



TRACTOR HAZARDS

HOSTA Task Sheet 4.2

Core

NATIONAL SAFE TRACTOR AND MACHINERY OPERATION PROGRAM

Introduction

Tractors are a primary source of work-related injury on farms, however, not all of the injuries happen while the tractor is being used for work.

Nationally, nearly one-third of all farm work fatalities are tractor-related. Injuries occur for a variety of reasons and in a number of different ways. This task sheet will describe types of tractor hazards and the nature and severity of injuries associated with using farm tractors.

Hazard Groups

There are several hazards associated with tractor operation. Tractor hazards are grouped into the following four categories:

1. Overturns
2. Runovers
3. Power Take-Off Entanglements
4. Older Tractors

Each of these is discussed briefly in this task sheet. Other task sheets will cover some of these topics in more detail.

Overturn

Tractor **overturns** is one major hazard group and accounts for the most farm-work fatalities. Approximately 50% of tractor fatalities come from tractors turning over either sideways or

backward. There are dozens of examples of tractor turnover situations. Most are preventable if operators follow good safe tractor operation practices. Some common examples of tractor overturns include:

- Turning or driving too close to the edge of a bank or ditch
- Driving too fast on rough roads and lanes and running or bouncing off the road or lane
- Hitching somewhere other than the drawbar when pulling or towing objects
- Driving a tractor straight up a slope that is too steep
- Turning a tractor sharply with a front-end loader raised high

A rollover protective structure (ROPS), a structural steel cage designed to surround the operator—particularly one that is built into an enclosed cab—can protect the operator from being killed when a tractor overturns. This is especially true if the operator has fastened the seat belt. Remember, though, that a ROPS can protect you from injury but cannot keep the tractor from overturning in the first place. This explains the importance of operating a tractor safely even if the tractor has a ROPS.

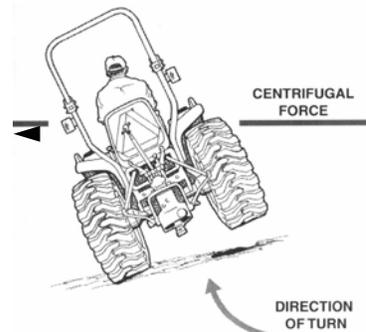


Figure 4.2.a. Tractor overturns can occur with high speed sharp turns. Avoid sudden sharp movements in all tractor work. *Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.*

Top-heavy, powerful tractors can upset if used improperly.

Learning Goals

- To recognize and avoid those hazardous situations which can result in exposure to overturns, runovers, PTO entanglements, and older tractor safety deficiencies.

Related Task Sheets:

Reaction Time	2.3
Mechanical Hazards	3.1
Agricultural Tractors	4.1
Tractor Stability	4.12
Using the Tractor Safely	4.13
Using PTO Implements	5.41

Follow this rule! One seat on a tractor means one rider only- the operator. Keep all others away.



Figure 4.2.b. Tractor runovers have claimed many lives. Extra riders can slip from the tractor and be crushed before the operator can stop. Say no to your friends who want to hitch a ride.

Runover

There are three basic types of tractor *runover* incidents. One is when a passenger (extra rider) on the tractor falls off. Extra rider incidents happen because there is only one safe place for a person to be on a tractor, and that is in the operator's seat. *Some new, larger tractors have an extra seat for temporary instructional purposes, but only if the tractor has an enclosed ROPS cab.* The tractors that most young and inexperienced operators drive will have only one seat—the operator's seat. Standing on the tractor drawbar, axle housing, side links of three-point hitches, rear-wheel fenders, and the area immediately around the operator's seat are common locations unsafely occupied by extra riders. Extra riders rarely keep a tight handgrip on the

tractor. Thus they can be easily thrown from the tractor.

Another runover incident involves the tractor operator either falling off the tractor as it is operating or being knocked out of the seat by a low-hanging tree branch or other obstacle. This most often happens on older tractors that do not have a ROPS and have an older seat that has no arm or back rest (often called pan seats). A person can more easily lose his or her balance and be knocked off or bounced out of a pan seat. An operator can also be run over while trying to mount or dismount a moving tractor. This type of incident can occur when the operator leaves the tractor seat without first shutting off the tractor and setting the brake or placing it in PARK, and the tractor moves unexpectedly. This may happen during the hitching and unhitching of equipment. Shut off the tractor before dismounting for any reason.

The third type of runover incident involves a person who is on the ground near a tractor. This may include the tractor operator who tries to start a tractor from the ground while the tractor is in gear. This usually involves an older tractor that can be started in gear or a newer tractor when an operator attempts to bypass a newer tractor's safe start-up design. Bypass starting hazards are discussed in more detail in Task Sheet 4.8.

Small children, often under the age of 5, are sometimes run over by a tractor (and equipment) as it is moved around the farmstead. Often, the tractor operator is unaware that the child is near the tractor. A loud noise, such as the start up of a tractor, is often attractive to a young child, and he or she may run toward it as it starts or begins to move.

Power Take-Off (PTO) Entanglement

The tractor *power take-off (PTO) stub* is another major hazard. The PTO stub transfers power from the tractor to PTO-powered machinery. The PTO stub normally turns between 540 and 1,000 revolutions per minute. At this rate, the stub is turning from 9 to 17 times per second. This is much faster than a human being can react if he or she is caught and pulled into or around the PTO stub or shaft. A person can have an arm or leg wrapped around a PTO stub shaft before they know they are in danger. A PTO master shield protects a person from the PTO stub. Some tractors have PTO stub guards that fasten to the PTO stub. All tractors should have a PTO master shield to protect the tractor operator and helpers.

Older Tractors

Older tractors should always be included when talking about tractor hazards. Many farm tractors still used for work may be 30 to 40 years old or older. These older tractors are often less safe to operate because they do not have modern safety features, and because some parts of the older tractor may not have been maintained in good working condition. A list of reasons why older tractors may be less safe to operate includes:

- Lack of ROPS and seat belt
- A seat without arm and back

rests (pan seat)

- Seat does not adjust easily or at all
- Absence of a safety start system
- No bypass starting protection
- Rear brakes and brake pedals do not operate properly
- Front wheels do not turn as quickly as the steering wheel turns
- Tractor has no warning flashers or the flashers do not work
- PTO master shield is missing or does not offer adequate protection

Young and inexperienced workers may be given older tractors to operate in many cases. The older tractor is best suited for the types of jobs a young or inexperienced operator is hired to do. These tractors are best suited for raking hay, hauling wagons, and mowing fields or pastures. Young and inexperienced operators should be given newer tractors to operate when possible.

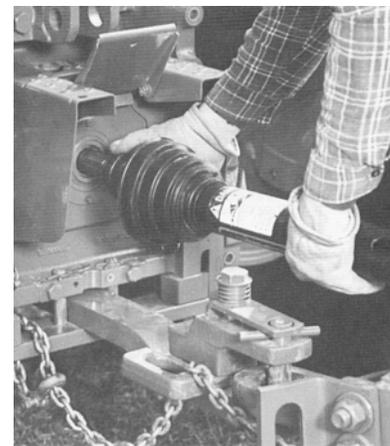


Figure 4.2.c. Power take-off stub and PTO shaft must be properly guarded to prevent entanglements. Locate the PTO area on every tractor you operate. Check whether or not that area is safely guarded.

PTO shafts kill or cripple countless victims. Some of these victims most likely live in your community.



Figure 4.2.d. Older tractors are often assigned to younger drivers to do less heavy chores. Raking hay, pulling wagons, and hauling feed to livestock does not require the most powerful tractor. Older tractors may have safety deficiencies due to age and missing safety features. This tractor does not have a ROPS or seat belt.

Safety Activities

1. Match the tractor hazard with the safety situation. (Some choices may be used more than once.)

___A. Overturn

___B. Runover

___C. PTO entanglement

___D. Older tractor deficiency

1. High lift carried in raised position in transit

2. Pet dog was tied to wagon

3. Bypass starting

4. PTO stub shaft missing

5. Driving too close to ditch embankment

6. A friend is helping to drop the hitch pin

2. Write a letter to your best friend explaining why you won't let him/her ride on the fender of the tractor to go to the field to help you make hay.
3. Explain how people are run over when they choose to bypass the ignition switch to start the tractor engine.
4. Learn more about the hazards of bypass starting a tractor engine by contacting a tractor salesperson or mechanic.

References

1. Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.
2. Safe Operation of Agricultural Equipment, Student Manual, 1988, Silletto and Hull, Hobar Publications.

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NAGCAT TRACTOR OPERATION CHART

HOSTA Task Sheet 4.3

Core

NATIONAL SAFE TRACTOR AND MACHINERY OPERATION PROGRAM

Introduction

Farm families often provide much of the labor for the operation of the farm. Farm work may start early in a child's life as a means of learning responsibility and contributing to the productivity of the farm.

Tractor operation can come at an early age for many farm youth because tractors are a large part of how farm work is done. Tractor work can range from the simple to the complex.

This task sheet presents a Tractor Operation Chart as a guide to appropriate tractor work for young tractor operators.

Youth and Tractors

Examples of common jobs performed by youth operating tractors include:

- Mowing pastures, fields, yards and lanes
- Raking and baling hay and straw
- Towing hay and grain wagons between fields and storage
- Picking rocks and other obstacles from fields using a front-end loader
- Scraping manure from barn floors with a tractor-mounted blade
- Using the tractor to power augers and elevators during unloading operations
- Pulling old fence posts and tree stumps out of the ground with log chains

Several hazards can arise during the course of these and other jobs that involve tractor use. Many times the larger the tractor, the more complex the operation of that tractor becomes. Additionally, large and complex equipment may be attached to and powered by the tractor.

Young tractor operators do not usually have the experience needed to skillfully and safely operate large and complex combinations of tractors and machinery.

North American Guidelines for Children's Agricultural Tasks (NAGCAT) Tractor Operation Chart

Farm injury prevention specialists from the U.S. and Canada have developed consensus opinion that a guide to tractor operations by age groups is a way of matching youthful capabilities with tractor operation jobs. The NAGCAT chart is presented on the reverse side of this task sheet.

You can use this chart:

- To see if you have been doing jobs with the size tractor that matches your age
- To guide an employer in determining what they can reasonably expect a person of your age to do with various types and sizes of tractors

It is common for youths to be over confident in their ability to react safely to new or unexpected hazard situations with tractors.



Figure 4.3.a. Oftentimes the youthful farm worker is willing to do more work than his or her mental and physical maturity will safely permit. Youth should never operate a tractor without a ROPS and seat belt.

Learning Goal

- To review safety recommendations in matching tractor size and tasks with the age of the tractor operator

Related Task Sheets:

Safety and Health Regulations	1.2
Injuries Involving Youth	2.1
Age-Appropriate Tasks	2.4

Refer to the specific guideline for recommended supervision	Size of Tractor →				
	LAWN & GARDEN less than 20hp	SMALL 20hp to 70hp	MEDIUM/LARGE more than 70hp	ARTICULATED	
Increased Complexity of Job →	OPERATING A FARM TRACTOR (no equipment attached)	12-13 years	12-13 years	14-15 years	16+ years
	TRAILED IMPLEMENT fieldwork	12-13 years	12-13 years	14-15 years	16+ years
	3-POINT IMPLEMENTS fieldwork	12-13 years	14-15 years	14-15 years	16+ years
	REMOTE HYDRAULICS fieldwork	14-15 years	14-15 years	14-15 years	16+ years
	PTO-POWERED IMPLEMENTS fieldwork	14-15 years	14-15 years	14-15 years	16+ years
	TRACTOR-MOUNTED FRONT-END LOADER	14-15 years	16+ years	16+ years	16+ years
	WORKING IN AN ORCHARD	14-15 years	16+ years	16+ years	16+ years
	WORKING INSIDE BUILDINGS	14-15 years	16+ years	16+ years	16+ years
	DRIVING ON PUBLIC ROADS*	N/A	16+ years	16+ years	16+ years
	PULLING OVERSIZED OR OVERWEIGHT LOAD	<p style="text-align: center;">Due to increased hazard and complexity, these jobs should not be assigned to children.</p>			
	HITCHING TRACTOR TO MOVE STUCK OR IMMOVABLE OBJECTS				
	SIMULTANEOUS USE OF MULTIPLE VEHICLES				
	ADDITIONAL PERSONS WORKING ON A TRAILING IMPLEMENT				
PESTICIDE OR ANHYDROUS AMMONIA APPLICATION*					

*Follow State/Providence Laws

References

1. [www.nagcat.org/Click on Guidelines/Select T1 Tractor Operation Chart, December 2002.](http://www.nagcat.org/Click on Guidelines/Select T1 Tractor Operation Chart, December 2002)
2. Cooperative Extension Service of your State's Land Grant University.

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TRACTOR STABILITY

HOSTA Task Sheet 4.12

Core

NATIONAL SAFE TRACTOR AND MACHINERY OPERATION PROGRAM

Introduction

No other machine is more identified with the hazards of farming as the tractor. Nearly 50% of tractor fatalities come from tractor overturns. Tractors are used for many different tasks. Because the tractor is a versatile machine, operators sometimes stretch the use of the tractor beyond what the machine can safely do. For example, an operator may turn a corner too quickly for the tractor to stay upright. The use of a rollover protective structure (ROPS) and a seat belt can save your life if a tractor overturns while you are driving.

This task sheet explains the four major reasons and forces that allow tractors to overturn, gives rules for how to prevent tractors from overturning, and discusses the use of tractor ROPS with a seat belt.

How Tractors Overturn

Center of gravity (CG). A center of gravity is the point where all parts of a physical object balance one another. When you balance a pencil on your finger, you have found the pencil's CG. This is the part of the pencil that is resting on your finger. On a two-wheel drive tractor, CG is about 10 inches above and 12 inches in front of the rear axle. Figure 4.12.a shows the normal position of a tractor's CG.

Look at Figure 4.12.b. This shows



Figure 4.12.a. Expected position of a tractor's center of gravity. *Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.*

that the CG is inside a tractor's stability baseline. Drawing a line to connect all the wheels of the tractor as the wheels set on level ground forms a tractor stability baseline. The line connecting the rear tire ground contact points is the rear stability baseline. The lines connecting the rear and front tire on the same side are the right and left side stability baselines. Front stability baselines exist but have limited use in tractor overturn discussions.

There are two very important points to remember about tractor CG and stability baselines:

- The tractor will not overturn if the CG stays inside the stability baseline.
- The CG moves around inside the baseline area as you operate the tractor.

As you can see in figure 4.12.b, a wide front-end tractor provides more space for the CG to move around without going outside the stability baseline.

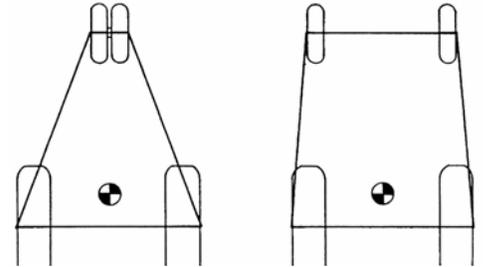


Figure 4.12.b. The tractor's center of gravity is inside the stability baseline.



Learning Goals

- To explain the role that center of gravity plays in tractor overturns
- To list reasons the center of gravity moves within a stability baseline
- To explain how to be protected during a tractor overturn

Related Task Sheets:

Agricultural Tractors	4.1
Tractor Hazards	4.2
Moving and Steering the Tractor	4.10
Using the Tractor Safely	4.13
Operating the Tractor on Public Roads	4.14

Reasons the CG Moves Around

There are five main reasons why a tractor's CG moves outside the stability baseline.

1. The tractor is operated on a steep slope.
2. The tractor's CG is raised higher from its natural location 10 inches above the rear axle.
3. The tractor is going too fast for the sharpness of the turn.
4. Power is applied to the tractor's rear wheels too quickly.
5. The tractor is trying to pull a load that is not hitched to the drawbar.

How Center of Gravity and Centrifugal Force Result in an Overturn

When a tractor is on a slope, the distance between the tractor's CG and stability baseline is reduced. Figure 4.12.c shows how this occurs. On steep slopes, the tractor is already close to an overturn. A small bump on the high side, or a groundhog hole on the low side, may be all that is needed for the tractor to overturn.

A front-end loader or other attachment mounted on a tractor can raise the tractor's CG. When the bucket is raised high, the balance point for the whole tractor is also raised. Figure 4.12.d shows how a raised CG makes it easier for a tractor to turn over sideways.

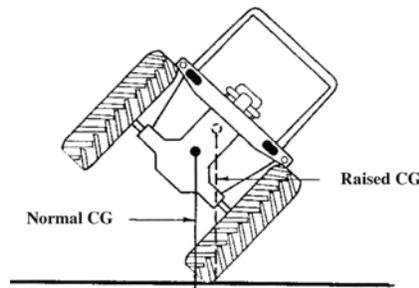


Figure 4.12.c. When a tractor is on a slope, the distance between the tractor's CG and stability baseline is reduced.

Centrifugal force (CF) is the outward force nature exerts on objects moving in a circular fashion. During tractor overturns, CF is that force trying to roll the tractor over whenever the tractor is turning. Centrifugal force increases both as the turning angle of the tractor becomes sharper (decreases), and as the speed of the tractor increases during a turn. For every degree the tractor is turned tighter, there is an equal amount of increased CF.

The relationship between CF and tractor speed, however, is different. Centrifugal force varies in proportion to the square of the tractor's speed. For example, doubling tractor speed from 3 mph to 6 mph increases the strength of CF four times ($2^2 = 2 \times 2 = 4$). Tripling tractor speed from 3 mph to 9 mph increases CF nine times ($3^2 = 3 \times 3 = 9$).

Centrifugal force is what usually pushes a tractor over when the tractor is driven too fast during a turn or during road travel. During road travel, rough roads may result in the tractor's front tires

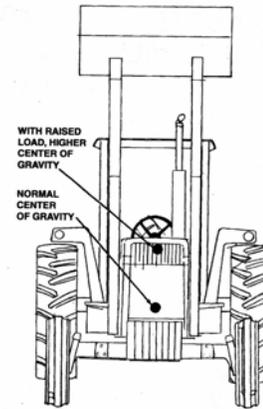


Figure 4.12.d. A raised CG makes it easier for a tractor to turn over sideways. *Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.*

bouncing and landing in a turned position. If the tractor starts to veer off the road, over correction of steering can result in side overturns. Centrifugal force is often a factor in tractor side overturns. When the distance between the tractor's CG and side stability baseline is already reduced from being on a hillside, only a little CF may be needed to push the tractor over.

Engaging the clutch of a tractor results in a twisting force, called torque, to the rear axle. Under normal circumstances, the rear axle (and tires) should rotate and the tractor will move ahead. If this occurs, the rear axle is said to be rotating about the tractor chassis. If the rear axle cannot rotate, then the tractor chassis rotates about the axle. This reverse action results in the front end of the tractor lifting off the ground until the tractor's CG passes the rear stability baseline. At this point, the tractor will continue rearward from its own weight until the tractor crashes into the ground or other obstacle. See Figure 4.12.e.

The CG of a tractor is found closer to the rear axle than the front axle. A tractor may only have to rear to about 75 degrees from a level surface before its CG passes the rear stability baseline and the tractor continues flipping over. This position is commonly called the “point of no return.” As Figure 4.12.e shows, this point can be reached more quickly than an operator can recognize the problem.

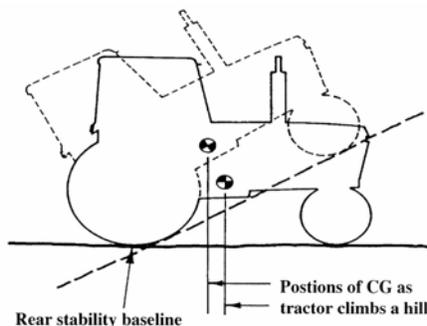


Figure 4.12.f. When a tractor is pointed up a slope, the CG is closer to the rear stability baseline.

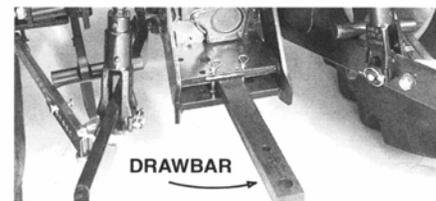


Figure 4.12.g. Only hitch to the drawbar. *Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.*

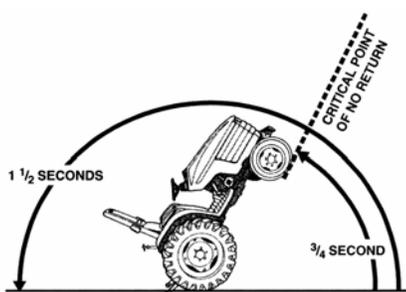


Figure 4.12.e. The point of no return is reached in 3/4 of a second. *Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.*

Common examples of this type of tractor overturn are: the rear tires are frozen to the ground; tires stuck in a mud hole; or tires blocked from rotating by the operator. Rear overturns can also happen on a slope if an operator applies too much power too quickly to the rear axle. When a tractor is pointed up a slope, there is less rise needed to reach the point of no return because the CG has already moved closer to the stability baseline. Figure 4.12.f shows how this occurs.

When a two-wheel drive tractor is pulling a load, the rear tires push against the ground. At the same time, the load attached to the tractor is pulling back and down

against the forward movement of the tractor. The load is described as pulling down because the load is resting on the earth’s surface. This backward and downward pull results in the rear tires becoming a pivot point, with the load acting as a force trying to tip the tractor rearward. An “angle of pull” is created between the ground’s surface and the point of attachment on the tractor.

A tractor, including the drawbar, is designed to safely counteract the rearward tipping action of pulled loads. When loads are attached to a tractor at any point other than the drawbar, the safety design of the tractor for pulling loads is defeated.

The heavier the load and the higher the “angle of pull,” the more leverage the load has to tip the tractor rearward. Figures 4.12.g, 4.12.h, and 4.12i. show important information about safe hitching points.

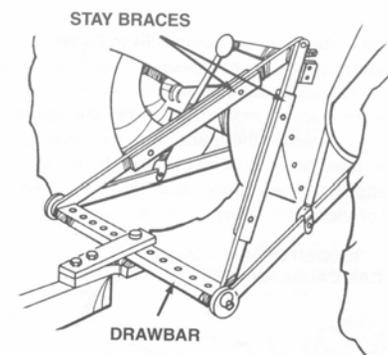


Figure 4.12.h. Never hitch to the top link of a 3-point hitch. *Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.*

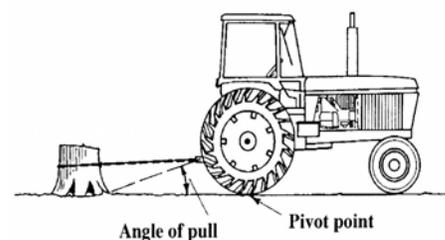


Figure 4.12.i. The angle of pull should be kept to a minimum.

Protect Yourself in a Tractor Overturn

The rollover protective structure (ROPS) and seat belt, when worn, are the two most important safety devices to protect operators from death during tractor overturns. Remember the ROPS does not prevent tractor overturns, but can prevent the operator from being crushed during an overturn. The operator must stay within the protective frame of the ROPS (Zone of Protection) in order for the ROPS to work as designed. This means the operator must wear the seat belt. Not wearing the seat belt may defeat the primary purpose of the ROPS.

A ROPS often limits the degree of rollover, which may reduce the probability of injury to the operator. A ROPS with an enclosed cab further reduces the

likelihood of serious injury because the sides and windows of the cab protect the operator. This assumes that cab doors and windows are not removed.

To prevent tractors from overturning in the first place, follow the safety recommendations that are illustrated in Task Sheet 4.13.

Note: ROPS are available in folding and telescoping versions for special applications, such as orchards and vineyards and low-clearance buildings. Some ROPS may be a protective frame only and not an enclosed cab.

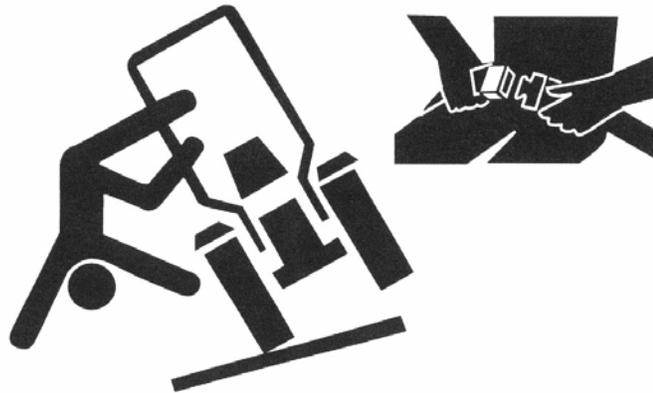


Figure 4.12.j. A rollover protective structure (ROPS) and a seat belt can protect you in the event of an overturn. If you are in the cab of a ROPS-equipped tractor, fasten the seat belt. *Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.*

Safety Activities

1. Use a toy scale model or a full-size tractor to illustrate the five main reasons tractors overturn.
2. Invite a farmer whom you know who has survived a tractor rollover to speak to the class about the experience.
3. Conduct a survey of area farm people to find out instances of tractor overturns in the last five years. How many overturns resulted in a fatality? How many survived an overturn? Did a ROPS play a role in their

References

1. *Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses*, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.
2. [www.cdc.gov/Type/agriculture/tractor overturn hazards](http://www.cdc.gov/Type/agriculture/tractor%20overturn%20hazards) in search box/Click on 1 0.67 Tractor Overturn Hazards, August 2002.
3. *Farm and Ranch Management*, John Deere Publishing, 1994.

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USING THE TRACTOR SAFELY

HOSTA Task Sheet 4.13

Core

NATIONAL SAFE TRACTOR AND MACHINERY OPERATION PROGRAM

Introduction

Tractors can be operated safely if they are used as designed and operated following recommended practices.

There are an estimated 300 farm tractor fatalities each year. Read these short examples.

- Teenager killed using tractor to spotlight deer in the woods.
- Man killed when tractor rolled onto him while dragging logs in the woods.
- Grandfather killed, but passenger grandson lives when tractor goes over an embankment while going for a fun ride.
- Tractor overturns while towing stalled pickup full of firewood.
- Tractor upsets sideways while high lift bucket is in a raised position while traveling across a rough slope.

This task sheet will identify several proper and improper uses of tractors.

Proper Use Defined

Tractors are made to work, not to be treated as ATVs, four-wheelers, dune buggies, or as other recreational vehicles.



Figure 4.13.a. When tractors are operated for their intended purpose, the American farm worker produces more food than in any other country in the world.

Tractors serve four purposes:

1. They are a remote power source.
2. They carry/pull machines.
3. They move loads.
4. They transport materials.

If you are not sure of a specific use for your tractor, consult the Owner's Manual.

A tractor is designed to do work.

Learning Goals

- To recognize proper uses of the tractor
- To recognize improper uses of the tractor

Related Task Sheets:

Agricultural Tractors

4.1

Proper Use Means Avoiding Improper Use



Figure 4.13.b. Tractors are designed for the operator only. No passengers allowed!



Figure 4.13.c. Tractors provide remote power to machinery. This turning shaft, the PTO, must be guarded to prevent entanglement hazards such as this.

Recognize when a driver is operating the tractor in an unsafe manner.

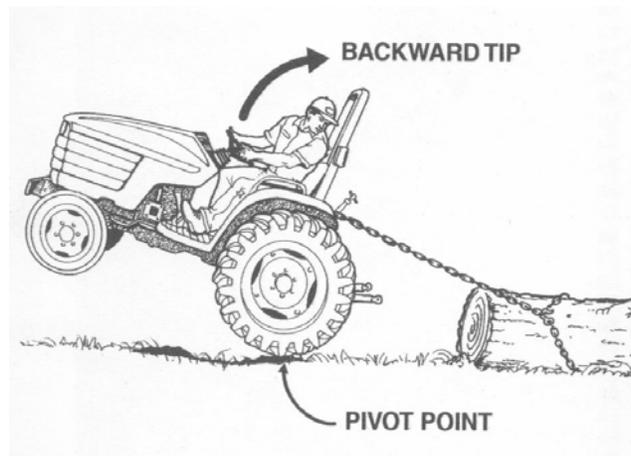


Figure 4.13.d. Hitch loads only to the drawbar. The drawbar has been engineered to pull heavy loads without risking a rear overturn hazard. *Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.*

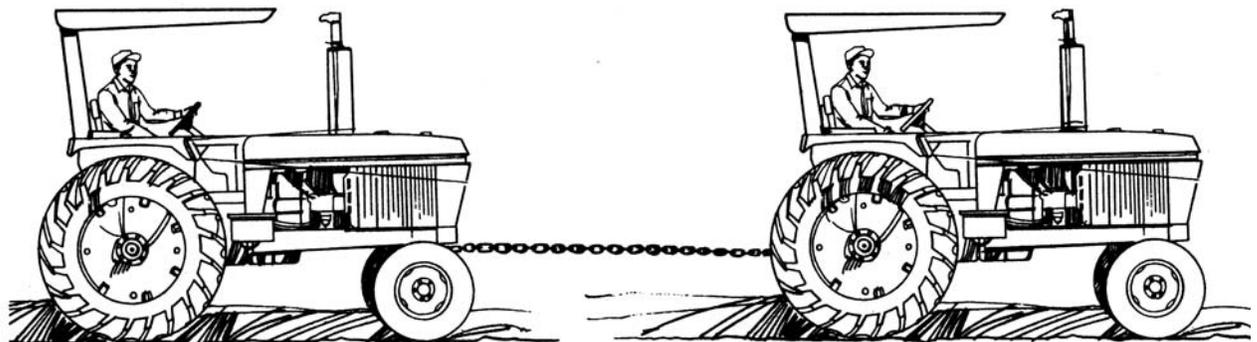


Figure 4.13.e. If you are stuck or need to be towed, you will need help from a second tractor. Use the strongest and best tow strap, cable, or chain that is available. Hitch only to the drawbar. The best advice for a young operator is to get adult help to pull the disabled or stuck tractor. *Farm and Ranch Safety Management, John Deere Publishing, 1994. Illustrations reproduced by permission. All rights reserved.*

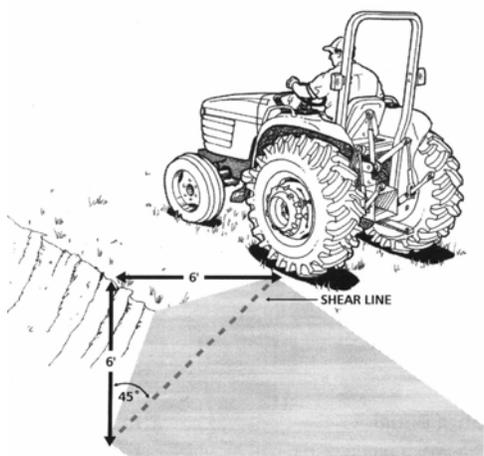


Figure 4.13.f. Avoid ditch embankments. Tractors are heavy and embankments can give way. For example, if the ditch is 6 feet deep, stay back at least 6 feet. *Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.*

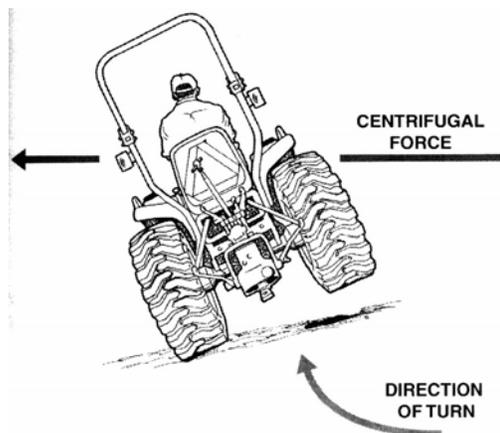


Figure 4.13.g. High speeds while making a turn can cause a sideways overturn. Make sure brakes are locked together. Reduce speed before entering the turn. *Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.*



Figure 4.13.h. Avoid obstacles as you operate the tractor. Some tractor operators will check the field before beginning the operation. Stumps, rocks, animal dens, etc, can upset a tractor.

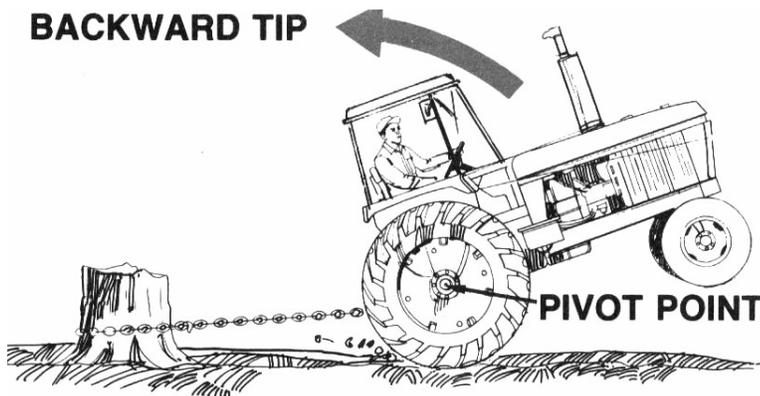


Figure 4.13.i. Tractors are powerful, but each one has a limit to its pulling power. Overloading a tractor could stall the engine, but rearward overturns can occur as well. *Farm and Ranch Safety Management, John Deere Publishing, 1994. Illustrations reproduced by permission. All rights reserved.*

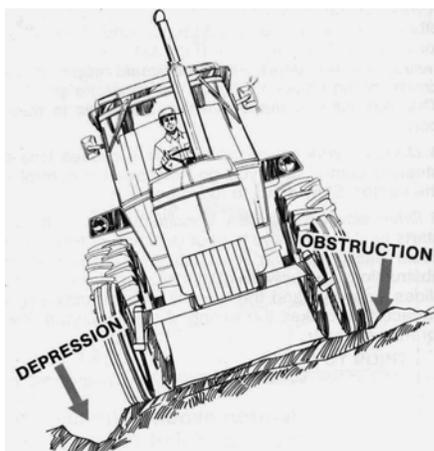


Figure 4.13.j. Field conditions pose special hazards to tractor operation. The operator must know where these obstructions and depressions are located. *Farm and Ranch Safety Management, John Deere Publishing, 1994. Illustrations reproduced by permission. All rights reserved.*



Figure 4.13.k. When operating a high-lift bucket with a load or without a load, keep the bucket as low to the ground as possible while in transport. Sideway overturns are possible if you try to travel with the bucket in the up position. *Farm and Ranch Safety Management, John Deere Publishing, 1994. Illustrations reproduced by permission. All rights reserved.*



Figure 4.13.l. A tractor stuck in mud is immovable without help. Adult supervision is necessary.

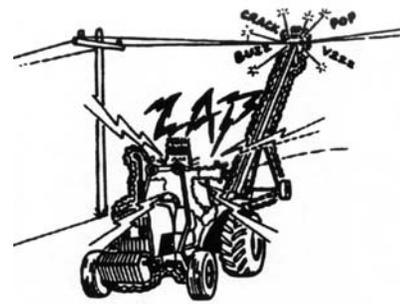


Figure 4.13.m. Avoid overhead power lines while transporting equipment to avoid risk of electrocution.

Safety Activities

1. Start a collection of farm accident reports from magazines, newspapers, and farm newsletters.
2. Using a camera or video recorder, take photos or video film of unsafe tractor use situations. Make a display for your club, classroom, employee room or farm shop.
3. Try this Word Search Game to find words related to proper tractor use. Words or phrases may be spelled forward, backward, up, down, or diagonally.

S A D Z C D E F G H
 J A T T I T U D E I
 K N F D L M G N O P
 Y O V E R T U R N X
 T R T E T S A Y R Q
 U I V P R Y R O W X
 D D C S E B D A Z Y
 L E F W L G S H I J
 K R L O A M N O P Q
 T S V L V W X Y Z R

Use this word list: attitude, safety, guards. no riders, overturn, alert, low speed, pto

References

1. The Ten Commandments of Tractor Safety, 1999, Kubota Tractor Corp., Compton, California.
2. www.cdc.gov/niosh/injury/traumagric.html, September 2002.
3. Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.
4. www.cdc.gov/niosh/nasd/At search box, type tow ropes, cables and chains.
5. Farm and Ranch Safety Management, John Deere Publishing, 1994. Illustrations reproduced by permission. All rights reserved.

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OPERATING THE TRACTOR ON PUBLIC ROADS

HOSTA Task Sheet 4.14

Core

NATIONAL SAFE TRACTOR AND MACHINERY OPERATION PROGRAM

Introduction

Today's farmers are traveling more miles than ever before on public roads to plant, grow, and harvest crops. Slow-moving tractors and implements are no match for the general public's high-speed travels. Most crashes between farm equipment and motor vehicles occur during daylight and in good weather. You can never let your guard down when traveling on a public road with farm equipment.

This Task Sheet discusses operation of the tractor and equipment on public roads.

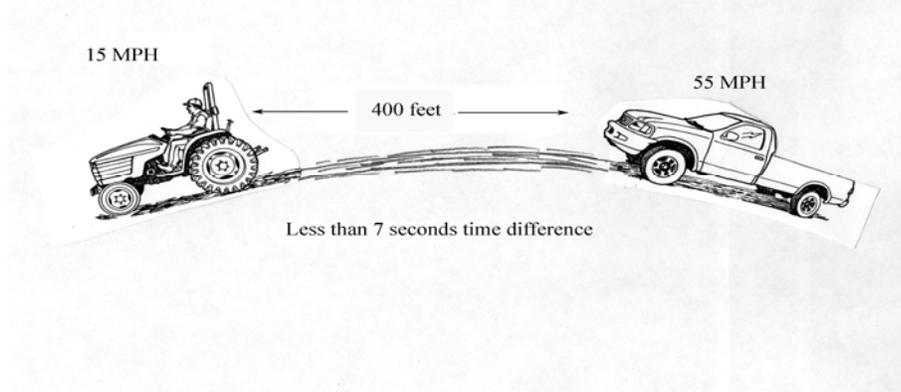


Figure 4.14.a. An automobile traveling 55 mph will cover the 400 ft. distance between the car and tractor in less than 7 seconds. Will that be enough time or space to get slowed or stopped to prevent a rear-end crash?

Movement Hazards

These traffic situations are created by operating tractors on public roadways.

- Pulling slowly onto roads with long and heavy loads
- Slow tractor travel speeds
- Left turns across traffic into narrow field lanes
- Swinging into the left lane to make a right turn into a field
- Wide machinery being transported
- Potential for spilled loads

All rules of vehicle safety, as well as all rules of courteous driving, must be followed to prevent traffic problems.

Obeying the Law

Each state varies in their highway regulations regarding the ages and places where one may operate a farm tractor. States seldom require a driver's license for a tractor, but many do limit 14- and 15-year-old drivers to crossing over public roadways only or to operating equipment on roads that bisect or adjoin their farm.

Check with your local state police to learn more about the laws in your area.

You must also obey all traffic laws and signs as well.

Tractor operators are at a great disadvantage when traveling on busy highways.

Learning Goals

- To understand the difference between farm equipment road use and normal highway vehicle road use
- To use all safe and courteous traffic driving practices to prevent farm equipment and motor vehicle crashes

Related Task Sheets:

Safety and Health Regulations	1.2
Reaction Time	2.3
Hand Signals	2.9



Figure 4.14.b. Lighting and marking standards may or may not be the standards for your state. Check your state laws.

Using the proper lighting and marking standards gives motorists ample warning that farm equipment is using the public roadway.

Lighting and Marking

American Society of Agricultural Engineers (ASAE) Standards for lighting and marking are summarized in Table 4.14.a. Most farm equipment delivered from the factory today will have used these standards. Does the equipment that you will use measure up to these

standards? If not, can the equipment be improved with retrofit kits of lights and reflectors?

Although not included in the ASAE standard, rotary beacons and back-up alarms are optional accessories which may be add-ons depending upon your needs. If accessories have been added, they should be in working order.

Table 4.14.a. Recommendations from ASAE for lighting and marking.

Item	Recommendation
Headlights	Two white lights mounted at the same level
Taillights	Two red lights mounted at the rear
Hazard Flashers	Two or more lamps with amber color to the front and red color to the rear
Turn Indicators	Two amber to the front and two red-colored lights to the rear mounted with flashers
SMV Emblem	One visible at 1000 ft. mounted to the rear and 2-10 ft. above the ground
Reflectors	Two red reflectors (on rear outside corners) and 2 yellow reflectors (on the front outside corners) of the machine
Conspicuity Material	Red retro-reflective and red-orange fluorescent color visible to mark the rear. Yellow retro-reflective material to mark the front.



Figure 4.14.c. Be sure that a work light that points to the rear is off during road travel at night. Single white lights may not be recognized as slow-moving or as a tractor light. Also if SMV emblems are worn or obsolete, replace them with newer more reflective SMV emblems.

Towing Safety



Figure 4.14.d. Secure hitch pins with locking clips as shown.

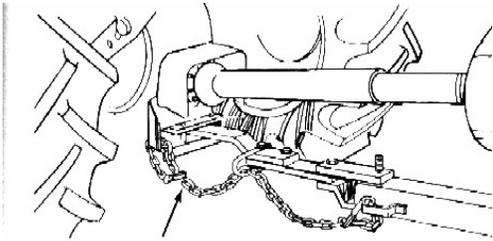


Figure 4.14.e. Use safety chains to insure load hitching safety when possible. Trucks pulling farm loads should have safety chains also. *Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.*



Figure 4.14.f. SMV emblems are required on vehicles designed to travel less than 25 mph while occupying public roadways. SMV emblems should be visible from no less than 1000 feet to the rear of the tractor or towed implement. Therefore, mounting height may vary from 2 to 10 feet above the road surface. Replace faded, damaged SMV emblems.

General Practices for Tractors on Highways

Think about the following when traveling on the highway with farm machinery.

- Time of day–Is it possible to avoid the busy times of the day to move equipment? Hauling large loads during early

morning or late afternoon while people hurry to and from work creates traffic problems for both of you. Moving loads after nightfall may be better timing, but lighting becomes a necessary consideration.

- Courtesy– Try to be as watchful of others as possible. Let the high-speed traffic go first. Your best manners on the highway will be the first safe practice to follow.
- Blind spots– Are there locations which pose problems with visibility? Avoid them if possible.
- Shifting loads– If you upset a load of hay, spill a load of manure or a tank of pesticide mixture, or coat the road with mud from the field, you are responsible for getting help for cleanup and alerting traffic to be cautious. If manure or chemical spills endanger waterways, notify your employer who may have reporting requirements with state environmental officials.

- Safe Equipment– Your walk-around inspection should have shown you if you have damaged equipment. Be sure damaged equipment does not create a road hazard. For example, a loose wheel on a hay rake could cause a disaster.



Figure 4.14.g. A best practice for transporting wide loads on a public roadway is to use an escort vehicle to assist in alerting other motorists. Be a courteous tractor operator to bring good public relations to the farm community.

Pull completely off the road to let traffic flow past if possible.

DO NOT SIGNAL THEM TO PASS YOU.

Signaling to motorists to pass makes you responsible for them.

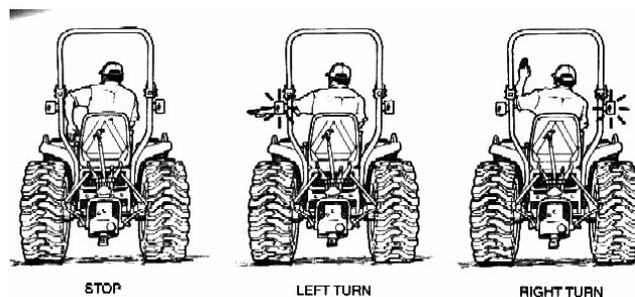


Figure 4.14.h. Use accepted hand signals to inform other drivers of your intentions. *Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.*

Safety Activities

1. Measure the length of the longest tractor and implement combination with which you will work. Then have someone time how long it takes you to move the front end of that tractor to the rear end of the towed implement past a point or across the highway in front of the farm. How many seconds did it take to cross the road? _____seconds.
2. A car approaching the farm driveway is traveling at 60 mph. How many feet will that car travel in 1 second? _____seconds.

Hint: 60 mph =1 mile/minute Calculate what distance in feet will be covered in 1 second.
Remember that 5,280 feet equals 1 mile.

$$1 \text{ mile} / \text{minute} = \text{_____} \text{ feet} / \text{second}.$$

3. Multiply the answer (feet/second) in question number 2 by the time you recorded in question number 1.

This is the distance the car going 60 mph will travel in the time it takes you to cross the road.
Record the answer here. _____ Can you see that far as you pull out to cross the roadway?

4. Conduct a survey of the lighting, marking, and hitching of the tractors on your farm or farm of employment. Does it meet the safety requirements of your state?
5. Practice the hand signals for right, left, and stop that you will use while operating a tractor not equipped with turn signals.

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1. Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.
2. Farm and Ranch Safety Management, John Deere Publications, 1994.
3. Safe Operation of Agricultural Equipment, Student Manual, 1988, Silletto and Hull, Hobar Publications.
4. State Laws and Regulations.

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