

# Construction Machinery Fatalities

**FATAL FACTS**

**Report #: 47-17-2009**

**Construction Machinery Fatalities, WA State, 1998-2008**

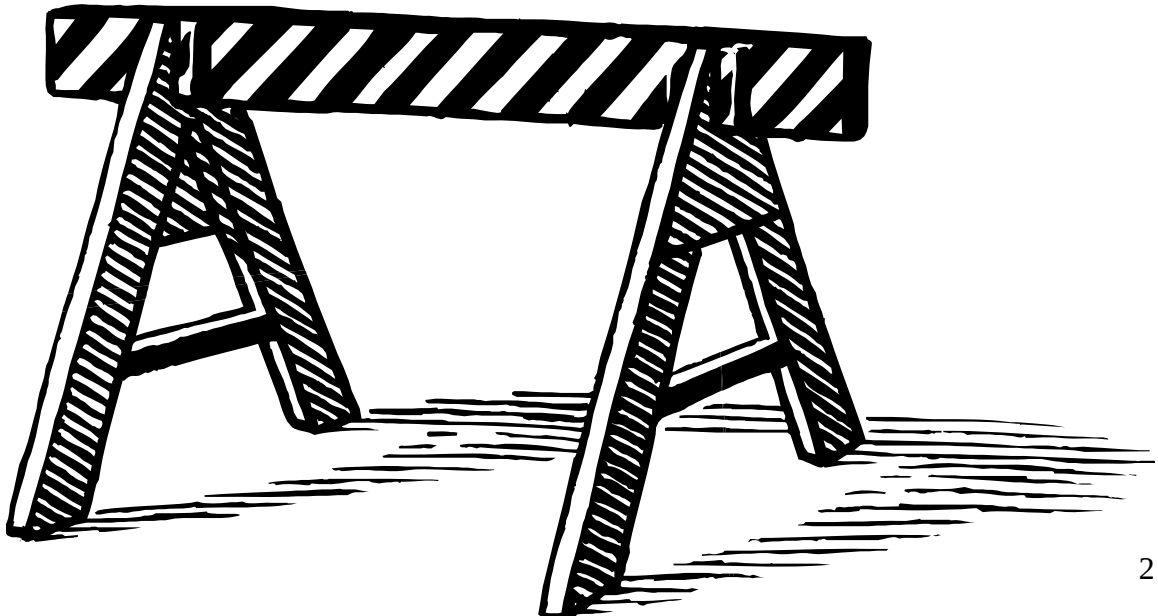
**Washington FACE Program, May 20, 2009**



# Construction Machinery Fatalities, WA State, 1998-2008

## Washington FACE Program, May 20, 2009

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## Construction Machinery Fatalities Overview WA State, 1998 - 2008

This report summarizes fatalities related to construction machinery in Washington State from 1998 to 2008. The data was compiled by the Washington State Fatality Assessment and Control Evaluation (FACE) Program. The data presented in this report were collected according to the North American Industrial Classification System (NAICS). NAICS six digit codes beginning with 23XXXX representing the construction industries were used for this report. This report exclusively includes incidents involving construction machinery and not vehicles that can go on the street. Construction machinery in this report does not include construction vehicles, such as dump trucks or other motor vehicle. Fatalities associated with construction machinery that were determined to be caused by electrocution were also excluded from this report. The data in this report may vary from data generated by other sources due to counting criteria.

According to the National Institute for Occupational Safety and Health (NIOSH), the construction industry had the highest number of fatalities of any sector in 2006. This was an increase of 3% from 2005. Construction and extraction occupations and transportation and material moving occupations together accounted for nearly half (48%) of all fatal work injuries in 2006. The events most frequently leading to work-related fatalities in construction from 1995 through 1999 were falls (33%), transportation incidents (20%), contact with objects or equipment (19%), and exposure to harmful substances and environments (17%). Each event type accounted for a similar proportion of construction occupational fatalities on 2006.

Within the construction industry, NIOSH identified machinery related traumatic occupational incidents as the fourth leading cause of fatalities. Cranes, excavating machinery, and tractors were the machines most frequently involved. The most common incident types were: struck by a mobile machine; overturn; and struck by a boom (Pratt, Kisner et al. 1997).

In Washington, the construction industry sectors where machinery fatalities happened most often were:

- Highway, bridge, and street construction.
- Site preparation.
- Water and sewer line construction.

The most common fatal incidents involved:

- Earth moving, and scraping machinery.
- Excavating machinery.
- Lifting machines and appliances.

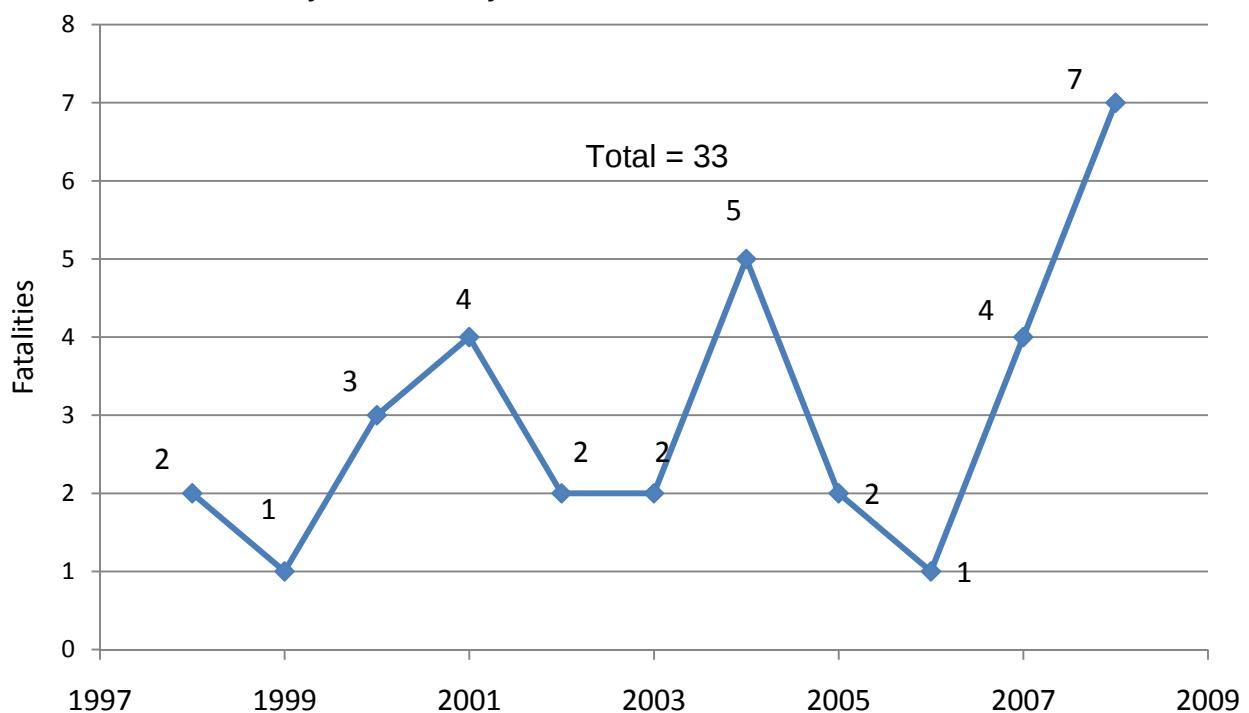


Between 1998 and 2008, fatalities were almost equal for machinery operators and workers on foot. Operators were killed most frequently in backhoe/trackhoe incidents while workers on foot were killed most frequently in excavating machinery incidents. Furthermore, machinery operators were predominately involved in fatal roll over incidents while workers on foot were either mainly struck by machinery or other objects. The majority of machine operators killed were not wearing seat belts or occupant restraints.

Employers and employees should follow the detailed prevention measures outlined by NIOSH for site set up, machinery operators, and other site workers (page 14).

Areas to focus prevention efforts are the use of seat belts and occupant restraints among machinery operators and reducing struck by incidents among workers on foot. Seventy percent of machinery operators involved in roll-over fatalities did not use seat belts or occupant restraints. Nearly 90% of workers on foot were struck and killed by machinery or other objects.

Construction Machinery Fatalities by Year, WA State, 1998 - 2008



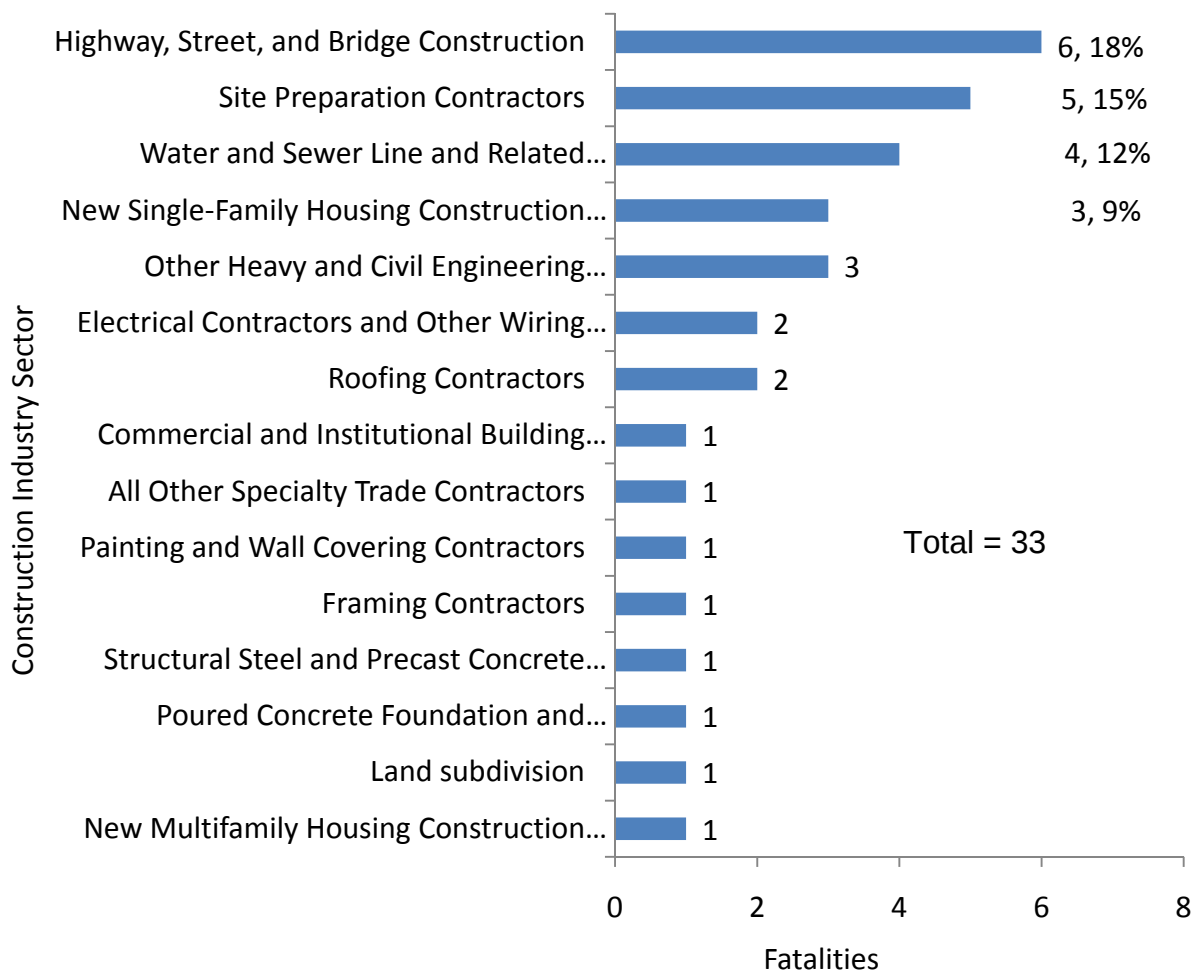
**33 workers died in construction machinery incidents in WA, 1998-2008**

Washington state construction machinery related fatalities were at their lowest point of one in 2006 but rose to four in 2007 and to a ten year high of seven in 2008. Prior to 2007, the number of fatalities averaged two per year.

There were clear increases in number of fatalities by specific industry sector or occupation to account for the increase in total fatalities in 2008 versus previous years. The difference between 2008 and previous years was that three of the seven fatalities involved boom lifts. Two workers were struck by and one pinned by boom lifts.

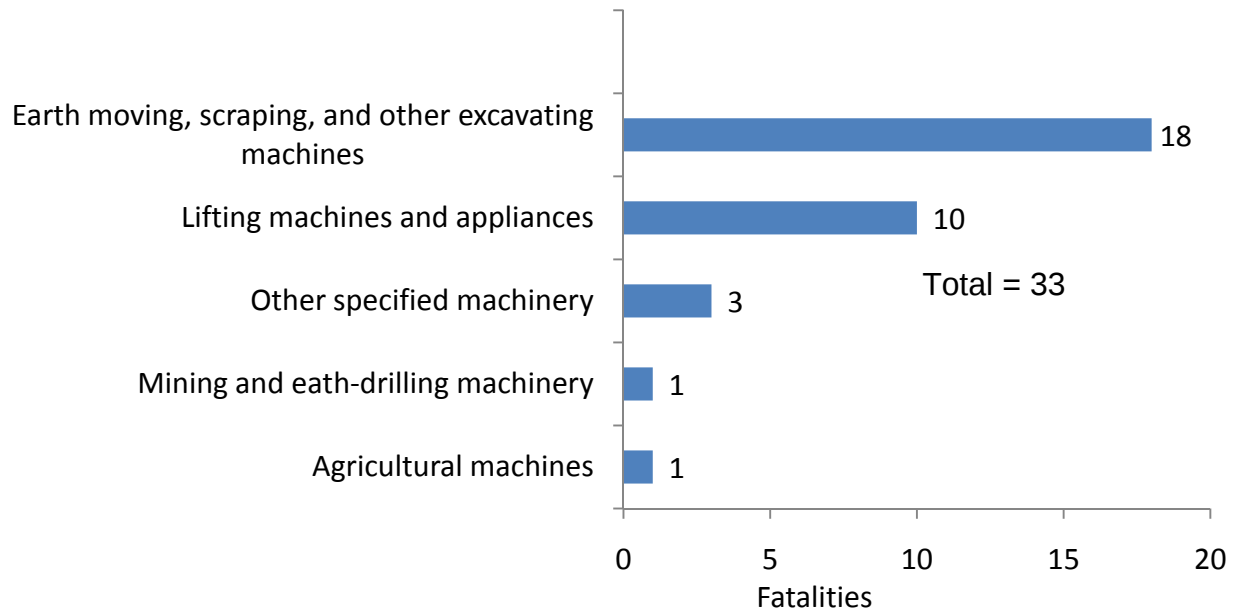
In years when fatalities are higher such as 2001, 2004, and 2008, there were multiple fatalities in the highway, bridge, and street construction industry. All six of the fatalities in this industry occurred in these three years. The occupation title construction laborer was present but not consistently higher for 2001, 2004, and 2007-2008 when fatalities were higher.

Construction Machinery Fatalities by Industry, WA State, 1998 - 2008



**The highway, bridge, and street construction industry had the most fatalities**

## Construction Machinery Fatalities by Machine Incident Type, WA State, 1998 - 2008



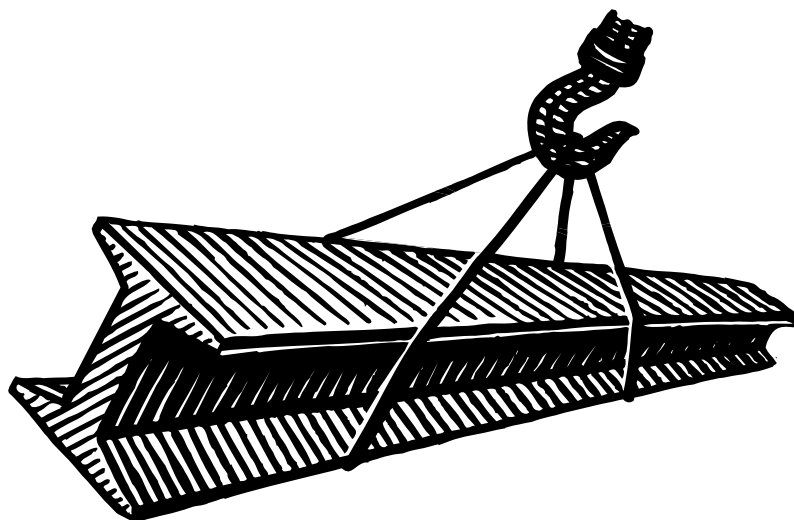
## Construction Machinery Fatalities by Occupation, WA State, 1998 - 2008

|                                                                               |    |
|-------------------------------------------------------------------------------|----|
| Operating Engineers and Other Construction Equipment Operators                | 11 |
| Construction Laborers                                                         | 11 |
| First-Line Supervisors/Managers of Construction Trades and Extraction Workers | 3  |
| Other                                                                         | 8  |

Fatalities by whether victim was operating construction machinery or was performing a task on-foot at the time of the fatal incident

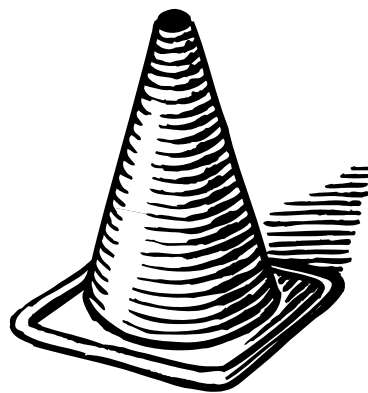
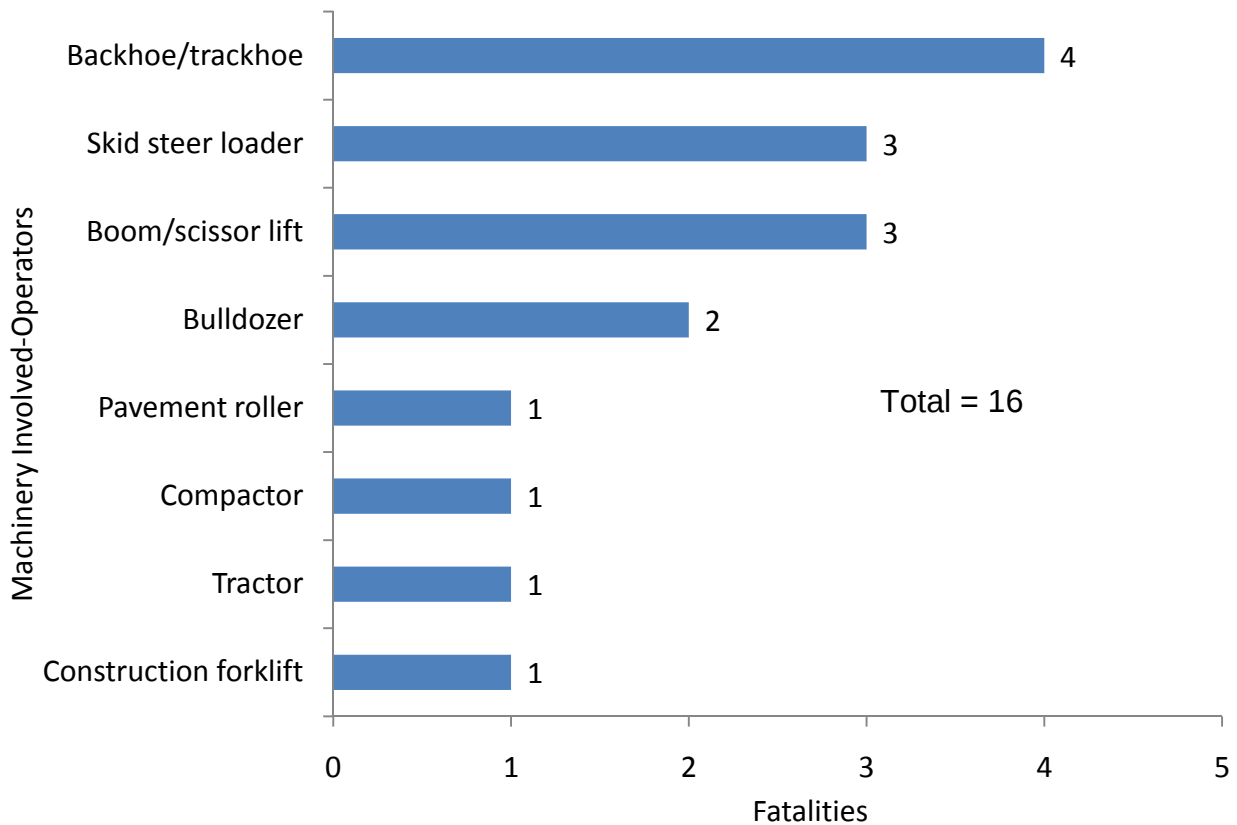
|                                  |    |
|----------------------------------|----|
| Operating construction equipment | 16 |
| On foot                          | 17 |

Equipment operators and construction laborers each accounted for a third of fatalities. All of the equipment operators died while operating equipment and ten of eleven construction laborers died while on foot. Supervisors, managers, and other occupations died in about equal numbers on foot and while operating equipment.



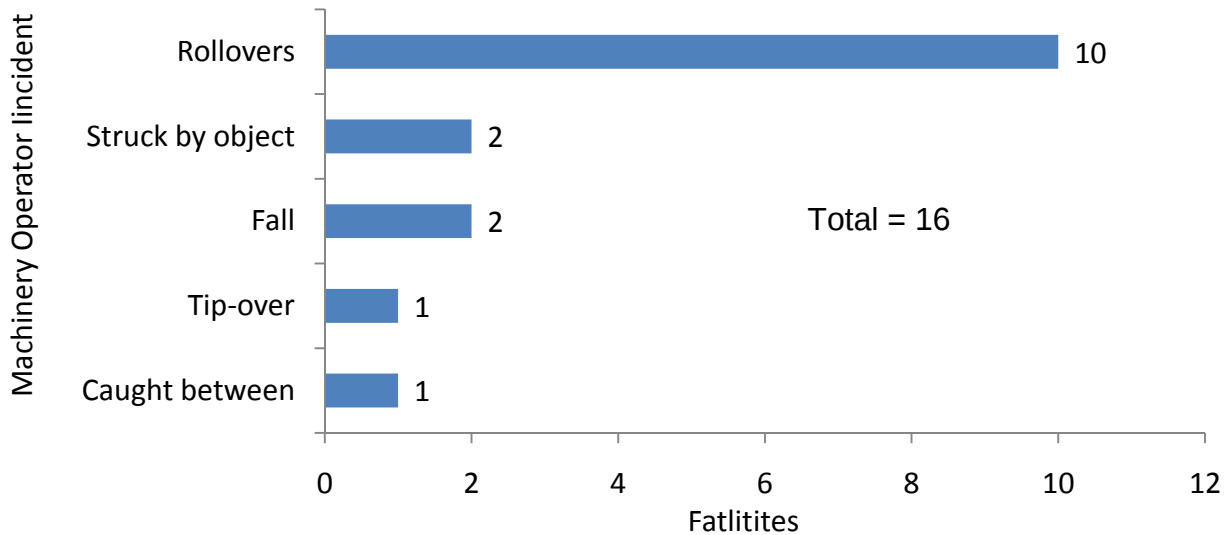
The following data for fatalities by machinery type does not include fatalities related to motor vehicle incidents. These were exclusively construction machinery related fatalities.

#### Construction Machinery Fatalities by Machinery Involved for Machinery Operators, WA State, 1998 - 2008



**Earth moving, scraping, and excavating machines were involved with the most fatalities**

# Construction Machinery Fatalities by Incident Type for Machinery Operator, WA State, 1998 - 2008



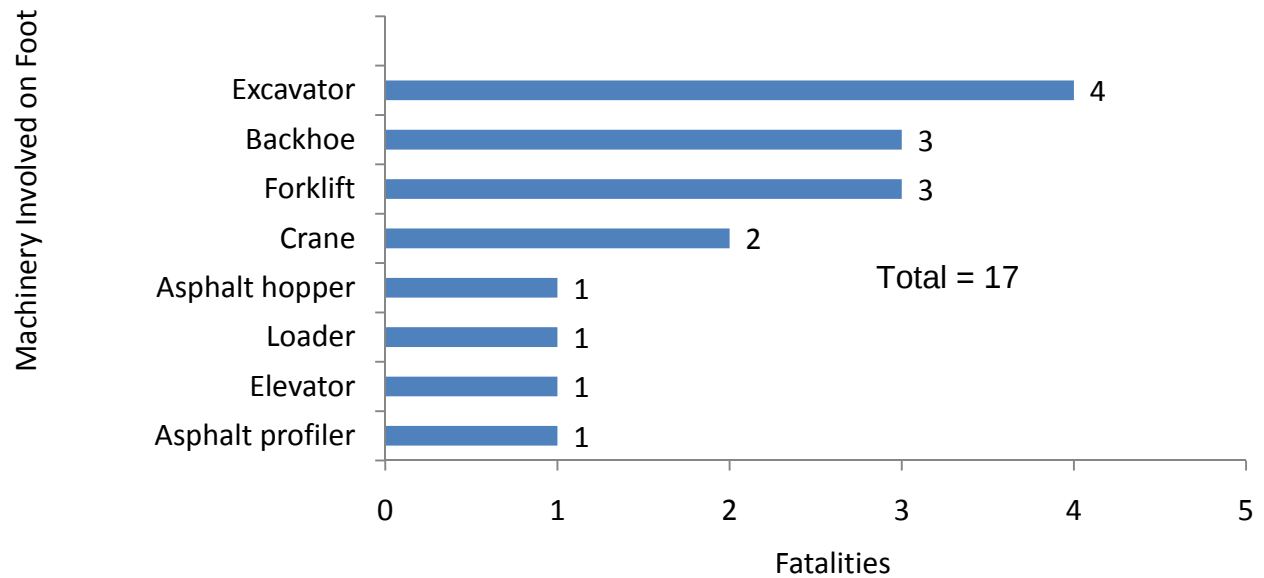
Rollover fatalities were the most common type of fatal incident for machinery operators. Ground conditions can be a major factor contributing to rollover incidents. Factors such as wet or muddy ground, compaction, and soil erosion affect the stability of machinery set-up, operation and transport. In Roll-over incidents, the use of seatbelts and occupant restraint systems save lives and reduce injuries. Failure to wear seat belts while using certain construction equipment was the most commonly cited violation in fiscal 2008 under the Occupational Safety and Health Act's general duty clause. The following is a breakdown of seat belt use among the ten WA State fatal incidents.

## Rollover Construction Machinery Fatalities and Seatbelt Use, WA State, 1998 – 2008

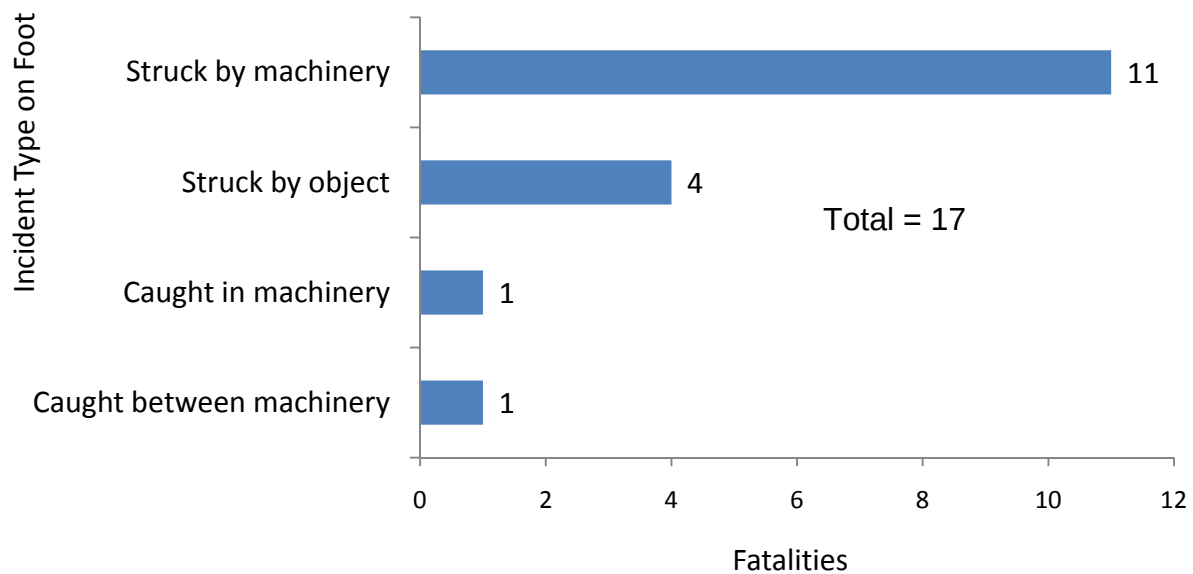
|                                              |   |
|----------------------------------------------|---|
| No seatbelt or restraint system used         | 7 |
| Unknown if seatbelt or restraint system used | 2 |
| Seatbelt or restraint system used            | 1 |

**Most machinery operators were involved in fatal roll-overs**

### Construction Machinery Fatalities by Machinery Involved to Workers on Foot, WA State, 1998-2008

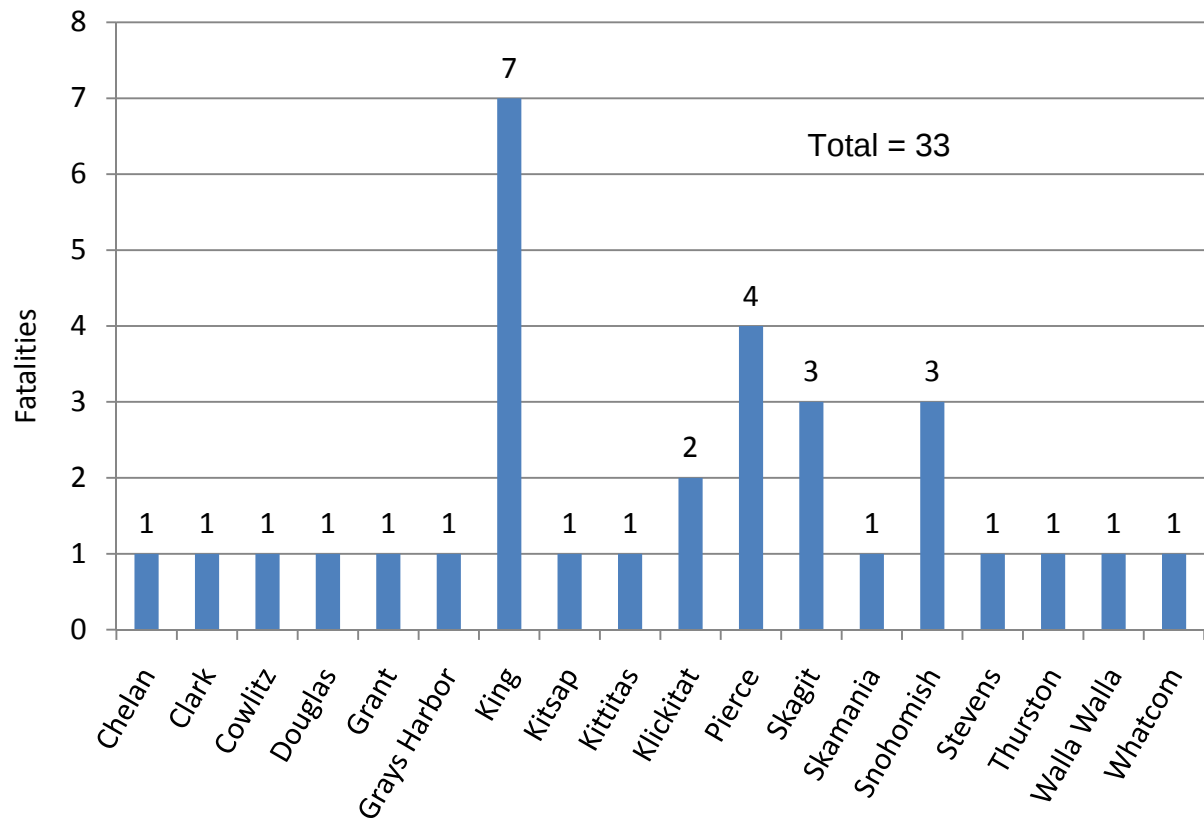


### Construction Machinery Fatalities by Incident Type to Workers on Foot, WA State, 1998-2008

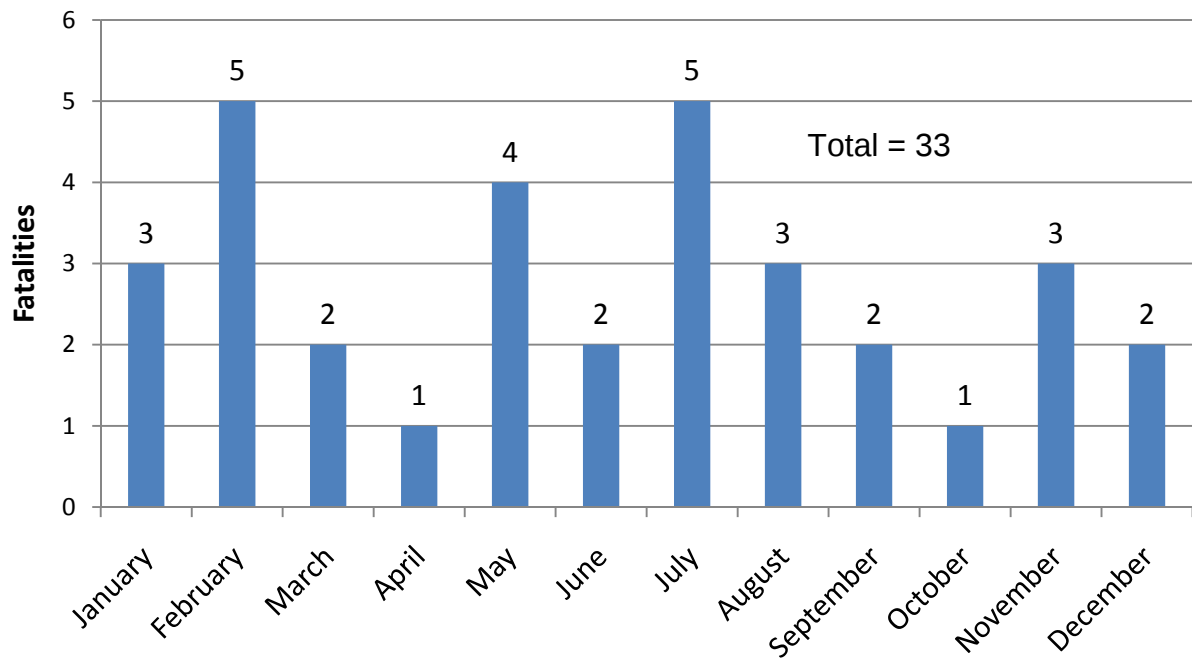


**Most workers on foot were killed by being struck by machinery**

Construction Machinery Fatalities by County, WA State, 1998 - 2008



Construction Machinery Fatalities by Month, WA State, 1998 - 2008



### ***CASE: Laborer on Foot Falls into Trench and Struck by Excavator***

**Industry:** Site preparation contractors.  
**Occupation:** Laborer.  
**Task:** Taking measurements of trench.  
**Type of Incident:** Struck by machinery.



#### ***DETAILS***

A 28-year-old victim had been working for about five months with a site preparation contractor. The victim was working with a crew digging a trench and helping the excavator operator by taking trench depth and length measurements. They had just finished exchanging measurements when the operator told the victim he was going to take another bucket of dirt away from near the victim. The operator began lowering the bucket when the victim stepped toward the bucket, slipped and fell seven feet to the trench bottom. The victim may have been trying to ride the bucket. The operator made an emergency stop of the bucket and boom, causing the bucket to bounce and pin the victim against the trench wall. The victim died of blunt force injuries to his chest and abdomen.

#### ***REQUIREMENTS***

Train employees to recognize and avoid unsafe conditions and to follow required safe work practices that apply to their work environment.

#### ***FACE RECOMMENDATIONS***

- Before each work shift, review and confirm communications signals between machine operators and workers on foot.
- Do not permit workers on foot to approach the hydraulic excavator or backhoe loader until they signal the operator to shut down the machine and receive acknowledgment from the operator.
- Keep workers outside the hydraulic excavator swing areas (danger zone) and clear of attachments.
- Keep non-essential workers away from moving equipment.
- Equipment operators must be aware of worker locations within site and maintain visual contact with persons who are working near the swing radius of the equipment.

## ***CASE: Excavator Operator Killed in Roll-over on Hilly Terrain***

**Industry:** New single-family housing construction.

**Occupation:** Heavy equipment operator.

**Task:** Backing excavator out of excavation.

**Type of Incident:** Machinery.



### ***DETAILS***

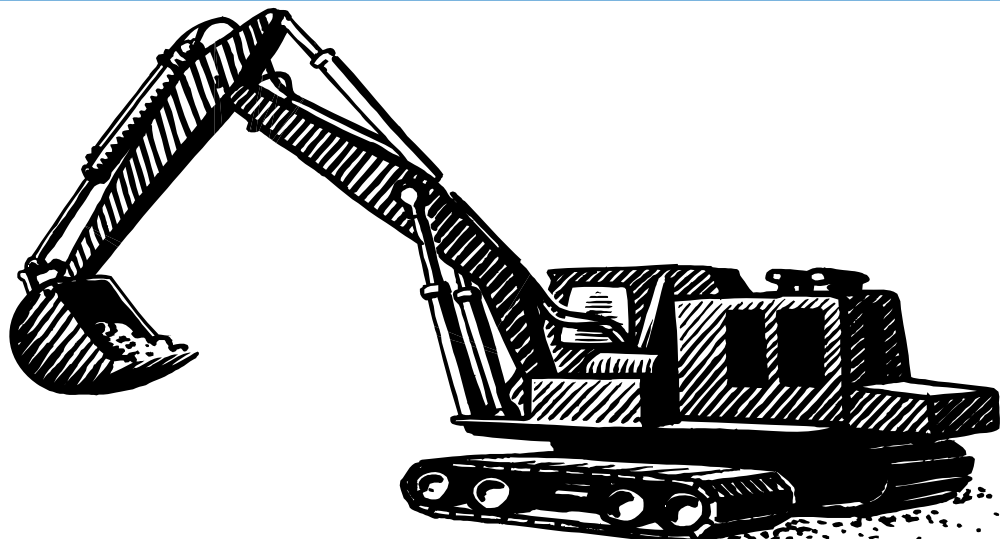
A 48-year-old heavy equipment operator had worked for his employer, a new single-family housing construction contractor, for five months and had about 25 years experience as a heavy equipment operator. He was operating an excavator to dig a foundation for a single-family residence at a development located on hilly terrain. As he was exiting the excavation by backing the excavator over the lip of the excavation, it rolled on to its top and then came to rest on its side. Emergency help was called but the victim was declared dead at the scene of multiple internal injuries and blunt impact to the head.

### ***REQUIREMENTS***

- Employers should ensure that equipment operators are provided with appropriate training, information, and instruction on how to maneuver their equipment on difficult terrain.
- Employees shall report the existence of any unsafe equipment or method or any other hazard, which is unsafe in their work operation to the employer for corrective action.

### ***FACE RECOMMENDATIONS***

- The equipment operator needs to have a clear understanding of the stability dynamics of driving their particular equipment on poor or uneven ground, hilly terrain, soft ground, potholes or driving over curbs for example.
- The operator should follow the equipment manufacturer's recommendations regarding proper equipment operation on uneven surfaces and hilly terrain.
- Using a ROPS equipped excavator or retrofitting a ROPS (Roll-over Protection System) to the excavator would help prevent fatal injuries in the event of an equipment roll over.
- Employers should explore installing active warning devices to alert operators when the machine's slope limits are approached.

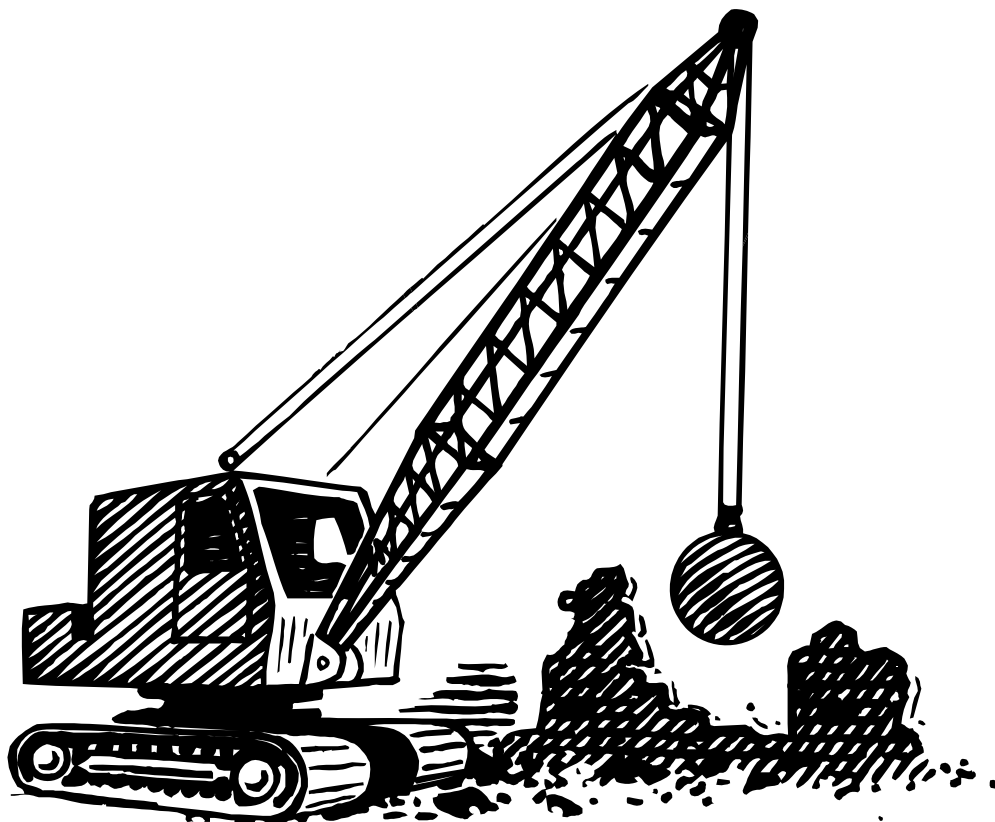


Full narratives are available by clicking on link. Full narratives provide more specific details and insight about the incident as well as relevant WA State administrative codes and incident specific recommendations.

|                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Well driller operating Bobcat pinned by water drill pipe sliding off back of truck</b>                                                                                                                                                     |
| <b>Construction worker operating boom lift pinned between lift and metal beam</b>                                                                                                                                                             |
| <b>Excavator Operator Killed When Excavator Tips Over</b><br><a href="http://www.Lni.wa.gov/Safety/Research/Face/Files/ExcavatorFall.pdf">http://www.Lni.wa.gov/Safety/Research/Face/Files/ExcavatorFall.pdf</a>                              |
| <b>Laborer Falls into Trench and Struck by Excavator Bucket</b><br><a href="http://www.Lni.wa.gov/Safety/Research/Face/Files/StruckByExcavator.pdf">http://www.Lni.wa.gov/Safety/Research/Face/Files/StruckByExcavator.pdf</a>                |
| <b>Excavator Operator Killed When Excavator Rolls On Its Side</b><br><a href="http://www.Lni.wa.gov/Safety/Research/Face/Files/ExcavatorRollover.pdf">http://www.Lni.wa.gov/Safety/Research/Face/Files/ExcavatorRollover.pdf</a>              |
| <b>Painter Killed When Scissor Lift Tips Over</b><br><a href="http://www.Lni.wa.gov/Safety/Research/Face/Files/ScissorLiftTipOver.pdf">http://www.Lni.wa.gov/Safety/Research/Face/Files/ScissorLiftTipOver.pdf</a>                            |
| <b>Laborer Struck by Excavator Bucket</b><br><a href="http://www.Lni.wa.gov/Safety/Research/Face/Files/LaborerStruckByExcavator.pdf">http://www.Lni.wa.gov/Safety/Research/Face/Files/LaborerStruckByExcavator.pdf</a>                        |
| <b>Skid Steer Loader Operator Ejected and Crushed by Bucket</b><br><a href="http://www.Lni.wa.gov/Safety/Research/Face/Files/SkidSteerOperator.pdf">http://www.Lni.wa.gov/Safety/Research/Face/Files/SkidSteerOperator.pdf</a>                |
| <b>Operator Killed When Tractor Rolls Over</b><br><a href="http://www.Lni.wa.gov/Safety/Research/Face/Files/TractorRoll2006.pdf">http://www.Lni.wa.gov/Safety/Research/Face/Files/TractorRoll2006.pdf</a>                                     |
| <b>Excavation Contractor Killed When Bulldozer Rolls Over While Unloading from Trailer</b><br><a href="http://www.Lni.wa.gov/Safety/Research/Face/Files/UnloadDozer.pdf">http://www.Lni.wa.gov/Safety/Research/Face/Files/UnloadDozer.pdf</a> |
| <b>Brush Cutter Operator Struck by Section of Pipe</b><br><a href="http://www.Lni.wa.gov/Safety/Research/FACE/files/BrushCut.pdf">http://www.Lni.wa.gov/Safety/Research/FACE/files/BrushCut.pdf</a>                                           |
| <b>Operator Killed When Construction Forklift Rolls Over</b><br><a href="http://www.Lni.wa.gov/Safety/Research/FACE/files/ForkliftRoll.pdf">http://www.Lni.wa.gov/Safety/Research/FACE/files/ForkliftRoll.pdf</a>                             |
| <b>Granite Installer Struck by Falling Granite Slabs</b><br><a href="http://www.Lni.wa.gov/Safety/Research/FACE/files/GraniteSlabs.pdf">http://www.Lni.wa.gov/Safety/Research/FACE/files/GraniteSlabs.pdf</a>                                 |
| <b>Loader Operator Struck by Hopper Lid at Asphalt Batch Plant</b><br><a href="http://www.Lni.wa.gov/Safety/Research/FACE/files/HopperLid.pdf">http://www.Lni.wa.gov/Safety/Research/FACE/files/HopperLid.pdf</a>                             |
| <b>Construction Laborer Struck by Headache Ball</b><br><a href="http://www.Lni.wa.gov/Safety/Research/FACE/files/WreckingBall.pdf">http://www.Lni.wa.gov/Safety/Research/FACE/files/WreckingBall.pdf</a>                                      |
| <b>Roofing Foreman Run Over by Forklift</b><br><a href="http://www.Lni.wa.gov/Safety/Research/FACE/files/StruckByForklift.pdf">http://www.Lni.wa.gov/Safety/Research/FACE/files/StruckByForklift.pdf</a>                                      |

|                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Bulldozer Operator Killed in Rollover on Icy Slope</b><br><a href="http://www.Lni.wa.gov/Safety/Research/FACE/files/DozerRoll.pdf">http://www.Lni.wa.gov/Safety/Research/FACE/files/DozerRoll.pdf</a> |
| <b>Front end loader falls on worker in trench</b><br><a href="http://www.Lni.wa.gov/Safety/Research/FACE/files/loader.pdf">http://www.Lni.wa.gov/Safety/Research/FACE/files/loader.pdf</a>               |
| <b>Worker Crushed While Maintaining a Construction Hoist</b><br><a href="http://www.Lni.wa.gov/Safety/Research/FACE/files/hoist.pdf">http://www.Lni.wa.gov/Safety/Research/FACE/files/hoist.pdf</a>      |
| <b>Pinned under backhoe when it rolls over</b>                                                                                                                                                           |
| <b>Pavement roller rollover</b>                                                                                                                                                                          |
| <b>Crushed between asphalt profiler and dump truck trailer</b>                                                                                                                                           |
| <b>Caught in rock crushing machine</b>                                                                                                                                                                   |
| <b>Backhoe falls on construction worker in trench</b>                                                                                                                                                    |
| <b>Caterpillar tractor compactor rollover</b>                                                                                                                                                            |
| <b>Pinned against flatbed trailer by backhoe bucket</b>                                                                                                                                                  |
| <b>Struck by backhoe bucket</b>                                                                                                                                                                          |
| <b>Crushed by large emergency power supply for computer</b>                                                                                                                                              |
| <b>Skid-steer loader rolled down 70 ft. into ravine</b>                                                                                                                                                  |
| <b>Victim struck by falling load being moved by crane</b>                                                                                                                                                |
| <b>Contractor struck by excavator boom</b>                                                                                                                                                               |
| <b>Roofing contractor falls 30 feet from manlift basket</b>                                                                                                                                              |
| <b>Construction worker struck by boom of excavator as it tipped over</b>                                                                                                                                 |
| <b>Well driller operating skid-steer loader pinned by water pipe sliding off truck</b>                                                                                                                   |
| <b>Construction worker operating boom lift pinned between lift and metal beam</b>                                                                                                                        |
| <b>Backhoe operator killed when backhoe falls from bridge into river</b>                                                                                                                                 |
| <b>Construction laborer crushed between excavator bucket and trench wall</b>                                                                                                                             |
| <b>Excavator operator dies when equipment rolls over</b>                                                                                                                                                 |
| <b>Painter killed when scissor lift tips over</b>                                                                                                                                                        |
| <b>Construction laborer struck by excavator bucket</b>                                                                                                                                                   |
| <b>Skid steer loader operator killed when ejected from seat and pinned under bucket</b>                                                                                                                  |
| <b>Construction worker killed when tractor rolls over</b>                                                                                                                                                |
| <b>Contractor killed when bulldozer overturns while being unloaded from trailer</b>                                                                                                                      |
| <b>Operator of excavator killed by pipe flung by brush cutter</b>                                                                                                                                        |
| <b>Construction forklift rolls down slope</b>                                                                                                                                                            |
| <b>Struck by granite slabs sliding off forklift</b>                                                                                                                                                      |
| <b>Struck by asphalt hopper lid</b>                                                                                                                                                                      |
| <b>Struck by headache ball</b>                                                                                                                                                                           |
| <b>Run over by forklift</b>                                                                                                                                                                              |

|                                                                          |
|--------------------------------------------------------------------------|
| <b>Dozer rolls down embankment</b>                                       |
| <b>Front end loader falls on worker in trench</b>                        |
| <b>Struck by elevator machinery</b>                                      |
| <b>Pinned under backhoe when it rolls over</b>                           |
| <b>Pavement roller rollover</b>                                          |
| <b>Crushed between asphalt profiler and dump truck trailer</b>           |
| <b>Caught in rock crushing machine</b>                                   |
| <b>Backhoe falls on construction worker in trench</b>                    |
| <b>Caterpillar tractor compactor rollover</b>                            |
| <b>Pinned against flatbed trailer by backhoe bucket</b>                  |
| <b>Struck by backhoe bucket</b>                                          |
| <b>Crushed by large emergency power supply for computer</b>              |
| <b>Skid-steer loader rolled down 70 ft. into ravine</b>                  |
| <b>Victim struck by falling load being moved by crane</b>                |
| <b>Contractor struck by excavator boom</b>                               |
| <b>Roofing contractor falls 30 feet from manlift basket</b>              |
| <b>Construction worker struck by boom of excavator as it tipped over</b> |



## Prevention Measures

These prevention measures are adopted from [NIOSH Publication No. 2004-107: Preventing Injuries When Working with Hydraulic Excavators and Backhoe Loaders](#).

They are applicable to all construction machinery such as skid steer loaders, bulldozers excavators, and backhoes.

Employers and employees should take the following steps to prevent injuries and fatalities while working with construction machinery. All prevention measures are relevant to operators and workers on foot as they were killed in equal numbers and their safety is interdependent.

### Site Set-Up

- Contact local utilities and other responsible parties to locate overhead and underground utility lines before beginning work. Avoid working near overhead power lines. If you must work near them, develop a plan to avoid contact.
- Do not permit construction machinery to be operated on grades steeper than those specified by the manufacturer.
- Make sure that workers position machinery at a safe distance from excavations such as trenches.
- Make sure that workers position machinery on stable supportive ground. Wet soil or loose ground can compromise machinery footing and stability.

### Equipment Operators-16 *killed in WA State, 1998-2008*

- Train equipment operators in the proper use of the equipment they are assigned to operate. Be sure to follow manufacturers' specifications and recommendations.
- Continually evaluate safety programs to address changing worksite conditions.
- Clearly identify and label all machine controls and make sure that the manufacturers' safety features are working.
- Install and maintain equipment attachments and their operating systems according to manufacturers' specifications.
- Securely latch attachments (such as quick-disconnect buckets) before work begins.
- Follow the manufacturer's instructions for using positive locks on quick-disconnect attachments.
- Train operators to conduct visual and operational checks on all machine systems and operating controls before working the machine.
- Make frequent visual inspections of quick-disconnect systems—especially after changing attachments.

- Use the ROPS and seat belts supplied by the manufacturer. Do not remove the ROPS.
- Do not exceed load capacities when lifting materials.
- Instruct operators to lower the boom to a safe position with the bucket or attachment on the ground and turn off the machine before stepping off for any reason.

### **Other Site Workers-17 killed in WA State, 1998-2008**

- Train site workers to recognize and avoid unsafe conditions and to follow required safe work practices that apply to their work environments.
- Make all workers on the site aware of the machines' established swing areas and blind spots before the operator works the machine. Keep workers on foot outside these areas by marking them with rope, tape, or other barriers.
- Before each work shift begins, review and confirm communications signals between machine operators and workers on foot.
- Instruct machine operators to keep the bucket as close to the ground as possible when workers are attaching loads for hoisting.
- Keep workers outside the hydraulic excavator swing areas and clear of attachments when using the machines for hoisting materials. Do not allow workers to stand under suspended loads or suspended machine components such as the boom, arm, or bucket.
- Do not permit workers on foot to approach the hydraulic construction machinery until they signal the operator to shut down the machine and receive acknowledgment from the operator.
- Use spotters or signal persons around operating equipment when necessary.
- Never permit workers to ride in or work from construction machinery buckets.
- Provide appropriate personal protective equipment and make sure that workers use and maintain it.

### References

[NIOSH Safety and Health Topic: Construction Safety. http://www.cdc.gov/niosh/topics/constructionsafety/#fatalities](http://www.cdc.gov/niosh/topics/constructionsafety/#fatalities)

[NIOSH Publication No. 2004-107: Preventing Injuries When Working with Hydraulic Excavators and Backhoe Loaders. http://www.cdc.gov/niosh/docs/2004-136 /](http://www.cdc.gov/niosh/docs/2004-136/)

Pratt, S. G., S. M. Kisner, et al. (1997). "Machinery-related fatalities in the construction industry." Am J Ind Med **32**(1): 42-50.

## Want more information?

Produced by the [Washington State Fatality Assessment & Control Evaluation \(FACE\) Program](#), [Fatality Assessment and Control Evaluation \(FACE\)](#) which is managed by the Safety and Health Assessment and Research for Prevention (SHARP) Program.

### [SHARP Program](#)

Washington Department of Labor & Industries

PO Box 44330

Olympia, WA 98504-4330

360-902-5669 or 1-888-667-4277 (toll-free)

<http://www.Lni.wa.gov/Main/ContactInfo/Safety/Sharp.asp>

DOSH Consultation Program

[Washington State Department of Labor and Industries](#)

<http://www.Lni.wa.gov/Safety/KeepSafe/Assistance/Consultation>

**Everett (Region 1, Northwest Washington): 425-290-1300**

**Seattle (Region 2, King County): 206-515-2800**

**Tacoma (Region 3, Pierce, Kitsap, Clallam, and Jefferson Counties): 253-596-3800**

**Olympia (Region 4, Southwest Washington): 360-902-5799**

**East Wenatchee (Region 5, Central and Southeastern Washington): 509-886-6500**

**Spokane (Region 6, Eastern Washington): 509-324-2600**

### **DOSH Technical Services**

Tumwater Central Office – Safety: 360-902-5460



The Safety and Health Assessment and Research for Prevention (SHARP) Program at the Washington State Department of Labor and Industries is funded in part by the National Institute for Occupational Safety and Health (NIOSH) to run the Fatality Assessment and Control Evaluation (FACE) Program in Washington State (Cooperative Agreement No.: 3 U60 OH008487-02S1). The FACE Program collects information on all work-related fatalities in Washington State, investigates select incidents using a safety systems/root-cause approach, and develops reports and other outreach activities. The FACE Program is not compliance-oriented. Its goal is to reduce the number of work-related acute trauma injuries and deaths.