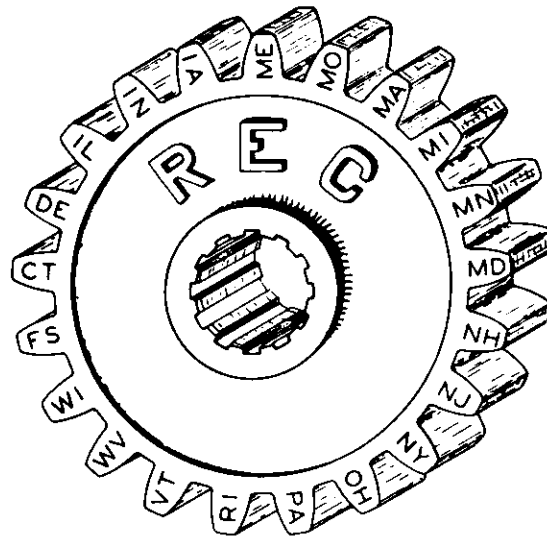


Roscommon
Equipment
Center
Program
Project No. 20



TRAILER TO TRANSPORT JD-350 OR EQUAL

June 1983



Northeast Forest Fire Supervisors
in Cooperation with
Michigan's Forest Fire Experiment Station

TRAILER TO TRANSPORT JD-350 OR EQUAL
ROSCOMMON EQUIPMENT CENTER
PROJECT NO. 20
FINAL REPORT

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Disclaimer

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P.O. Box 68
Roscommon, MI 48653*

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370 Reed Rd.
Broomall, PA 19008*

Introduction

With the advent of newer, heavier, medium-sized crawler tractors, some states found their tractor-plow transport trailers were developing more bent axles.

The original intent of this project was to have the Roscommon Equipment Center (REC) design a trailer for hauling these new, heavier, tractor-plow units. The desired design criterion was a trailer with single wheels in tandem. Single wheels were chosen since dual wheels tend to snowplow through loose sand, and three wheels in line have difficulty negotiating sharp curves.

Discussion

Upon review of the problem, REC decided it wouldn't be cost effective to design and manufacture the trailers themselves since numerous manufacturers currently produce suitable trailers.

Instead, REC contacted several truck and trailer manufacturers' for more information. As a result of those contacts general safety guidelines were developed to be used when selecting and using trailers. A list of trailer manufacturers is included at the end of this report. The list is not comprehensive and undoubtedly suitable products are available from other sources.

Safety Considerations - Heavy Equipment Trailer Selection

The primary consideration when selecting a trailer is the weight relationship between the towing vehicle and the towed load. The maximum gross trailer weight (GTWR) that might be towed should not exceed 74% of the gross vehicle weight (GVWR) of the towing vehicle. This 75% factor is a safe maximum and should be adhered to regardless of the terrain.

The 75% factor is based on:

1. Numerous telephone conversation with representatives from truck and trailer manufacturers.
2. An article entitled "Weight Watchers Guide to Camper-Pickup Loads".
3. Calculations undertaken using ratings from truck manufacturers' data books.

Most truck and trailer manufacturers agree that the 75% limit is a good general guide for braking stability and for the weight limitations imposed on the rear axle of the prime mover.

The essential criteria for braking stability is for the towing vehicle to control the trailer and not vice-versa.

A trailer whose weight is greater than 75% of the towing vehicles' weight may control the direction of the towing vehicle in emergency braking situations. For example, if a truck towing a trailer at high speed had to swerve quickly to avoid hitting some obstruction in its path, it would have the inertia the trailer had in the original direction. If the weight of the trailer even approached the weight of the truck, the trailer would exert significant control over the motion of the truck and dangerous fishtailing would occur. This is especially true at high speeds and could happen even if the trailer were equipped with brakes. The brakes on the axles of both prime mover and trailer are designed to decelerate each mass respectively within a specific straight line distance. The 75% limit is considered to be the maximum weight which allows control of the truck-trailer combination. Therefore, although truck-trailer combinations are used mostly at low speeds and off the road, even the small amount of use on highways justifies this limit.

Critical design criteria, or emergency braking, maximizes the capability of all the service brakes when there is a full load in the prime mover. For the brakes to be effective the force normal to the friction surface, or tire prints, must be maximum.

On a level surface approximately 15% of the trailer weight is conveyed to the rear axle of the truck through the hitch. When going down steep grades the weight conveyed by the hitch may increase to as much as 20%. For example, if a dump truck with a full payload is also required to pull a heavily loaded trailer, the 15 to 20% weight increase imposed by the trailer may be too great for the rear axle. The 75% limit will reduce the possibility of putting too much weight on the rear axle.

Tires not inflated to recommended pressures build up heat with speed. The higher the speed the greater the heat and the chance for blowouts. Therefore when pulling a trailer at high speeds make sure tires are inflated to required pressure and that the load rating is sufficient for the speed.

Name data plates, required by federal law, carry load rating data. Trailer manufacturer representatives can supply information about trailer capacity at greater-than-rated speeds.

Trailer Safety Tips

Inspect tires frequently

Keep tires inflated to recommended pressures. Check daily for cuts and bruises. Remove imbedded stones and other foreign matter. Replace bald tires which are blow-out prone, and hamper braking. Avoid the use of mismatched tires, especially on dual wheels. Duals 9.0 or larger should have same rolling circumference within 1- $\frac{1}{4}$ inches of each other; half that if smaller. If tire diameters differ, the larger tire carries greater portion of load; braking force becomes uneven, spindles can deflect, load is distributed unevenly on bearings, and brake linings wear faster. Remember that properly matched tires insure maximum tire life, peak safety, reduced downtime and greater profits.

Check tire pressure after service

All tires heat-up during use, but if they get too hot they can blow out or catch fire. A check immediately after use will tell if tires have exceeded safe operating temperatures. Tires properly sized and inflated for their load and speed reach a temperature at which the rate of heat generation equals the rate of loss. If this equalization temperature stays below the safe operating temperature, the air pressure build-up within the tire will be 20 lbs. or less; if the pressure build-up exceeds 20 lbs., the tire is no longer safe. Overheated tires may be caused by overload, excess speed or underinflation. Don't "bleed" tires to correct pressure build-up; instead, lighten the load, slow down, or inflate tires properly.

Wheel end play

Leave some end play in the wheel-to-axle fit when replacing trailer wheels. Some operators of heavy equipment trailers tighten a wheel's adjusting nut to take out end play. This creates a safety hazard by pre-loading the bearings. When a trailer with no end play in the wheel fit hauls heavy equipment, the weight on the tightly fitted bearing creates excessive frictional heat. This causes bearing and axle surfaces to expand, creating more heat that melts the bearing lubricant. Under these conditions, the bearings burn-up. Further wear could result in the wheel coming off during operation.

Size trucks and trailers properly

Most probable cause of poor trailing is a mismatched truck and trailer or an improperly balanced load.

Too often, trucks are marginal in size for their loads. That is, a truck may have the weight to satisfactorily pull a loaded trailer on local streets at 30 mph, but poor trailing will show up on expressway speeds of 40 to 45 mph.

Trucks with excessive rear overhang, such as long bodied stake or tilting platform trucks, also make poor towing vehicles. The long overhang permits the trailer to exert side forces on the truck, causing it to weave. The closer the pintle hook to the truck's rear axle, the safer the vehicle for trailer hauling.

An improperly balanced load can cause poor trailing. A trailer's load should be adjusted so that 10 to 15 percent of its weight is carried by the truck at the pintle hitch.

Selecting trucks for various sizes and types of trailers often requires expert advice. For greatest safety, we suggest consulting a trailer dealer for advice on proper match of truck to trailer.

Wheel maintenance

- a) bearings - Clean old grease from wheel hub and bearing cones with kerosene or diesel fuel oil, inspect for signs of wear due to abrasive dirt. This can be recognized by dull appearance of rollers and raceways; they may feel rough or show pit marks or indentations. Look for fractures, hairline cracks, pits or wear on cup or cone, indentations on raceways, corrosion and pockmarks on raceways and rollers, blue or blue-brown discoloration indicating bearing metal has been damaged. When packing bearings, be sure to knead grease through all the rollers. Use a pressure packer.
- b) brakes - Inspect drums for hard spots, which result from changes in the metal caused by heat or braking. These spots must be ground out. Check for scored drums and recondition these on lathe. Check runout of drum while it is bolted to hub or wheel. Runout should be less than .015". If greater, true drum on lathe. Don't reuse a drum if its diameter is .060" greater than nominal. Inspect the shoe springs for damage. If necessary to replace a spring, replace all springs on the brakes on the axle. Otherwise, uneven braking may result.
- c) wheel cylinders - See that cups and pistons move freely. If there is any sign of leakage, check all parts. If cylinder wall is pitted or scored, install a new assembly.
- d) hoses and lines - Check tubing for kinks and inspect hoses for swelling, collapse or wear. A hose that shows wet spots should be replaced.
- e) air brakes - Check that air system is correctly balanced with gauges connected by tees into line at each brake. With trailer air system connected to required air supply, gauges should register same pressure within 5 pounds per square inch.
- f) electric brakes - Examine wiring and connections for damage. Magnet faces should be smooth; resurface and shim, or renew if worn or scored. Inspect armature face. It should be smooth; renew if scored or worn thin. Check that spring returns magnet to central position and that magnet moves freely. Connect a DC ammeter in circuit and check amp reading as specified by manufacturer.

Trailer Manufacturers

Following is a list of trailer manufacturers. Many national companies have regional or local dealers.

Birmingham Manufacturing Co. Inc.
Box 289
Springville, Ala 35146
(205) 595-6183

Bush Hog Division
Allied Products Corp.
Box 1039
Selma, Ala. 36701
(205) 872-6261

Dakota Manufacturing Co.
Box 954
Mitchell, S. Dakota 57301
(605) 996-5571

DEMCO
North Loop 340
Box 4308
Waco, Tex 76705
(817) 799-4941

Donahue Corporation
Box 126
Durham, Kansas 67438
(316) 732-2665

Flexi-coil, Ltd.
Box 1928
2326 Millar Avenue
Saskatoon, Sask., Canada
S7K-2Y2
(306) 652-9022

General Engines Company, Inc.
Eager Beaver Trailers
Interstate 295
Thorofare, NJ 08086
(609) 845-5400

Hyster Company
Construction Equipment Division
Box 289
Kewanee, ILL 61443
(309) 853-3571

Jacobsen Trailer Company
6333 East South Ave.
Fowler, California 93625
(209) 834-2409

Lakeside Truck Body Company
Box 1104
Turlock, California 95380
(209) 632-7501

Miller Tilt Top Trailer, Inc.
450 South 92nd St.
Milwaukee, WI 53214
(414) 476-4030

Ranch Manufacturing Co., Inc.
Box 856
Lamar, CO 81052
(303) 336-9041

Rivinius, Inc.
Rural Rt. 2, Box 63
Eureka, IL 61530
(309) 467-2303

Shoala American Industries, Inc.
Box 2646
Muscle Shoala, Ala. 35660
(205) 381-3820

Transport Trailers
1200 12th St. SW
Cedar Rapids, Iowa 52406
(319) 365-1481

Wisconsin Trailer Co., Inc.
3090 Polk
Richfield, WI 53076
(414) 628-1161

Zieman Products
Box 698
Whittier, CA 90608
(213) 696-1186

USER'S CAUTION...

A NOTE ABOUT GROSS VEHICLE WEIGHT (GVW)

American truck manufacturers have long relied on GVW (gross vehicle weight) to designate the maximum allowable loading of their vehicles. These gross weight limits are carefully established through numerous design considerations and often depend, amongst other factors, on the strength and life expectancy of such vehicle components as frames, axles, springs, wheels, tires and power trains. Most manufacturers will not guarantee their products if users exceed GVW specifications.

The U. S. Armed Forces are acutely conscious of the importance of vehicle reliability. They have insisted that manufacturers clearly specify limits to the full extent that conditions will allow.

At the present time, a large number of military vehicles are becoming available to state and local agencies through federal government excess property programs and surplus sales. Many of these vehicles are being converted into fire fighting units. Those anticipating such conversions are urged to heed the GVW limits, and other vital information, posted on the dashboard of most of these vehicles. Federal excess property vehicles, on loan through State Forestry organizations, may be recalled if they are abused.

Blueprints and construction procedures prepared and issued by the Roscommon Equipment Center are intended to serve as guidelines for potential users of this equipment. It is possible that if all the options and alternatives specified on these drawings are used on any single vehicle, that GVW limits may be exceeded.

Therefore, users are cautioned to:

- (1) plan design and construction carefully
- (2) weigh each unit before actual duty assignment, and
- (3) make whatever weight adjustments are necessary to bring the system into safe load limits.

GUIDELINES FOR USE AND ACCOUNTABILITY OF FEDERAL EXCESS PROPERTY

Federal excess property is acquired under two authorities. One is the Cooperative Forestry Assistance Act of 1978 which covers fire control on forest and watershed lands, the other is the Rural Development Act of 1972 which is for assistance in all phases of fire control for communities of under 10,000 population. The regulations for use depend on the authority and purpose as stated above. The procedures for accountability, care, protection, and disposal are the same. The property is assigned to the State Forester by the U.S. Forest Service. He may in turn assign it to a cooperator.

The primary use of equipment obtained through the Cooperative Forestry Assistance Act authority is for fire control on forested and watershed lands. A limited number of other uses may be allowed. No non-fire use can be planned on a regular basis. If there is any doubt regarding authorized use contact the local State fire officer.

Equipment obtained through the Rural Development Act (Rural Community Fire Protection Program) may be used on all fire activities. It is not restricted to wildlands. However, non-fire use may be improper and your local State fire officer should be contacted before such use.

All Federal excess property should be stored so as to avoid undue exposure to danger from theft, damage, or deterioration. Only licensed drivers are to operate the equipment. Renting or sale of Federal excess property is not permitted. Normal operation and use charges may be recovered on mutual aid assignments or similar missions.

If you have any questions regarding the proper use of a piece of Federal excess property, contact your local State fire officer to avoid any legal problems or loss of equipment.

The property must be identified as Federal excess property and in such a manner that indicates the cooperation between the State Forester and fire district or company. The State is required to keep a record of its assignment, and to periodically inspect the equipment. Title is retained by the Forest Service for the Federal Government, although the State Forester may license vehicles when appropriate.

Modification of Federal excess property must be done in a safe and efficient manner and all major conversion work coordinated with your State fire officer.

The State is required to have a written agreement with each fire district (or company) that is assigned equipment. The agreement must stipulate insurance and liability conditions. Licensing is handled by the State.

When such equipment becomes unserviceable through use or damage, or is no longer desired by the fire company, it must be reassigned or disposed of by the States using procedures established by the Federal Government.