North American Cargo Securement Standard

Training Program

Instructors Manual

Edition 1 - December 2003

Module Overview

Introduction

Learning Objectives

At the completion of training, participants will be able to:

- Describe the requirements of the North American Cargo Securement Standard
- Explain how the cargo securement principles apply to different commodities
- Determine what is required to properly load and secure different commodities including the number, placement and types of cargo securing devices
- Identify securement systems that are not in compliance with the Standard.

Time Required

1 hour

Topics

1. Welcome
2. Introductions and Housekeeping
3. Course Purpose and Learning Objectives
4. Course Structure and Materials
5. Importance of Proper Securement
6. North American Cargo Securement Standard

Training Methods

1. Participative lecture

Participant Materials

1. Participant Manual
2. Driver's Handbook on Cargo Securement
3. North American Cargo Securement Standard

Training Materials

1. Instructor Guide
2. PowerPoint slides and projection system
3. Easel pad and markers
4. Participant materials

Instructor Notes

Check with your local regulatory agency to make sure you know what your local regulations and requirements are and that you teach to the local needs.

Introduction

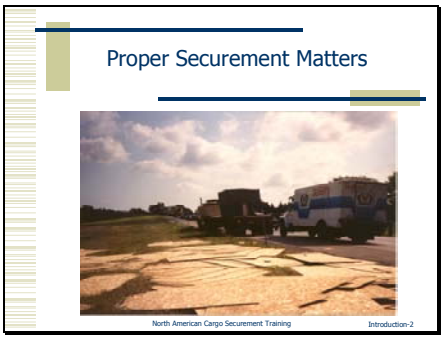
Lesson Plan	Instructor Notes
## Welcome	*5 minutes* Introduce the course and capture the audience's attention. Show Slide Introduction-1.

Brief welcome to the course

Welcome participants to the North American Cargo Securement Training course.

Show participants why proper cargo securement is important.

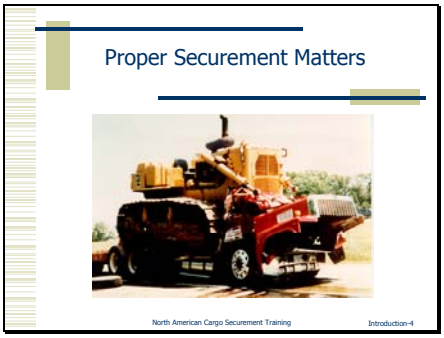
Show Slide Introduction-2.



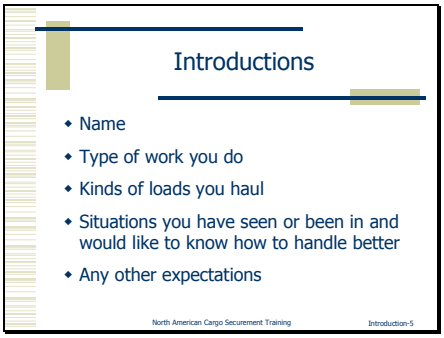
Show Slide Introduction-3.

In Grande Prairie, Alberta, Canada this truck driver slammed on the brakes for a red light. He was charged with having an unsafe load.

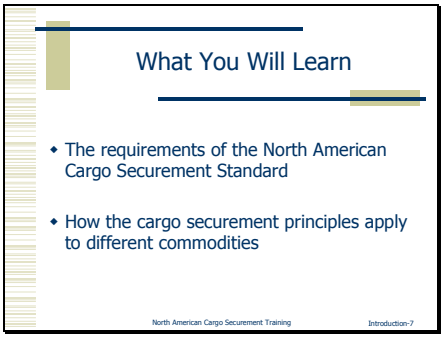
Show Slide Introduction-4.

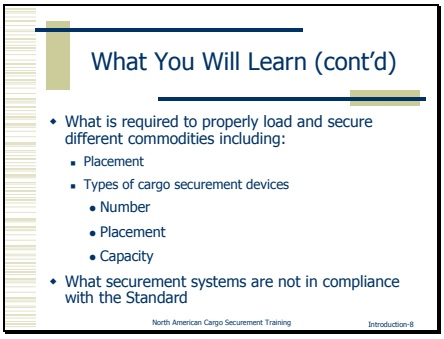
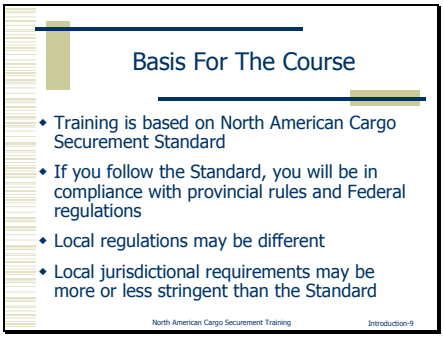


This truck was going down an interstate in the Midwest US at 50-55 mph. The bulldozer was restrained with one 3/8” chain. When the driver stopped suddenly, the bulldozer landed on top of the truck. The driver did not survive.

Lesson Plan	Instructor Notes
Introductions and Housekeeping	*15 minutes*
Instructor(s) Introductions	All instructors should introduce themselves and give their credentials.
Participant Introductions **Ask** participants to introduce themselves to the group. ◆ Name ◆ Type of work they do (e.g., driver, shipper, enforcement officer) ◆ Kinds of loads they haul ◆ Situations they have seen or been in and would like to know how to handle better ◆ Any other expectations that are not already listed	Participants should introduce themselves and share their work-related experiences. Show Slide Introduction-5.  During the introductions, capture the situations and the expectations on two sheets of an easel pad. This indicates where emphasis should be placed during the course and ensures that participants' needs are addressed. Post the sheets on the wall to refer to throughout the course.

Lesson Plan	Instructor Notes
Review of housekeeping items	If there are any housekeeping items that need to be addressed, do so at this time. Examples: - Restroom location - Policy on turning off phones/beepers - Lunch options - Schedule changes

Lesson Plan	Instructor Notes
Course Purpose and Learning Objectives	*5 minutes*
	Explain the purpose of the training and its objectives.
Explain that the purpose of this training is to make sure that carriers, drivers, shippers, and enforcement personnel understand the requirements for safe cargo securement.	Show Slide Introduction-6.
Explain that everyone (carriers, drivers, shippers, and enforcement personnel) will receive the same training.	
Tell participants that, at the completion of the training, they will be able to: ◆ Describe the requirements of the North American Cargo Securement Standard ◆ Explain how the cargo securement principles apply to different commodities.	Show Slide Introduction-7. 

Lesson Plan	Instructor Notes
◆ Determine what is required to properly load and secure different commodities including the: – Placement – Types of cargo securing devices ➢ Number ➢ Placement ➢ Capacity. ◆ Identify securement systems that are not in compliance with the Standard.	Show Slide Introduction-8. 
Explain to participants that: ◆ The training is based on the North American Cargo Securement Standard – If you follow the Standard, you will be in compliance with provincial rules and Federal regulations ◆ Local jurisdictional requirements may be more or less stringent than the Standard – Local regulations may be different – For example, some jurisdictions may require loads to be tarped (i.e., sand, gravel, dirt, etc.)	Show Slide Introduction-9. 

Lesson Plan	Instructor Notes

Course Structure and Materials

5 minutes

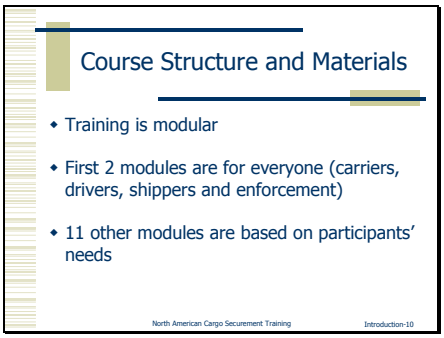
Explain the structure of the course and tell participants about training modules available to them.

Tell the participants that this training is modular.

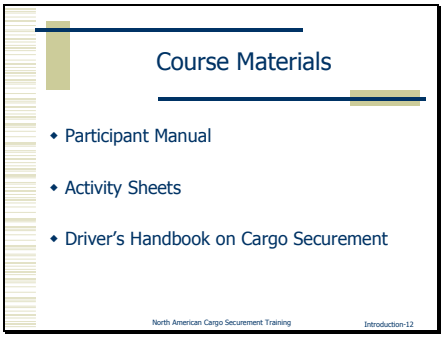
Explain that the first 2 modules are for everyone and that depending on the participants' needs there are 11 other modules.

- Module 1: The Standard and Basic Physics Principles
- Module 2: General Cargo Securement Requirements: Equipment and Methods
- Module 3: Logs
- Module 4: Dressed Lumber and Similar Building Materials
- Module 5: Metal Coils
- Module 6: Paper Rolls
- Module 7: Concrete Pipe Loaded Crosswise on a Platform Vehicle
- Module 8: Intermodal Containers
- Module 9: Automobiles, Light Trucks, and Vans
- Module 10: Heavy Vehicles, Equipment, and Machinery
- Module 11: Flattened or Crushed Vehicles
- Module 12: Roll-on/Roll-off Containers and Hook Lift Vehicles
- Module 13: Large Boulders

Show Slide Introduction-10.



Show Slide Introduction-11.

Lesson Plan	Instructor Notes
Tell the participants that the course materials consist of a Participant Manual with mini-slides and note-taking space as well as activity sheets. **Tell** the participants that there is also a Driver's Handbook on Cargo Securement. The Driver's Handbook on Cargo Securement will be used with the course. It will also be a ready reference for drivers to use when they are planning, securing, and/or checking a load they are responsible for transporting.	Show Slide Introduction-12. 

Lesson Plan	Instructor Notes

Importance of Proper Securement

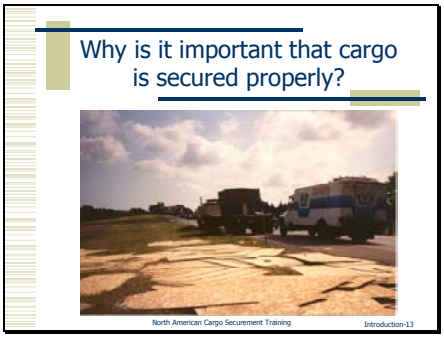
10 minutes

Help participants to understand the benefits of securing cargo properly (i.e., "what's in it for them."). Capture participants' responses on the easel pad.

Ask these questions:

> Why is it important that cargo is secured properly?

Show Slide Introduction-13.



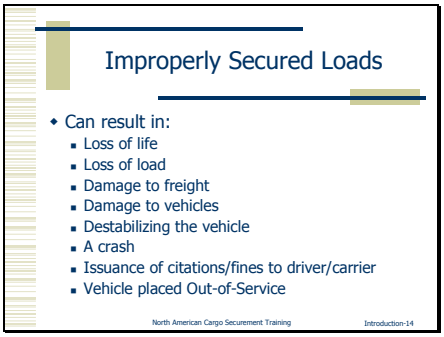
Suggested responses:

- So you don't lose your load
- So you don't get fined
- So you don't incur liability

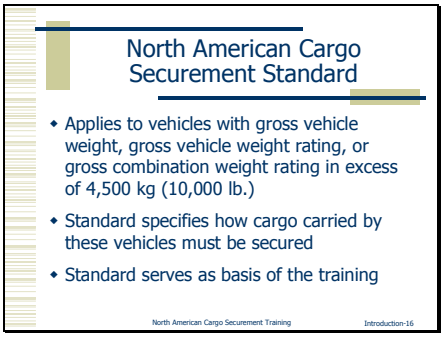
Explain to the participants that improperly secured loads can result in:

- Loss of life
- Loss of load
- Damage to freight
- Damage to vehicles
- Destabilizing the vehicle
- Crash
- Issuance of citations/fines to driver/carrier
- Vehicle being placed Out-of-Service

Show Slide Introduction-14.



Lesson Plan	Instructor Notes
Who benefits if the load is secured properly?	Show Slide Introduction-15. Suggested responses: 1. The driver - Feels more confident about handling the vehicle - Feels safer - No time lost reloading - Keeps his job 2. The carrier - Better safety record - Improves business competitiveness - Improves company's reputation/image - Reduced insurance costs - Reduced cargo damage claims; no "lost" cargo - No time lost reloading - Reduced liability 3. The public - Road safety - More confidence sharing the road with big trucks 4. The receiver - Improved sales - No lost production time - Satisfied customers - Reduced overtime - Reduced waste - More efficient operations

Lesson Plan	Instructor Notes
North American Cargo Securement Standard	*15 minutes*
Say that you want to quickly review the North American Cargo Securement Standard so the participants are familiar with it.	Give a brief overview of the North American Cargo Securement Standard and its relationship to the course. Ask the participants to open to the Standard in their materials.
What is it? **Explain** that the North American Cargo Securement Standard applies to vehicles with a gross vehicle weight, gross vehicle weight rating, or gross combination weight rating in excess of 4,500 kg (10,000 lb.). **Say** that the Standard specifies how cargo carried by one of these motor vehicles must be secured when the vehicle is operated on a highway. **Explain** to the participants that the North American Cargo Securement Standard serves as a basis of the training as regulations differ slightly from country to country.	Show Slide Introduction-16. 

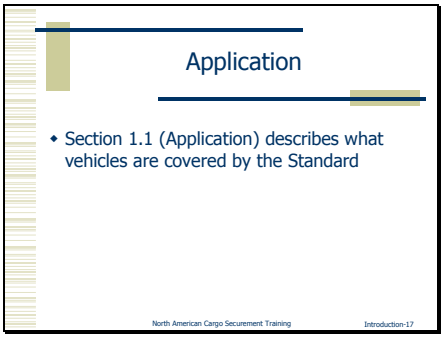
Lesson Plan	Instructor Notes

What does it say?

Point out Section 1.1 (Application) and tell participants that this section describes what vehicles are covered by the Standard.

Have participants turn to Part 1 in the Standard.

Show Slide Introduction-17.

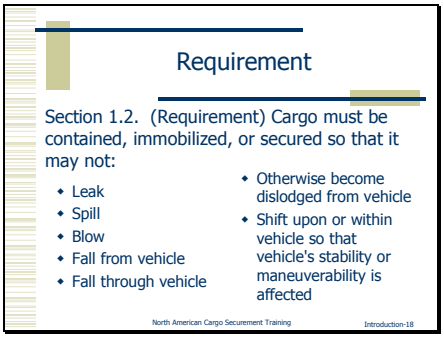


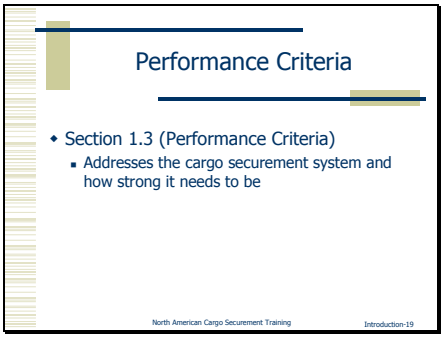
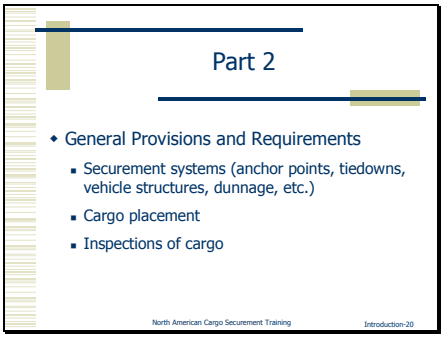
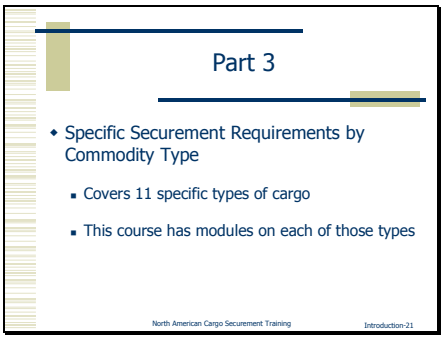
Point out Section 1.2. (Requirement). This section says that cargo must be contained, immobilized, or secured so that it may not:

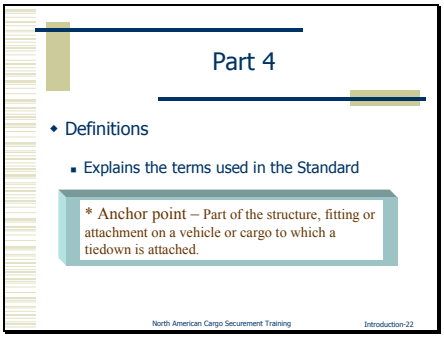
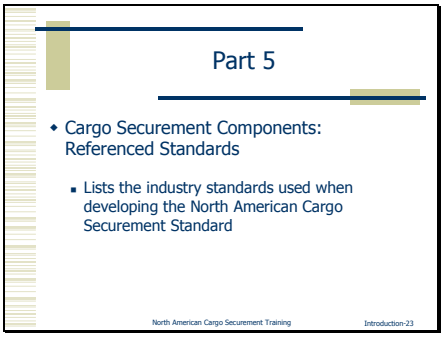
- Leak
- Spill
- Blow off the vehicle
- Fall from the vehicle
- Fall through the vehicle
- Otherwise become dislodged from the vehicle
- Shift upon or within the vehicle to such an extent that the vehicle's stability or maneuverability is adversely affected.

Say that you will be talking more about this requirement in Module 1, The Standard and Basic Physics Principles.

Show Slide Introduction-18.



Lesson Plan	Instructor Notes
Point out Section 1.3 (Performance Criteria). This section addresses the cargo securement system and how strong it needs to be. The Performance Criteria will also be discussed more in Module 1, The Standard and Basic Physics Principles.	Show Slide Introduction-19. 
Explain that there are 5 more Parts to the Standard. ◆ Part 2, General Provisions and Requirements, talks about: – Securement systems (anchor points, tiedowns, vehicle structures, dunnage, etc.) – Cargo placement – Inspections of cargo.	Have participants turn to Part 2 in the Standard. Show Slide Introduction-20. 
◆ Part 3, Specific Securement Requirements by Commodity Type, covers 11 specific types of cargo. This course has modules on each of those types.	Have participants turn to Part 3 in the Standard. Show Slide Introduction-21. 

Lesson Plan	Instructor Notes
◆ Part 4, Definitions, explains the terms used in the Standard.	Have participants turn to Part 4 in the Standard. Show Slide Introduction-22. 
◆ Part 5, Cargo Securement Components: Referenced Standards, lists the industry standards used when developing the North American Cargo Securement Standard.	Have participants turn to Part 5 in the Standard. Show Slide Introduction-23.  Note: If the component's defect affects the Working Load Limit, it should not be used. Refer participants to the handout in the Participant Materials (and on the next page) that describes what constitutes a defective component.

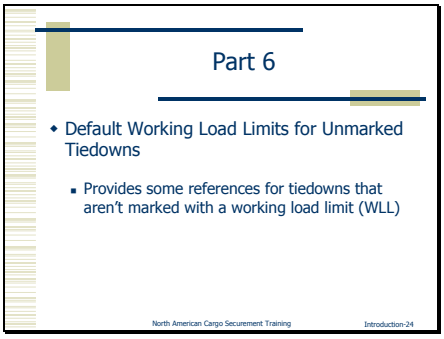
Inspection for Wear

Chains, load binder attachments, and anchor points must be maintained in good condition. A complete listing of what constitutes defective securing devices can be found in the Commercial Vehicle Safety Alliance's (CVSA) Cargo Securement Tiedown Requirements and Out-of-Service criteria. Here are some commonly cited deficiencies that would prohibit the use of tiedown equipment.

The following conditions in tiedowns are **not** acceptable for load securement:

- Chain containing cracked welds or links
- Chain containing bent, twisted, stretched, or collapsed links
- Chain links weakened by gouges, nicks or pits
- Chains incorrectly repaired
- Links obviously worn or showing other visible evidence of loss of strength
- Knots in any portion of the chain, wire rope, or webbing
- Spread or disturbed grabhooks
- Cuts, nicks, or splits in nylon webbing
- Wire cable with missing strands or wraps
- An anchor point that is weakened or shows loss of strength due to cracks, breaks, or distortion
- Split lumber that is used as dunnage to prevent movement or distribute the load.

Lesson Plan	Instructor Notes
◆ Part 6, Default Working Load Limits for Unmarked Tiedowns, provides some references for tiedowns that aren't marked with a working load limit.	Have participants turn to Part 6 in the Standard. Show Slide Introduction-24.



Why was it developed?

Explain that, in the early 1990's governments in both Canada and the United States called for a review of the adequacy of cargo securement regulations because of several serious accidents involving loss of cargo.

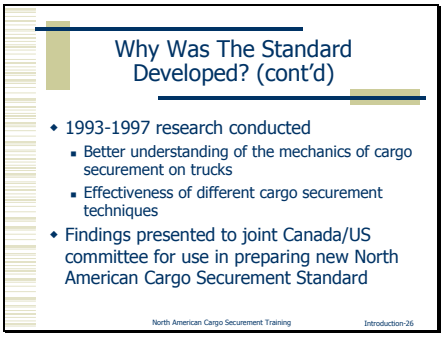
Explain that in 1993 government and industry groups from both Canada and the United States agreed to sponsor a major research program on cargo securement.

Show Slide Introduction-25.

Explain that over the period 1993 to 1997 government and industry worked closely together on the research program to develop a better understanding of the mechanics of cargo securement on trucks, and on the effectiveness of different cargo securement techniques.

Explain that in 1997 the findings of the research were delivered to a joint Canada/US committee with representatives from both government and industry. The findings were to be used in preparing a new North American Cargo Securement Standard.

Show Slide Introduction-26.



Lesson Plan	Instructor Notes
Who developed it? **Say** that the Standard was developed by a committee of volunteer experts (about 160) from government and industry in both Canada and the United States, including representatives from: ◆ Federal, state, and provincial highway agencies ◆ Police, enforcement agencies, and highway safety organizations ◆ The trucking industry ◆ Truck and trailer manufacturing industries ◆ Cargo securement equipment manufacturing industries and associations ◆ Manufacturing and processing industry sectors and associations (e.g., steel, aluminum, forest products, concrete, recycling) ◆ Research and standards setting organizations.	Show Slide Introduction-27. -

Lesson Plan	Instructor Notes

Summary and Transition

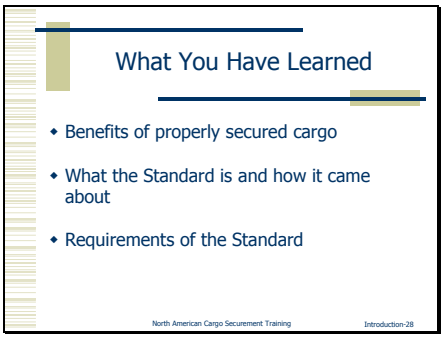
5 minutes

Summarize the Introduction, recapping what the participants have just learned.

Tell the participants that they now know:

- Benefits of properly secured cargo
- What the Standard is and how it came about
- The general requirements of the Standard

Show Slide Introduction-28.

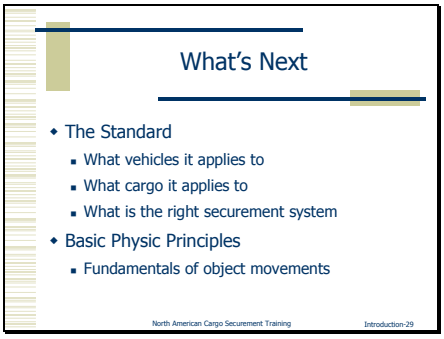


Tell the participants that, now that they have a basic understanding of the Standard and its requirements, you will now get into more detail about the Standard.

- What vehicles it applies to
- What cargo it applies to
- What is the right securement system

Transition to next topic (The Standard and Basic Physics Principles).

Show Slide Introduction-29.



Tell participants that, in order to be able to make sure the load is properly secured, they also need to understand some basic fundamentals about objects and when they move and how they move.

Module Overview

Module 1: The Standard and Basic Physics Principles

Learning Objectives

At the completion of the training, participants will be able to:

- List the vehicles that are required to comply with the Standard
- State the Standard's general requirements for cargo securement
- Describe how the forces generated under normal driving conditions affect cargo (Laws of Physics)
- State the Performance Criteria in the Standard.

Time Required

1 hour 50 minutes

Topics

1. Overview
2. Guiding Principle of Public Safety
3. When to Apply the Standard
4. How Cargo Must Be Contained, Immobilized, or Secured
5. The Laws of Physics
6. Performance Criteria

Training Methods

1. Participative lecture
2. Group activity (Small group exercises)

Participant Materials

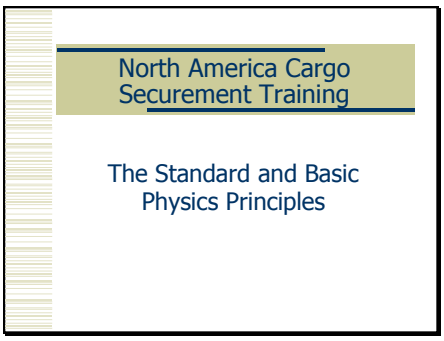
1. Participant Manual
2. Driver's Handbook on Cargo Securement

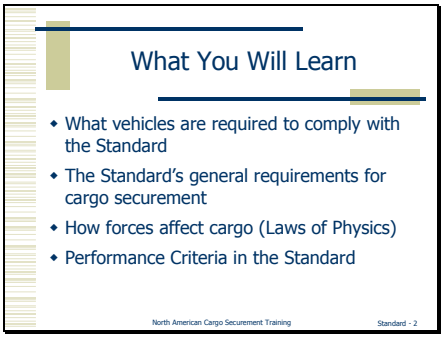
Training Materials

1. Instructor Guide
2. PowerPoint slides and projection system
3. Easel pad and markers
4. Participant materials
5. Block of wood (2 in x 4 in x 6 in)
6. Formica (8 in x 12 in). It must be slippery so that the block will slide.

Instructor Notes

The Standard and Basic Physics Principles

Lesson Plan	Instructor Notes
Overview	
	5 minutes Introduce the course and capture the audience's attention. Instructor should show enthusiasm. Show the formica and block of wood during the course overview to gain the participant's attention.
Tell the participants that, now that they have a basic understanding about the Standard, you are going to now explain it in more detail. **Tell** the participants that you will also discuss some basic physic principles. **Tell** the participants that, by using a block of wood and a piece of formica, you will demonstrate how different forces can affect cargo securement.	Show Slide Standard-1. 

Lesson Plan	Instructor Notes
Learning Objectives **Tell** participants that at the completion of the topic on the Standard and Basic Physics Principles they will be able to: ◆ List the vehicles that are required to comply with the Standard ◆ State the Standard's general requirements for cargo securement ◆ Describe how the forces generated under normal driving conditions affect cargo (Laws of Physics) ◆ State the Performance Criteria in the Standard.	Introduce the course objectives. Show Slide Standard-2. 

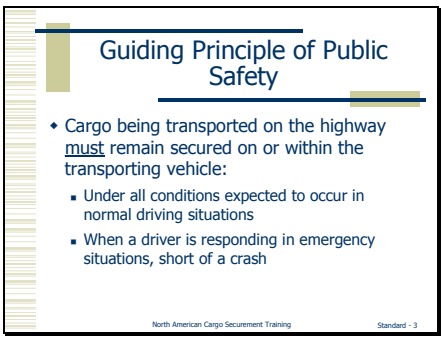
Lesson Plan	Instructor Notes

Guiding Principle of Public Safety

5 minutes

Introduce the guiding principle of public safety when transporting cargo on the highway.

Show Slide Standard-3.



Explain that there is one principle of cargo securement that is particularly important: cargo being transported on the highway must remain secured on or within the transporting vehicle.

Explain that this applies under all conditions that could reasonably be expected to occur in normal driving. It also applies when a driver is responding in all emergency situations, except when there is a crash.

Say that this principle is what prompted the experts to develop the North American Cargo Securement Standard.

Lesson Plan	Instructor Notes

When to Apply the Standard

10 minutes

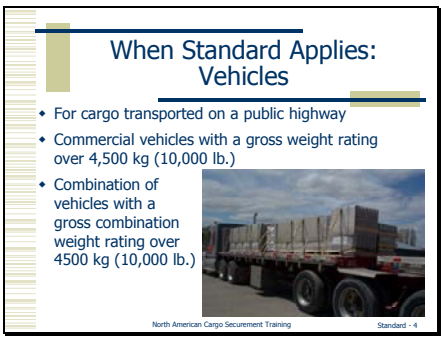
Explain when to apply the Standard and what type of cargo it applies to.

Tell participants that they must know what kinds of vehicles and cargo the Standard covers.

Tell participants that, for vehicles, the Standard applies to cargo transported on a public highway.

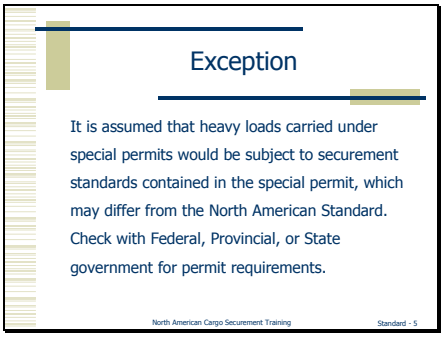
Explain that the Standard applies to commercial vehicles with a gross weight rating over 4,500 kg (10,000 lb.), or a combination of vehicles with a gross combination weight rating over the same value (4,500 kg or 10,000 lb.).

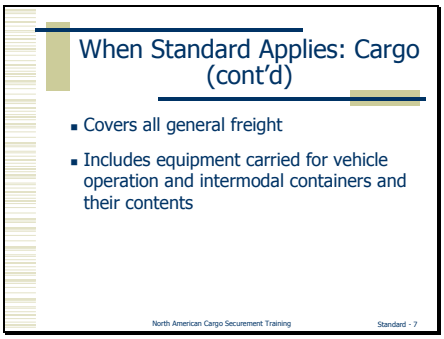
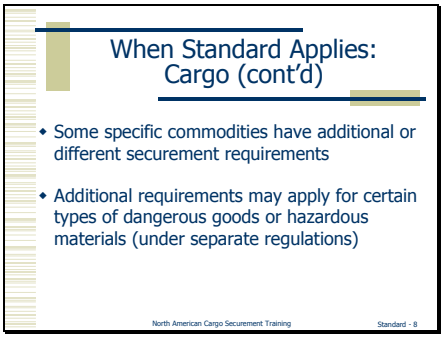
Show Slide Standard-4.



Note: It is assumed that heavy loads carried under special permits would be subject to securement standards contained in the special permit, which may differ from the North American Standard. Check with your Federal, Provincial, or State government for any permit requirements.

Show Slide Standard-5.



Lesson Plan	Instructor Notes
Explain that, for cargo, the Standard applies to <u>any</u> cargo including dangerous goods/hazardous materials carried by these vehicles. This means that the Standard covers all general freight. The Standard also covers equipment carried for vehicle operation and intermodal containers and their contents.	Show Slide Standard - 6.
	Show Slide Standard - 7. 
Explain that some specific commodities have additional or different securement requirements. **Tell** the participants that additional requirements under separate regulations may also apply for transportation of certain types of dangerous goods or hazardous materials.	Show Slide Standard - 8. 

Lesson Plan	Instructor Notes

How Cargo Must Be Contained, Immobilized, or Secured

Ask the participants this question.

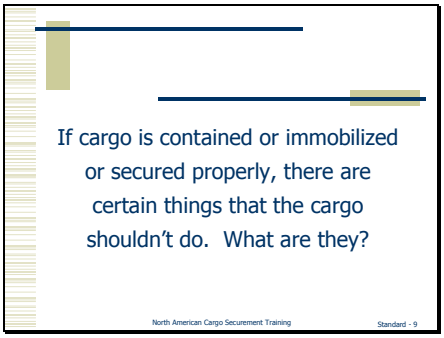
> If cargo is contained/secured /immobilized properly, there are certain things that the cargo shouldn't do. What are those things?

10 minutes

Explain how cargo must be contained, immobilized, or secured when being transported.

This is a review question.

Show Slide Standard-9.



Suggested responses:

- Leak
- Spill
- Blow
- Fall from the vehicle
- Fall through the vehicle
- Become dislodged from the vehicle
- Shift making the vehicle unstable or affecting its maneuverability

Lesson Plan	Instructor Notes

Explain that cargo must be contained, immobilized, or secured so it does not:

- Leak
- Spill
- Blow
- Fall from vehicle
- Fall through vehicle
- Become dislodged from vehicle
- Shift, making the vehicle unstable or affecting its maneuverability

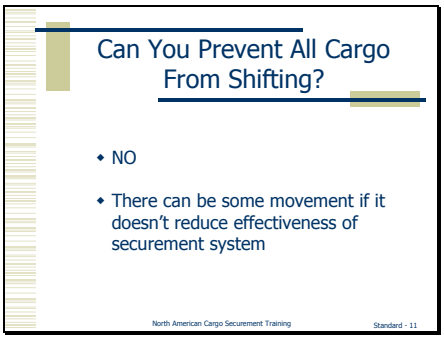
After the participants have responded to the question, show Slide Standard-10.

Ask the question (before showing the slide):

> Can you prevent all cargo from shifting?

This is another review question.

Ask the question first and then Show Slide Standard-11.



Explain to the participants that it is difficult to prevent all shifting.

Explain that there can be some movement if it doesn't reduce the effectiveness of the securement system.

Lesson Plan	Instructor Notes

When the cargo system has failed

Ask the participants:

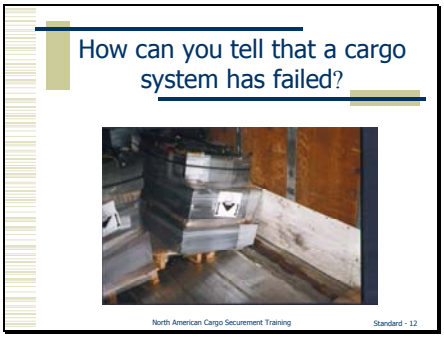
> How can you tell that a cargo system has failed?

Explain that the cargo securement system has failed if:

- Cargo dislodges from a vehicle under normal conditions
- Cargo shifts making the vehicle unstable or affecting its maneuverability
- Cargo shifts in a manner that reduces the effectiveness of the securement system.

This is another review question.

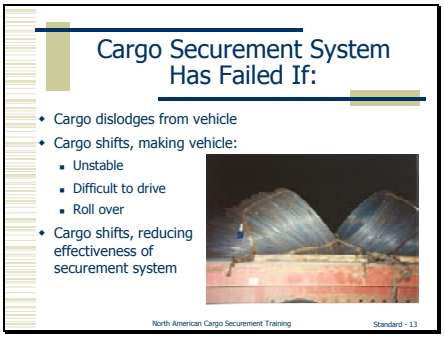
Show Slide Standard-12.



Suggested responses:

- Cargo falls off vehicle
- Cargo shifts making the vehicle become unstable, difficult to drive, or making the vehicle roll over
- Cargo is not effectively secured

Show Slide Standard-13.



Lesson Plan	Instructor Notes

Consequences of Improperly Secured Loads Activity

Ask participants:

> What are the potential problems if you do not follow proper methods when securing cargo or when inspecting cargo and securement systems? To you? To others?

5 minutes

The purpose of this section is to ensure that shippers, drivers, carriers, and enforcement personnel are aware of the consequences of improperly securing cargo.

Show Slide Standard-14.

With input from the participants, create a list of the potential problems that could occur if you do not follow proper methods when securing cargo or when inspecting cargo and securement systems.

Urge every participant to present a consequence that has not already been mentioned. Keep going until no person has a new idea. Record the consequences on an easel pad.

Lesson Plan	Instructor Notes
	Suggested responses: 1. Shippers, Drivers, Carriers, Receivers - Injury - Delay of trip due to roadside enforcement activity - Possible accident resulting in personal injury or death - Financial losses to the driver and motor carrier: ➢ Loss of shipment ➢ Prosecution ➢ Increase in insurance rates ➢ Clean-up costs after the accident - Loss of load - Damage to cargo - Impact on motor carrier safety rating 2. Enforcement - Permitting unsafe shipments to proceed - Detaining properly secured shipments - Time spent on accident handling and investigation

Lesson Plan	Instructor Notes

The Laws of Physics

5 minutes

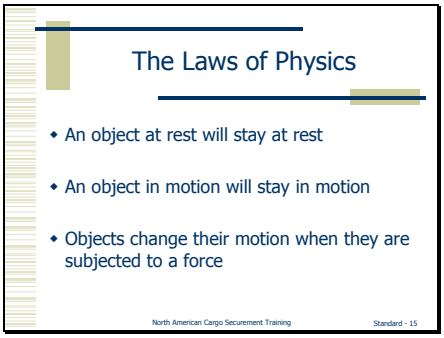
Review the Laws of Physics and demonstrate the Laws of Physics using a small block of wood and a piece of waxed formica.

Say that so far you have talked about what vehicles and cargo the Standard covers. You have also reviewed why it is important to secure cargo carefully.

Say that now you want to talk about some basic laws of nature and how and why things move or stay still. These basic laws are called the Laws of Physics.

Explain that you will first review the Laws of Physics and then demonstrate how the laws of physics work by using a small block of wood on a piece of formica. The formica represents the flatbed of a truck and the piece of wood represents the cargo.

Show Slide Standard-15.



Tell the participants that these are the Laws:

- An object at rest will stay at rest
- An object in motion will stay in motion
- Objects change their motion when they are subjected to a force.

Demonstrate the laws using a small block of wood and a piece of formica.

Place the block of wood (simulating cargo) on the formica (simulating a tractor-trailer). The formica should be horizontal. The block should stay in place and not move.

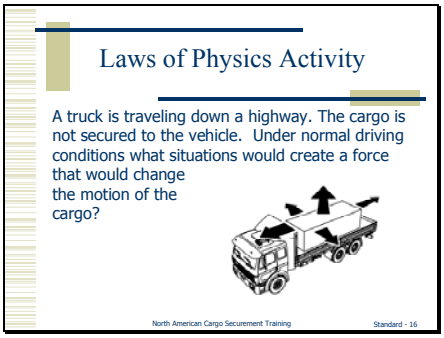
Tell the participants:

- The block of wood stays in place because gravity applies a downward force on the block and the ground applies an equal and opposite force
- The block of wood moves when pushed, in the direction in which it is pushed

Push the block so that it slides in one direction. Then stop it and push it so that it slides in another direction.

Lesson Plan	Instructor Notes
◆ The block turns when it is pushed from the side ◆ The block stops when it encounters an obstacle in front of it.	Push the block forward and, while the block is sliding, tap it from the side. Lay the formica flat. Place a book perpendicular to the end of the formica board (the book will represent the bulkhead). Place the block on the formica. Push the block so that it slides into the bulkhead and stops.

Lesson Plan	Instructor Notes
Laws of Physics Activity **Explain** that the participants will now complete a short activity. Note: This activity could also be presented as a group discussion using the slide and suggested responses on the following page.	*10 minutes* *Activity instructions: 1* *Individual work time: 5* *Report out: 4* The purpose of this activity is to get participants to think about situations that could cause unsecured cargo to move. Turn to the page following the instructions to see the Laws of Physics Activity worksheet. Have the participants turn to the Laws of Physics activity worksheet. Read the scenario on the slide. Give them 5 minutes to complete the activity. When the participants have completed the activity, review and discuss the worksheet.

Lesson Plan	Instructor Notes
	Show Slide Standard-16.  Suggested Responses: 1. Forward direction - Braking - Braking going downhill 2. Rearward direction - Acceleration - Braking in reverse - Shifting gears going uphill 3. Sideways direction - Cornering - Changing lanes 4. Upward direction - Hitting bumps and holes on the road

Module 2 - Law of Physics Activity

A truck is traveling down a highway. The cargo is not secured to the vehicle. Describe the situations, under normal driving conditions, that would create a force that would change the motion of the cargo.

- In a forward direction:

  _____

- In a rearward direction:

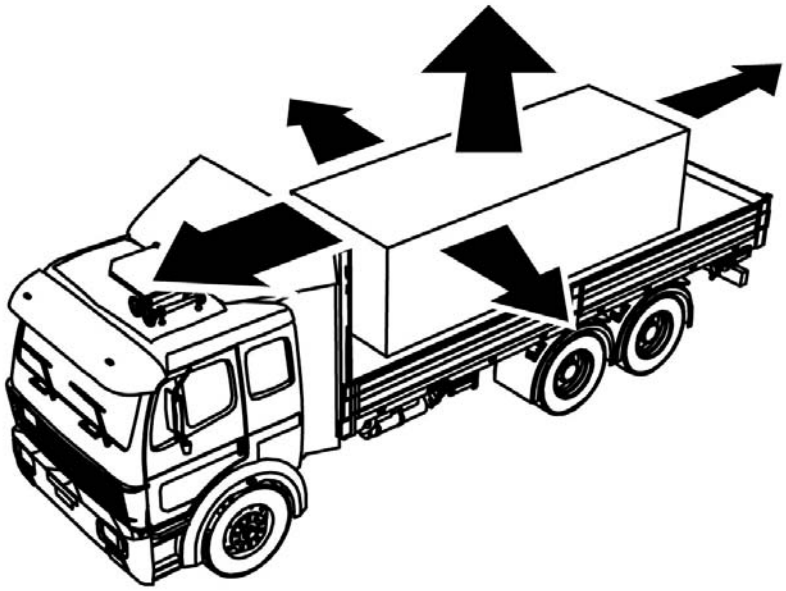
  _____

- In a sideways direction:

  _____

- In an upward direction:

  _____



Lesson Plan	Instructor Notes

Performance Criteria

5 minutes

This section reviews Section 1.3 of the Standard (Performance Criteria). In particular, it focuses on what amount of securement is enough.

Overview

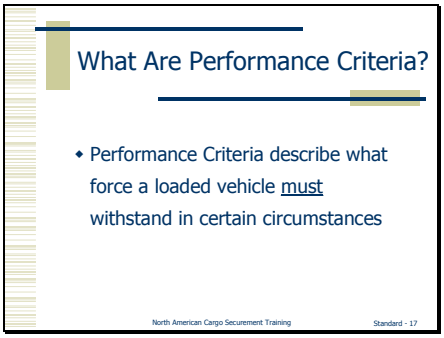
Remind participants that earlier you talked about the different parts of the Standard. Section 1.3 is called Performance Criteria. This section addresses the cargo securement system and how strong it needs to be.

Explain that you are now going to talk about the Performance Criteria. This term is used to describe the force a loaded vehicle must withstand in certain given circumstances.

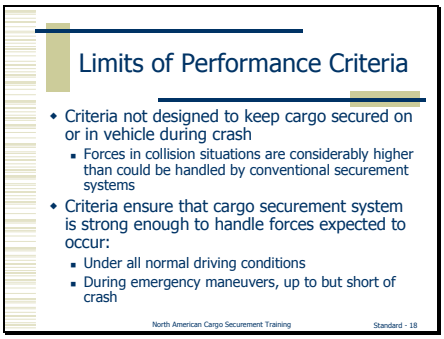
Explain that the North American Cargo Securement Standard was not designed to keep cargo secured on or in the vehicle during a crash situation. The forces that occur in collision situations are considerably higher than could be handled by conventional securement systems.

For this reason, the Standard is based on performance criteria that will ensure that the cargo securement system is strong enough to handle forces that could be expected to occur under all normal driving conditions and during emergency maneuvers, up to but short of a crash.

Show Slide Standard-17.



Show Slide Standard-18.



Lesson Plan	Instructor Notes

What securement is enough

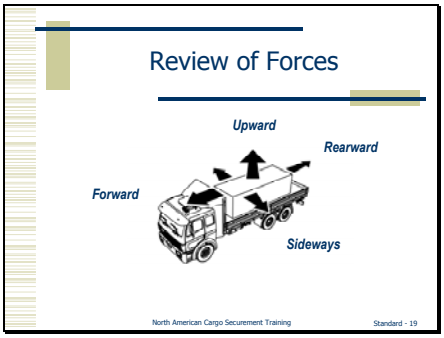
Remind participants of the activity they just completed where they identified situations that would create forces in 4 directions:

- Forward
- Backward or rearward
- Sideways
- Upward.

Explain that the Performance Criteria tell how much force the cargo securement system needs to be able to resist in each of those directions.

Review the securement requirements in the Standard and the amount of force resistance cargo must be able to withstand.

Show Slide Standard-19.



How do I measure force?

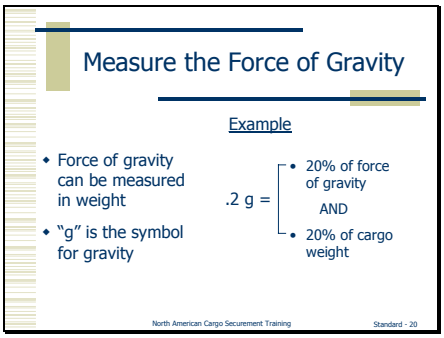
Explain that force of gravity can be measured in weight.

Explain that "g" is the symbol for gravity.

Tell the participants that .2 g is:

- 20% of the force of gravity
- 20% of the cargo weight

Show Slide Standard-20.



Lesson Plan	Instructor Notes

Forward Force

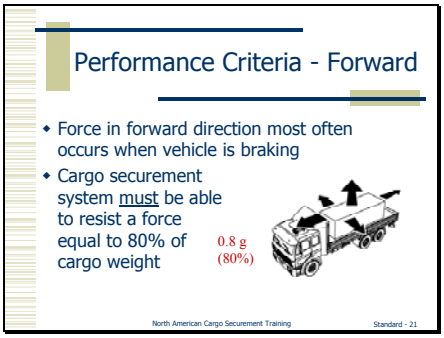
Tell the participants that the force in the forward direction would most often occur when the vehicle is braking.

Tell the participants that the cargo securement system must be able to resist a force equal to 80% of the cargo weight.

For example:

> Your cargo weighs 1,000 kg. How much resistance must the securement system provide against the forward force?

Show Slide Standard-21.



For each of these questions, you may substitute lb. for kg.

Answer: 800 kg

Rearward Force

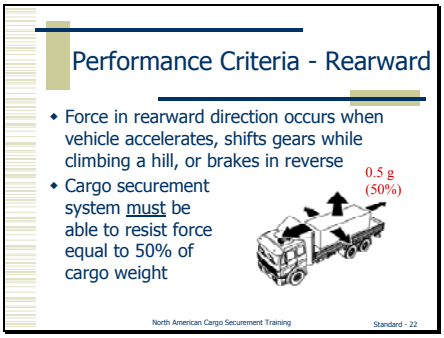
Tell the participants the force in the rearward direction occurs when the vehicle accelerates, shifts gears while climbing a hill, or brakes in reverse.

Tell the participants that the cargo securement system must be able to resist a force equal to 50% of cargo weight.

For example:

> Your cargo weighs 1,000 kg. How much resistance must the securement system provide against the rearward force?

Show Slide Standard-22.



Answer: 500 kg

Lesson Plan	Instructor Notes

Sideways Force

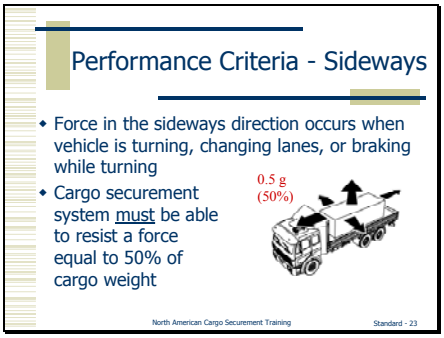
Tell the participants that force in the sideways direction occurs when the vehicle is turning, changing lanes, or braking while turning.

Tell the participants that the cargo securement system must be able to resist a force equal to 50% of cargo weight.

For example:

> Your cargo weighs 1,000 kg. How much resistance must the securement system provide against the rearward force?

Show Slide Standard-23.



Answer: 500 kg

Upward Force

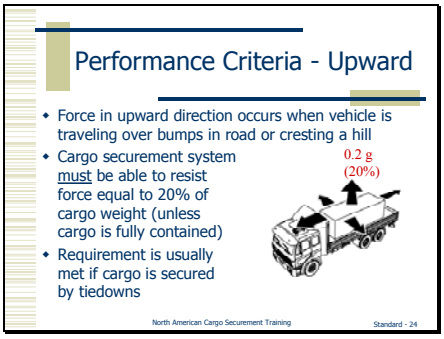
Tell the participants that force in the upward direction occurs when the vehicle is traveling over bumps in the road or cresting a hill.

Tell the participants that the cargo securement system must be able to resist a force equal to 20% of cargo weight. The requirement is usually met if the cargo is secured by tiedowns. The exception is if the cargo is fully contained in a structure of sufficient strength.

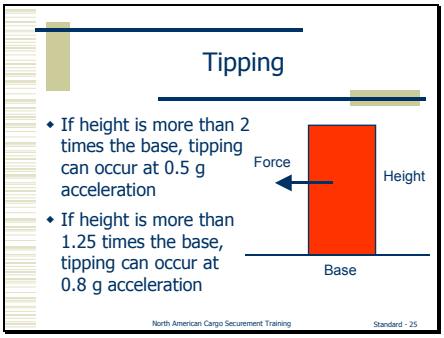
For example:

> Your cargo weighs 1,000 kg. How much resistance must the securement system provide against the upward force?

Show Slide Standard-24.



Answer: 200 kg

Lesson Plan	Instructor Notes
Tipping **Tell** participants that tipping is when an article falls over. **Explain** to participants that, if the height of the cargo is more than 2 times the base on which the cargo is secured on, then tipping can occur at 0.5 g acceleration. **Explain** that, if the height of the cargo is more than 1.25 times the base in which the cargo is secured on, then tipping can occur at 0.8 g acceleration.	Show Slide Standard-25.  Use the block of wood to demonstrate. Place the block flat on the formica with the base 6 in and the height 2 in. The load is not likely to tip. Place the block on end with the base 2 in and the height 6 in. The load will tip if not braced.

Lesson Plan	Instructor Notes

Summary and Transition

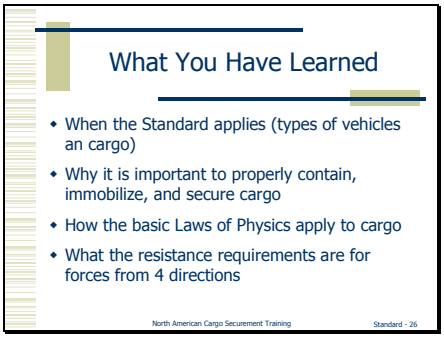
5 minutes

Summarize the lesson on the Standard and Basic Physics Principles, recapping what the participants just learned.

Tell the participants they now know:

- When the Standard applies (types of vehicles and cargo)
- Why it is important to properly contain, immobilize, and secure cargo
- How the basic Laws of Physics apply to cargo
- What the resistance requirements are for forces from 4 directions

Show Slide Standard-26.



Tell the participants that they will now learn about the various components of the cargo securement system and how they are properly used.

Show Slide Standard-27.

Note: The left image is a rubber tire wheel loader with chain going to a lift eye. The middle image is a D-ring anchor point. The right image is a tiedown within the rubrail.

Module Overview

Module 2: General Cargo Securement Requirements: Equipment and Methods

Learning Objectives

At the completion of the training, participants will be able to state what the cargo securement system includes and how it must be maintained and used:

- Describe the elements of a securement system
- Describe the methods of using tiedowns (attached to cargo or pass over cargo) and explain how they each work
- Describe when no additional securement is required
- Explain how to identify the Working Load Limit for marked and unmarked securing devices
- Calculate aggregate working load limits of a securement system
- Describe inspection requirements.

Time Required

4 hours 45 minutes

Topics

1. Introduction (5 minutes)
2. Overview of Cargo Securement (10 minutes)
3. Elements of a Securement System (50 minutes)
4. General Requirements For Containing, Immobilizing, and Securing Cargo, Section #1 (35 minutes)

   Exceptions to requirements

   Securement Categories

   Working Load Limit (WLL)

5. Activity: Identify WLL of an Unmarked Securing Device (20 minutes)
6. General Requirements For Containing, Immobilizing, and Securing Cargo, Section #2 (25 minutes)

   Packaging, Unitization or Stacking

   General Cargo Placement and Restraint

   Bracing
7. General Requirements For Containing, Immobilizing, and Securing Cargo, Section #3 (30 minutes)

   Aggregate Working Load Limit

   Working Load Limit for tiedowns

   Tiedowns attached to the cargo

   Calculate Aggregate Working Load Limit for tiedowns attached to the cargo
8. Activity: Calculate Aggregate Working Load Limit for Tiedowns That Attach to the Cargo (20 minutes)
9. General Requirements For Containing, Immobilizing, and Securing Cargo, Section #4 (25 minutes)

   Tiedowns that pass over the cargo

   Aggregate Working Load Limit for tiedowns that pass over the cargo

   Practice Examples: Number of tiedowns needed for blocked and unblocked cargo

9. Activity: Determine Aggregate WLL for Tiedowns That Pass Over Cargo (15 minutes)
10. Inspecting Securement Systems (10 minutes)
11. Group Activity: Determining If Cargo Is Secured Properly (30 minutes)
12. Summary and Wrap Up

Training Methods

1. Participative lecture
2. Activity

Participant Materials

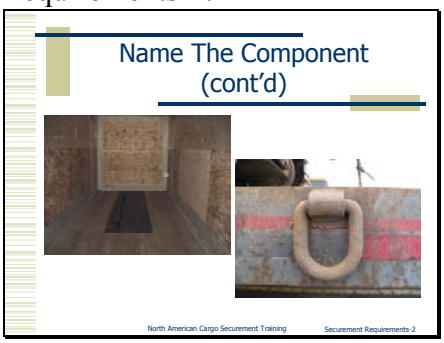
1. Participant Manual
2. Driver's Handbook of Cargo Securement

Training Materials

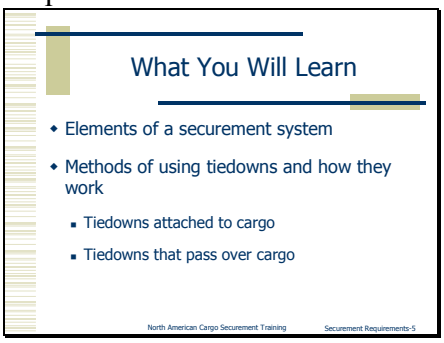
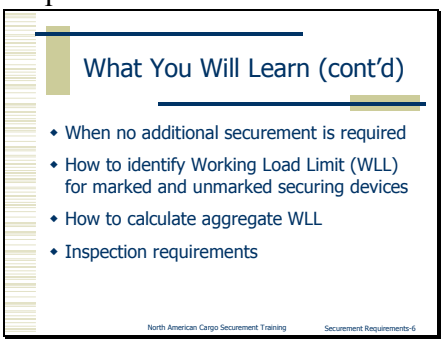
1. Instructor Guide
2. PowerPoint slides and projection system
3. Easel pad and markers
4. Participant materials

Instructor Notes

1. Activity: Identify the WLL of an Unmarked Securing Device
   Prior to offering the course, prepare the easel pad page as described in the activity.

Lesson Plan	Instructor Notes
Introduction **Ask** the participants to name some components of the cargo securement system.	*5 minutes* Introduce the course and capture the participants' attention. Show Slide Securement Requirements-1. Answers: ♦ Left – Headboard ♦ Right – Tiedowns Show Slide Securement Requirements-2.  Answers: ♦ Left – Friction mat ♦ Right – D-Ring Anchor point

Lesson Plan	Instructor Notes
	Show Slide Securement Requirements-3. Answers: ♦ Left – Blocking ♦ Right – Chain
Tell the participants that in this module they are going to learn about cargo securement equipment and methods.	Show Slide Securement Requirements-4.

Lesson Plan	Instructor Notes
Learning Objectives **Tell** participants that, at the completion of the training, they will be able to: ◆ Describe the elements of a securement system ◆ Describe the methods of using tiedowns (attached to cargo or pass over cargo) and explain how they each work ◆ Describe when no additional securement is necessary	State the learning objectives of the course. Show Slide Securement Requirements-5. 
◆ Explain how to identify the Working Load Limit for marked and unmarked securing devices ◆ Calculate aggregate working load limits ◆ Describe inspection requirements	Show Slide Securement Requirements-6. 

Lesson Plan	Instructor Notes

Overview of Cargo Securement

10 minutes

Review basic cargo securement concepts.

Basic principle of cargo securement

Remind participants that, as you have already discussed, there is a basic principle about cargo securement that everyone needs to remember:

- Cargo being transported on the highway has to remain secured on or within the transporting vehicle.

Show Slide Securement Requirements-7.

Say that everyone knows that cargo doesn't stay on a vehicle just because you tell it to. As the cargo is traveling down the highway on or with in a vehicle, it encounters certain forces.

These are review questions.

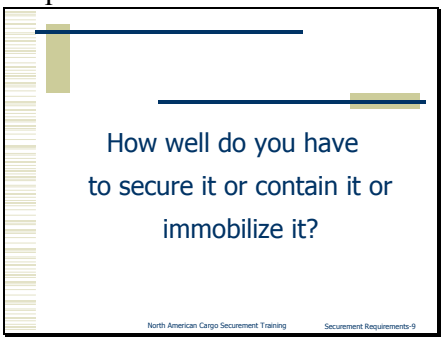
Ask this question:

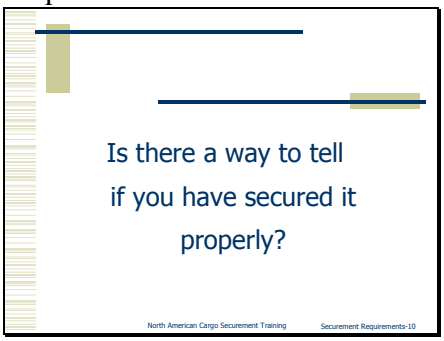
> So how do you keep cargo in place?

Show Slide Securement Requirements-8.

Desired response:

You contain, immobilize, or secure it.

Lesson Plan	Instructor Notes
Ask this question: And how well do you have to secure it or contain it or immobilize it?	Show Slide Securement Requirements-9.  Desired response: So it doesn't leak, spill, blow, fall from the vehicle, fall through the vehicle, become dislodged from the vehicle, or shift upon or within the vehicle, making the vehicle unstable or affecting its maneuverability.

Lesson Plan	Instructor Notes
Ask this question: Is there a way to tell if you have secured it properly?	Show Slide Securement Requirements-10.  Desired response: It is secured properly if the securement system will resist a force equal to: – Forward force: 0.8 g or 80% of cargo weight – Rearward force: 0.5 g or 50 % of cargo weight – Sideways force: 0.5 g or 50 % of cargo weight – Upward force: 0.2 g or 20 % of cargo weight Participants may not know this. Explain that you will be talking about it in more detail later.

Lesson Plan	Instructor Notes
Ask this question: How do you keep cargo from tipping?	Show Slide Securement Requirements-11. Desired response: You brace it. Note: Unitizing can make the load simpler to brace but it may not be sufficient to prevent tipping.

Lesson Plan	Instructor Notes

Cargo Securement System

Ask this question:

> What is included in the cargo securement system?

Remind participants that the cargo securement system includes the vehicle structure, blocking and bracing equipment, and securing devices.

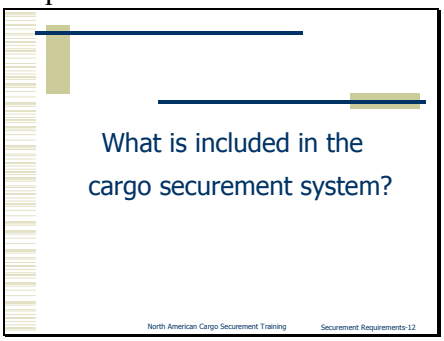
Explain that the cargo securement system:

- Is maintained by the carriers and drivers
- Must be in good working order with no obvious signs of damage or weakness
- Must be used within its capability.

This is a review question.

By now participants should know the answer to this question. Watch for those who seem confused. They may need additional instruction.

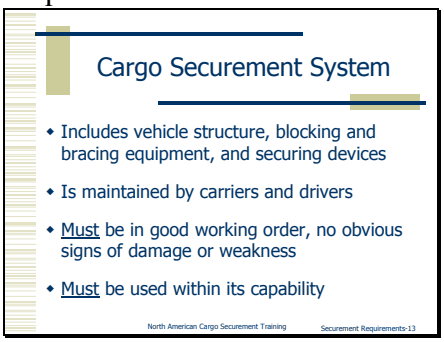
Show Slide Securement Requirements-12.

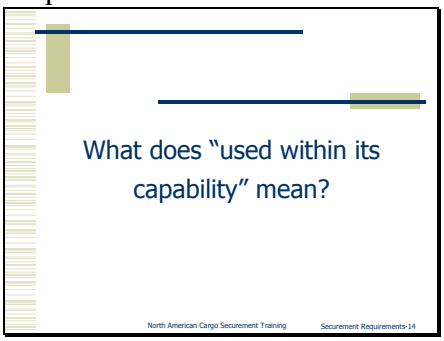


Desired responses:

- The vehicle structure
- Securing devices (tiedowns, etc.)
- Blocking and bracing equipment
- Dunnage

Show Slide Securement Requirements-13.



Lesson Plan	Instructor Notes
Ask this question: What does "used within its capability" mean?	Show Slide Securement Requirements-14.  Desired response: It has to be able to do the job. It has to be strong enough to contain, immobilize, and secure the cargo if it is subjected to the forces described in the Performance Criteria.
Say that the way you know the capability of the securement system is by knowing the working load limits of all the parts of the system. **Tell** participants that you will be talking about working load limits later in the module.	

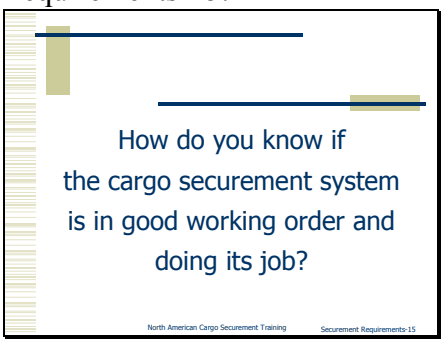
Lesson Plan	Instructor Notes

Inspection methods

Ask the participants:

> How do you know if the cargo securement system is in good working order and doing its job?

Show Slide Securement Requirements-15.



Desired response:

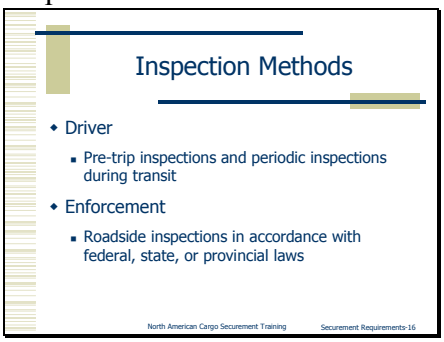
You check it out. You inspect it.

Explain to the participants that it is the driver's responsibility to make:

- Pre-trip inspections
- Periodic inspections during transit.

Explain to the participants that law enforcement is responsible for roadside inspections in accordance with federal, state, or provincial laws.

Show Slide Securement Requirements-16.



There will be more information about inspection at the end of the module.

Lesson Plan	Instructor Notes

Elements of a Securement System

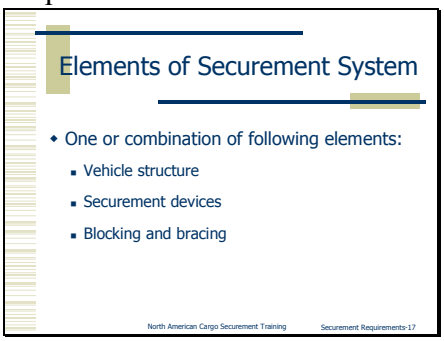
50 minutes

Discuss the elements of a securement system.

Explain that a securement system is in fact a securement method using one or a combination of the following elements:

- The vehicle structure
- The securing devices
- Blocking and bracing.

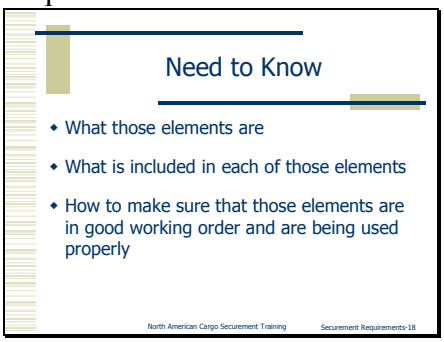
Show Slide Securement Requirements-17.

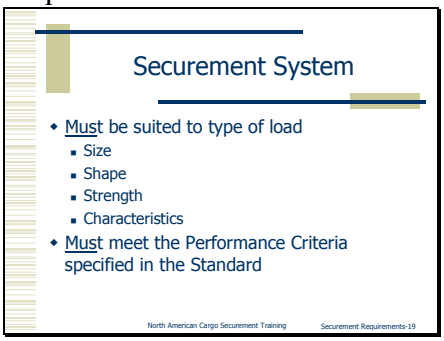
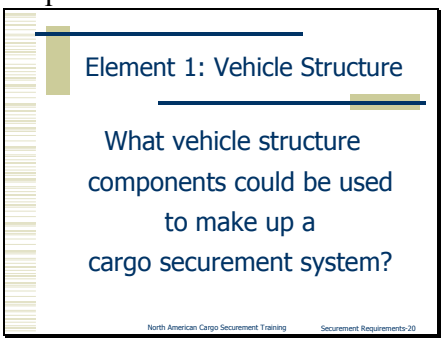


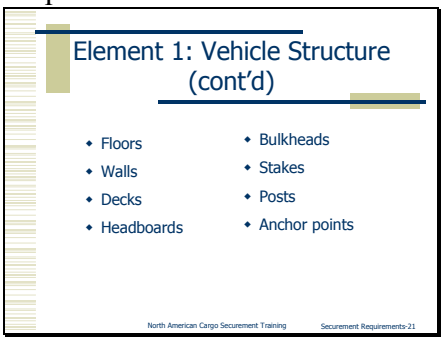
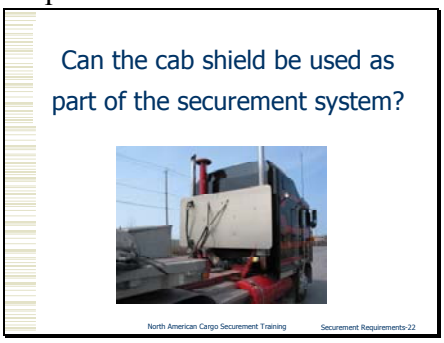
Say that participants need to know:

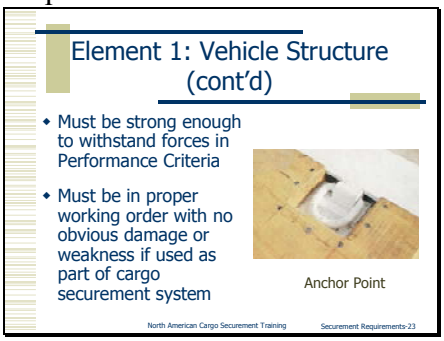
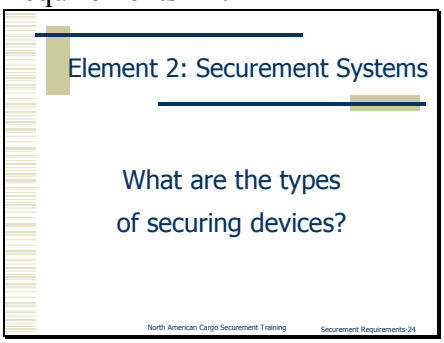
- What those elements are
- What is included in each of those elements
- How to make sure that those elements are in good working order and are being used properly.

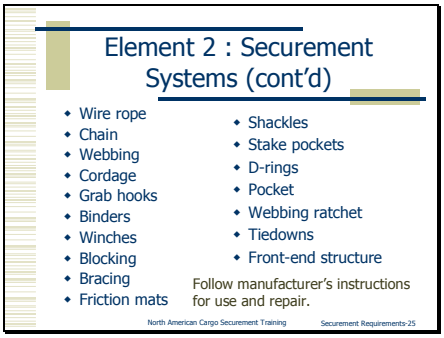
Show Slide Securement Requirements-18.

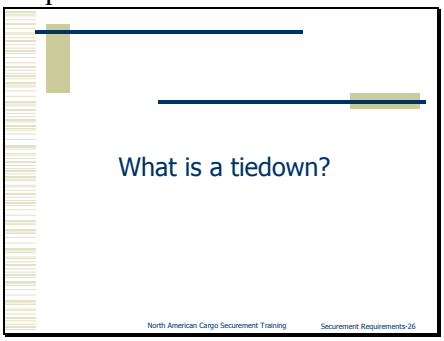
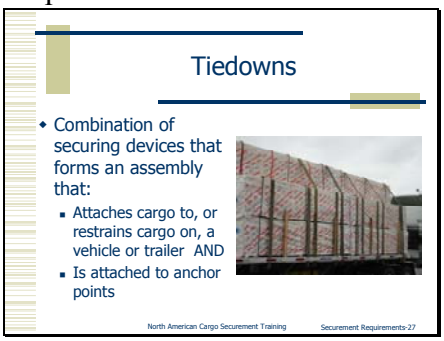


Lesson Plan	Instructor Notes
Explain that the securement system: ◆ Must be suited to the type of load (size, shape, strength, characteristics) ◆ Must meet Performance Criteria specified in the Standard.	Show Slide Securement Requirements-19. 
Element 1: Vehicle structure **Ask** the participants: What vehicle structure components could be used to make up a cargo securement system?	Show Slide Securement Requirements-20.  Desired responses: - Floors - Walls - Decks - Headboards - Bulkheads - Stakes - Posts - Anchor points

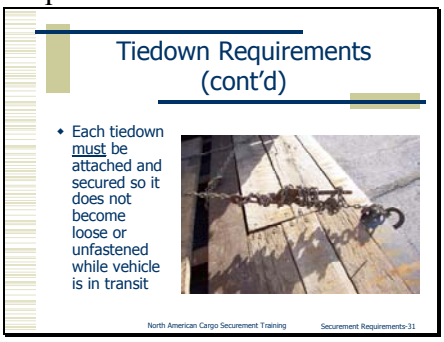
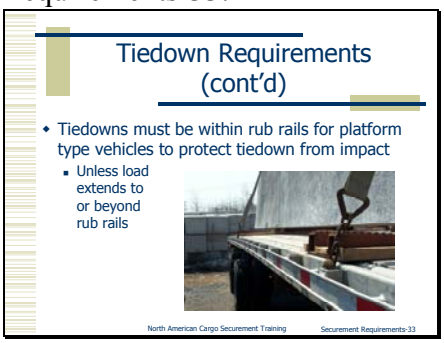
Lesson Plan	Instructor Notes
Explain that the cargo securement components included in the vehicle structure and anchor points are: ◆ Floors ◆ Walls ◆ Decks ◆ Headboards ◆ Bulkheads ◆ Stakes ◆ Posts ◆ Anchor points.	Show Slide Securement Requirements-21.  Anchor points are treated as securing devices rather than part of the vehicle structure.
Ask the participants: Can the cab shield be used as part of the securement system?	Show Slide Securement Requirements-22.  Desired response: NO.
Tell the participants that generally best practices would dictate that the cab shield should not be used as part of the securement system. However, a front-end structure could be used to provide some restraint against forward movement if the cargo is in contact with it.	Only a front-end structure (such as a headboard) can be used to restrain against forward movement.

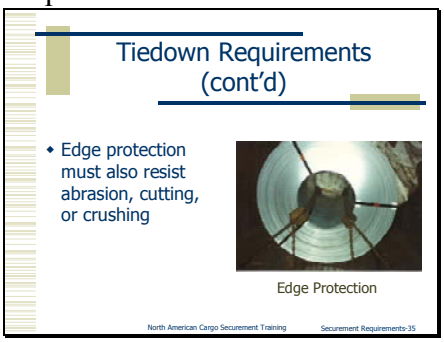
Lesson Plan	Instructor Notes
Explain that the vehicle structure must be strong enough to withstand the forces in the Performance Criteria. **Tell** the participants that the vehicle structure must be in proper working order with no obvious damage or weakness if it is used as part of the cargo securement system.	Show Slide Securement Requirements-23. 
Element 2: Securing devices **Ask** the participants: What are the types of securing devices?	Show Slide Securement Requirements-24.  Give the participants one minute to write down as many securing devices that they can think of. When the minute is up, have the participants tell you what components they had written down. Capture the participants' responses on an easel pad.

Lesson Plan	Instructor Notes
	Suggested responses: - Wire rope - Chain - Webbing - Cordage - Grab hooks - Binders - Shackles - Winches - Stake pockets - D-rings - Pocket - Webbing ratchet - Tiedowns - Blocking - Bracing - Front-end structure - Friction mats Show Slide Securement Requirements-25 to recap the discussion. 
Explain to the participants that they should follow the manufacturer's instructions for use and repair.	

Lesson Plan	Instructor Notes
Tiedowns **Ask** the participants: What is a tiedown? **Tell** the participants that tiedowns consist of a combination of securing devices that forms an assembly that: ♦ Attaches cargo to, or restrains cargo on, a vehicle or trailer AND ♦ Is attached to anchor point(s).	Show Slide Securement Requirements-26.  Desired response: - A device or combination of devices that keep the cargo on the vehicle - Attached to anchor points - May attach to the cargo or may pass over the cargo or pass through the cargo Show Slide Securement Requirements-27. 

Lesson Plan	Instructor Notes
Tell participants that some tiedowns are attached to the cargo. ◆ They provide direct resistance to oppose the forces that are acting on the cargo. ◆ This direct resistance restrains the cargo from movement.	Show Slide Securement Requirements-28.
Tell participants that some tiedowns pass over the cargo. ◆ They create a downward force that increases the effect of friction between the cargo and the deck. ◆ This friction restrains the cargo.	Show Slide Securement Requirements-29.
Explain the following tiedown requirements: ◆ Except for steel strapping, tiedowns <u>must</u> be designed, constructed, and maintained so the driver can tighten them. ◆ Tiedowns <u>must</u> be inspected and retightened by the driver during transit, when required.	Emphasize these requirements. As appropriate, give examples of things you have seen that do NOT meet the requirements. Show Slide Securement Requirements-30.

Lesson Plan	Instructor Notes
◆ Each tiedown <u>must</u> be attached and secured so it does not become loose or unfastened while the vehicle is in transit. ◆ Tiedowns <u>must</u> be in good working order.	Show Slide Securement Requirements-31.  Refer the participants to the Standards handout. Discuss how to keep tiedowns from becoming loose or unfastened, opening, or releasing.
Discuss with participants what is meant by "good working order." ♦ No knots or obvious damage ♦ No distress ♦ No weakened parts ♦ No weakened sections.	Show Slide Securement Requirements-32.
◆ Tiedowns <u>must</u> be within the rub rails for platform type vehicles to protect tiedown from impact, unless load extends to or beyond the rub rails.	Show Slide Securement Requirements-33. 

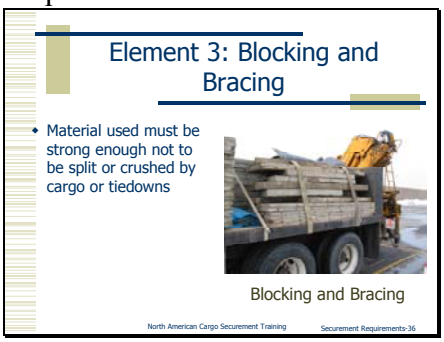
Lesson Plan	Instructor Notes
◆ Edge protection must be used if a tiedown may be cut or worn where it touches the cargo; edge protection must also resist abrasion, cutting, or crushing	Show Slide Securement Requirements-34. Show Slide Securement Requirements-35. 

Lesson Plan	Instructor Notes

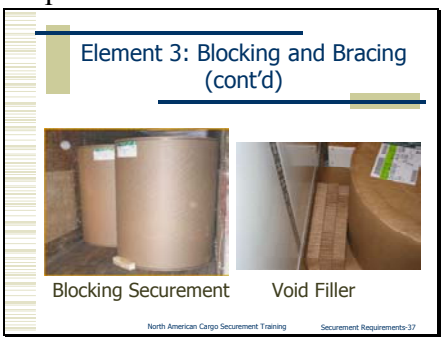
Element 3: Blocking and bracing

Explain that material used as dunnage, chocks, cradles, or for blocking or bracing, must be strong enough not to be split or crushed by the cargo or tiedowns.

Show Slide Securement Requirements-36.



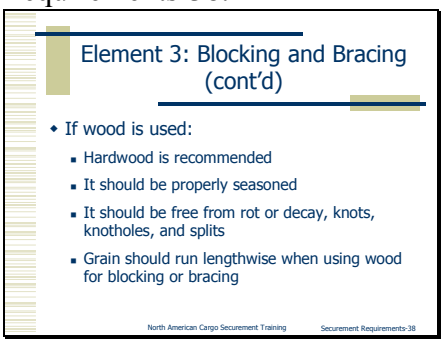
Show Slide Securement Requirements-37.



Explain that, if wood is used:

- Hardwood is recommended
- It should be properly seasoned
- It should be free from rot or decay, knots, knotholes, and splits
- The grain should run lengthwise when using wood for blocking or bracing.

Show Slide Securement Requirements-38.



Before continuing, **ask** for questions about the elements of a securement system:

- Vehicle structure
- Securing devices
- Blocking and bracing.

Lesson Plan	Instructor Notes
General Requirements for Containing, Immobilizing, and Securing Cargo, Section #1	*35 minutes*
Tell participants that you have talked about the elements of a securement system: ◆ Vehicle structure ◆ Securing devices ◆ Blocking and bracing. **Explain** that you are now going to look in detail at the requirements for containing and immobilizing cargo. In particular, you will be talking about: ◆ Working load limit or WLL ◆ Cargo placement and restraint ◆ Aggregate working load limits for tiedowns.	Discuss the general requirements in the Standard for containing, immobilizing, and securing cargo. Show Slide Securement Requirements-39.

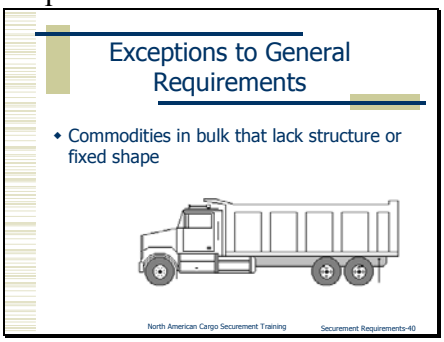
Lesson Plan	Instructor Notes

Exceptions to requirements

Explain to the participants that these requirements cover all types of cargo, <u>except:</u>

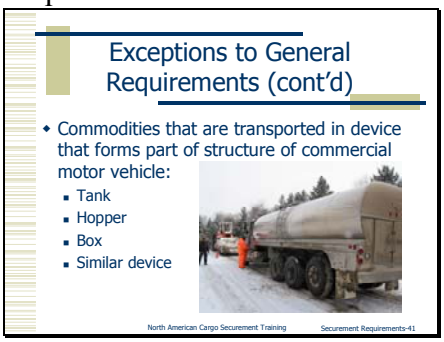
- Commodities in bulk that lack structure or fixed shape AND

Show Slide Securement Requirements-40.



- Commodities that are transported in the structure of a commercial motor vehicle, e.g.:
  - Tank
  - Hopper
  - Box
  - Similar device.

Show Slide Securement Requirements-41.

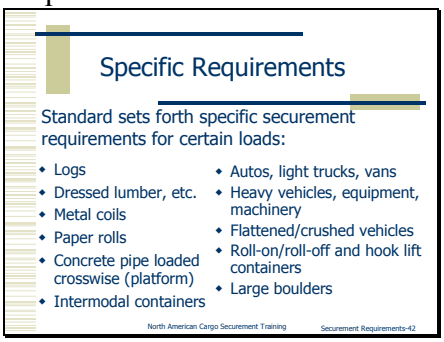


Ask this question:

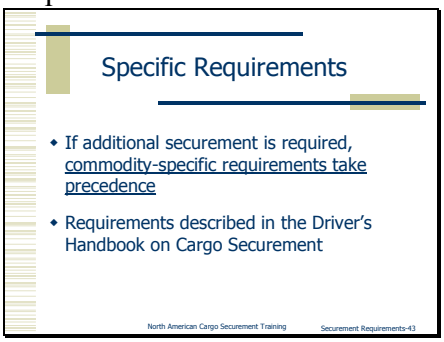
> What are some commodities that lack a structure or fixed shape?

Suggested responses:

- Liquids
- Gases
- Grain
- Liquid concrete
- Sand
- Gravel
- Aggregates

Lesson Plan	Instructor Notes
Explain that, in addition, the Standard sets forth specific securement requirements for certain loads. If transporting these commodities, you have to use the specific requirements for that commodity.	Show Slide Securement Requirements-42. 
List the commodities that have specific requirements: ◆ Logs ◆ Dressed lumber and similar building materials ◆ Metal coils ◆ Paper rolls ◆ Concrete pipe loaded crosswise on a platform vehicle ◆ Intermodal containers ◆ Automobiles, light trucks and vans ◆ Heavy vehicle, equipment, or machinery ◆ Flattened or crushed vehicles ◆ Roll-on/Roll-off and hook lift containers ◆ Large boulders.	

Lesson Plan	Instructor Notes
Say that, if additional securement is required for these loads, that commodity-specific requirement takes precedence. These requirements are described in the Driver's Handbook on Cargo Securement and in the North American Cargo Securement Standard.	Show Slide Securement Requirements-43.



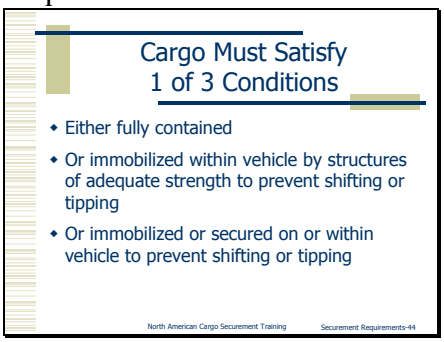
Point out where this information can be found in the Handbook.

Securement categories

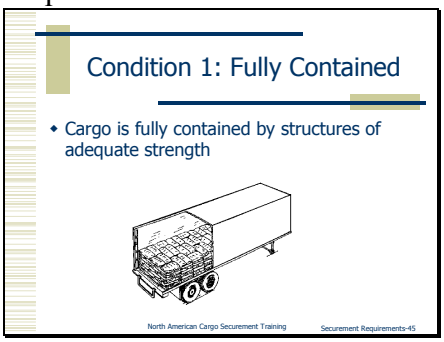
Explain that all types of cargo must satisfy one of three conditions:

- Condition 1: Cargo is fully contained by structures of adequate strength.
- Condition 2: Cargo is immobilized by structures of adequate strength or a combination of structure, blocking, and bracing to prevent shifting or tipping.
- Condition 3: Cargo is immobilized or secured on or within a vehicle to prevent shifting or tipping.

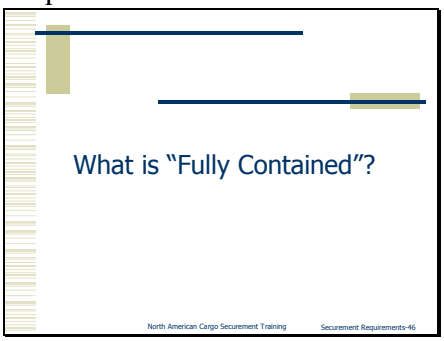
Show Slide Securement Requirements-44.



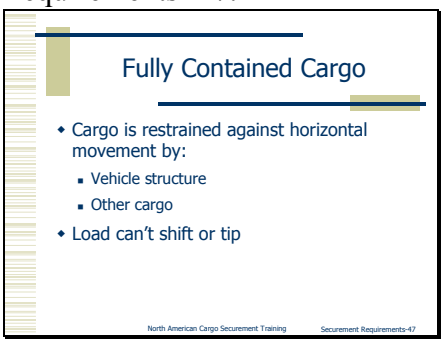
Lesson Plan	Instructor Notes
Condition 1: Cargo is fully contained by structures of adequate strength.	Show Slide Securement Requirements-45.



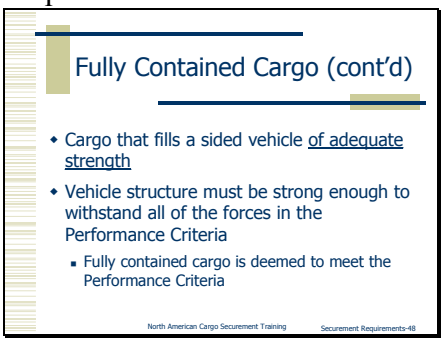
Ask the participants: What is "Fully Contained?"	Show Slide Securement Requirements-46.



	Suggested Responses: - Cargo is restrained by vehicle structure of adequate strength - Cargo cannot shift to the extent it affects stability
Explain that fully contained means that cargo is restrained against horizontal movement in all four directions by vehicle structure, or by other cargo. Horizontal movement includes forward, rearward, and side to side. That means that the cargo cannot shift or tip.	Show Slide Securement Requirements -47.



Lesson Plan	Instructor Notes
Explain that cargo that fills a sided vehicle of adequate strength is considered fully contained. The vehicle structure must be strong enough to withstand all of the forces in the Performance Criteria. Note: Fully contained cargo is deemed to meet the Performance Criteria.	Show Slide Securement Requirements -48.



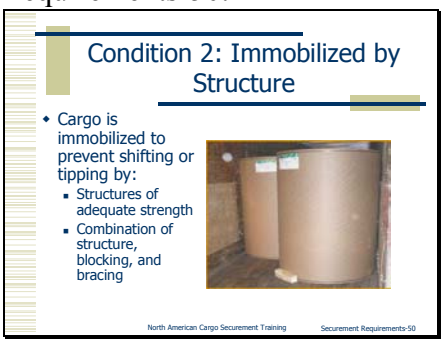
Note that the key here is "of adequate strength."

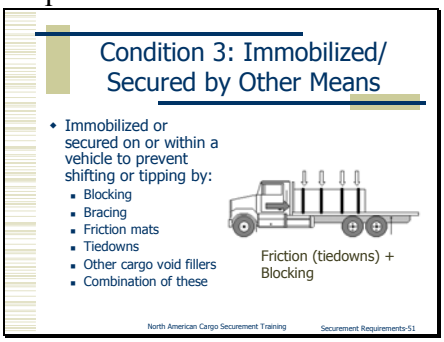
- A load of lampshades in a sided vehicle is not likely to be a problem. They won't go through the sides of the vehicle.
- However, a load of unsecured metal coils may fill the vehicle and appear to be restrained from movement. Yet they could easily go right through the walls of most vehicles.

Show Slide Securement Requirements -49.

- Condition 2: Cargo is immobilized by structures of adequate strength or a combination of structure, blocking, and bracing to prevent shifting or tipping.

Show Slide Securement Requirements-50.



Lesson Plan	Instructor Notes
◆ Condition 3: To prevent shifting or tipping, cargo is immobilized or secured on or within a vehicle by: – Blocking – Bracing – Friction mats – Tiedowns – Other cargo – Void fillers – Combination of these.	Show Slide Securement Requirements-51.  Point out that blocking can take various forms. Show Slide Securement Requirements-52.

Lesson Plan	Instructor Notes

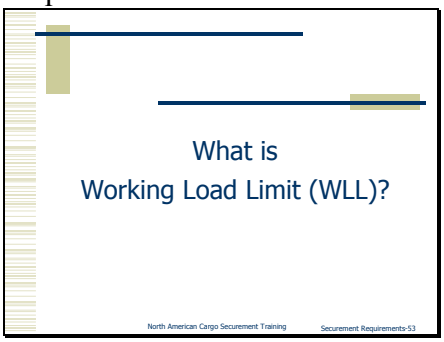
Working Load Limit (WLL)

Ask the participants:

> What is Working Load Limit (WLL)?

Explain to the participants that the Working Load Limit (WLL) is the maximum load that may be applied to a component of a cargo securement system during normal service. The manufacturer of the component usually assigns the WLL.

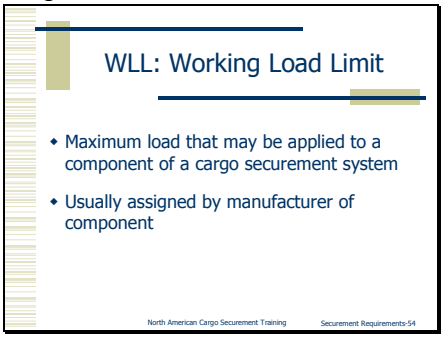
Show Slide Securement Requirements-53.

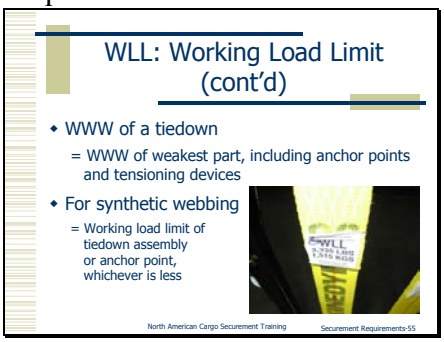


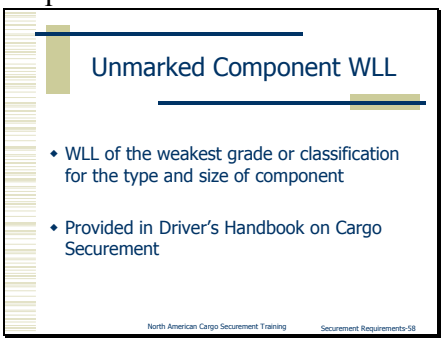
Suggested response:

- The maximum load that may be applied to a component of a cargo securement system as assigned by the manufacturer or through default values.

Show Slide Securement Requirements-54.



Lesson Plan	Instructor Notes
Explain that the Working Load Limit of a tiedown is the working load limit of its weakest part, including anchor points and tensioning devices. **Explain** that for synthetic webbing, WLL is the working load limit of the tiedown assembly or the anchor point, whichever is less.	Show Slide Securement Requirements-55. 
Tell the participants that most components are marked with the WLL. **Explain** that some manufacturers mark their manufactured tiedown assemblies, or components, with a numeric working load limit value. **Explain** that, if the marking cannot be read, it will be treated at a default value.	Show Slide Securement Requirements-56.
Explain that other manufacturers mark components using a code or symbol that is defined in a recognized standard (see Section 5 of the Standard).	Show Slide Securement Requirements-57.

Lesson Plan	Instructor Notes
Explain to the participants that for unmarked components, WLL is the WLL of the weakest grade or classification for the type and size of the component. These are provided in the Driver's Handbook on Cargo Securement and in the North American Cargo Securement Standard.	Show Slide Securement Requirements-58. 
◆ Chain not marked by its manufacturer shall be considered to have a working load limit equal to an equivalent size Grade 3 Proof Coil as indicated in Table 6.1 of the North American Cargo Securement Standard ◆ Synthetic webbing not marked by its manufacturer shall be considered to have a working load limit based on its width as provided in Table 6.2 of the North American Cargo Securement Standard ◆ Wire rope not marked by its manufacturer with a working load limit shall be considered to have a working load limit based on its diameter as provided in Table 6.3 of the North American Cargo Securement Standard ◆ Manila rope not marked by its manufacturer with a working load limit shall be considered to have a working load limit based on its diameter as provided in Table 6.4 of the North American Cargo Securement Standard	Refer participants to the appropriate tables in the Driver's Handbook on Cargo Securement for each unmarked component. These tables are also found here on the following pages. Participants need to be familiar with these tables.

Lesson Plan	Instructor Notes
◆ Synthetic fiber rope not marked by its manufacturer with a working load limit shall be considered to have a working load limit based on its diameter as provided in Table 6.5 of the North American Cargo Securement Standard ◆ Steel strapping not marked by its manufacturer with a working load limit shall be considered to have a working load limit based on its width as provided in Table 6.6. Steel strapping that is one inch wide or wider must have at least two pairs of crimps in each seal and, when an end-over-end lap joint is formed, it must be sealed with at least two seals as provided in Table 6.6 of the North American Cargo Securement Standard.	

Default Working Load Limits for Unmarked Tiedowns

Chain

	Working Load Limit				
Size	**Grade 30 proof coil**	**Grade 43 High test**	**Grade 70 Transport**	**Grade 80 Alloy**	**Grade 100 Alloy**
7 mm (1/4 in)	580 kg (1300 lb)	1180 kg (2600 lb)	1430 kg (3150 lb)	1570 kg (3500 lb)	1950 kg (4300 lb)
8 mm (5/16 in)	860 kg (1900 lb)	1770 kg (3900 lb)	2130 kg (4700 lb)	2000 kg (4500 lb)	2600 kg (5700 lb)
10 mm (3/8 in)	1200 kg (2650 lb)	2450 kg (5400 lb)	2990 kg (6600 lb)	3200 kg (7100 lb)	4000 kg (8600 lb)
11 mm (7/16 in)	1680 kg (3700 lb)	3270 kg (7200 lb)	3970 kg (8750 lb)	-	-
13 mm (1/2 in)	2030 kg (4500 lb)	4170 kg (9200 lb)	5130 kg (11300 lb)	5440 kg (12000 lb)	6800 kg (15000 lb)
16 mm (5/8 in)	3130 kg (6900 lb)	5910 kg (13000 lb)	7170 kg (15800 lb)	8200 kg (18100 lb)	10300 kg (22600 lb)
Chain Marks					
Example 1 Example 2 Example 3	3 30 300	4 40 400	7 70 700	8 80 800	10 100 1000

Note: Chain that is not marked is considered Grade 30.

Synthetic Webbing

Width	WLL
45 mm (1-3/4 in)	790 kg (1750 lb)
50 mm (2 in)	910 kg (2000 lb)
75 mm (3 in)	1360 kg (3000 lb)
100 mm (4 in)	1810 kg (4000 lb)

Wire Rope (6 x 37, Fiber Core)

Diameter	WLL
7 mm (1/4 in)	640 kg (1400 lb)
8 mm 5/16 in)	950 kg (2100 lb)
10 mm (3/8 in)	1360 kg (3000 lb)
11 mm (7/16 in)	1860 kg (4100 lb)
13 mm (1/2 in)	2400 kg (5300 lb)
16 mm (5/8 in)	3770 kg (8300 lb)
20 mm (3/4 in)	4940 kg (10900 lb)
22 mm (7/8 in)	7300 kg (16100 lb)
25 mm (1 in)	9480 kg (20900 lb)

Manila Rope

Diameter	WLL
10 mm (3/8 in)	90 kg (205 lb)
11 mm (7/16 in)	120 kg (265 lb)
13 mm (1/2 in)	150 kg (315 lb)
16 mm (5/8 in)	210 kg (465 lb)
20 mm (3/4 in)	290 kg (640 lb)
25 mm (1 in)	480 kg (1050 lb)

Polypropylene Fiber Rope (3-Strand and 8-Strand Constructions)

Diameter	WLL
10 mm (3/8 in)	180 kg (400 lb)
11 mm (7/16 in)	240 kg (525 lb)
13 mm (1/2 in)	280 kg (625 lb)
16 mm (5/8 in)	420 kg (925 lb)
20 mm (3/4 in)	580 kg (1275 lb)
25 mm (1 in)	950 kg (2100 lb)

Polyester Fiber Rope (3-Strand and 8-Strand Constructions)

Diameter	WLL
10 mm (3/8 in)	250 kg (555 lb)
11 mm (7/16 in)	340 kg (750 lb)
13 mm (1/2 in)	440 kg (960 lb)
16 mm (5/8 in)	680 kg (1500 lb)
20 mm (3/4 in)	850 kg (1880 lb)
25 mm (1 in)	1500 kg (3300 lb)

Nylon Rope

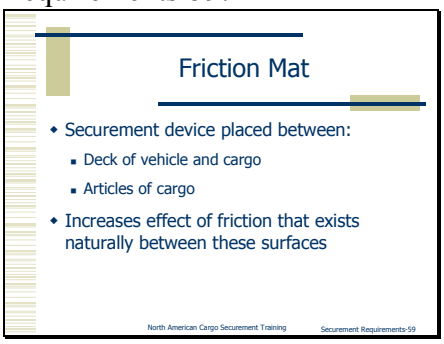
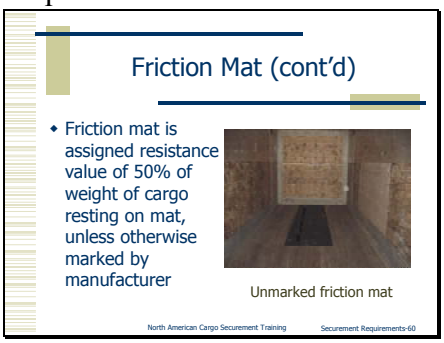
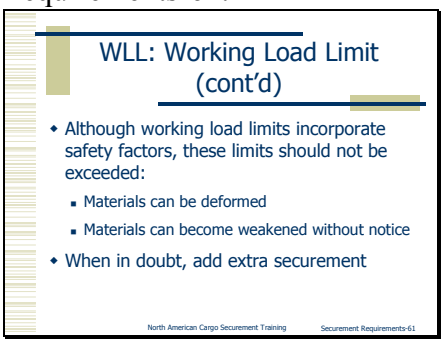
Diameter	WLL
10 mm (3/8 in)	130 kg (278 lb)
11 mm (7/16 in)	190 kg (410 lb)
13 mm (1/2 in)	240 kg (525 lb)
16 mm (5/8 in)	420 kg (935 lb)
20 mm (3/4 in)	640 kg (1420 lb)
25 mm (1 in)	1140 kg (2520 lb)

Double Braided Nylon Rope

Diameter	WLL
10 mm (3/8 in)	150 kg (336 lb)
11 mm (7/16 in)	230 kg (502 lb)
13 mm (1/2 in)	300 kg (655 lb)
16 mm (5/8 in)	510 kg (1130 lb)
20 mm (3/4 in)	830 kg (1840 lb)
25 mm (1 in)	1470 kg (3250 lb)

Steel Strapping

Width-thickness mm (in)	WLL
31.7 x 0.74 (1-1/4 x 0.029)	540 kg (1190 lb)
31.7 x 0.79 (1-1/4 x 0.031)	540 kg (1190 lb)
31.7 x 0.89 (1-1/4 x 0.035)	540 kg (1190 lb)
31.7 x 1.12 (1-1/4 x 0.044)	770 kg (1690 lb)
31.7 x 1.27 (1-1/4 x 0.050)	770 kg (1690 lb)
31.7 x 1.5 (1-1/4 x 0.057)	870 kg (1925 lb)
50.8 x 1.12 (2 x 0.044)	1200 kg (2650 lb)
50.8 x 1.27 (2 x 0.050)	1200 kg (2650 lb)

Lesson Plan	Instructor Notes
Explain that another securement device is a friction mat. It is placed between the deck of a vehicle and cargo, or between articles of cargo, to increase the effect of friction that exists naturally between these surfaces.	Show Slide Securement Requirements-59. 
Explain that a friction mat is assigned a resistance value of 50% of the weight of the cargo resting upon the mat unless otherwise marked by the manufacturer.	Show Slide Securement Requirements-60. 
Explain to the participants that, although working load limits incorporate safety factors, these limits should not be exceeded since materials can be deformed or become weakened without notice. **Tell** participants that, when in doubt, add extra securement.	Show Slide Securement Requirements-61. 

Lesson Plan	Instructor Notes

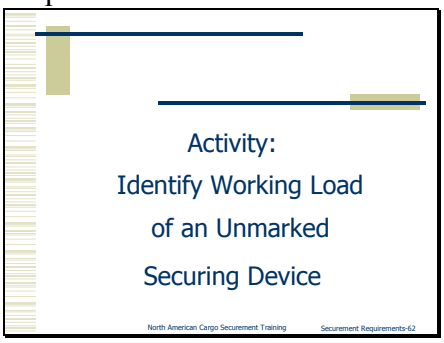
Activity: Identifying WLL of an Unmarked Securing Device

Explain to participants that they are going to use the Driver's Handbook on Cargo Securement to help them determine the working load limits for some unmarked securing devices.

20 minutes

Activity instructions: 5 minutes
Individuals work out answers: 10 minutes
Report out: 5 minutes

Show Slide Securement Requirements-62.



The purpose of this activity is to get the participants familiarized with the Driver's Handbook on Cargo Securement and how to look up the WLL for unmarked securing devices.

The activity worksheet is on the page following these instructions.

Have the participants turn to the WLL of an Unmarked Securing Device Activity worksheet. Read the instructions to the participants. Allow 10 minutes to complete the activity.

After 10 minutes, work together to complete the blank easel pad worksheet (prepared ahead). The easel pad worksheet should be a copy of the worksheet. See directions below.

Lesson Plan	Instructor Notes
	The easel pad should have two columns and 5 rows. The left column row should be titled "Securing Device" and the right column should be titled "WLL." Down the left, the rows should be labeled: 1) 8 mm (5/16 in) chain 2) 50 mm (2 in) webbing 3) 13 mm (1/2 in) wire rope (6x37, fiber core) 4) 25 mm (1 in) manila rope 5) 50.8 x 1.27 mm (2 in x 0.050) steel strapping The correct answers are: 1) Grade 30: 860 kg (1900 lb) Grade 43: 1770 kg (3900 lb) Grade 70: 2130 kg (4700 lb) Grade 80: 2000 kg (4500 lb) Grade 100: 2600 kg (5700 lb) 2) 910 kg (2000 lb) 3) 2400 kg (5300 lb) 4) 480 kg (1050 lb) 5) 1200 kg (2650 lb)

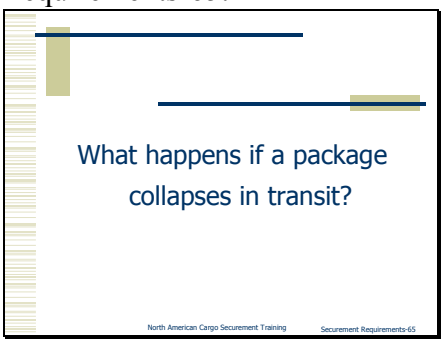
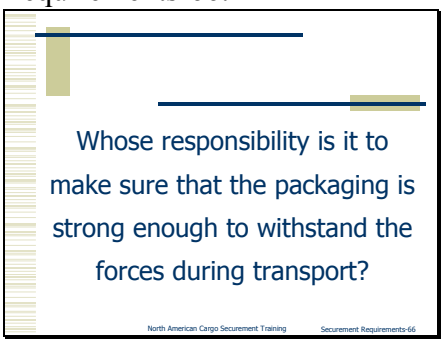
Module 3
Identifying WLL Of An Unmarked Securing Device

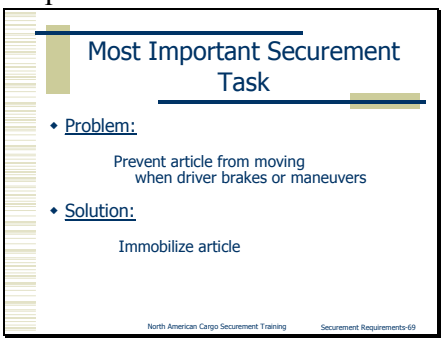
Using the Driver Handbook on Cargo Securement, record the working load limits for the following unmarked securing devices.

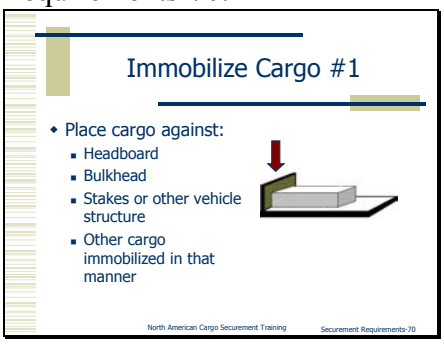
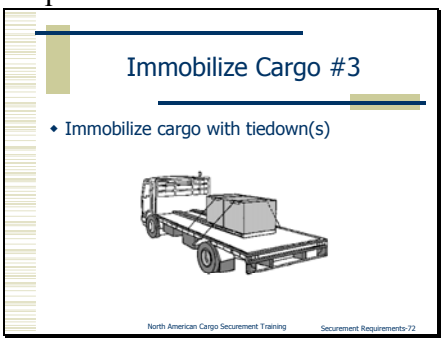
Securement System Component	Working Load Limit (WLL)
1) 8 mm (5/16 in) chain	
2) 50 mm (2 in) webbing	
3) 13 mm (1/2 in) wire rope (6x37, fiber core)	
4) 25 mm (1 in) manila rope	
5) 50.8 x1.27 (2 in x 0.050) steel strapping	

Lesson Plan	Instructor Notes
General Requirements For Containing, Immobilizing, and Securing Cargo, Section #2	*25 minutes*
Explain that you have just looked at components of the securement system and how to determine if they are strong enough. **Say** that now you need to talk for a few minutes about the cargo: packing it, placing it, and restraining it.	This section reviews cargo packing, placement, and restraint. Show Slide Securement Requirements-63.

Packaging, unitization, or stacking **Explain** to the participants that packaging, unitization, or stacking <u>must</u> be strong enough to withstand the forces of loading, securement, and transportation.	Show Slide Securement Requirements-64.

Lesson Plan	Instructor Notes
Ask this question: What happens if the package collapses in transit after the tiedowns are tensioned?	Show Slide Securement Requirements-65.  Desired response: The tiedowns become loose and parts of the load may fall from the vehicle.
Ask this question: Whose responsibility is it to make sure that the packaging is strong enough to withstand the forces during transport?	Show Slide Securement Requirements-66.  Desired response: The shipper and the driver.

Lesson Plan	Instructor Notes
Explain that, since the shipper usually packages the cargo, the shipper needs to make sure that packages are strong enough to withstand the forces during transport (see Module 1, Performance Criteria).	Show Slide Securement Requirements-67.
Explain that, when a driver inspects the load, the driver must inform the carrier if packaging is not adequate. ◆ For example: – Banding is loose or not symmetrical on package – Banding attachment device(s) are inefficient – Wrapping is broken or ineffective – Pallets are broken.	Show Slide Securement Requirements-68.
General cargo placement and restraint **Tell** the participants that the most important securement task is to prevent an article from moving when the driver brakes or maneuvers.	Show Slide Securement Requirements-69. 

Lesson Plan	Instructor Notes
Say that, to prevent movement, you need to immobilize the cargo. You can do this in one of 3 ways: 1. Place it against: ◆ Headboard ◆ Bulkhead ◆ Stakes or other vehicle structure OR ◆ Against other cargo that is immobilized in that manner. 2. Place something between the article and the vehicle structure. ◆ Blocking and bracing ◆ Other cargo ◆ Void-filler ◆ Friction mates 3. Immobilize cargo with tiedown(s)	Show Slide Securement Requirements-70.  Show Slide Securement Requirements-71. Show Slide Securement Requirements-72. 

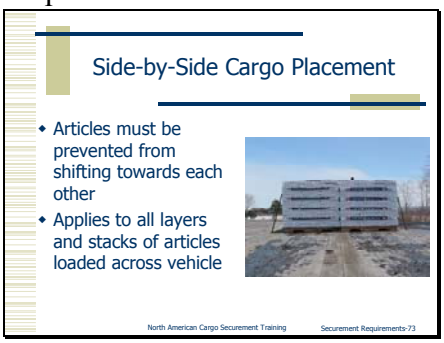
Lesson Plan	Instructor Notes

Cargo placed beside each other

Explain that cargo placement and restraint is especially important for articles of cargo that are placed beside each other.

Tell participants to think about cargo placed beside each other and secured by side-to-side tiedowns that pass over the cargo.

Show Slide Securement Requirements-73.



Requirement

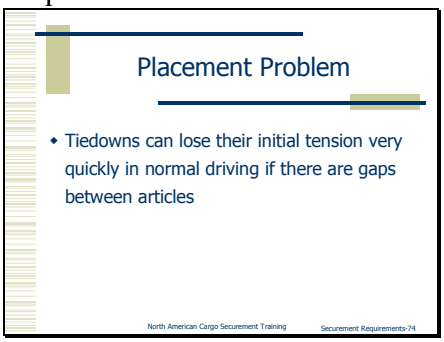
Explain that the cargo must be prevented from shifting towards each other.

Explain that the requirement applies to all layers and stacks of articles that are loaded across a vehicle.

Placement

Explain that tiedowns can lose their initial tension very quickly in normal driving if there are gaps between articles.

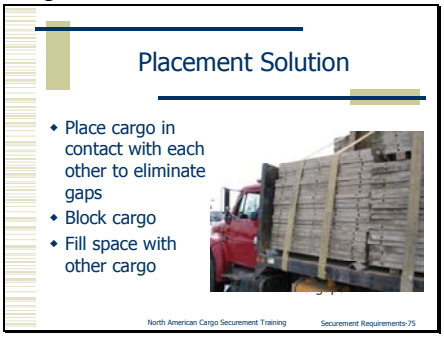
Show Slide Securement Requirements-74.



Explain that there are two options:

1. Either place the articles of cargo in direct contact with each other to eliminate gaps
2. Or block the cargo or fill the space with other cargo.

Show Slide Securement Requirements-75.



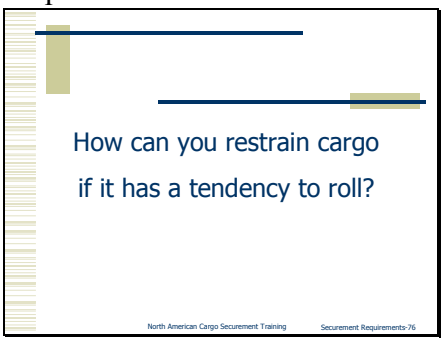
Lesson Plan	Instructor Notes

Cargo that has a tendency to roll

Ask the participants:

> How can you restrain cargo if it has a tendency to roll?

Show Slide Securement Requirements-76.



Suggested responses:

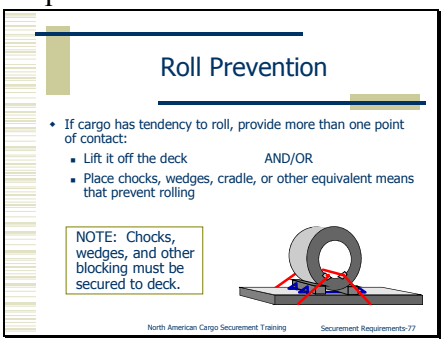
- Contain it
- Immobilize it by using chocks, wedges, or a cradle to lift it off the deck

Explain to participants that, if cargo has a tendency to roll, provide more than one point of contact:

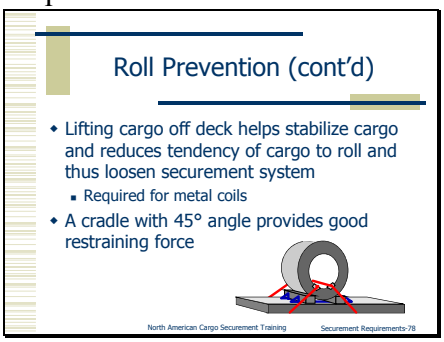
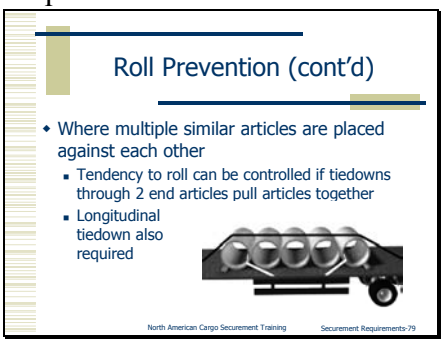
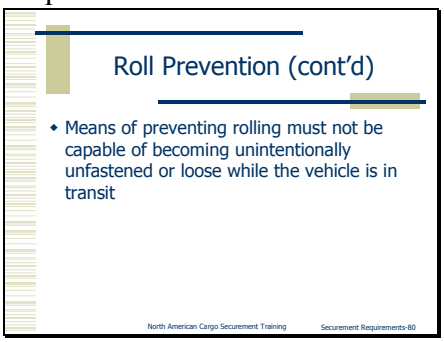
- ♦ Lift it off the deck AND/OR
- ♦ Place chocks, wedges, a cradle, or other equivalent means that prevent rolling.

NOTE: Chocks, wedges, and other blocking must be secured to the deck.

Show Slide Securement Requirements-77.



Nailed lumber can be used for blocking except where prohibited. However, research shows that nailed wood provides minimal resistance in blocking.

Lesson Plan	Instructor Notes
Explain that lifting it off the deck helps stabilize the cargo by providing more than one point of contact between the cargo and the deck of the vehicle. This reduces the tendency of the cargo to roll and thus loosen the securement system. <u>This procedure is required for metal coils</u>. **Say** that a cradle with 45-degree angles, where the coil meets the cradle, provides good restraining force.	Show Slide Securement Requirements-78. 
Explain that, where multiple similar articles are placed against each other, the tendency to roll can be controlled if tiedowns through the two end articles pull the articles together. <u>This is required for concrete pipe.</u> A longitudinal tiedown is also required.	Show Slide Securement Requirements-79. 
Explain that the means of preventing rolling <u>must not</u> be capable of becoming unintentionally unfastened or loose while the vehicle is in transit.	Show Slide Securement Requirements-80. 

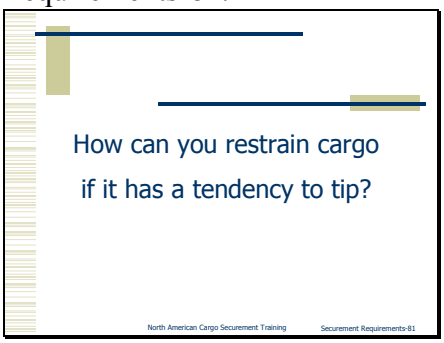
Lesson Plan	Instructor Notes

Cargo that has a tendency to tip

Ask the participants:

> How can you restrain cargo if it has a tendency to tip?

Show Slide Securement Requirements-81.



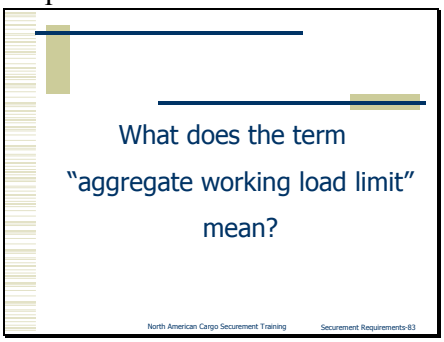
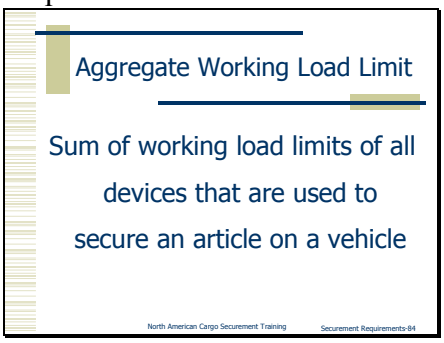
Suggested response:

You brace it.

Explain to participants that some cargo is tall and needs to be secured from falling over. You keep it from tipping by bracing it.

Tell participants that bracing also prevents the cargo from shifting.

Show Slide Securement Requirements-82.

Lesson Plan	Instructor Notes
General Requirements for Containing, Immobilizing, and Securing Cargo, Section #3	*30 minutes*
Tell the participants that you are going to talk about tiedowns that are attached to the cargo and how to determine their aggregate working load limit.	This section deals with tiedowns that are attached to the cargo and how to determine their strength ratings (aggregate working load limit).
Aggregate Working Load Limit	
Ask this question:	Show Slide Securement Requirements-83.
What does the term "aggregate working load limit" mean?	
Explain that the aggregate working load limit is the sum of the working load limit for all of the devices used to secure an article on a vehicle.	Show Slide Securement Requirements-84. 

Lesson Plan	Instructor Notes

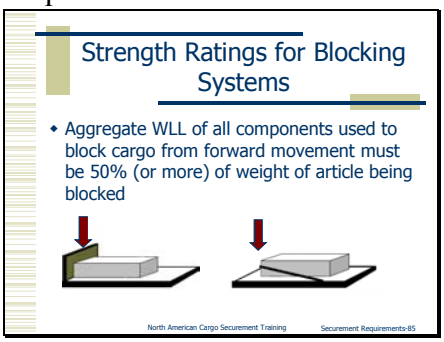
Strength ratings for blocking systems

Requirement

Explain that, in terms of blocking, the Standard says that the sum of the working load limit of the components must be at least 50% of the weight of the article(s) being blocked.

Remind participants that additional securing devices need to be used to secure articles in other directions.

Show Slide Securement Requirements-85.

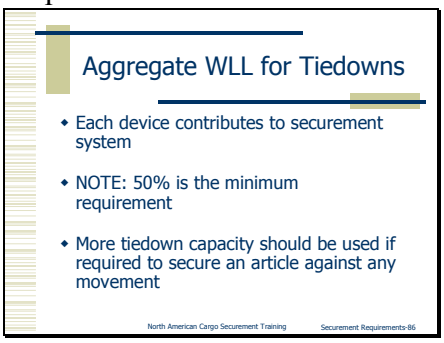


Note: Tiedown on right would have to be secured so that it did not fall down.

Working Load Limit for tiedowns

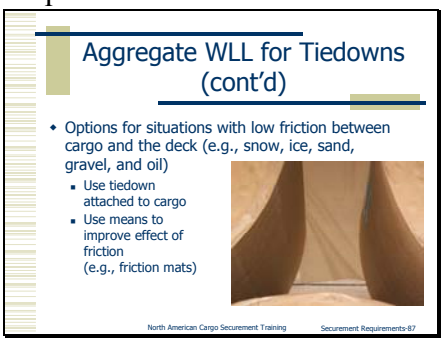
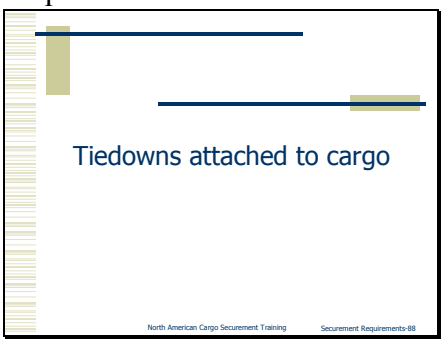
Explain that, if multiple means of securement are used, each device contributes to the system. However, if ONLY tiedowns are used for securement, then the tiedown(s) must have a working load limit of 50% of the weight of the article.

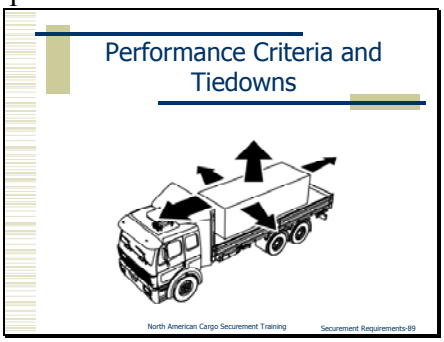
Show Slide Securement Requirements-86.

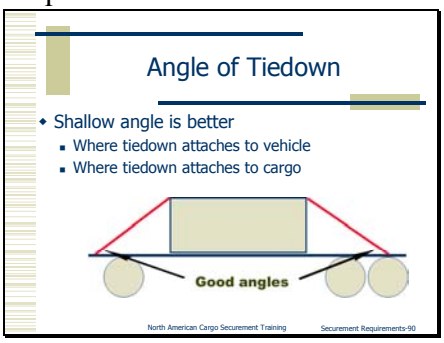
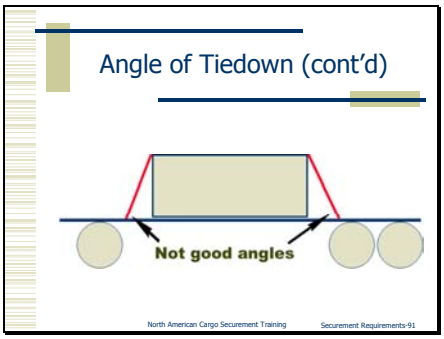


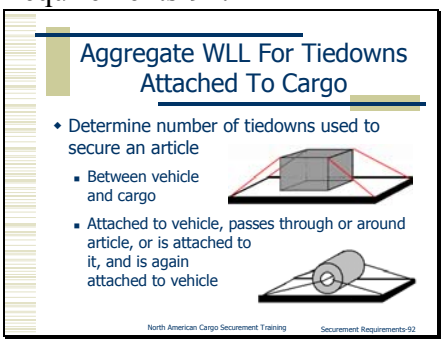
Remind participants that these are the minimum requirements.

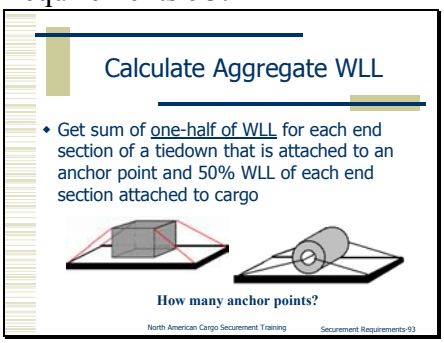
Explain to the participants that more tiedown capacity should be used if required to secure an article against any movement.

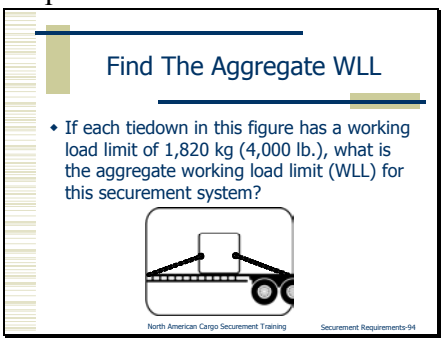
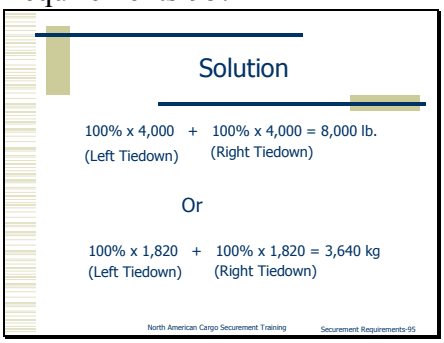
Lesson Plan	Instructor Notes
Option for low-friction situations **Tell** the participants that the options for situations with low friction between cargo and the deck (e.g., snow, ice, sand, gravel, and oil) are to: 1. Use tiedowns attached to the cargo 2. Use means to improve friction (e.g., friction mats, tiedowns that pass over cargo) 3. Use blocking and tiedowns	Show Slide Securement Requirements-87. 
Tiedowns attached to the cargo **Explain** that you want to talk about tiedowns attached to the cargo.	These questions review the Performance Criteria and identify where tiedowns need to be attached. Show Slide Securement Requirements-88. 

Lesson Plan	Instructor Notes
<u>Where to attach the tiedown</u>	Show Slide Securement Requirements-89 and ask these 5 questions. 
Ask this question:	
Where should you attach the tiedown to counteract forward force?	Response: Attach the tiedown so it pulls the cargo toward the rear of the vehicle.
Ask this question:	
Where should you attach the tiedown to counteract forward force?	Response: Attach the tiedown so it pulls the cargo toward the front of the vehicle.
Ask this question:	
Where should you attach the tiedown to counteract upward force?	Response: Attach tiedowns to opposing sides of the cargo below the cargo.

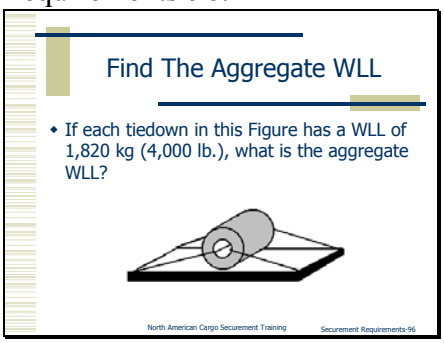
Lesson Plan	Instructor Notes
Ask this question: Where should you attach the tiedown to counteract movement to the left side?	Response: Attach tiedown so it pulls cargo toward the right side of vehicle.
Ask this question: Where should you attach the tiedown to counteract movement to the right side?	Response: Attach the tiedown so it pulls the cargo toward the left side of the vehicle.
<u>Angle of tiedown</u> **Explain** that the angle where the tiedown attaches to the cargo and to the vehicle is important. The more shallow angles are more effective. *Recommendation:* Angles less than 45 degrees are the most effective and are required for certain heavy commodities such as machinery and steel coils.	Show Slides Securement Requirements-90 and 91.  

Lesson Plan	Instructor Notes
Calculate Aggregate Working Load Limit for tiedowns attached to the cargo	Show Slide Securement Requirements-92.
Explain to the participants that you are going to teach them how to calculate aggregate WLL of all tiedowns attached to cargo.	
Explain that the aggregate working load limit of tiedowns is the sum of the working load limits (WLL) of each tiedown used to secure an article. This includes: ◆ Tiedowns attached to the vehicle and attached to the cargo ◆ Tiedowns that are attached to the vehicle, pass through or around an article, or are attached to it, and are again attached to the vehicle.	
Ask this question about the top graphic on the slide: From what you can see, how many tiedowns need to be included in the aggregate Working Load Limit?	Response: 4
Ask this question about the bottom graphic on the slide: From what you can see, how many tiedowns need to be included in the aggregate Working Load Limit?	Response: 2

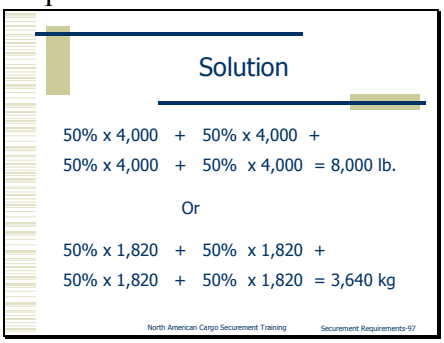
Lesson Plan	Instructor Notes
Tell the participants that, to establish the WLL of a tiedown, count 50% of the WLL for each end section of a tiedown that is attached to an anchor point and 50% of the WLL of each end section attached to the cargo.	Show Slide Securement Requirements-93. 
Ask this question about the left graphic on the slide: How many tiedowns are there and how many end sections are attached to anchor points?	Response: 4 tiedowns and 4 anchor points.
Say that therefore the calculation will be 100% of the WLL for each of the 4 tiedowns.	
Ask this question about the right graphic on the slide: How many tiedowns are there with how many end sections attached to anchor points?	Response: 2 tiedowns and 4 anchor points.
Say that therefore the calculation will be 100% of the WLL for the 2 tiedowns.	

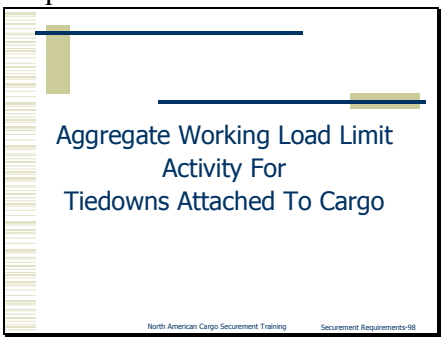
Lesson Plan	Instructor Notes
Ask the participants: There are two tiedowns in this figure. If each tiedown in this figure has a working load limit of 1,820 kg (4,000 lb.), what is the aggregate working load limit (WLL) for this securement system? **Explain** that the correct answer is 3,640 kg (8,000 lb.).	Practice making an Aggregate WLL calculation with the class. Show Slide Securement Requirements-94.  As a class, work out this problem on an easel pad. Answer: 3,640 kg (8,000 lb.) Show Slide Securement Requirements-95. 

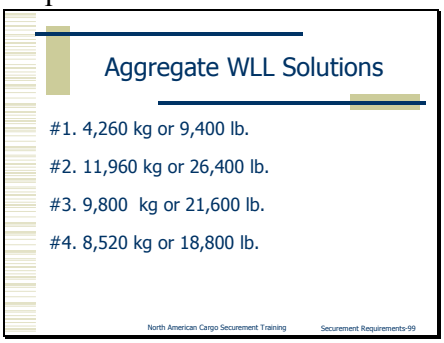
Lesson Plan	Instructor Notes
Ask the participants: If each tiedown in this Figure has a WLL of 1,820 kg (4,000 lb.), what is the aggregate WLL?	Show Slide Securement Requirements-96.



	As a class work, out this problem on an easel pad. Answer: 3,640 kg (8,000 lb.)
Explain that the correct answer is 3,640 kg (8,000 lb.).	Show Slide Securement Requirements-97.



Lesson Plan	Instructor Notes
## Activity: Calculate Aggregate Working Load Limits for Tiedowns That Attach to the Cargo	*20 minutes*
Tell the participants that they are now to try a few problems on their own.	Read instructions and questions: 5 minutes Individuals work out answers: 10 minutes Report out: 5 minutes Show Slide Securement Requirements-98.  The purpose of this activity is to have the participants find the aggregate WLL for tiedowns that are attached to cargo. Turn to the page following the instructions to see the worksheet for the Aggregate WLL Activity For Tiedowns Attached to Cargo. Have the participants turn to the Aggregate WLL Activity For Tiedowns Attached to Cargo Activity worksheet. Read the instructions and questions to the participants. Give them 10 minutes to complete the activity.

Lesson Plan	Instructor Notes
	Discuss the answers when the participants are finished. The correct answers are: - #1. 4,260 kg or 9,400 lb. - #2. 11,960 kg or 26,400 lb. - #3. 9,800 kg or 21,600 lb. - #4. 8,520 kg or 18,800 lb. Show Slide Securement Requirements-99. 

Module 3
Aggregate Working Load Limit Activity
For Tiedowns Attached To Cargo

Determine the Aggregate Working Load Limits (WLL) for the following situations.

#1. A 4,545 kg (10,000 lb.) steel coil has two G7 8 mm (5/16 in) chains through the eye for securement that are affixed to the trailer at four locations.

Aggregate WLL = _____

#2. An 18,180 kg (40,000 lb.) air-handling unit, which has lifting eyes at each corner, is secured to a trailer by four G7 10 mm (3/8 in) chains. Each chain is affixed to the trailer and to the air-handling unit at each corner. Aggregate WLL = _____

Module 3
Aggregate Working Load Limit Activity
For Tiedowns Attached To Cargo

#3. A bulldozer weighing 10,910 kg (24,000 lb.) is secured with four G43 10 mm (3/8 in) chains, one at each corner hooked to the tracks. Aggregate WLL = _____

#4. A 6.1 m (20 ft) intermodal container is transported on a flatbed trailer. The loaded weight is 15,910 kg (35,000 lb.). It is secured with a G7 8 mm (5/16 in) chain at each corner. The chains are attached to the trailer, go through the corner lock, and then go back to the trailer stake pocket. Aggregate WLL = _____

Lesson Plan	Instructor Notes
General Requirements for Containing, Immobilizing, and Securing Cargo, Section #4	*25 minutes*

Tiedowns that pass over the cargo

Tell the participants you are now going to talk about tiedowns that pass over the cargo.

Purpose of tiedowns that pass over cargo

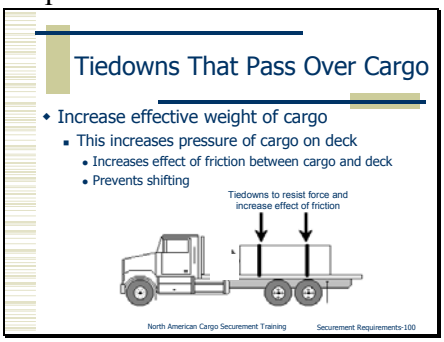
Explain to participants that tiedowns that pass over the cargo increase the effective weight of the cargo (make the cargo seem heavier). This increases the pressure of the article on the deck (i.e., to increase the effect of friction between the article and the deck). This keeps the cargo from shifting.

Explain that, if the cargo shifts, then the securement system has failed.

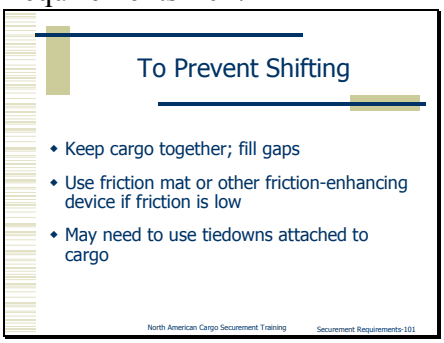
To prevent shifting

- Keep cargo together or fill gaps.
- Use a friction mat or other friction-enhancing device if friction is low (e.g., plastic skid, plastic-coated article, oil coated or slippery deck).
- If necessary, use tiedowns attached to the cargo to keep cargo from shifting.

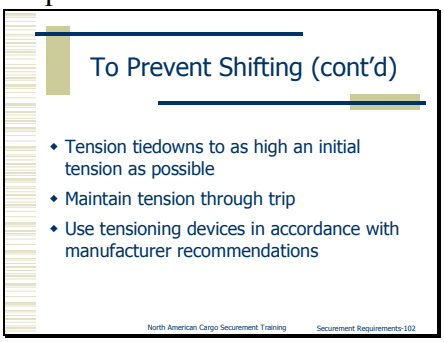
Show Slide Securement Requirements-100.



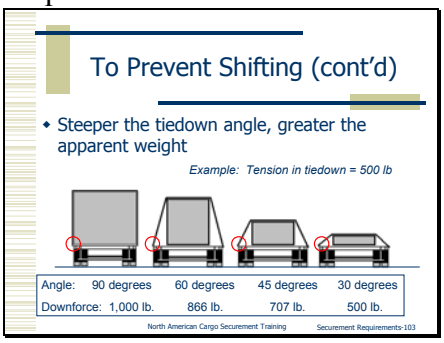
Show Slide Securement Requirements-101.



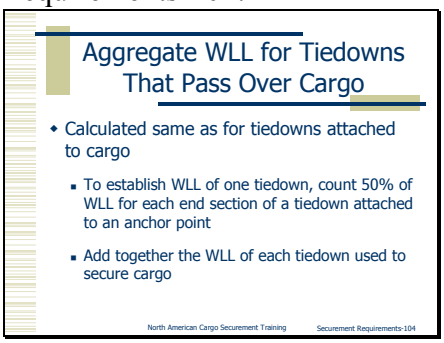
Lesson Plan	Instructor Notes
◆ Tension tiedowns to as high an initial tension as possible. Maintain the tension throughout the trip. Tensioning devices should be used in accordance with manufacturer recommendations.	Show Slide Securement Requirements-102.



◆ Maintain steep tiedown angles. *Recommendation:* Ideally the angles should be more than 30 degrees.	Show Slide Securement Requirements-103.



Aggregate WLL for tiedowns that go over the cargo **Explain** to participants that you calculate the aggregate WLL for tiedowns that go over the cargo the same as you do for tiedowns attached to the cargo: ◆ Establish WLL of a tiedown by counting 50% of the WLL for each end section of a tiedown that is attached to an anchor point ◆ Add together the working load limits of each tiedown used to secure an article.	Show Slide Securement Requirements-104.



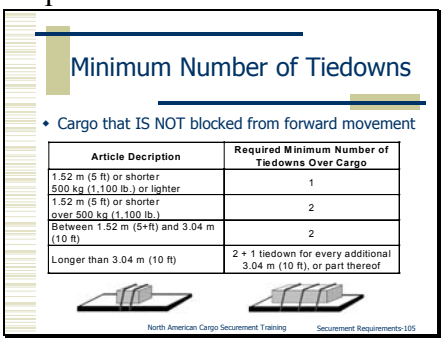
Lesson Plan	Instructor Notes

Minimum number of tiedowns required

Explain the minimum number of tiedowns needed for cargo that is not blocked from forward movement (i.e., by a headboard, bulkhead, other cargo, tiedown attached to cargo):

1. One tiedown for articles up to 1.52 m (5 ft) in length and up to 500 kg (1,100 lb.) in weight
2. Two tiedowns if the article is:
   - Up to 1.52 m (5 ft) in length and more than 500 kg (1,100 lb.) in weight
   - Longer than 1.52 m (5 ft) but less than or equal to 3.04 m (10 ft) in length irrespective of the weight
   - Longer than 3.04 m (10 ft), and one additional tiedown for every 3.04 m (10 ft) of article length, or part thereof, beyond the first 3.04 m (10 ft) of length

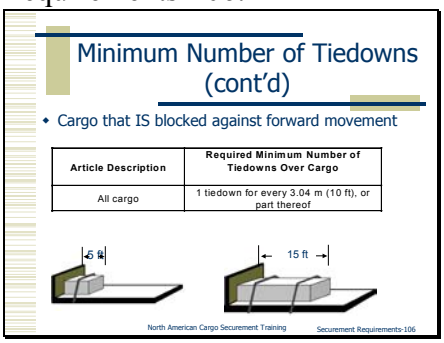
Show Slide Securement Requirements-105.



Explain the minimum number of tiedowns needed for cargo that is blocked from forward movement:

1. Must be secured by at least one tiedown for every 3.04 m (10 ft) of article length, or fraction thereof

Show Slide Securement Requirements-106.



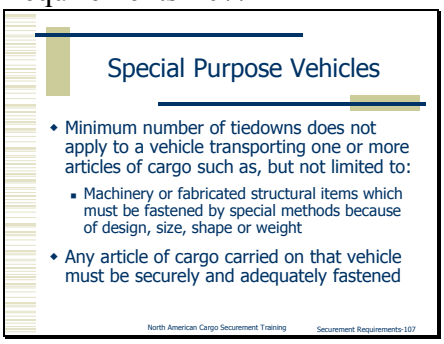
Lesson Plan	Instructor Notes

Special purpose vehicles

Explain that there are special tiedown rules for special purpose vehicles.

Explain that the minimum number of tiedowns does not apply to a vehicle transporting one or more articles of cargo such as, but not limited to, machinery or fabricated structural items (e.g., steel or concrete beams, crane booms, girders, and trusses, etc.). These articles, because of their design size, shape or weight, must be fastened by special methods. However, any article of cargo carried on that vehicle must be securely and adequately fastened to the vehicle.

Show Slide Securement Requirements-107.



Practice Examples: Number of tiedowns needed for blocked and unblocked cargo

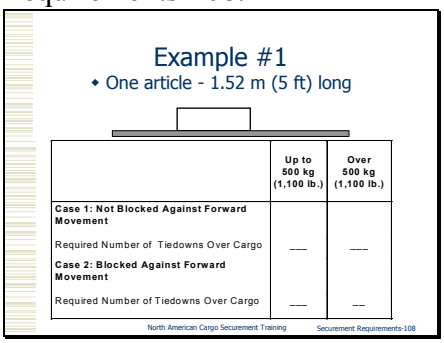
Tell participants that you are going to now present a few practice activities on determining the minimum number of tiedowns for blocked and unblocked cargo.

Tell them they are to use the requirements from the Standard to help them determine the minimum number of tiedowns that are required for the safe securement of the following loads. (Section 2.2.3.1)

Remind participants that, regardless of the number of tiedowns used, they still need to meet the performance criteria.

Ask the participants to determine the number of tiedowns that are required to safely secure one article that is 1.52 m (5 ft) long.

Show Slide Securement Requirements-108.

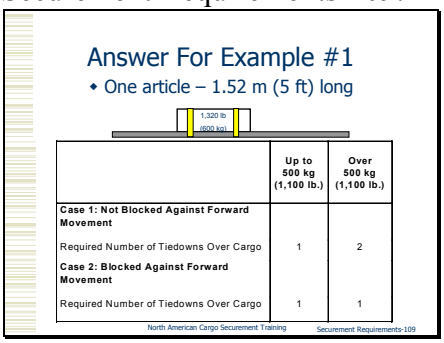


Collectively as a group work out this example. Use the easel pad if needed.

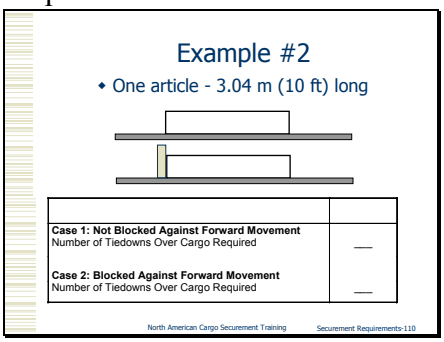
Lesson Plan	Instructor Notes

Ask the participants to determine the number of tiedowns that are required to safely secure one article that is 3.04 m (10 ft) long.

Once the group has determined the number, show Slide Securement Requirements-109.

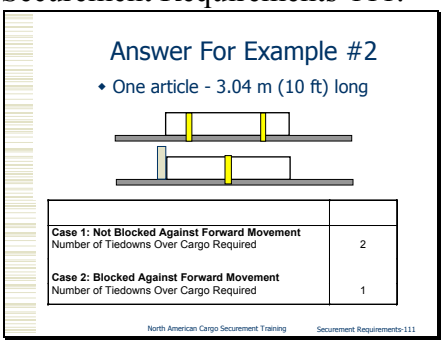


Show Slide Securement Requirements-110.

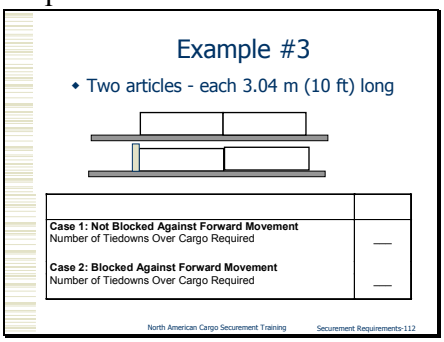


Collectively as a group work out this example. Use the easel pad if needed.

Once the group has determined the number, show Slide Securement Requirements-111.

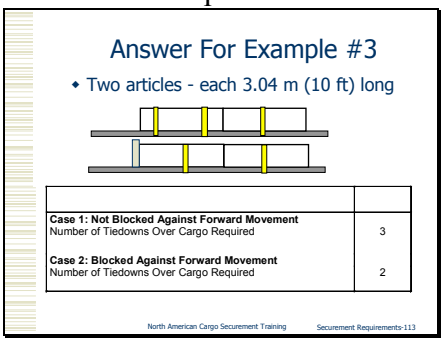


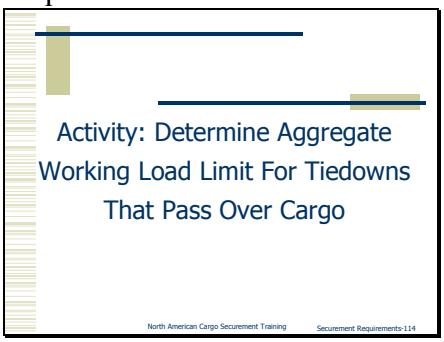
Lesson Plan	Instructor Notes
Ask the participants to determine the number of tiedowns that are required to safely secure two articles that are each 3.04 m (10 ft) long.	Show Slide Securement Requirements-112.



Collectively as a group work out this example. Use the easel pad if needed.

Once the group has determined the number, show Slide Securement Requirements-113.



Lesson Plan	Instructor Notes
Activity: Determine Aggregate WLL for Tiedowns That Pass Over Cargo	*15 minutes*
Tell the participants that they are now to try a few problems on their own.	Read instructions and questions: 5 minutes Individuals work out answers: 5 minutes Report out: 5 minutes Show Slide Securement Requirements-114.  The purpose of this activity is to have the participants find the aggregate WLL for tiedowns that pass over cargo. Turn to the page following the instructions to see worksheet for the Aggregate WLL Activity For Tiedowns That Pass Over Cargo. Have the participants turn to the Aggregate WLL Activity For Tiedowns That Pass Over Cargo Activity worksheet. Read the instructions and questions to the participants. Give them 5 minutes to complete the activity. Discuss the answers when the participants are finished.

Lesson Plan	Instructor Notes
	Show Slide Securement Requirements-115.

Module 3
Aggregate Working Load Limit Activity For Tiedowns Pass Over Cargo

Determine the Aggregate Working Load Limits (WLL) for the following situations.

#1. Four 50 mm (2 in) webbings pass from the left to the right side of a trailer over a load of 2x4's. The webbing is unmarked. Aggregate WLL = _____

#2. A wooden box, 1.5 m x 1.5 m (5 ft x 5 ft), has one G43 10 mm (3/8 in) chain passing over it. Aggregate WLL = _____

Lesson Plan	Instructor Notes

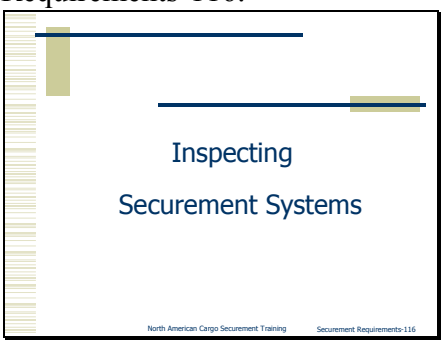
Inspecting Securement Systems

10 minutes

Tell participants that the final topic to cover is how to inspect securement systems.

Explain the requirements for inspecting securement systems.

Show Slide Securement Requirements-116.



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Securement requirements

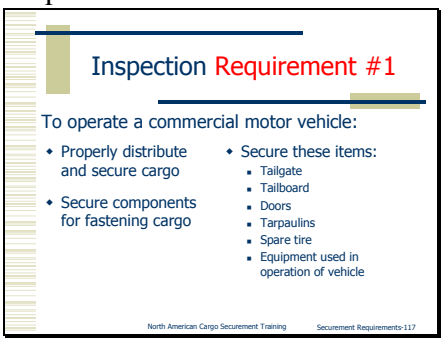
Say that the first thing to talk about is what requirements must be met.

Requirement #1

Explain to the participants that, to operate a commercial motor vehicle, they must:

1. Properly distribute and adequately secure the cargo
2. Secure the components for fastening the commercial motor vehicle's cargo
3. Secure the following items:
   - Tailgate
   - Tailboard
   - Doors
   - Tarpaulins

Show Slide Securement Requirements-117.



Lesson Plan	Instructor Notes

– Spare tire

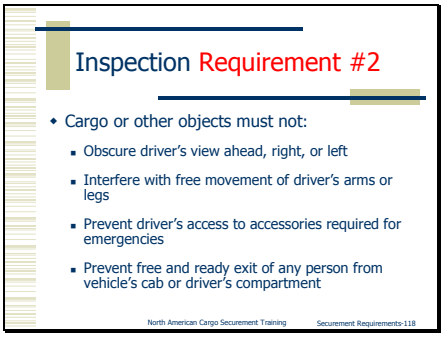
– Equipment used in operation of the vehicle.

Requirement #2

Explain that cargo or any other object must not:

1. Obscure the driver's view ahead or to the right or left sides (except for drivers of self-steer dollies)
2. Interfere with the free movement of the driver's arms or legs
3. Prevent the driver's free and ready access to accessories required for emergencies
4. Prevent the free and ready exit of any person from the commercial motor vehicle's cab or driver's compartment

Show Slide Securement Requirements-118.

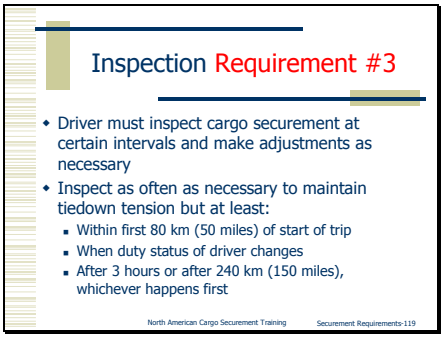


Requirement #3

Explain to the participants that drivers must inspect cargo securement at certain intervals and make adjustments as necessary. Inspect as often as necessary to maintain tiedown tension but at least:

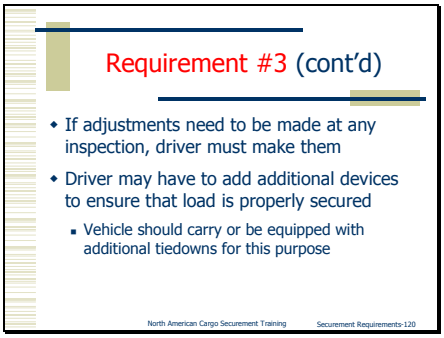
1. Within first 80 km (50 miles)
2. When the duty status of the driver changes
3. After 3 hours or after 240 km (150 miles), whichever happens first

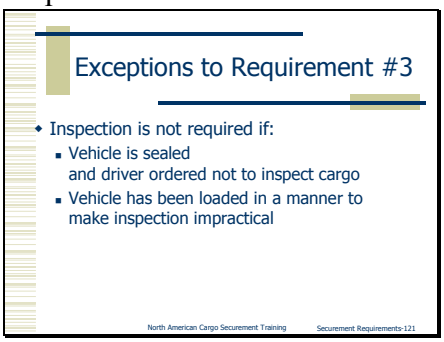
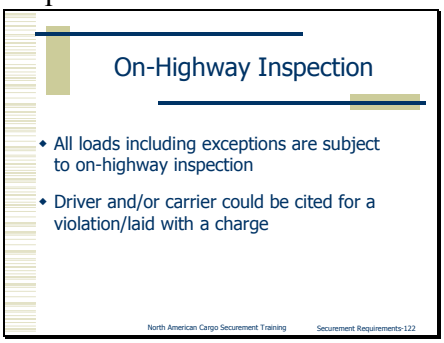
Show Slide Securement Requirements-119.



Explain that, if adjustments need to be made at any inspection, the driver must make them. This may mean adding additional devices to ensure that the load is properly secured. Therefore, the vehicle should carry or be equipped with additional tiedowns for this purpose.

Show Slide Securement Requirements-120.



Lesson Plan	Instructor Notes
Explain to the participants that there are some exceptions for inspecting securement systems, such as: 1. Vehicle is sealed and driver ordered not to inspect cargo 2. Vehicle has been loaded in a manner to make inspection impractical	Show Slide Securement Requirements-121. 
Explain that all loads including exceptions are subject to on-highway inspection. **Tell** the participants that the driver and/or carrier could be cited for a violation/laid with a charge.	Show Slide Securement Requirements-122. 

Lesson Plan	Instructor Notes

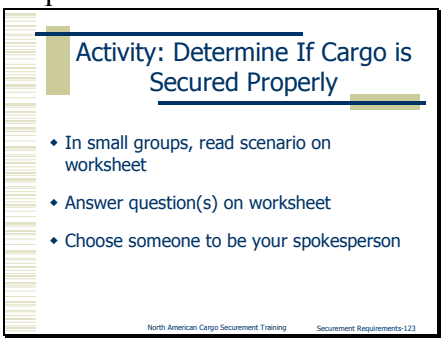
Group Activity: Determining If Cargo Is Secured Properly

30 minutes

Explain that you will now break the class into four small groups for an activity. Each small group will be given a scenario. The small group is to study the scenario and answer the questions.

Break into small groups and review instructions: 5 minutes
Small groups complete activity: 15 minutes
Report out: 10 minutes

Show Slide Securement Requirements-123.



The purpose of this activity is to have the participants evaluate the cargo securement system described in the scenario. Participants will identify how the system meets the Standard and how to correct anything that doesn't meet the Standard.

Turn to the page following the instructions to see the worksheet for the Determine If Cargo Is Secured Properly worksheet.

Have the participants turn to the Determine If Cargo Is Secured Properly worksheet. Review the instructions and the questions.

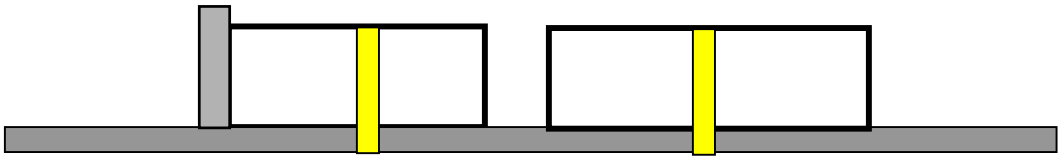
Lesson Plan	Instructor Notes
	Give the groups 15 minutes to complete the activity. Discuss the answers when the participants are finished. Each small group should report. After each group's spokesperson has completed the group's report, ask the following question of the members in that small group: Question: <u>When should the driver inspect the load?</u> There are really 4 answers to the question so make each small group give a different answer: – Within first 80 km (50 miles) – When the duty status of the driver changes – After three hours or after 240 km (150 miles), whichever happens first – As often as necessary to maintain tiedown tension. **Answers** **Scenario 1:** Question 1: The front article is properly secured. Question 2: The rear article needs another tiedown or a void filler to fill the 1 ft void from the front article.

Lesson Plan	Instructor Notes
	Scenario 2: The van doors must be closed to prevent the mattresses from falling from the vehicle. **Scenario 3:** Question 1: Load the stacks two abreast against the nose of the trailer. This will use 24 feet of trailer space. Question 2: At the rear of the stacks, use a means of bracing to prevent tipping toward the rear. **Scenario 4:** <u>Option 1:</u> Question 1: Transport in an enclosed trailer. Split the load with 10 pallets side-by-side loaded in front to the nose and 10 pallets side-by-side to the rear. Question 2: Use bracing, blocking or friction mats to prevent front to rear shifting or rear to front shifting, assuming the bricks are unitized to the pallet. <u>Option 2:</u> Question 1: Use a flatbed trailer. Load the pallets side-by-side forming a double row of 10 pallets. The bricks are shrink wrapped and banded to each pallet.

Lesson Plan	Instructor Notes
	Question 2: Use 2 tiedowns over the front 2 pallets having a minimum WLL of 816.46 m (1800 lb.) and a single tiedown over each other row having a WLL of 816 kg (1800 lb.). <u>Option 3:</u> Question 1: Same vehicle and loading as 2 above except the pallets are sitting on friction mats having an .8g rating. Question 2: Secure each row with a tiedown having a WLL of 326 kg (720 lb.) **Scenario 5:** Question 1: No. Question 2: ♦ There is too much room at the side of the cargo. ♦ The cargo may shift to the side. ♦ The cargo must be secured at the rear. Question 3: ♦ Secure the cargo against sideways movement using blocking, friction mats, void filler, or some other manner. ♦ Secure the cargo against rearward movement using blocking, friction mats, or some other manner.

Module 3 – Scenario 1
Determine If Cargo Is Secured Properly Activity

Instructions: Read the scenario and answer the questions.



Scenario:

A truck equipped with a headboard is transporting 2 concrete sewer boxes. Each box weighs 1,360 kg (3,000 lb.) and is 1.5 m (5 ft) square.

The front box is against the headboard and secured with one tiedown that passes over the box.

The rear box is 1.85 m (6 ft) from the headboard and secured with one tiedown that passes over the box. Both tiedowns have a working load limit of 3,000 kg (6,600 lb.).

Question #1: Is any part of the cargo secured properly (in accordance with the Standard)? If so, what part? Describe how the securement complies with the Standard.

Question #2: Is any part of the cargo not secured properly (in accordance with the Standard)? If so, what part? Describe how the securement system needs to be changed to comply with the Standard.

Module 3 – Scenario 2
Determine If Cargo Is Secured Properly Activity

Instructions: Read the scenario and answer the question.

Scenario:

Twenty-five mattresses are to be transported in a van type truck.

Question: How should this cargo be secured to be in accordance with the Standard?

Module 3 – Scenario 3
Determine If Cargo Is Secured Properly Activity

Instructions: Read the scenario and answer the questions.

Scenario:

A load of auto parts in racks needs to be transported.

The racks are stacked four high. Each stack is 1.22 x 1.22 x 2.7 m (4 x 4 x 9 ft) high.

Twelve stacks will be transported. Each stack weights 907 kg (2000 lb.) A 16.15 m (53 ft) van semi trailer will be used.

Question #1: How should the cargo be loaded (in accordance with the Standard)?

Question #2: How should the cargo be secured properly (in accordance with the Standard)?

Module 3 – Scenario 4
Determine If Cargo Is Secured Properly Activity

Instructions: Read the scenario and answer the questions.

Scenario:

A semitrailer will transport 20 pallets of brick. Each loaded pallet weights 816 kg (1800 lb.). Each loaded pallet is 1.22 x 1.22 x .91 m (4 x 4 x 3 ft) high.

Question #1: How should the cargo be loaded (in accordance with the Standard)?

Question #2: How should the cargo be secured properly (in accordance with the Standard)?

Module 3 – Scenario 5
Determine If Cargo Is Secured Properly Activity

Instructions: Read the scenario and answer the questions.

Scenario:

A 16.15 m (53 ft) van is transporting 22 pallets of unitized copy paper. The pallets weigh 952 kg (2100 lb.) each. They are 1.22 x .91 x 1.27 (48 x 36 x 50 in) tall. The cargo is loaded side by side down the center of the trailer, starting against the nose of the trailer. Due to axle-loading issues, the pallets are loaded with the 1.22 m (48 in) dimension parallel to the trailer length.

Question #1: Is this cargo properly secured in accordance with the Standard?

Question #2: If parts of the load are not properly secured, what are the problems?

Module 3 – Scenario 5
Determine If Cargo Is Secured Properly Activity

Question #3: If you have decided that there are problems with this load, how would you correct them?

Lesson Plan	Instructor Notes

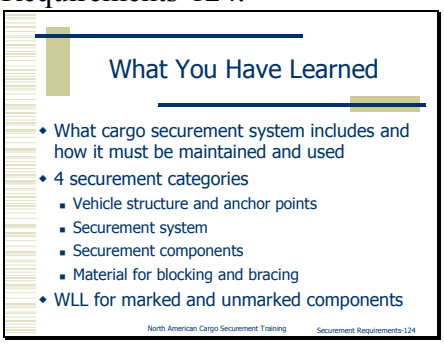
Summary and Wrap Up

Summarize Cargo Securement Requirements: Equipment and Methods, recapping what the participants have just learned. Summarize the overall training.

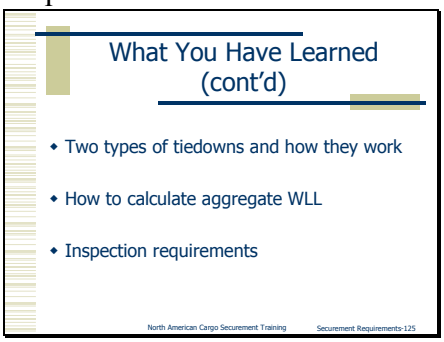
Tell the participants that they now know:

1. What the cargo securement system includes and how it must be maintained and used
2. The 4 securement categories
   - Vehicle structure and anchor points
   - Securement system
   - Securement components
   - Materials for blocking and bracing
3. How to identify the Working Load Limit for marked and unmarked components
4. How to load and place cargo
5. The two types of tiedowns
6. How to calculate aggregate working load limits
7. Inspection requirements

Show Slide Securement Requirements-124.



Show Slide Securement Requirements-125.



Tell the participants that they have just completed the basic part of the training course on the North American Cargo Securement Standard.

Tell them that they should now be able to identify securement systems that are not in compliance with the Standard and correct the securement system so that it will pass any on-highway inspection.

Lesson Plan	Instructor Notes
Remind participants that the Driver's Handbook on Cargo Securement will be a valuable tool for them should they ever have a question about securing a load. **Thank** participants for their commitment to ensuring that cargo being transported on the highway system of North American will remain on or within the transporting vehicle.	

Module Overview

Module 3: Logs

Learning Objectives

At the completion of the training, participants will be able to:

- Describe how the cargo securement principles apply to logs
- Determine what is required to properly load and secure logs for different types of vehicles, including the number, placement, and types of cargo securing devices
- Identify securement systems that are not in compliance and determine what is required to correctly secure the load

Time Required

2 hours

Topics

1. Overview and Learning Objectives (5 minutes)
2. Principles for Securing Logs (5 minutes)
3. Application (5 minutes)
4. Securement Requirements for Logs (45 minutes)
5. Securement Requirements for Shortwood Logs Loaded Crosswise on Frame, Rail, and Flatbed Vehicles (15 minutes)
6. Securement Requirements for Logs Loaded Lengthwise on Flatbed and Frame Vehicles (Both Shortwood and Longwood) (15 minutes)
7. Securement Requirements for Logs Transported on Pole Trailers (10 minutes)
8. Group Activity: Securing Logs on a Frame, Rail, or Flatbed Vehicle (20 minutes)
9. Summary

Training Methods

1. Participative lecture
2. Activity

Participant Materials

1. Participant Manual
2. Driver's Handbook on Cargo Securement

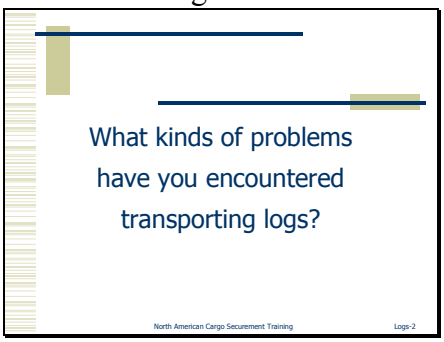
Training Materials

1. Instructor Guide
2. PowerPoint slides and projection system
3. Easel pad and markers
4. Participant materials

Instructor Notes

Check with your local regulatory agency to make sure you know what your local regulations and requirements are and that you teach to the local needs.

Logs

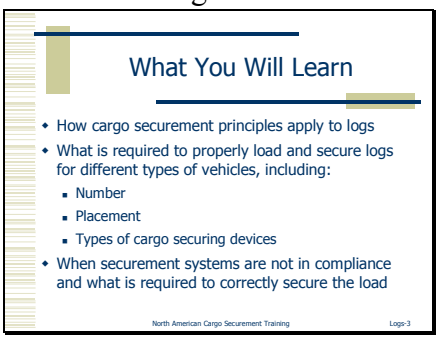
Lesson Plan	Instructor Notes
## Overview and Learning Objectives	*5 minutes*
Tell the participants that they are now going to learn about specific cargo securement for logs.	Explain to the participants what they will learn in the training for log securement. Show Slide Logs-1.
Ask the participants: What kinds of problems have you encountered transporting logs?	Show Slide Logs-2.  Record the problems on easel pad. Make sure problems are addressed during the module.

Lesson Plan	Instructor Notes

Tell the participants that, after this training, they will be able to:

- Say what a log is
- Describe how the cargo securement principles apply to logs
- Determine what is required to properly load and secure logs for different types of vehicles, including the:
  - Number
  - Placement
  - Types of cargo securing devices.
- Identify securement systems that are not in compliance and determine what is required to correctly secure the load

Show Slide Logs-3.

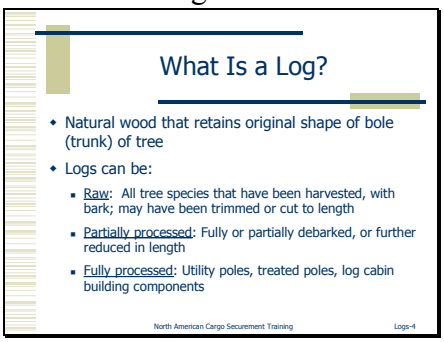


What is a log?

Explain that the Standard defines what falls under the description of a log.

- All natural wood that retains the original shape of the bole of the tree, whether raw, partially processed, or fully processed
  Note: The bole is the trunk of the tree.
- Raw: All tree species that have been harvested, with bark; may have been trimmed or cut to length
- Partially processed: Fully or partially debarked, or further reduced in length
- Fully processed: Utility poles, treated poles, log cabin building components.

Show Slide Logs-4.



Lesson Plan	Instructor Notes

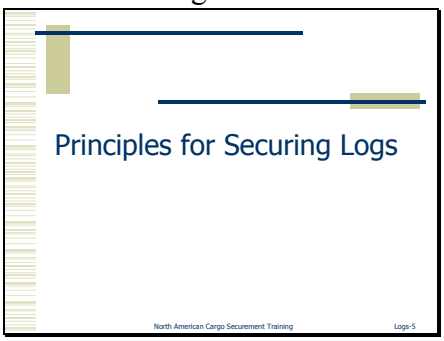
Principles for Securing Logs

5 minutes

Tell the participants that you are now going to talk about the principles for securing logs.

Explain the principles for securing logs.

Show Slide Logs-5.

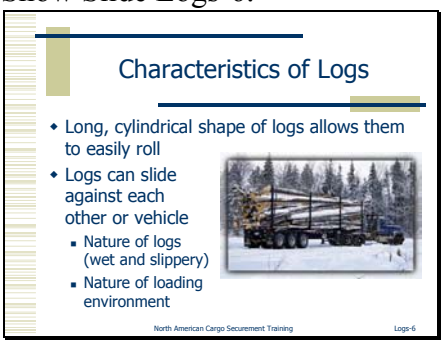


Characteristics and cargo securement failure modes

Tell participants that the following principles must be considered when applying specific securement requirements for logs:

- Logs are long, cylindrical objects that easily roll if they are not secured correctly
- Logs can slide against each other or against the vehicle due to the wet and slippery characteristics of logs and of the environment that is common when loading logs

Show Slide Logs-6.



Return to the list generated from the opening question listing the types of problems the participants have had in securing logs.

Tell participants that they will now learn how to avoid these problems by planning a securement system.

Lesson Plan	Instructor Notes

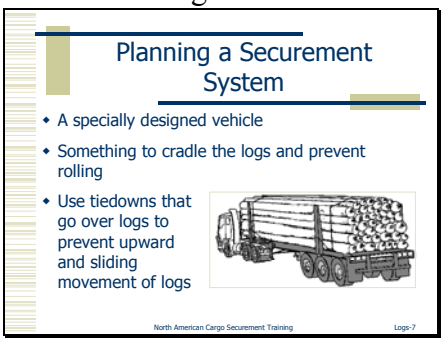
Planning a securement system for logs

Explain to the participants that, since logs have unique characteristics, specially designed vehicles are often used to transport logs.

Tell the participants that they need to ensure that transport vehicles are equipped with some means to cradle the logs and prevent them from rolling.

Tell the participants that they need to use tiedowns in combination with these to prevent upward and sliding movement of logs.

Show Slide Logs-7.



Lesson Plan	Instructor Notes

Application

Tell participants that you are now going to discuss the guidelines for securing and loading logs and the difference between longwood and shortwood.

Guidelines

Explain to the participants that these guidelines apply to raw and processed logs loaded on a log truck or flatbed.

Tell the participants that, in some instances, logs can be secured in accordance with general cargo securement requirements:

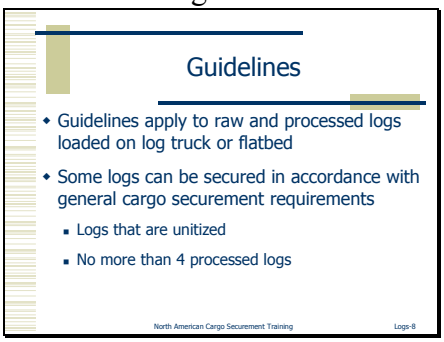
- Logs that are unitized
- No more than 4 processed logs.

Tell the participants that some short logs (e.g., firewood, stumps, log debris, etc.) must be transported in a sided vehicle. Longer logs also may be transported within a sided vehicle.

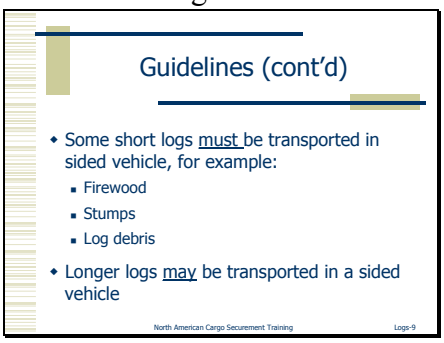
5 minutes

Explain the guidelines for securing and loading logs and distinguish the difference between longwood and shortwood.

Show Slide Logs-8.



Show Slide Logs-9.



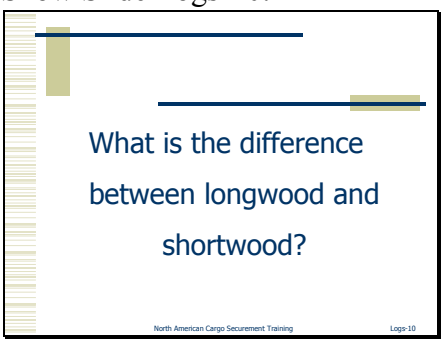
Lesson Plan	Instructor Notes

Difference between longwood and shortwood

Ask the participants:

> What is the difference between longwood and shortwood?

Show Slide Logs-10.



Suggested responses:

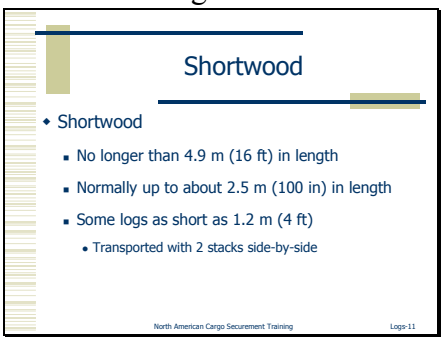
- Shortwood is no longer than 4.9 m (16 ft)
- Shortwood embedded in longwood can be treated as longwood
- Shortwood must follow shortwood securement requirements

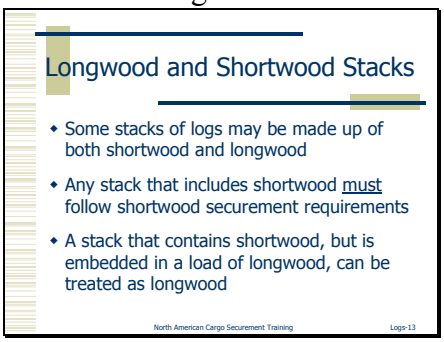
Explain to the participants that the Standard considers shortwood to be no longer than 4.9 m (16 ft) in length. These logs may also be called:

- Cut-up logs
- Cut-to-length logs
- Bolts
- Pulpwood.

Explain that such logs are normally up to about 2.5 m (100 in) in length. However, some logs as short as 1.2 m (4 ft) are transported with 2 stacks side-by-side.

Show Slide Logs-11.



Lesson Plan	Instructor Notes
Tell participants that longwood is anything not considered shortwood. Longwood is usually described as long logs or treelength.	Show Slide Logs-12.
Tell the participants that some stacks of logs may be made up of both shortwood and longwood. **Explain** that any stack that includes shortwood must follow the shortwood securement requirements. **Tell** the participants that a stack that contains shortwood, but is embedded in a load of longwood, can be treated as longwood.	Show Slide Logs-13. 

Lesson Plan	Instructor Notes

Securement Requirements for Logs

45 minutes

Tell participants that you are now going to discuss some of the securement and loading requirements for logs.

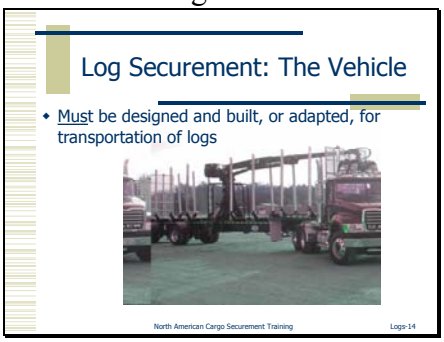
Explain the securement requirements for logs.

Securement system requirements

The Vehicle

Remind participants that logs must be transported on a vehicle designed and built, or adapted, for the transportation of logs.

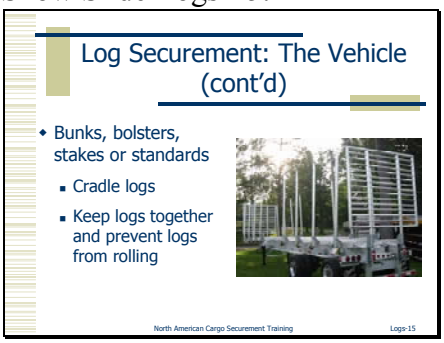
Show Slide Logs-14.



Remind participants that the vehicle must be fitted with some means to cradle the logs and prevent them from rolling.

Explain that a log truck normally has bunks, bolsters, and stakes or standards. The logs are cradled by the bunks and stakes, keeping a stack of logs together, and preventing them from rolling.

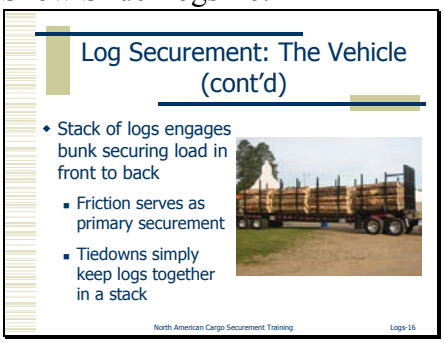
Show Slide Logs-15.



Explain to participants that a stack of logs usually engages the bunk. The result is a secured load in the front to back direction.

Tell the participants that the weight of the logs creating friction serves as the primary securement. Tiedowns simply keep the logs together in a stack.

Show Slide Logs-16.



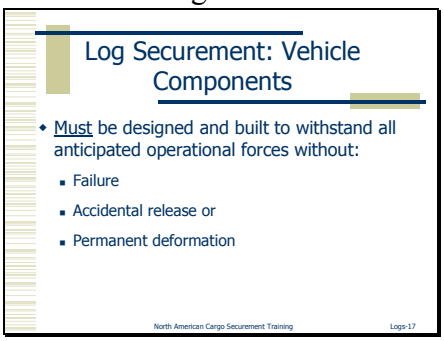
Lesson Plan	Instructor Notes

Vehicle Components

Explain to participants that all vehicle components involved in securement of logs must be designed and built to withstand all anticipated operational forces without:

- Failure
- Accidental release or
- Permanent deformation.

Show Slide Logs-17.



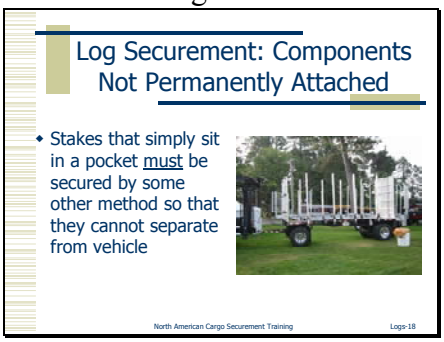
Components Not Permanently Attached

Explain to participants that a log truck may experience very high upward and downward force when returning empty.

Tell participants that this force may be so severe that it causes the stakes to separate from the vehicle.

Explain that stakes that simply sit in a pocket must be secured by some other method so that they cannot separate from the vehicle.

Show Slide Logs-18.



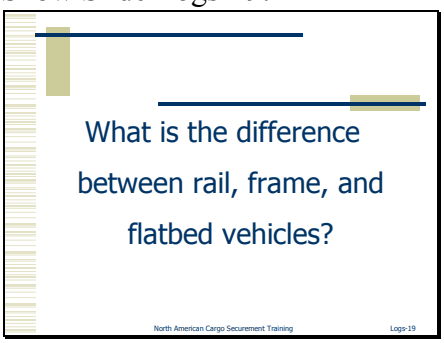
Lesson Plan	Instructor Notes

Distinction between vehicle types (rail, frame, flatbed)

Ask the participants:

> What is the difference between rail, frame, and flatbed vehicles?

Show Slide Logs-19.



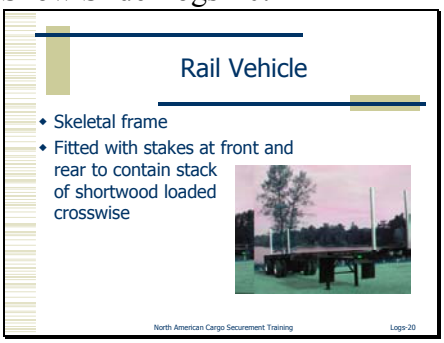
Suggested responses:

- Rail: skeletal frame and fitted with stakes
- Frame: skeletal frame and fitted with bunk units
- Flatbed: an open deck vehicle

Rail

Tell the participants that a rail log truck or trailer has a skeletal frame and is fitted with stakes at the front and rear to contain a stack of shortwood loaded crosswise.

Show Slide Logs-20.

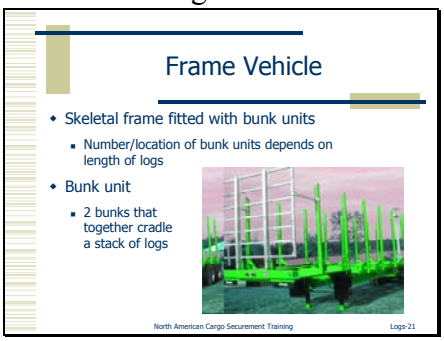


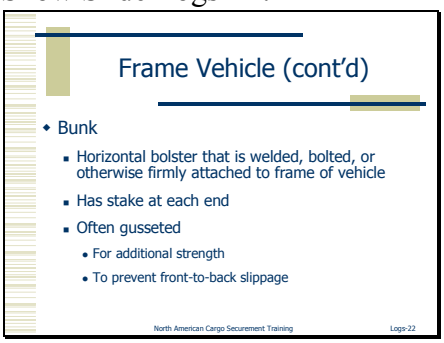
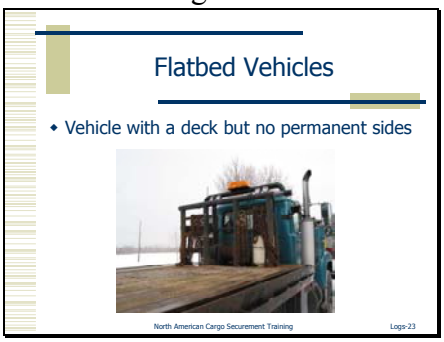
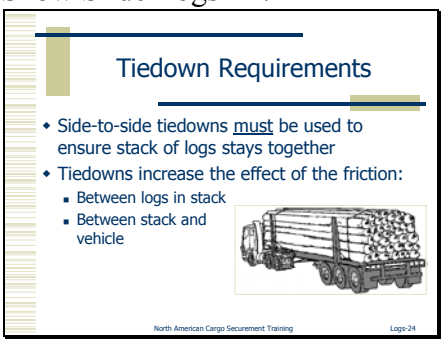
Frame

Explain to the participants that a frame log truck or trailer has a skeletal frame and is fitted with bunk units. The numbers and locations of bunk units depend on the length of logs carried.

Tell the participants that a bunk unit consists of 2 bunks that together cradle a stack of logs.

Show Slide Logs-21.



Lesson Plan	Instructor Notes
Tell them that a bunk consists of a horizontal bolster that is welded, bolted, or otherwise firmly attached across the frame of the vehicle, and has a stake at each end. **Explain** that the bunks are often gusseted, for additional strength and to engage the logs to prevent front-to-back slippage.	Show Slide Logs-22. 
<u>Flatbed</u> **Tell** the participants that a flatbed vehicle is a vehicle with a deck but no permanent sides.	Show Slide Logs-23. 
Tiedown requirements **Tell** participants that logs that are cradled by bunks and stakes <u>must</u> be secured by tiedowns so that the stack of logs stays together as a bundle. **Explain** to the participants that logs are secured by side-to-side tiedowns. Tiedowns that go over the logs bunch the logs together into a bundle and increase the effect of the friction: ◆ Between logs in the stack ◆ Between the stack and the vehicle.	Show Slide Logs-24. 

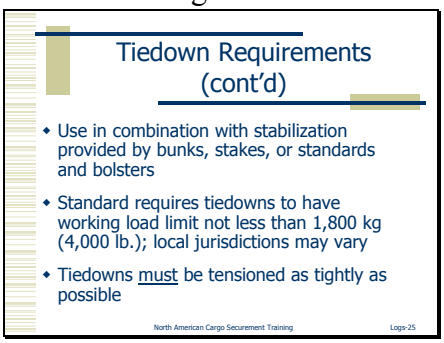
Lesson Plan	Instructor Notes

Tell participants that tiedowns must be used in combination with the stabilization provided by bunks, stakes, or standards and bolsters to secure the load.

Explain that the Standard requires any tiedown to have a working load limit of at least 1,800 kg (4,000 lb.). Local jurisdictions may vary.

Tell participants that it is best to tension the tiedowns as tightly as possible.

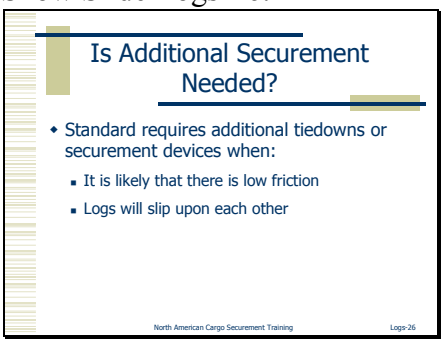
Show Slide Logs-25.



Additional Securement

Tell participants that additional tiedowns or securing devices must be used when it is likely that there is low friction and the logs will slip upon each other.

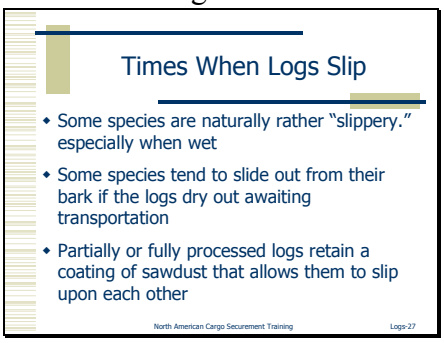
Show Slide Logs-26.



Describe the situations when additional tiedowns may be needed.

- Some species are naturally rather "slippery," especially when wet.
- Some species tend to slide out from their bark if the logs dry out awaiting transportation.
- Partially or fully processed logs retain a coating of sawdust that allows them to slip upon each other.

Show Slide Logs-27.

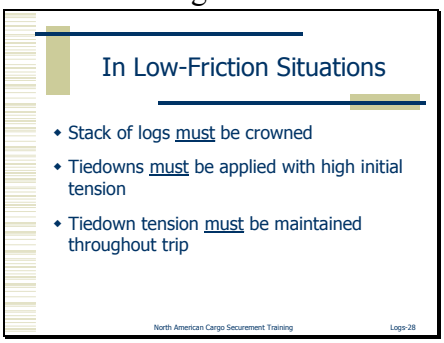


Lesson Plan	Instructor Notes

Explain to participants that in these cases:

- The stack of logs must be crowned
  - Crowned means that, when you look at the stack of the logs from the ends, it must have a rounded profile at the top
- Tiedowns must be applied with high initial tension
- Tension must be maintained in the tiedowns throughout the trip.

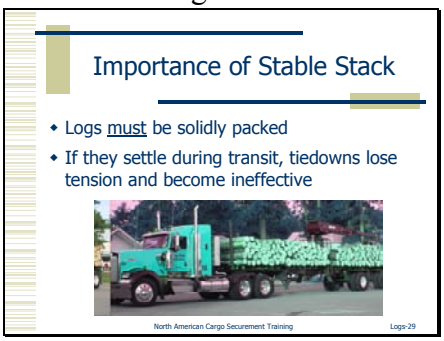
Show Slide Logs-28.



Packing requirements

Explain that logs cannot be secured adequately unless a stable stack is built while the vehicle is being loaded. Logs must be solidly packed together because, if they settle, the tiedowns lose tension and become ineffective.

Show Slide Logs-29.

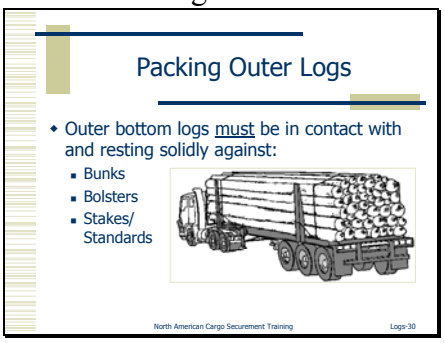


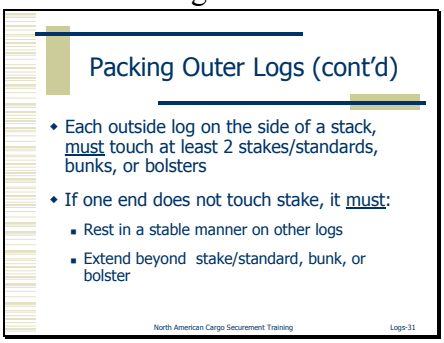
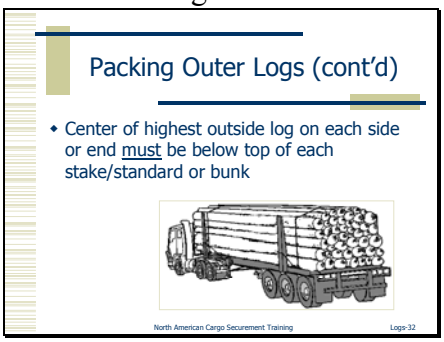
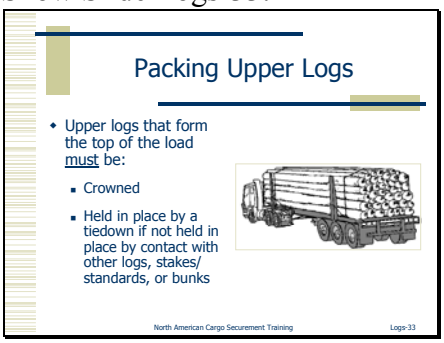
Outer Logs

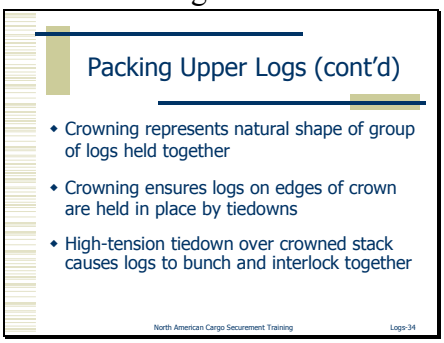
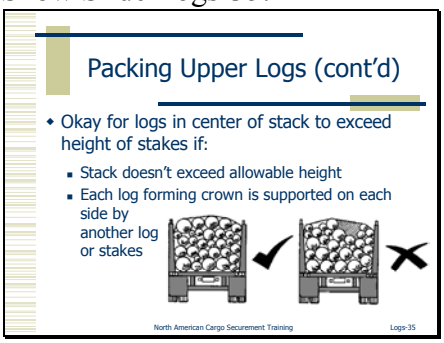
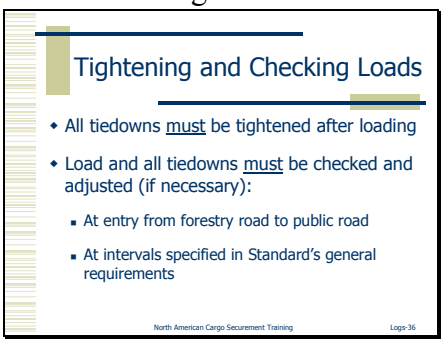
Explain that the outer bottom logs must be in contact with and resting solidly against the:

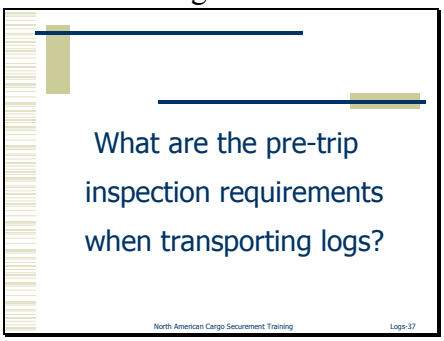
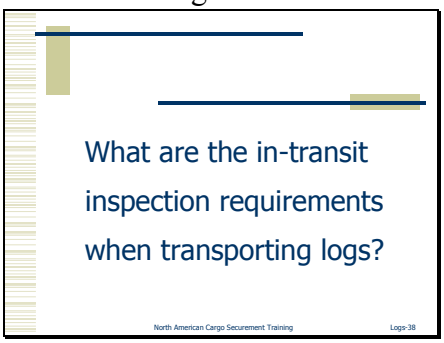
- Bunks
- Bolsters
- Stakes or standards.

Show Slide Logs-30.



Lesson Plan	Instructor Notes
Explain that each outside log on the side of a stack of logs must touch at least 2 stakes, bunks, bolsters, or standards. If one end does not actually touch a stake, it must rest on other logs in a stable manner and must extend beyond the stake, bunk, bolster or standard.	Show Slide Logs-31. 
Explain that the center of the highest outside log on each side or end must be below the top of each stake/standard or bunk.	Show Slide Logs-32. 
Upper Logs **Explain** that the upper logs that form the top of the load must be packed in one of two ways: ♦ Crowned ♦ If the stack is not crowned, each log that is not held in place by contact with other logs, stakes/standards, or bunks must be held in place by a tiedown.	Show Slide Logs-33. 

Lesson Plan	Instructor Notes
Explain that crowning represents the natural shape of a group of logs held together by tension in a tiedown. It also ensures logs on the edges of the crown are held in place by the tiedowns. **Tell** participants that testing has shown that a high-tension tiedown over a crowned stack of logs causes the logs to bunch and interlock together into a stable stack. This does not happen when the tiedown tension is low, or if the top of the stack is not crowned. **Explain** that crowning may result in logs in the center of the stack exceeding the height of the stakes. **Tell** the participants that this is acceptable, up to the allowable legal height, as long as each log forming the crown is supported on each side by another log or stakes.	Show Slide Logs-34.  Show Slide Logs-35. 
Tightening and checking loads **Explain** to participants that all tiedowns <u>must</u> be tightened after loading. **Tell** participants that, at the point the trip moves from a forestry road to a public road, an inspection of the load and its securement system is required. This is in addition to the periodic inspections required in the Standard.	Show Slide Logs-36. 

Lesson Plan	Instructor Notes
Requirements for inspecting loads **Review** load inspection requirements by asking the following questions. What are the pre-trip inspection requirements when transporting logs?	If participants need prompting, ask them what needs to happen and when it needs to happen. Show Slide Logs-37.  Suggested responses: When: After loading What: Tighten tiedowns
What are the in-transit inspection requirements when transporting logs?	Show Slide Logs-38.  Suggested responses: When: - Within first 50 miles - At public road entry What: - Check and adjust tiedowns - Add additional tiedowns if necessary

Lesson Plan	Instructor Notes

Securement Requirements for Shortwood Logs Loaded Crosswise on Frame, Rail, and Flatbed Vehicles

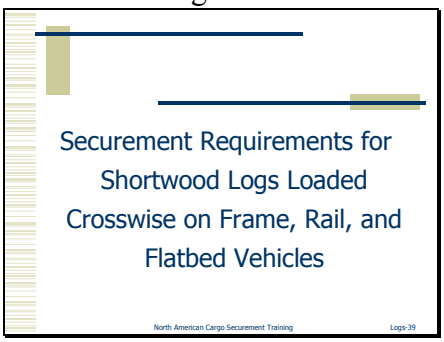
15 minutes

Explain that you have been talking about securement requirements for all types of logs.

Tell participants that you are now going to discuss some additional specific securement requirements for shortwood logs loaded crosswise on frame, rail, and flatbed vehicles. These requirements are in addition to the requirements already covered.

Discuss any additional securement requirements for shortwood logs loaded crosswise on frame, rail, and flatbed vehicles.

Show Slide Logs-39.

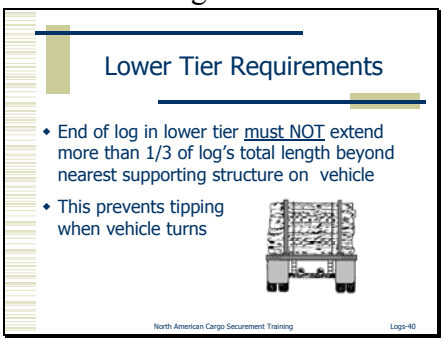


Lower tier requirements

Explain to participants that the lower tier of shortwood loaded crosswise is the foundation of the load.

Tell participants that, in no case may the end of a log in the lower tier extend more than 1/3 of the log's total length beyond the nearest supporting structure on the vehicle. This is to prevent tipping when the vehicle turns.

Show Slide Logs-40.



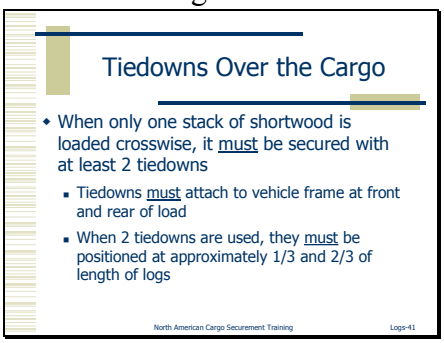
Lesson Plan	Instructor Notes

Tiedowns

Say that, when only one stack of shortwood is loaded crosswise, it must be secured with at least 2 tiedowns. The tiedowns must attach to the vehicle frame at the front and rear of the load.

Explain that, when 2 tiedowns are used, they must be positioned at approximately 1/3 and 2/3 of the length of the logs.

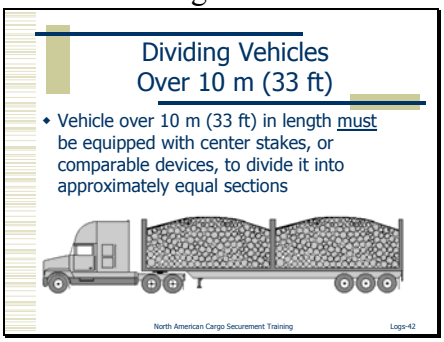
Show Slide Logs-41.



Dividing vehicles over 10 m (33 ft)

Tell participants that a vehicle that is more than 10 m (33 ft) long must be equipped with center stakes, or comparable devices, to divide it into sections approximately equal in length**.**

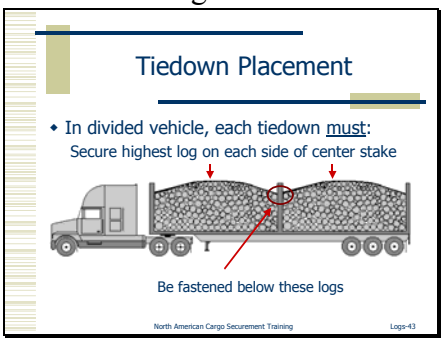
Show Slide Logs-42.



Explain that, where a vehicle is so divided, each tiedown must:

- Secure the highest log on each side of the center stake
- Be fastened below these logs.

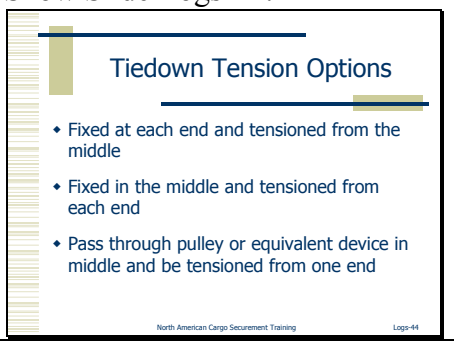
Show Slide Logs-43.



The tiedown may:

- Be fixed at each end and tensioned from the middle
- Be fixed in the middle and tensioned from each end
- Pass through a pulley or equivalent device in the middle and be tensioned from one end.

Show Slide Logs-44.

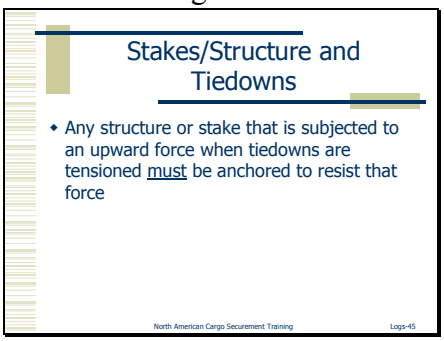


Lesson Plan	Instructor Notes

Stakes/structure and tiedowns

Explain that any structure or stake that is subjected to an upward force when the tiedowns are tensioned must be anchored to resist that force.

Show Slide Logs-45.



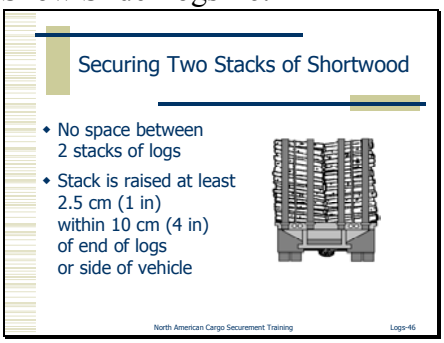
Additional securement requirements for securing 2 stacks of shortwood

Explain to participants that, if 2 stacks of shortwood are loaded side-by-side, they must be loaded so that:

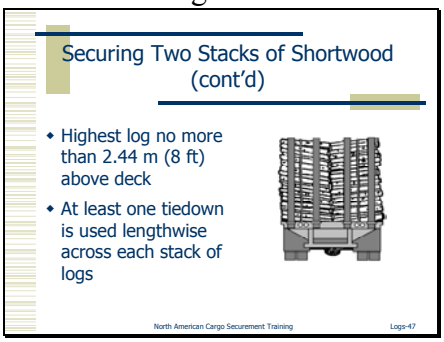
- There is no space between the 2 stacks of logs
- The outside of each stack is raised at least 2.5 cm (1 in) within 10 cm (4 in) of the end of the logs or the side of the vehicle

  This ensures that, if the tier settles, it will settle inwards towards the center of the trailer. This outer support should have an edge that will engage the logs.
- The highest log is no more than 2.44 m (8 ft) above the deck (This reduces the risk of the stack tipping while turning.)
- At least one tiedown is used lengthwise across each stack of logs.

Show Slide Logs-46.



Show Slide Logs-47.



Lesson Plan	Instructor Notes

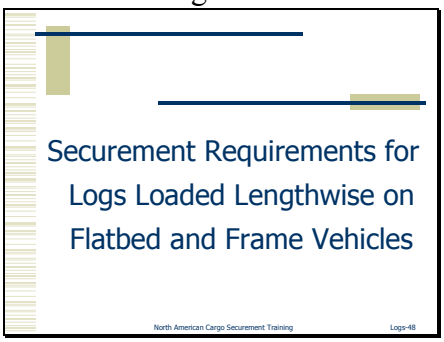
Securement Requirements for Logs Loaded Lengthwise on Flatbed and Frame Vehicles

15 minutes

Tell the participants that you are now going to talk about additional specific securement requirements for logs loaded lengthwise on flatbed and frame vehicles. These requirements are in addition to the requirements already covered.

Discuss any additional securement requirements for shortwood and longwood logs loaded lengthwise on flatbed and frame vehicles.

Show Slide Logs-48.



Shortwood and tiedowns

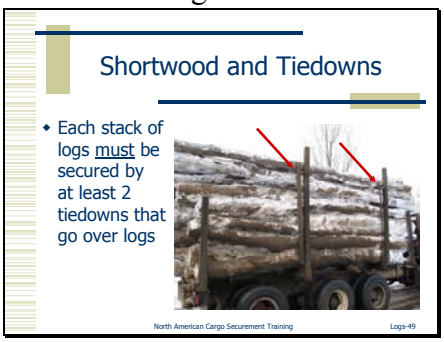
Tell participants that each stack of shortwood loaded lengthwise on a frame vehicle or on a flatbed must be secured to the vehicle by at least 2 tiedowns.

Explain to participants that in the following scenario they can use one tiedown for logs in a stack less than 3.04 m (10 ft) in length:

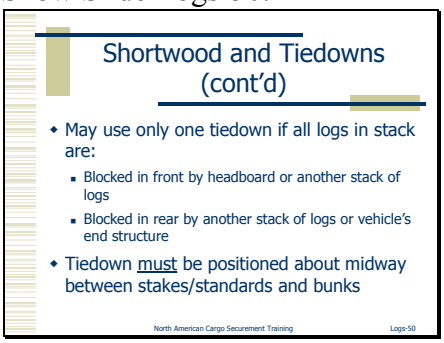
- All logs are blocked in the front by a headboard strong enough to restrain the load or by another stack of logs
- All logs are blocked in the rear by another stack of logs or the vehicle's end structure.

Explain that, if one tiedown is used, it must be positioned about midway between the bunks and stakes/ standard.

Show Slide Logs-49.



Show Slide Logs-50.



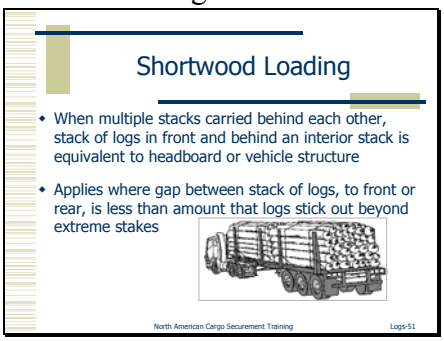
Lesson Plan	Instructor Notes

Shortwood loading

Explain that, where multiple stacks are carried behind each other, the stack of logs in front and behind an interior stack is equivalent to a headboard or vehicle structure.

Tell participants that this only applies where the gap between a stack of logs, to the front or rear, is less than the amount the logs stick out beyond the extreme stakes.

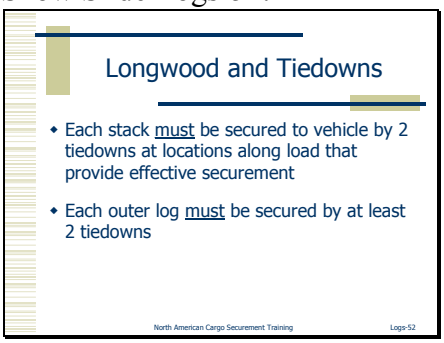
Show Slide Logs-51.



Longwood and tiedowns

Tell the participants that each stack of longwood loaded lengthwise on a frame vehicle or a flatbed must be secured to the vehicle by at least 2 tiedowns at locations along the load that provide effective securement. Each outer log (periphery of the load0 must be secured with at least 2 tiedowns.

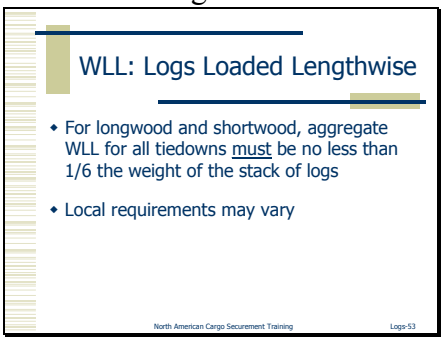
Show Slide Logs-52.



Working Load Limit for longwood and shortwood loaded lengthwise

Explain that the aggregate working load limit for all tiedowns must be no less than 1/6 the weight of the stack of logs. Local requirements may vary.

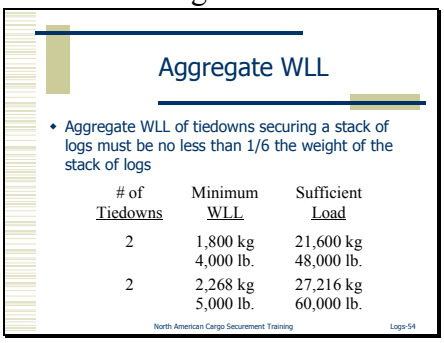
Show Slide Logs-53.

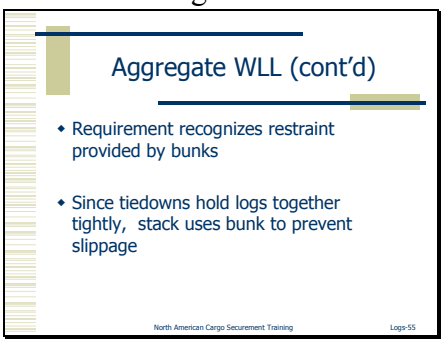
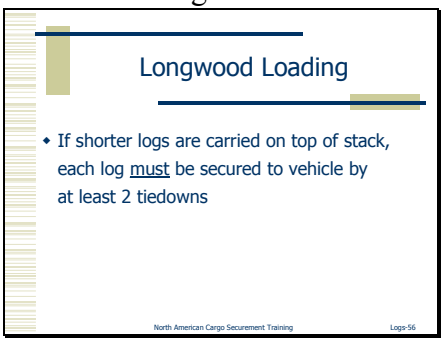


Give example:

- 2 tiedowns with the minimum working load limit of 1,810 kg (4,000 lb.) each are sufficient for a load of 21,600 kg (48,000 lb.)
- 2 tiedowns with a working load limit of 2,268 kg (5,000 lb.) each are sufficient for a load of 27,216 kg (60,000 lb.)

Show Slide Logs-54.



Lesson Plan	Instructor Notes
Explain that this requirement is much less than the general requirement of an aggregate working load limit to equal 1/2 the weight of the load. It recognizes the restraint provided by bunks. Since tiedowns hold logs together tightly, the stack uses the bunk to prevent slippage.	Show Slide Logs-55. 
Explain to the participants that, if shorter logs are carried on top of the stack, each such log must be secured to the vehicle by at least 2 tiedowns.	Show Slide Logs-56. 

Lesson Plan	Instructor Notes

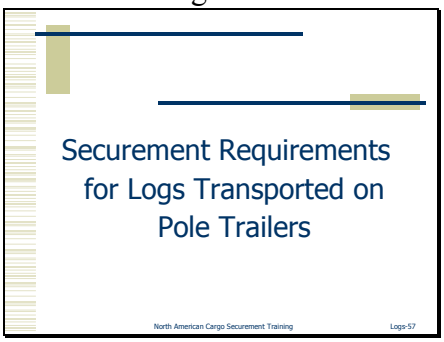
Securement Requirements for Logs Transported on Pole Trailers

10 minutes

Tell the participants that you are now going to tell them about securement requirements for logs transported on pole trailers.

Explain securement requirements for logs transported on pole trailers.

Show Slide Logs-57.

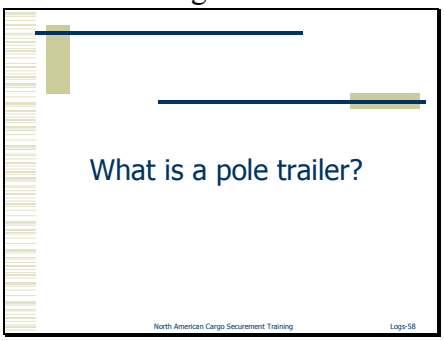


Pole trailer definition

Ask the participants?

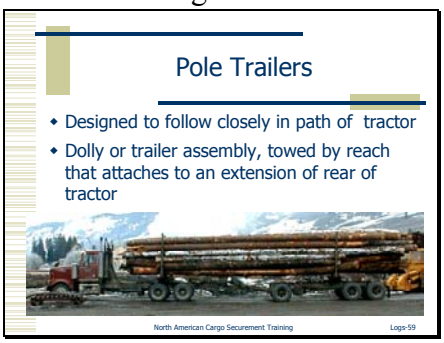
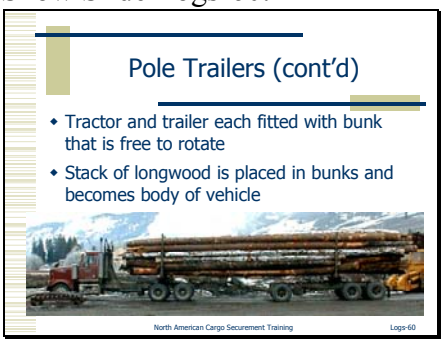
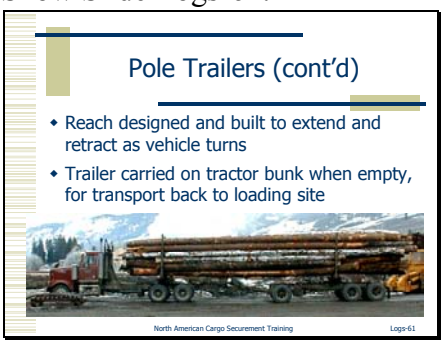
> What is a pole trailer?

Show Slide Logs-58.



Suggested responses:

- Designed to follow close to a tractor
- Dolly or trailer assembly that attaches to extension at rear of tractor
- Tractor and trailer are fitted with a bunk that is free to rotate

Lesson Plan	Instructor Notes
Tell participants that a pole trailer is designed to follow closely in the path of the tractor. **Say** that the trailer consists simply of a dolly or trailer assembly, towed by a reach that attaches to an extension of the rear of the tractor.	Show Slide Logs-59. 
Explain to participants that the tractor and trailer are each fitted with a bunk that is free to rotate. **Tell** them that a stack of longwood is placed in the bunks and becomes the body of the vehicle.	Show Slide Logs-60. 
Explain that the reach is designed and built to extend and retract as the vehicle turns. The trailer is usually carried on the tractor bunk when empty, for transport back to the loading site.	Show Slide Logs-61. 

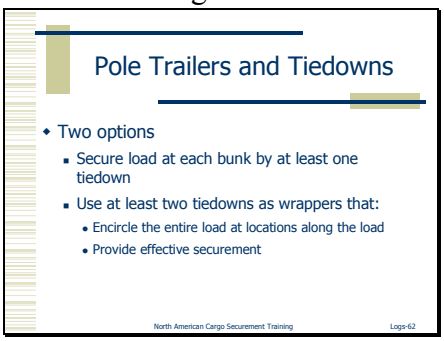
Lesson Plan	Instructor Notes

Securing a load using tiedowns

Explain to participants that there are 2 ways to secure the load:

1. Secured at each bunk by at least one tiedown at each bunk
2. Secured by at least 2 tiedowns used as wrappers that:
   - Encircle the entire load at locations along the load
   - Provide effective securement.

Show Slide Logs-62.

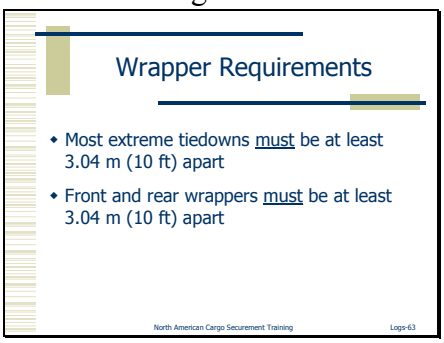


Wrappers

Tell participants that:

- The most extreme wrappers must be at least 3.04 m (10 ft) apart
- Front and rear wrappers must be at least 3.04 m (10 ft) apart.

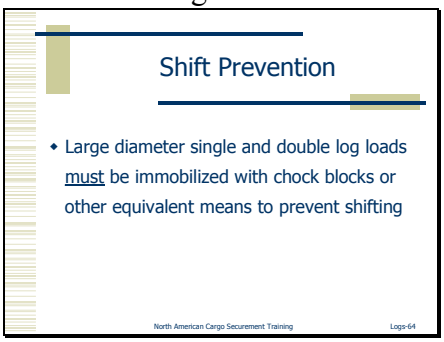
Show Slide Logs-63.

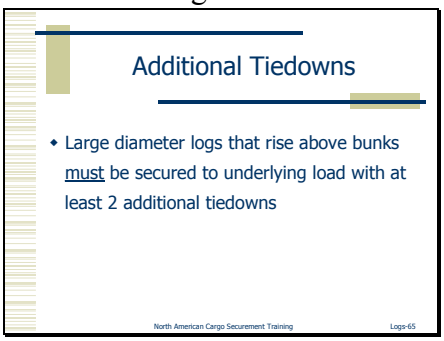


Large Logs – Shift Prevention

Tell participants that large diameter single and double log loads must be immobilized with chock blocks or other equivalent means to prevent shifting.

Show Slide Logs-64.



Lesson Plan	Instructor Notes
Large Logs – Additional Tiedowns **Tell** the participants that large diameter logs that rise above the bunks must be secured to the underlying load with at least 2 additional wrappers.	Show Slide Logs-65. 

Lesson Plan	Instructor Notes

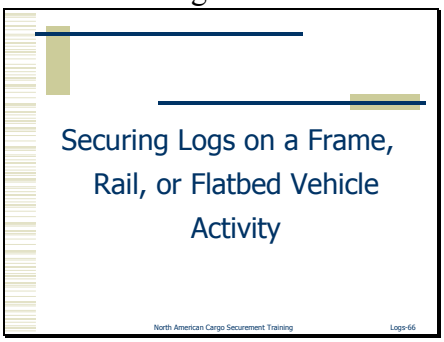
Group Activity: Securing Logs on a Frame, Rail, or Flatbed Vehicle

Explain to participants that they will now be broken into groups for an activity on securing logs on a frame, rail, or flatbed vehicle.

20 minutes

Break into small groups and review instructions: 5
Small groups complete activity: 5
Report out: 10

Show Slide Logs-66.



The purpose of this activity is to help the participants get a better understanding of how to secure logs on a frame, rail, or flatbed vehicle. They will discuss the requirements and the number, placement, and type of cargo securing devices necessary.

Turn to the page following the instructions to see the Securing Logs activity worksheets.

Break the participants up into 4 small groups. Have the participants turn to the Securing Logs activity worksheets. Read the directions to the participants. Give them 5 minutes to complete the activity.

Lesson Plan	Instructor Notes
	When participants have completed their work, have each group present the answer to their scenario. - Read the scenario - Describe the securement system chosen - Name the items on their checklist Walk around during the activity and make sure that participants are selecting the correct log loading orientation and securing devices. Each inspection checklist should include: - Check for proper stacking - Check WLL of tiedown - Check integrity of stakes - Check tiedown tension. **Answers** **Scenario #1** Number, Placement, Type of Cargo Securing devices: ♦ Number: 2 securing devices ♦ Placement: Approximately 1/3 and 2/3 of length of logs ♦ Type of securing device: Tiedowns with two end stakes or comparable device on front and rear and two center stakes.

Inspection Checklist: (for 2 nonadjacent stacks)

- Check if vehicle structure supports logs within 12 in of each end.
- Check for at least 2 tiedowns.
- Check that the tiedowns are positioned about 1/3 in from the end of the logs.
- If the vehicle is longer that 33 ft, check for center stakes to divide the vehicle.

Scenario #2

Number, Placement, Type of Cargo Securing devices:

- Number: 2 securing devices

- Placement: Approximately 1/3 and 2/3 of length of log.

- Type of securing device: Tiedowns with two end stakes or comparable device on front and rear.

Inspection Checklist: (for 2 adjacent stacks)

- No space between the 2 stacks.
- Outside of each stack is raised at least 1 in within 4 in of the end of the logs or the side of the vehicle.
- The highest log is no more than 8 ft above the deck.
- At least one tiedown is used lengthwise across each stack.

Scenario #3

Number, Placement, Type of Cargo Securing devices:

- Number: At least 2 tiedowns per stack unless stack is 3.04 m (10 ft) or less and properly blocked in the front and rear. Then only 1 tiedown required.

- Placement: Approximately in the middle if one tiedown used.

- Type: Tiedowns with at least 2 stakes or comparable device on each side of each stack.

Inspection Checklist:

- Check for proper stacking.
- Check WLL of tiedown.
- Check integrity of stakes.
- Check tiedown tension.

Scenario #4

Number, Placement, Type of Cargo Securing devices:

- Number: 2

- Placement: At locations along the load that provide effective securement.

- Type: Tiedowns with at least two stakes or comparable device (bunk, bolster etc.) on each side.

Inspection Checklist:

- Check for proper stacking.
- Check WLL of tiedown.
- Check integrity of stakes.
- Check tiedown tension.

Securing Logs

In a small group, determine how to secure the following log load. Consider the log loading requirements and the number, placement, and type of cargo securing devices. Create a checklist of securement requirements that you would use to ensure the logs are safely secured.

Scenario #1: A load of shortwood is to be transported crosswise in a divided rail vehicle.

Number, Placement, and Type of Cargo Securement Device	Inspection Checklist

Securing Logs

Scenario #2: A load of shortwood (two stacks) is to be transported crosswise on a rail vehicle that is not divided.	
Number, Placement, and Type of Cargo Securement Device	Inspection Checklist

Securing Logs

Scenario #3: A load of shortwood is to be transported lengthwise on a flatbed vehicle.	
Number, Placement, and Type of Cargo Securement Device	Inspection Checklist

Securing Logs

Scenario #4: A load of logs that are 17 ft long is to be transported in one stack on a frame vehicle.	
Number, Placement, and Type of Cargo Securement Device	Inspection Checklist

Lesson Plan	Instructor Notes

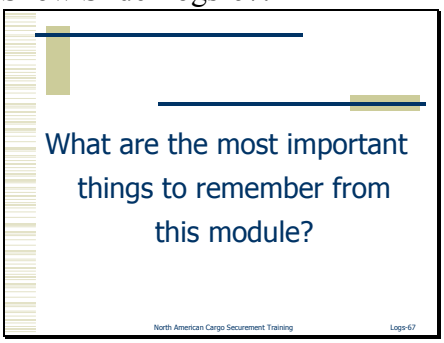
Summary

Ask the participants:

> What are the most important things to remember from this module?

Summarize the lesson on Logs, recapping what the participants just learned.

Show Slide Logs-67.



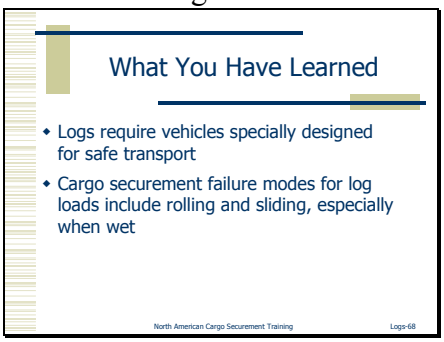
Record participants' responses on an easel pad.

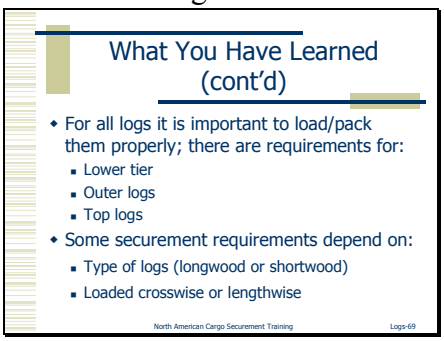
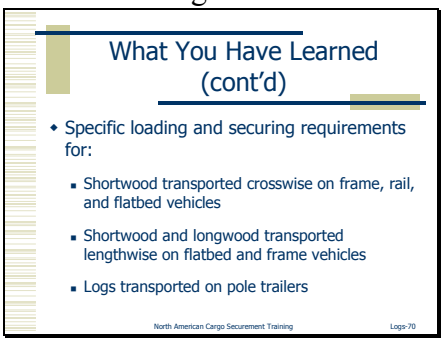
- Logs roll and slide, hard to transport
- Stakes, bunks, cradles and tiedowns are important parts of cargo securement system
- There are different ways to secure shortwood and longwood and logs loaded lengthwise and crosswise

Tell the participants that they now know that:

- The cylindrical shape of logs and their slippery nature require specially designed vehicles for safe transport
- Cargo securement failure modes for log loads include rolling and sliding

Show Slide Logs-68.



Lesson Plan	Instructor Notes
◆ For all logs it is important to load/pack them properly; there are requirements for the: – Lower tier – Outer logs – Top logs. ◆ **Say** that some securement requirements depend on the type of logs (shortwood or longwood) and how they are loaded (crosswise or lengthwise).	Show Slide Logs-69. 
♦ Specific loading and securing requirements for: – Shortwood transported crosswise on frame, rail, and flatbed vehicles – Shortwood and longwood transported lengthwise on flatbed and frame vehicles – Logs transported on pole trailers.	Show Slide Logs-70. 

Module Overview

Module 4: Dressed Lumber and Similar Building Products

Learning Objectives

At the completion of the training, participants will be able to:

- Describe how the cargo securement principles apply to dressed lumber and similar building products
- Determine what is required to properly load and secure dressed lumber and similar building products, including number of bundles, placement, and types of cargo securing devices
- Identify securement systems that are not in compliance and determine what is required to correctly secure the load.

Time Required

1 hour

Topics

1. Overview and Learning Objectives
2. Principles for Securing Dressed Lumber and Similar Building Products
3. Application
4. Securement Requirements for Dressed Lumber and Similar Building Products
5. Group Activity: Securement of Dressed Lumber or Similar Building Materials
6. Summary

Training Methods

1. Participative lecture
2. Group activity (Small group exercises)

Participant Materials

1. Participant Manual
2. Driver's Handbook on Cargo Securement

Training Materials

1. Instructor Guide
2. PowerPoint slides and projection system
3. Easel pad and markers
4. Participant materials

Instructor Notes

Research and testing of securement of bundles of dressed lumber with tiedowns on highway trailers demonstrated that, under ideal conditions, high friction levels between bundles of lumber and between the lumber and the trailer deck securement systems currently in common use for this commodity would likely meet the proposed performance criteria, with the possible exception of restraint against movement in the forward direction. Ideal conditions include:

- Sound and secure strapping of bundles
- Clean deck
- Careful placement of bundles on deck.

Testing and research on friction also showed that vibrations that occur on the highway tend to decrease the friction level provided between contact surfaces.

Testing and research on tiedowns also revealed that tiedown tension on compliant loads (non-rigid) tends to decrease rapidly with vibration and load settlement. If the load is more rigid, tension doesn't decrease as rapidly.

Dressed Lumber and Similar Building Materials

Lesson Plan	Instructor Notes

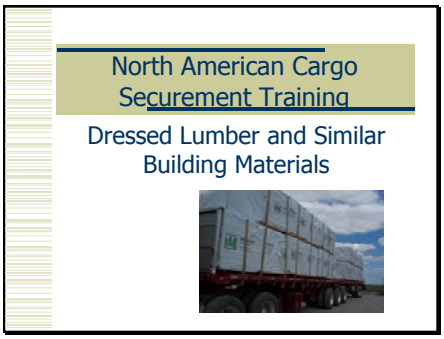
Overview and Learning Objectives

5 minutes

Tell the participants that they are going to learn about securement for dressed lumber and similar building materials such as engineered building products, packaged lumber, plywood, gypsum board or other materials which are unitized in bundles and are transported on flatbed or open vehicles. When transported in closed vehicles, the general securement rules apply.

Explain the objectives of the training.

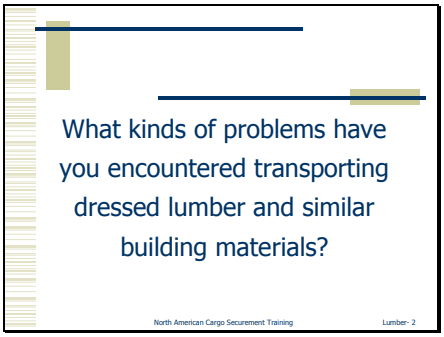
Show Slide Lumber-1.



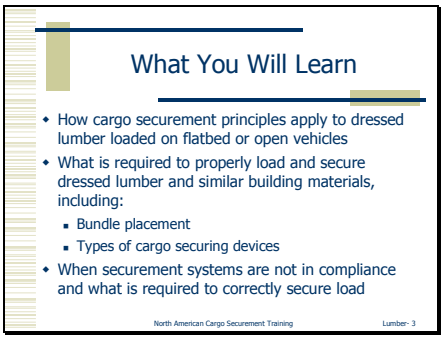
Ask the participants:

> What kinds of problems have you encountered transporting dressed lumber or similar bundled building materials?

Show Slide Lumber-2.



Record the problems on easel pad. Make sure problems are addressed during the module.

Lesson Plan	Instructor Notes
Tell participants that, at the completion of training, they will be able to: ◆ Describe how the cargo securement principles apply to dressed lumber and similar building materials loaded on flatbed or open vehicles ◆ Determine what is required to properly load and secure dressed lumber and similar building materials, including: – Bundle placement – Types of cargo securing devices. ◆ Identify securement systems that are not in compliance and determine what is required to correctly secure the load.	Show Slide Lumber-3. 

Lesson Plan	Instructor Notes

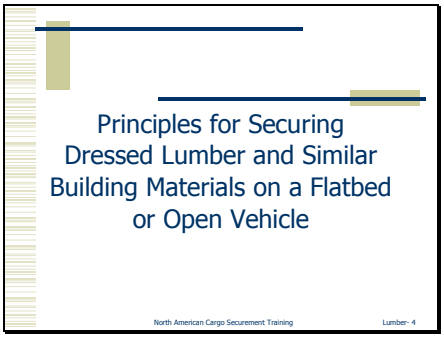
Principles for Securing Dressed Lumber and Similar Building Materials

10 minutes

Tell the participants that you are now going to talk about the principles for securing dressed lumber and similar building materials on a flatbed or open vehicle.

Explain the principles for securing dressed lumber on a platform vehicle.

Show Slide Lumber-4.



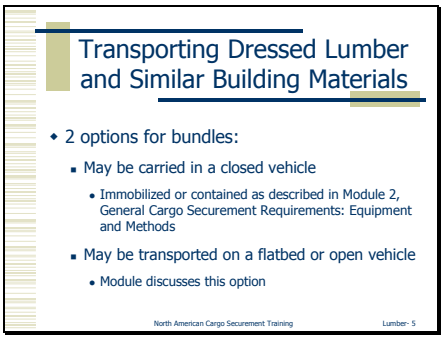
Transporting dressed lumber and similar building materials

Explain that there are two options for transporting dressed lumber and similar building materials. Bundles may be:

- Carried in a closed vehicle, and immobilized or contained as outlined in Module 2 (General Cargo Securement Requirements: Equipment and Methods)
- Secured on a flatbed or open vehicle.

This section will discuss the second option.

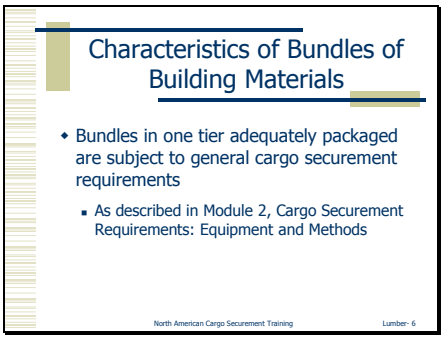
Show Slide Lumber-5.

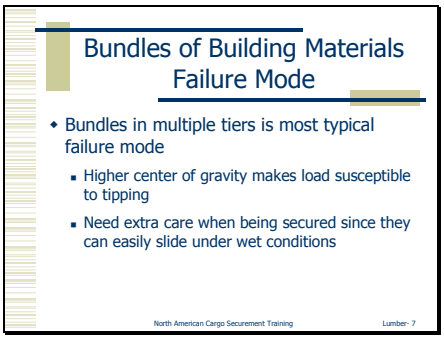


Bundles of Building Materials: characteristics and failure modes

Explain to the participants that bundles of lumber or similar building materials in one tier that are adequately packaged are subject to the general cargo securement requirements (Module 2, General Cargo Securement Requirements: Equipment and Methods).

Show Slide Lumber-6.



Lesson Plan	Instructor Notes
Explain that extra care is needed with the securement system for multiple tiers of bundles: ◆ The high center of gravity makes the load susceptible to tipping and failure of the securement system. ◆ Extra care is needed when being secured because the bundles can easily slide under wet conditions.	Show Slide Lumber-7.  Return to the list generated from the opening question listing the types of problems the participants have had in securing dressed lumber. Tell the participants that they will now learn how to avoid these problems by planning a securement system.

Lesson Plan	Instructor Notes

Planning a securement system for bundled building materials

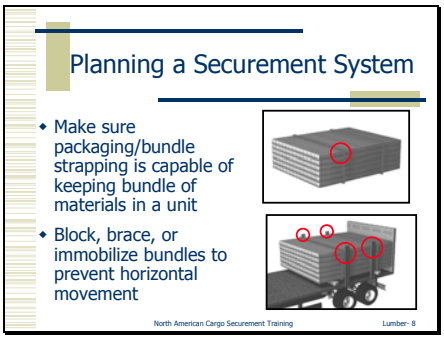
Explain to the participants that, when planning a securement system for bundled building materials, they need to make sure that the packaging or bundle strapping is capable of keeping the bundle of building materials in a unit.

Tell them that they may also need to block, brace, or immobilize bundles to prevent horizontal movement.

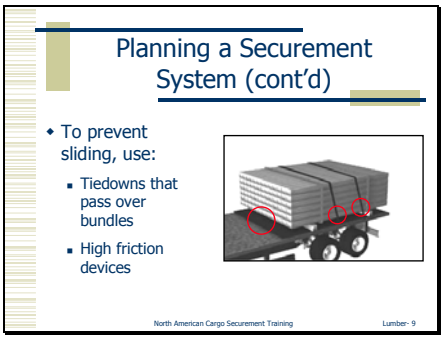
Explain to the participants that, to prevent sliding, they may need to use:

- Tiedowns that pass over the bundles
- High friction devices (such as friction mats, wood with high friction surfaces, cleated mats etc).

Show Slide Lumber-8.



Show Slide Lumber-9.



Lesson Plan	Instructor Notes

Application

Explain to the participants that the requirements in this module apply to the transportation of bundles, such as:

- Dressed lumber
- Packaged and engineered lumber
- Bundled building materials (plywood, drywall, oriented strand board etc.)
- Other similar bundled materials.

Explain that the requirements in this module do not apply to the transportation of building materials such as:

- Shingles
- Palletized bags
- Metal products.

However, these products may be transported on the same vehicle as building materials. Securement of these products is covered in the general cargo securement requirements (Module 2, General Cargo Securement Requirements: Equipment and Methods).

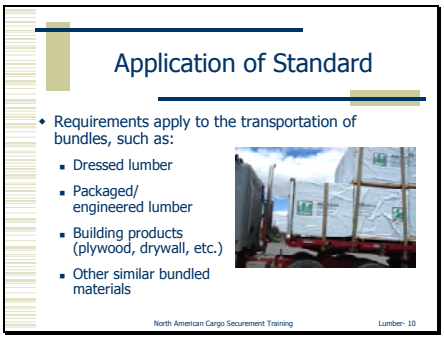
Tell them that lumber or building materials that are not bundled or packaged should be treated as loose items and transported using the general cargo securement requirements (Module 2, General Cargo Securement Requirements: Equipment and Methods).

> ** Note: "Bundle" refers to packages of lumber, building materials or similar products that are unitized for securement as a single item of cargo.*

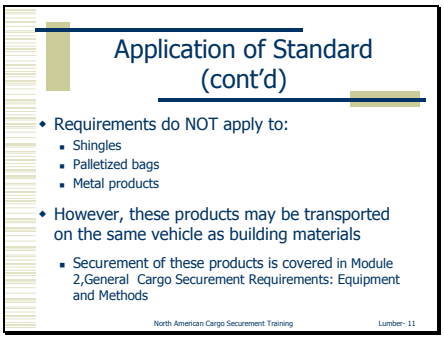
5 minutes

Explain the application of the Standard.

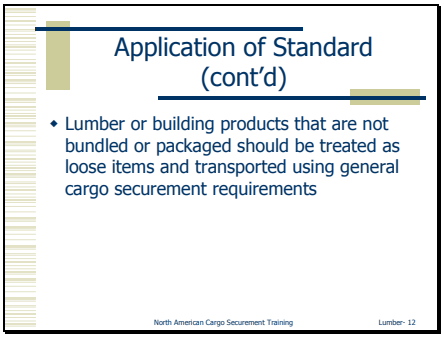
Show Slide Lumber-10.



Show Slide Lumber-11.



Show Slide Lumber-12.



Lesson Plan	Instructor Notes

Securement Requirements for Dressed Lumber and Similar Building Materials

15 minutes

Explain the securement requirements for dressed lumber.

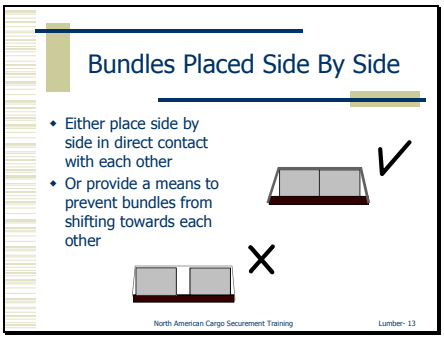
Securement of Bundles

Bundles placed side by side in on a platform vehicle

Explain to the participants that for all bundles in a tier:

- Either place side by side in direct contact with each other
- Or provide a means to prevent bundles from shifting towards each other (e.g., dunnage or blocking)

Show Slide Lumber-13.

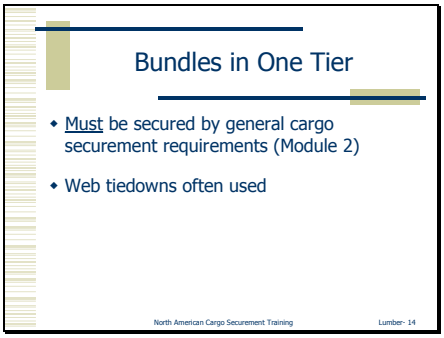


Bundles in one tier

Explain that bundles in one tier must be secured in compliance with the general cargo securement requirements (Module 2, General Cargo Securement Requirements: Equipment and Methods).

Explain that web tiedowns are often used to secure building materials.

Show Slide Lumber-14.



Lesson Plan

Securement system requirements

Summarize the requirements for web tiedowns and their attachment points that are more thoroughly explained in Module 2.

The securement system must:

- Be capable of meeting forces applied to the cargo of 0.8 g forward, 0.5 g rearward, 0.5 g lateral
- Provide a downward force equal to at least 20% of the weight of the cargo
- Be in proper working order with no damaged or weakened components that affect their performance or reduce their working load limit

All vehicle structure and anchor points also must be in proper working order with no damaged or weakened components that affect their performance for cargo securement purposes or reduce their working load limit.

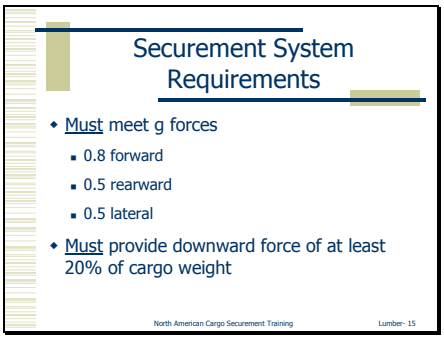
Web tiedowns must:

- Not contain knots
- Be attached and secured in a manner that prevents them from coming loose during transit
- Be able to be tightened by a driver of an in-transit vehicle (also applies to attachment mechanisms)
- Be located inboard of rub rails whenever practicable.

Edge protection must be used when a tiedown would be subject to abrasion or cutting.

Instructor Notes

Show Slide Lumber-15.



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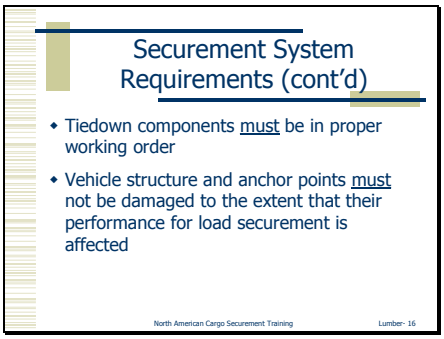

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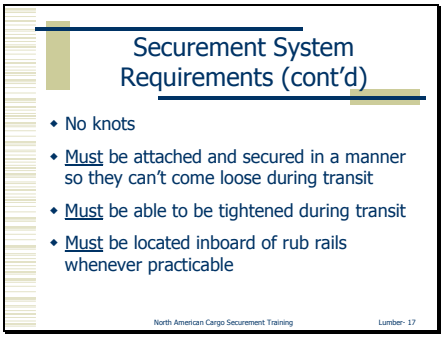

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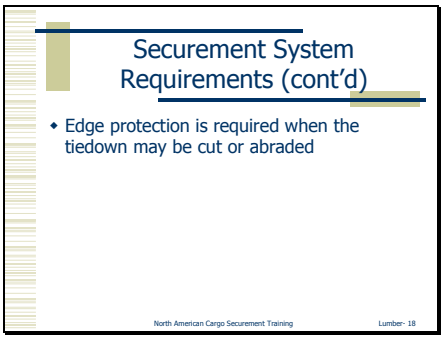


Lesson Plan	Instructor Notes

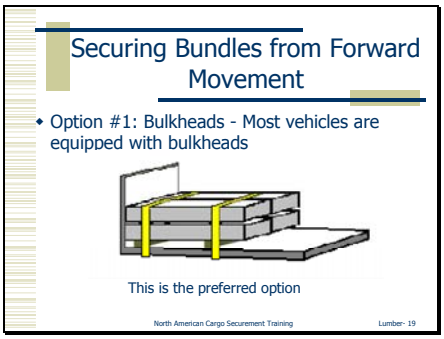
Securing Bundles From Forward Movement

Explain to the participants that stopping cargo from forward movement is important, especially when cargo is carried in several tiers.

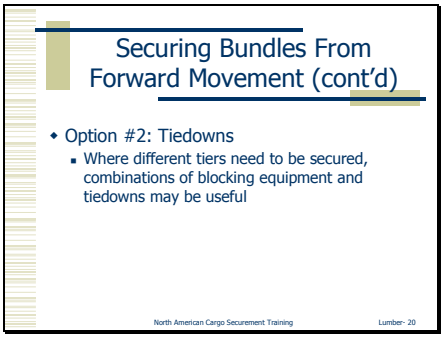
Tell them that the following options can be used to secure cargo from forward motion:

- Option #1: Bulkheads/Front End Structure – Some vehicles are equipped with bulkheads or headboards. This is the preferred option.
- Option #2: Tiedowns – When different tiers need to be secured, combinations of blocking equipment and tiedowns may be useful.

Show Slide Lumber-19.



Show Slide Lumber-20.



Securement of Multi-Tiered Bundles

Tell the participants that you are now going to talk about how to secure bundles in multiple tiers.

Explain that bundles carried in more than one tier must be secured in one of 4 ways:

1. Blocked against lateral movement by stakes on the sides of the vehicle and secured by tiedowns that pass over the top tier, as described in the general cargo securement requirements (Module 2, General Cargo Securement Requirements: Equipment and Methods).

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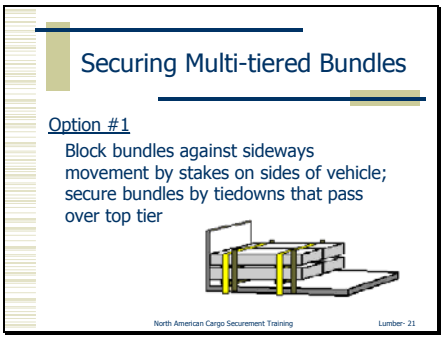


Lesson Plan	Instructor Notes

2. Restrained from lateral movement by blocking or high friction devices between the tiers and secured by tiedowns that pass over the top tier, as described in the general cargo securement requirements (Module 2, General Cargo Securement Requirements: Equipment and Methods).

Tell the participants that a high friction device could be a:

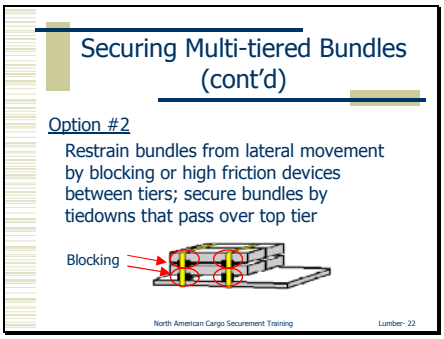
- Friction mat
- Piece of wood with friction surface
- Cleated mat
- Other specialized equipment

3. Placed directly on top of each other or on spacers and
   - Secured by tiedowns over the second tier of bundles or at 1.85 m (6 ft) above the trailer deck (whichever is greater), or not over 1.85 m (6 ft) above the trailer deck for other multiple tiers
   - Secured by tiedowns over the top tier of bundles with a minimum of 2 tiedowns over each top bundle longer than 1.52 m (5 ft).

   The tiedowns <u>must</u> be secured in accordance with the general cargo securement requirements (Module 2, General Cargo Securement Requirements: Equipment and Methods).

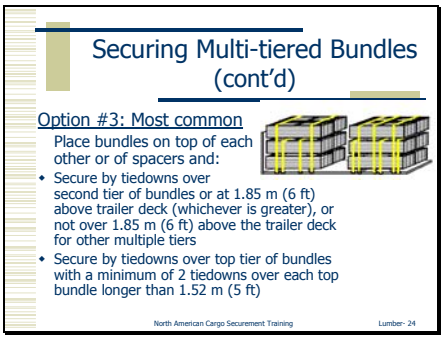
Option 3 is the most common form of securement used for building materials.

Show Slide Lumber-22.



Show Slide Lumber-23.

Show Slide Lumber-24.



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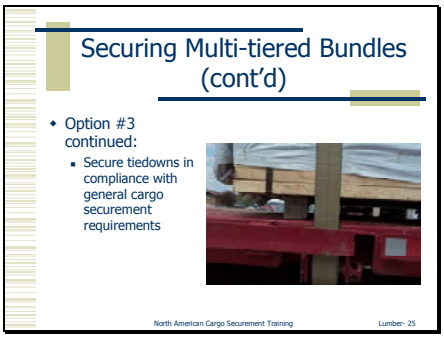


Lesson Plan	Instructor Notes

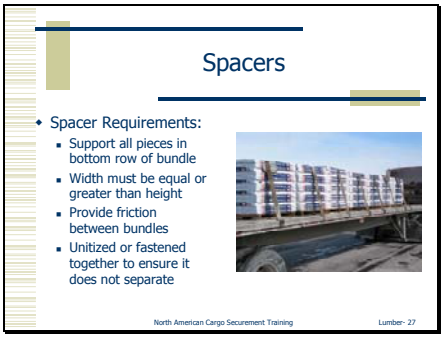
Here are several examples of the securement required by Option 3:

- Two or more tiers, overall height less than 6 feet above the trailer deck: Requires at least 2 tiedowns over a row on the top tier (the length of the bundles may dictate additional tiedowns) and no tiedowns over intermediate tiers.
- Two or more tiers, overall height 6 feet or more above the trailer deck: Requires at least 2 tiedowns over a row on the top tier (the length of the bundles may dictate additional tiedowns) and tiedowns over a row of an intermediate tier not over 6 feet above the deck in accordance with the general rules.

> About spacers: The length of spacers must provide support to all pieces in the bottom row of the bundle. The width of the spacers must be greater than or equal to the height and spacers should provide good interlayer friction. If spacers are comprised of layers of material, the layers must be unitized or fastened together to ensure the spacer performs as a single piece of material.

Show Slide Lumber-26.

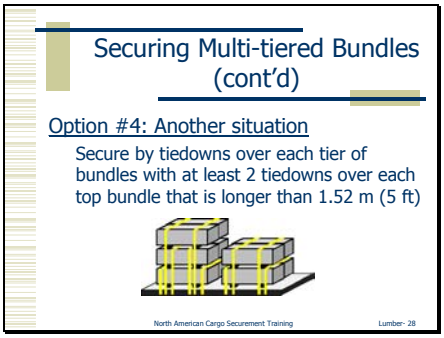
Show Slide Lumber-27.



Lesson Plan	Instructor Notes

4. Another situation
   - Secure by tiedowns over each tier of bundles in accordance with the general cargo securement requirements (Module 2, General Cargo Securement Requirements: Equipment and Methods) with at least 2 tiedowns over each bundle on the top tier that is longer than 1.52 m (5 ft).

Show Slide Lumber-28.



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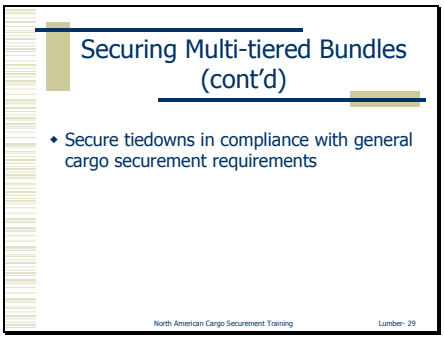
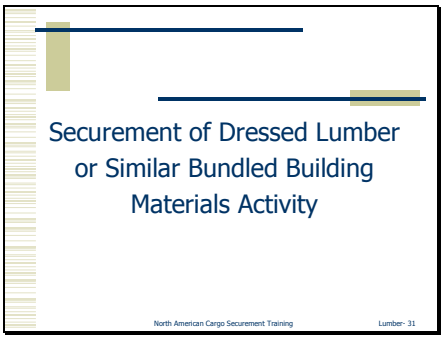


Securing mixed loads

Tell the participants that they will often encounter full loads of unitized building materials in route from manufacturers to distribution centers.

Additionally, they will frequently encounter mixed loads of unitized building materials and other building materials traveling to retail outlets or building sites. These mixed loads must be secured in accordance with the dressed lumber and similar building materials rules and the general cargo securement requirements (Module 2).

Show Slide Lumber-30.

Lesson Plan	Instructor Notes
Activity – Securement of Dressed Lumber or Similar Bundled Building Materials	*25 minutes* Break into small groups and review instructions: 5 Small groups complete activity: 10 Report out: 10 Show Slide Lumber-31.  The purpose of this activity is to help the participants get a better understanding of how to secure dressed lumber or similar bundled building materials. They will discuss the requirements and the number, placement, and type of cargo securing devices necessary. Turn to the page following the instructions to see the Securing Dressed Lumber activity worksheet. Break the participants up into 5 groups. Have the participants turn to the activity worksheet. Read the directions to the participants. Give them 25 minutes to complete the activity.

Lesson Plan	Instructor Notes
	When participants have completed their work, have each group present the answer to their scenario. - Read the scenario - Describe the securement system chosen - Name the items on their inspection checklist As each group reports its checklist items, the instructor will record the items on the easel pad. At the conclusion of the activity, you will have created a generic checklist for everyone. Walk around during the activity and make sure that participants are selecting the correct dressed lumber loading orientation and securing devices. After a group has presented their securement system, ask another group to use that group's inspection checklist to determine if the securement system is safe. Note: Depending on the orientation of the truck, there may be additional answers.

Lesson Plan	Instructor Notes
	Answers: **<u>Scenario #1</u>** *Option #1*: ♦ 2 bundles are placed adjacent to each other, side-by-side and front to rear. ♦ Each set of bundles is secured with two 50 mm (2 in) webbing tiedowns. *Option #2*: The 4 bundles are placed crosswise on the truck and each bundle has a 50 mm (2 in) webbing tiedown used for securement. *Option #3*: ♦ A truck with a headboard is used. ♦ 2 bundles are placed adjacent to each other, side-by-side and front to rear. ♦ The front row of bundles is touching the headboard. ♦ Each set of bundles is secured with one 50 mm (2 in) webbing tiedown.

Lesson Plan	Instructor Notes
	<u>Scenario #2</u> *Option #1:* ♦ Load the longer units on the floor of the trailer side by side: - 4.27 m (14 ft) beside 4.27 m (14 ft) - 4.88 m (16 ft) beside 4.88 m (16 ft) - 6.1 m (20 ft) beside 5.49 m (18 ft). ♦ Place 3.66 m (12 ft) unit on top of and in the center of the 4.27 m (14 ft) units. ♦ Install three 75 mm (3 in) or greater straps over this unit. ♦ Place the second 3.66 m (12 ft) unit on top of and in the center of the 4.88 m (16 ft) units. ♦ Install three 75 mm (3 in) or greater straps over this unit. ♦ Place the 3.05 m (10 ft) and the 2.44 m (8 ft) units on top of and in the center of the 6.1 m (20 ft) beside the 5.49 m (18 ft) unit. ♦ Install two 75 mm (3 in) or greater straps over both top units. ♦ This load has a total of 10 straps.

Lesson Plan	Instructor Notes
	Option #2: ♦ Load the longer units on the floor of the trailer side by side: - 4.27 m (14 ft) beside 4.27 m (14 ft) - 4.88 m (16 ft) beside 4.88 m (16 ft) - 6.1 m (20 ft) beside 5.49 m (18 ft). ♦ Place 3.66 m (12 ft) unit on top of and in the center of the 4.27 m (14 ft) units. ♦ Install three 75 mm (3 in) or greater straps over this unit. ♦ Place the second 3.66 m (12 ft) unit on top of and in the center of the 4.88 m (16 ft) units and against the 3.66 m (12 ft) unit in front of it. ♦ Install two 75 mm (3 in) or greater straps over this unit. ♦ Place the 3.05 m (10 ft) and the 2.44 m (8 ft) units on top of and in the center of the 6.1 m (20 ft) beside the 5.49 m (18 ft) unit. ♦ Install two 75 mm (3 in) or greater straps over both top units. ♦ This load has total of 9 straps. **<u>Scenario #3</u>** *Option #1*: ♦ Bundles are single tiered, butting against each other longitudinally. ♦ Each bundle is secured by three 50 mm (2 in) webbing tiedowns.

Lesson Plan	Instructor Notes
	Option #2: ♦ The 2 bundles are tiered and loaded to the front edge of the trailer. ♦ 2x4 spacers are placed between the bundles. ♦ Three 50 mm (2 in) or greater webbing tiedowns are used for securement over the top unit. ♦ Three 50 mm (2 in) or greater webbing tiedowns over the bottom unit since the overall height of both units together is 8 feet. If the truck had a headboard only two 50 mm (2 in) or greater tiedowns would be required over each tier. **Scenario #4** *Option #1*: ♦ Place five bundles on the trailer deck. ♦ 2 are side by side in the front against a header board. ♦ A single bundle is placed down the trailer centerline butting against the front 2 bundles. ♦ The rear 2 bundles will butt against the middle bundle. ♦ The second tier will have 2 bundles on friction mats directly over the front 2 bundles. ♦ The remaining 2 bundles will be over the rear 2 lower bundles, with friction mats between. (continued next page)

Lesson Plan	Instructor Notes
	♦ Tiedowns will be webbing: - Two 100 mm (4 in) for the front 4 bundles - Two 50 mm (2 in) for middle - Three 100 mm (4 in) for rear 4 bundles. *Option #2*: ♦ Front loaded the same as option #1. ♦ Middle bundles are same configuration. ♦ Rear is the single bundle. ♦ The tiedowns are two 100 mm (4 in) for front, same for middle, and two 50 mm (2 in) for rear bundle. **Scenario #5** *Option #1*: Secure laterally against a header board with one 50 mm (2 in) web for securement. *Option #2*: Secure carried in a van, blocked by other freight. Inspection Checklist: - Proper amount of securement in WLL - Proper spacer dimensions - Proper tiedown locations - Required number of tiedowns - Defective tiedowns - Loose tiedown.

Securing Dressed Lumber and Bundled Building Materials

In a small group, determine a safe securement system for the following load of dressed lumber. Consider the bundle loading orientation and the number, placement, and type of cargo securement device. Create a checklist of securement requirements that you would use to ensure that the bundles are safely secured.

Scenario #1: Four bundles of wallboard are to be delivered to a customer by the use of a flatbed truck. Each bundle weighs 907 kg (2,000 lb.) and is 1.22 m (4 ft) x 2.44 m (8 ft).

Loading Requirements	Number, Placement, Type of Cargo Securement Device	Inspection Checklist

Securing Dressed Lumber and Bundled Building Materials

Scenario #2: This load of random length green fir 2x4's is shipped loaded on a 16.15 m (53 ft) flat bed trailer without a headboard. All units are 1.22 m (4 ft) wide and 0.76 m (30 in) tall.

1 unit 2.44 m (8 ft) @ 2,800 lbs

1 unit 3.05 m (10 ft) @3,400 lbs

2 units 3.66 m (12 ft) @4,200 lbs

2 units 4.27 m (14 ft) @ 4,900 lbs

2 units 4.88 m (16 ft) @ 5,300 lbs

1 unit 5.49 (18 ft) @ 5,700 lbs

1 unit 6.1 m (20 ft) @6,200 lbs.

10 units in all that weigh a total of 21,273 kg (46,900 lb.).

Loading Requirements	Number, Placement, Type, of Cargo Securement Device	Inspection Checklist

Securing Dressed Lumber and Bundled Building Materials

Scenario #3: 2 bundles of 2x12's, 6.1 m (20 ft) long by 1.83 m (6 ft) wide and 1.22 m (4 ft) high. Bundle weight is 3401 kg (7,500 lb.).		
Loading Requirements	Number, Placement, Type, of Cargo Securement Device	Inspection Checklist

Securing Dressed Lumber and Bundled Building Materials

Scenario #4: Nine bundles of 6x6's, 4.88 m (16 ft) long by 1.22 m (4 ft) x 1.22 m (4 ft). Bundle weight is 1814 kg (4,000 lb.).		
Loading Requirements	Number, Placement, Type, of Cargo Securement Device	Inspection Checklist

Securing Dressed Lumber and Bundled Building Materials

Scenario #5: One bundle of 2x4's, 2.44 m (8 ft) long. Bundle size is 1.22 m (4 ft) x 1.22 m (4 ft). Weight is 907 kg (2,000 lb.)		
Loading Requirements	Number, Placement, Type, of Cargo Securement Device	Inspection Checklist

Lesson Plan	Instructor Notes

Summary

Ask the participants:

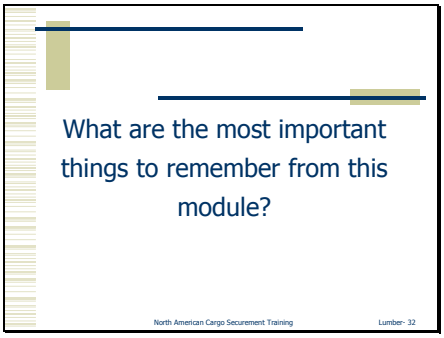
> What are the most important things to remember from this module?

Tell the participants that they now know:

- The securement system requirements for dressed lumber and similar bundled building materials
  - Bundle <u>must</u> stay in unit
  - <u>Must</u> prevent forward and horizontal movement
  - <u>Must</u> prevent sliding and tipping
- The securement requirements for this module apply for all lumber and building materials that are packaged in bundles.

Summarize the lesson on Dressed Lumber, recapping what the participants just learned.

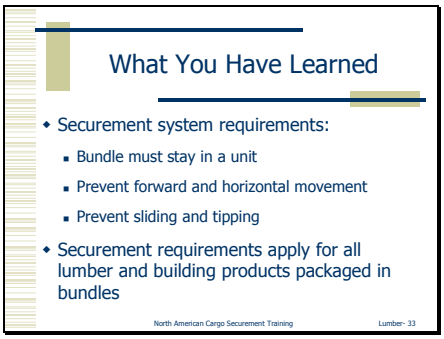
Show Slide Lumber-32.

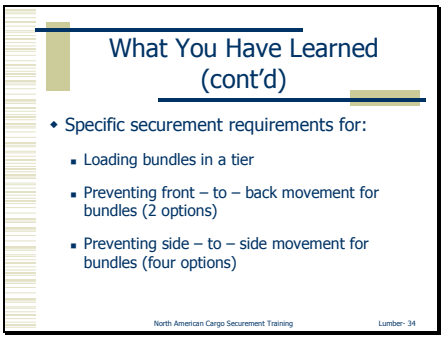


Record participants' responses on an easel pad.

Use the final slides to review the important points.

Show Slide Lumber-33.



Lesson Plan	Instructor Notes
Tell the participants that they also now know specific securement requirements for: ◆ Loading bundles in a tier ◆ Preventing front – to – back movement for bundles (2 options) ◆ Preventing side – to – side movement for bundles (4 options)	Show Slide Lumber-34. 

Module Overview

Module 5: Metal Coils

Learning Objectives

At the completion of the training, participants will be able to:

- Describe how the cargo securement principles apply to metal coils
- Determine what is required to properly load and secure metals coils, including the metal coil orientation and the number, placement, and types of cargo securing devices
- Identify securement systems that are not in compliance.

Time Required

1 hour 50 minutes

Topics

1. Overview and Learning Objectives
2. Principles for Securing Metal Coils
3. Application
4. Securement of Coils Transported on a Flatbed, in a Sided Vehicle, or in an Intermodal Container with Anchor Points
5. Group Activity: Securing Metal Coils with Eyes Loaded Vertical
6. Securement of Coils Transported in Sided Vehicles or Intermodal Containers without Anchor Points
7. Summary

Training Methods

1. Participative lecture
2. Group activity (Small group exercises)

Participant Materials

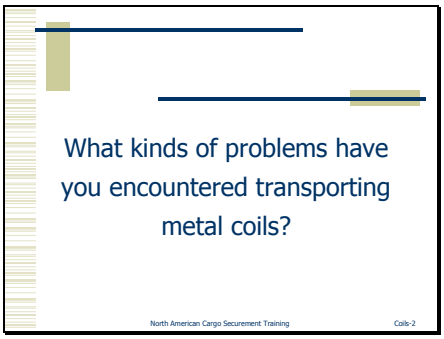
1. Participant Manual
2. Driver's Handbook on Cargo Securement

Training Materials

1. Instructor Guide
2. PowerPoint slides and projection system
3. Easel pad and markers
4. Participant materials

Instructor Notes

Metal Coils

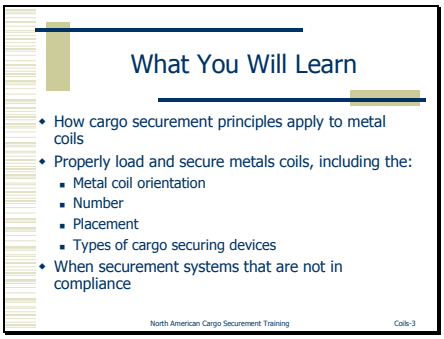
Lesson Plan	Instructor Notes
Overview and Learning Objectives	*5 minutes*
Tell the participants that you are going to talk about securement for metal coils.	Explain the objectives of the training. Show Slide Coils-1.
Ask the participants: What kinds of problems have you encountered transporting metal coils?	Show Slide Coils-2.  Record the problems on easel pad. Make sure problems are addressed during the module.

Lesson Plan	Instructor Notes

Tell participants that, at the completion of training, they will be able to:

- Describe how the cargo securement principles apply to metal coils
- Determine what is required to properly load and secure metals coils, including the:
  - Metal coil orientation
  - Number
  - Placement
  - Types of cargo securing devices.
- Identify securement systems that are not in compliance.

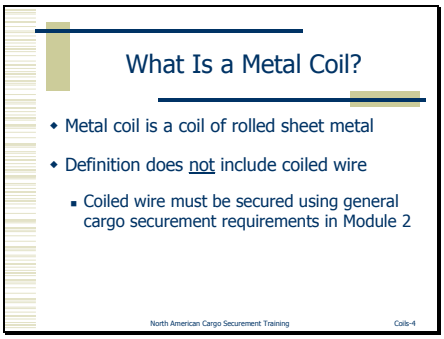
Show Slide Coils-3.



What is a metal coil?

Explain that a metal coil is defined as a coil of rolled sheet metal. This definition does not include coiled wire. Coiled wire must be secured using the general cargo securement requirements in Module 2 (General Cargo Securement Requirements: Equipment and Methods).

Show Slide Coils-4.



Lesson Plan	Instructor Notes

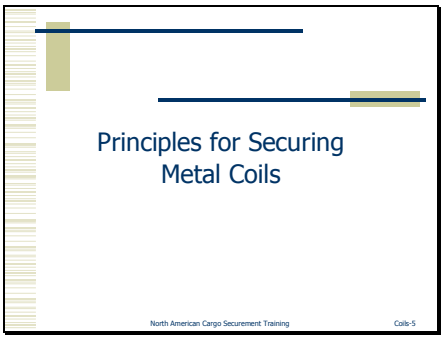
Principles for Securing Metal Coils

Tell the participants that you are now going to talk about the principles for securing metal coils.

5 minutes

Explain the principles for securing metal coils.

Show Slide Coils-5.



Metal Coils: characteristics and failure modes

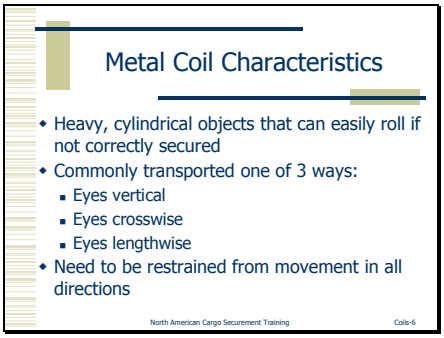
Explain to participants that metal coils are heavy, cylindrical objects that can easily roll if they are not correctly secured.

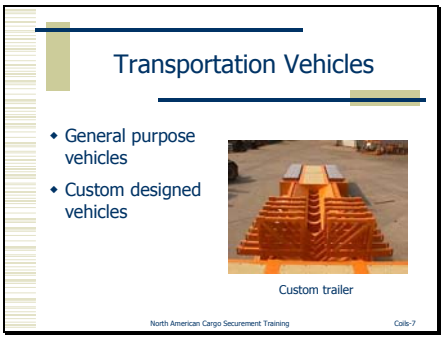
Tell the participant that there are 3 common orientations for transporting coils:

- Eyes vertical
- Eyes crosswise
- Eyes lengthwise.

Explain that, for highway transport, metal coils need to be restrained from forward, rearward, and sideways movement (see Module 1,The Standard and Basic Physics Principles).

Show Slide Coils-6.



Lesson Plan	Instructor Notes
Tell them that there are custom designed vehicles for transporting metal coils, but industry also uses general purpose vehicles for transport.	Show Slide Coils-7. 
Explain that the sliding, rolling, and tipping of coils are the failure modes for metal coil securement. **Tell** the participants they need to design a securement system to prevent these failure modes.	Show Slide Coils-8.
	Return to the list generated from the opening question listing the types of problems the participants have had in securing metal coils. Tell participants that they will now learn how to avoid these problems by planning a securement system.

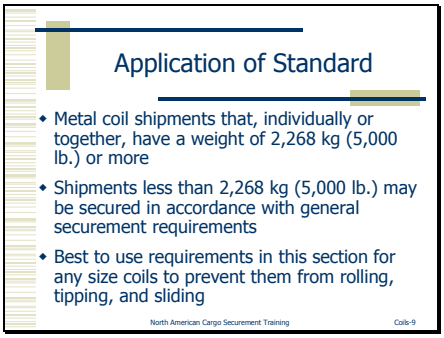
Lesson Plan	Instructor Notes

Application

2 minutes

Explain the application of the Standard.

Show Slide Coils-9.



Explain to participants that the requirements in this module apply to metal coil shipments that, individually or together, have a weight of 2,268 kg (5,000 lb.) or more.

Explain that shipments that weigh less than 2,268 kg (5,000 lb.) may be secured in accordance with the general securement requirements (Module 2, General Cargo Securement Requirements: Equipment and Methods). However, it is best to use the requirements in this section for any size coils to prevent them from rolling, tipping, and sliding.

Lesson Plan	Instructor Notes

Securement of Coils Transported on a Flatbed, in a Sided Vehicle, or in an Intermodal Container with Anchor Points

45 minutes

Explain the securement requirements for coils transported on a flatbed, in a sided vehicle, or in an intermodal container with anchor points.

Refer participants to the correct section in the Driver's Handbook on Cargo Securement so that they become familiar with it.

Tell participants that the following securement requirements are for metal coils transported:

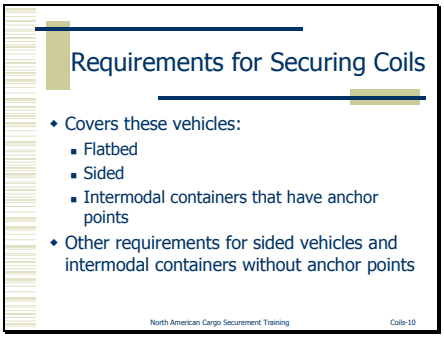
- On flatbed vehicles
- In sided vehicles with anchor points
- In intermodal containers with anchor points.

Say that securement requirements for sided vehicles or intermodal containers without anchor points are covered at the end of this module.

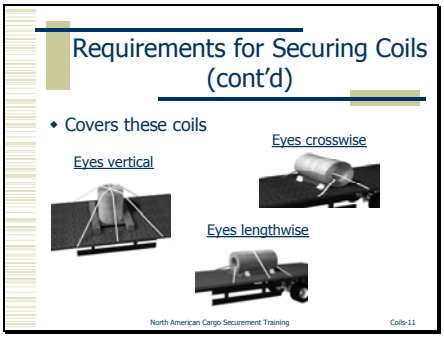
Say that you will be talking about:

- Coils with eyes vertical
- Coils with eyes crosswise
- Coils with eyes lengthwise.

Show Slide Coils-10.



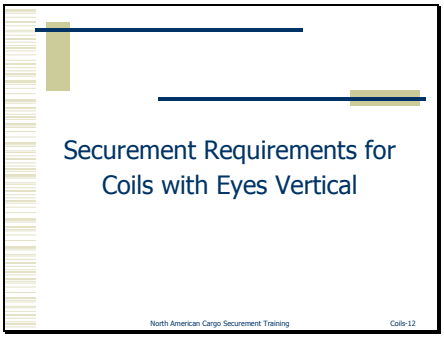
Show Slide Coils-11.



Lesson Plan	Instructor Notes

Securement requirements for coils with eyes vertical

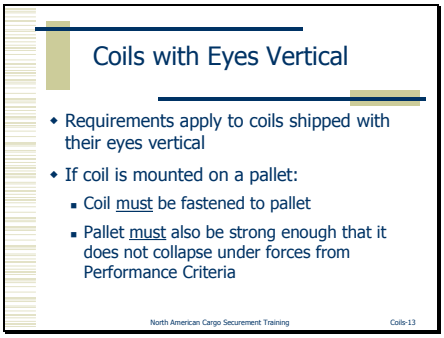
Show Slide Coils-12.



Explain to participants that this section applies to coils shipped with their eyes vertical. If the coil is mounted on a pallet:

- The coil <u>must</u> be fastened to the pallet so that it may not move on the pallet.
- The pallet <u>must</u> also be strong enough so it may not collapse under the forces from the Performance Criteria (See Module #1, The Standard and Basic Physics Principles).

Show Slide Coils-13.

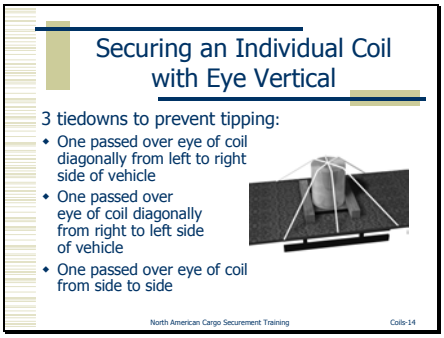


<u>Securing an Individual Coil with Eyes Vertical</u>

Explain to participants that tiedowns <u>must</u> be arranged in the following manner to prevent the coils from tipping in the forward, rearward, and side-to-side directions:

1. At least one tiedown passed diagonally over the eye of the coil from the left side of the vehicle, across to the right side of the vehicle
2. At least one tiedown passed diagonally over the eye of the coil from the right side of the vehicle, across to the left side of the vehicle
3. At least one tiedown passed over the eye of the coil from side-to-side

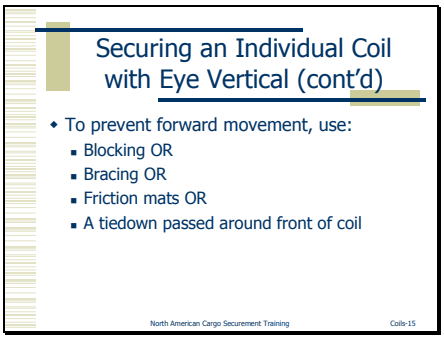
Show Slide Coils-14.



Lesson Plan	Instructor Notes

4. Either blocking, bracing, friction mats, or a tiedown passed around in front of the coil <u>must</u> be used to prevent forward movement.

Show Slide Coils-15.



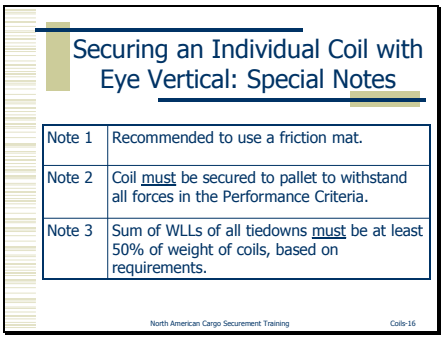
Explain the following notes to the participants:

Note 1: It is also recommended to use a friction mat.

Note 2: The coil <u>must</u> be secured to the pallet to withstand all the forces in the Performance Criteria in Module #1, The Standard and Basic Physics Principles.

Note 3: The sum of the Working Load Limits of all tiedowns <u>must</u> be at least 50% of the weight of the coils, based on the requirements from Module 2, General Cargo Securement Requirements: Equipment and Methods.

Show Slide Coils-16.



Lesson Plan	Instructor Notes

Securing Rows of Coils

Explain to participants that coils transported in rows must be secured by:

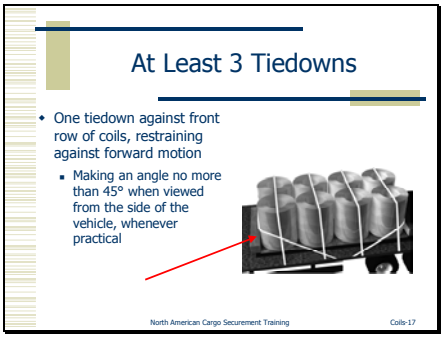
1. At least one tiedown against the front of the row of coils, restraining against forward motion, making an angle with the floor no more than 45° whenever practical, when viewed from the side of the vehicle

2. At least one tiedown against the rear of the row of coils, restraining against rearward motion, making an angle with the floor no more than 45° whenever practical, when viewed from the side of the vehicle

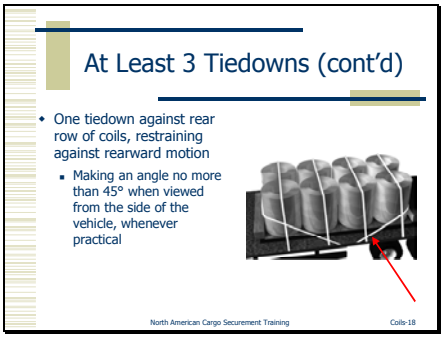
3. At least one tiedown passed over the top of each coil or side-by-side row of coils, restraining against vertical motion. Tiedowns passing over the top of a coil(s) must be as close as possible to the eye of the coil.

Explain that tiedowns must be arranged to prevent shifting or tipping in all directions.

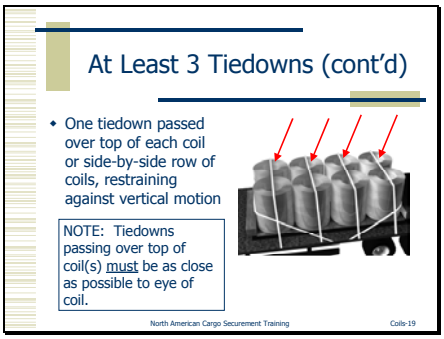
Show Slide Coils-17.



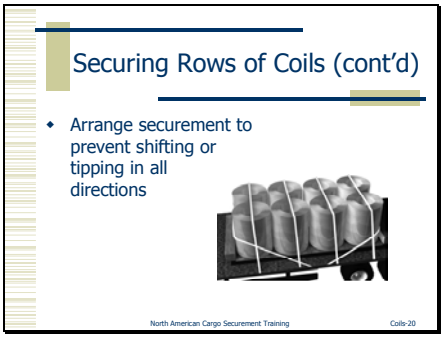
Show Slide Coils-18.



Show Slide Coils-19.



Show Slide Coils-20.

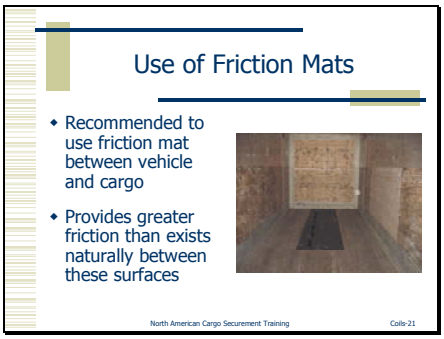


Lesson Plan	Instructor Notes

Use of Friction Mats

Explain to participants that it is recommended to use a friction mat or other friction-enhancing device if friction is low. A friction mat is a device placed between the deck of a vehicle and cargo, or between articles of cargo, to provide greater friction than exists naturally between these surfaces.

Show Slide Coils-21.



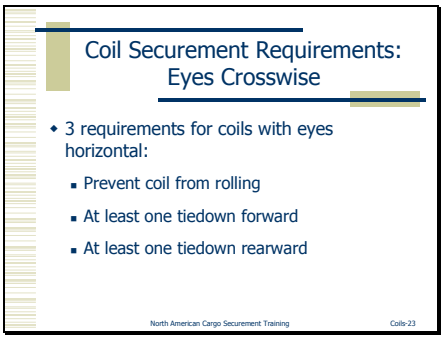
Requirements for coils with eyes crosswise

Show Slide Coils-22.

Explain that there are 3 requirements for coils with eyes crosswise:

1. Prevent the coil from rolling
2. At least one tiedown forward
3. At least one tiedown rearward

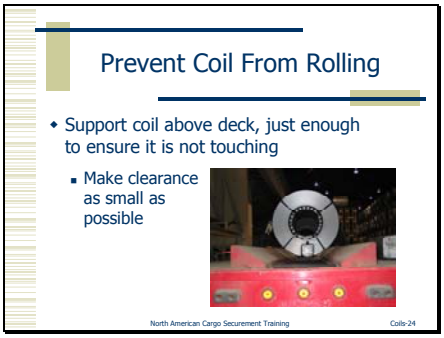
Show Slide Coils-23.

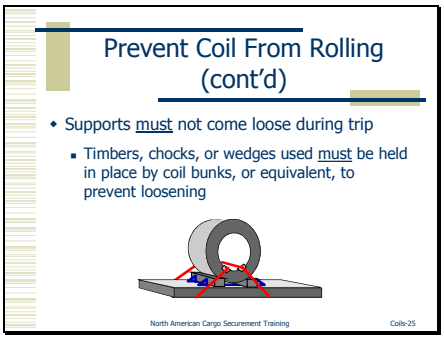
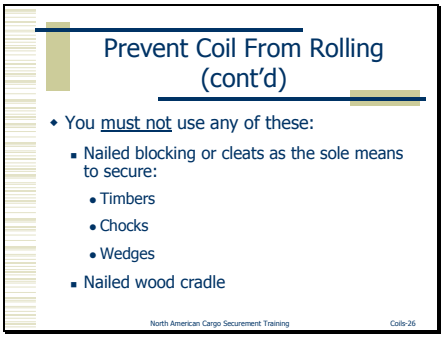
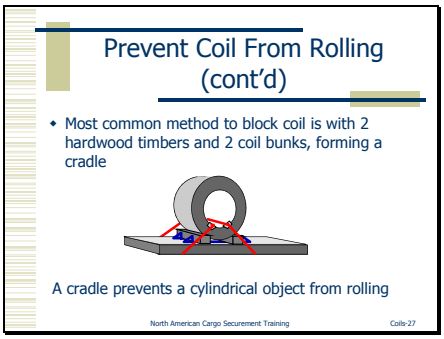


Prevent the coil from rolling

Say that you prevent the coil from rolling by supporting it. The coil must be supported above the deck, just enough to make sure that it is not touching the deck. The clearance should be as small as possible.

Show Slide Coils-24.



Lesson Plan	Instructor Notes
Explain to participants that the coil supports must be held in place so they do not become loose during a trip. ◆ If timbers, chocks, or wedges are used, they must be held in place by coil bunks or similar devices to prevent them from coming loose.	Show Slide Coils-25. 
◆ You must not use any of these: – Nailed blocking or cleats as the sole means to secure timbers, chocks, or wedges – A nailed wood cradle.	Show Slide Coils-26. 
Tell participants that the most common method to support a coil is with 2 hardwood timbers and 2 coil bunks, forming a cradle. A cradle prevents a cylindrical object from rolling.	Show Slide Coils-27. 

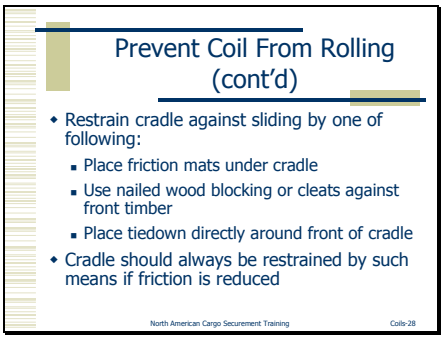
Lesson Plan	Instructor Notes

Explain that the cradle can be restrained against sliding by one of the following means:

- Place friction mats under the cradle
- Use nailed wood blocking or cleats against the front timber
- Place a tiedown directly around the front of the cradle.

Say that the cradle should always be restrained by such means if friction is reduced, such as when the deck or the coil is soaked with oil.

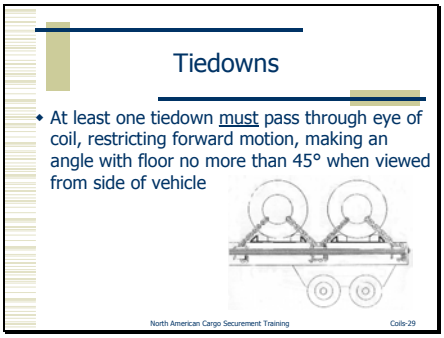
Show Slide Coils-28.



Tiedowns

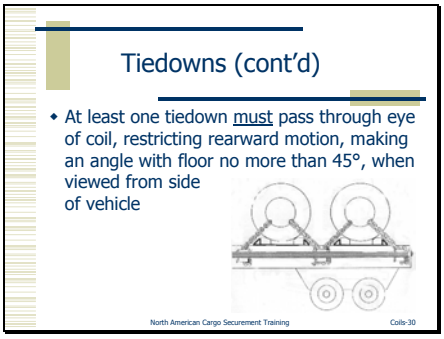
Tell participants that at least one tiedown must pass through the eye of the coil, restricting forward motion, making an angle with the floor no more than 45° when viewed from the side of the vehicle, whenever practical.

Show Slide Coils-29.



Tell participants that at least one tiedown must pass through the eye of the coil, restricting rearward motion, making an angle with the floor no more than 45° when viewed from the side of the vehicle, whenever practical.

Show Slide Coils-30.



Lesson Plan

Explain that chains should be used for tiedowns through the coil. A tiedown like synthetic webbing should not be used since it is too flexible for this purpose and because it can be cut.

Explain to participants that, if more than 2 chains are required, they should be placed symmetrically on either side of the coil. If an odd number of chains are required, there should be greater number pulling toward the rear.

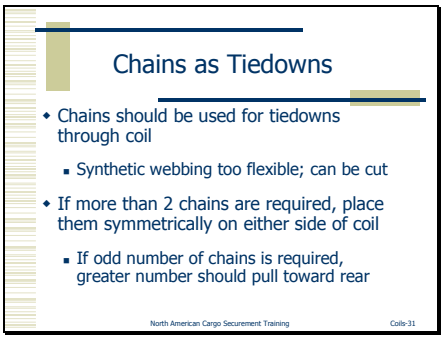
Tell participants that attaching tiedowns diagonally through the eye of a coil to form an X-pattern when viewed from above the vehicle is prohibited.

Ask the participants:

> Why can't you attach tiedowns diagonally through the eye of a coil to form an X-pattern?

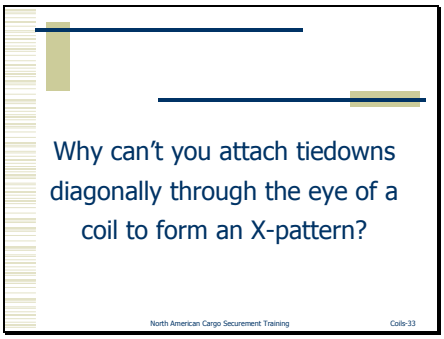
Instructor Notes

Show Slide Coils-31.



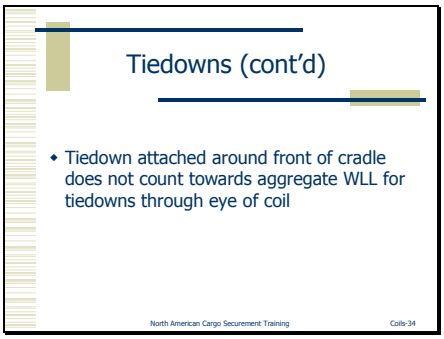
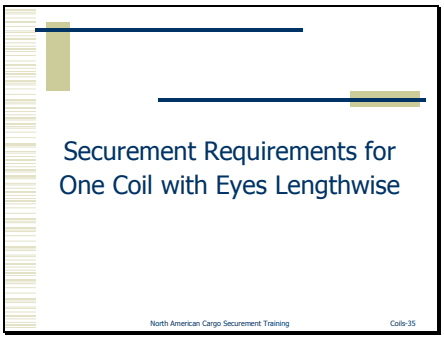
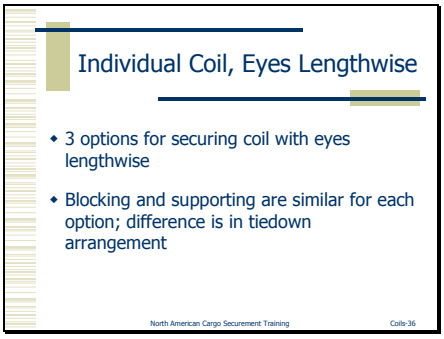
Show Slide Coils-32.

Show Slide Coils-33.



Suggested responses:

Effect of preventing forward or rearward movement is drastically reduced.

Lesson Plan	Instructor Notes
Tell the participants that, if a tiedown is attached around the front of the cradle, it does not count towards the aggregate working load limit for tiedowns through the eye of the coil.	Show Slide Coils-34. 
Securement requirement of coils with eyes lengthwise **Tell** participants that you are now going to talk about the securement requirements of coils with eyes lengthwise, starting with the requirements for an individual coil.	Show Slide Coils-35. 
<u>Securing Individual Coils with Eyes Loaded Lengthwise</u> **Tell** participants that there are 3 options for securing individual coils that are loaded with eyes lengthwise. **Tell** them that: ◆ Blocking and supporting the coils is the same in the 3 options and similar to the requirements for coils loaded eyes crosswise ◆ Difference is in the tiedown arrangement	Show Slide Coils-36. 

Lesson Plan	Instructor Notes

Option #1 Step 1: Prevent the Coil from Rolling

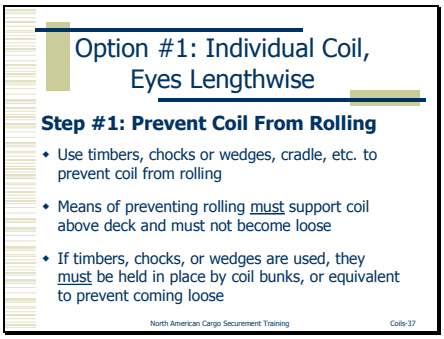
Explain to participants that they need to use a means (e.g., timbers, chocks or wedges, a cradle, etc.) to prevent the coil from rolling.

Tell participants that the means of preventing rolling must support the coil off the deck. It must not be capable of becoming unfastened or loose while the vehicle is in transit.

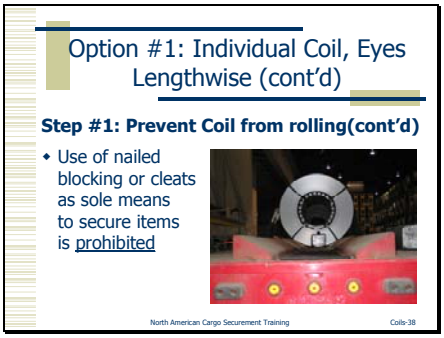
Explain that, if timbers, chocks, or wedges are used, they must be held in place by coil bunks or similar devices to prevent them from coming loose.

Say that the use of nailed blocking or cleats as the sole means to secure timbers, chocks, or wedges, or a nailed wood cradle, is prohibited.

Show Slide Coils-37.



Show Slide Coils-38.

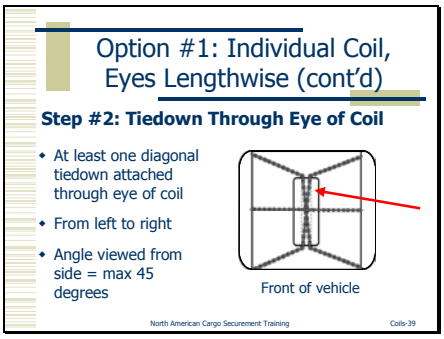


Option #1 Step 2: Tiedowns Through Eye of Coil

Tell participants that there must be at least one tiedown attached diagonally through its eye:

- From the left side of the vehicle or intermodal container (near the forward-most part of the coil)
- To the right side of the vehicle or intermodal container (near the rearmost part of the coil)
- Making an angle no more than 45 degrees, whenever practicable, with the floor of the vehicle or intermodal container
  - When viewed from the side of the vehicle or container.

Show Slide Coils- 39.



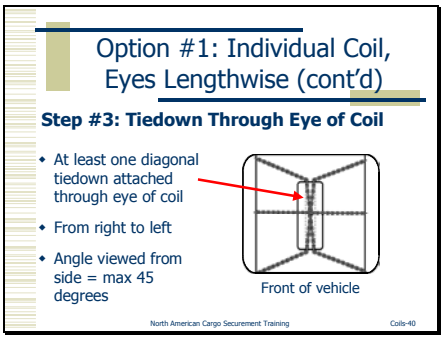
Lesson Plan	Instructor Notes

Option #1 Step 3: Tiedowns Through Eye of Coil

Tell participants that there must be at least one tiedown attached diagonally through its eye:

- From the right side of the vehicle or intermodal container (near the forward-most part of the coil)
- To the left side of the vehicle or intermodal container (near the rearmost part of the coil)
- Making an angle no more than 45 degrees, whenever practicable, with the floor of the vehicle or intermodal container
  - When viewed from the side of the vehicle or container.

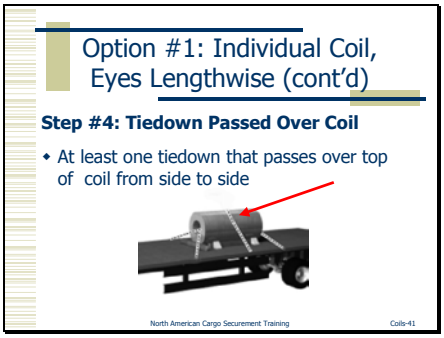
Show Slide Coils-40.



Option #1 Step 4: Tiedowns Passed Over Coils

Tell participants that there must be at least one tiedown that passes over the top of the coil from side to side.

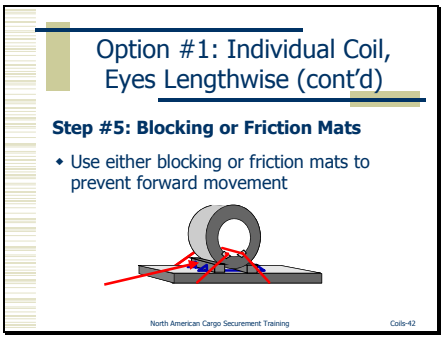
Show Slide Coils-41.



Option #1 Step 5: Blocking or Friction Mats

Tell participants to use either blocking or friction mats to prevent forward movement.

Show Slide Coils-42.

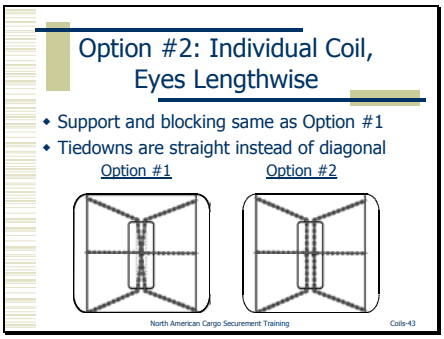


Lesson Plan	Instructor Notes

Option #2

Tell participants that Option #2 is the same as Option #1, except the tiedowns that are directly attached to the coils are straight instead of diagonal. Again the angle should be no more than 45 degrees, whenever practicable, with the floor of the vehicle or intermodal container.

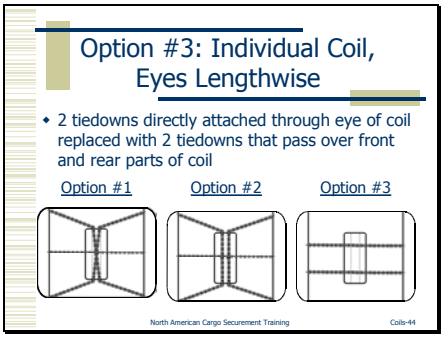
Show Slide Coils-43.



Option #3

Tell the participants that Option #3 is the same as Option #1 and #2, except the 2 tiedowns that are attached through the coils are replaced with 2 tiedowns that pass over the front and rear parts of the coil.

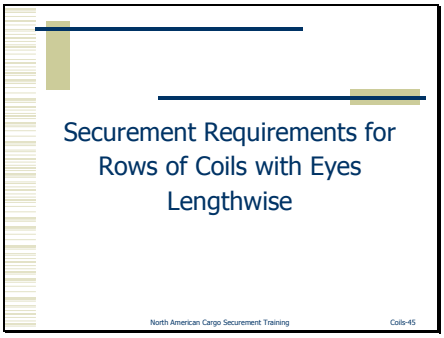
Show Slide Coils-44.



Lesson Plan	Instructor Notes

Securing Rows of Coils with Eyes Loaded Lengthwise

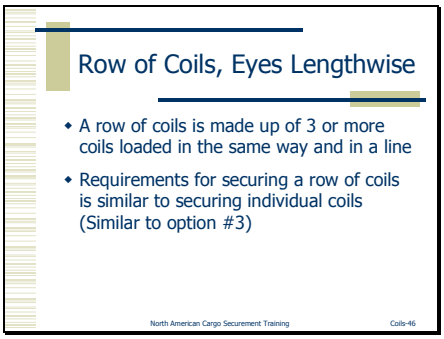
Show Slide Coils-45.



Explain that a row of coils is made up of 3 or more coils loaded in the same way and in a line.

Say that securing a row of coils is similar to the 3rd option for securing an individual coil.

Show Slide Coils-46.



Step #1: Prevent the Coil from Rolling

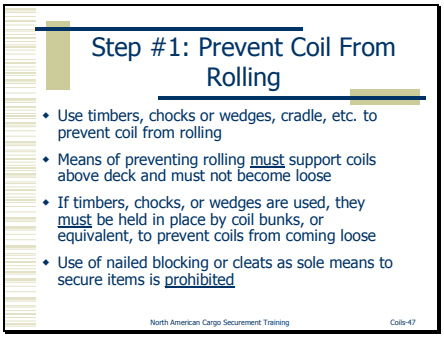
Explain to participants that they need to use a means (e.g., timbers, chocks or wedges, a cradle, etc.) to prevent the coil from rolling.

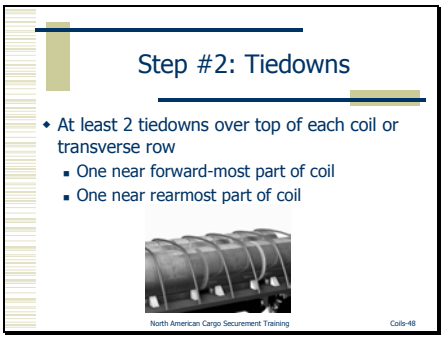
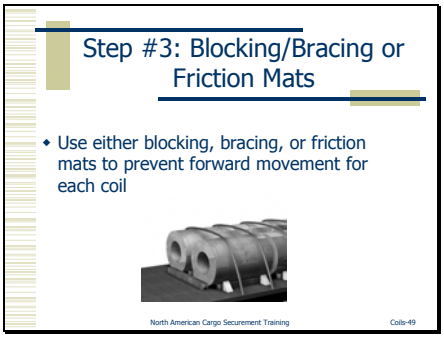
Tell participants that the means of preventing rolling must support the coil off the deck, and must not be capable of becoming unfastened or loose while the vehicle is in transit.

Explain that, if timbers, chocks, or wedges are used, they must be held in place by coil bunks or similar devices to prevent them from coming loose.

Tell participants that the use of nailed blocking or cleats as the sole means to secure timbers, chocks or wedges, or a nailed wood cradle, is prohibited.

Show Slide Coils-47.



Lesson Plan	Instructor Notes
Step #2: Tiedowns **Tell** the participants that at least 2 tiedowns are required: ◆ One over the top of each coil or transverse row, located near the forward-most part of the coil ◆ Over the top of each coil or transverse row, located near the rearmost part of the coil.	Show Slide Coils-48. 
Step #3: Blocking/Bracing or Friction Mats **Tell** participants to use either blocking, bracing, or friction mats to prevent forward movement for each coil.	Show Slide Coils-49. 

Lesson Plan	Instructor Notes

Group Activity: Securing Metal Coils with Eyes Loaded Vertical

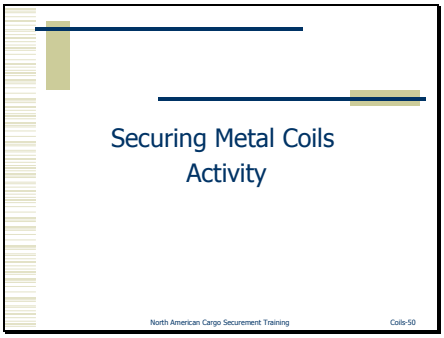
Tell participants they are now going to work in groups on a brief activity for securing metal coils.

Tell participants that they can use the Driver's Handbook on Cargo Securement to complete the activity.

25 minutes

Break into small groups and review instructions: 5 minutes
Small groups complete activity: 10 minutes
Report out: 5 minutes

Show Slide Coils-50.



The purpose of this activity is to help the participants get a better understanding of how to secure metal coils. They will discuss the requirements and the number, placement, and type of cargo securing devices necessary.

Turn to the page following the instructions to see the Securing Metal Coils activity worksheet.

Break the participants up into 5 groups. Have the participants turn to the Securing Metal Coils activity worksheet. Read the directions to the participants. Give them 10 minutes to complete the activity.

Lesson Plan	Instructor Notes
	Walk around during the activity and make sure that participants are selecting the correct securement system. When participants have completed their work, have each group present the answer to their scenario. - Read the scenario - Describe the securement system chosen - Name the items on their inspection checklist As each group reports its checklist items, the instructor will record the items on the easel pad. At the conclusion of the activity, you will have created a generic checklist for everyone. After a group has presented its securement system, ask another group to use its inspection checklist to determine if the securement system is safe.

Lesson Plan	Instructor Notes
	Answers: **<u>Scenario #1</u>** <u>Option #1</u>: Refuse to transport this size and weight of coil loaded in this position. <u>Option #2</u>: ♦ Use G70 10 mm (3/8 in) chain for all tiedowns. ♦ Attach one tiedown diagonally from left front of trailer over the top of coil to right rear of trailer. ♦ Attach one tiedown from right front diagonally over the top of coil to left rear of trailer. ♦ Attach one tiedown transversely over the coil. ♦ Place a friction mat under the coil. ♦ Attach a tiedown to the coil to prevent longitudinal movement in the forward direction.

Lesson Plan	Instructor Notes
	Scenario #2 Option #1: ♦ Coils are loaded in 2 rows of 2 each. ♦ Coils sit on friction mats. ♦ Coils are unitized by use of four G7 10 mm (3/8 in) chains. ♦ Two G7 10 mm (3/8 in) chains are placed over each row and attached to anchor points on each side of the trailer. ♦ One 16 mm (5/8 in) chain over each row of coils will also meet the requirement. ♦ One G7 10 mm (3/8 in) chain wraps around front of coils to prevent forward movement ♦ One G7 10 mm (3/8 in) chain wraps around rear coils to prevent rearward movement. Option #2: ♦ Coils are loaded in a single row. ♦ Coils sit on friction mats. ♦ Devices are placed on the upper coil side edges to unitize the 4 coils. ♦ A G7 10 mm (3/8 in) chain is placed over each coil. ♦ A G7 10 mm (3/8 in) chain is placed around the front and another G7 10 mm (3/8 in) chain is placed around the rear of the coils to prevent forward and rearward movement.

Lesson Plan	Instructor Notes
	<u>Scenario #3</u> <u>Option #1:</u> ♦ Coil is loaded onto trailer with eye lengthwise. ♦ Coil is mounted in a cradle consisting of 3 coil racks with 6x6-beveled timber to hold coil off trailer deck. ♦ Friction mats are placed under bunks and between coil and timbers. ♦ Two G7 10 mm (3/8 in) chains are crisscrossed through the coil eye. ♦ A 100 mm (4 in) 1810 kg (4000 lb.) web is placed over the coil and attached to anchor points at each side of the trailer. <u>Option #2:</u> ♦ Coil is loaded crosswise. ♦ Coil is mounted on 6x6-beveled timbers in 3 coil racks. ♦ The coil bunks sit on friction mats. ♦ Two G7 8 mm (5/16 in) chains are placed through the coil eye, securing front of coil. ♦ Two G7 8 mm (5/16 in) chains are placed through the coil eye, securing rear of the coil. ♦ The front and rear chains are parallel through the coil eye and are fastened to anchor points. ♦ The chains have angle of less than 45 degrees to the trailer deck.

Lesson Plan	Instructor Notes
	Scenario #4 Option #1: ♦ Load single row of coils loaded longitudinal. ♦ All coils are mounted on 4x4-beveled timbers in coil bunks. ♦ The front coil is blocked by the use of a 6x6 timber bearing against the trailer front-end structure. ♦ The timber is secured to the trailer deck. ♦ Each of the other coils bears against the coil in front, which provides blocking against forward movement. ♦ Two 75 mm (3 in) 1360 kg (3000 lb.) webbing placed over each coil, secured to anchor points on trailer sides. Option #2: ♦ Load row of 4 coils, mounted crosswise. ♦ All coils are mounted on 4x4-beveled timbers, which are mounted in coil bunks. ♦ Each coil has 2 G7 10 mm (3/8 in) chain used for securement. ♦ The chains are parallel through the coil eye.

Lesson Plan	Instructor Notes
	Scenario #5: ♦ Use 6x6 beveled timbers in 4 coil racks. ♦ Use edge protectors for all chains. ♦ Use 4 G7 10 mm (3/8 in) chains through coil eye, two on each side, forming an X pattern through the eye. ♦ Use one 100 mm (4 in) web having 1810 kg (4000 lb.) over the top of the coil, attached to anchor points at each side of the trailer. ♦ One G7 10 mm (3/8 in) chain wrapped around a vertical 6x6 timber in front of coil. ♦ End of chain is be anchored behind coil to prevent forward movement. ♦ Friction mat is placed between trailer deck and coil bunks and between coil and timbers. Additional checklist item: Ensure that the vehicle is capable of carrying this concentrated weight. Some trailers do have spec plates for concentrated loads. Look for it.

Lesson Plan	Instructor Notes
	<u>Inspection Checklist for All Scenarios</u> - Freight bill for coil weight - Edge protectors - Tiedown within rubrails - Tiedown angles of less than 45 degrees for tiedown attached to cargo, wherever possible - Tiedown angles as close to 90 degrees for tiedown that passes over cargo, wherever possible - Defective tiedown - Vehicle structure capable of carrying load - Defective vehicle anchor points - Tiedown strength rating - Load binder strength rating - Defective timbers - Coils loaded above the trailer deck, in cradle - Load binders, handles secured to prevent releasing

Securing Metal Coils

In small groups, determine how to secure the following loads of metal coils. Consider the loading orientation and the number, placement, and type of cargo securing devices. Create a checklist of securement requirements that you would use to ensure the loads of metal coils are safely secured.

Scenario #1: A 13,600 kg (30,000 lb.) steel coil that is 1.85 m (6 ft) long and 1.25 m (4 ft) in diameter is to be transported on a flatbed semi-trailer. The purchaser insists that the coil must be shipped with the eye vertical.

Loading Requirements	Number, Placement, Type of Cargo Securement Device	Inspection Checklist

Metal Coils
Securing Metal Coils with Eyes Loaded Vertical

Scenario #2: Four steel coils, each weighing 4,500 kg (10,000 lb.) and which are 1.5 m (5 ft) long and 1 m (3 ft) in diameter are to be transported on a flatbed. Again the purchaser wants the eyes to be vertical.

Loading Requirements	Number, Placement, Type, of Cargo Securement Device	Inspection Checklist

Securing Metal Coils

Scenario #3: A 13,600 kg (30,000 lb.) steel coil that is 1.85 m (6 ft) long and 1.25 m (4 ft) in diameter is to be transported on a flatbed semi-trailer with an oily deck. The purchaser insists that the coil must be shipped with the eye horizontal.

Loading Requirements	Number, Placement, Type of Cargo Securement Device	Inspection Checklist

Securing Metal Coils

Scenario #4: Four steel coils, each weighing 4,500 kg (10,000 lb.) and are 1.5 m (5 ft) long and 1 m (3 ft) in diameter are to be transported on a flatbed with an oily deck. Again the purchaser wants the eyes to be horizontal.

Loading Requirements	Number, Placement, Type, of Cargo Securement Device	Inspection Checklist

Securing Metal Coils

Scenario #5: A 50,000lb. master coil will be shipped on a platform vehicle, equipped with anchor points. The coil eye will be lengthwise on the trailer.		
Loading Requirements	Number, Placement, Type, of Cargo Securement Device	Inspection Checklist

Lesson Plan	Instructor Notes

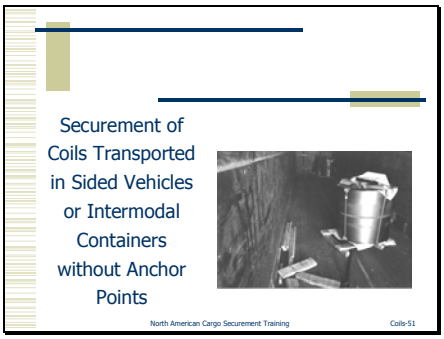
Securement of Coils Transported in Sided Vehicles or Intermodal Containers without Anchor Points

5 minutes

Tell participants that the following securement requirements are for metal coils transported in sided vehicles or intermodal containers without anchor points.

Discuss the securement of coils transported in sided vehicles or intermodal containers without anchor points.

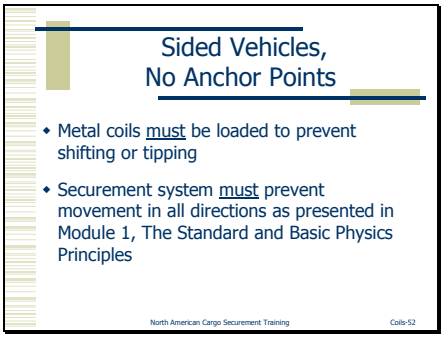
Show Slide Coils-51.

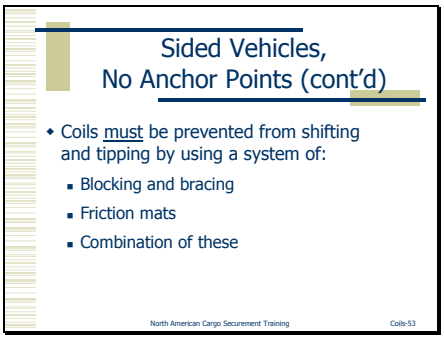


Explain to participants that, when metal coils are transported in sided vehicles or in intermodal containers, the coils must be loaded in such a way that they do not shift or tip.

Tell participants that the securement system must prevent movement in all directions as presented in Module 1, The Standard and Basic Physics Principles.

Show Slide Coils-52.



Lesson Plan	Instructor Notes
The coils may be secured by using a system of: ◆ Blocking and bracing ◆ Friction mats ◆ Combination of these.	Show Slide Coils-53.  Discuss with participants securement systems that they have used.

Lesson Plan	Instructor Notes

Summary

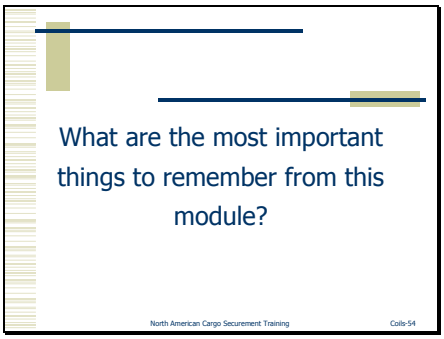
Ask the participants:

> What are the most important things to remember from this module?

5 minutes

Summarize the lesson on Metal Coils, recapping what the participants just learned.

Show Slide Coils-54.



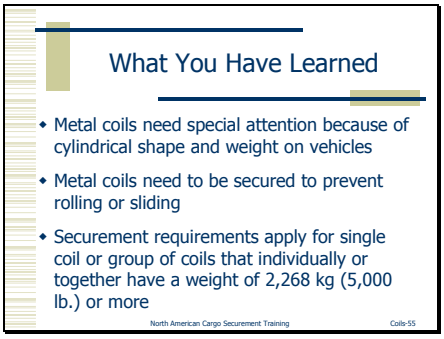
Record participants' responses on an easel pad.

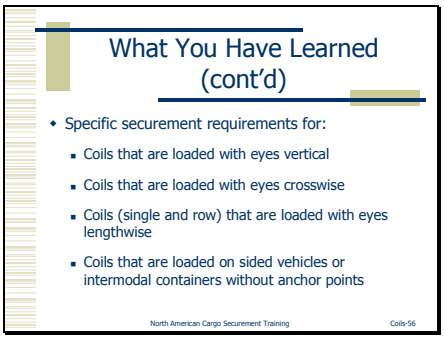
Use the final slides to review the important points.

Recap by telling participants that they now know that:

- Metal coils need special attention because of the cylindrical shape, and heavy concentration of weight on vehicles.
- Metal coils need to be secured to prevent from rolling or sliding.
- The securement requirements in this module apply for a single coil or a group of coils that individually or together have a weight of 2,268 kg (5,000 lb.) or more. Lighter coils can also be secured using these requirements.

Show Slide Coils-55.



Lesson Plan	Instructor Notes
Tell them that there are specific tiedown requirements for metal coils when: ◆ Coils that are loaded with eyes vertical ◆ Coils that are loaded with eyes crosswise ◆ Coils that are loaded with eyes lengthwise ◆ Coils that are loaded on sided vehicles or intermodal containers without anchor points	Show Slide Coils-56. 

Module Overview

Module 6: Paper Rolls

Learning Objectives

At the completion of the training, participants will be able to:

- Describe how the cargo securement principles apply to paper rolls
- Determine what is required to properly load and secure paper rolls, based on their orientation in the vehicle and the loading pattern used
- Identify securement systems that are not in compliance

Time Required

1 hour 25 minutes

Topics

1. Overview and Learning Objectives
2. Principles for Securing Paper Rolls
3. Application
4. Securement Requirements for Loading and Securing Paper Rolls with Eyes Vertical in a Sided Vehicle
5. Group Activity: Securing Paper Rolls with Eyes Loaded Vertical
6. Securement Requirements for Loading and Securing Paper Rolls with Eyes Horizontal in a Sided Vehicle
7. Securement Requirements for Loading and Securing Paper Rolls on a Flatbed Vehicle or in a Curtain-Sided Vehicle
8. Group Activity: Securing Paper Rolls
9. Summary

Training Methods

1. Participative lecture
2. Group activity (Small group exercises)

Participant Materials

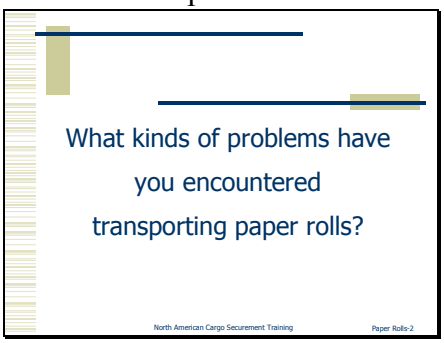
1. Participant Manual
2. Driver's Handbook on Cargo Securement

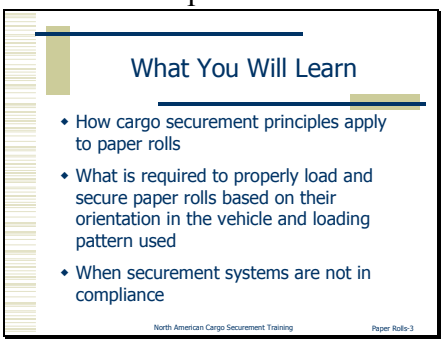
Training Materials

1. Instructor Guide
2. PowerPoint slides and projection system
3. Easel pad and markers
4. Participant materials

Instructor Notes

Paper Rolls

Lesson Plan	Instructor Notes
## Overview and Learning Objectives	*2 minutes*
Tell participants that you are going to talk about securement for paper rolls.	Explain the objectives of the training.
	Show Slide Paper Rolls-1.
Ask the participants:	Show Slide Paper Rolls-2. 
What kinds of problems have you encountered transporting paper rolls?	Record the problems on easel pad. Make sure problems are addressed during the module.

Lesson Plan	Instructor Notes
Tell participants that, at the completion of training, they will be able to: ◆ Describe how the cargo securement principles apply to paper rolls ◆ Determine what is required to properly load and secure paper rolls based on their orientation in the vehicle and loading pattern used ◆ Identify securement systems that are not in compliance.	Show Slide Paper Rolls-3. 

Lesson Plan	Instructor Notes

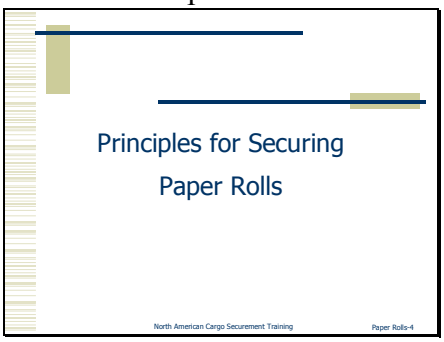
Principles for Securing Paper Rolls

Tell participants that you are now going to talk about the principles for securing paper rolls.

5 minutes

Explain the principles for securing paper rolls.

Show Slide Paper Rolls-4.

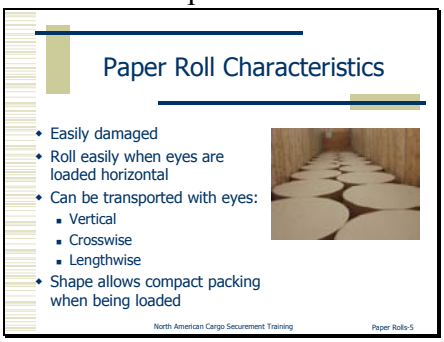


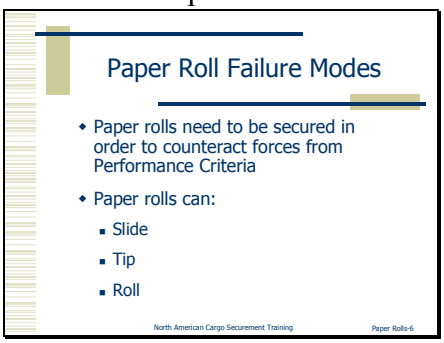
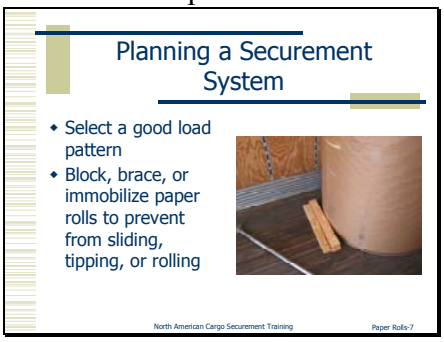
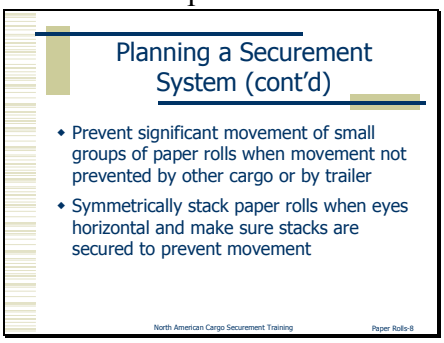
Paper Rolls: characteristics and cargo securement failure modes

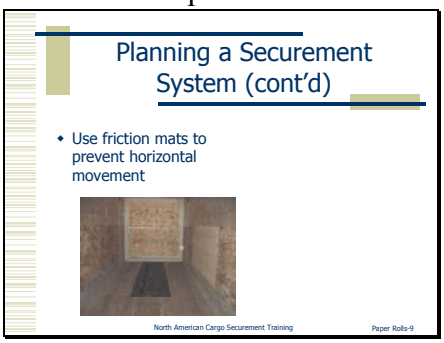
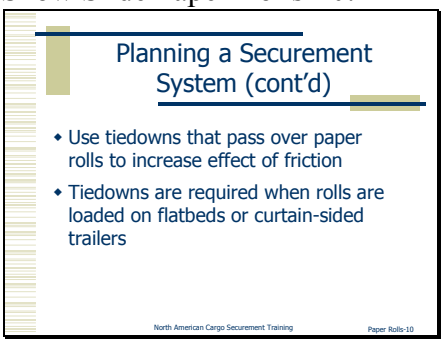
Explain that the following characteristics of paper rolls need to be considered when they are being secured:

- Paper rolls are easily damaged
- Paper rolls can easily roll when eyes are loaded horizontal
- Paper rolls can be transported with eyes:
  - Vertical
  - Crosswise
  - Lengthwise.
- Paper rolls have a shape that allows compact packing when being loaded.

Show Slide Paper Rolls-5.



Lesson Plan	Instructor Notes
Explain that for, safe highway transport, paper rolls need to be secured in order to counteract the forces from the Performance Criteria (Module 1, The Standard and Basic Physics Principles). Paper rolls can slide, tip, or roll.	Show Slide Paper Rolls-6.  Return to the list generated from the opening question listing the types of problems the participants have had in securing paper rolls. The instructor will then tell the participants that they will now learn how to avoid these problems by planning a securement system.
Planning a securement system for paper rolls **Explain** to participants that they need to select a good load pattern. They also need to block, brace, or immobilize paper rolls to make sure they are prevented from sliding, tipping, or rolling.	Show Slide Paper Rolls-7. 
Tell participants they need to prevent significant movement of small groups of paper rolls when movement is not prevented by other cargo or by the vehicle structure. **Tell** participants to symmetrically stack paper rolls when eyes are horizontal and to make sure that stacks are secured to prevent significant movement.	Show Slide Paper Rolls-8. 

Lesson Plan	Instructor Notes
Tell participants to use friction mats to prevent horizontal movement.	Show Slide Paper Rolls-9. 
Tell participants to use tiedowns that pass over the paper rolls to increase the effect of friction. Tiedowns are used when rolls are loaded on flatbeds or curtain-sided vehicles.	Show Slide Paper Rolls-10. 

Lesson Plan	Instructor Notes

Application

Explain that the securement requirements for paper rolls apply to shipments of paper rolls that individually or together weigh 2,268 kg (5,000 lb.) or more.

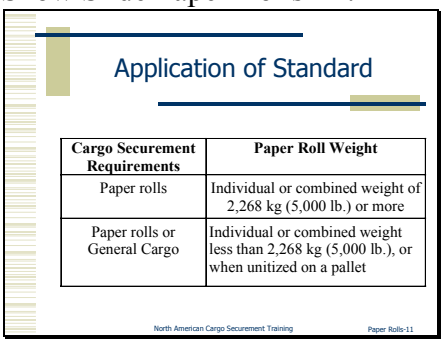
Say that shipments of paper rolls that weigh less than 2,268 kg (5,000 lb.) or rolls that are unitized on a pallet can also be secured by these guidelines or they can be secured as specified in the general securement requirements (Module 2, General Cargo Securement Requirements: Equipment and Methods).

Explain that this section does not apply to small rolls of paper shipped in cartons/containers such as toilet paper or paper towels that would be used in the kitchen. This type of product is covered in the general securement requirements (Module 2, General Cargo Securement Requirements: Equipment and Methods).

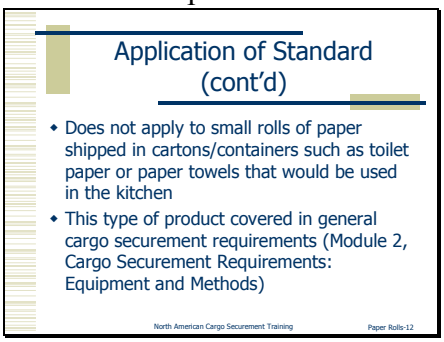
1 minute

Explain the application of the Standard.

Show Slide Paper Rolls-11.



Show Slide Paper Rolls-12.



Lesson Plan	Instructor Notes

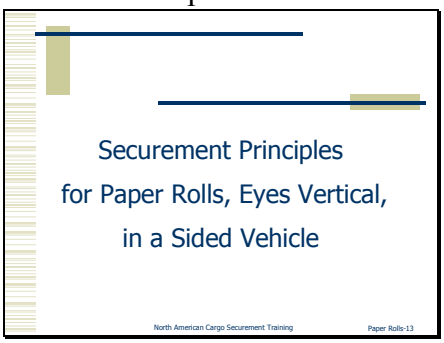
Securement Requirements for Loading and Securing Paper Rolls with Eyes Vertical in a Sided Vehicle

25 minutes

Explain the securement requirements for loading and securing paper rolls with eyes vertical in a sided vehicle.

Tell participants that you are going to talk about securement requirements for paper rolls, eyes vertical, in a sided vehicle or an intermodal container. Securing paper rolls on a flatbed or curtain-sided vehicle will be covered later.

Show Slide Paper Rolls-13.



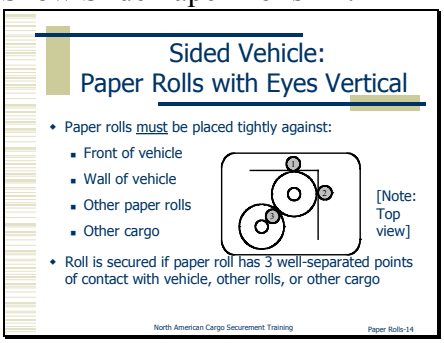
Loading paper rolls with eyes vertical

Explain that paper rolls should be placed together in a group so that the structure of the group can be maintained.

Tell participants that rolls should be placed against the front and walls of the vehicle, each other, and other cargo.

Explain that, usually, if a paper roll has 3 well-separated points of contact with the vehicle, other rolls, or other cargo, the roll is secured.

Show Slide Paper Rolls-14.



Lesson Plan	Instructor Notes

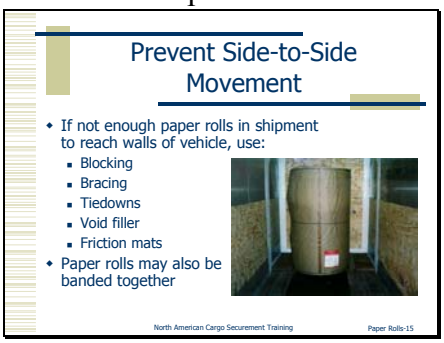
Preventing side-to-side movement

Tell participants that, if there are not enough paper rolls in the shipment to reach the walls of the vehicle, side – to – side movement must be prevented by:

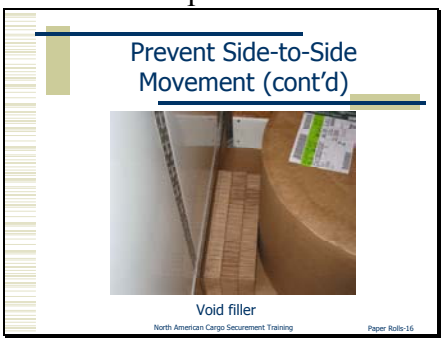
- Blocking
- Bracing
- Tiedowns
- Void filler (such as honeycomb dunnage)
- Friction mats.

The paper rolls may also be banded together.

Show Slide Paper Rolls-15.



Show Slide Paper Rolls-16.

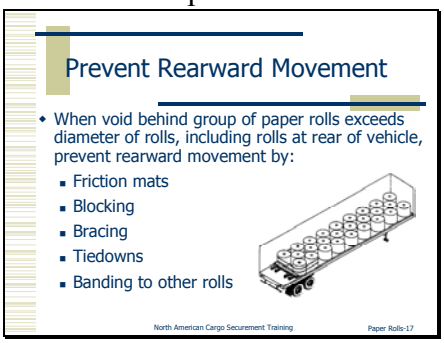


Preventing rearward movement

Explain to the participants that, when any void behind a group of paper rolls exceeds the diameter of the rolls, including rolls at the rear of the vehicle, prevent rearward movement by:

- Friction mats
- Blocking
- Bracing
- Tiedowns
- Banding to other rolls.

Show Slide Paper Rolls-17.



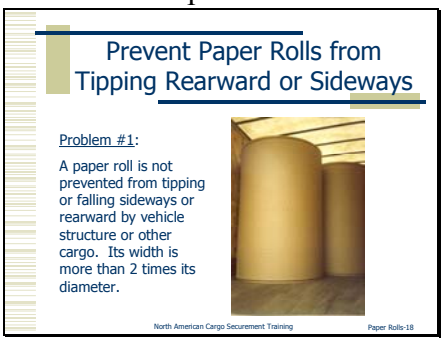
Lesson Plan	Instructor Notes

<u>Preventing paper rolls from tipping when loaded with eyes vertical</u>

Explain how to handle these four situations.

<u>Problem #1</u>: A paper roll is not prevented from tipping or falling sideways or rearward by vehicle structure or other cargo. Its width is more than 2 times its diameter.

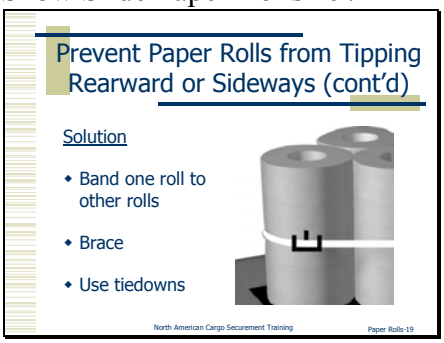
Show Slide Paper Rolls-18.



<u>Solution:</u> Prevent the roll from tipping or falling sideways or rearward by:

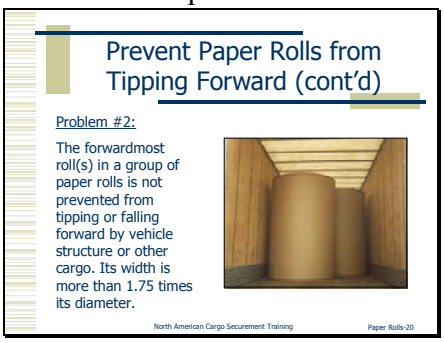
- Banding it to other rolls
- Bracing or
- Tiedowns.

Show Slide Paper Rolls-19.



<u>Problem #2:</u> The forwardmost roll(s) in a group of paper rolls is not prevented from tipping or falling forward by vehicle structure or other cargo. Its width is more than 1.75 times its diameter.

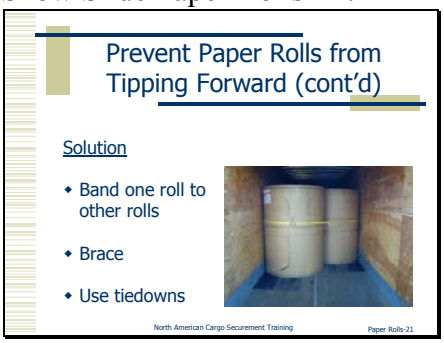
Show Slide Paper Rolls-20.



<u>Solution:</u> Prevent it from tipping or falling forward by:

- Banding it to other rolls
- Bracing or
- Tiedowns.

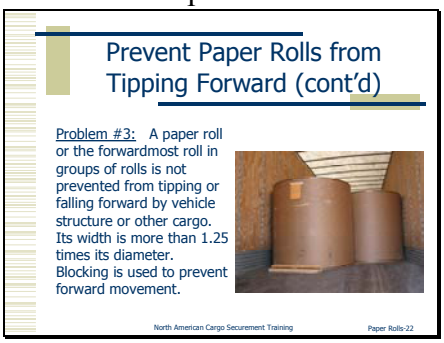
Show Slide Paper Rolls-21.



Lesson Plan	Instructor Notes

Problem #3: A paper roll or the forwardmost roll in groups of rolls is not prevented from tipping or falling forward by vehicle structure or other cargo. Its width is more than 1.25 times its diameter and blocking is used to prevent forward movement.

Show Slide Paper Rolls-22.

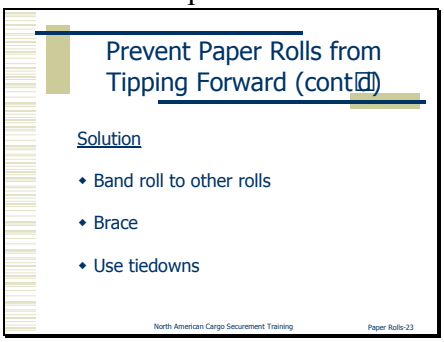


Solution: Prevent it from tipping or falling forward by:

- Banding it to other rolls
- Bracing or
- Tiedowns.

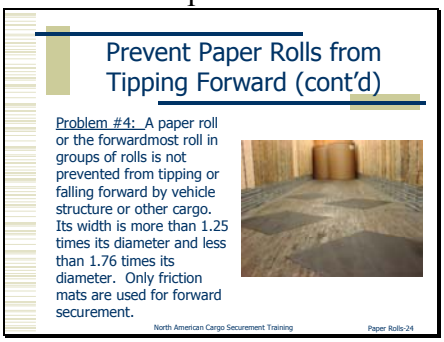
Note: The blocking tends to "trip" the roll so additional tipping securement is required.

Show Slide Paper Rolls-23.



Problem #4: A paper roll or the forwardmost roll in groups of rolls is not prevented from tipping or falling forward by vehicle structure or other cargo. Its width is more than 1.25 times its diameter and less than 1.76 times its diameter. Only friction mats are used for forward securement.

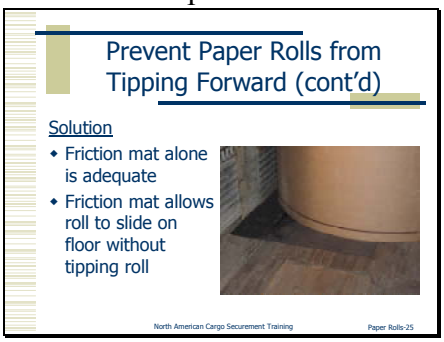
Show Slide Paper Rolls-24.



Solution: Prevent it from tipping or falling forward by:

- The friction mat alone is adequate.
- The friction mat allows the roll to slide lightly on the floor without tipping the roll.

Show Slide Paper Rolls-25.



Lesson Plan	Instructor Notes

Banding and friction mat application requirements for paper rolls loaded with eyes vertical

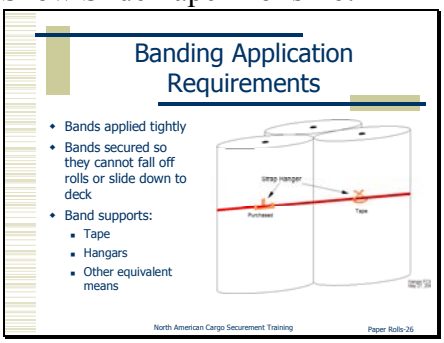
Banding

Explain that, if paper rolls are banded together, the rolls must be placed tightly against each other to form a stable group and the bands must be:

- Applied tightly
- Secured so that they cannot fall off the rolls or slide down to the deck.

Tell them that banding is effective if it is applied tightly and if the bands are supported by tape, hangers, or other equivalent means so that they cannot fall to the deck even if they become loose.

Show Slide Paper Rolls-26.

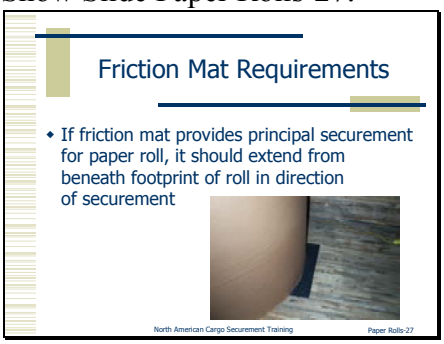


Friction Mat

Explain that, a friction mat is a device placed between the deck of a vehicle and cargo, or between articles of cargo, intended to provide greater friction than exists naturally between these surfaces.

Explain that, where a friction mat provides the principal securement for a paper roll, it should extend from beneath the footprint of the roll in the direction(s) in which it is providing securement.

Show Slide Paper Rolls-27.



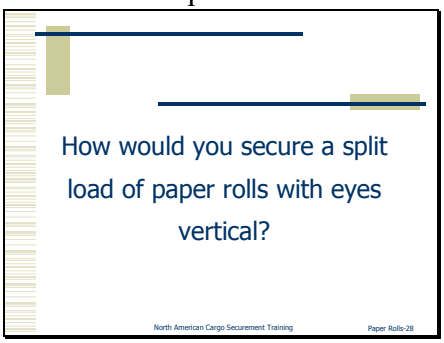
Lesson Plan	Instructor Notes

Split loads of paper rolls loaded with eyes vertical

Ask the participants:

> How would you secure a split load of paper rolls with eyes vertical?

Show Slide Paper Rolls-28.



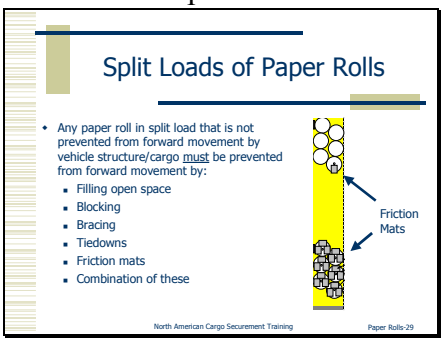
Suggested response:

- Frictions mats and/or
- Blocking and/or
- Bracing and/or
- Banding

Explain that any paper roll in a split load that is not prevented from forward movement by vehicle structure or other cargo <u>must</u> be prevented from forward movement by:

- Friction mats
- Filling the open space
- Blocking
- Bracing
- Tiedowns
- Some combination of these.

Show Slide Paper Rolls-29.



Lesson Plan	Instructor Notes

Stacked loads of paper rolls loaded with eyes vertical

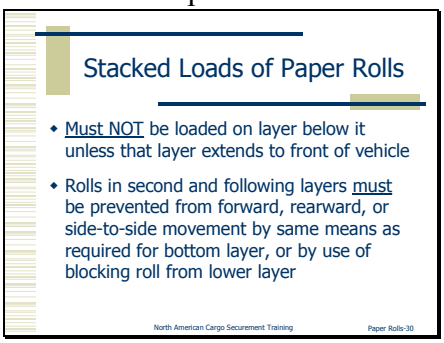
Tell participants that paper rolls must not be loaded on a layer below it unless that layer extends to the front of the vehicle.

Explain that paper rolls in the second and following layers must be prevented from forward, rearward, or side – to – side movement by the same means as required for the bottom layer, or by use of a blocking roll from a lower layer.

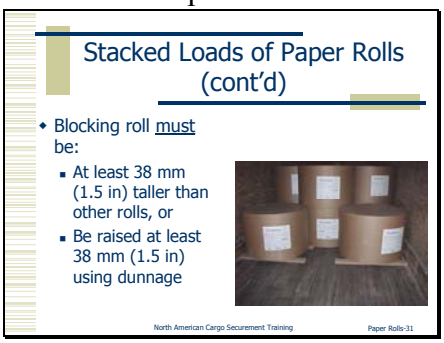
Tell participants that the blocking roll must be at least 38 mm (1.5 in) taller than other rolls, or must be raised at least 38 mm (1.5 in) using dunnage.

Say that a roll in the rearmost row of any layer must not be raised using dunnage unless the roll is blocked or braced or banded or tied down to prevent rearward movement.

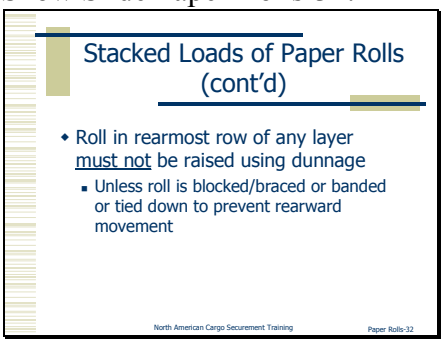
Show Slide Paper Rolls-30.



Show Slide Paper Rolls-31.



Show Slide Paper Rolls-32.

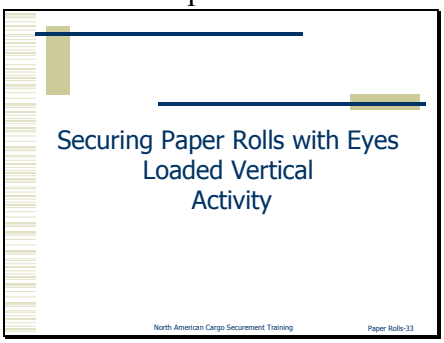


Lesson Plan	Instructor Notes

Activity: Securing Paper Rolls with Eyes Loaded Vertical

Tell participants that you want to review what participants have learned.

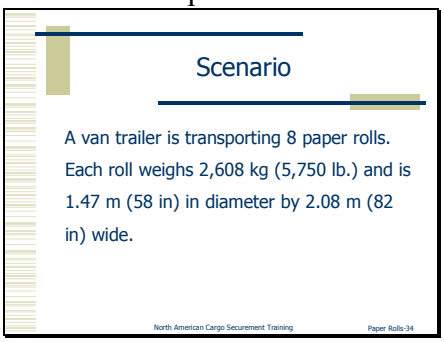
Show Slide Paper Rolls-33.



Read the scenario to participants:

> A van trailer is transporting 8 paper rolls. Each roll weighs 2,608 kg (5,750 lb.) and is 1.47 m (58 in) in diameter by 2.08 m (82 in) wide. The rolls are loaded in a split load configuration.

Show Slide Paper Rolls-34.



Ask this question:

> What would be the correct way to secure these paper rolls?

Response from participants should include:

- Load 4 rolls in the nose of the trailer in a 1-1 offset pattern (staggered from side-to-side).
- Load 4 rolls in the rear of the trailer separated from the front group of rolls by about 15 ft in the same pattern.
- All rolls <u>must</u> be in contact with the vehicle wall.
- All rolls <u>must</u> be in contact with another roll in their group.

Lesson Plan	Instructor Notes
	♦ The rear roll in the front group must be secured against rearward movement. Friction mats, blocking, bracing, banding to other rolls or tiedowns may be used. ♦ A method to prevent rearward tipping of the last roll in the forward group of rolls is not required since the rolls are not at least 2 times the diameter in width. (82/58=1.41) ♦ The forward roll in the rear group of rolls must be secured against forward movement. Friction mats, blocking bracing, banding to other rolls or tiedowns may be used. ♦ A method to prevent forward tipping of the first roll in the rear group of rolls is required, if forward movement is not prevented by rubber mats alone, since the rolls are over 1.25 times the diameter in width. (82/58=1.41) ♦ The rear roll in the rear group must be secured against rearward movement. Friction mats, blocking, bracing, banding to other rolls or tiedowns may be used. ♦ A method to prevent rearward tipping of the last roll in the rear group of rolls is not required since the rolls are not at least 2 times the diameter in width. (82/58=1.41)

Lesson Plan	Instructor Notes
Ask this question: What items would you include on a checklist to make sure the paper rolls were secured properly?	Record responses on easel pad. Responses for the checklist should include: ♦ Look for rolls contacting each other and sidewalls. ♦ Look for friction mats, banding, blocking, bracing, tiedowns. ♦ Look for excessive movement. ♦ Measure the height and diameter of the rolls. ♦ Check the height to diameter ratio if it appears that the ratio is near 2 at the rear of the vehicle and the rolls have not been banded together.

Lesson Plan	Instructor Notes

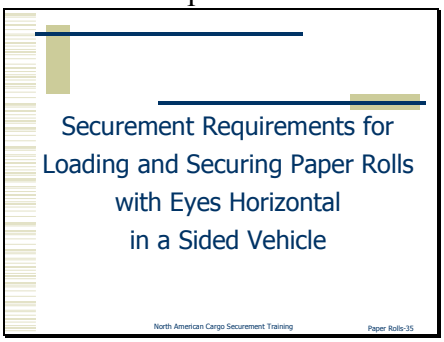
Securement Requirements for Loading and Securing Paper Rolls with Eyes Horizontal in a Sided Vehicle

20 minutes

Tell participants that you are now going to talk about the securement requirements for loading and securing paper rolls with eyes horizontal in a sided vehicle.

Explain the securement requirements for loading and securing paper rolls with eyes horizontal in a sided vehicle.

Show Slide Paper Rolls-35.

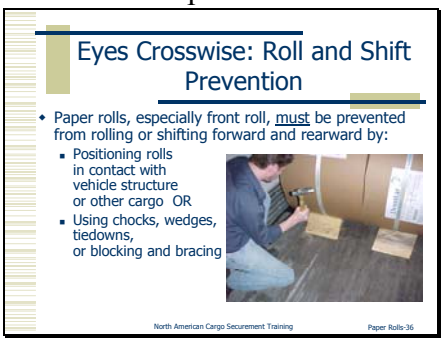


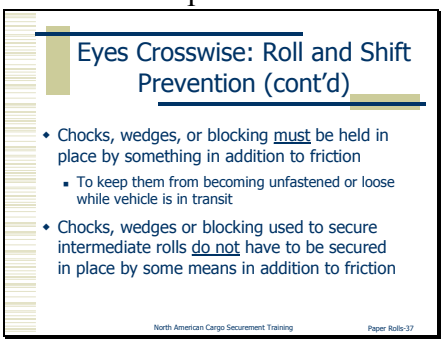
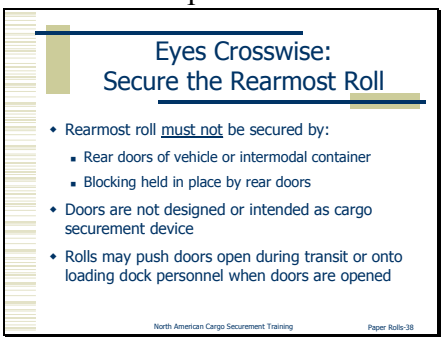
Paper rolls loaded with eyes crosswise – Roll and shift prevention

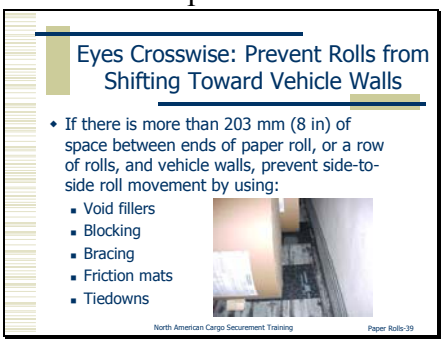
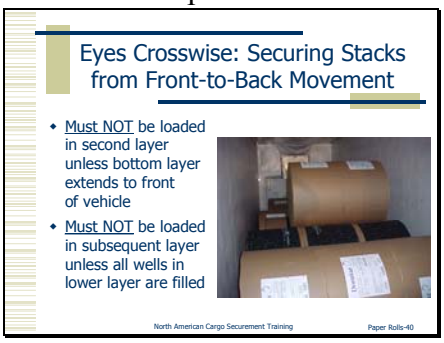
Explain that paper rolls, especially the end rolls, must be prevented from rolling or shifting in the forward and rearward direction by:

- Positioning the rolls in contact with the vehicle structure or other cargo or
- Using chocks, wedges, tiedowns or blocking and bracing.

Show Slide Paper Rolls-36.



Lesson Plan	Instructor Notes
Tell participants that chocks, wedges, or blocking securing the front or rear roll must be held in place by some means in addition to friction so they cannot become unintentionally unfastened or loose while the vehicle is in transit. This is often accomplished with nails. Chocks, wedges or blocking used to secure intermediate rolls from forward or rearward movement during loading do not have to be secured in place.	Show Slide Paper Rolls-37. 
Additional requirements for securing paper rolls with eyes loaded crosswise in a sided vehicle or intermodal container	
Requirements for securing the rearmost roll **Tell** participants that the rearmost roll must not be secured using: ◆ The rear doors of the vehicle or intermodal container ◆ Blocking held in place by those doors. **Explain** that the doors are not designed or intended as a cargo securement device. There is danger that the rolls may push the doors open during transit or onto loading dock personnel when the doors are opened.	Show Slide Paper Rolls-38. 

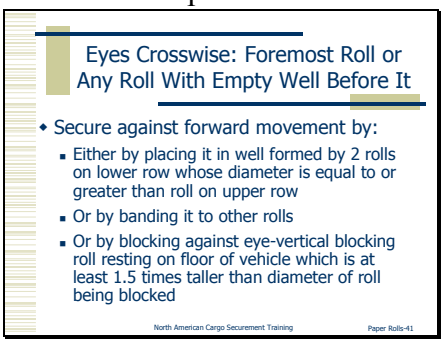
Lesson Plan	Instructor Notes
<u>Preventing the rolls from shifting toward the vehicle walls</u> **Explain** that, if there is more than a total of 203 mm (8 in) of space between the ends of a paper roll, or a row of rolls, and the walls of the vehicle, use void fillers (such as honeycomb), blocking, bracing, friction mats, or tiedowns to prevent the roll from shifting towards either wall.	Show Slide Paper Rolls-39.  Air bladders are not commonly used against the wall of a trailer because they can be easily deflated by protrusions. If an air bladder extends past an edge of the roll, the roll will cut the bladder. Air bladders require special attention and added cost causing them to be an infrequent means of securement in transportation of roll paper in trailers.
<u>Securing stacks of paper rolls from front-to-back movement</u> **Explain** that rolls <u>must not</u> be loaded in a second layer unless the bottom layer extends to the front of the vehicle. Rolls <u>must not</u> be loaded in a subsequent layer unless all wells in the lower layer are filled.	Show Slide Paper Rolls-40. 

Lesson Plan	Instructor Notes

Tell participants that the foremost roll in each upper layer (or any roll with an empty well in front of it) must be secured against forward movement by:

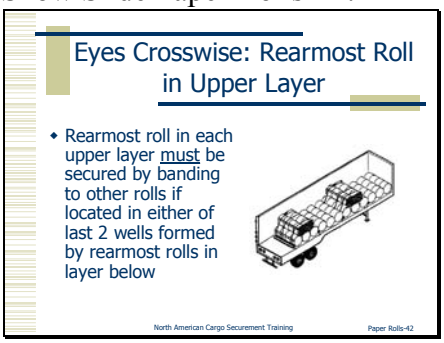
- Either by placing it in a well formed by 2 rolls on the lower row whose diameter is equal to or greater than that of the roll on the upper row. Since most loads are of the same diameter rolls this in the most common method.
- Or by banding it to other rolls
- Or by blocking against an eye-vertical blocking roll resting on the floor of the vehicle which is at least 1.5 times taller than the diameter of the roll being blocked

Show Slide Paper Rolls-41.



Tell participants the rearmost roll in each upper layer must be secured by banding it to other rolls if it is located in either of the last 2 wells formed by the rearmost rolls in the layer below.

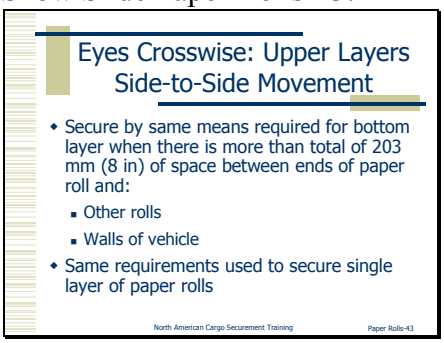
Show Slide Paper Rolls-42.



Securing Stacks of Paper Rolls from Side-to-Side Movement

Tell the participants that rolls must be secured against side-to-side movement by the same means required for the bottom layer when there is more than a total of 203 mm (8 in) of space between the ends of a paper roll or row of rolls and the walls of the vehicle. These are the same requirements that are used to secure a single layer of paper rolls.

Show Slide Paper Rolls-43.



Lesson Plan	Instructor Notes

Paper Rolls Loaded with Eyes Lengthwise

Tell participants that so far you have been talking about paper rolls, eyes horizontal, loaded crosswise. Now you want to talk about paper rolls, eyes horizontal, loaded lengthwise.

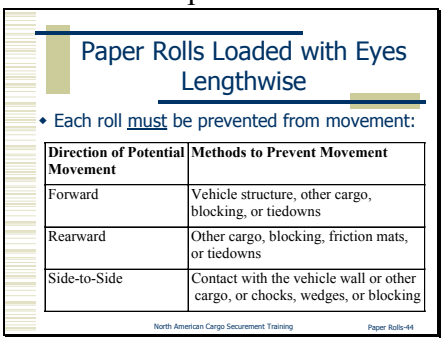
- Each roll must be prevented from forward movement by contact with vehicle structure, other cargo, blocking, or tiedowns.
- Each roll must be prevented from rearward movement by contact with other cargo, blocking, friction mats, or tiedowns.
- Paper rolls must be prevented from rolling or shifting laterally by contact with the wall of the vehicle or other cargo, or by chocks, wedges or blocking of adequate size.

Tell participants that chocks, wedges or blocking must be held securely in place by some means in addition to friction, so they cannot become unintentionally unfastened or loose while the vehicle is in transit. This is typically accomplished using nails.

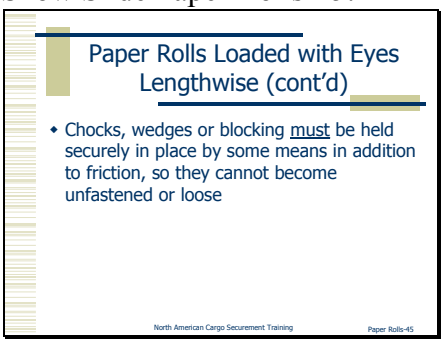
Tell participants that rolls must not be loaded in a higher layer if another roll will fit in the layer below it.

Explain that an upper layer must be formed by placing paper rolls in the wells formed by the rolls below it.

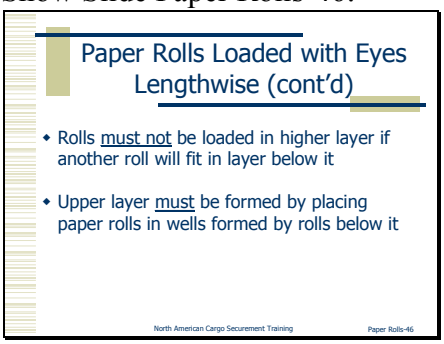
Show Slide Paper Rolls-44.

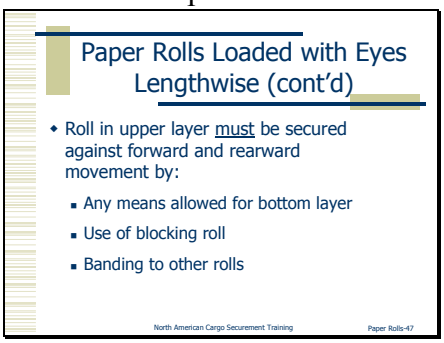


Show Slide Paper Rolls-45.



Show Slide Paper Rolls-46.



Lesson Plan	Instructor Notes
Tell them that a roll in an upper layer must be secured against forward and rearward movement by any of the means required for the bottom layer or, by use of a blocking roll, or by banding to other rolls.	Show Slide Paper Rolls-47. 

Lesson Plan	Instructor Notes

Securement Requirements for Loading and Securing Paper Rolls on a Flatbed Vehicle or in a Curtain-Sided Vehicle

5 minutes

Tell the participants that you are now going to talk about the securement requirements for loading and securing paper rolls loaded on a flatbed vehicle or in a curtain-sided vehicle.

Explain the securement requirements for loading and securing paper rolls loaded on a flatbed vehicle or in a curtain sided vehicle.

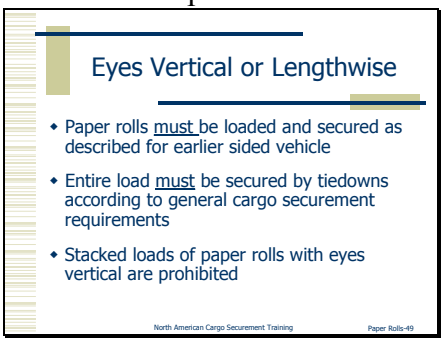
Show Slide Paper Rolls-48.

Requirements for Eyes Vertical or Eyes Lengthwise

Tell participants that paper rolls must be loaded and secured as described for a sided vehicle. The entire load must be secured by tiedowns according to the general securement requirements (Module 2, General Securement Requirements: Equipment and Methods).

Tell participants that stacked loads of paper rolls with eyes vertical are prohibited.

Show Slide Paper Rolls-49.



Lesson Plan	Instructor Notes

Requirements for Eyes Crosswise

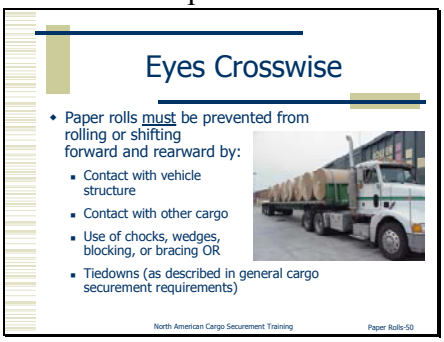
Explain that paper rolls must be prevented from rolling or shifting forward and rearward by:

- Contact with the vehicle structure
- Contact with other cargo
- Use of chocks, wedges, blocking or bracing
- Tiedowns (must be used as described in general requirements (Module 2, General Securement Requirements: Equipment and Methods)).

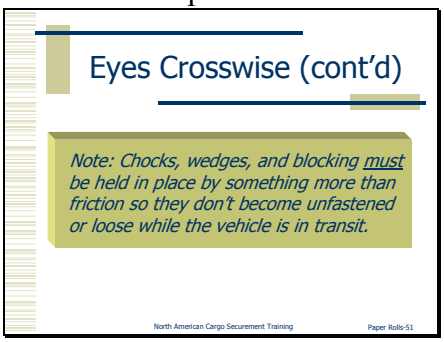
Note: Chocks, wedges, and blocking must be held in place by some additional means to friction so they may not become unfastened or loose while the vehicle is in transit.

Say that side-to-side or front-to-back tiedowns must be used to prevent side-to-side movement.

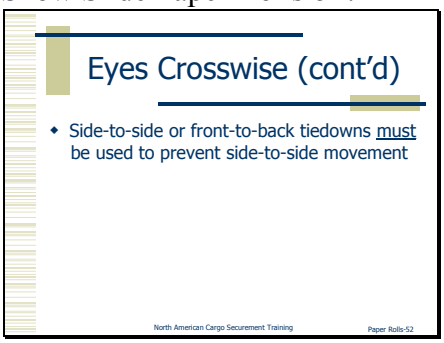
Show Slide Paper Rolls-50.



Show Slide Paper Rolls-51.



Show Slide Paper Rolls-52.



Lesson Plan	Instructor Notes

Activity - Securing Paper Rolls

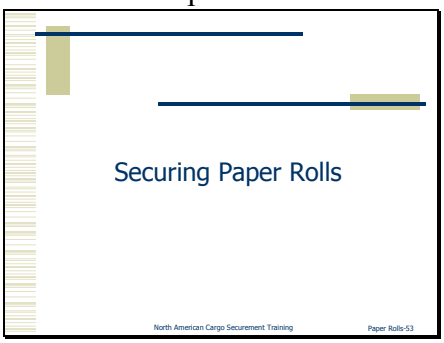
Tell participants they are now going to work in groups on a brief activity for securing paper rolls.

Tell participants that they can use the Driver's Handbook on Cargo Securement to complete the activity.

25 minutes

Break into small groups and review instructions: 5 minutes
Small groups complete activity: 10 minutes
Report out: 10 minutes

Show Slide Paper Rolls-53.



The purpose of this activity is to help the participants get a better understanding of how to secure paper rolls. They will discuss the requirements and the number, placement, and type of cargo securing devices necessary.

Turn to the page following the instructions to see the Securing Paper Rolls activity worksheet.

Break the participants up into 3 groups. Have the participants turn to the Securing Paper Rolls activity worksheet. Read the directions to the participants. Give them 10 minutes to complete the activity.

When participants have completed their work, have each group present the answer to their scenario.

Lesson Plan	Instructor Notes
	- Read the scenario - Describe the securement system chosen - Name the items on their inspection checklist As each group reports its checklist items, the instructor will record the items on the easel pad. At the conclusion of the activity, you will have created a generic checklist for everyone. Walk around during the activity and make sure that participants are selecting the correct loading orientation and securement methods. After a group has presented their securement system, ask another group to use that group's inspection checklist to determine if the securement system is safe. **Answers:** **<u>Scenario #1</u>** ♦ This load is loaded with 30 rolls on the floor and 17 rolls in a second layer. ♦ The rolls should be loaded beginning at the nose of the trailer and placed against the walls or firmly against the rolls in front of it. ♦ Each roll should have 3 well separated points of contact with other rolls or the vehicle wall otherwise some form of added securement is required for that roll.

Lesson Plan	Instructor Notes
	♦ Rearward securement is required for the bottom layer and top layers. ♦ Friction mats, blocking, bracing, or banding the rear rolls together may be used for this purpose for the bottom layer or the top layer (tiedowns could also be used but are an uncommon form of rearward securement in a van). ♦ Additionally the top layer could have securement against both forward and rearward movement provided by blocking rolls that had been raised at least 1.5 inches. ♦ The height to diameter ratio is 28/40 = 0.7 so no tipping securement is required. ♦ The 17 rolls on the second layer must be positioned so that the axle weights of the trailer are legal. - This is usually done by positioning the 17 rolls in one group near the center of the trailer. - A legal axle load could also be accomplished by placing 8 rolls at the nose of the trailer and 9 rolls near the rear of the trailer.

Lesson Plan	Instructor Notes
	Scenario #2 ♦ This load will only fit in the trailer eye to the sky. ♦ The rolls should be loaded beginning at the front on the trailer on the driver's side. ♦ Each roll should have 3 well separated points of contact with other rolls or the vehicle wall otherwise some form of added securement is required for that roll. ♦ Rearward securement is required. ♦ Friction mats, blocking, bracing, or banding the rear rolls together may be used. ♦ The height to diameter ratio is 55/58 = 0.95 so no tipping securement is required. **Scenario # 3** Option #1: ♦ The rolls are transported with eyes vertical. ♦ They are placed on the trailer in a 1-1 off-set pattern V-boards are placed on the tops of the rolls on both sides of the trailer. ♦ Tiedowns are applied to the load, an aggregate WWL of at least 25,300 pounds must be achieved.

Lesson Plan	Instructor Notes
	Option #2: ♦ The rolls are transported with eyes horizontal, cross-wise. ♦ 12 rolls are on the floor of the trailer and 6 rolls are placed on the second layer in the wells formed by the lower rolls. ♦ V-boards are placed on the tops of the rolls on both sides of the trailer. ♦ Tiedowns are applied to the load; an aggregate WWL of at least 25,300 pounds must be achieved. ♦ The rear roll on the bottom is firmly chocked and the chock secured in place. ♦ The front roll is blocked using the headboard if present or firmly chocked. Option #3: ♦ The rolls are transported with eyes horizontal, cross-wise. ♦ 12 rolls are on the floor of the trailer and 6 rolls are placed on the second layer in the wells formed by the lower rolls. ♦ Tiedowns are applied to the load through the core of each upper roll ♦ 50 mm (2 in) wide or greater tiedowns must be used on the single stacked rolls. ♦ 75 mm (3 in) wide or greater tiedowns must be used on top rolls in the double stack area.

Lesson Plan	Instructor Notes
	Responses for the checklist should include: ♦ If there is space in front of the rolls, they must be prevented from shifting. ♦ Vehicle structure must be capable of carrying the load. ♦ Rolls must be secured against rearward movement. ♦ Rolls must be against the trailer wall or there must be no ways to move sideways. ♦ Rolls must be prevented from tipping if the width to diameter ratio is 2 or greater. ♦ All rolls on a flatbed are secured by tiedowns. ♦ Chocks used to secure the rolls at the end of the load are prevented from becoming loose.

Securing Paper Rolls

In a small group, determine a safe securement system for the following loads of paper rolls. Consider the loading orientation and the number, placement, and type of cargo securement device. Create a checklist of securement requirements that you would use to ensure that the paper rolls are safely secured.

Scenario #1: A 14.63 (48 ft) van trailer is transporting 47 rolls of printing paper. All the rolls are 1.0 m (40 in) in diameter, 0.7 m (28 in) wide and weight 444 kg (980 lbs). The rolls are loaded eye to the sky, in a 2-1-2 pattern, with 30 rolls on the floor.

Loading Requirements	Number, Placement, Type of Cargo Securement Device	Inspection Checklist

Securing Paper Rolls

Scenario #2: A 16.14 m (53 ft) van trailer is transporting 13 rolls of corrugating medium. Each of the rolls is 1.5 m (58 in) in diameter, 1.4 m (55 in) wide and weights 1,590 kg (3,500 pounds).

Loading Requirements	Number, Placement, Type, of Cargo Securement Device	Inspection Checklist

Securing Paper Rolls

Scenario #3: A driver with a 16.14 m (53 ft) flatbed trailer has the opportunity to haul a load of 18 rolls of newsprint. Each roll weighs 1,275 kg (2,811 lb.) and each roll is 1.25 m (50 in.) in diameter and 1.4 m (55 in.) in width.		
Loading Requirements	Number, Placement, Type, of Cargo Securement Device	Inspection Checklist

Lesson Plan	Instructor Notes

Summary

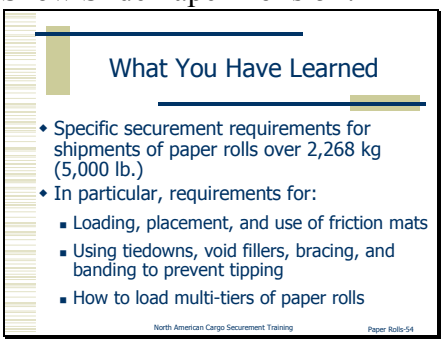
2 minutes

Summarize the lesson on Paper Rolls, recapping what the participants just learned.

Tell participants that they now know the specific securement requirements for shipments of paper rolls over 2,268 kg (5,000 lb.). In particular, there are requirements for:

- Loading, placement, and use of friction mats
- Using tiedowns, void fillers, bracing, and banding to prevent tipping
- How to load multi-tiers of paper rolls.

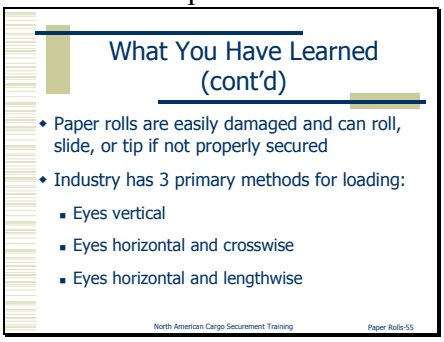
Show Slide Paper Rolls-54.



Remind participants that:

- Paper rolls are easily damaged and can roll, slide, or tip if not properly secured
- The industry has 3 primary methods for loading:
  - Eyes vertical
  - Eyes horizontal and crosswise
  - Eyes horizontal and lengthwise

Show Slide Paper Rolls-55.



Module Overview

Module 7: Concrete Pipe Loaded Crosswise on a Platform Vehicle

Learning Objectives

At the completion of the training, participants will be able to:

- Describe how the cargo securement principles apply to concrete pipes
- Determine what is required to properly load and secure different sizes of concrete pipe, including the number, placement, and types of cargo securing devices
- Identify securement systems that are not in compliance

Time Required

1 hour 15 minutes

Topics

1. Overview and Learning Objectives
2. Principles for Securing Concrete Pipe
3. Application
4. Securement Requirements for Concrete Pipe
5. Securement Requirements for Concrete Pipe Up To 1.143 m (45 in) in Diameter
6. Securement Requirements for Large-Sized Concrete Pipe
7. Summary

Training Methods

1. Participative lecture
2. Group activity (Small group exercises)

Participant Materials

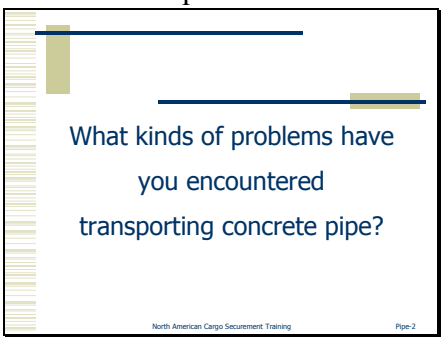
1. Participant Manual
2. Driver's Handbook on Cargo Securement

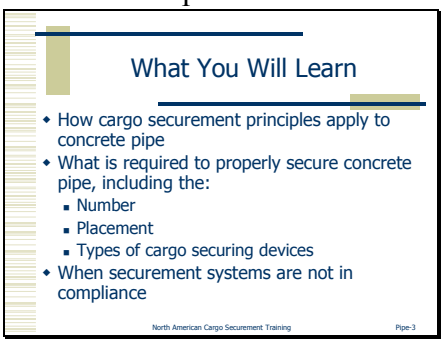
Training Materials

1. Instructor Guide
2. PowerPoint slides and projection system
3. Easel pad and markers
4. Participant materials

Instructor Notes

Concrete Pipe

Lesson Plan	Instructor Notes
Overview and Learning Objectives	*2 minutes*
Tell participants that you are going to talk about how to secure concrete pipe loaded crosswise on a platform vehicle.	Explain the objectives of the training. Show Slide Pipe-1.
Ask the participants: What kinds of problems have you encountered transporting concrete pipe?	Show Slide Pipe-2.  Record the problems on easel pad. Make sure problems are addressed during the module.

Lesson Plan	Instructor Notes
Tell participants that, at the completion of training, they will be able to: ◆ Describe how the cargo securement principles apply to concrete pipes ◆ Determine what is required to properly load and secure different sizes of concrete pipe, including the: – Number – Placement – Types of cargo securing devices. ◆ Identify securement systems that are not in compliance.	Show Slide Pipe-3. 

Lesson Plan	Instructor Notes

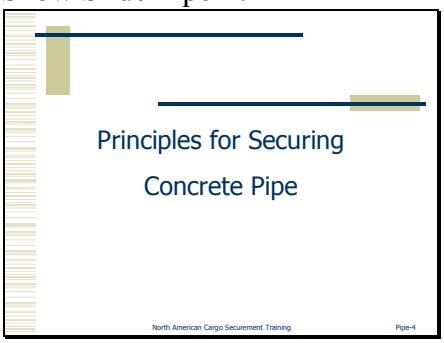
Principles for Securing Concrete pipe

Tell participants that you are now going to talk about the principles for securing concrete pipe.

5 minutes

Explain the principles for securing concrete pipe.

Show Slide Pipe-4.

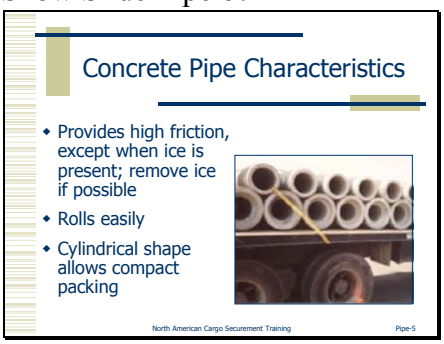


Concrete Pipe: characteristics and cargo securement failure modes

Explain that you should consider the following characteristics when securing concrete pipe:

- Concrete pipe provides a high amount of friction against the trailer bed, spacers, and each other, as long as there is no ice present; effort should be made to remove ice if possible
- Concrete pipe easily rolls
- Concrete pipes have a shape that allows compact packing when being loaded.

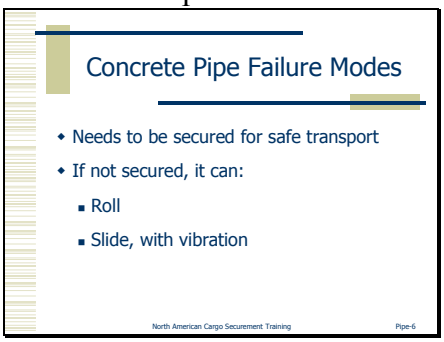
Show Slide Pipe-5.

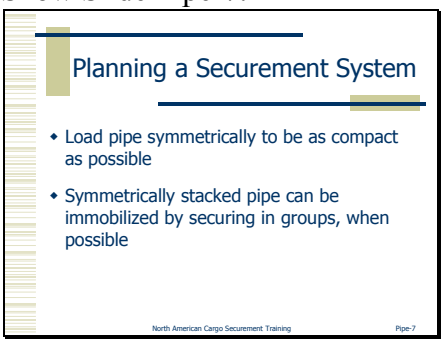
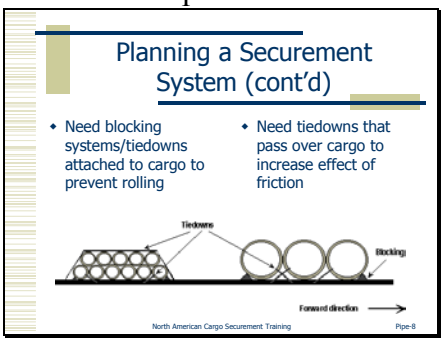


Explain that, for safe highway transport, concrete pipe need to be secured in order to counteract the forces from the Performance Criteria (Module 1, The Standard and Basic Physics Principles). If concrete pipe is not secured, it can:

- Roll
- Slide, with vibration.

Show Slide Pipe-6.



Lesson Plan	Instructor Notes
	Return to the list generated from the opening question listing the types of problems the participants have had with transporting concrete pipe. The instructor will then tell the participants that they will now learn how to avoid these problems by planning a securement system.
Planning a securement system for concrete pipe **Explain** that, when securing concrete pipe, you need to make sure that the pipes are loaded to be as compact as possible. **Tell** participants that these symmetrically stacked pipes need to be immobilized by securing them in groups, when possible.	Show Slide Pipe-7. 
Tell participants that they also need to have blocking systems/tiedowns attached to the cargo to prevent the pipe from rolling. **Say** that tiedowns that pass over the cargo can also be used to increase the effect of friction.	Show Slide Pipe-8. 

Lesson Plan	Instructor Notes

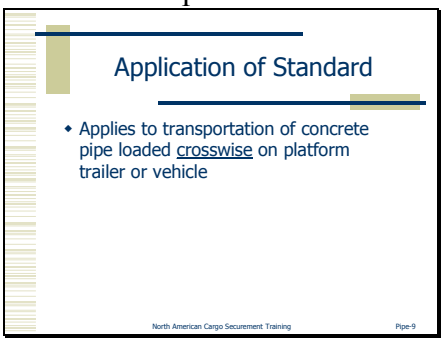
Application

1 minute

Explain the application of the Standard.

Explain that the rules in this section apply to the transportation of concrete pipe loaded crosswise on a platform trailer or vehicle.

Show Slide Pipe-9.



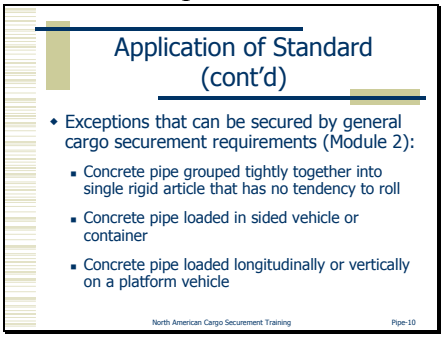
Say that some concrete pipe can be secured by the general cargo securement requirements (Module 2, General Cargo Securement Requirements: Equipment and Methods):

- Concrete pipe grouped tightly together into a single rigid article that has no tendency to roll
- Concrete pipe loaded in a sided vehicle or container
- Concrete pipe loaded longitudinally or vertically on a platform vehicle.

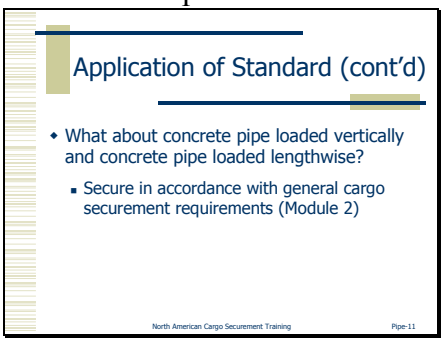
All other concrete pipe loaded crosswise on a vehicle must be secured in accordance with this section.

Concrete pipe loaded vertically and concrete pipe loaded lengthwise must be secured in accordance with general cargo securement requirements (Module 2, General Cargo Securement Requirements: Equipment and Methods).

Show Slide Pipe-10.



Show Slide Pipe-11.



Lesson Plan	Instructor Notes

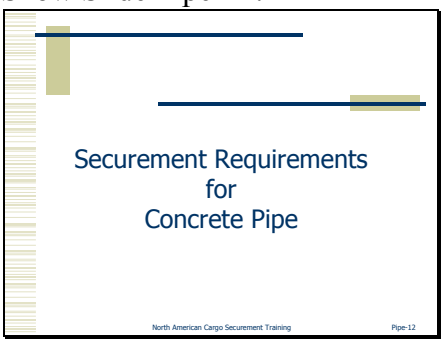
Securement Requirements for Concrete Pipe

20 minutes

Tell participants that you are now going to talk about the securement requirements for concrete pipe.

Explain the securement requirements for concrete pipe.

Show Slide Pipe-12.

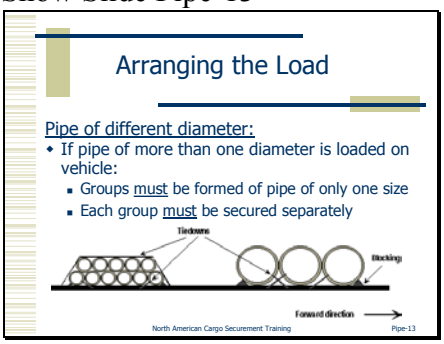


Arranging the load

Arranging the load with pipe of different diameter

Explain that, if pipe of more than one diameter is loaded on a vehicle, groups must be formed that consist of pipe of only one size. Each group must be secured separately.

Show Slide Pipe-13

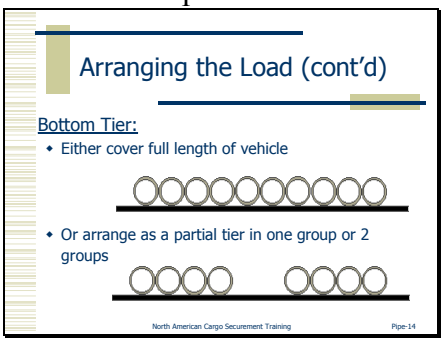


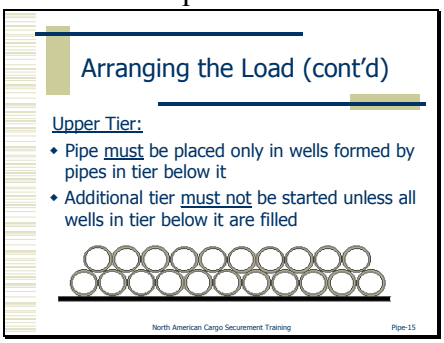
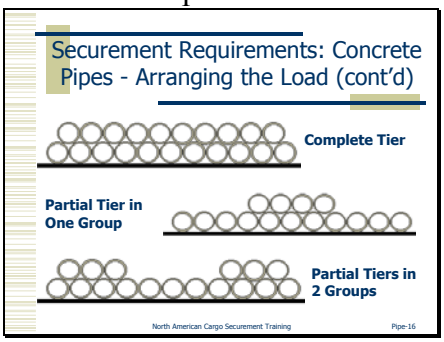
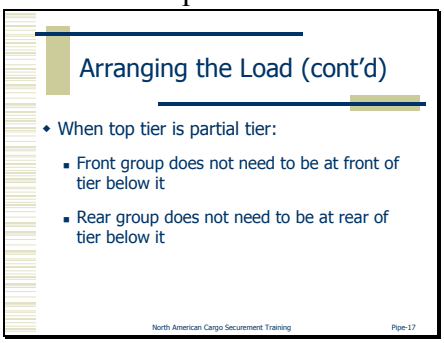
Arranging the bottom tier

Tell participants that the bottom tier must be arranged to:

- Either cover the full length of the vehicle
- Or as a partial tier in one group or 2 groups.

Show Slide Pipe-14.



Lesson Plan	Instructor Notes
Arranging the upper tier **Tell** participants that pipe must be placed only in the wells formed by pipes in the tier below it. An additional tier must not be started unless all wells in the tier below it are filled.	Show Slide Pipe-15. 
Explain that the top tier must be arranged in one of 3 ways: ◆ A complete tier ◆ A partial tier in one group ◆ A partial tier in 2 groups.	Show Slide Pipe-16. 
Say that when the top tier is a partial tier: ◆ The front group does not need to be at the front of the tier below it ◆ The rear group does not need to be at the rear of the tier below it.	Show Slide Pipe-17. 

Lesson Plan	Instructor Notes

Loading bell pipe

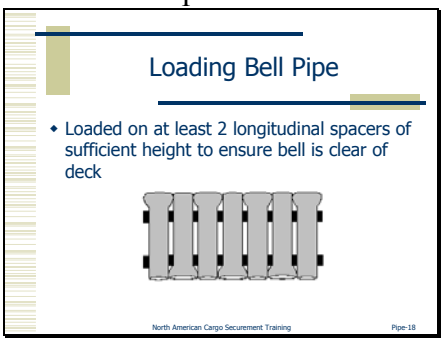
Tell participants that you are now going to talk about the loading requirements for bell pipe.

Explain the loading requirements for bell pipe.

Loading bell pipe on one tier

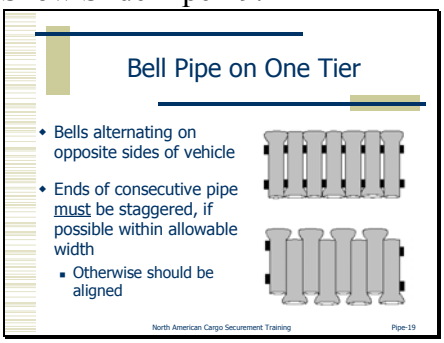
Explain that bell pipe must be loaded on at least 2 longitudinal spacers of sufficient height to ensure that the bell is clear of the deck.

Show Slide Pipe-18.



Tell participants that bell pipe loaded in one tier must have the bells alternating on opposite sides of the vehicle. The ends of consecutive pipe must be staggered, if possible within the allowable width. Otherwise they must be aligned.

Show Slide Pipe-19.

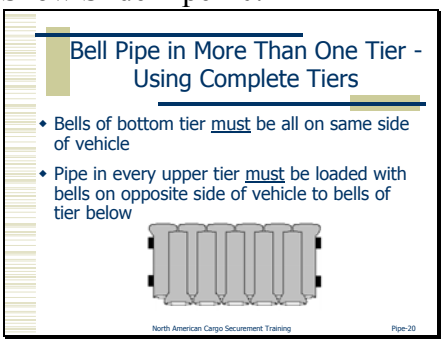


Loading bell pipe in more than one tier - using complete tiers

Explain that for bell pipe loaded in more than one tier:

- The bells of the bottom tier must all be on the same side of the vehicle
- Pipe in every upper tier must be loaded with bells on the opposite side of the vehicle to the bells of the tier below.

Show Slide Pipe-20.

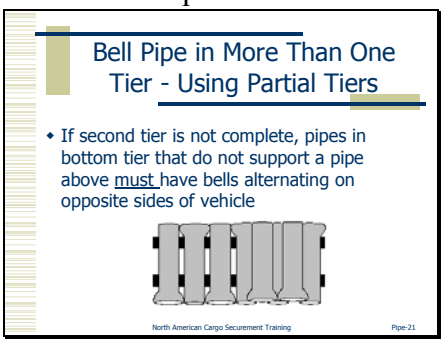


Lesson Plan	Instructor Notes

Loading bell pipe in more than one tier - using partial tiers

Tell the participants that, if the second tier is not complete, pipes in the bottom tier that do not support a pipe above must have their bells alternating on opposite sides of the vehicle.

Show Slide Pipe-21.

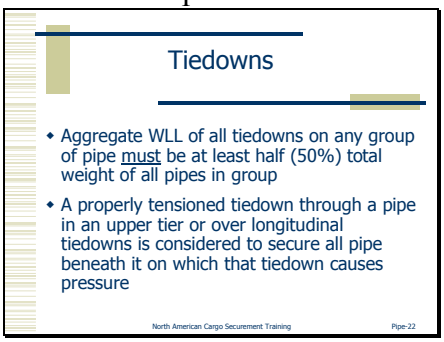


Tiedowns

Explain that the aggregate working load limit of all tiedowns on any group of pipe must be at least half (50%) the total weight of all pipes in the group.

Explain that, if you run a properly tensioned tiedown through a pipe in an upper tier or over longitudinal tiedowns, it is considered to secure all the pipe beneath it on which that tiedown causes pressure.

Show Slide Pipe-22.



Blocking for concrete pipe

Tell participants that blocking, which may also include chocks or wedges, must be used to prevent the pipe from rolling or rotating.

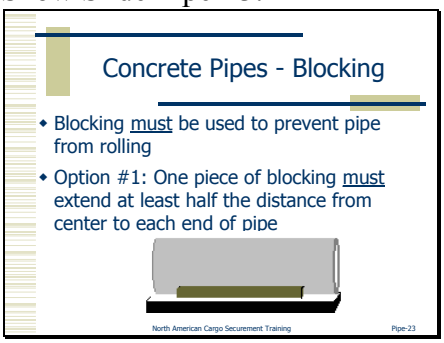
Explain that the blocking, chocks, or wedges must be prevented from becoming loosened or unfastened.

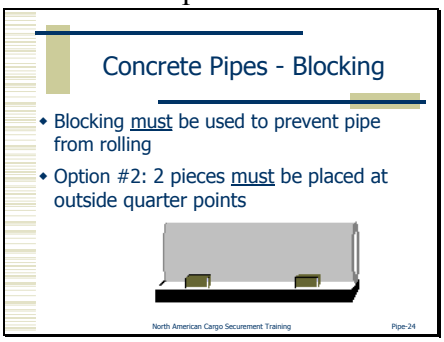
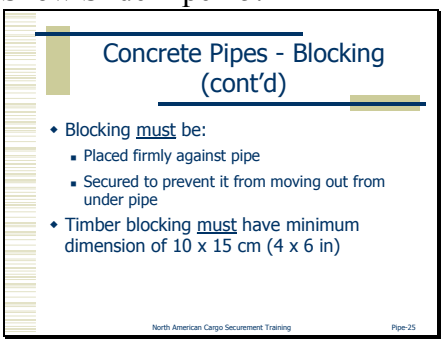
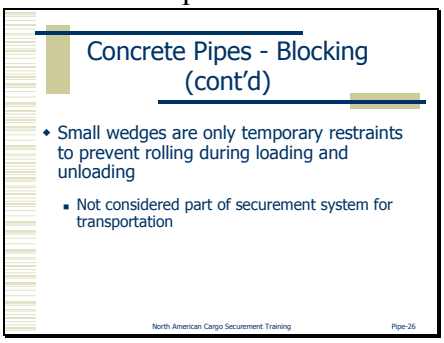
Explain that blocking may be one or more pieces placed at equal distance from the center of a pipe.

Tell participants that there are two blocking options:

- One piece of blocking must extend at least half the distance from the center to each end of the pipe

Show Slide Pipe-23.



Lesson Plan	Instructor Notes
♦ Two pieces <u>must</u> be placed at the outside quarter points.	Show Slide Pipe-24. 
Tell participants that blocking <u>must</u> be: ◆ Placed firmly against the pipe ◆ Secured to prevent it from moving out from under the pipe. **Explain** that timber blocking <u>must</u> have a minimum nominal dimension of at least 10 x 15 cm (4 x 6 in).	Show Slide Pipe-25. 
Explain that small wedges are only suitable as temporary restraints to prevent rolling during loading and unloading. They are not considered part of the securement system for transportation.	Show Slide Pipe-26. 

Lesson Plan	Instructor Notes

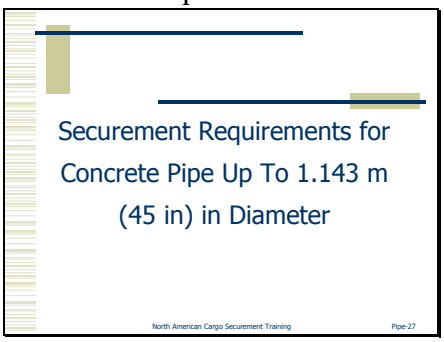
Securement Requirements for Concrete Pipe Up to 1.143 m (45 in) in Diameter

20 minutes

Tell participants that you are now going to talk about the securement requirements for concrete pipe up to 1.143 m (45 in) in diameter.

Explain the securement requirements for securing concrete pipe up to 1.143 m diameter.

Show Slide Pipe-27.

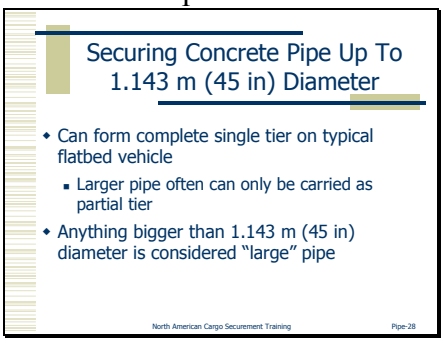


Explain that concrete pipe with an inside diameter up to 1.143 m (45 in) can form a complete single tier on a typical flatbed vehicle.

Say that larger pipe often can only be carried as a partial tier.

Tell participants that this pipe diameter of 1.143 m (45 in) is simply a convenient breaking point between "medium" and "large" diameter pipe.

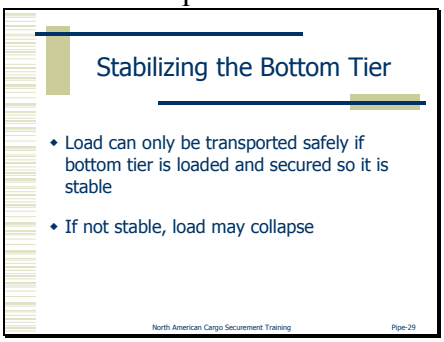
Show Slide Pipe-28.

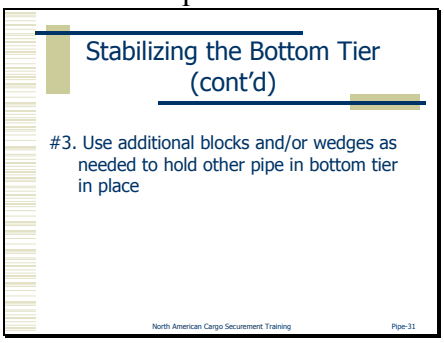
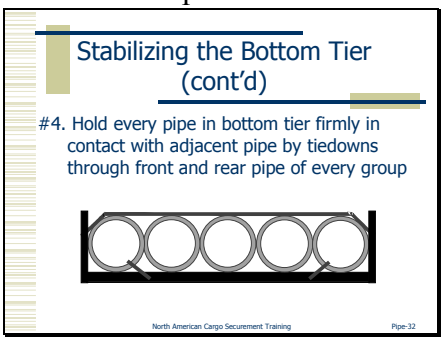


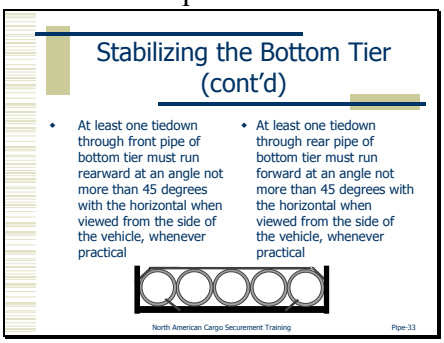
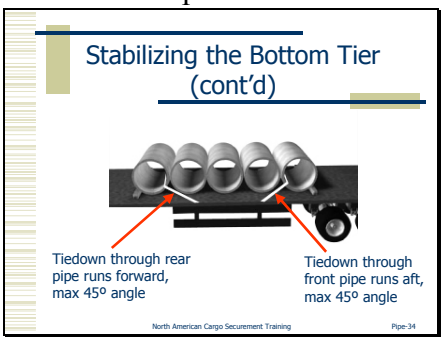
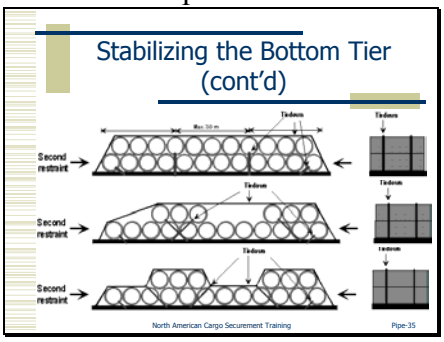
Stabilizing the bottom tier

Explain that a load can only be transported safely if the bottom tier is loaded and secured so that it is stable. If it is not stable, the load may collapse.

Show Slide Pipe-29.



Lesson Plan	Instructor Notes
Tell participants that this is how to stabilize the bottom tier: 1. Arrange the load as described earlier (pages 8-12). 2. Immobilize the front and rear pipes of every group by: – Blocking – Wedges – Stakes – Vehicle end structure – Locked pipe unloader OR – Other equivalent means. 3. Additional blocks and/or wedges may also be used to hold other pipe in the bottom tier in place.	Show Slide Pipe-30.
	Show Slide Pipe-31. 
4. Hold every pipe in the bottom tier firmly in contact with the adjacent pipe by tiedowns though the front and rear pipes of every group	Show Slide Pipe-32. 

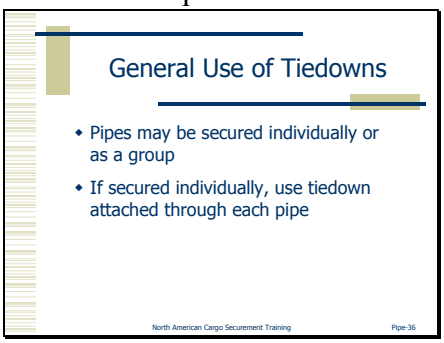
Lesson Plan	Instructor Notes
– At least one tiedown through the front pipe of the bottom tier <u>must</u> run rearward at an angle not more than 45 degrees with the horizontal, whenever practical, when viewed from the side of the vehicle – At least one tiedown through the rear pipe of the bottom tier <u>must</u> run forward at an angle not more than 45 degrees with the horizontal, whenever practical, when viewed from the side of the vehicle.	Show Slide Pipe-33.  Show Slide Pipe-34.  Show Slide Pipe-35. 

Lesson Plan	Instructor Notes

General use of tiedowns

Say that pipes may be secured individually or as a group. If secured individually, use a tiedown attached through each pipe.

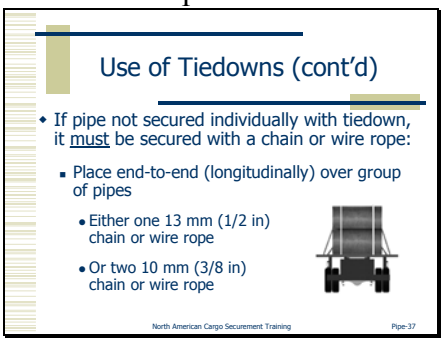
Show Slide Pipe-36.



Explain that, if each pipe is not secured individually with a tiedown, then it <u>must</u> be secured with a chain or wire rope.

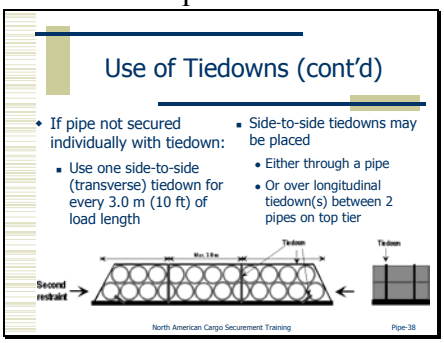
- Place longitudinally over the group of pipes
  - Either one 13 mm (1/2 in) chain or wire rope
  - Or two 10 mm (3/8 in) chain or wire rope

Show Slide Pipe-37.



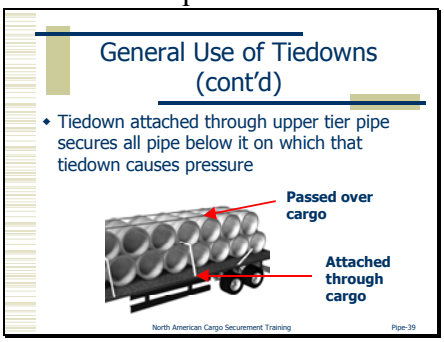
- Use one transverse tiedown for every 3.0 m (10 ft) of load length
  - The transverse tiedown may be placed through a pipe, or over the longitudinal tiedown(s) between 2 pipes on the top tier.

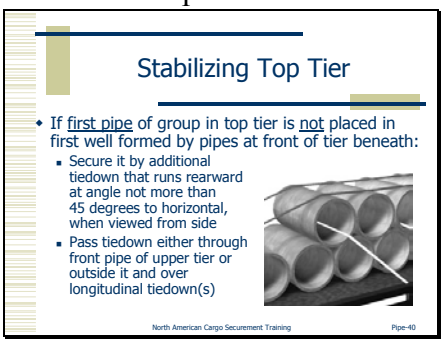
Show Slide Pipe-38.



Explain that a tiedown attached through a pipe in an upper tier is considered to secure all those pipes below it on which that tiedown causes pressure.

Show Slide Pipe-39.



Lesson Plan	Instructor Notes
Stabilizing top tier **Explain** that, if the first pipe of a group in the top tier is not placed in the first well formed by the pipes at the front of the tier beneath, it must be secured by an additional tiedown that runs rearward at an angle not more than 45 degrees to the horizontal when viewed from the side of the vehicle or container, whenever practical. Tiedown must pass either through the front pipe of the upper tier or outside it and over the longitudinal tiedown(s).	Show Slide Pipe-40. 
Explain that, if the rear pipe of a group in the top tier is not placed in the last well formed by the pipes at the rear of the tier beneath, it must be secured by an additional tiedown that runs forward at an angle not more than 45 degrees to the horizontal when viewed from the side of the vehicle or container, whenever practical. Tiedown must pass either through the rear pipe of the upper tier or outside it and over the longitudinal tiedown(s).	Show Slide Pipe-41.

Lesson Plan	Instructor Notes

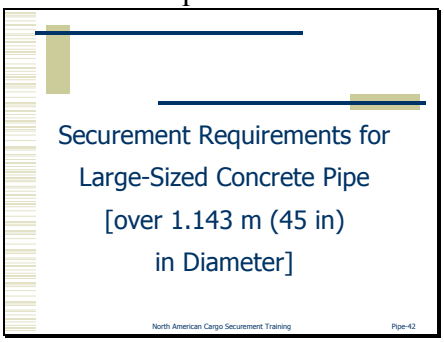
Securement Requirements for Large-Sized Concrete Pipe

20 minutes

Tell participants that you are now going to talk about the securement requirements for large-sized concrete pipe with an inside diameter of over 1.143 (45 in) m.

Explain the securement requirements for large-sized concrete pipe.

Show Slide Pipe-42.

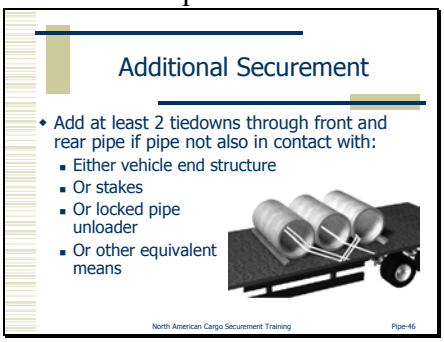


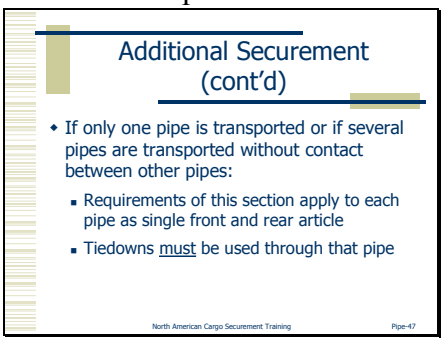
Tell participants that this is how to stabilize large sized pipe:

1. Arrange pipe as described earlier
2. Immobilize the front and rear pipe by:
   - Blocking
   - Wedges
   - Vehicle end structure
   - Stakes
   - Locked pipe unloader OR
   - Other equivalent means

   Reminder: Blocking and wedges must be prevented from becoming loosened or unfastened.
3. For all other pipe, use blocks and/or wedges that are nailed in place

Show Slide Pipe-43.

Lesson Plan	Instructor Notes
4. Each pipe <u>must</u> be secured by tiedowns through the pipe:	Show Slide Pipe-44.
– At least one tiedown through each pipe in the front half of the load, which includes the middle one if there are an odd number; tiedown <u>must</u> run rearward at an angle not more than 45 degrees with the horizontal, whenever practicable.	
– At least one tiedown through each pipe in the rear half of the load; tiedown <u>must</u> run forward at an angle not more than 45 degrees with the horizontal, whenever practicable, to hold each pipe firmly in contact with adjacent pipe.	Show Slide Pipe-45.
– At least 2 tiedowns <u>must</u> be used through the front and rear pipe if they are not also in contact with:	Show Slide Pipe-46.
> Vehicle end structure	
> Stakes	
> A locked pipe unloader or	
> Other equivalent means.	

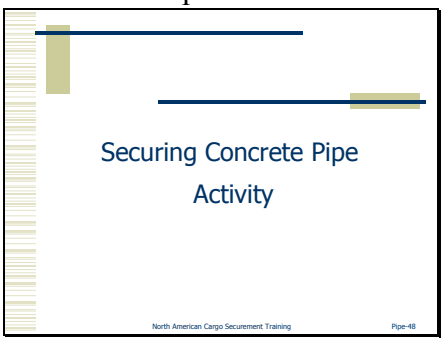
Lesson Plan	Instructor Notes
5. If only one pipe is transported, or if several pipes are transported without contact between other pipes, the requirements of this section apply to each pipe as a single front and rear article. Tiedowns must be used through that pipe.	Show Slide Pipe-47. 

Lesson Plan	Instructor Notes

Activity: Securing Concrete Pipe

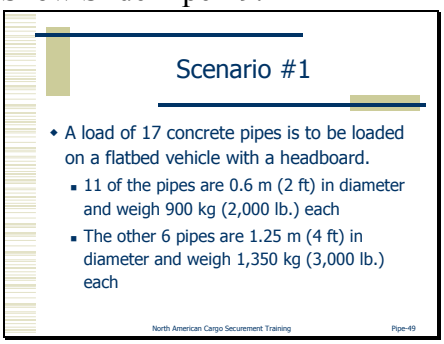
Tell participants that you want to review what participants have learned.

Show Slide Pipe-48.



There are three scenarios.

Show Slide Pipe-49.



Read the first scenario to participants:

> A load of 17 concrete pipes is to be loaded on a flatbed vehicle with a headboard. Eleven of the pipes are 0.6 m (2 ft) in diameter and weigh 900 kg (2,000 lb.) each, while the other six pipes are 1.25 m (4 ft) in diameter and weigh 1,350 kg (3,000 lb.) each.

Ask this question:

> What would be the correct way to secure this pipe?

Response from participants should include:

- Load pipe in two groups based on the pipe's diameter. Bell pipe must be loaded on spacers.

- Securement for 0.6 m (2 ft) diameter pipe:
  - Load in two tiers, 6 pipes in lower tier and 5 pipes in top tier. Top tier pipes loaded in wells formed by pipe in lower tier.
  - Secure front and rear pipe from movement by blocking (or stakes or front end structure, etc.).
  - Use a tiedown through front and rear pipe in lower tier (angle of no more than 45 degrees with horizontal).
  - Use one 13 mm (1/2 in) chain/wire rope longitudinally over the group of pipe (or two 10 mm (3/8 in) chain/wire rope).
  - Use two transverse tiedowns over longitudinal tiedowns.

- Securement of 1.25 m (4 ft) diameter pipe:

  - Load in one tier.
  - Secure front and rear pipe from movement (blocking, front end structure, stakes, etc.).
  - One tiedown through each pipe, except that front and rear pipes require two tiedowns (unless secured by vehicle end structure, stakes, or equivalent). Three front pipe tiedowns run rearward at an angle of no more than 45 degrees with horizontal. Three rear pipe tiedowns run forward at an angle of no more than 45 degrees with horizontal.

Read the second scenario to participants:

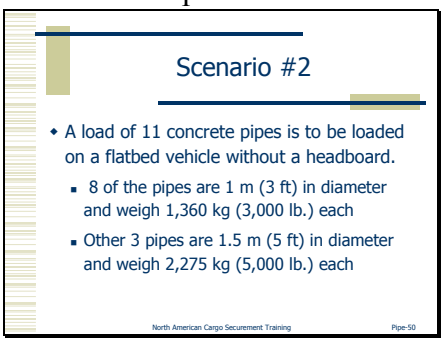
> A load of 11 concrete pipes is to be loaded on a flatbed vehicle without a headboard. 8 of the pipes are 1 m (3 ft) in diameter and weigh 1,360 kg (3,000 lb.) each, while the other 3 pipes are 1.5 m (5 ft) in diameter and weigh 2,275 kg (5,000 lb.) each.

Ask this question:

> What would be the correct way to secure this pipe?

This is one way to secure the load. There are others based on the configuration of the pipe groups (i.e., number of tiers).

Show Slide Pipe-50.



Response from participants should include:

- Bell pipe must be loaded on spacers.
- Nail a 4x6 block at the front of the trailer.
- Place one of the 1.5 m (5 ft) diameter pipes on the trailer next to the block.
- Secure each pipe before the loading equipment is released from the pipe. Secure that pipe using a chain or strap at a 45-degree angle pulling toward the rear of the trailer.
- Place the remaining two 1.5 m (5 ft) diameter pipes behind the first one and put one chain or strap through the middle of the pipes securing them down.
- Place the 1 m (3 ft) diameter pipes behind the 1.5 m (5 ft) diameter pipes securing 7 of them with one chain or strap through the middle of each pipe.

Read the third scenario to participants:

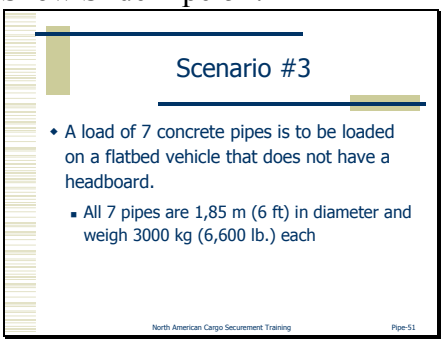
> A load of 7 concrete pipes is to be loaded on a flatbed vehicle that does not have a headboard. All 7 pipes are 1,85 m (6 ft) in diameter and weigh 3000 kg (6,600 lb.) each.

Ask this question:

> What would be the correct way to secure this pipe?

- Place the last 1 m (3 ft) diameter pipe on the trailer; place a 4x6 block up against the bottom of the pipe.
- Secure the pipe by placing one chain or strap at a 45-degree angle pulling toward the front of the trailer.
- Double check that the block on the front of the trailer is in contact with the first pipe.

Show Slide Pipe-51.



Response from participants should include:

<u>If the trailer is equipped with a winch system to secure the pipe:</u>

- Place 7 of the pipes on the lower tier.
- Place the first pipe up tight against the winch.
- Set a block of wood up against the pipe until the next pipe is put in place.
- Continue to move the block of wood as each pipe is put in place on the trailer until the last pipe is put in position on the bottom tier.
- Secure the last pipe that is placed on the rear of the trailer using one chain or strap pulling toward the front of the trailer, and nail a 4x6

block of wood across the trailer behind the pipe.

- Either place two 10 mm (3/8 in) chain or wire rope longitudinally over the pipe.
- Or place one 13 mm (½ in) chain or wire rope longitudinally over the pipe.
- Use one transverse tiedown for every 3.10 m (10 ft) of load length.

<u>If the trailer is not equipped with a winch</u>:

- Nail a 4X6 block of wood at the front of the trailer.
- Place one of the 1.85 m (6 ft) diameter pipes on the trailer next to the block. Secure each pipe before the loading equipment is released from the pipe.
- Secure that pipe using 2 chains or straps at a 45-degree angle pulling toward the rear of the trailer.
- Place five 1.85 m (6 ft) pipes behind the first one and put one chain or strap through the middle of the pipes securing them down.
- Place the last 1.85 m (6 ft) pipe on the trailer and place a 4x6 block up against the bottom of the pipe. Secure the pipe by placing 2 chains or straps at a 45-degree angle pulling toward the rear of the trailer.
- Double check that the block on the front of the trailer is in contact with the first pipe.

Lesson Plan	Instructor Notes

Summary

Tell participants that they now know to properly secure concrete pipe loaded crosswise on a platform trailer or vehicle. In particular, they know:

- How to arrange the load, including loading bell pipe, in one or more tiers
- How to secure pipe up to 1.143 m (45 in)
- How to secure pipe over 1.143 m (45 in)

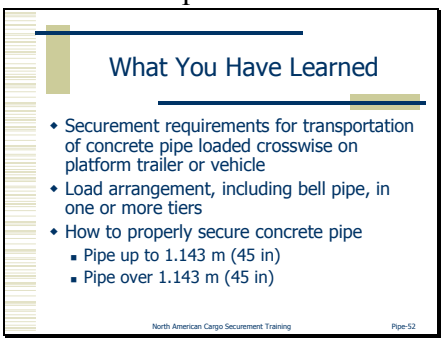
Remind participants that:

- Concrete pipes pack well together and they provide high friction when they are free of ice.
- Pipes need to be secured to prevent them from sliding and rolling.

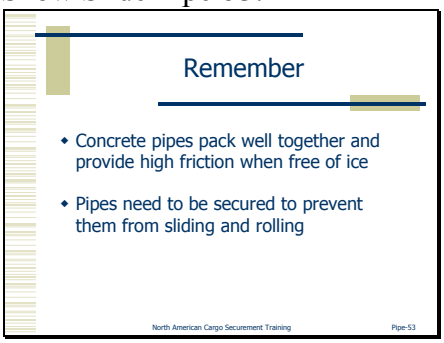
2 minutes

Summarize the lesson on Concrete Pipe, recapping what the participants just learned.

Show Slide Pipe-52.



Show Slide Pipe-53.



Module Overview

Module 8: Intermodal Containers

Learning Objectives

At the completion of the training, participants will be able to:

- Describe how the cargo securement principles apply to intermodal containers
- Determine what is required to properly secure and transport intermodal containers, including the type of vehicle and the number, placement and types of cargo securing devices
- Identify securement systems that are not in compliance

Time Required

30 minutes

Topics

1. Overview and Learning Objectives
2. Principles for Securing Intermodal Containers
3. Application
4. Securement Requirements for Intermodal Containers
5. Summary

Training Methods

1. Participative lecture
2. Group activity (Small group exercises)

Participant Materials

1. Participant Manual
2. Cargo Securement Guidebook

Training Materials

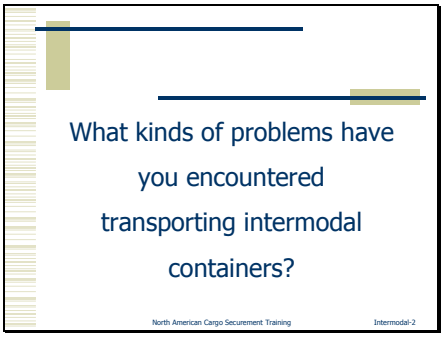
1. Instructor Guide
2. PowerPoint slides and projection system
3. Easel pad and markers
4. Participant materials

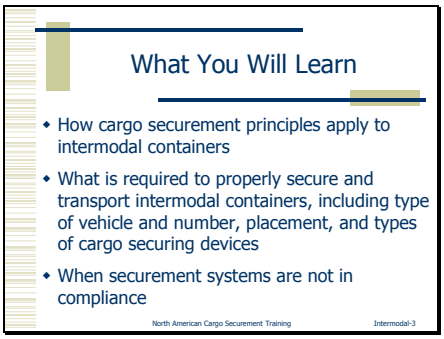
Instructor Notes

An intermodal container typically has posts that are designed as legs and latching points at the bottom, and has lifting points at the top. In most cases, there is one post at each corner of the container, though in some cases the two posts at one end, or even all four posts, may be inset from the ends of the container. Most containers longer than 12.19 m (40ft) have posts at each corner and two additional posts equal distances in from each end that pick up standard attachment points on container chassis trailers and rail cars.

The container includes posts that are designed both as legs and anchor points. An integral-locking device designed for the purpose of securing containers includes a pedestal. When a post on the container stands over the pedestal, it immobilizes the post and prevents it from sliding in any direction. The four pedestals immobilize the container, and the locks then secure the container to the trailer. If integral locking devices are not used, the securement system must have equivalent means to immobilize the container against both longitudinal and lateral movement, and to secure the container to the vehicle.

Intermodal Containers

Lesson Plan	Instructor Notes
## Overview and Learning Objectives	*2 minutes*
Tell participants that you are going to talk about securement for intermodal containers.	Explain the objectives of the training. Show Slide Intermodal-1.
Ask the participants: What kinds of problems have you encountered transporting intermodal containers?	Show Slide Intermodal-2.  Record the problems on easel pad. Make sure problems are addressed during the module.

Lesson Plan	Instructor Notes
Tell participants that, at the completion of the training, they will be able to: ◆ Describe how the cargo securement principles apply to intermodal containers ◆ Determine what is required to properly secure and transport intermodal containers, including the type of vehicle and the number, placement, and types of cargo securing devices ◆ Identify securement systems that are not in compliance	Show Slide Intermodal-3. 

Lesson Plan	Instructor Notes

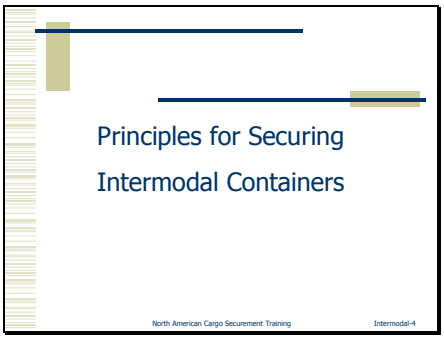
Principles for Securing Intermodal Containers

5 minutes

Tell participants that you are now going to talk about the principles for securing intermodal containers.

Explain the principles for securing intermodal containers.

Show Slide Intermodal-4.

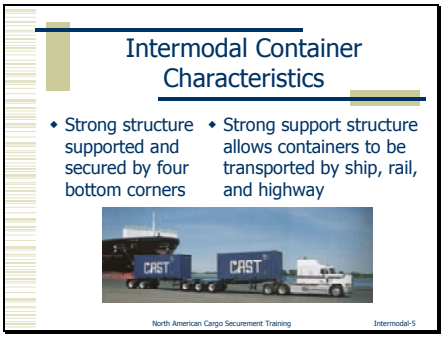


Intermodal Containers: characteristics and cargo securement failure modes

Explain that intermodal containers are built so the structure is strong enough to be supported and secured by the four bottom corners.

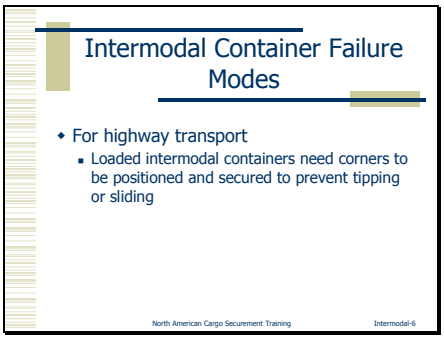
Tell participants that this strong support structure allows these containers to be transported by ship, rail, and highway.

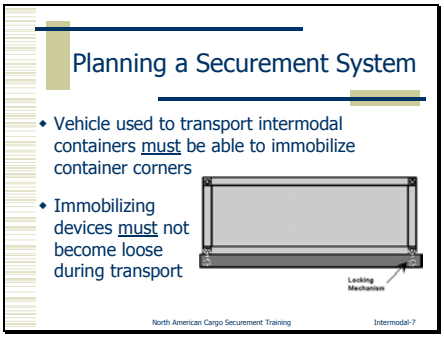
Show Slide Intermodal-5.



Explain that, for highway transport, intermodal containers need the corners to be positioned and secured to prevent tipping or sliding.

Show Slide Intermodal-6.



Lesson Plan	Instructor Notes
	Return to the list generated from the opening question listing the types of problems the participants have had in securing intermodal containers. The instructor will then tell the participants that they will now learn how to avoid these problems by planning a securement system.
Planning a securement system for intermodal containers **Explain** to participants that, when planning a securement system for intermodal containers, they need to ensure that: ♦ The vehicle used to transport intermodal containers is capable of immobilizing the container corners ♦ The immobilizing devices do not become loose during transport.	Show Slide Intermodal-7. 

Lesson Plan	Instructor Notes

Application

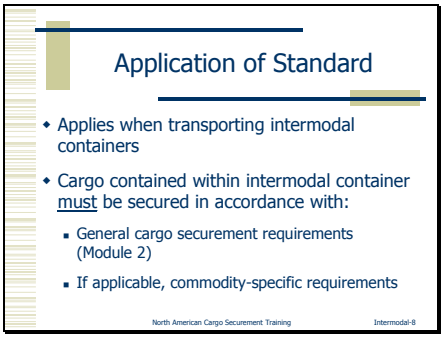
Explain to the participants that the securement requirements in this module apply when transporting intermodal containers.

Tell participants that cargo contained within an intermodal container must be secured in accordance with the general cargo securement requirements (Module 2, General Cargo Securement Requirements: Equipment and Methods) or, if applicable, in accordance with the commodity specific requirements.

1 minute

Explain the application of the standard.

Show Slide Intermodal-8.



Lesson Plan	Instructor Notes

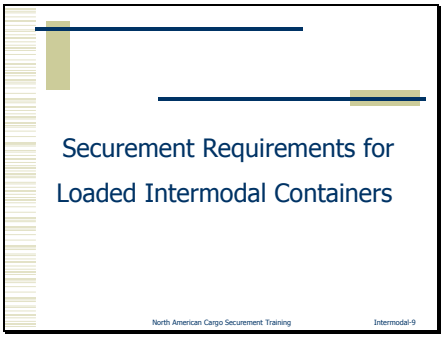
Securement Requirements for Intermodal Containers

20 minutes

Tell participants that you are now going to talk about the securement requirements for intermodal containers, both loaded and empty.

Explain the securement requirements for intermodal containers.

Show Slide Intermodal-9.

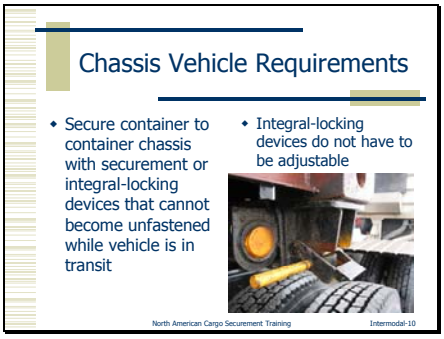


Requirements for securing loaded intermodal containers: container chassis vehicles

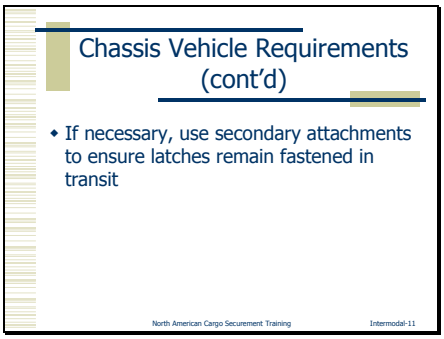
Explain to participants that the loaded intermodal container must be secured to the container chassis with securing devices or integral-locking devices that cannot accidentally become unfastened while the vehicle is in transit. Integral-locking devices are not required to be adjustable.

Explain that, if this cannot be assured, secondary attachments should be used to ensure that the latches remain fastened in transit.

Show Slide Intermodal-10.



Show Slide Intermodal-11.



Lesson Plan	Instructor Notes

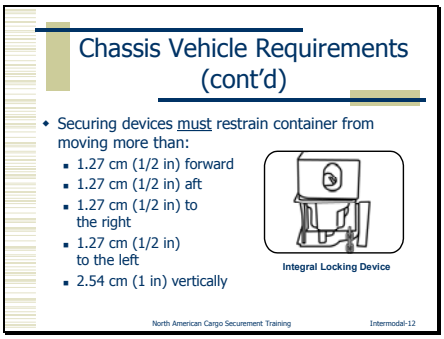
Explain that the securing devices must restrain the loaded container from moving more than:

- 1.27 cm (1/2 in) forward
- 1.27 cm (1/2 in) rearward
- 1.27 cm (1/2 in) to the right
- 1.27 cm (1/2 in) to the left
- 2.54 cm (1 in) vertically

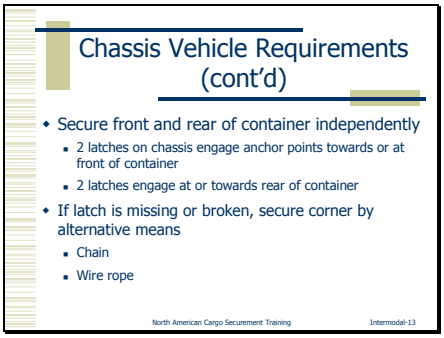
Tell participants that two latches on the chassis engage anchor points towards or at the front of the loaded container, and two latches engage at or towards the rear of the loaded container.

Explain that, if a latch is missing or broken, the corner must be secured to the vehicle by alternative means, such as chain or wire rope.

Show Slide Intermodal-12.



Show Slide Intermodal-13.



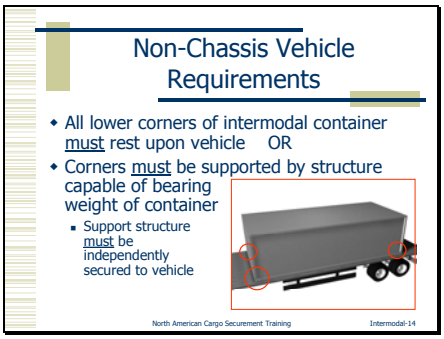
Requirements for securing loaded intermodal containers: containers on non-chassis vehicles

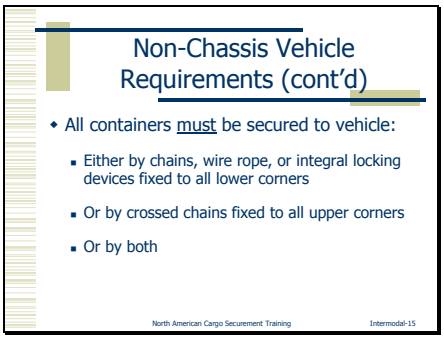
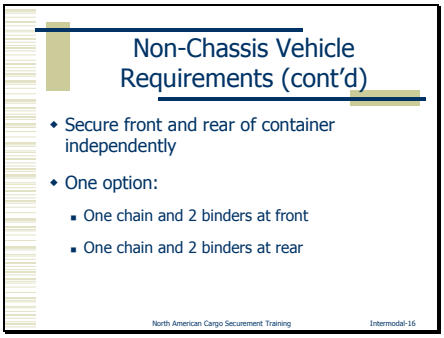
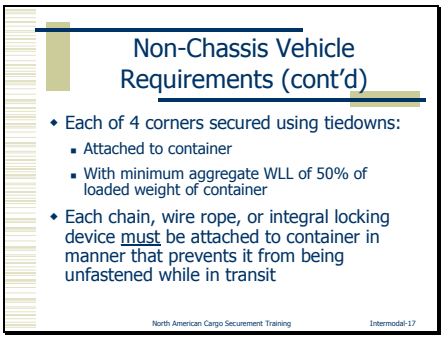
Explain to participants that, when securing loaded intermodal containers on non-chassis vehicles:

- All lower corners of the loaded intermodal container must rest upon the vehicle OR
- The corners must be supported by a structure capable of bearing the weight of the loaded container.

Tell participants that the support structure must be independently secured to the vehicle.

Show Slide Intermodal-14.



Lesson Plan	Instructor Notes
Explain that each loaded container must be secured to the vehicle in one of three ways: ◆ Chains, wire ropes, or integral devices that are fixed to all lower corners ◆ Crossed chains that are fixed to all upper corners OR ◆ Both.	Show Slide Intermodal-15. 
Tell participants that the front and rear of the loaded container must be secured independently. This could be done by using one chain and two binders at the front end and one chain and two binders at the rear.	Show Slide Intermodal-16. 
Say that each of the four corners must be secured using tiedowns that: ♦ Are attached to the loaded container ♦ Have an aggregate working load limit of at least 50% of the loaded weight of the loaded container, based on the securement requirements for general cargo.	Show Slide Intermodal-17. 
Explain that each chain, wire rope, or integral locking device must be attached to the loaded container in a manner that prevents it from being unfastened while the vehicle is in transit.	

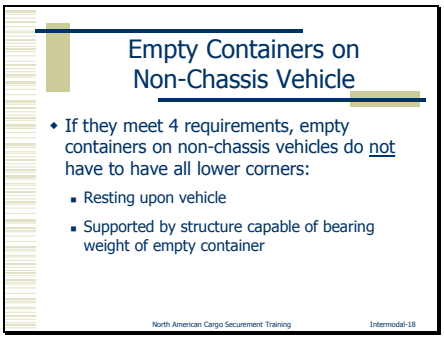
Lesson Plan	Instructor Notes

Requirements for securing empty intermodal containers

Explain that, if they meet certain requirements, empty intermodal containers transported on vehicles other than container chassis vehicles do not have to have all lower corners of the intermodal container:

- Resting upon the vehicle
- Supported by a structure capable of bearing the weight of the empty container.

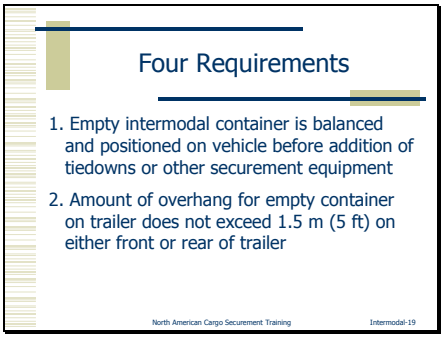
Show Slide Intermodal-18.



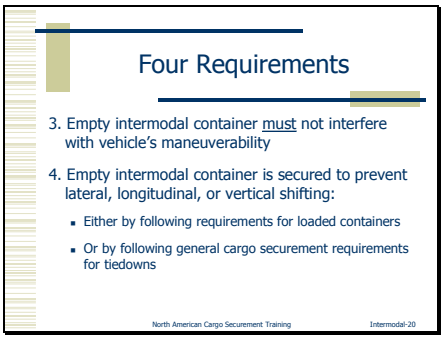
Tell participants the requirements that empty containers must meet are:

1. The empty intermodal container is balanced and positioned on the vehicle in a manner such that the container is stable before the addition of tiedowns or other securement equipment
2. The amount of overhang for the empty container on the trailer does not exceed 1.5 m (5 ft) on either the front or rear of the trailer
3. The empty intermodal container must not interfere with the vehicle's maneuverability
4. The empty intermodal container is secured to prevent lateral, longitudinal, or vertical shifting:
   - Either by following the requirements for loaded containers
   - Or by following the general cargo securement requirements for tiedowns.

Show Slide Intermodal-19.



Show Slide Intermodal-20.

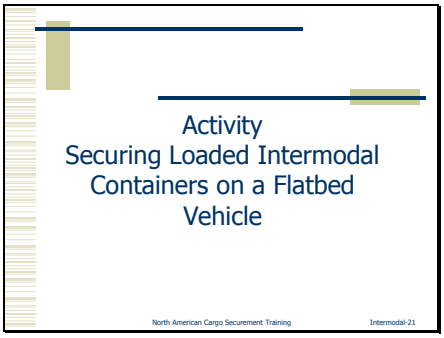


Lesson Plan	Instructor Notes

Activity: Securing Intermodal Containers on a Flatbed Vehicle

Tell participants that you want to review what participants have learned.

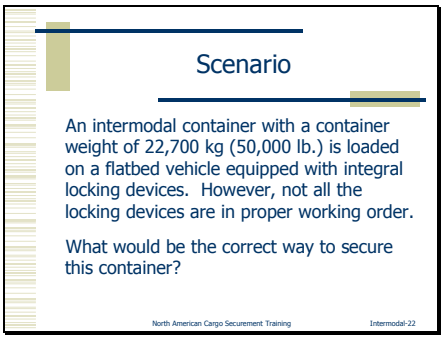
Show Slide Intermodal-21.



Read the scenario to participants:

> **Scenario:** An intermodal container with a container weight of 22,700 kg (50,000 lb.) is loaded on a flatbed vehicle equipped with integral locking devices. However, not all the locking devices are in proper working order.

Show Slide Intermodal-22.



Ask this question:

> What would be the correct way to secure this container?

Response from participants should include:

1. Either cross chains to upper 4 corners
2. Or secure chains or wire rope at each lower corner.
3. Or do both
4. The container must be totally supported by the vehicle.

Lesson Plan	Instructor Notes

Summary

2 minutes

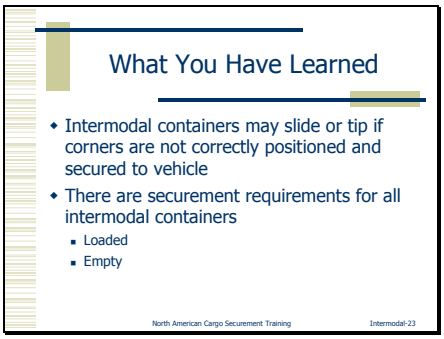
Summarize the lesson on Intermodal Containers, recapping what the participants just learned.

Tell participants that they now know to properly secure Intermodal containers.

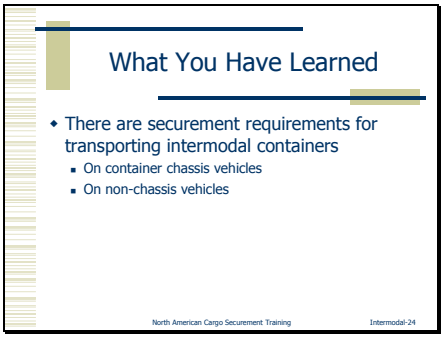
Remind participants that:

- Intermodal containers are rigid steel structures that may slide or tip if the corners are not correctly positioned and secured to the vehicle.
- There are securement requirements for loaded intermodal containers and for empty containers.
- There are securement requirements and minimum movement requirements for containers transported on chassis vehicles and for containers on non-chassis vehicles.

Show Slide Intermodal-22.



Show Slide Intermodal-23.



Module Overview

Module 9: Automobiles, Light Trucks, and Vans

Learning Objectives

At the completion of the training, participants will be able to:

- Describe how the cargo securement principles apply to automobiles, light trucks, and vans
- Determine what is required to properly secure automobiles, light trucks and vans, including the number, placement, and types of cargo securing devices
- Identify securement systems that are not in compliance

Time Required

30 minutes

Topics

1. Overview and Learning Objectives
2. Principles for Securing Automobiles, Light Trucks, and Vans
3. Application
4. Securement Requirements for Automobiles, Light Trucks, and Vans
5. Summary

Training Methods

1. Participative lecture
2. Group activity (Small group exercises)

Participant Materials

1. Participant Manual
2. Cargo Securement Guidebook

Training Materials

1. Instructor Guide
2. PowerPoint slides and projection system
3. Easel pad and markers
4. Participant materials

Instructor Notes

Restraint is required in all 4 directions. However if the securement requirements can be satisfied with two tiedowns then they must be positioned diagonally.

Automobiles, Light Trucks, and Vans

Lesson Plan	Instructor Notes

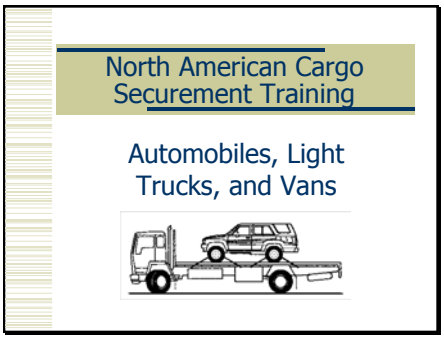
Overview and Learning Objectives

2 minutes

Tell the participants that you are going to talk about securement for automobiles, light trucks, and vans.

Explain the objectives of the training.

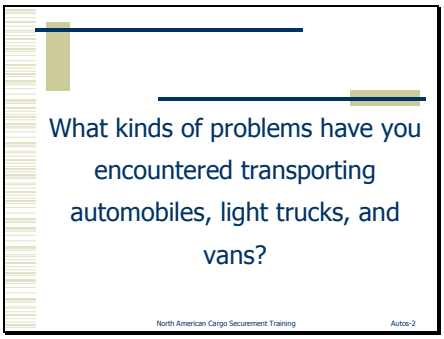
Show Slide Autos-1.



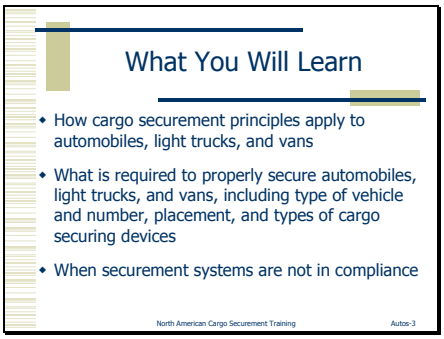
Ask the participants:

> What kinds of problems have you encountered transporting automobiles, light trucks, and vans?

Show Slide Autos-2.



Record the problems on easel pad. Make sure problems are addressed during the module.

Lesson Plan	Instructor Notes
Tell participants that, at the completion of training, they will be able to: ◆ Describe how the cargo securement principles apply to automobiles, light trucks, and vans ◆ Determine what is required to properly secure automobiles, light trucks and vans, including the number, placement, and types of cargo securing devices ◆ Identify securement systems that are not in compliance	Show Slide Autos-3. 

Lesson Plan	Instructor Notes

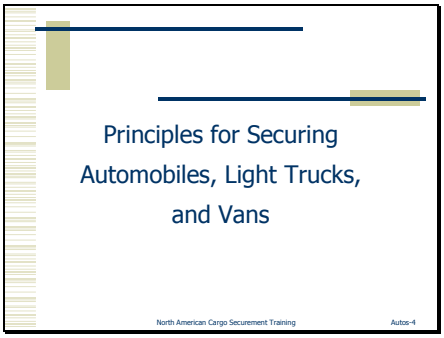
Principles for Securing Automobiles, Light Trucks, and Vans

5 minutes

Tell the participants that you are now going to talk about the principles for securing automobiles, light trucks, and vans.

Explain the principles for securing automobiles, light trucks, and vans.

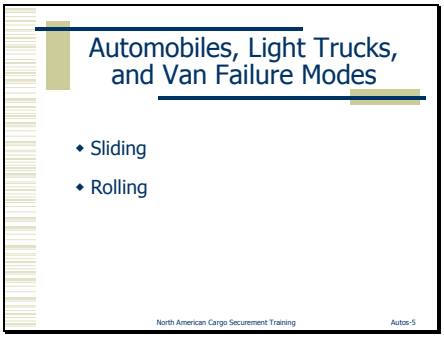
Show Slide Autos-4.



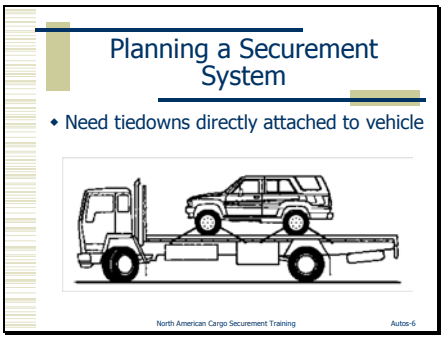
Automobiles, light trucks, and vans: characteristics and cargo securement failure modes

Explain that, for automobiles, light trucks, and vans, sliding and rolling are the two failure modes for vehicle securement.

Show Slide Autos-5.



Return to the list generated from the opening question listing the types of problems the participants have had in securing automobiles, light trucks, and vans. The instructor will then tell the participants that they will now learn how to avoid these problems by planning a securement system.

Lesson Plan	Instructor Notes
Planning a securement system for automobiles, light trucks, and vans **Explain** to participants that, when planning a securement system for automobiles, light trucks, and vans, tiedowns directly attached to the vehicle being transported are the most effective method.	Show Slide Autos-6. 

Lesson Plan	Instructor Notes

Application

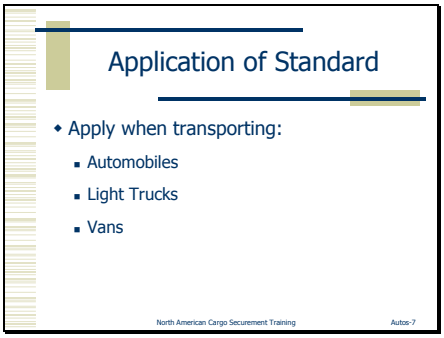
1 minute

Explain the application of the standard.

Explain to participants that the securement requirements in this module apply when transporting:

- Automobiles
- Light Trucks
- Vans

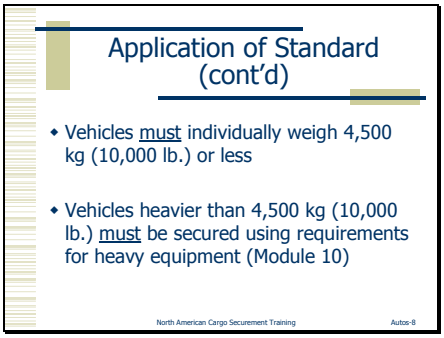
Show Slide Autos-7.



Tell participants that these vehicles must individually weigh 4,500 kg (10,000 lb.) or less.

Tell participants that vehicles heavier than 4,500 kg (10,000 lb.) must be secured using the requirements for heavy equipment (Module 10).

Show Slide Autos-8.



Lesson Plan	Instructor Notes

Securement Requirements for Automobiles, Light Trucks, and Vans

20 minutes

Explain the general securement requirements for automobiles, light trucks, and vans.

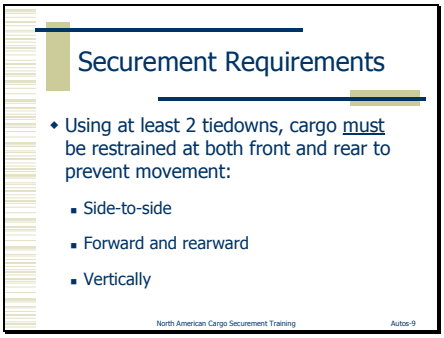
Refer participants to the correct section in the Cargo Securement Guidebook so that they become familiar with it.

Securement Requirements: automobiles, light trucks, and vans

Explain to participants the securement requirements for automobiles, light trucks, and vans.

- Using at least two tiedowns, cargo must be restrained at both the front and the rear to prevent movement:
  - Side – to – side
  - Forward and rearward
  - Vertically.
- Tiedowns that are designed to be attached directly to the structure of the automobile, light truck, or van must use the vehicle securement mounting points.

Show Slide Auto-9.



Show Slide Auto-10.

Lesson Plan

- Tiedowns that are designed to fit over or around the wheels of an automobile, light truck, or van <u>must</u> provide restraint:
  - Side – to – side
  - Forward and rearward
  - Vertically.

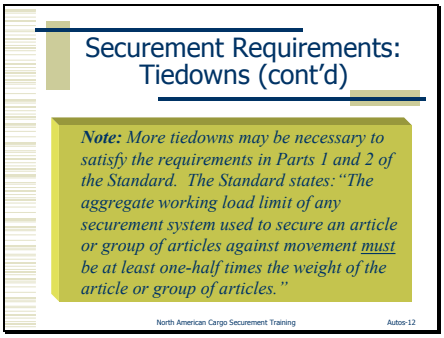
> ***Note:*** *More tiedowns may be necessary to satisfy the requirements in Parts 1 and 2 of the Standard. The Standard states: "The aggregate working load limit of any securement system used to secure an article or group of articles against movement <u>must</u> be at least one-half times the weight of the article or group of articles."*

- Edge protectors are not required for synthetic webbing at points where the webbing comes in contact with the tires.

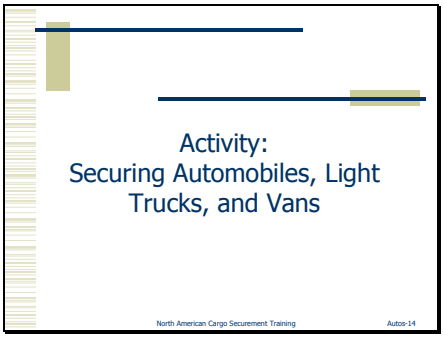
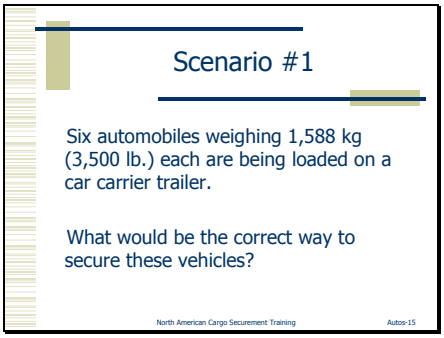
Instructor Notes

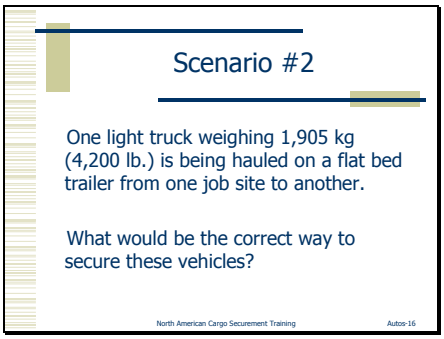
Show Slide Auto-11.

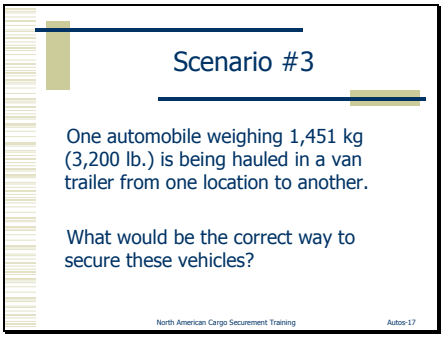
Show Slide Autos-12.



Show Slide Autos-13.

Lesson Plan	Instructor Notes
Activity: Securing Automobiles, Light Trucks, and Vans	
Tell participants that you want to review what participants have learned.	Show Slide Autos-14. 
Read the scenario to participants: **Scenario #1:** Six automobiles weighing 1,588 kg (3,500 lb.) each are being loaded on a car carrier trailer.	Show Slide Autos-15. 
Ask this question: What would be the correct way to secure these vehicles?	Response from participants should include: Option # 1: ♦ Secure each vehicle with two tiedowns or more to provide restraint against forward, rearward and sideways movement using the mounting points on the vehicles. ♦ All vehicles are less than 4,500 kg (10,000 lb.). If any were over 4,500 kg (10,000 lb.), they would be required to be secured in accordance with requirements in Module 10.

Lesson Plan	Instructor Notes
	Option # 2: ♦ Each vehicle <u>must</u> be restrained to prevent forward, rearward, lateral and vertical movement using a minimum of two tiedowns. ♦ Tiedowns that are designed to fit over or around the wheels of and automobile, light truck, or van <u>must</u> provide lateral, longitudinal and vertical restraint.
Read the scenario to participants: **Scenario #2:** One light truck weighing 1,905 kg (4,200 lb.) is being hauled on a flat bed trailer from one job site to another.	Show Slide Autos-16. 
Ask this question: What would be the correct way to secure these vehicles?	Response from participants should include: Option # 1: ♦ The vehicle <u>must</u> be restrained to prevent forward, rearward, lateral and vertical movement using a minimum of two tiedowns. ♦ These tiedowns <u>must</u> be affixed to mounting points on the vehicle that are specifically designed for that purpose.

Lesson Plan	Instructor Notes
	Option # 2: ♦ The vehicle <u>must</u> be restrained to prevent forward, rearward, lateral and vertical movement using a minimum of two tiedowns. ♦ Tiedowns that are designed to fit over or around the wheels of an automobile, light truck, or van <u>must</u> provide lateral, longitudinal and vertical restraint.
Read the scenario to participants: **Scenario #3:** One automobile weighing 1,451 kg (3,200 lb.) is being hauled in a van trailer from one location to another.	Show Slide Autos-17. 
Ask this question: What would be the correct way to secure these vehicles?	Response from participants should include: Option # 1: ♦ The vehicle <u>must</u> be restrained to prevent forward, rearward, lateral and vertical movement using a minimum of two tiedowns. ♦ These tiedowns <u>must</u> be affixed to mounting points on the vehicle that are specifically designed for that purpose.

Lesson Plan	Instructor Notes
	Option # 2: ♦ The vehicle <u>must</u> be restrained to prevent forward, rearward, lateral and vertical movement using a minimum of two tiedowns. ♦ Tiedowns that are designed to fit over or around the wheels of and automobile, light truck, or van <u>must</u> provide lateral, longitudinal and vertical restraint.

Lesson Plan	Instructor Notes

Summary

2 minutes

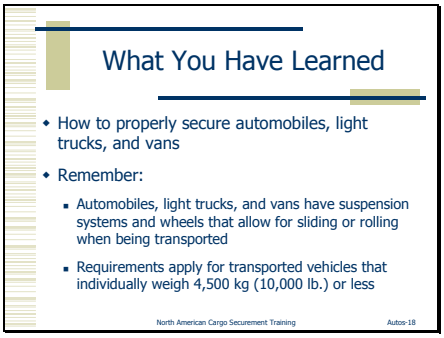
Summarize the lesson on Automobiles, Light Trucks, and Vans, recapping what the participants just learned.

Tell participants that they now know how to properly secure automobiles, light trucks, and vans.

Remind participants that:

- Automobiles, light trucks, and vans have suspension systems and wheels that allow for sliding, rolling, and bouncing when being transported.
- The requirements in this module apply for transported vehicles that individually weigh 4,500 kg (10,000 lb.) or less.

Show Slide Autos-18.



Module Overview

Module 10: Heavy Vehicles, Equipment, and Machinery

Learning Objectives

At the completion of the training, participants will be able to:

- Describe how the cargo securement principles apply to heavy vehicles, equipment, and machinery
- Determine what is required to properly secure heavy vehicles, equipment, and machinery, including the number, placement and types of cargo securing devices
- Identify securement systems that are not in compliance

Time Required

30 minutes

Topics

1. Overview and Learning Objectives
2. Principles for Securing Heavy Vehicles, Equipment, and Machinery
3. Application
4. Securement Requirements for Heavy Vehicles, Equipment, and Machinery
5. Summary

Training Methods

1. Participative lecture
2. Group activity (Small group exercises)

Participant Materials

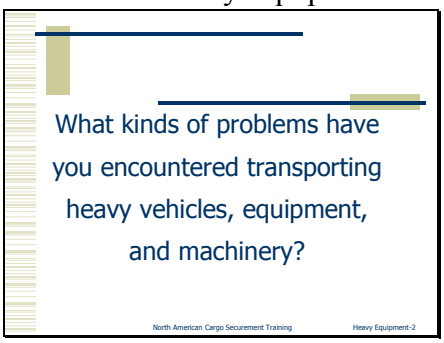
1. Participant Manual
2. Driver's Handbook on Cargo Securement

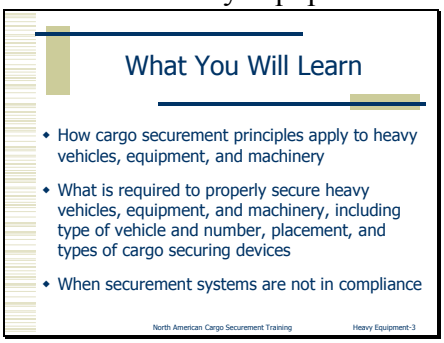
Training Materials

1. Instructor Guide
2. PowerPoint slides and projection system
3. Easel pad and markers
4. Participant materials

Instructor Notes

Heavy Vehicles, Equipment, and Machinery

Lesson Plan	Instructor Notes
## Overview and Learning Objectives	*2 minutes*
Tell participants that you are going to talk about securement for heavy vehicles, equipment, and machinery.	Explain the objectives of the training. Show Slide Heavy Equipment-1.
Ask the participants: What kinds of problems have you encountered transporting heavy vehicles, equipment, and machinery?	Show Slide Heavy Equipment-2.
	
	Record the problems on easel pad. Make sure problems are addressed during the module.

Lesson Plan	Instructor Notes
Tell participants that, at the completion of the training, they will be able to: ◆ Describe how the cargo securement principles apply to heavy vehicles, equipment, and machinery ◆ Determine what is required to properly secure heavy vehicles, equipment, and machinery, including the number, placement, and types of cargo securing devices ◆ Identify securement systems that are not in compliance	Show Slide Heavy Equipment-3. 

Lesson Plan	Instructor Notes

Principles for Securing Heavy Vehicles, Equipment, and Machinery

5 minutes

Tell participants that you are now going to talk about the principles for securing heavy vehicles, equipment, and machinery.

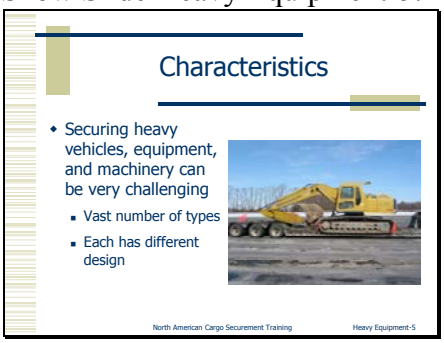
Explain the principles for securing heavy vehicles, equipment, and machinery.

Show Slide Heavy Equipment-4.

Heavy Vehicles, Equipment, and Machinery: characteristics and cargo securement failure modes

Explain to participants that securing heavy vehicles, equipment, and machinery can be very challenging since there are a vast number of types and each has a different design.

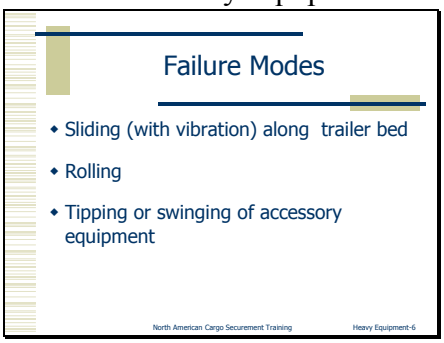
Show Slide Heavy Equipment-5.

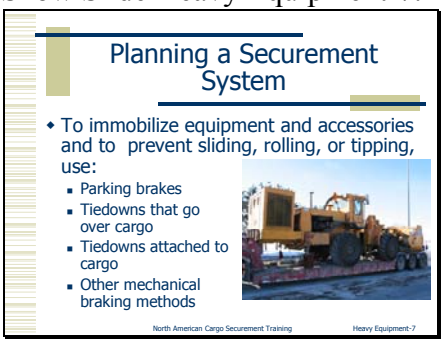


Explain that the cargo securement failure modes for heavy vehicles, equipment, and machinery are as follows:

- Sliding (with vibration) along the trailer bed
- Rolling
- Tipping or swinging of accessory equipment such as buckets or for articulated vehicles

Show Slide Heavy Equipment-6.



Lesson Plan	Instructor Notes
	Return to the list generated from the opening question listing the types of problems the participants have had in securing heavy vehicles, equipment, and machinery. The instructor will then tell the participants that they will now learn how to avoid these problems by planning a securement system.
Planning a securement system for heavy vehicles, equipment, and machinery **Explain** to participants that, to make sure cargo is secured safely, tiedowns attached to heavy vehicles, equipment, and machinery are used to prevent the cargo from sliding, rolling, or tipping. **Say** that several methods are used to immobilize equipment and accessories: ♦ Parking brakes on equipment ♦ Tiedowns that go over the cargo ♦ Tiedowns attached to the cargo ♦ Other mechanical braking methods.	Show Slide Heavy Equipment-7. 

Lesson Plan	Instructor Notes

Application

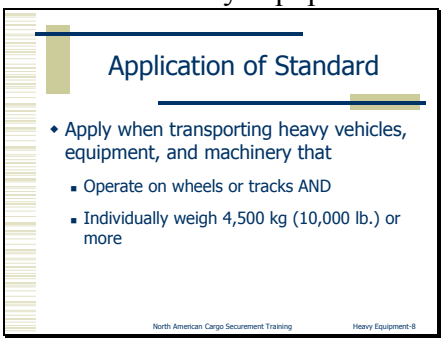
1 minute

Explain the application of the standard.

Explain to participants that the securement requirements in this module apply when transporting heavy vehicles, equipment, and machinery that:

- Operate on wheels or tracks AND
- Individually weigh 4,500 kg (10,000 lbs.) or more (e.g., front end loaders, bulldozers, tractors, power shovels).

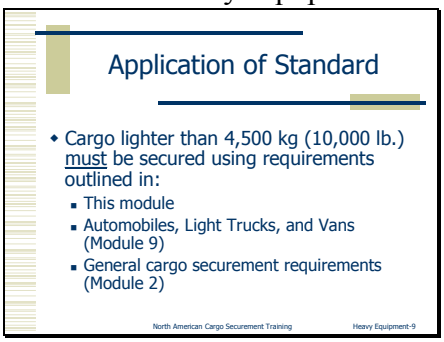
Show Slide Heavy Equipment-8.



Tell participants that vehicles, equipment, and machinery that are lighter than 4,500 kg (10,000 lb.) must be secured using the requirements outlines in:

- This module
- Automobiles, Light Trucks, and Vans (Module 9)
- General Cargo Securement Requirements: Equipment and Methods (Module 2).

Show Slide Heavy Equipment-9.



Lesson Plan	Instructor Notes

Securement Requirements for Heavy Vehicles, Equipment, and Machinery

20 minutes

Tell participants that you are now going to talk about the securement requirements for heavy vehicles, equipment, and machinery.

Explain the general securement requirements for heavy vehicles, equipment, and machinery.

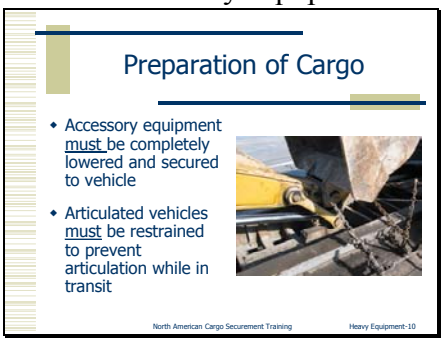
Refer participants to the correct section in the Driver's Handbook on Cargo Securement so that they become familiar with it.

Preparation of cargo

Explain to participants that accessory equipment such as hydraulic shovels must be completely lowered and secured to the vehicle.

Tell participants that articulated vehicles must be restrained in a manner that prevents articulation while in transit.

Show Slide Heavy Equipment-10.



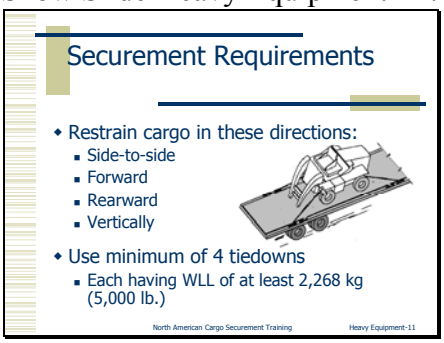
Heavy vehicles, equipment, and machinery with crawler tracks or wheels

Explain to participants that heavy equipment or machinery with crawler tracks or wheels must be restrained in these directions:

- Side-to-side
- Forward
- Rearward
- Vertically.

Use a minimum of 4 tiedowns, each having a working load limit of at least 2,268 kg (5,000 lbs.)

Show Slide Heavy Equipment-11.



Lesson Plan	Instructor Notes
Tell participants that tiedowns attached to the cargo must be attached: ♦ At the front and rear of the vehicle OR ♦ At the mounting points on the cargo specifically designed for that purpose.	Show Slide Heavy Equipment-12.
Explain that more tiedowns may be necessary to satisfy the requirements of Part 2 of the Standard which states: "The aggregate working load limit of any securement system used to secure an article or group of articles against movement must be at least one-half times the weight of the article or group of articles."	Show Slide Heavy Equipment-13. Show Slide Heavy Equipment-14.

Lesson Plan	Instructor Notes

Activity: Securing heavy vehicles, equipment, and machinery

Tell participants that you want to review what participants have learned.

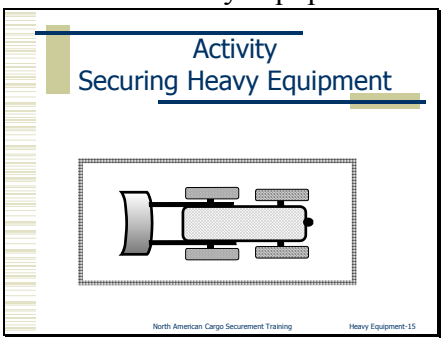
Read the scenario to participants:

> **Scenario #1:** One tracked Excavator weighing 4,990 kg (11,000 lb.) is to be delivered to a customer using a stepdeck trailer that is equipped with a rub rail. The driver has G70 10 mm (3/8 in) chains to secure the load.

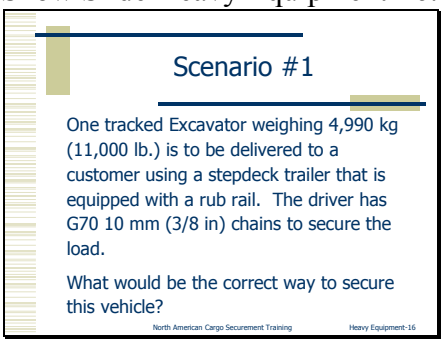
Ask this question:

> What would be the correct way to secure this vehicle?

Show Slide Heavy Equipment-15.

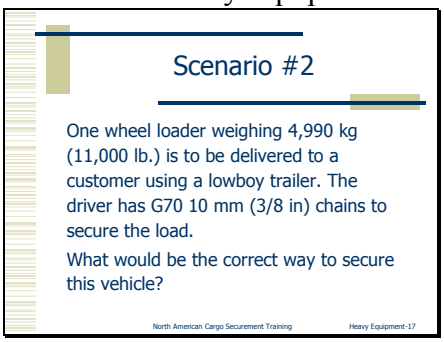


Show Slide Heavy Equipment-16.

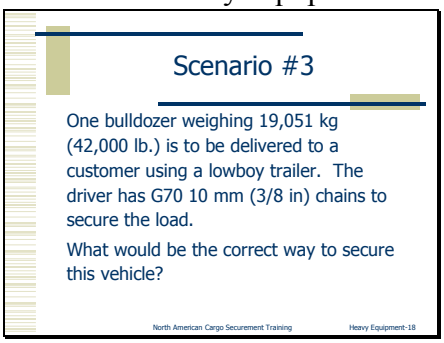


Response from participants should include:

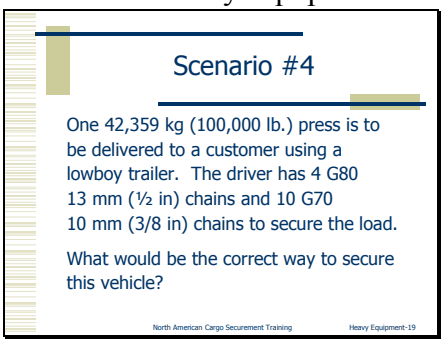
- A minimum of four 2,268 kg (5,000 lb.) tiedowns are required to comply with the Standard.
- The hydraulic shovel <u>must</u> be lowered completely and secured to the trailer. A chain or a webbing tiedown could be used. If a webbing tiedown is used, edge protectors should be used to prevent damage to the webbing tiedown.
- The machine <u>must</u> be restrained against movement in the lateral, forward, rearward, and vertical direction using a minimum of four tiedowns.

Lesson Plan	Instructor Notes
	♦ Each tiedown must be affixed as close as practical to the front and rear of the vehicle, or mounting points on the vehicle that have been specifically designed for that purpose. ♦ Two chains attached to the tracks pulling across the trailer, pulling rearward and down. ♦ Two chains attached to the tracks pulling across the trailer, pulling forward and down. ♦ The securing devices should not be exposed beyond the rub rail. NOTE: For US purposes, the bucket securement counts toward an aggregate securement value.
Read the scenario to participants: **Scenario #2:** One wheel loader weighing 4,990 kg (11,000 lb.) is to be delivered to a customer using a lowboy trailer. The driver has G70 10 mm (3/8 in) chains to secure the load.	Show Slide Heavy Equipment-17. 
Ask this question: What would be the correct way to secure this vehicle?	Response from participants should include: ♦ The hydraulic shovel must be lowered completely and secured to the trailer by a tiedown.

Lesson Plan	Instructor Notes
	♦ The articulating point of the machine should be restrained to prevent articulation in transit. A supplied lock bar may be used, or two chains must be attached to the frame with one chain pulling to the right side of the trailer and one chain pulling to the left side of the trailer. ♦ The machine must be restrained against movement in the lateral, forward, rearward, and vertical direction using a minimum of four tiedowns. ♦ Each tiedown must be affixed as close as practical to the front and rear of the vehicle, or mounting points on the vehicle that have been specifically designed for that purpose. ♦ Two chains must be attached to either the lift eyes provided, the rear axle, or tow pin in the counter weight pulling across the trailer, pulling rearward and down. ♦ Two chains must be attached to the lift eyes provided, or the front axle pulling across the trailer, pulling forward and down.

Lesson Plan	Instructor Notes
Read the scenario to participants: **Scenario #3:** One bulldozer weighing 19,051 kg (42,000 lb.) is to be delivered to a customer using a lowboy trailer. The driver has G70 10 mm (3/8 in) chains to secure the load. **Ask** this question: What would be the correct way to secure this vehicle?	Show Slide Heavy Equipment-18.  Response from participants should include: Option # 1: ♦ The machine <u>must</u> be restrained against movement in the lateral, forward, rearward, and vertical direction using a minimum of four tiedowns. ♦ Each tiedown <u>must</u> be affixed as close as practical to the front and rear of the vehicle, or mounting points on the vehicle that have been specifically designed for that purpose. ♦ Two chains <u>must</u> be attached to the tracks pulling across the trailer, pulling rearward and down. ♦ Two chains <u>must</u> be attached to the rear tow pin pulling across the trailer, pulling rearward and down. ♦ Two chains <u>must</u> be attached to the tracks pulling across the trailer, pulling forward and down.

Lesson Plan	Instructor Notes
	Option # 2: ♦ The machine must be restrained against movement in the lateral, forward, rearward, and vertical direction using a minimum of four tiedowns. ♦ Each tiedown must be affixed as close as practical to the front and rear of the vehicle, or mounting points on the vehicle that have been specifically designed for that purpose. ♦ Four chains must be attached to the tracks pulling across the trailer, pulling rearward and down. ♦ Two chains must be attached to the tracks pulling across the trailer, pulling forward and down. ♦ One chock block must be secured to the trailer in front of each track of the machine. ♦ One chock block must be secured to the trailer behind each track of the machine.

Lesson Plan	Instructor Notes
Read the scenario to participants: **Scenario #4:** One 42,359 kg (100,000 lb.) press is to be delivered to a customer using a lowboy trailer. The driver has 4 G80 13 mm (½ in) chains and 10 G70 10 mm (3/8 in) chains to secure the load. **Ask** this question: What would be the correct way to secure this vehicle?	Show Slide Heavy Equipment-19.  Response from participants should include: Option # 1: ♦ The machine <u>must</u> be restrained against movement in the lateral, forward, rearward, and vertical direction using a minimum of four tiedowns. ♦ Each tiedown <u>must</u> be affixed as close as practical to the front and rear of the vehicle, or mounting points on the vehicle that have been specifically designed for that purpose. ♦ Two ½" chains <u>must</u> be attached to the machine pulling across the trailer, pulling rearward and down. ♦ Two ½" chains <u>must</u> be attached to the machine pulling across the trailer, pulling forward and down. ♦ Two 3/8" chains <u>must</u> be attached to the machine pulling across the trailer, pulling rearward and down. ♦ Two 3/8" chains <u>must</u> be attached to the machine pulling across the trailer, pulling forward and down.

Lesson Plan	Instructor Notes
	Option # 2: ♦ The machine must be restrained against movement in the lateral, forward, rearward, and vertical direction using a minimum of four tiedowns. ♦ Each tiedown must be affixed as close as practical to the front and rear of the vehicle, or mounting points on the vehicle that have been specifically designed for that purpose. ♦ Two ½" chains must be attached to the machine pulling across the trailer, pulling rearward and down. ♦ Two ½" chains must be attached to the machine pulling across the trailer, pulling forward and down. ♦ Two 3/8" chain must be attached to one side of the trailer that go over the cargo and attached to the opposite side of the trailer. Friction mats should be placed under the entire press.

Lesson Plan	Instructor Notes

Summary

2 minutes

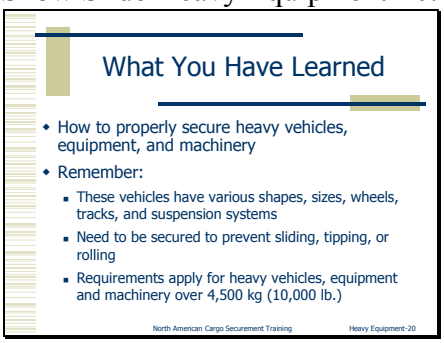
Summarize the lesson on Heavy Vehicles, Equipment, and Machinery, recapping what the participants just learned.

Tell participants that they now know to properly secure heavy vehicles, equipment, and machinery.

Remind participants that:

- Heavy vehicles, equipment, and machinery have various shapes and sizes, along with wheels, tracks, and suspension systems
- These vehicles, equipment, and machinery need to be secured to prevent sliding, tipping or rolling
- The securement requirements in this module apply for heavy vehicles, equipment and machinery over 4,500 kg (10,000 lb.), with optional use of this module for vehicles, equipment and machinery lighter than 4,500 kg (10,000 lb.).

Show Slide Heavy Equipment-20.



Module Overview

Module 11: Flattened or Crushed Vehicles

Learning Objectives

At the completion of the training, participants will be able to:

- Explain how the cargo securement principles apply to flattened or crushed vehicles
- Determine what is required to safely transport and secure flattened or crushed vehicles, including the number, placement, and types of cargo securing devices
- Identify securement systems that are not in compliance.

Time Required

30 minutes

Topics

1. Overview and Learning Objectives
2. Principles for Securing Flattened or Crushed Vehicles
3. Application
4. Securement Requirements for Flattened or Crushed Vehicles
5. Summary

Training Methods

1. Participative lecture
2. Group activity (Small group exercises)

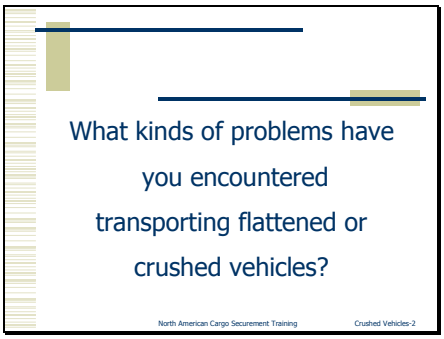
Participant Materials

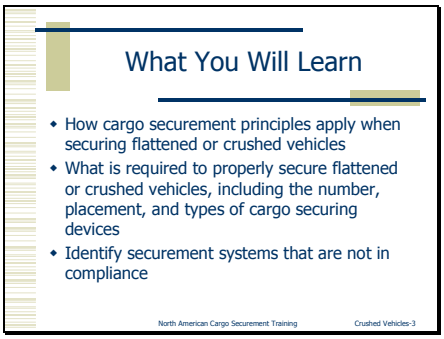
1. Participant Manual
2. Driver's Handbook on Cargo Securement

Training Materials

1. Instructor Guide
2. PowerPoint slides and projection system
3. Easel pad and markers
4. Participant materials

Flattened or Crushed Vehicles

Lesson Plan	Instructor Notes
Overview and Learning Objectives	*2 minutes*
Tell the participants that you are going to talk about securement for flattened or crushed vehicles.	Explain the objectives of the training. Show Slide Crushed Vehicles-1.
Ask the participants: What kinds of problems have you encountered transporting flattened or crushed vehicles?	Show Slide Crushed Vehicles-2.  Record the problems on easel pad. Make sure problems are addressed during the module.

Lesson Plan	Instructor Notes
Tell participants that, at the completion of training, they will be able to: ◆ Explain how the cargo securement principles apply to flattened or crushed vehicles ◆ Determine what is required to safely transport and secure flattened or crushed vehicles, including the number, placement, and types of cargo securing devices ◆ Identify securement systems that are not in compliance	Show Slide Crushed Vehicles-3. 

Lesson Plan	Instructor Notes

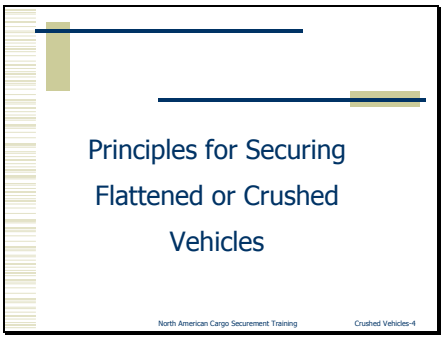
Principles for Securing Flattened or Crushed Vehicles

4 minutes

Tell the participants that you are now going to talk about the principles for securing flattened or crushed vehicles.

Explain the principles for securing flattened or crushed vehicles.

Show Slide Crushed Vehicles-4.



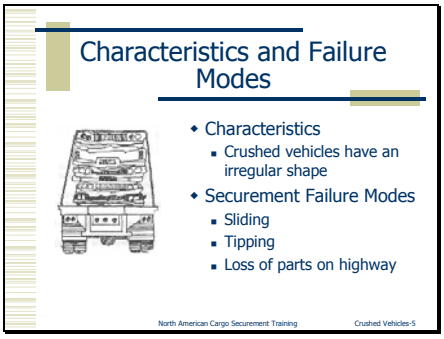
Flattened or Crushed Vehicles: characteristics and cargo securement failure modes

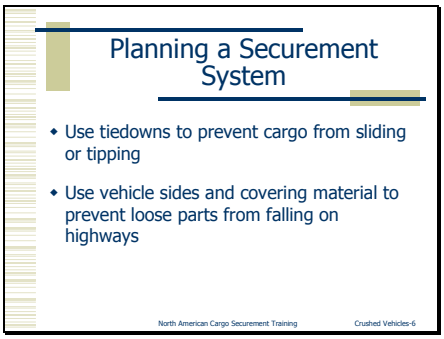
Explain that crushed or flattened vehicles are difficult cargo to secure because of their irregular shape. The challenge for the securement system is to:

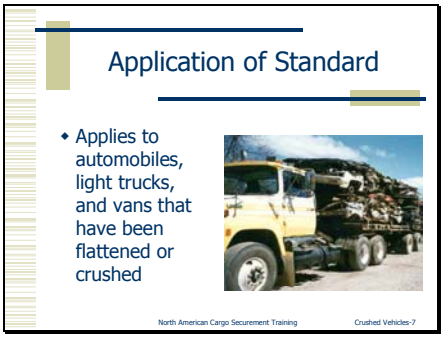
- Safely hold the cargo on the vehicle deck and
- Contain loose parts from falling from the vehicle.

Explain that sliding, tipping, and the loss of parts on the highway are the failure modes for flattened and crushed vehicles securement systems.

Show Slide Crushed Vehicles-5.



Lesson Plan	Instructor Notes
	Return to the list generated from the opening question listing the types of problems the participants have had in securing flattened or crushed vehicles. The instructor will then tell the participants that they will now learn how to avoid these problems by planning a securement system.
Planning a securement system for flattened or crushed vehicles	Show Slide Crushed Vehicles-6. 
Point out that tiedowns are used to prevent the cargo from sliding or tipping.	
Tell participants that the vehicle sides and/or covering material prevent loose parts from falling on the highway.	

Lesson Plan	Instructor Notes
Application **Explain** that the rules in this section apply to the transportation of vehicles such as automobiles, light trucks, and vans that have been flattened or crushed.	*2 minutes* Explain the application of the standard. Show Slide Crushed Vehicles-7. 

Lesson Plan	Instructor Notes

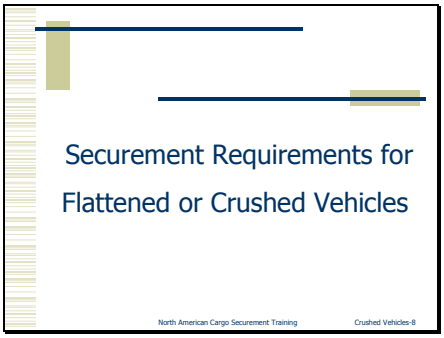
Securement Requirements for Flattened or Crushed Vehicles

10 minutes

Explain the securement requirements for flattened or crushed vehicles.

Refer participants to the correct section in the Cargo Securement Guidebook so that they become familiar with it.

Show Slide Crushed Vehicles-8.

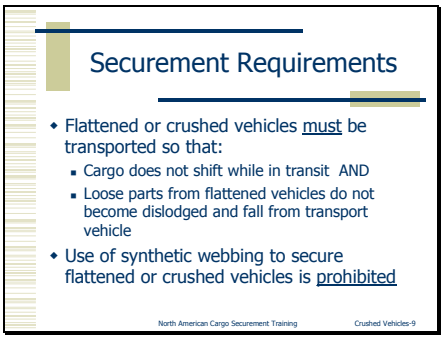


Tell participants that flattened or crushed vehicles must be transported so that:

- Cargo does not shift while in transit AND
- Loose parts from the flattened vehicles do not dislodge and fall from the transport vehicle.

Tell participants that the use of synthetic webbing to secure flattened or crushed vehicles is prohibited.

Show Slide Crushed Vehicles-9.



Lesson Plan	Instructor Notes

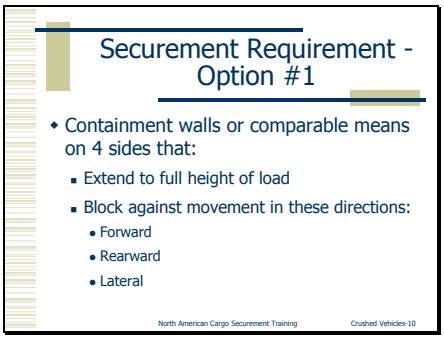
Requirements for securing flattened or crushed vehicles

Point out that there are 4 securement options for transporting flattened or crushed vehicles. Vehicles must have one of the following:

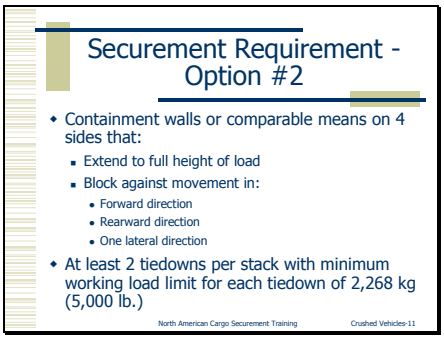
1. Containment walls or comparable means on 4 sides that:
   - ♦ Extend to the full height of the load
   - ♦ Block against cargo movement in these directions:
     - Forward
     - Rearward
     - Lateral
2. Containment walls or comparable means on 3 sides that:
   - ♦ Extend to the full height of the load
   - ♦ Block against cargo movement in these directions:
     - Forward
     - Rearward
     - One lateral

   A minimum of 2 tiedowns per vehicle stack with every tiedown having a minimum working load limit of 2,268 kg (5,000 lb.)

Show Slide Crushed Vehicles-10.



Show Slide Crushed Vehicles-11.



Lesson Plan	Instructor Notes

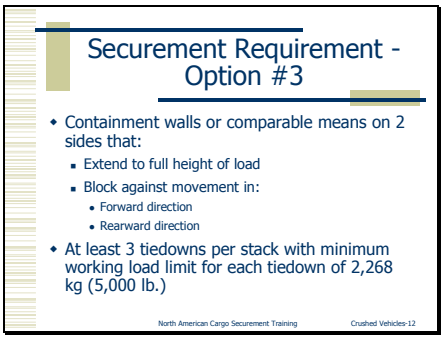
3. Containment walls or comparable means on 2 sides that:
   - ♦ Extend to the full height of the load
   - ♦ Block against cargo movement in these forward and rearward directions

   A minimum of 3 tiedowns per vehicle stack with every tiedown having a minimum working load limit of 2,268 kg (5,000 lb.)

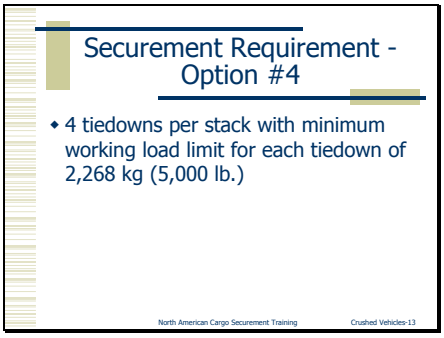
4. A minimum of 4 tiedowns per vehicle stack with every tiedown having a minimum working load limit of 2,268 kg (5,000 lb.)

> ***Note:*** *Additional tiedowns may be needed to satisfy the requirements of Part 2 of the Standard which states: "The aggregate working load limit of any securement system used to secure an article or group of articles against movement must be at least one-half times the weight of the article or group of articles."*

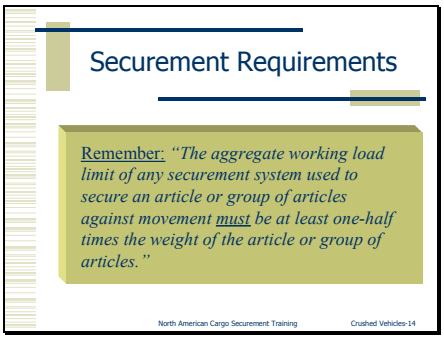
Show Slide Crushed Vehicles-12.



Show Slide Crushed Vehicles-13.



Show Slide Crushed Vehicles-14.



Lesson Plan	Instructor Notes

Containment of loose parts

Explain that, regardless of the securement option used, vehicles used to transport flattened or crushed vehicles must use a containment system that:

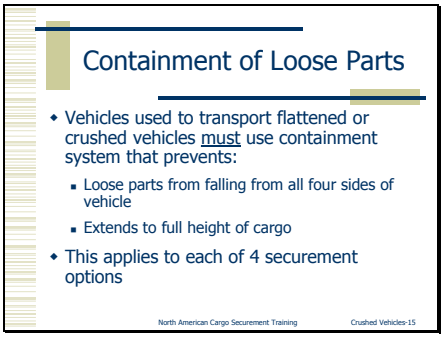
- Prevents loose parts from falling from any of the four sides of the vehicle, and
- Extends to the full height of the cargo.

Tell participants that the containment system can consist of one or a combination of the following:

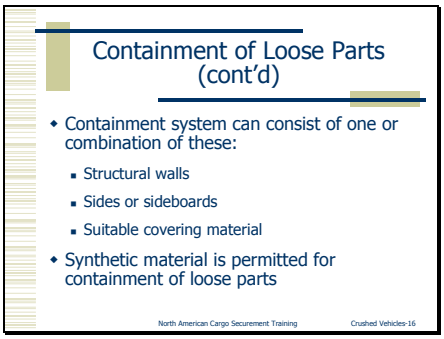
- Structural walls
- Sides or sideboards
- Suitable covering material.

Tell participants that the use of synthetic material for containment of loose parts is permitted.

Show Slide Crushed Vehicles-15.



Show Slide Crushed Vehicles-16.



Lesson Plan	Instructor Notes

Activity: Securing flattened or crushed vehicles

Tell participants that you want to review what participants have learned.

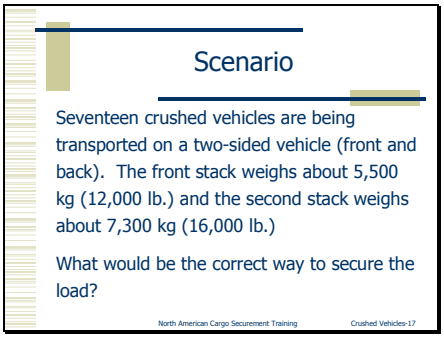
Read the scenario to participants:

> **Scenario:** Seventeen crushed vehicles are being transported on a two-sided vehicle (front and back). The front stack weighs about 5,500 kg (12,000 lb.) and the second stack weighs about 7,300 kg (16,000 lb.).

Ask this question:

> What would be the correct way to secure these crushed vehicles?

Show Slide Crushed Vehicles-17.



Response from participants should include:

- Use 3 tiedowns per stack of vehicles
- Each tiedown <u>must</u> have a working load limit of at least 2,268 kg (5,000 lb.)
- Use a loose parts containment system for both open sides.

Lesson Plan	Instructor Notes

Summary

2 minutes

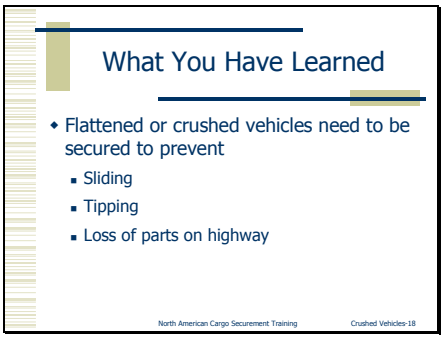
Summarize the lesson on Flattened or Crushed Vehicles, recapping what the participants just learned.

Tell participants that they now know how to properly secure flattened or crushed vehicles.

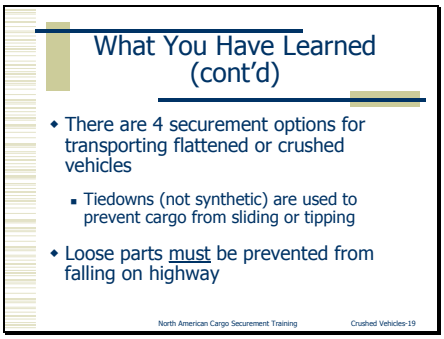
Remind participants that:

- Flattened or crushed vehicles need to be secured to prevent sliding, tipping, and the loss of parts on the highway
- There are 4 securement options for transporting flattened or crushed vehicles
- Tiedowns (not synthetic) are used to prevent the cargo from sliding or tipping
- Loose parts must be prevented from falling on the highway.

Show Slide Crushed Vehicles-18.



Show Slide Crushed Vehicles-19.



Module Overview

Module 12: Roll-on/Roll-off and Hook-Lift Containers

Learning Objectives

At the completion of the training, participants will be able to:

- Describe how the cargo securement principles apply to Roll-on/ Roll-off and Hook-Lift containers
- Determine what is required to properly secure Roll–on/ Roll–off and Hook-Lift containers, including the number, placement and types of cargo securing devices
- Identify securement systems that are not in compliance

Time Required

30 minutes

Topics

1. Overview and Learning Objectives
2. Principles for Securing Roll-on/ Roll-off and Hook-Lift Containers
3. Application
4. Securement Requirements for Roll-on/Roll-off and Hook-Lift Containers
5. Summary

Training Methods

1. Participative lecture
2. Group activity (Small group exercises)

Participant Materials

1. Participant Manual
2. Driver's Handbook on Cargo Securement

Training Materials

1. Instructor Guide
2. PowerPoint slides and projection system
3. Easel pad and markers
4. Participant materials

Instructor Notes

Integral Securement System Definition:

A feature of roll-on/roll-off containers and hook-lift containers and their related transport vehicles in which compatible front and rear hold down devices are mated to provide securement of the complete vehicle and its cargo.

Roll-on/Roll-off and Hook-Lift Containers

Lesson Plan	Instructor Notes

Overview and Learning Objectives

2 minutes

Tell the participants that they are going to learn about securement for roll-on/roll-off and hook-lift containers.

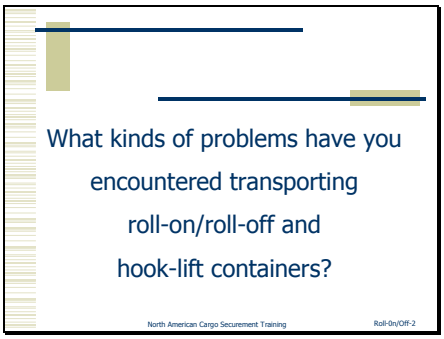
Explain the objectives of the training.

Show Slide Roll-On/Off-1.

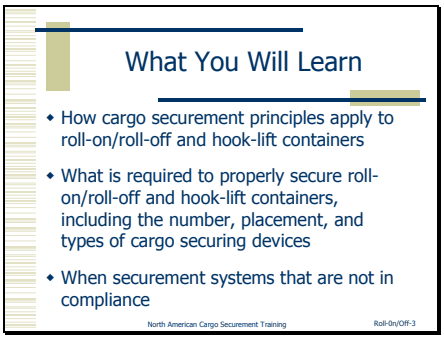
Ask the participants:

> What kinds of problems have you encountered transporting roll-on/roll-off and hook-lift containers?

Show Slide Roll-On/Off -2.



Record the problems on easel pad. Make sure problems are addressed during the module.

Lesson Plan	Instructor Notes
Tell participants that, at the completion of training, they will be able to: ◆ Describe how the cargo securement principles apply to roll-on/roll-off and hook-lift containers ◆ Determine what is required to properly secure roll–on/roll–off and hook-lift containers, including the number, placement, and types of cargo securing devices ◆ Identify securement systems that are not in compliance	Show Slide Roll-On/Off -3. 

Lesson Plan	Instructor Notes

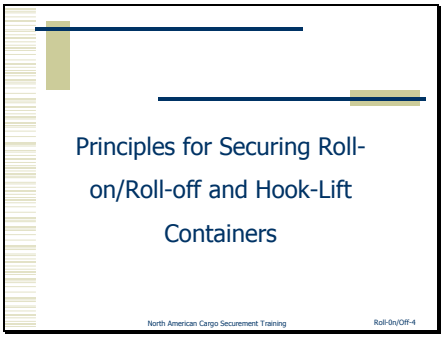
Principles for Securing Roll-on/Roll-off and Hook Lift Containers

5 minutes

Tell the participants that you are now going to talk about the principles for securing roll-on/roll-off and hook-lift containers.

Explain the principles for securing roll-on/roll-off and hook lift containers.

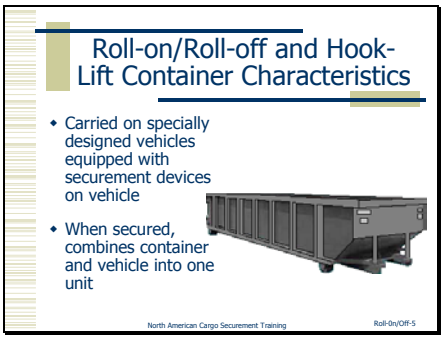
Show Slide Roll-On/Off -4.



Roll-on/Roll-off and Hook-Lift Containers: characteristics and cargo securement failure modes

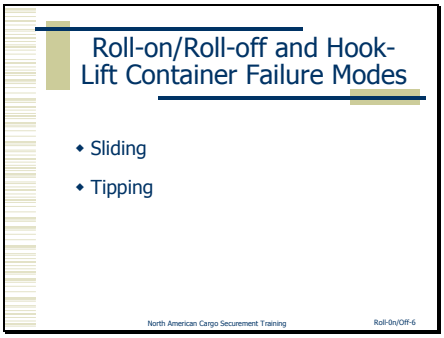
Explain to participants that roll-on/roll-off and hook-lift containers are carried on specially designed vehicles that are equipped with securing devices on the vehicle. When the container is secured, it combines the container and the vehicle into one unit.

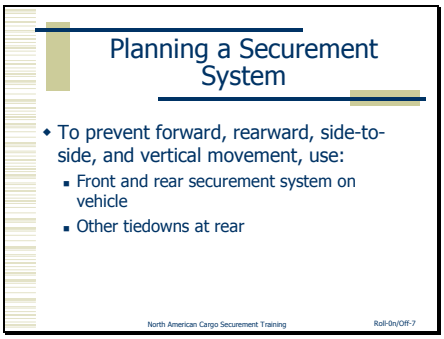
Show Slide Roll-On/Off -5.

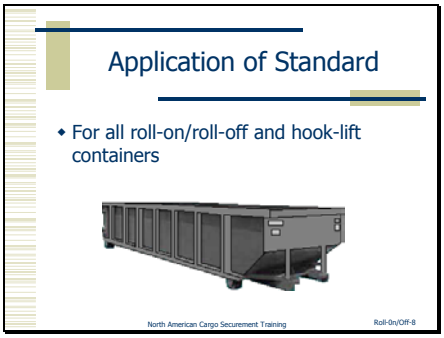


Explain that, if roll-on/roll-off and hook-lift containers are not correctly secured, they may fail by sliding or tipping.

Show Slide Roll-On/Off -6



Lesson Plan	Instructor Notes
	Return to the list generated from the opening question listing the types of problems the participants have had in securing roll-on/roll-off and hook-lift containers. The instructor will then tell the participants that they will now learn how to avoid these problems by planning a securement system.
Planning a securement system for roll-on/roll-off and hook-lift containers	Show Slide Roll-On/Off -7. 
Explain to the participants that, when securing roll-on/roll-off and hook-lift containers, they need to use: ♦ The front and rear securement system that is on the vehicle ♦ Other tiedowns at the rear. The goal is to prevent forward, rearward, side-to-side, and vertical movement.	

Lesson Plan	Instructor Notes
## Application **Explain** to the participants that the securement requirements in this module apply to the transportation of roll-on/roll-off and hook-lift containers.	*1minute* Explain the application of the standard. Show Slide Roll-On/Off -8. 

Lesson Plan	Instructor Notes

Securement Requirements for Roll-on/Roll-off and Hook Lift Containers

20 minutes

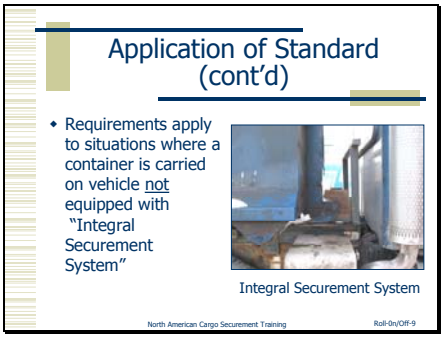
Explain the securement requirements for roll-on/roll-off and hook lift containers.

Refer participants to the correct section in the Cargo Securement Guidebook so that they become familiar with it.

Securement Requirements: roll-on/roll-off and hook lift containers

Tell participants that these requirements apply to situations where a container is carried on a vehicle that is not equipped with a compatible and functioning "Integral Securement System."

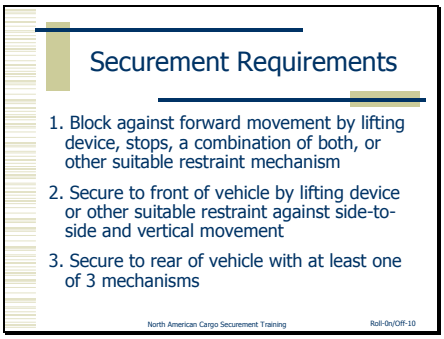
Show Slide Roll-On/Off -9.

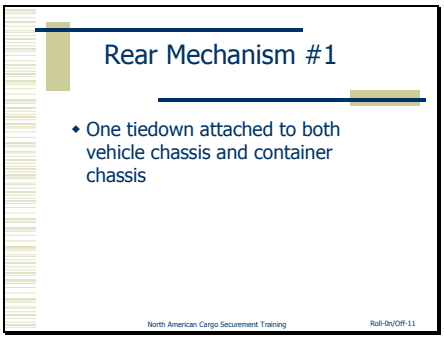
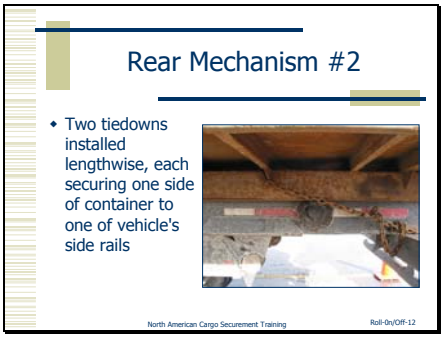
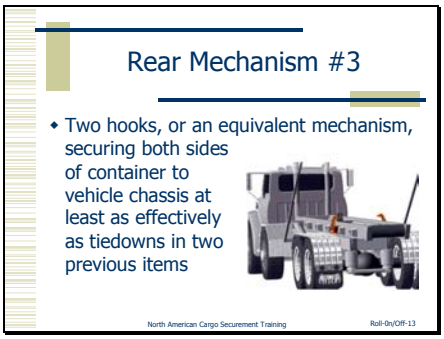


Explain to participants that any container carried on a vehicle which is not equipped with a compatible and functioning "Integral Securement System" must be:

- Blocked against forward movement by the lifting device, stops, a combination of both, or other suitable restraint mechanism AND
- Secured to the front of the vehicle by the lifting device or other suitable restraint against side-to-side and vertical movement AND
- Secured to the rear of the vehicle with at least one of the following mechanisms:

Show Slide Roll-On/Off -10.



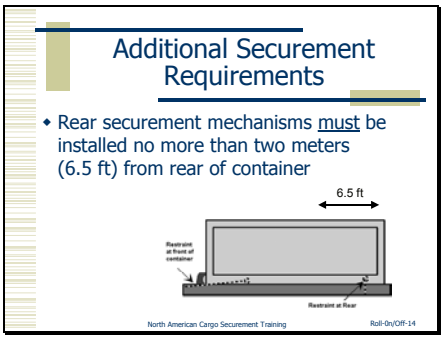
Lesson Plan	Instructor Notes
– One tiedown attached to both the vehicle chassis and the container chassis	Show Slide Roll-On/Off -11. 
- Two tiedowns installed lengthwise, each securing one side of the container to one of the vehicle's side rails	Show Slide Roll-On/Off -12. 
- Two hooks, or an equivalent mechanism, securing both sides of the container to the vehicle chassis at least as effectively as the tiedowns in the two previous items.	Show Slide Roll-On/Off -13.  Note: Graphic provided by www.automaticlock.com.

Lesson Plan	Instructor Notes

Additional Requirements

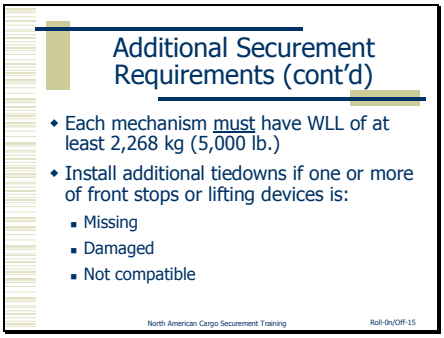
Explain to participants that the mechanisms used to secure the rear end of a roll-on/roll-off or hook lift container must be installed no more than two meters (6.5 ft) from the rear of the container.

Show Slide Roll-On/Off -14.



Tell participants that, in addition, each mechanism must have a Working Load Limit of at least 2,268 kg (5,000 lb.).

Show Slide Roll-On/Off -15.



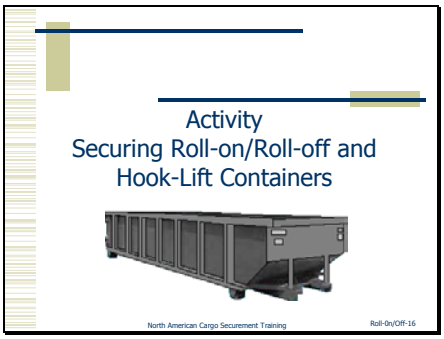
Explain that, in the event that one or more of the front stops or lifting devices is missing, damaged or not compatible, additional manually installed tiedowns must be used to secure the container to the vehicle, providing the same level of securement as the missing, damaged, or incompatible components.

Lesson Plan	Instructor Notes

Activity: Securing Roll–on/Roll–off and Hook-Lift Containers

Tell participants that you want to review what participants have learned.

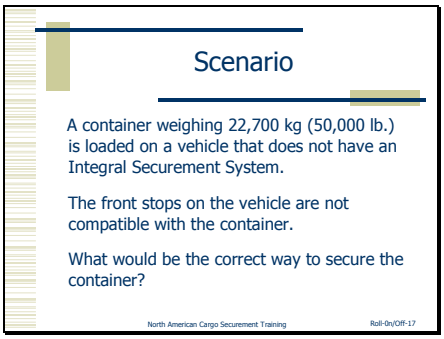
Show Slide Roll-On/Off -16.



Read the scenario to participants:

> **Scenario:** A container weighing 50,000 lbs. (22,700 kg) is loaded on a vehicle that does not have an Integral Securement System. The front stops on the vehicle are not compatible with the container.

Show Slide Roll-On/Off -17.



Ask this question:

> What would be the correct way to secure this container?

Response from participants should include:

- Block against forward movement by the lifting device, stops, a combination of both, or other suitable restraint mechanism
- Secure the container to the front of the vehicle by the lifting device or other suitable restraint against side – to – side and vertical movement

Lesson Plan	Instructor Notes
	♦ Secured to the rear of the vehicle with at least one of the following mechanisms: - One tiedown that secures the side rails of the vehicle chassis and the container chassis at the same time - Two tiedowns installed lengthwise, each securing one side of the container to one of the vehicle's side rails - Two hooks, or an equivalent mechanism, securing both sides of the container to the vehicle chassis at least as effectively as the tiedowns in the two previous items ♦ The mechanisms used to secure the rear end of a roll-on/roll off or hook lift container <u>must</u> be installed no more than two meters from the rear of the container. In addition, each mechanism <u>must</u> have a WLL of at least 2,268 kg (5,000 lb.). ♦ Since the front stops are not compatible, additional manually installed tiedowns <u>must</u> be used to secure the container to the vehicle, providing the same level of securement as the missing, damaged, or incompatible components.

Lesson Plan	Instructor Notes

Summary

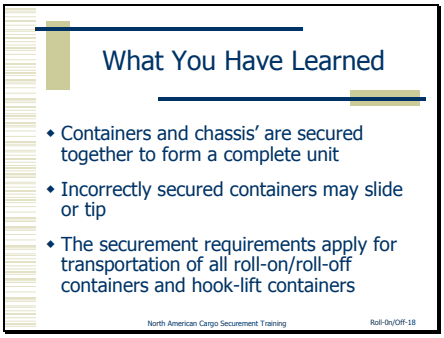
2 minutes

Summarize the lesson on Roll-on/Roll-off and Hook-Lift Containers, recapping what the participants just learned.

Tell participants that they now know that:

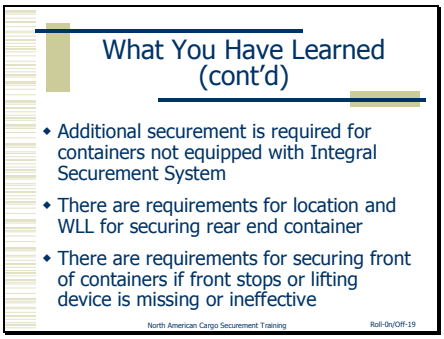
- Containers and chassis' are secured together to form a complete unit
- Incorrectly secured containers may slide or tip
- The securement requirements in this module apply for the transportation of all roll–on/roll-off containers and hook-lift containers.

Show Slide Roll-On/Off -18.



- Additional securement is required for roll–on/roll–off or hook-lift containers that are not equipped with an Integral Securement System.
- There are requirements for location and working load limit for securing the rear end of the container.
- There are requirements for securing the front of containers if front stops or the lifting device is missing or ineffective.

Show Slide Roll-On/Off -19.



Module Overview

Module 13: Large Boulders

Learning Objectives

At the completion of the training, participants will be able to:

- Describe how the cargo securement principles apply to large boulders
- Determine what is required to properly secure large boulders, including the number, placement, and types of cargo securing devices
- Identify securement systems that are not in compliance

Time Required

40 minutes

Topics

1. Overview and Learning Objectives
2. Principles for Securing Large Boulders
3. Application
4. Securement Requirements for Large Boulders
5. Securement Requirements for Specific Shapes
6. Summary

Training Methods

1. Participative lecture
2. Group activity (Small group exercises)

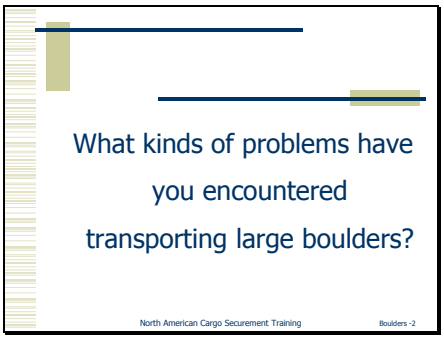
Participant Materials

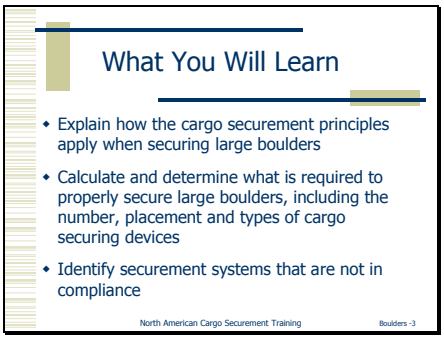
1. Participant Manual
2. Driver's Handbook on Cargo Securement

Training Materials

1. Instructor Guide
2. PowerPoint slides and projection system
3. Easel pad and markers
4. Participant materials

Large Boulders

Lesson Plan	Instructor Notes
Overview and Learning Objectives	*2 minutes*
Tell the participants that you are going to talk about securement for large boulders.	Explain the objectives of the training. Show Slide Boulders-1.
Ask the participants: What kinds of problems have you encountered transporting large boulders?	Show Slide Boulders-2.  Record the problems on easel pad. Make sure problems are addressed during the module.

Lesson Plan	Instructor Notes
Tell participants that, at the completion of training, they will be able to: ◆ Describe how the cargo securement principles apply to large boulders ◆ Determine what is required to properly secure large boulders, including the number, placement, and types of cargo securing devices ◆ Identify securement systems that are not in compliance	Show Slide Boulders-3. 

Lesson Plan	Instructor Notes

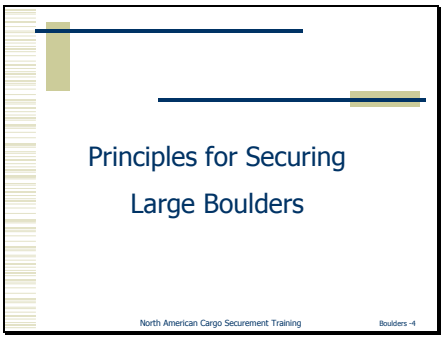
Principles for Securing Large boulders

Tell the participants that you are now going to talk about the principles for securing large boulders.

4 minutes

Explain the principles for securing large boulders.

Show Slide Boulders-4.

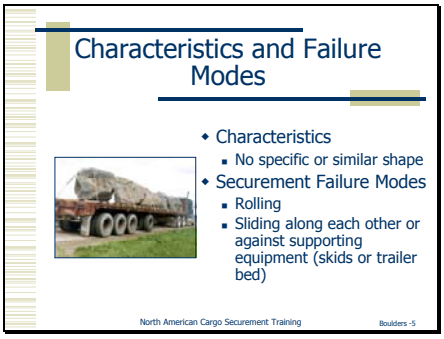


Large boulders: characteristics and cargo securement failure modes

Explain that large boulders are challenging cargo to secure since no two boulders have exactly the same size or shape.

Point out that sliding and rolling are the two failure modes for boulder securement systems.

Show Slide Boulders-5.



Return to the list generated from the opening question listing the types of problems the participants have had in securing large boulders. The instructor will then tell the participants that they will now learn how to avoid these problems by planning a securement system.

Lesson Plan	Instructor Notes
Planning a securement system for large boulders **Explain** that, when planning a securement system for large boulders, you need to consider: ♦ Tiedowns to prevent sliding ♦ Tiedowns and timber to prevent rolling.	Show Slide Boulders-6.

Lesson Plan	Instructor Notes

Application

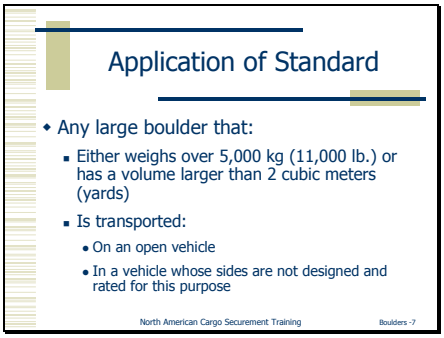
2 minutes

Explain the application of the standard.

Explain that the securement requirements for large boulders apply to any large irregularly shaped rock that:

- Weighs over 5,000 kg (11,000 lb.) <u>or</u> has a volume larger than two cubic meters
- Is transported on an open vehicle or in a vehicle whose sides are not designed and rated for the transportation of boulders.

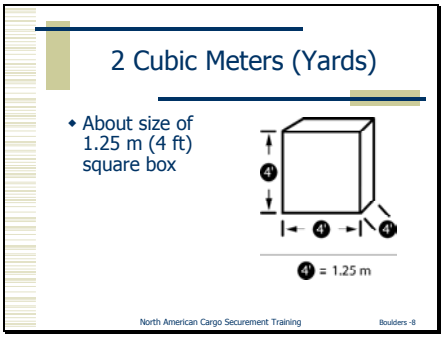
Show Slide Boulders-7.



Explain how to estimate two cubic meters (two cubic yards).

Two cubic meters (yards) is about the size of a box with dimensions of 1.25 m (4 ft) on every side

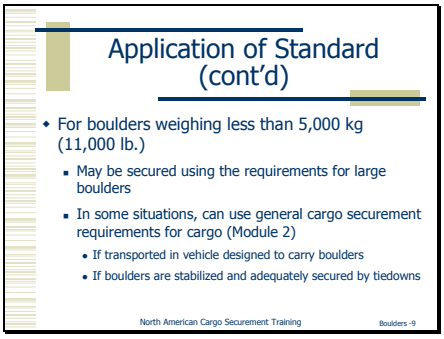
Show Slide Boulders-8.

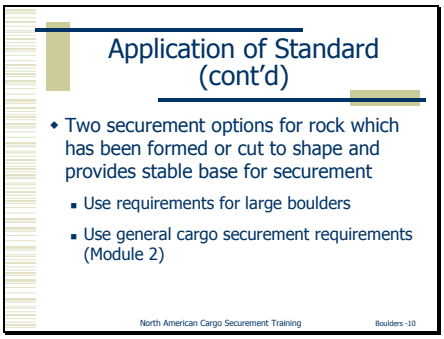


Point out that boulders weighing less than 5,000 kg (11,000 lb.) may be secured in one of these ways:

- Using the requirements for large boulders OR
- Using the general cargo securement requirements (Module 2) IF
  - Transported in a vehicle designed to carry boulders
  - Boulders are stabilized and adequately secured by tiedowns.

Show Slide Boulders-9.



Lesson Plan	Instructor Notes
Explain that rock which has been formed or cut to a shape and which provides a stable base for securement can be secured by the requirements for large boulders or the general cargo securement requirements (Module 2, General Cargo Securement Requirements: Equipment and Methods).	Show Slide Boulders-10. 

Lesson Plan	Instructor Notes

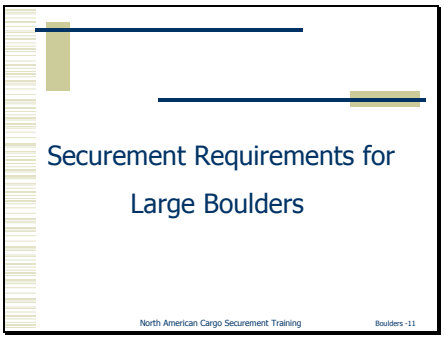
Securement Requirements for Large Boulders

10 minutes

Explain the securement requirements for large boulders.

Refer participants to the correct section in the Driver's Handbook on Cargo Securement so that they become familiar with it.

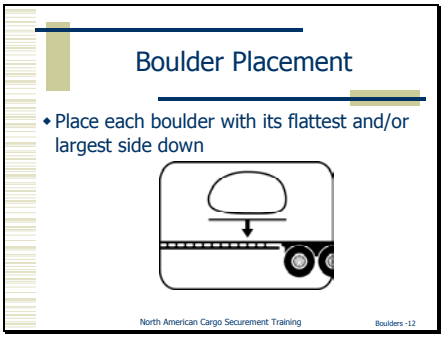
Show Slide Boulders-11.



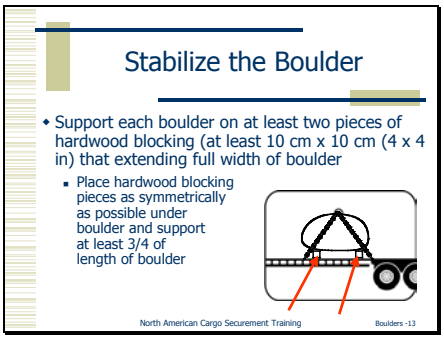
Boulder placement

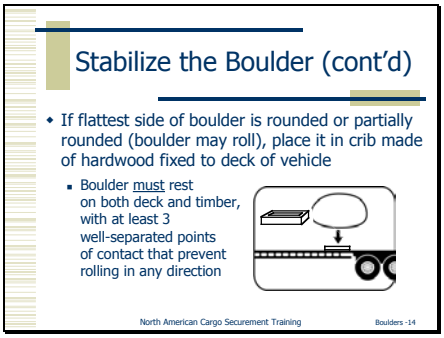
Explain that each boulder must be placed with its flattest and/or largest side down.

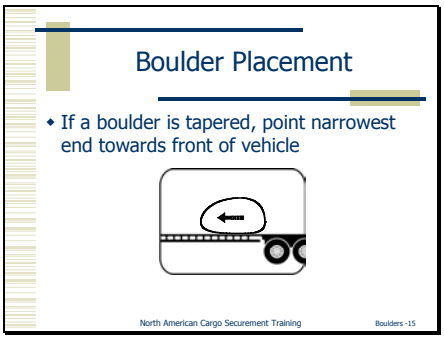
Show Slide Boulders-12.



Lesson Plan	Instructor Notes
Say that each boulder must be supported on at least two pieces of hardwood blocking [at least 10 cm x 10 cm (4 x 4 in)] that extend the full width of the boulder. ♦ Hardwood blocking pieces must be placed as symmetrically as possible under the boulder and should support at least ¾ of the length of the boulder.	Show Slide Boulders-13.
Explain that, if the flattest side of a boulder is rounded or partially rounded (so that the boulder may roll), it must be placed in a crib made of hardwood. ♦ The crib must be fixed to the deck of the vehicle ♦ The boulder must rest on both the deck and the timber. ♦ There must be at least three well-separated points of contact that prevent the boulder from rolling in any direction.	Show Slide Boulders-14.
Point out that, if the boulder is tapered, the narrowest end must point towards the front of the vehicle.	Show Slide Boulders-15.







Lesson Plan	Instructor Notes
Tiedowns **Explain** that only chain can be used as tiedowns to secure large boulders. **Say** that tiedowns that are in direct contact with the boulder: ♦ Should be located in valleys or notches across the top of the boulder where possible ♦ Must be arranged to prevent sliding across the rock surface.	Show Slide Boulders-16.

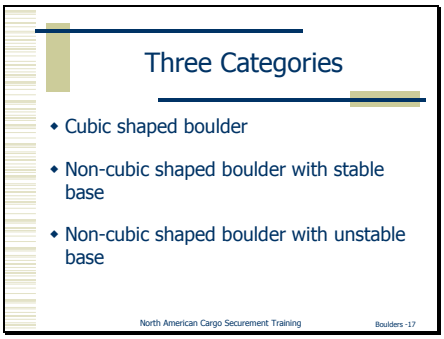
Lesson Plan	Instructor Notes

Securement Requirements for Specific Shapes

20 minutes

Explain the securement requirements for cubic shaped boulders.

Show Slide Boulder-17.



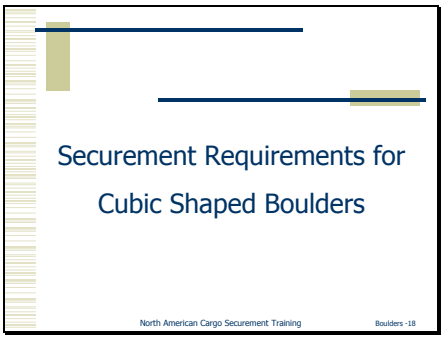
Explain that there are so many shape variations of boulders and large rocks, the Standard has set three different categories of boulders and has determined specific requirements for each category.

- Cubic shaped boulder
- Non-cubic shaped boulder with a stable base
- Non-cubic shaped boulder with an unstable base

Lesson Plan	Instructor Notes

Cubic-shaped boulder

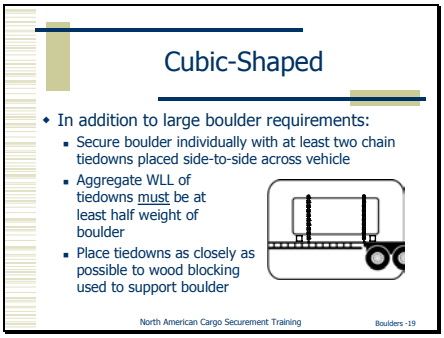
Show Slide Boulder-18.



Explain that, in addition to the large boulder securement requirements (see pages 9-12):

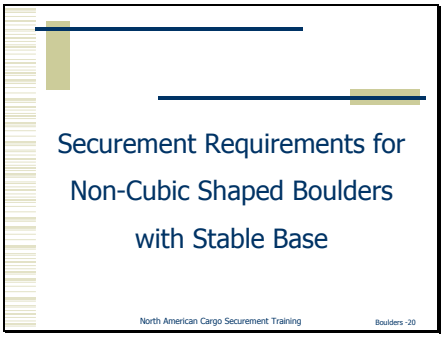
- The boulder must be secured individually with at least two chain tiedowns placed side-to-side across the vehicle.
- The aggregate working load limit of the tiedowns must be at least half the weight of the boulder.
- The tiedowns must be placed as closely as possible to the wood blocking used to support the boulder.

Show Slide Boulder-19.



Non-cubic shaped boulder with stable base

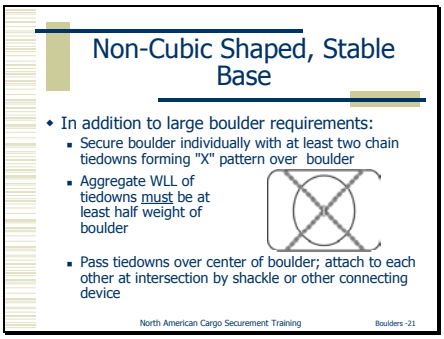
Show Slide Boulder-20.



Explain that, in addition to the large boulder securement requirements (see pages 9-12):

- The boulder must be secured individually with at least two chain tiedowns forming an "X" pattern over the boulder.
- The aggregate working load limit of the tiedowns must be at least half the weight of the boulder.
- The tiedowns must pass over the center of the boulder and must be attached to each other at the intersection by a shackle or other connecting device.

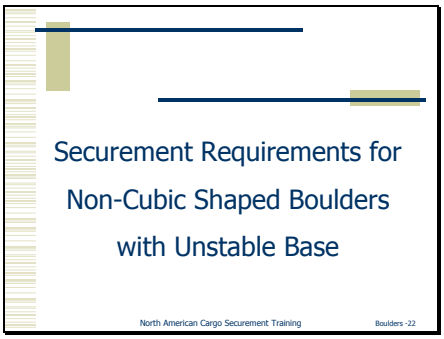
Show Slide Boulder-21.



Lesson Plan	Instructor Notes

Non-cubic shaped boulder with unstable base

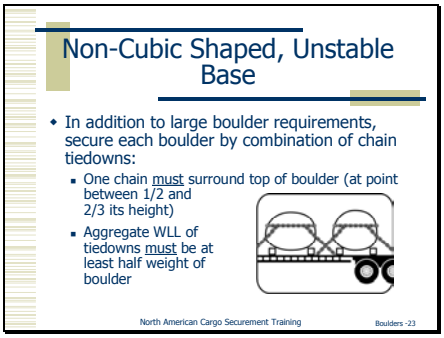
Show Slide Boulder-22.



Explain that, in addition to the previous boulder securement requirements (see pages 9-12), each boulder must be secured by a combination of chain tiedowns:

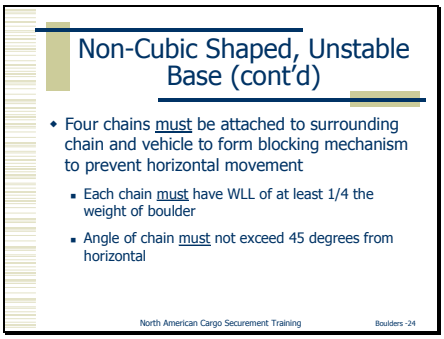
- One chain must surround the top of the boulder (at a point between one half and two thirds of its height)
- The working load limit of the surrounding chain must be at least half the weight of the boulder.

Show Slide Boulder-23.



- Four chains must be attached to the surrounding chain and the vehicle to form a blocking mechanism that prevents any horizontal movement
  - Each chain must have a working load limit of at least 1/4 the weight of the boulder
  - Whenever practicable, the angle of the chain must not exceed 45 degrees from the horizontal.

Show Slide Boulder-24.



Lesson Plan	Instructor Notes

Activity: Securing Large boulders

Tell participants that you want to review what participants have learned.

Read the scenario to participants:

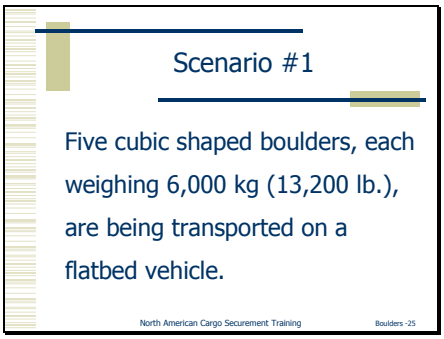
Scenario #1: Five cubic shaped boulders, each weighing 6,000 kg (13,200 lb.), are being transported on a flatbed vehicle.

Ask this question:

> What would be the correct way to secure these boulders?

There are 3 scenarios. Depending on the time available, use one or more scenarios to help participants review the securement requirements.

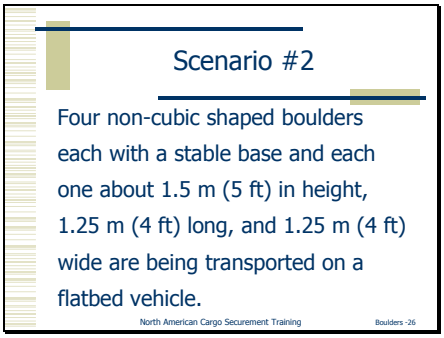
Show Slide Boulders-25.



Response from participants should include:

- Ensure vehicle is capable of carrying weight.
- Place flattest side of boulder down.
- Use two 4"x4" pieces of hardwood for blocking, placing them symmetrically under the boulder and supporting 3/4 of boulder length.
- Use at least 2 chains (aggregate WLL of the 2 chains must be at least 1/2 the weight of the boulder) placed side-to-side across boulder and as close as possible to the wood blocking.
- Pass tiedowns through notches or valleys in the boulder.

Lesson Plan	Instructor Notes
Scenario #2: Four non-cubic shaped boulders each with a stable base and each one about 1.5 m (5 ft) in height, 1.25 m (4 ft) long, and 1.25 m (4 ft) wide are being transported on a flatbed vehicle.	Show Slide Boulders-26.



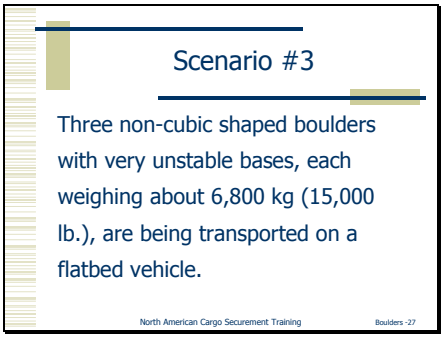
Ask this question:

> What would be the correct way to secure these boulders?

Response from participants should include:

- Place flattest side of boulder down.
- Use two 4"x4" pieces of hardwood for blocking, placing them symmetrically under the boulder and supporting 3/4 of boulder length.
- Use 2 chains (aggregate WLL of the 2 chains must be at least 1/2 the weight of the boulder) passing over the center of the boulder forming an “X” and attached to each other at the intersection.

Lesson Plan	Instructor Notes
Scenario #3: Three non-cubic shaped boulders with very unstable bases, each weighing about 6,800 kg (15,000 lb), are being transported on a flatbed vehicle.	Show Slide Boulders-27.



Ask this question:

> What would be the correct way to secure these boulders?

Response from participants should include:

- Place flattest side of boulder down.
- Use two 4"x4" pieces of hardwood for blocking, placing them symmetrically under the boulder and supporting 3/4 of boulder length. This crib or cradle should be affixed to the trailer deck.
- Use one chain [WLL 3,400 kg (7,500 lb. minimum)] as a “bridle” around top of boulder (at 2/3 the height off the trailer deck.)
- Attach 4 chains [each with a WLL of 850 kg (1,875 lb.)] to the “bridle” and affix to the vehicle at an angle not more than 45 degrees with the horizontal. Chains should be attached at the front and back of both sides.

Lesson Plan	Instructor Notes

Summary

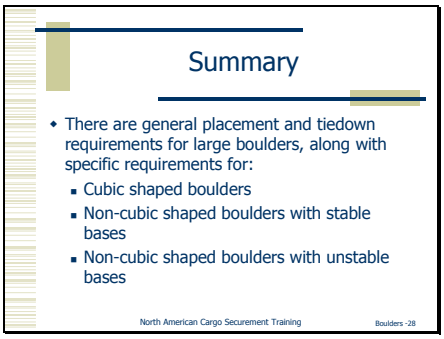
2 minutes

Summarize the lesson on Large boulders, recapping what the participants just learned.

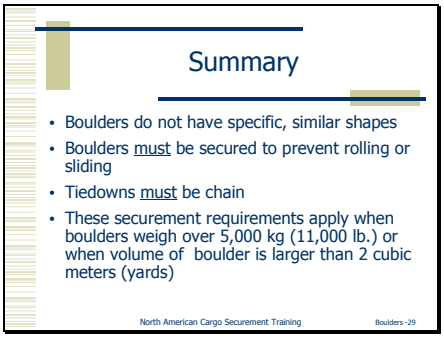
Tell participants that they now know to properly secure large boulders. There are general placement and tiedown requirements for large boulders, along with specific requirements for:

- Cubic shaped boulders
- Non-cubic shaped boulders with stable bases
- Non-cubic shaped boulders with unstable bases.

Show Slide Boulders-28.



Remind participants that:

- Boulders do not have specific, similar shapes
- Boulders need to be secured to prevent from rolling or sliding
- Tiedowns <u>must</u> be chain
- These securement requirements apply when boulders weigh over 5,000 kg (11,000 lb.) or when the volume of the boulder is larger than 2 cubic meters.

Show Slide Boulders-29.