<a href="#">1794</a>	scraper
<a href="#">111658415</a>	<a href="#">1799</a>	dump truck
<a href="#">111658407</a>	<a href="#">1629</a>	dump truck
<a href="#">111658373</a>	<a href="#">1622</a>	dump truck
<a href="#">111658399</a>	<a href="#">1629</a>	dump truck
<a href="#">102063294</a>	<a href="#">8641</a>	flatbed truck
<a href="#">106213465</a>	<a href="#">1611</a>	scraper
<a href="#">104382627</a>	<a href="#">1611</a>	truck
<a href="#">104694179</a>	<a href="#">1629</a>	earthmover
<a href="#">105598551</a>	<a href="#">9199</a>	front end loader
<a href="#">103282984</a>	<a href="#">1611</a>	front end loader
<a href="#">102829918</a>	<a href="#">3271</a>	truck
<a href="#">102552163</a>	<a href="#">1531</a>	dump truck
<a href="#">2435477</a>	<a href="#">1389</a>	oil field truck

**Table 1:** No backup alarm installed on vehicle.

<a href="#">104379425</a>	<a href="#">7363</a>	bulldozer
<a href="#">104379433</a>	<a href="#">1629</a>	bulldozer
<a href="#">105459945</a>	<a href="#">1542</a>	front end loader
<a href="#">105458822</a>	<a href="#">9199</a>	garbage truck
<a href="#">107039117</a>	<a href="#">1542</a>	scraper
<a href="#">101275626</a>	<a href="#">1623</a>	bucket truck
<a href="#">105879738</a>	<a href="#">0179</a>	flatbed truck
<a href="#">100938208</a>	<a href="#">4491</a>	forklift
<a href="#">105900476</a>	<a href="#">0133</a>	dump truck
<a href="#">102452968</a>	<a href="#">1611</a>	Road grader
<a href="#">101116861</a>	<a href="#">1611</a>	Scraper
<a href="#">104553342</a>	<a href="#">3272</a>	concrete truck
<a href="#">102217569</a>	<a href="#">4131</a>	dump truck
<a href="#">103426722</a>	<a href="#">1623</a>	Truck
<a href="#">101615169</a>	<a href="#">1389</a>	Truck
<a href="#">103099636</a>	<a href="#">1611</a>	dump truck
<a href="#">104703137</a>	<a href="#">1389</a>	frac truck
<a href="#">3328895</a>	<a href="#">1611</a>	asphalt truck
<a href="#">3328903</a>	<a href="#">1611</a>	asphalt truck
<a href="#">3328929</a>	<a href="#">1611</a>	asphalt truck
<a href="#">3328911</a>	<a href="#">1611</a>	asphalt truck
<a href="#">18749572</a>	<a href="#">1541</a>	dump truck
<a href="#">102040581</a>	<a href="#">3089</a>	asphalt truck
<a href="#">101718922</a>	<a href="#">1611</a>	dump truck
<a href="#">100355593</a>	<a href="#">1611</a>	grader
<a href="#">2877793</a>	<a href="#">2421</a>	forklift
<a href="#">100260959</a>	<a href="#">3731</a>	cherry picker truck
<a href="#">100314764</a>	<a href="#">1622</a>	scraper
<a href="#">2531655</a>	<a href="#">1794</a>	dump truck
<a href="#">14804256</a>	<a href="#">4212</a>	dump truck
<a href="#">1778034</a>	<a href="#">1794</a>	front end loader
<a href="#">1821818</a>	<a href="#">1623</a>	dump truck
<a href="#">1823459</a>	<a href="#">1794</a>	dump truck
<a href="#">15055890</a>	<a href="#">1611</a>	dump truck
<a href="#">14971048</a>	<a href="#">1611</a>	scraper
<a href="#">14971030</a>	<a href="#">49199</a>	scraper
<a href="#">1174028</a>	<a href="#">1794</a>	scraper
<a href="#">1701853</a>	<a href="#">4212</a>	dump truck
<a href="#">14478523</a>	<a href="#">2085</a>	dump truck
<a href="#">301993374</a>	<a href="#">1611</a>	dump truck

**Table 1:** No backup alarm installed on vehicle.

<a href="#">102755048</a>	<a href="#">2656</a>	tractor trailer
<a href="#">300510815</a>	<a href="#">4953</a>	dump truck
<a href="#">301994604</a>	<a href="#">4491</a>	front end loader
<a href="#">105237572</a>	<a href="#">4911</a>	flatbed truck
<a href="#">123746646</a>	<a href="#">9621</a>	dirt truck

**Table 2:** Backup alarm installed, but no longer functioning.

<b>Inspection Number</b>	<b>SIC</b>	<b>Vehicle Type</b>
<a href="#">306438755</a>	<a href="#">4959</a>	water truck
<a href="#">306309493</a>	<a href="#">4212</a>	front end loader
<a href="#">306309451</a>	<a href="#">2679</a>	front end loader
<a href="#">305569717</a>	<a href="#">1771</a>	bulldozer
<a href="#">305569725</a>	<a href="#">1794</a>	bulldozer
<a href="#">305997355</a>	<a href="#">0783</a>	front end loader
<a href="#">306073719</a>	<a href="#">9199</a>	garbage truck
<a href="#">305501793</a>	<a href="#">1611</a>	grader
<a href="#">301328142</a>	<a href="#">1795</a>	loader
<a href="#">303985568</a>	<a href="#">0851</a>	fertilizer loader
<a href="#">303985535</a>	<a href="#">4213</a>	fertilizer loader
<a href="#">103629242</a>	<a href="#">1611</a>	dump truck
<a href="#">303675144</a>	<a href="#">4953</a>	garbage truck
<a href="#">120278312</a>	<a href="#">1629</a>	grader
<a href="#">300611126</a>	<a href="#">1622</a>	sweeper truck
<a href="#">120278312</a>	<a href="#">1629</a>	grader
<a href="#">302535851</a>	<a href="#">1751</a>	dump truck
<a href="#">302535869</a>	<a href="#">1751</a>	dump truck
<a href="#">125674960</a>	<a href="#">175</a>	mechanical harvester
<a href="#">302090238</a>	<a href="#">3272</a>	front-end loader
<a href="#">125471110</a>	<a href="#">1611</a>	dump truck
<a href="#">301928909</a>	<a href="#">1794</a>	dump truck
<a href="#">301911590</a>	<a href="#">1611</a>	grader
<a href="#">119747491</a>	<a href="#">8331</a>	forklift
<a href="#">125311589</a>	<a href="#">1611</a>	excavator
<a href="#">100756436</a>	<a href="#">3325</a>	bulldozer
<a href="#">110098290</a>	<a href="#">5093</a>	front end loader
<a href="#">124765009</a>	<a href="#">1794</a>	scraper
<a href="#">119528321</a>	<a href="#">1611</a>	grader
<a href="#">109690560</a>	<a href="#">1611</a>	truck
<a href="#">106941578</a>	<a href="#">1622</a>	dump truck

**Table 2:** Backup alarm installed, but no longer functioning.

<a href="#">110092764</a>	<a href="#">1611</a>	dump truck
<a href="#">114848245</a>	<a href="#">1629</a>	semi trailer
<a href="#">100748730</a>	<a href="#">1611</a>	grader
<a href="#">106506918</a>	<a href="#">1623</a>	dump truck
<a href="#">109869214</a>	<a href="#">4953</a>	front end loader
<a href="#">123970527</a>	<a href="#">1611</a>	dump truck
<a href="#">116039025</a>	<a href="#">4953</a>	soil compactor
<a href="#">112160221</a>	<a href="#">1623</a>	loader
<a href="#">116039587</a>	<a href="#">3316</a>	forklift
<a href="#">100756436</a>	<a href="#">3325</a>	bulldozer
<a href="#">17874876</a>	<a href="#">4953</a>	bulldozer
<a href="#">106624240</a>	<a href="#">4953</a>	bulldozer
<a href="#">109018895</a>	<a href="#">1794</a>	dump truck
<a href="#">105933139</a>	<a href="#">3399</a>	W36 Articulator
<a href="#">107301897</a>	<a href="#">1794</a>	dump truck
<a href="#">107301889</a>	<a href="#">1541</a>	dump truck
<a href="#">102277415</a>	<a href="#">1629</a>	dump truck
<a href="#">102277407</a>	<a href="#">1629</a>	dump truck
<a href="#">111897625</a>	<a href="#">4213</a>	front-end loader
<a href="#">110390648</a>	<a href="#">1629</a>	scraper
<a href="#">17966078</a>	<a href="#">4491</a>	Ottawa yard hustlers
<a href="#">17966086</a>	<a href="#">4491</a>	Ottawa yard hustlers
<a href="#">103528477</a>	<a href="#">1611</a>	scraper
<a href="#">18061713</a>	<a href="#">3271</a>	dump truck
<a href="#">111510848</a>	<a href="#">2411</a>	loader
<a href="#">17853524</a>	<a href="#">1623</a>	dump truck
<a href="#">108499351</a>	<a href="#">1542</a>	scraper
<a href="#">104471412</a>	<a href="#">1611</a>	dump truck
<a href="#">110288958</a>	<a href="#">1611</a>	front end loader
<a href="#">106263791</a>	<a href="#">1611</a>	scraper
<a href="#">104393251</a>	<a href="#">1611</a>	pan
<a href="#">104399753</a>	<a href="#">4212</a>	front end loader
<a href="#">102538840</a>	<a href="#">8711</a>	dump truck
<a href="#">102538857</a>	<a href="#">1611</a>	dump truck
<a href="#">102538865</a>	<a href="#">1611</a>	dump truck
<a href="#">101030542</a>	<a href="#">4214</a>	compactor truck
<a href="#">104384151</a>	<a href="#">1794</a>	bulldozer
<a href="#">106317522</a>	<a href="#">8711</a>	dump truck
<a href="#">105686281</a>	<a href="#">1794</a>	Wabco pan
<a href="#">105686273</a>	<a href="#">1794</a>	Wabco pan
<a href="#">18391961</a>	<a href="#">1611</a>	dump truck

**Table 2:** Backup alarm installed, but no longer functioning.

<a href="#">2765733</a>	<a href="#">1611</a>	dump truck
<a href="#">18746685</a>	<a href="#">1611</a>	earthmover
<a href="#">105419626</a>	<a href="#">1611</a>	dump truck
<a href="#">105421275</a>	<a href="#">1799</a>	dump truck
<a href="#">18085522</a>	<a href="#">1622</a>	scraper
<a href="#">18085530</a>	<a href="#">1791</a>	scraper
<a href="#">17700873</a>	<a href="#">8711</a>	truck
<a href="#">17700899</a>	<a href="#">1721</a>	truck
<a href="#">101808483</a>	<a href="#">1611</a>	dump truck
<a href="#">2175305</a>	<a href="#">1611</a>	scraper
<a href="#">14989024</a>	<a href="#">9190</a>	grader
<a href="#">970970</a>	<a href="#">1794</a>	bucket loader
<a href="#">1976398</a>	<a href="#">1623</a>	grcraper
<a href="#">1657147</a>	<a href="#">2061</a>	front end loader
<a href="#">15247794</a>	<a href="#">1611</a>	dump truck
<a href="#">955518</a>	<a href="#">7363</a>	dump truck
<a href="#">116309592</a>	<a href="#">1629</a>	grader

**Table 3:** Backup alarm installed and audible.

<b>Installed, Audible</b>	<b>SIC</b>	<b>Vehicle Type</b>
<a href="#">307567727</a>	<a href="#">1611</a>	grader
<a href="#">300839925</a>	<a href="#">1542</a>	spray truck
<a href="#">305351330</a>	<a href="#">1611</a>	dump truck
<a href="#">303773824</a>	<a href="#">2421</a>	forklift
<a href="#">125917039</a>	<a href="#">2657</a>	forklift
<a href="#">304593858</a>	<a href="#">1611</a>	flatbed truck
<a href="#">304957020</a>	<a href="#">1611</a>	tack truck
<a href="#">303987101</a>	<a href="#">1761</a>	pickup truck
<a href="#">304161599</a>	<a href="#">5093</a>	front end loader
<a href="#">301273371</a>	<a href="#">4491</a>	forklift
<a href="#">302970884</a>	<a href="#">1611</a>	truck
<a href="#">125517425</a>	<a href="#">1761</a>	forklift
<a href="#">116508060</a>	<a href="#">1611</a>	truck
<a href="#">119992048</a>	<a href="#">1623</a>	asphalt truck
<a href="#">111910451</a>	<a href="#">1611</a>	slurry rig
<a href="#">105639744</a>	<a href="#">1542</a>	forklift
<a href="#">108012667</a>	<a href="#">1611</a>	grader



**Table 3:** Backup alarm installed and audible.

<a href="#">103038931</a>	<a href="#">1542</a>	asphalt truck
<a href="#">106105547</a>	<a href="#">1611</a>	dump truck
<a href="#">101278612</a>	<a href="#">1611</a>	scraper
<a href="#">3306966</a>	<a href="#">1771</a>	dump truck
<a href="#">105218614</a>	<a href="#">9131</a>	paver
<a href="#">2997625</a>	<a href="#">1611</a>	dump truck
<a href="#">2929461</a>	<a href="#">1611</a>	grader
<a href="#">2929453</a>	<a href="#">1522</a>	grader
<a href="#">970954</a>	<a href="#">1611</a>	asphalt truck
<a href="#">969568</a>	<a href="#">4212</a>	asphalt truck
<a href="#">969550</a>	<a href="#">1611</a>	asphalt truck
<a href="#">1151463</a>	<a href="#">5093</a>	wheel loader
<a href="#">1517903</a>	<a href="#">3273</a>	front end loader
<a href="#">301165304</a>	<a href="#">4213</a>	truck
<a href="#">115753774</a>	<a href="#">1611</a>	dump truck
<a href="#">303176622</a>	<a href="#">1623</a>	dump truck

**Table 4:** Backup alarm installed but inaudible.

<b>Installed, inaudible</b>	<b>SIC</b>	<b>Vehicle Type</b>
<a href="#">306377250</a>	<a href="#">1623</a>	backhoe
<a href="#">119820157</a>	<a href="#">1771</a>	dump truck
<a href="#">303092993</a>	<a href="#">1611</a>	dump truck
<a href="#">119802825</a>	<a href="#">2033</a>	forklift
<a href="#">122022536</a>	<a href="#">3312</a>	dump truck
<a href="#">102579984</a>	<a href="#">1629</a>	dump truck

## ANALYSIS

The census of pedestrian-backing vehicle accidents developed from the OSHA Accident database reveals a number of interesting patterns. As might be expected, construction vehicles comprised a preponderance of the vehicle types and businesses employing persons injured in such accidents. Vehicles used in construction which may have an obstructed rear view are already required to have either a spotter or a spotter before backing (29 CFR 1926.1926.601). To date, OSHA has not approved other methods such as cameras or ultrasonic sensors as alternate means to address the hazard of pedestrians being struck by backing

vehicles. It should be noted that of the pedestrian-backing vehicle accidents in the OSHA database for which insufficient detail was available to classify the records according to one of the four categories in the above tables, 48 of 121 incidents involved workers employed by firms which fell under the Standard Industrial Classification Codes of construction. This compared with 72 of 109 construction employers involved in accidents where backup alarms were not installed, 61 of 85 instances where construction employers were involved in pedestrian-backing vehicle accidents where an installed reverse alarm was no longer functioning, and 26 of 35 instances where a backup alarm was reported to be audible at the time of the accident. As shown by Table 4, four of six instances involved construction employers in cases where a backing vehicle struck a pedestrian and the backup alarm was sounding, but likely not audible to the pedestrian above the background noise.

As ergonomics professionals, it must be a concern that so many of the back-up alarms were no longer functioning. Perhaps they were disabled because of their annoying properties, leaving a hazard in the workplace. It is also possible that the worker became habituated to the sound of the alarm. This study suggests that if a back-up alarm is to be relied on to prevent these type of accidents, then they must be regularly checked for proper functioning

## REFERENCES

- OSHA Accident Database, "Backup Alarm" category, OSHA Website: [http://www.osha.gov/pls/imis/AccidentSearch.search?acc\\_keyword=%22Backup%20Alarm%22&keyword\\_list=on](http://www.osha.gov/pls/imis/AccidentSearch.search?acc_keyword=%22Backup%20Alarm%22&keyword_list=on)
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