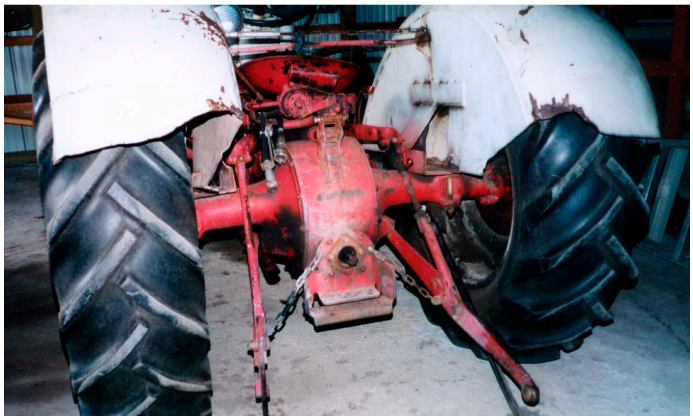
MIFACE INVESTIGATION: #01MI015

SUBJECT: Farmer Pinned Beneath Tractor Overturned To the Rear

Summary



On February 11, 2001, a 40- year old part-time male farmer was killed when his 1950 agricultural tractor overturned to the rear while attempting to free a stuck pickup truck from a frozen, muddy field. The victim and a helper were working together to free the truck. The victim attached a log chain from the rear bumper of the pickup truck to the top link connection of the tractor's three-point hitch. The helper started the truck and placed the truck in reverse gear, ready to assist the victim, who was using the tractor. While attempting to pull the truck out of the mud, the front of the tractor bounced up and down several times, then upset to the rear, landing on the victim. Unable to assist, the driver of the truck ran to the victim's house, and called 911. The Fire Department responded, and determining that the victim had no vital signs, contacted the medical examiner. The medical examiner pronounced the victim dead at the scene.

RECOMMENDATIONS

- Use proper equipment and procedures to free and tow a stuck vehicle, such as a 4-wheel drive truck.
- Tractor owners can retro-fit many older tractors with a Rollover Protection System (ROPS) that includes a seat belt.
- Farm tractor operators should always follow recommended hitching techniques when using a tractor.
- Only use farm equipment as intended by the manufacturer. Pulling motor vehicles or fixed objects, such as a tree stump or fence post, with a farm tractor is a misapplication of the intended use of an agricultural tractor. Read, understand and follow the manufacturer's operator's manual.

INTRODUCTION

On February 11, 2001, a 40- year old male part time farmer was killed when his 1950s model agricultural tractor overturned to the rear while attempting to free a stuck pickup truck from a frozen, muddy field. On June 1, 2001, MIFACE investigators traveled to the site of the incident, interviewed the wife of the deceased and viewed the tractor and incident site. The death certificate, autopsy results, police report and maintenance manual were obtained during the course of the investigation.

INVESTIGATION

The victim grew up on a family farm and at the time of this incident was a part-time blueberry farmer. On his 10- acre farm were 3 acres of blueberries. The farm acreage was mostly level, with only a small low area in the land on the south side of the blueberry acreage. The victim had been growing blueberries for approximately eight years. Behind the blueberry acreage was an open field that in the future, was to be additional blueberry acreage. The victim was having a problem with deer eating and damaging the blueberry bushes. The deer were entering the blueberry acreage from a wooded area surrounding the open field. The victim had been hazing the deer by driving his pickup truck through the blueberry acreage and the open field. When this action did not discourage the deer, he requested and received permission from the appropriate state agency to kill, out of season, some of the deer damaging his blueberry bushes. The victim drove a full size pickup truck to this field to assist in the deer hunting activities. The truck became stuck in mud in the field. The victim had tried to free the truck prior to using the tractor, as indicated by mud coming up to mid-tire level of the truck.

Earlier in the winter, there had been heavy snows. Tracking the weather pattern, for several weeks prior to the incident, the weather had been above freezing during the day and below freezing in the evening. The warm temperatures melted the snow during the day and led to softening of the ground. Two days prior to the incident, the temperature was below freezing, both during the day and night. The wife of the deceased could not recall the exact length of time the truck was in the field, only stating it was one or two days. There was approximately 1" of snow on the ground on the day of the incident. The truck, although when originally stuck in the ground, may have been only in mud. After a couple days of freezing temperatures, the truck may have been frozen in the ground.

On the day of the incident, the victim used a vintage 1950s Ford tractor with a manual transmission and 2-wheel drive to try to free the truck. The vintage tractor did not have a Rollover Protection System (ROPS) with a seat belt. The victim and his helper went out to the field. It is unknown if the victim had previous experience in using the tractor to pull out a stuck vehicle. The victim attached a log chain from the rear bumper of the pickup truck to the top link connection of the tractor's three-point hitch (the centered upper attachment point). The helper started the truck and placed the truck in reverse gear, ready to assist the victim, who was driving the tractor. While attempting to pull the truck, the front of the tractor bounced up and down several times, then upset to the rear, landing on the victim. It is unknown if the victim was "popping" the clutch or using short bursts of power which would jerk the tractor while pulling on the truck. The helper witnessed the rear turnover, and exited the truck to assist the victim. Unable to assist, the helper ran to the victim's house, and called 911, and returned to the incident site to wait for emergency personnel. The Fire and Police Departments responded. The Fire

Department determined that the victim had no vital signs, and contacted the medical examiner. The medical examiner pronounced the victim dead at the scene.

CAUSE OF DEATH

The cause of death as stated on the death certificate was mechanical and positional asphyxia.

RECOMMENDATIONS/DISCUSSION

- Use proper equipment and procedures to free and tow a stuck vehicle, such as a 4-wheel drive truck.

An agricultural tractor is not designed for this specific job application. If a tractor is used to free and tow a stuck vehicle, the operator should hitch the front of the towing tractor to the front of the stuck vehicle. Operating the tractor slowly and deliberately, and using a slow, steady pull, drive the towing tractor in reverse.

- Tractor owners can retro-fit many older tractors with a Rollover Protection System (ROPS) and seat belts.

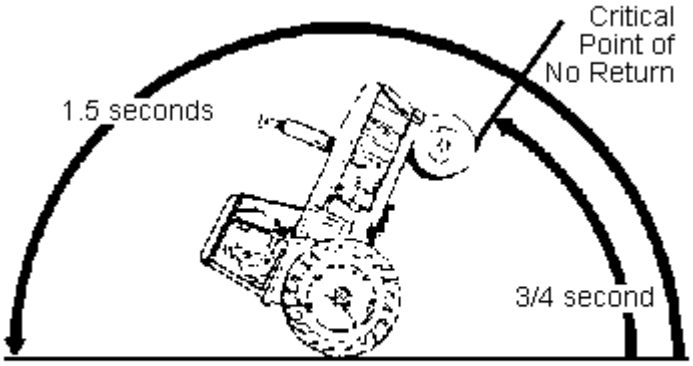
The 1950s Ford 800 N tractor being used to free the truck from the muddy field was not originally equipped with a ROPS and seat belt. The ROPS, in conjunction with wearing a seatbelt, provides a protective zone for the operator in the event of a turnover (rear or side). ROPS first became available as optional equipment on farm tractors in 1971. These safety features were not required on tractors until 1976, when OSHA standard 29 CFR 1928.51 went into effect. This standard required employers to provide ROPS and safety belts for all employee-operated tractors manufactured after October 25, 1976. However, this standard does not apply to family farms or farms employing fewer than 11 employees. A retrofit system for the tractor in this incident is available from SAF-T-CAB (a supplier) for an 2-post ROPS model for about $1,724. A retro 4-post system from the same supplier costs about $1,491.

A ROPS and seat belt may have protected the operator while using the vintage tractor in this situation. Tractors are designed with a high center of gravity and are sometimes used in circumstances where there are risks of overturning, even on level ground. Considering the variety of jobs tractors are asked to perform, retrofitting a tractor with a ROPS and seat belt will provide protection in all tractor applications where a turnover may occur.

It is important to remember that the ROPS and wearing the seat belt does not prevent a tractor overturn; it protects the operator from being crushed if an overturn occurs.

Rear overturns of tractors are sudden events: following start of an rear overturn, the tractor may reach a critical point of no return in approximately ¾ of a second – a time often shorter than that required by the operator to react and attempt to correct the rear overturn. The whole rear overturn event can occur in 1 ½ seconds. Human reaction time to responds varies from ½ to 1 second.

For a tractor to stay upright, its center of gravity must stay within the tractor's stability baseline (an imaginary line drawn between points where the tractor tires contact the ground). A tractor's center of gravity is a point where all parts balance one another. The center of gravity is located closer to the rear axle than the front axle. Normally, a tractor's center of gravity is located about 2 feet in front of and 10 inches above the rear axle resulting in approximately 30% of the tractor weight on the front axle and 70% of the weight on the rear axle. A tractor's center of gravity does not move – but its relationship to the stability baseline can change. If the distance between the center of gravity and the stability baseline is reduced, then the potential for an overturn (either side or rear) is increased.



Rescue time in a rear turnover is 3/4 of a second. You can't always stop it in time.

Engaging the tractor clutch results in a twisting force, called torque, to the rear axle. In a 2-wheel drive tractor, rear-axle torque involves an energy transfer between the tractor engine and the rear axle. This torque is then transferred to the tractor tires. The tractor can respond to the torque in 4 different ways, depending on the circumstance. When the tractor can move freely, the rear axle and tires will rotate and the tractor will move ahead. If the tractor remains stationary, the wheels can spin or the tractor engine can stall out. In each of these cases, the rear axle is rotating about the tractor chassis. *If the rear axle cannot rotate, then the tractor chassis rotates about the axle (reverse rotation).* This reverse rotation results in the front end of the tractor lifting off the ground, moving the tractor's center of gravity past the tractor's rear stability baseline. Unless the operator compensates, which is unlikely due to human reaction time and the speed of an overturn event, the tractor's center of gravity may pass the rear stability baseline. When the center of gravity passes the rear stability baseline, the tractor's critical point of no return is reached, and the tractor will continue its rearward motion until it hits the ground. Depending on the tractor, the critical point of no return may only be 75 degrees from a level surface. The center of gravity "moves" toward the tractor's rear stability baseline when the tractor is headed up a hill, or if the rear wheels are below normal ground surface, such as when sunk in soft ground.

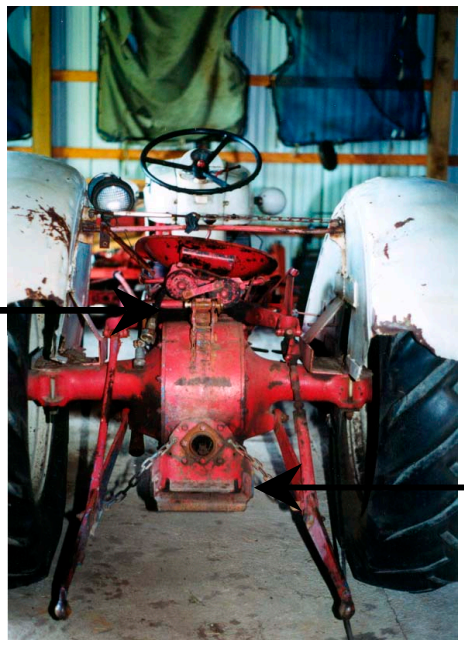
- Farm tractor operators should follow recommended hitching techniques when using a tractor. Pulling motor vehicles or fixed objects, such as a tree stump or fence post with a farm tractor is a misapplication of the intended use of an agricultural tractor.

In addition to the center of gravity factor in a rear overturn, load weight and proper hitching of the load to a 2-wheel drive tractor must be considered. The weight of the load, and the tractor's angle of pull (where the load is attached to the tractor) are important safety considerations. If the load is hitched high (especially a heavy load), both the angle of pull and the leverage a load may exert on the tractor to tip rearward is

increased. A higher hitch point also increases the pressure of the rear tires against the ground. This may prevent the rear tires from slipping. When the rear tires stop slipping, rear axle torque begins to lift the tractor's front end. As the tractor's front end is raised off the ground, the distance of the tractor's center of gravity from the rear stability baseline is reduced, and the possibility of rear overturn is increased.

When a load is hitched to the drawbar, if the front end of the tractor lifts, the rear drawbar will lower. As the drawbar lowers, the angle of pull and the leverage the load has to tip the tractor rearward is lowered. This action prevents the tractor's center of gravity from passing the rear stability baseline.

When a load is hitched high on the tractor or attached directly to the rear axle, less power is required to lift the front end of the tractor than to move the load or slip the wheels, which may result in a overturn through rearward rotation. Hitching a load to the rear axle of the tractor may also be a factor in a tractor rear overturn. The angle of pull and leverage do not reduce as the front end raises because the location of the hitch point (rear axle) stays constant throughout the rearward tip.



Another strategy for minimizing the potential for a rear turnover is to add appropriate counterweight to the front of the tractor. This can be accomplished by using front-end weights or weighted front tires. Use the tractor's operator's manual to obtain the correct method of attachment and the weight/capacity limits for front-end weights.

Always hitch to the drawbar or the drawbar area – not the axle or higher.

- Only use farm equipment as intended by the manufacturer. Read, understand and follow the manufacturer's information manual if one is available.

Using farm equipment other than for intended use may create unsafe work conditions. The vintage tractor was not designed to extricate a stuck vehicle. The farm owner apparently did not have an operator's manual for the tractor. Tractor owners should make every effort to obtain an operator's manual for each tractor on the farm, as well as other safety materials, booklets to use as training aids for safe tractor operation.

An agricultural tractor is not designed for this specific job application – pulling vehicles or tree stumps is a misapplication of the intended use of an agricultural tractor.

MIFACE
Investigation Report # 01 MI 015
Evaluation

To improve the quality of the MIFACE program and our investigation reports, we would like to ask you a few questions regarding this report.

Please rate the following on a scale of:

Excellent	**Good**	**Fair**	**Poor**
1	2	3	4

What was your general impression of this MIFACE investigation report?

1 2 3 4

Was the report…

Objective?	1	2	3	4
Clearly written?	1	2	3	4
Useful?	1	2	3	4

Were the recommendations …

Clearly written?	1	2	3	4
Practical?	1	2	3	4
Useful?	1	2	3	4

How will you use this report? (Check all that apply)

- o Distribute to employees/family members
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Thank You!

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