THE OHIO STATE UNIVERSITY EXTENSION

FACT SHEET

Agriculture and Natural Resources

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Make Sure Your Load Is Secure

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Hauling cargo of different sizes and weights is common practice in agriculture whether the load is being hauled down the road or across the state. While hauling your tractor, tile, or pallet of seed, the driver is responsible for making sure the load is properly secured.

When hauling a piece of equipment with a Slow Moving Vehicle (SMV) emblem at speeds greater than 25 mph, cover or remove the emblem. If the SMV emblem cannot be removed or easily covered, consider loading the piece of equipment backwards on the trailer. Remember, SMV emblems are designed for road speeds less than 25 MPH; equipment hauled or driven at speeds greater than this should not display a SMV emblem.

Before hauling/transporting a load, complete a pre-trip inspection, consider the working load limits (WLL-rated strength) of chains or straps, and ensure proper tie-down of the cargo.

Pre-Trip Inspection

Be sure the rated capacity of the truck and/or trailer matches or exceeds the weight of the load to be hauled. The same is true for the trailer hooks or tie-down points. Before each use of a trailer, take time to inspect:

- Trailer tire pressure.
- Re-torque lug nuts.
- Trailer hitch and locking mechanism.
- Electrical and brake system. Inspect all lights and turn signals for damage and function.
- Chains and straps for working load limit (WLL) rating, cracks, and damage. If no WLL rating is visible, assume the lowest WLL rating. If strap is ripped or red line jeopardized, discontinue its use.
- Trailer floor. Remove any excess dirt, rocks, mud, etc., from the trailer and cargo. Flying debris could create a hazard when transporting the cargo down the road.

Working Load Limit of Chains

Each manufactured chain and strap has a working load limit (WLL), which is approximately one-third of its break strength. Break strengths (BS) are based on the force a component can withstand before breaking. Knowing the WLL is helpful to properly secure the cargo. Table 1 outlines the WLL for different sizes and grades of chain according to the Federal Department of Transportation Federal Motor Carrier Safety Association.

Table 1. Work Load Limit (WLL) in Pounds (lbs)

Chain Size (in.)	Grade 30	Grade 43	Grade 70	Grade 80	Grade 100
1/4	1,300	2,600	3,150	3,500	4,300
5/16	1,900	3,900	4,700	4,500	5,700
*3/8	2,650	5,400	6,600	7,100	8,800
7/16	3,700	7,200	8,750	—	—
1/2	4,500	9,200	11,300	12,000	15,000
5/8	6,900	13,000	15,800	18,100	22,600

*3/8" is a common size chain and is used as an example in this document.

Some manufacturers' rating may differ from the chart. Be sure to check for WLL on each tie-down.

Proper Tie-Downs

To properly secure the cargo, it is important to consider the number of tie-downs needed to keep the cargo on the trailer at all times. When transporting equipment consider the six different directions the load can shift: forward, backward, left, right, up, and down.

How many tie-downs are needed:

One tie-down for cargo:

- Shorter than 5 feet **and less** than 1,100 pounds in weight.

Two tie-downs for cargo:

- 5 feet or less in length **and more** than 1,100 pounds in weight.
- Greater than 5 feet **but less** than 10 feet.

Four tie-downs (at least) for cargo:

- Weighing over 10,000 pounds

Additional tie-downs:

For any cargo 10 feet or greater, additional tie-downs are needed. Add 1 tie-down for every 10 feet of length. For example, a 20-foot long culvert tube would need to be secured with at least two tie-downs but a 21-foot long culvert tube would need at least three tie-downs.

It is recommended that the total working load limit (WLL) of all used tie-downs must equal at least half of the cargo's weight. For example, if you are hauling a small tractor that weighs 12,000 pounds, at least four tie-downs with a combined WLL of 6,000 pounds (1,500 pounds each) will need to be used. To find this aggregate working load limit depends on how the chain or strap is secured.

Tie-Down Methods and WLL

There are two proper methods to tie-down loads. One method is to connect directly to a manufactured anchored point on the trailer then through, over, or around the cargo to another manufactured trailer point. This is referred to as an **indirect tie-down** and has the full WLL rating of the chain or strap. If you are securing a 9,500-pound rectangular object by putting the chain over the object (not directly tying onto the object), you would need at least **two** 3/8" grade 43 chains (see table 1). If the object had been greater than 10,000 pounds, at least **four** chains would be required.

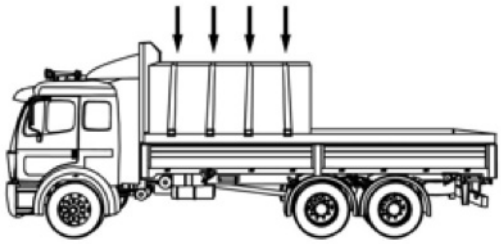

Figure 1. Indirect tie-down is shown.

The second method is a **direct tie-down**. This is when a tie-down is attached from a manufactured anchor point on the truck or trailer to an attachment point on the cargo (i.e., frame of vehicle or equipment). Using this method of tie-down provides half of the WLL of the chain or strap. There is no maximum number of tie-downs when securing a load.

In addition to securing the cargo, it is recommended to tie-down attachments of the equipment being hauled. Examples are front-end loader buckets, backhoe attachments, and blades on either the front or back of equipment.

Immobilizing and Containing Cargo

Another step in securing the load should be to immobilize and contain the cargo. To prevent sliding

or shifting of equipment or cargo, consider using blocking, bracing, or friction mats. To prevent cargo from rolling, place a chock or wedge slightly under the edge of the cargo. Make sure the chock or wedge is secured to the trailer. If the cargo has a tendency to tip, use a brace. Material used for the chock, wedge, or brace must be strong enough to withstand being split or crushed by the cargo. When using wood, hardwood is recommended, properly seasoned, and free from rot or decay, knots, and splits. When using wood such as a block or brace, it is recommended for the grain to run lengthwise.

Centering Weight

It is recommended to place the weight of the load in the center of the trailer or cargo area. To achieve this, each tie-down should counteract another tie-down by fastening the chains in an "X" pattern. By doing this, the chains will pull tight against each other and keep the load secured in the center of the trailer.

Remember to take the time to properly secure any load no matter how far it is being hauled. Anything hauled on a trailer or in a cargo area of a truck should be secured. Following these few steps may save you time and even money when transporting cargo.

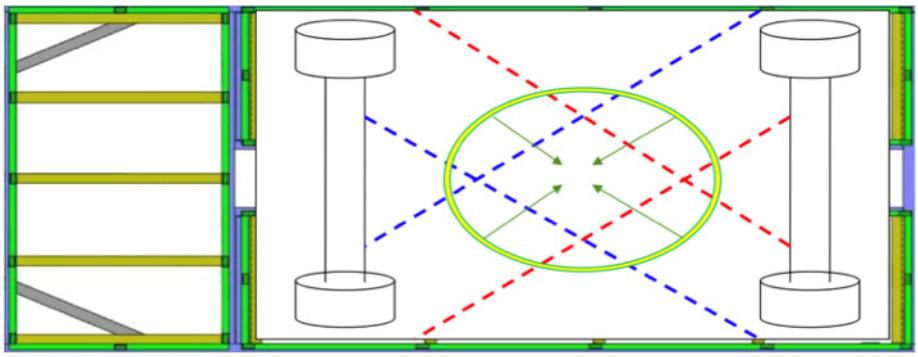

Figure 2. Aerial view of a loaded trailer using the X pattern to center the weight.

References:

Federal Department of Transportation Federal Motor Carrier Safety Association. (2011). "Driver's Handbook on Cargo Securement." Retrieved from http://www.fmcsa.dot.gov

Merckle, C., & McLaughlin, D. (2011). "How a Loose Load Can Ruin Your Day." Presentation at Ohio Safety Congress and Expo. Columbus, Ohio.

Reviewers:

This fact sheet was reviewed by Carl Merckle, Program Manager with ODOT Office of Training, and Jon Rausch, OSU Extension Agriculture and Natural Resources Educator.