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## Equipment Operator Dies After Scraper Overturns--Virginia

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### SUMMARY

A 47-year-old male equipment operator (the victim) died when the scraper he was operating overturned while negotiating a turn. As part of a parkway construction project, the victim had been moving earth from a cut area to a fill area. As he was completing a U-turn into the cut area, the right side tire of the scraper's tractor ran up on an elevated berm causing the machine to slowly tip over to the left. As the machine tipped, the victim apparently abandoned the operator's cab, jumping to the ground where he slipped and fell. As he was attempting to get up and retreat to safety, he was crushed by the top bar of the machine's rollover protective structure (ROPS). A co-worker who had been operating a bulldozer behind the scraper immediately notified the job foreman who called for emergency assistance. A local emergency medical service (EMS) responded in 15 minutes; however, because of the extent of the victim's injuries no life saving attempts were made and the victim was pronounced dead at the scene.

NIOSH investigators concluded that, to prevent similar occurrences, employers should:

- *ensure that earthmoving equipment operators are aware of the hazards of attempting escape from the equipment during overturns and should emphasize that operators remain inside the protection of the ROPS with seat belt fastened.*
- *ensure that operators of earthmoving equipment are aware of the importance of maintaining the lowest possible machine center of gravity at all times.*
- *ensure that haul road routes are free from overturn hazards of sharply contrasting gradients and curves.*

### INTRODUCTION

On March 14, 1996, a 47-year-old equipment operator (the victim) died when the scraper he was operating overturned and pinned him beneath the ROPS after he jumped from the operator's cab. On April 22, 1996, officials of the Virginia Occupational Safety and Health Administration (VAOSHA) notified the Division of Safety Research (DSR) of the incident and requested technical assistance. On May 14, 1996, a DSR safety engineer met with the VAOSHA compliance officer assigned to the case and reviewed the case. The employer's safety director was interviewed and the scraper was photographed and measurements were taken.

The employer was a construction company which performed road construction, site preparation, and the associated pipe laying. The company had been in business for 10 years employing about 160 workers depending on the number of jobs in progress. The company had a written safety policy and program which contained general safety rules dealing with the hazards of working near equipment and personal safety. Specific equipment operating procedures were learned on-the-job. Jobsite safety meetings were conducted routinely every two weeks. The pipe superintendent served as the safety director. Construction crews normally worked five days per week, starting at 7:00 a.m. and continuing until about 5:30 p.m. depending on the weather. The victim had worked for the company for about 9 years. This was the company's first fatality.

### INVESTIGATION

The employer had been contracted to widen a stretch of road as part of a parkway construction project. The job had

been started in November 1995 and was scheduled for completion in October 1996. The work crew consisted of two scraper (pan) operators, a bulldozer (pusher) operator, a roller operator, and a site foreman. Work had begun at the usual start time of 7:00 a.m. and proceeded normally until just before 2:30 p.m. The crew was removing material from a 40 foot wide cut area along the east edge of the existing two-lane road and transporting the material to a fill area located along the west edge of the road. The length of haul varied from 200 to 300 yards as work progressed northward. The scrapers normally cut a 6 inch deep lift, aided by the bulldozer which pushed them through the cut area. Once the scraper was loaded, the bulldozer returned to the mouth of the cut and waited to assist in loading the next scraper. The victim had successfully operated the machine during the morning and had made 4 or 5 passes through the cut area after the lunch break. He had been turning in approximately the same area for about 45 minutes. As he was completing a turn into the cut area, to begin loading another lift, and while the scraper was still articulated in the turn, the right side wheel of the tractor rode up on a berm, causing it to slowly overturn. As the tractor overturned, the victim jumped from the cab, falling down as he landed on the ground. While he was attempting to get up, the top member of the ROPS struck and pinned him to the ground. The bulldozer operator observed the overturn from the rear of the scraper, dismounted, and went to notify the jobsite foreman located several hundred feet down road at the fill area. The foreman notified the company dispatcher at the main office who notified EMS. EMS arrived within 15 minutes; however, because of the extent of injury no life saving attempts were made and the victim was pronounced dead at the scene.

## CAUSE OF DEATH

Autopsy revealed the cause of death to be multiple crush injuries of the thorax, abdomen, and lower extremities.

## RECOMMENDATIONS

***Recommendation #1: Employers should ensure that earthmoving equipment operators are aware of the hazards of attempting escape from the equipment during overturns and should emphasize that operators remain inside the protection of the ROPS with seat belt fastened.***

Discussion: The machine in this incident was equipped with a ROPS and seat belt. Evidence indicates that the victim routinely used the seat belt and was wearing it at the time of the incident. After the incident, the belt was found to be in clean condition with each end laying over the edge of the seat as if it had recently been unbuckled. The victim had been routinely observed using the belt and had attended two jobsite safety talks on this issue within the past year prior to the incident. The incident was witnessed by a truck driver located on the road who reported that he observed the victim jump from the cab as the scraper slowly rolled over. When the victim landed on the ground, his feet slipped and he fell down. As he was attempting to regain his footing to escape, the top of the ROPS struck and pinned him to the ground. After the scraper was righted, it was allowed to sit idle overnight, examined for defects and started up. The only damage to the scraper consisted of scratches and scraped paint. The ROPS and operator's compartment suffered no damage. Had the victim remained in the seat with seat belt fastened, his risk of injury would have been minimal.

***Recommendation #2: Employers should ensure that operators of earthmoving equipment are aware of the importance of maintaining the lowest possible machine center of gravity at all times.***

Discussion: Earthmoving machines are routinely exposed to travel across steeply sloped ground. In this case, the 41-foot long scraper had to negotiate a turn in a width of about 40 feet while ascending a 12% grade and traversing as much as a 20% grade. Witnesses observed that the machine's apron was in a fully raised position during the turn, which would raise the machine's center of gravity. The bowl of the scraper may also have been in the raised position, further raising the center of gravity. As the machine was making the turn, the right wheels ran up on a berm created from previous turns and the machine slowly rolled over. Witnesses stated that the machine had successfully turned in the same location 4 or 5 times before. During one of the turns, a witness observed the right wheel raise up, but the

machine did not roll. This indicates that the machine was being operated on the edge of stability. Had the apron been lowered during the turn, it may have lowered the center of gravity enough to prevent overturn.

***Recommendation #3: Employers should ensure that haul road routes are free from overturn hazards of sharply contrasting gradients and curves.***

Discussion: The turning area being used contained a berm-like ridge which may have been a result of continued turning by the scrapers in the same location. This ridge caused a difference in elevation between the left side of the machine and the right side of the machine of about 2 feet. The wheels of the machine encountered this ridge while the machine was still negotiating an uphill turn, causing the weight of the machine to be concentrated downhill. This condition would exacerbate the tendency of the machine to overturn.

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