

Classification of Wood Chipper Accident Types: Influence of Bottom Bump Bar

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Abstract: This paper analyzes the potential efficacy of a commercial wood chipper bottom bump bar device with respect to various accident types as part of an international study. The operating condition of the wood chipper bottom bump bar is evaluated with respect to the various real-world accident categories. Field testing was conducted using commercial wood chippers equipped with a bottom bump bar and anthropomorphic dummies to evaluate the ability of a bottom bump bar to prevent a standing operator entangled with brush being fed into the chipper from getting pulled into the feed wheels during operation under specific conditions. Field testing also was performed to analyze the potential for nuisance shut downs of the wood chipper feed wheels due to the fed brush contacting the bottom bump bar during operating conditions.

Keywords: Wood Chipper, Accident Types, Bottom Bump Bar

1. Accident Type Literature Review

Previous research has studied the ability of a human worker to activate the safety control bar and safety pull cable devices to stop and reverse the mechanical infeed system inside a commercial tree chipper infeed hopper (Brickman and Purswell, 2009; Brickman, 2011). This paper analyzes the potential efficacy of a commercial wood chipper bottom bump bar device with respect to various accident types identified as part of an international literature review. Accident statistics databases, news articles, and incident investigations were examined to classify commercial wood chipper accidents into accident type categories. Representative examples are described below. Reported commercial wood chipper feed wheel related accidents are classified as the following: standing operator reaching/kicking into the infeed chute, standing operator entangled with the brush, operator climbing on the tray table, winch line/climbing rope entering the feed wheels, homicide, suicide, and children. In addition, when applicable the operating condition of the commercial wood chipper bottom bump bar is evaluated with respect to the various accident categories, such as properly functioning, intentionally bypassed by modification, bypassed by the provided wood chipper design bypass device, and equipment malfunction.

1.1 Standing Operator Reaching/Kicking into Infeed Chute

On September 23, 2011, a 16-year-old lost all of the toes and most of the ball on his right foot involving a poorly maintained commercial wood chipper in Maidenhead, England (SHP, 2013). The teenage worker was only three weeks into his first job as a general laborer for a tree surgeon company. The injured worker was feeding brushwood into a wood chipper on the site of a small residential property. The worker felt he was falling behind and inserted his right foot into the feed chute to speed up the flow, but his shoe snagged on the feed rollers and was drawn into the cutting blades. The wood chipper was missing a bottom bump bar around the bottom of the feed chute, which hindered the teenager's ability to disable the chipper. An HSE investigation established that the employer had identified the wood chipper's non-functioning bottom bump bar eleven days prior to the incident. Although the employer informed workers about the problem, and had ordered a replacement part from a supplier, the firm allowed the continued use of the wood chipper while waiting for the part to arrive. Pleading guilty to breaching UK regulations, the employer was fined and was also charged a criminal surcharge.



Figure 1. Commercial Wood Chipper Equipped with Bypassed Electronic Bottom Bump Bar Involved in Fatality

1.2 Standing Operator Entangled with Brush

On September 7, 2019, a male worker sustained fatal injuries when he was pulled into a commercial wood chipper in New South Wales, Australia (SafeWork NSW, 2019). A group of workers were felling branches and vegetation at a school in Lindfield. The victim was hand feeding branches into the wood chipper and was drawn into the infeed hopper and into the internal cutting drum. The employer was fined a record multi-million-dollar amount by the court in New South Wales for using a wood chipper which was found to have several defects and failing to comply with its safety obligations. The authors' investigation suggests the wood chipper likely was provided with a bottom bump bar.

On August 23, 2021, a 28-year-old worker suffered serious leg injuries while feeding tree branches into a commercial wood chipper in New South Wales, Australia (SafeWork NSW, 2021). A rope attached to the branches became caught in the blades and wrapped around the worker's legs pulling him into the wood chipper. A photograph taken of the wood chipper after the incident displays that the chipper was equipped with an electronic bottom bump bar. SafeWork NSW reported that this was the fourth serious incident involving commercial wood chipping machinery in the past two years. Two incidents led to workers being killed, while the other two incidents resulted in serious injuries.

1.3 Operator Climbing on Tray Table

On December 5, 2015, a North Carolina tree crew worker was fatally injured when his body entered the feed rollers of a commercial wood chipper from his feet to his lower rib cage during his first day on the job (OSHA, 2016). The OSHA investigation determined that the most likely case of what happened is the worker climbed into the wood chipper infeed to unclog branches or feed shorter limbs into the chipper. The worker either slipped or was pulled down and drug into the feed rollers. OSHA reported that it would be difficult for the worker to be pulled feet first from the ground, up into the wood chipper feed table, and then into the feed rollers and cutting drum, which is consistent with the authors' previous testing (Brickman, 2002). At the time of the accident, there were branches still in the wood chipper infeed, as shown in Figure 1A. This would indicate that the worker went into the chipper with some branches and some of them behind him. This is another indication that the worker most likely climbed into the chipper infeed to unclog a jam and was pulled into the chipper feed rollers.

The chipper was equipped with an electronic bottom bump bar, which was found pushed in and stuck in the locked off position, as shown in Figure 1B. A pry bar had to be used to get the bottom bump bar back into the on position after the accident. If the bottom bump bar was functioning properly, the feed system cannot be restarted without operator pressing the reset button. The spring that pushes the bottom bump bar back into the operating mode was missing. The two electronic switches on each side of the bottom bump bar were not operating, which prevented the signal from being sent to stop the chipper feed rollers, as displayed in Figure 1C. The employer knew the bottom bump bar was not functioning and knew the operator's manual instructed the chipper not to be operated if the bottom bump bar was not functional. The employer stated that the chipper feed rollers would constantly stop if the bottom bump bar was operational, preventing work from getting done.

1.4 Climbing Rope Entering Feed Wheels

On September 14, 2020, an employee was fatally injured when a climbing rope wrapped around his neck while feeding a branch into a wood chipper in Illinois (OSHA, 2020). The employee was working with two other coworkers removing maple branches from the ground after tree trimming operations at a residence. The employees were using a wood chipper to break up the limbs. The wood chipper was missing the electronic lower bottom bump bar on the bottom of the feed tray table, as indicated by the arrow in Figure 2. The foreman positioned in the tree was lowering branches to the employee and coworker. Both the employee and the coworker were feeding branches into the wood chipper. The employee was moving a branch which



Figure 2. Wood Chipper with Removed Electronic Bottom Bump Bar Involved in Climbing Rope Fatality



Figure 3. Wood Chipper with Removed Electronic Bottom Bump Bar Involved in Winch Line Rope Fatality

was still attached to the rope used to lower it to the ground. When the employee began feeding the limb into the chipper, the rope became wrapped around his neck and tightened. The employee was killed when he was decapitated.

1.5 Winch Line Entering Feed Wheels

On September 1, 2021, an employee was fatally injured when he experienced blunt force trauma to his head and face while winching tree debris with a commercial wood chipper winch line rope in Michigan (OSHA, 2021). The accident site was in a subdivision with houses on both sides of the site, as exhibited in Figure 3A. The tree crew had cut down approximately eight large red pine trees approximately seven to eight inches in diameter and 30 feet tall and were working on the last tree when the unwitnessed incident occurred. The employee had brush and tree limbs attached to the winch line rope and was near the wood chipper controls. After the incident, there was very little rope still attached to the winch, because the vast majority of the rope had gone through the chipper, as depicted in Figure 3B. The rope had been shredded and the bulk of it had been thrown into the box truck via the discharge from the chipper. The MIOSHA investigation and photographs taken at the incident site determined that the electronic bottom bump bar had been removed from the chipper at the time of the incident, as indicated by the arrow in Figure 3C.

1.6 Homicide

On November 12, 2017, a 54-year-old man reportedly was killed in an industrial-grade wood chipper exhibited in Figure 4A near Gympie, Australia when he was working with two men on the property (The Courier Mail, 2018). The wood chipper was equipped with a bottom bump bar, as depicted in Figure 4B. The coworkers told the owner of the property where the victim died, shown in Figure 4C, that he had been leaning back into the chipper as well as standing on top of it. The two coworkers originally told investigators that they did not see the victim enter the wood chipper, but they did find him inside the chipper and tried to pull him out. The death was initially deemed an industrial accident. The accidental death was upscaled to a murder investigation. An investigator made a technical assessment of the 15-inch wood chipper blade that was ruled out as a cause of the victim's death. An investigator stated that the chipper was set up in a way that if a user fell, they would not be pulled straight into the chipper. The coworker, who was clearing trees with the victim, was accused of killing the victim (ABC, 2022). During the murder trial, the court was told that the chipper was used to make the victim's death look like an accident. Police footage showed the victim's legs protruding from the wood chipper. The accused man later admitted to disposing of the victim's body at the beginning of his trial. The accused man was sentenced to life in prison after being found guilty of murder.



Figure 4. Commercial Wood Chipper Equipped with Bottom Bump Bar Involved in Homicide

1.7 Suicide

In 2008, a 20-year-old man reportedly lingered near a working commercial wood chipper and then dove into it in a witnessed, apparent suicide attempt in Roseville, Minnesota (Pioneer Press, 2008). A log loader operator who was angling a log toward the wood chipper at the time saw the man jogging and then suddenly breaking into a sprint before diving arm first into a 21-inch-diameter capacity wood chipper. The victim's arm, shoulder, and chest were pulled into the wood chipper feed rollers. The loader operator jumped down on the wood chipper and activated a safety lever to shut the chipper down. The representative for the manufacturer of the wood chipper associated with the incident stated that there is no way on earth to prevent that kind of intentional entry into the machine. The authors' investigation suggests the wood chipper likely was provided with a bottom bump bar.

There have been other reports of attempted suicide by wood chipper. In 2001, a 43-year-old Canadian woman died by throwing herself into a wood chipper on her family's acreage near Ottawa after leaving a four-page suicide note. In 2000, a Phoenix man killed himself with a wood chipper and tried to drag his fiancée in with him (Pioneer Press, 2008).

1.8 Children

On April 10, 2012, a 6-year-old child in Salem, Connecticut was killed after being pulled into a commercial wood chipper (Norwich Bulletin, 2012). The boy's father owns a tree service and was on a landscaping job when the incident occurred. A police spokesman stated that the boy was helping his father clear brush and grind trees from a neighbor's yard at the time of the incident. When the father's back was turned, the boy apparently picked up a branch and tried to feed it into the wood chipper at the time of the incident. The authors' investigation suggests the wood chipper may have been provided with a bottom bump bar.

2. Anthropomorphic Dummy Testing

The scientific method was employed to conduct anthropomorphic dummy field testing with commercial wood chippers equipped with a bottom bump bar. Of interest was the bottom bump bar efficacy to stop the feed rollers during a branch pull-in event. Accident reconstruction methods involving biomechanical and human factors considerations were incorporated in the study design (Knox, 2015). Two anthropomorphic dummies were utilized. A semi-self-supporting Big Blue dummy constructed of a Cordura suit filled with sand, tubing, and dense foam materials was obtained from OK Fine Productions. The Big Blue dummy was approximately 63 inches tall and weighed approximately 135 pounds. The Big Blue dummy has been utilized by South Dakota State University Professors during product safety testing. A Simulaids Rescue Randy durable vinyl manikin used for rescue and extrication training by firefighters, police, military, and safety teams was also utilized. The Rescue Randy model 1344 manikin was 65 inches tall, weighed 145 pounds, and had articulated joints and weight distribution according to a human weight distribution chart (Savelives, 2025). The commercial chippers used in the test program were equipped with bottom bump bars which operate electronically and hydraulically.

2.1 "Big Blue" Dummy Testing

Figure 5 demonstrates Big Blue dummy testing associated with a commercial chipper electronic bottom bump bar similar to that shown in Figure 1. In Figure 5A, the standing dummy's right hand is tied to a branch being fed into the chipper



Figure 5. Big Blue Dummy Does Not Activate Electronic Bottom Bump Bar During Branch Pull-In Test



Figure 6. Rescue Randy Dummy Does Not Activate Hydraulic Bottom Bump Bar During Branch Pull-In Test



Figure 7. Branch Contacts Electronic Bottom Bump Bar Causing Nuisance Shut Down (B) & Control Reset (C)

feed rollers. In Figure 5B, the branch passes through the feed rollers, and the dummy's feet get pulled off the ground and contact the bottom bump bar. In Figure 5C, as the dummy's head and torso enter the rotating feed rollers, the dummy's feet are dragged against and over the bottom bump bar without activating it, and the feed rollers are not stopped. This testing result is consistent with real-world commercial chipper incidents as presented in the accident type literature review.

2.2 "Rescue Randy" Dummy Testing

Figure 6 demonstrates Rescue Randy dummy testing associated with a commercial chipper bottom bump bar typically used in Europe. The mechanical bottom bump bar is connected to the safety control bar and controls the hydraulic feed rollers. In Figure 6A, the standing dummy's right hand is tied to a branch being fed into the chipper feed rollers. In Figure 6B, the branch passes through the feed rollers, and the dummy's feet get pulled off the ground and contact the bottom bump bar. In Figure 6C, as the dummy's head and torso enter the rotating feed rollers, the feed rollers did not stop when the dummy's feet are dragged against and over the bottom bump bar. This testing result is consistent with real-world commercial chipper incidents described in the accident type literature review.

3. Nuisance Trip Testing

Figure 7 displays video still frames showing the nuisance shut down of the commercial chipper feed rollers when a branch contacts and activates the electronic bottom bump bar. In Figure 7A, the branch is being fed into the infeed chute. In Figure 7B, the branch contacts and activates the bottom bump bar, which stops the feeding operation. In Figure 7C, the operator has to reset the chipper controls after the electronic bottom bump bar activation to continue feeding brush into the chipper. This testing result is consistent with the accident type literature review where an employer stated that the wood chipper feed rollers would constantly stop if the bottom bump bar was operational preventing work from getting done (OSHA, 2016).

4. Conclusions

An international literature review classified commercial wood chipper accidents into accident type categories to assist in the technical analysis of the influence of bottom bump bar devices. This paper also presents commercial wood chipper anthropomorphic dummy branch pull-in field testing as data to evaluate the potential influence of the bottom bump bar device to prevent a standing operator entangled with brush from getting pulled into the feed wheels during operation under specific conditions. The test results of this study indicate that the standing anthropomorphic dummies were pulled off their feet and entered the feed wheels without the dummies activating the bottom bump bar and stopping the feed wheels.

While not intended to recreate human reactions in all potential scenarios, these experimental findings are consistent with real-world commercial wood chipper accidents as reported in the international literature, which indicate that the bottom bump bar does not always activate to stop the feed wheels. Additionally, field testing demonstrated the potential for nuisance shut downs of the wood chipper feed wheels due to the fed brush contacting the bottom bump bar during operating conditions, which corroborates reported feedback contained in the commercial tree care industry literature of intentional user bypass of the device. Further, intentional bypass is facilitated with the commercial wood chipper with an electronic bottom bump bar device, which is equipped with a hold to run button to override the device, allowing the feed wheels to continue to operate. It is noted that current arboricultural safety standards in the United States do not require a bottom bump bar on commercial wood chippers (ANSI, 2017).

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