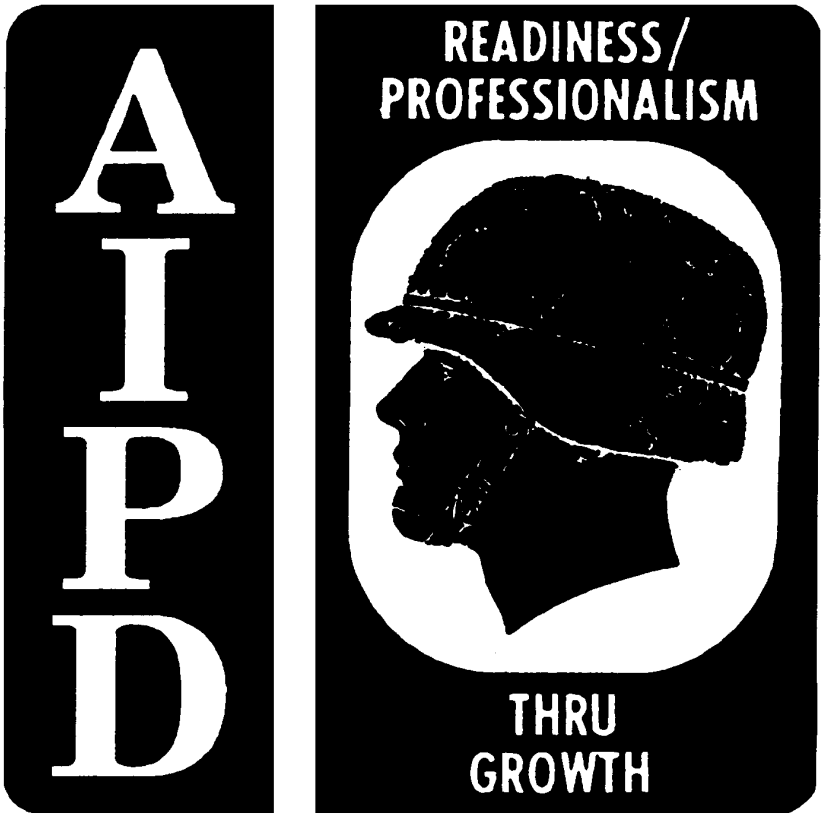
SUBCOURSE
TR 0690

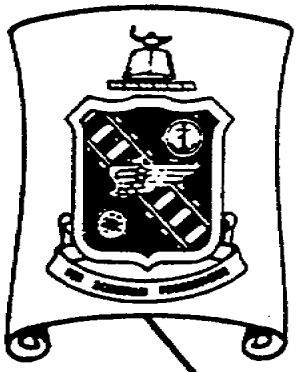
EDITION
3

LOADING, BLOCKING, AND BRACING ON RAIL CARS



THE ARMY INSTITUTE FOR PROFESSIONAL DEVELOPMENT

ARMY CORRESPONDENCE COURSE PROGRAM



CORRESPONDENCE COURSE OF THE
U. S. ARMY
TRANSPORTATION SCHOOL

LOADING, BLOCKING, AND BRACING ON RAIL CARS

LESSON BOOKLET
TRANS SUBCOURSE 690

Supersedes Trans 690, Loading, Blocking, and Bracing on Rail Cars, November 1970.

TRANS SUBCOURSE 690

LOADING, BLOCKING, AND BRACING ON RAIL CARS

INTRODUCTION

Cargo is blocked and braced to make it as stationary as possible during rail shipment. Unrestrained on a flatcar, cargo would be flung off the side on a curve, or pounded to rubble by bouncing, or hurtled forward in a sudden stop. The loading is done according to carefully detailed rules and specifications of the Association of American Railroads (AAR). The shipper of military freight finds a ready source of information in the AAR's Rules Governing the Loading of Commodities On Open Top Cars and in the many Army manuals on the subject. This subcourse introduces you to the regulations, illustrating them with examples of military cargo commonly shipped by flatcar. After studying lesson materials, you should be able to describe the construction of a typical flatcar and to list the loading rules of the AAR having the greatest significance for the military shipper. You should also be able to apply the principles and procedures for shipping military vehicles on flatcars.

To complete this subcourse, you must--

- Study the text material assigned for each lesson.
- Answer each question in all the lesson exercises by marking or circling your answer in the lesson book.
- Check your answers against the solutions listed at the end of the subcourse. Look up the text reference given on the solution sheet if you answered any question incorrectly. Study the reference and evaluate all possible exercise solutions; make sure you understand why the correct answer is the best choice.
- After completing the lesson exercises to your satisfaction, complete the examination as directed and mail your response sheet to AIPD for grading.

After you finish this subcourse, keep the reference text, lesson book, solution sheets, and the examination. Only return the examination response sheet to AIPD.

Text and materials furnished: Trans Subcourse TR0690, Loading, Blocking, and Bracing on Railcars, November 1973, and one response sheet for answering the examination questions.

LESSON 1..... Loading Rules and Regulations.

CREDIT HOURS..... 1.

TEXT ASSIGNMENT..... Reference Text 690, paras 1.1 - 1.19.

MATERIALS REQUIRED..... None.

***** IMPORTANT NOTICE *****

THE PASSING SCORE FOR ALL ACCP MATERIAL IS NOW 70%

PLEASE DISREGARD ALL REFERENCES TO THE 75% REQUIREMENT.

LESSON OBJECTIVE.....To enable you to describe the design and construction of a flatcar; to apply the AAR's loading rules and regulations; and to follow the Army's procedures when loading military freight.

SUGGESTIONS.....None.

EXERCISES

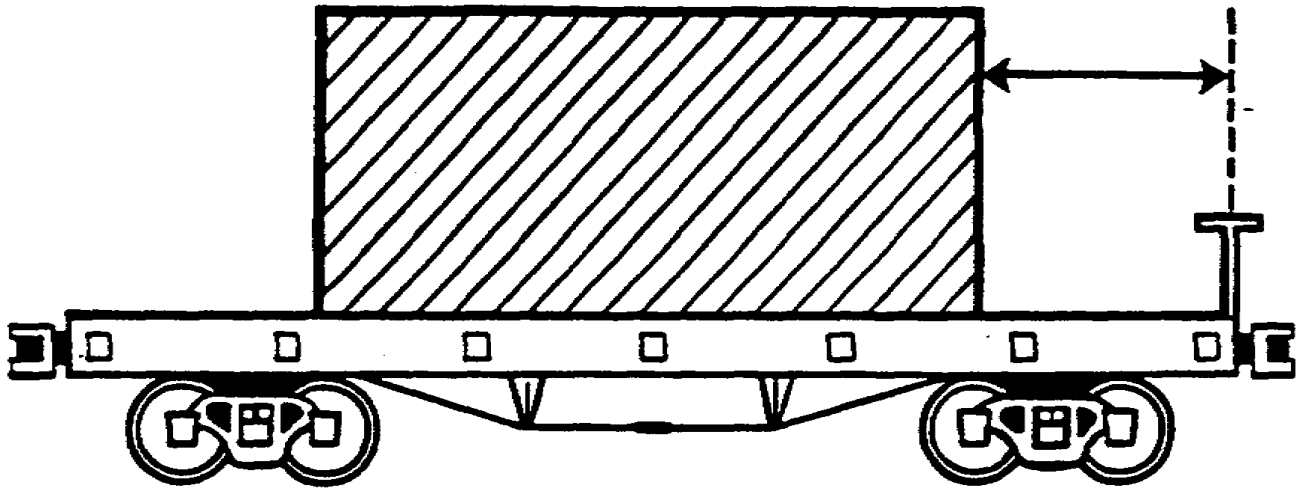
Weight — True-False

(Write T for true or F for false.)

2 1. Rail cars must be inspected before loading.

2 2. Loading drawings for missile components get final approval at the Savanna Army Depot.

2 3. The truck center is simply the center of the truck, no matter how many wheels it has.



2 4. Brake wheel clearance, indicated by the space between arrows in the sketch above, must be at least 14 inches.

Cluster True-False

(Each of the following groups of questions is related to the statement that precedes them. Write by each question T or F.)

Weight

FIRST GROUP

You notice frequent reference to "truck centers" in the AAR rules. Puzzled by the unfamiliar term, you do some research and learn that:

3 5. Fishbelly flatcars are without truck centers.

3 6. Each wheel of the flatcar has a truck center.

3 7. The center plate is the place, where the underframe and truck join.

3 8. The center of a six-wheel truck is at the center of the last axle.

3 9. To show the location of a truck center, you place a chalk mark directly above it on the side sill of the underframe.

SECOND GROUP

The new clerk in the transportation office asks what those long numbers are that he sees stenciled on flatcars. You tell him that:

3 10. The figure following LD LMT gives the nominal capacity of the flatcar.

3. 11. CAP is expressed in tons.

3 12. The capacity figure added to load weight figures gives you the light weight of the car.

3 13. Maximum height and width of load are stenciled on the car.

3 14. Load limit (LD LMT) is expressed in pounds.

3 15. The LD LMT figure gives the maximum load for that car.

THIRD GROUP

Newly assigned to the post transportation office, you begin studying the regulations you will be using. You turn to

Weight

section 6 of AAR's Rules Governing the Loading of Commodities on Open Top Cars and find:

3 16. Charts showing blocking patterns.

3 17. General rules 1 through 5.

3 18. Descriptions of how military equipment is blocked and braced on flatcars.

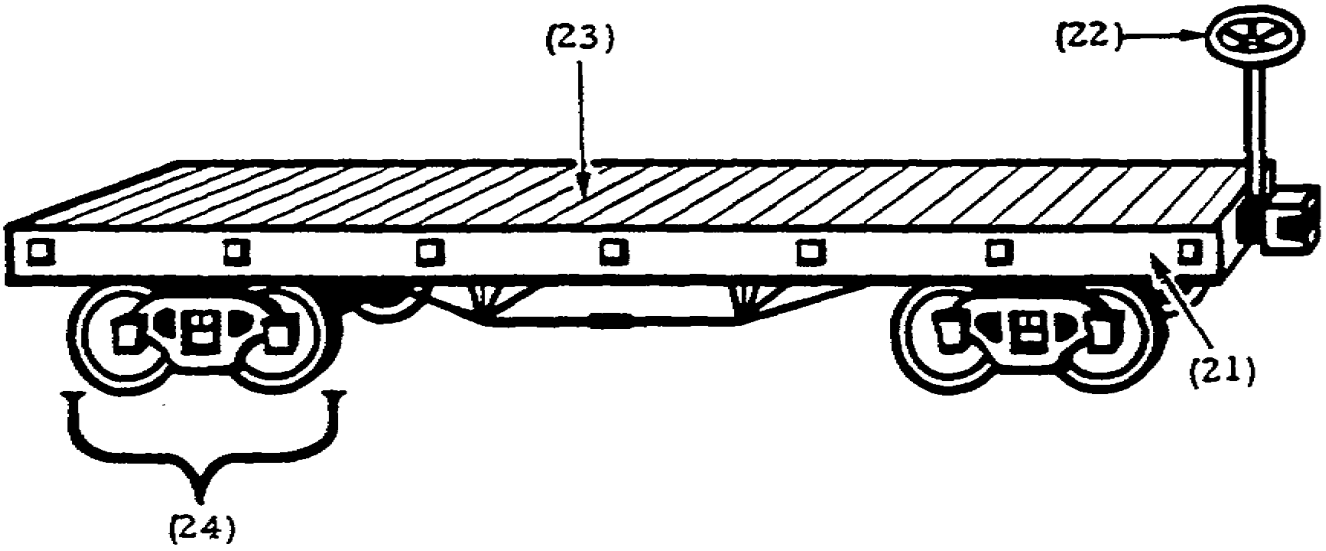
3 19. Drawings showing how to load 1/4-ton trucks on flatcars.

3 20. Drawings showing how boats are to be secured on railcar.

Matching

8* The sketch shown in column I is a nonfishbelly flatcar. Identify the numbered items in the sketch by matching them with the name of the car component from those listed in column I. Write the proper letter by each question. Each item in column 1 may be used once, more than once, or not at all.

Column I



*2 credit points for each choice

Weight

Column II

A. Deck.

B. Underframe.

C. Truck center.

D. Truck.

E. Brake wheel.

Match the subject of a rule from column II to the appropriate rule in column I by writing the proper letter by each question. Each item in column II may be used once, more than once, or not at all.

		Column I	Column II
		Rule No.	Subject
4	25.	1.	A. Limit of weight on a single car.
4	26.	2.	B. Location of load on car.
4	27.	4.	C. Clearance around brake wheel.
4	28.	4e.	D. Center of gravity.
4	29.	5.	E. Inspection of car before loading.

Analytical

(Using the following key, indicate your reaction to each of the next four questions by writing the proper letter in the lesson book.)

A. The underscored statement is true, and the reason for it or result of it is true.

B. The underscored statement is true, but the reason or result is false.

C. The underscored statement is false.

Weight

4 30. Army requirements for shipping by rail are at least as rigid as the AAR's rules because military equipment needs extra support.

4 31. In general, the higher the load the wider it may be since tunnels are narrowest at the top.

4 32. Car loading procedures must be effective because the safety of load, property, and people is at stake.

4 33. The fishbelly flatcar can carry a greater proportion of a load between truck centers than the nonfishbelly because its design makes the fishbelly stronger.

LESSON ASSIGNMENT SHEET

TRANS SUBCOURSE 690.....	Loading, Blocking, and Bracing on Rail Cars.
LESSON 2.....	Principles and Procedures.
CREDIT HOURS.....	1.
TEXT ASSIGNMENT.....	Reference Text 690, paragraphs 2.1-2.13; appendix II.
MATERIALS REQUIRED.....	None.
LESSON OBJECTIVE.....	To enable you to describe ramps and spanners and explain how they are used in getting vehicles onto flatcars, to apply the techniques employed in loading, and to select the materials used in blocking and bracing certain items.
SUGGESTIONS.....	None.

EXERCISES

Weight — *True-False*

(Write T for true or F for false.)

3 1. An idler car can carry up to half the weight of the equipment loaded on the preceding car.

3 2. Blocking and bracing a lightweight semitrailer with its truck tractor is one of the most complicated jobs.

3 3. Waterproof paper is placed between the cleat and a vehicle's tire to prevent chafing.

3 4. A piece of old inner tube or rags can be used to prevent wire from chafing where it touches stake pockets.

3 5. Transverse force causes the load to continue moving forward after a rail car makes a sudden stop.

Weight

3 6. Powered vehicles are usually driven up ramps and onto flatcars.

Cluster True-False

(Each of the following groups of questions is related to the statement that precedes them. Write by each question T or F.)

FIRST GROUP

Understanding the reason behind a regulation helps men to comply with it more readily. Realizing this, you call a meeting of your loading crews and explain some of the major physical forces that affect cargo in transit. You tell them:

4 7. Nails driven into the deck of the car at a 45-degree angle give greatest holding power.

4 8. Wire is used to protect a vehicle from the effects of vertical force.

4 9. Without cleats alongside truck tires, centrifugal force might push the vehicle off the side of the flatcar.

4 10. No nail size is specified for applying blocks because most nails have the needed strength.

4 11. Blocks are secured against the wheels to keep the vehicle from moving longitudinally.

SECOND GROUP

Several units on post will soon be leaving for a desert exercise. Since the units will actually load their own vehicles on flatcars, the men will need refresher training in how it is done. If you were the instructor, which of the following points would you properly cover?

3 12. The circus method of loading vehicles on flatcars is too time consuming to be used in this instance.

3 13. A spanner should be built to support the heaviest vehicle to be loaded.

Weight

3 14. When any kind of ramp is used, the rear truck of the flatcar must be removed during loading.

3 15. When a ramp is unavailable, one can be fabricated of lumber.

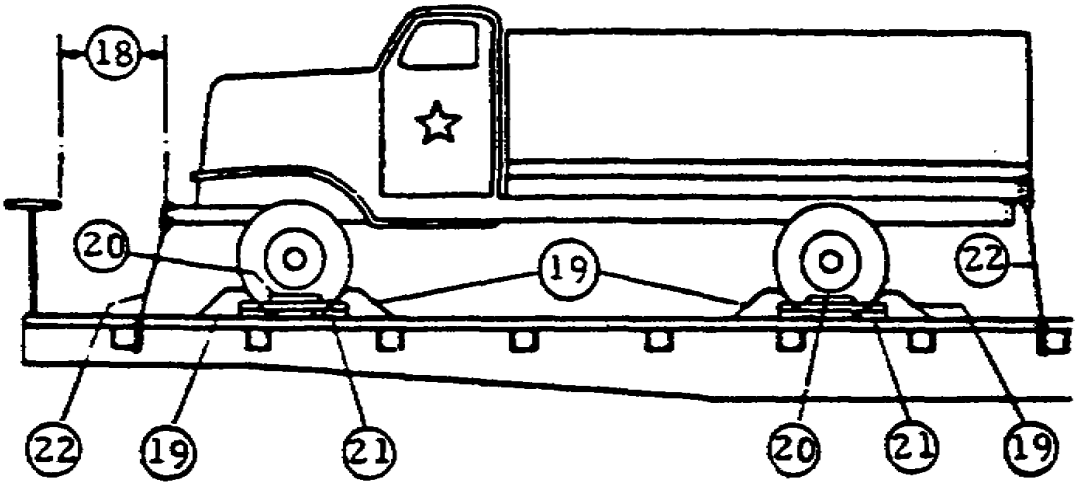
3 16. Space between railroad tracks should be filled with wood or some other material when a ramp is used.

3 17. Spanners are used between flatcars so that trucks may be driven from one car to another during loading.

Matching

20* The sketch shown in column I represents a 2 1/2-ton truck properly blocked and braced on a flatcar. Circled numbers refer to some of the specific items, materials, clearances, etc., used in securing the truck. Among the descriptions in column II are those that cover the items referred to by the circled numbers in the sketch. Match a description from column II with the item it correctly describes in column I. Choices from column I may be used once, more than once, or not at all.

Column I



Column II

A. 4 strands No. 8-gage black-annealed wire. Attach to each corner of vehicle and to stake pockets and twist taut.

*4 credit points for each choice

Weight

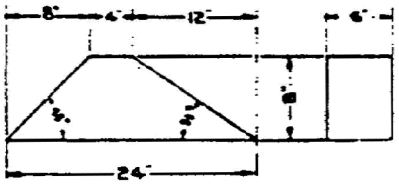
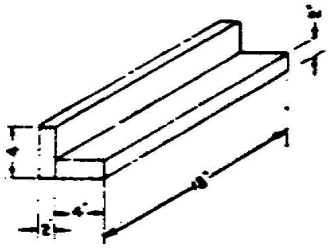
B. Suitable material, such as waterproof paper, burlap, etc. Locate bottom portion under item 21, top portion to extend 2 inches above item 21.

C. Brake wheel clearance.

D. Each to consist of two pieces of 2- by 4- by 36-inch lumber. Nail lower piece to floor with four thirtypenny nails and top piece to the one below with four thirtypenny nails.

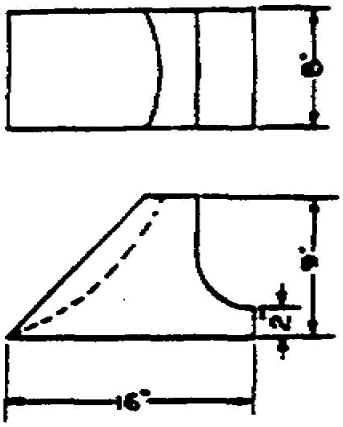
E. 6- by 8- by 24-inch blocks, pattern 16. Locate 45° portion of block against the front and rear of front wheels and in front of and behind the outside rear wheels. Nail heel of block to floor with three fortypenny nails in a triangular pattern and nail that portion under tire to floor with two fortypenny nails, one on either side, before items 20 and 21 are applied.

Match the pattern number in column II with the sketch of the pattern in column I to which it applies by writing the proper letter by each question. Each Item in column II may be used once, more than once, or not at all.

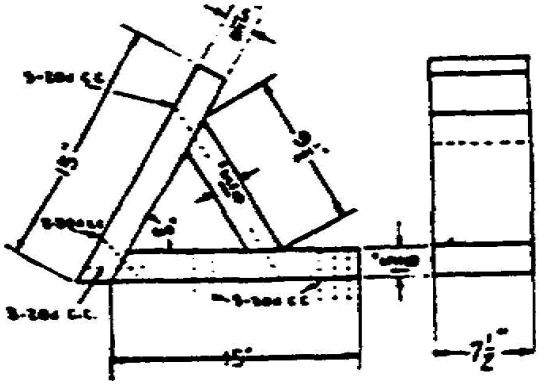
		Column I Pattern	Column II Pattern No.
4	25.		A. 16. B. 18. C. 20. D. 24. E. 25.
4	24.		

Weight

4. 25.



4. 26.



Analytical

(Using the following key, indicate your reaction to each of the next two questions by writing the proper letter in the lesson book.)

A. The underscored statement is true, and the reason for it or result of it is true.

B. The underscored statement is true, but the reason or result is false.

C. The underscored statement is false.

4 27. <u>The longer a load overhangs the end of a flatcar the wider it is permitted to be</u> since the wider it is the more it tends to remain centered over the idler car.

4 28. <u>The flatcar floor may be widened</u> when the full width of the truck tire extends over the side sill.

REFERENCE TEXT

690

LOADING, BLOCKING, AND BRACING ON RAIL CARS

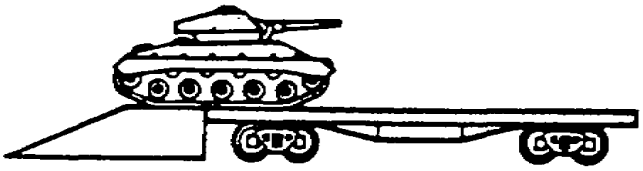
The information contained herein is provided for instructional purposes only. It reflects the current thought of this school and conforms to printed Department of the Army doctrine as closely as possible. Development and progress render such doctrine continuously subject to change.

U. S. ARMY TRANSPORTATION SCHOOL

Supersedes Reference Text 690, Loading, Blocking, and Bracing on Rail Cars, November 1970.

CONTENTS

INTRODUCTION



If you were planning to tile your foyer with slate, what questions must you be able to answer before you contact the building materials dealer? Obviously, you must know the size of the area to be covered. Then you need to know the dimensions of the pieces of slate and how many it will take to do the job. Armed with these figures, you get into the car and drive to town. The dealer looks over your list and then asks: "Will the floor support all that added weight?" This question had never occurred to you.

The transportation officer shipping equipment by rail cannot afford to overlook such questions; at stake are the lives of his men, the security of the shipment, and the safe use of rail equipment. Regulations on securing loads for rail transport remind the shipper of all the limitations he must reckon with before his first vehicle rolls into place on a flatcar. Dimensions of the rail car and how much weight it can carry are obvious limitations. Less obvious are restrictions on placing the load on the car in relation to the car's brake wheel and trucks, or wheel arrangements. Then, too, railroad bridges, tunnels, and other structures along the right-of-way necessarily limit the height and width of the load. But all of these are spelled out by the Association of American Railroads and repeated or modified in Army regulations. By carefully observing the published rules, the shipper insures that proper precautions have been taken against foreseeable mishaps to men and materiel.

This text opens the rule book and underscores some of the fundamental requirements of shipping by rail. Then, using typical Army equipment, the text illustrates exactly how a shipment is prepared for a rail journey.

Three appendixes are included. Appendix I lists references used in preparing the text, appendix II contains vehicle loading data, and appendix III consists of a glossary of pertinent terms.

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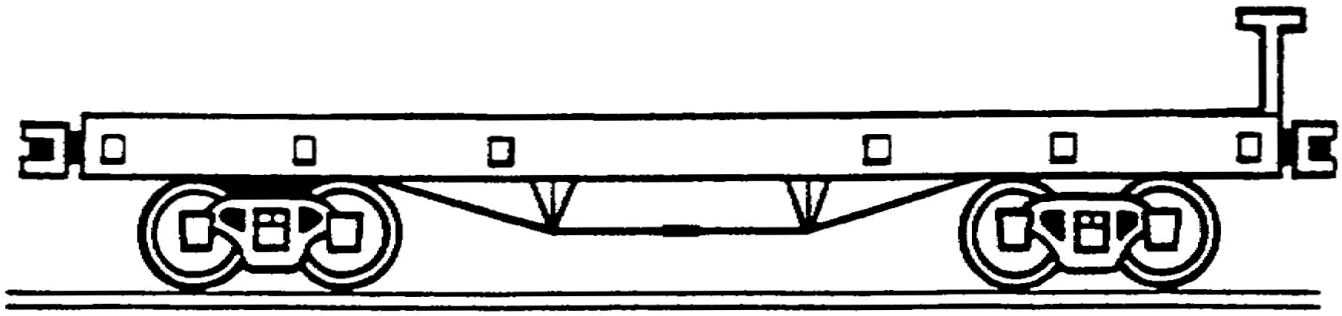
Chapter 1

LOADING RULES AND REGULATIONS



1.1. INTRODUCTION

"One killed, three injured in freight car collision" reads a recent newspaper headline. The article recounted the tragic details of how the load on a westbound train had shifted in transit, fouling the adjacent main track. Here is how it happened. An eastbound freight was approaching a westbound one on the other track at 45 miles an hour. The eastbound's engineer noticed sparks flying from under the oncoming train and thought one of its cars might have derailed. Seeing this, he immediately moved the handle of the automatic brake valve to emergency position. As the trains passed, lading protruding from the south side of a car on the westbound train struck the north side of the diesel-electric units and the first 16 cars of the eastbound. A brakeman in one of the eastbound diesel-electric units was killed, and the other crew members on the locomotive were injured. The accident report stated that if the lading had been secured as prescribed by Association of American Railroads (AAR) general rules, the accident probably would not have occurred.

The Association of American Railroads describes how individual items, including Department of Defense items, are to be loaded, blocked, and braced on rail cars. To understand the AAR's rules, you must first know something about rail equipment itself. Section I of this chapter examines flatcar construction and design, since the flatcar is commonly used for shipping large items. Throughout the text, reference is made to commercial flatcars in use in the United States. Section II introduces you to the basic rules of the AAR and to their application in Army regulations.

Section I. Flatcar Construction and Design

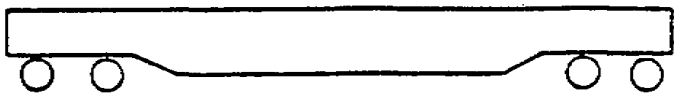
1.2. GENERAL

Asking how many 5-ton trucks can fit on a flatcar is a little like asking how many angels can dance on the head of a pin, unless

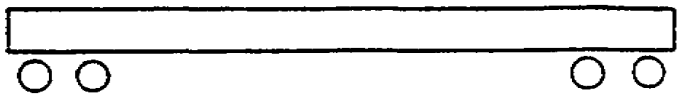
you know the platform dimensions and weight-carrying capacity of the car. This section gets loading off on the right foot by discussing the varieties of flatcars available to the shipper of military freight as well as their construction, size, rated capacity, load limits, and vehicle-carrying capacity.

1.3. COMPONENTS OF A TYPICAL FLATCAR

Known as the workhorse of the rail service for its capability of transporting a wide variety of large and heavy items, the flatcar is essentially a platform on wheels. Flatcars are generally of fishbelly or nonfishbelly design as shown in the sketches. The main structural components of a flatcar are the trucks containing the wheels, the underframe connecting trucks and deck, and the deck or load-carrying surface itself. Figure 1.1 pictures a typical flatcar, showing its three main components. Figure 1.2 exposes the car's underframe. And figure 1.3 shows the truck itself. Each of these flatcar elements is described briefly in the subparagraphs that follow. In addition, the brake wheel is described. Although not a primary structural member, the brake wheel plays a significant part in loading the flatcar and is therefore important to the shipper of military freight.



Fishbelly Flatcar



Nonfishbelly Flatcar

a. Trucks. As you can see in figure 1.4, trucks are wheel units that include brake components, axles, springs, and frames in addition to two, or sometimes more, pairs of wheels. Note the axle; it is axle strength that determines the total allowable weight of the car and its lading on the rails. Weight limits of interest to the military shipper are explained later in this section. Notice the side

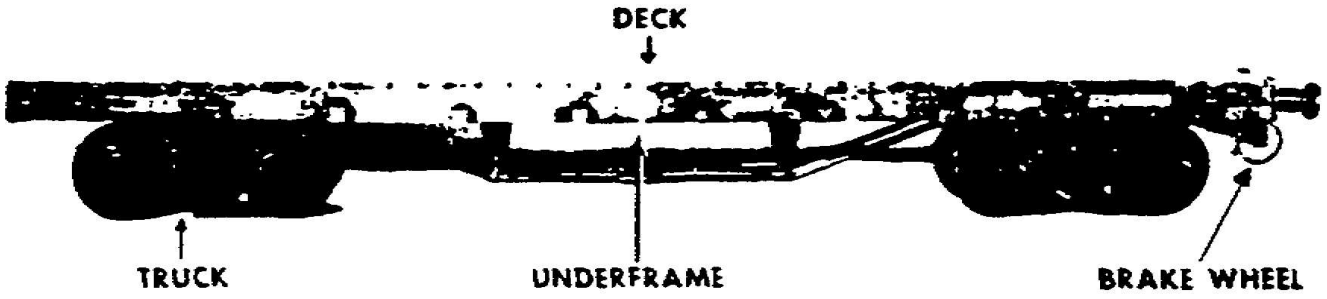


Figure 1.1. Typical Flatcar.

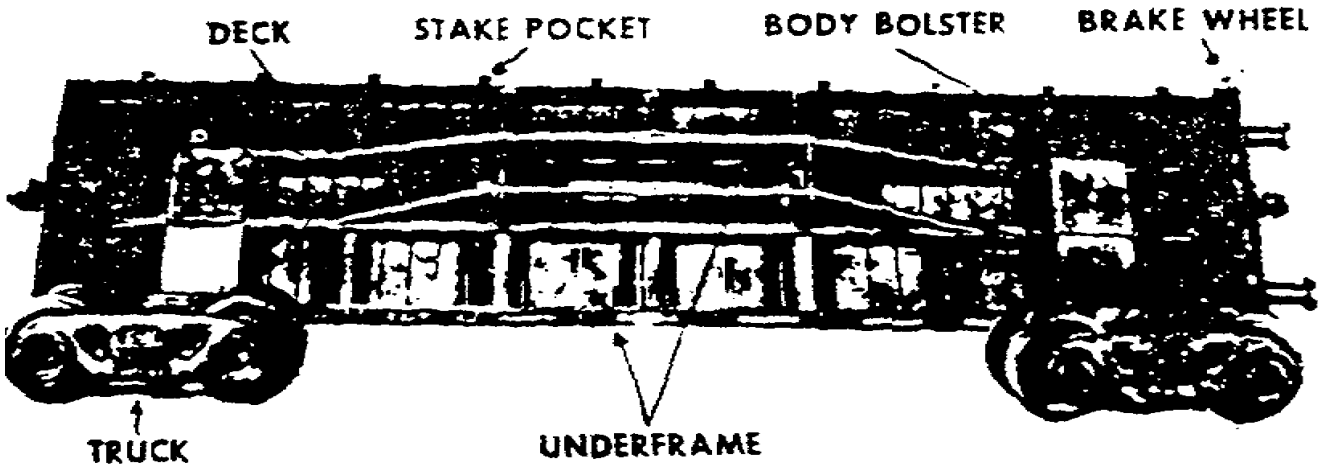


Figure 1.2. Flatcar Disassembled.

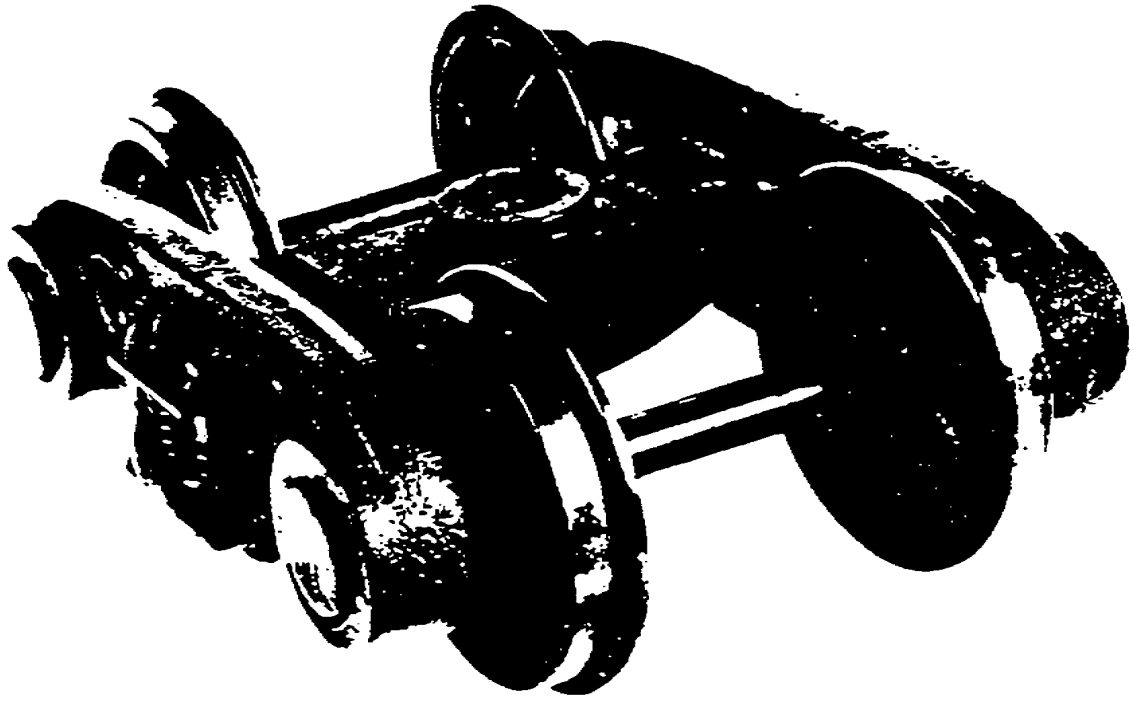


Figure 1.3. Typical Truck.

bearing and bolster on the truck. Side bearings--two on each truck--provide stability for the car during transit, particularly on a curve. The center plate joins the truck to the underframe, holding the car together and providing a pivot point for the truck when the car is taking a curve.

b. Underframe. The framework or underframe, shown in figure 1.2, is the foundation of the flatcar. It receives buffing and pulling stresses and carries the weight of the deck and lading. Two

long members on either side are called side sills, the long member in the center paralleling the side sills is the center sill, and the short end members are end sills, as shown in the sketch below. Some flatcars have two center sills, as shown on the underframe in figure 1.2. Stake pockets attached to the side sills support stakes that form a temporary side above the deck. A transverse intermediate member at each end, called a body bolster, contains a projection that fits down into the center plate receptacle on the truck. You can see the center plate in the middle of the truck sketched in figure 1.4.

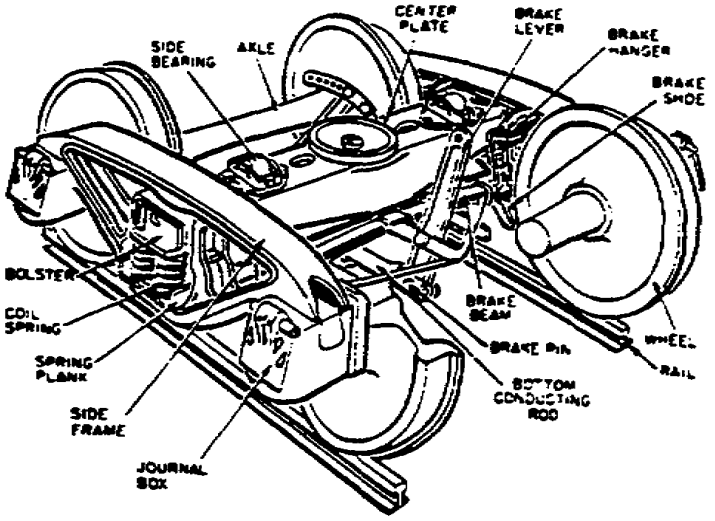
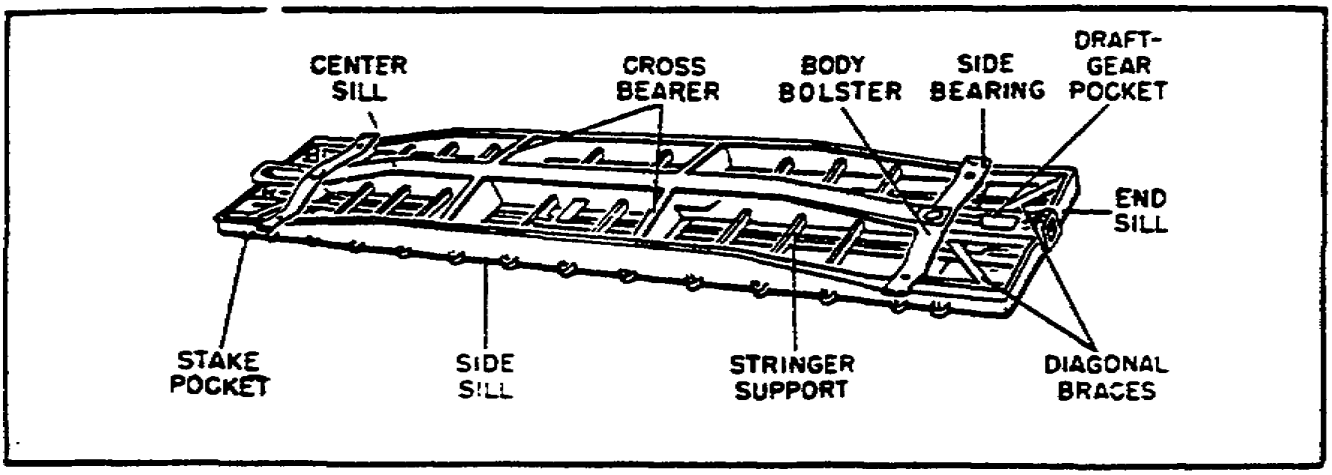


Figure 1.4. Truck Components.



c. Deck. The platform on top of the flatcar where the load rests is called the deck. Normally constructed of tongue and groove wood planking for a solid fit, the deck is secured to the underframe. Figures 1.1 and 1.2 illustrate the deck clearly.

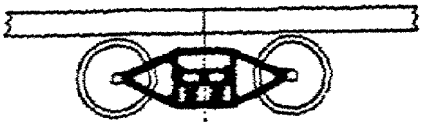
d. Brake wheel. Located at one end of each car is a brake wheel used to operate the handbrake. Although our "typical" flatcar in figure 1.1 shows the brake wheel under and to the side of the deck, the more common position is upright, as in the sketch, and extending above the level of the deck. When the brake wheel is used, it secures--holds--a car at a siding, much as the handbrake in your car keeps it from moving once it is parked. In some yard or road operations, the handbrake is used to slow down or stop a car when it is in

motion. And the brake wheel can be lowered or removed to make loading the flatcar easier. Loading rules specify certain clearances around the brake wheel to make sure it is accessible at all times. More about clearances is given when car loading rules are discussed in section II.

1.4. TRUCK CENTERS

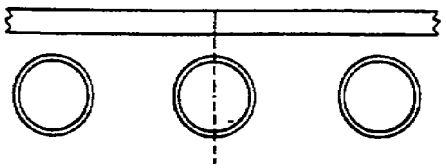
Since loading rules are often expressed in terms of the location of truck centers, it is important for you to understand what the term means. Quite simply, the truck center is the center of the truck regardless of the number of wheels. How to find the centers is discussed in the following subparagraphs.

a. Four-wheel truck. In a four-wheel truck, the center of its bolster is the same as the center of the truck. A chalk mark placed on the side sill directly above this point can help you to find the spot while loading the flatcar. The sketch shows how to mark the center of a four-wheel truck.



Center of Four-Wheel Truck

b. Six-wheel truck. The center of a six-wheel truck is the center of the middle axle, as sketched here.



Center of Six-Wheel Truck

c. Center casting. The most accurate method of locating the truck center is by finding the center casting, or the place where the underframe joins the truck, identified on figure 1.4 as the center plate.

1.5. WEIGHT LIMITS

Although there are no standard dimensions for commercial cars, the following data describe flatcars commonly used on railroads in the United States. The Official Railway Equipment Register should be consulted for descriptions of specific cars to be used.

Capacity, short tons	Platform dimensions, ft. approx.	
	Length	Width
40	40	9
50	45	9
70	50	9

Of the information stenciled on a flatcar, three items give the military shipper essential data about the car he is to load: capacity, load limit, and light weight.

a. Capacity. Suppose you see a car marked CAP 100,000. What does it mean to you? Simply that this is the capacity marking of the car that places it in a tonnage class. Capacity in this instance is "nominal"; it is expressed in multiples of 1,000 pounds and is based on the weight of the car itself and the total allowable weight of car and load. CAP 100,000 means this car is in the 50-ton class. The CAP figure does not tell you how heavy your load can be any more than the nominal rating of a 5-ton truck (10,000 pounds) limits the payload to 10,000 pounds. As you may know, a so-called 5-ton truck can carry more than 5 tons on a highway.

b. Load limit. The abbreviation LD LMT with a number--after it expresses the maximum load limit in pounds the car is designed to carry without endangering car or load. The notation "LD LMT 118,600" on a flatcar means the car can carry a load of up to 118,600 pounds. Load limit plus the weight of the car, described in subparagraph 1.5c as "light weight," equals the total allowable weight on the rails, mentioned in paragraph 1.3a as depending upon axle strength.

c. Light weight. The abbreviation LT WT and a number (for pounds) refers to the weight of the car itself--its "light weight"--without a load, clean, standing still on the scales, and uncoupled at each end.

1.6. HEIGHT AND WIDTH LIMITS

Equipment prepared for unrestricted rail transportation on United States main lines with standard 56 1/2-inch gage must not exceed the following height and width limits. Notice that the higher the load the narrower it must be; this is to allow for tunnel and other overhead obstructions found along railway lines. Thus, a load 9 feet

7 inches high can be as wide as 10 feet 8 inches, whereas a load 11 feet 11 inches high cannot exceed 7 feet in width.

Height of Load (measured from top of car platform)		Width of Load		1/2 Width of Load (measured to left or right of centerline of track)	
Ft.	In.	Ft.	In.	Ft.	In.
9	7	10	8	5	4
10	1	10	0	5	0
11	11	7	0	3	6

Although these height and width figures provide a general guide for shipping items on flatcars, the limits of particular railroads vary from them and must be determined whenever a move is planned. Delays, unsafe loads, and damage to equipment must be avoided by checking in advance with individual lines.

1.7. VEHICLE-CARRYING CAPACITY

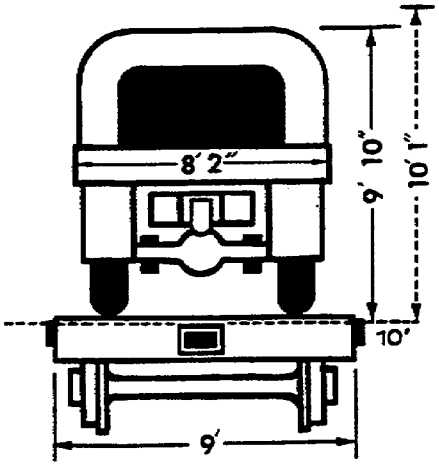
Now to try to answer the question "How many 5-ton trucks can fit on a flatcar?" Basically, this is what you must know: dimensions and weight of the 5-ton cargo truck including any cargo in the truck, length and width of the flatcar deck, and load limit of the flatcar. Not all 5-ton cargo trucks are alike: models differ in size and weight. Look at the dimensions for two examples:

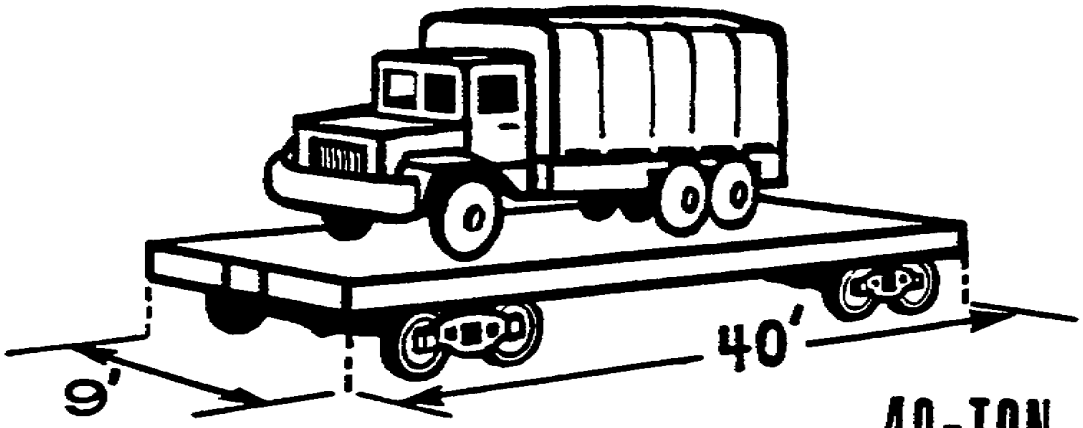
	Example A	Example B
Length, in.	297	373.3
Width, in.	98	98
Height, in.	117.8	118.8
Empty weight, lb	19,231	23,349

Note that example B is 76 inches longer than example A and an inch higher. Example B is over 4,000 pounds heavier than example A. A few inches or pounds can make the difference between "go" and "no go" on a flatcar. Example A is illustrated in the sketch on the left.

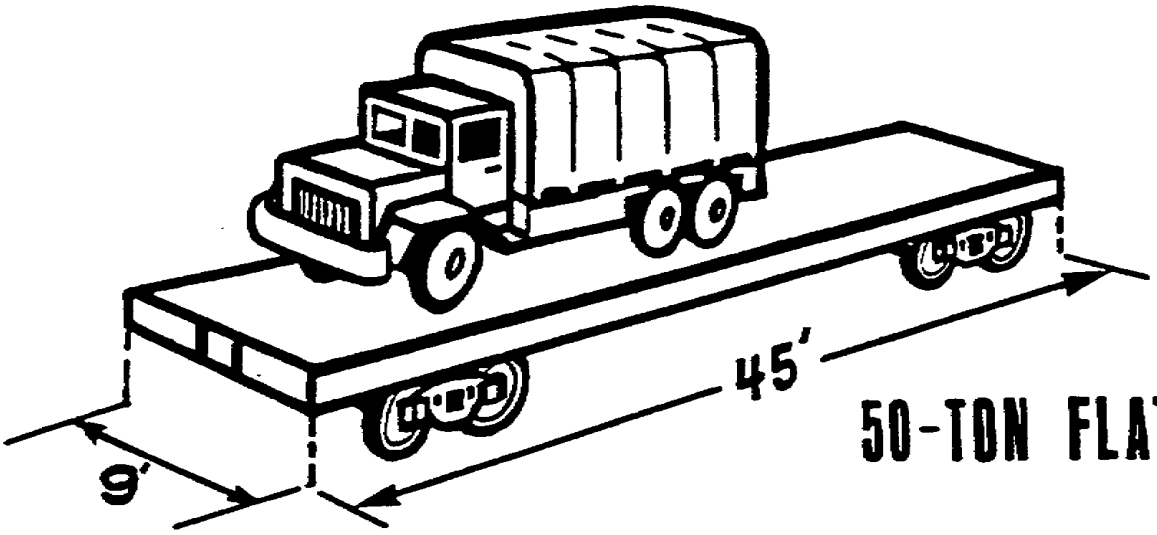
Looking back at the flatcars described in paragraph 1.5, and taking into account the height and width limits given in paragraph 1.6, try to place the example A cargo truck on one or more of the cars. As this sketch demonstrates, weight, height, and width of the load present no problem on any of flatcars listed in paragraph 1.5.

Going on to length and width, you find that one of the example A trucks is transportable on the 40- and 45-foot cars. And two of these trucks could be transported on either the 50- or 60-foot car, one behind the other,



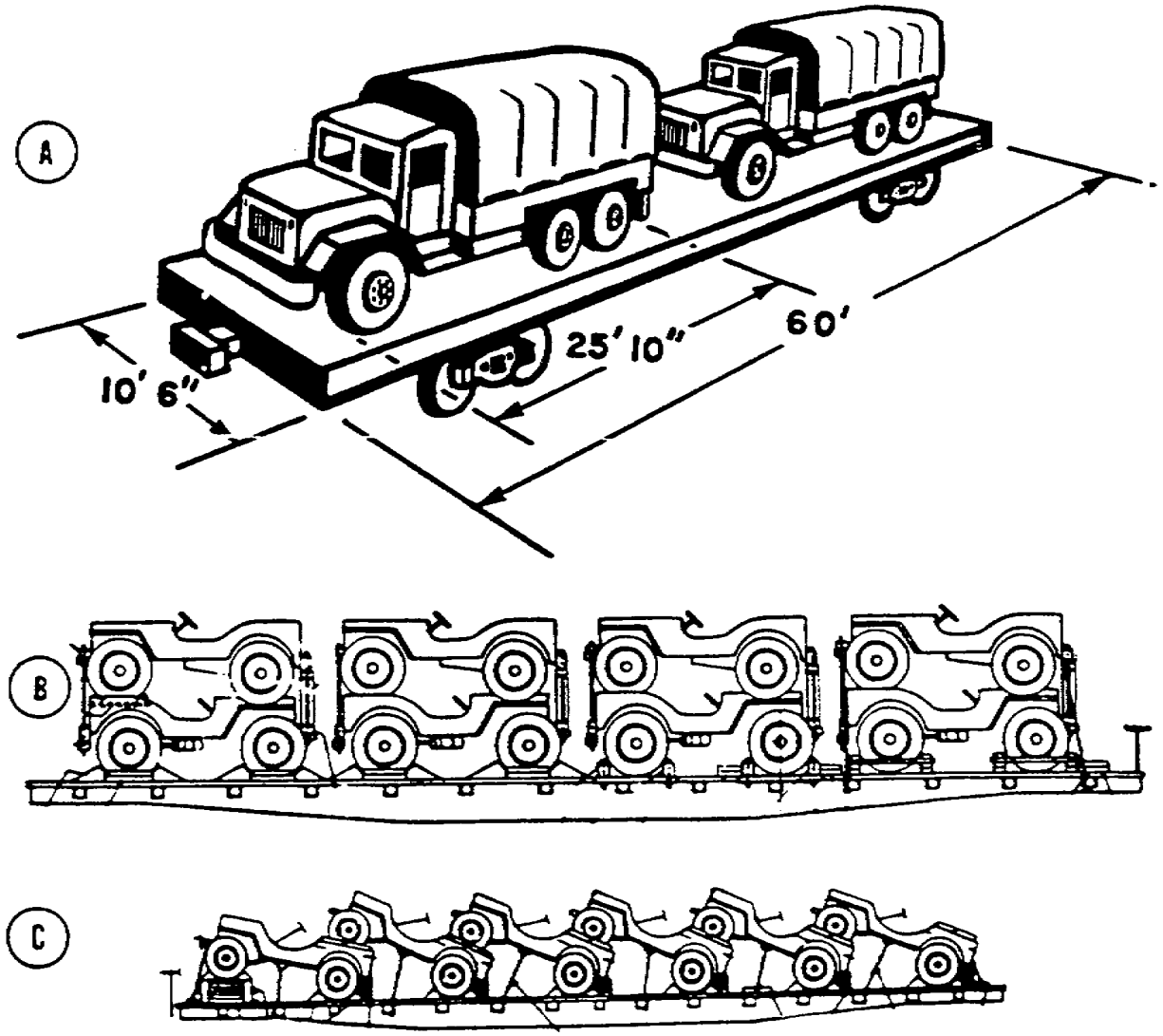


40-TON FLATCAR



50-TON FLATCAR

as shown on the 60-foot car in sketch A below. Some vehicles can be double tiered or inclined, as sketches B and C show for the 1/4-ton truck, depending upon their dimensions and weight and upon the size and load limit of the flatcar.



1.8. SUMMARY

Generally found in fishbelly or nonfishbelly design, a flatcar has three basic components: trucks, underframe, and platform or deck. Trucks contain two or more pairs of wheels that ride on the rails, brake elements, axles, etc. Centered in the top of each truck is a center plate or casting that provides the receptacle for the complementary fitting on the underframe, joining trucks and deck. The underframe, the skeleton to which the deck is attached, takes the buffing and pulling stresses applied to the flatcar and bears the weight of platform and load. Customarily made of wood planking, the deck provides the surface upon which the load rests. Located at one

end of the car is a brake wheel which is used to operate the handbrake. The latter is used to hold the car while it is standing still and, sometimes, to slow it down or stop it when it is moving.

Truck centers are simply the centers of trucks. Because loading rules make frequent reference to truck centers, it is important to know how to find them. The center of a four-wheel truck is midway between the two wheels on the same side of the car or in the middle of the truck bolster. A six-wheel truck has its center at the axle of the middle wheel on one side of the car. Placing a chalk mark on the side sill above the truck centers makes the centers obvious to those doing the loading.

Commercial flatcars do not have standard dimensions but may vary from one car to another. Still, flatcars commonly used in the United States are in the 40-, 50-, or 70-ton class--named for their capacities--and range from 40 to 60 feet long. All are approximately 9 feet wide. Three of the items stenciled on the side sill of the flatcar are of particular value to the shipper: capacity, load limit, and light weight of the car. Of these, load limit is most important because it states the payload in pounds of the particular car. Light weight is the weight of the car itself, and capacity gives the tonnage class of the car.

Because of the limits of tunnels and other obstructions, restrictions are necessarily placed upon the height and width of loads. It is possible to specify limits for unrestricted travel on main rail lines in the United States by citing the lowest overhead and narrowest passage to be found on any of these lines.

In general, if you know the dimensions and weight of the item you are shipping and the size and load limit of the flatcar to be used, you can determine whether the flatcar can accommodate the load and how many of that item can be transported on a single flatcar.

As you will see in the next section, dimensions and weight alone do not determine whether a load can be shipped on a particular flatcar. Special rules and regulations cover clearances around the brake wheel, location of the load on the car, blocking and bracing the load, and other essentials, all affecting the transportability of your shipment on a flatcar.

Section II. Army and AAR Loading Requirements

1.9. GENERAL

The prospect of having to ship Army equipment on rail cars at some future time may be alarming to you. It needn't be. Regulations spell out in the smallest detail everything you will need to know to send your shipment safely to its destination. But you must know the source of such regulations and what they cover. This section identifies the basic publications and shows you how to use them.

1.10. RESPONSIBILITY FOR LOADING

Proficiency in rail-car loading is a command responsibility. Army Regulation Z20-10, Preparation for Oversea Movement of Units (POM), makes it one. Three reasons underscore the need for effective car-loading procedures: they help to prevent damage to the cargoes; they avoid the costly delays that damaged shipments create; and they protect Government and railroad property and employees. The car loader, or shipper, is directly responsible for loading items on rail cars. Whether you are a unit commander, a movements officer, an installation transportation officer, a cargo handler, a trainman, or other shipper of military freight, you will be directly involved in loading, blocking, and bracing equipment on rail cars. The continuing emphasis on mobility makes it necessary for every officer to have a general knowledge of this important subject.

1.11. ASSOCIATION OF AMERICAN RAILROADS RULES

The AAR has established the rules that form the foundation for properly loading, blocking, and bracing equipment on rail cars. It goes without saying that rail cars cannot be loaded according to the whim or for the convenience of each shipper. The AAR rules are based on years of experience and are changed as necessary to accommodate new items and new rail equipment. Among their many books, pamphlets, and supplements on the subject, the AAR's Rules Governing the Loading of Commodities on Open Top Cars is particularly valuable to the military shipper. Section 1 of that publication contains general rules, and section 6 gives rules for loading Department of Defense (DOD) materiel on open top cars. Four of the general rules, and part of one of them, are given in the next five paragraphs. Following those, the rules found in section 6 are discussed.

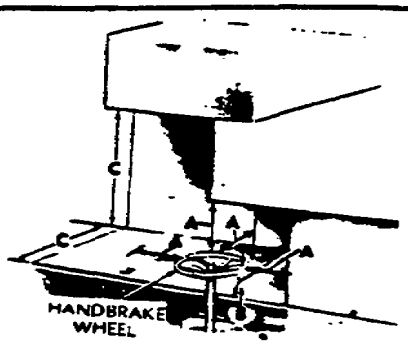
1.12. RULE 1--INSPECTION AND COMPLIANCE

Essentially, rule 1 requires that cars be inspected by the originating carrier (the C&O Railroad, for example) either before they are placed for loading or at the loading point to see that they are fit for the intended loads and can carry them safely to destination. The shipper, such as the transportation officer, must comply with drawings and specifications, if any, and the applicable AAR rules for the item being shipped. After loading, the shipper must inspect the shipment to see that it is properly and safely secured and that all rules have been complied with before tendering the shipment to the carrier. Then the carrier, too, inspects the shipment for proper loading. Rule 1 also states what the shipper must do to ship items not covered in the rules.

1.13. RULE 2--BRAKE WHEEL CLEARANCE

Rule 2 defines and illustrates the necessary brake wheel clearance on a car. It also points out when brake wheels may be removed to make loading easier.

a. The clearance around the brake wheel must not be less than that shown in this sketch based upon the AAR rule. Clearance should be increased as much as is consistent with properly locating the load.



Clearances:

A: 6 inches behind, on both sides of, and above brake wheel, except as shown in loading plans for tanks and similar shapes in one piece.

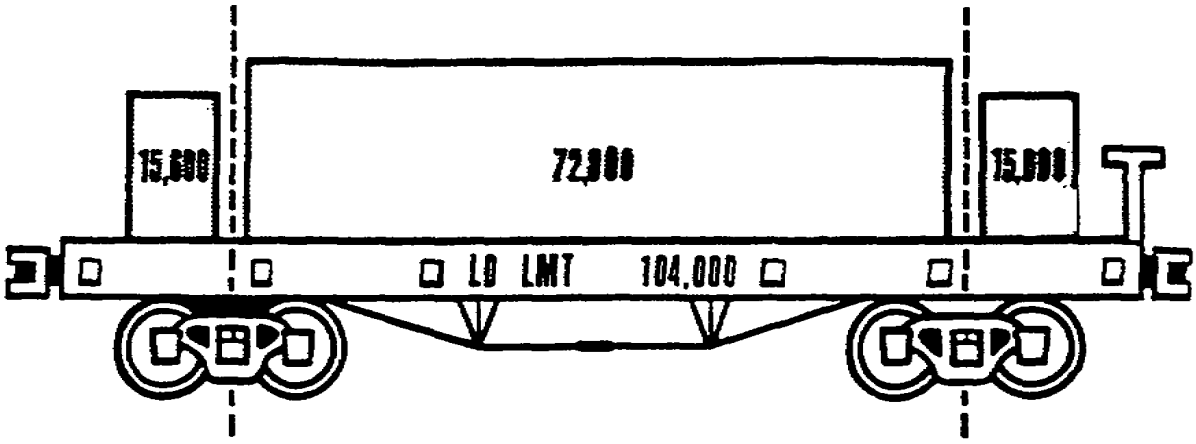
B: 4 inches underneath brake wheel.

C: 12 inches minimum from end of car to load, extending from center of brake wheel to nearest side of car and 6 feet above car floor.

b. Handbrakes may be removed from all but one car when a number of cars are combined for an overlong shipment extending to more than one car.

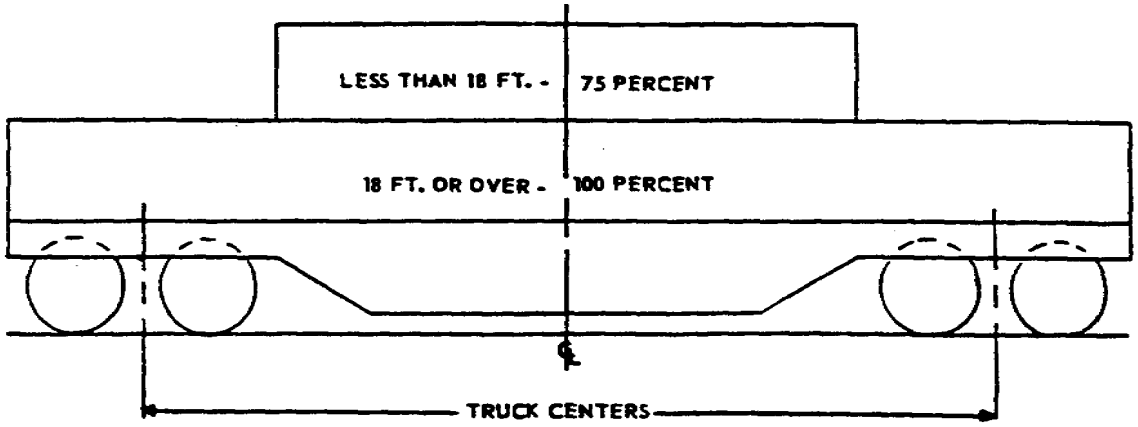
1.14. RULE 4--MAXIMUM LOAD WEIGHT, SINGLE CARS

The weight of the load on a car must not exceed the load limit stenciled on that car. The weight of material loaded between truck centers and the ends of the car must not exceed 30 percent of stenciled load limit--15 percent each end. For example, if the stencil on the car reads LD LMT 104,000, you know you may load 15,600 pounds at each end of the flatcar, that is, between the truck center and the end of the car.

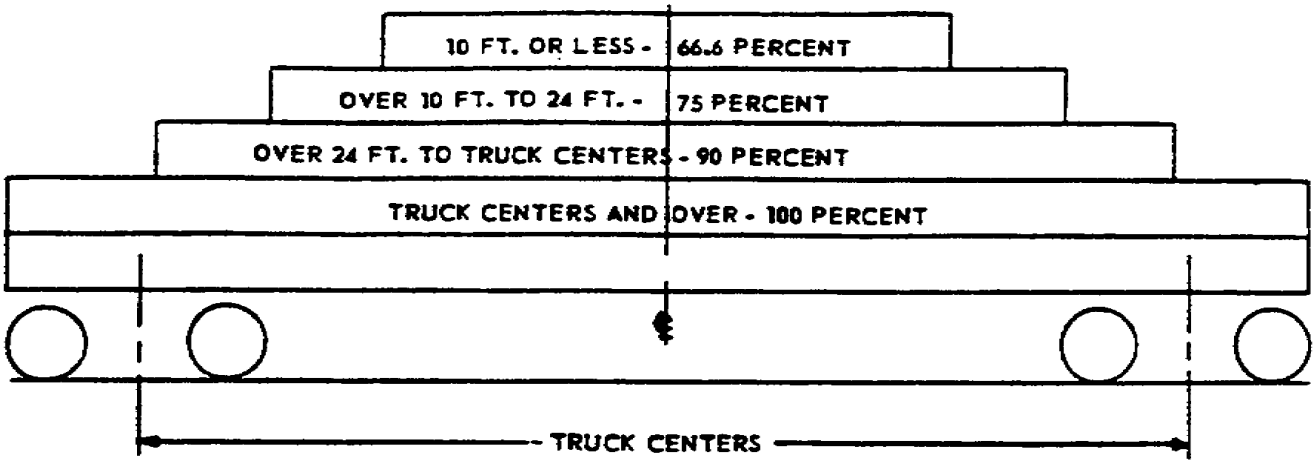


If the load length is less than the distance between truck centers, only established percentages of the stenciled load weight limit can be loaded unless the car owner has designated otherwise in The Official Railway Equipment Register. Established percentages differ for fishbelly and nonfishbelly flatcars. When the load is lapped or staggered between truck centers, covering about the full length of the car, and does not exceed the stenciled nominal capacity of the car, the percentages shown in the following subparagraphs do not apply.

a. Fishbelly. The fishbelly design gives a car greater carrying capability than the nonfishbelly. A load extending 18 feet or less between truck centers can equal 75 percent of the stenciled limit, as the sketch shows. If the load is longer than 18 feet, it can weigh 100 percent of the limit.

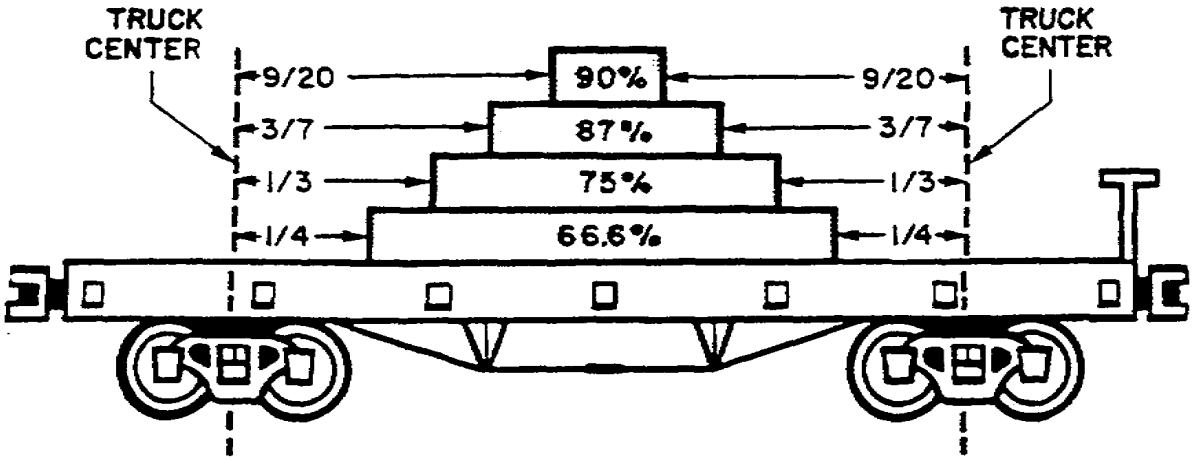


b. Nonfishbelly. Percentages for nonfishbelly cars are lower than for fishbelly. A lengthwise load 10 feet or less can equal only 66.6 percent of the stenciled load limit, while a load measuring between 10 and 24 feet can weigh 75 percent. Over 24 feet, and still located between truck centers, the load can equal 90 percent of the limit. A load extending beyond the truck centers can weigh 100 percent of the load limit.



1.15. RULE 4e--CENTER OF GRAVITY

Although not a separate rule, 4e is emphasized because of its significance to the shipper. Center of gravity (CG) figures importantly in loading a flatcar regardless of design. The problem is to balance the load on the car, lining up the load's center of gravity with the center of the car as closely as possible. Perhaps you can think of some military equipment that cannot be balanced in the center of a flatcar; for example, a crane with boom attached. To insure that loads are properly balanced on the car, the AAR has established rules for loading items that are not centered on the car but whose length is less than the distance between truck centers. The diagram on the next page shows the location of CG in relation to the ratio of load weight to load limit. For example, if your load weighs 75 percent of the stenciled load limit, its CG must not be placed closer to truck centers than one-third of the distance between truck centers. Again, if your shipment weighs 87 percent of the load limit, its center of gravity could be situated anywhere in the middle one-seventh of the deck between truck centers. Notice that as the load weight increases, the farther the load's center of gravity must be from the truck centers. Whereas the CG of a load weighing only 87 percent of the load limit may be placed anywhere in the center one-seventh of the deck between truck centers, the CG of a 90 percent load is limited to the middle one-tenth. Thus:

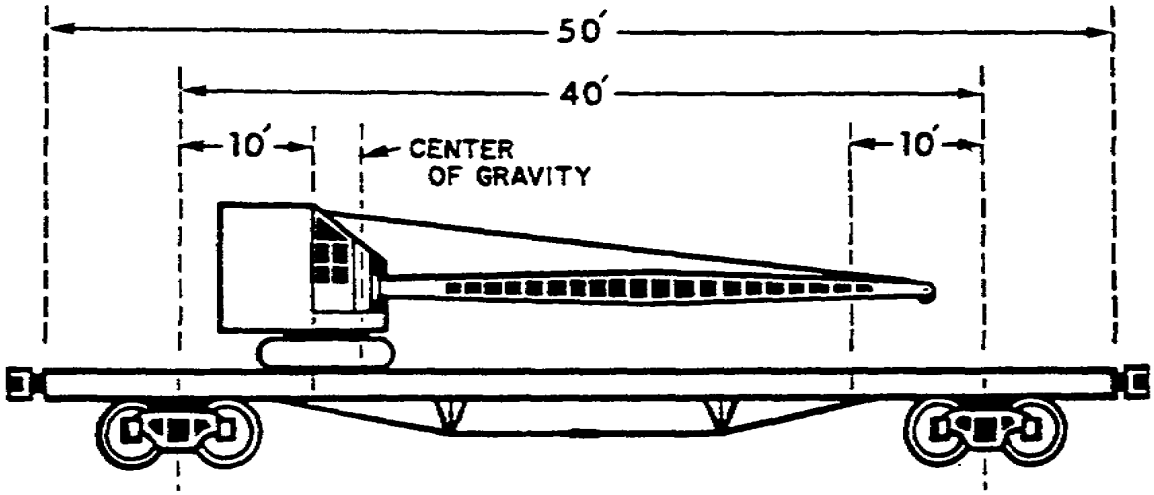


$$\frac{9}{20} + \frac{9}{20} = \frac{18}{20}$$

$$\frac{20}{20} - \frac{18}{20} = \frac{2}{20} \text{ or } \frac{1}{10}$$

Now look at the sketch below which illustrates how the crane with boom might be loaded. Assume that the crane weighs 75,924 pounds and that the 50-foot flatcar has a load limit of 114,000 pounds. Truck centers are 40 feet apart. Dividing the weight of the load by the load limit gives you the percentage of load limit. Thus:

75,924 + 114,000 = .666 or 66.6 percent.



As you know from the previous diagram, the CG of a 66.6 percent load must not be closer to either truck center than one-fourth of the distance between truck centers. In our example, one-fourth of 40 feet--the distance between truck centers--is 10 feet. Is the crane in

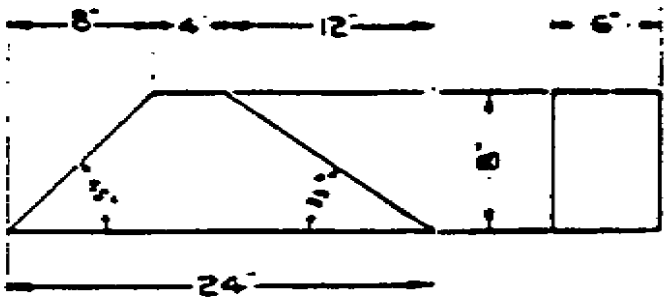
the sketch properly located? Yes, its CG is more than 10 feet from either truck center.

1.16. RULE 5--LOCATION OF LOAD, ALL CARS

The weight of the load on one truck must not exceed one-half of the stenciled load limit. When the weight is in doubt, it must be verified by weighing. In addition, the load must be so located that the weight along both sides of the car is about equal for the entire length of the load. When the load's shape or weight or both combined make it impossible to distribute its weight equally crosswise of the car, suitable ballast must be used to equalize the weight.

1.17. THE AAR RULES FOR DOD MATERIEL

As mentioned in paragraph 1.11, section 6 of the AAR's Rules Governing the Loading of Commodities on Open Top Cars specifies how military materiel will be loaded on open top cars. Section 6 consists of drawings illustrating how individual items are to be secured to the cars. Drawings cover particular equipment in several categories, such as artillery, boats, containers, and vehicles. Among the vehicles are 1/4-ton trucks, 1 1/2-ton trailers, and tanks and similar vehicles under 60,000 pounds. Also included in section 6 are material charts giving dimensions of various wooden and metal blocking patterns specified in the drawings. Pattern 16 is a wooden chock, shown in the sketch, that is commonly specified for wheeled vehicles. Figure 1.5 reproduces a page from section 6 showing AAR loading specifications for 1/4-ton trucks. Item A under Description refers to clearances in the sketch reproduced in paragraph 1.13a of this text. Items D through P appear on the next page of the rule book and are not included here. Notice references to patterns under description of the lettered items. Shippers of DOD materiel desiring new rules or specifications, or changes to those presently in effect, must submit such proposals to Headquarters, Military Traffic Management and Terminal Service, Washington, D. C. 20315, through appropriate channels, for handling with the Mechanical Division of the AAR.

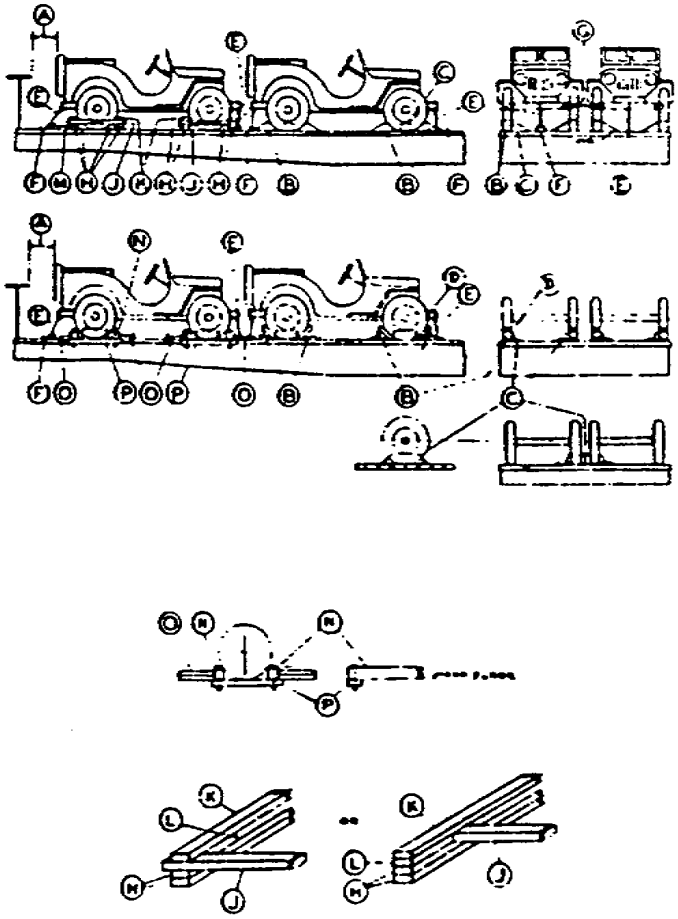


PATTERN 16

1.18. ARMY REQUIREMENTS

From the foregoing, you can see that the military works closely with the AAR. Nothing may be shipped over commercial rail

¼ TON, 4 X 4 TRUCKS, LENGTHWISE, SINGLE OR DOUBLE ROWS—FLAT CARS SINGLE ROWS—GONDOLA CARS WITH WOODEN FLOORS



Item	No. of Pcs.	Description
A		Brake wheel clearance. See Fig. 2, Sec. 1..
B	8 per unit.	Blocks, pattern 25. Locate 53 degree portion of block against front and rear of wheels. Secure heel of block to floor with three 40-D nails and toe-nail that portion under tire to floor with two 40-D nails. Substitute, if desired, at each location, blocks, pattern 24, or blocks, pattern 18. When units are loaded, side by side on flat cars, items "B" not required against inside of inside front and rear wheels.
		Items "B" not required when items "H", "J", "K" and "L" or "N", "O" and "P" are used.
C	1 ea. wheel.	Blocks, pattern 25. Locate 53 degree portion against inside of each wheel and secure heel of block to floor with three 40-D nails and toe-nail other end to floor with one 40-D nail. Substitute, if desired, at each location, blocks, pattern 20. Secure to floor with four 30-D nails at each location. If desired, each block, pattern 25, or pattern 20, located against wheels nearest side of car may be omitted, provided a double 2 in. x 4 in. x 24 in. block is used between inside wheels of side by side units to prevent contacting each other. Secure lower piece to floor with four 20-D nails and top piece to one below with four 30-D nails in each.
		Not required when items "E", "J", "K" and "L" are used.

Courtesy of Association of American Railroads.

Figure 1.5. Loading 1/4-Ton Trucks.

lines in this country unless the sender observes published AAR rules or, lacking these, has special permission from the AAR to ship an unusual load. Another important point is this--AAR rules give minimum acceptable standards for shipping by rail. Standards may be exceeded, however, as the shipper may prefer. For example, 5/8-inch cable may be substituted for wire strands because it is at least as strong as the wire called for in the rules. Army requirements, then, may be depended upon to meet at least the minimum standards set by the AAR. Army requirements for rail shipment do not appear in a single handbook. Instead, particular aspects of the subject are covered in separate publications such as field manuals (FM), technical manuals (TM), technical bulletins (TB), and loading drawings for special equipment. In the subparagraphs that follow, you find what to expect from the more commonly used Army publications on the loading of rail cars.

a. Field manuals. Among the field manuals treating the subject of loading rail cars, FM 101-10 (Part 1), Staff Officers' Field Manual, Organization, Technical, and Logistical Data, is useful in planning rail movements. Tables give characteristics of some U. S. and foreign rolling stock (unpowered rail cars), data on moving divisions by rail showing how many of what kinds of cars are needed, and vehicle loading tables. Field Manual 55-15, Transportation Reference Data, also contains a great deal of rail loading information in tabular form that is useful for planning.

b. Technical manuals. The TM of almost-every item of equipment in general Army use today contains specific car loading and blocking instructions. In the last chapter of TM 9-2320-211-20 on the 5-ton truck, for example, you would find instructions for shipping the vehicle. Figure 1.6 reproduces the drawing found in the TM to illustrate the prescribed method of blocking the 5-ton truck. Note the chocks against the wheels.

Other TM's contain information only on the transportability of a particular piece of equipment. One of these is TM 55-2330-207-20-1, Transportability Guidance, Semitrailer, Stake, 12-ton, 4-wheel, M127A1C and M127A2C. Included in it is significant transportability and safety guidance in the movement of the semitrailer by various modes of transport as well as side- and end-elevation drawings, characteristics of the item, and precautions to be observed. For shipment of the semitrailer by rail, a blocking and restraining diagram, a bill of materials, a blocking detail diagram, and a wheel tiedown diagram are also included.

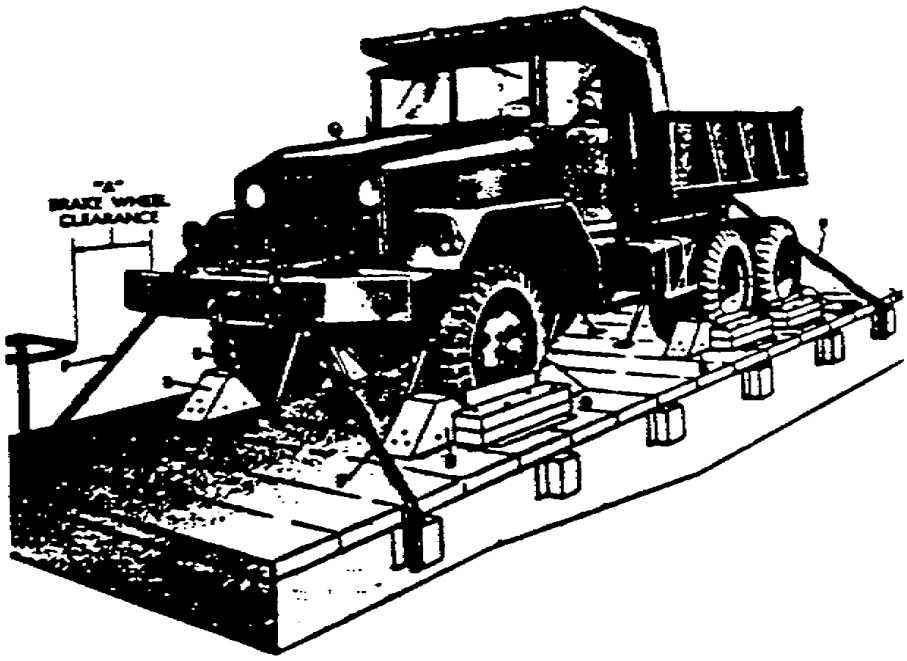


Figure 1.6. Blocking the 5-Ton Truck on Flatcar.

Technical Manual 55-601, Railcar Loading Procedures, is especially valuable to the transportation officer. The guide contains an appendix on loading rules that includes patterns, diagrams for securing some common and some not-so-common vehicles on rail cars, detailed descriptions of the tiedown materials needed for each vehicle covered, and photographs to illustrate certain methods. Figure 6-8 and the instructions accompanying it from TM 55-601 are reproduced in figure 1.7, which shows how 1/4-ton trailers may be secured on a flatcar.

c. Technical bulletins. Among the technical bulletins the Army publishes in the 55 series is one of particular interest to the transportation officer shipping equipment by rail: Technical Bulletin 55-46-1, Standard Characteristics (Dimensions, Weight, and Cube) for Transportability of Military Vehicles and Other Outsize/Overweight Equipment. Figure 1.8 gives the shipping data found in the TB for the 1 1/2-ton cargo trailer M105A2, M105, and M105A1. Notice that the entries show the TOE line item numbers (LIN) and the Federal stock numbers in addition to the pertinent dimensions for the vehicles and their cargo compartments. Under SHIPPING CONFIGURATION for these particular items is the notation OPERATIONAL. This means that the vehicles are moved in tactical condition with all component assemblies in place. RED-AR 220-10 means reduced to minimum shipping dimensions by securing antennae, removing canvas

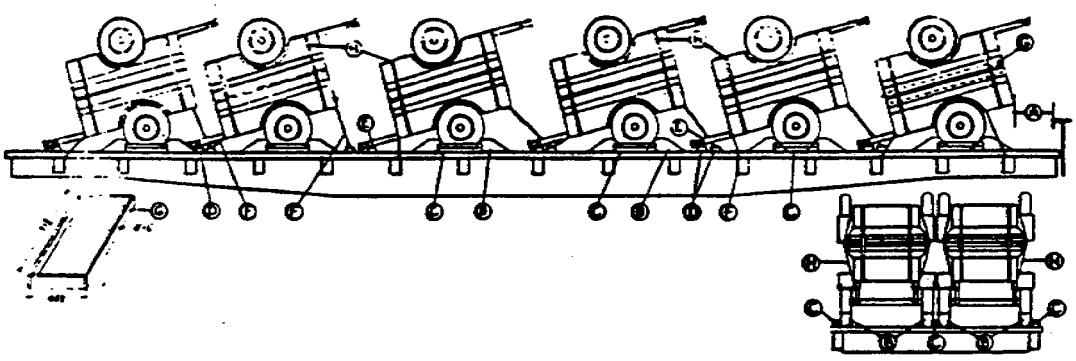


Figure 6-8. Securing 1/4-ton trailers, lengthwise, side by side, double-decked, flatcars.

10. Instructions, Figure 6-8

Item	No. of pieces	Description
A		Brake wheel clearance. See figure 26.
B	4 each bottom unit.	Blocks, pattern 16. Locate 45° portion of block against front and rear of wheels. Secure heel of block to floor with three 40d nails and toe-nail that portion under tire with two 40d nails.
C	As required	Each to consist of two pieces of 2-in. x 4-in. x 24-in. Locate one against tires of outside wheels of units and one between tires of wheels on side by side units. Secure lower piece to floor with four 30d nails and top piece to one below in like manner.
D	As required	2-in. x 4-in. x 24-in. Locate one under tongue and one between units, as shown. Secure each to floor with five 30d nails.
E	2 each bottom unit.	Each to consist of four strands No. 8-gage black-annealed wire. Attach to tongue of unit on each side, as shown, and around item D.
F	4 each bottom unit.	Each to consist of four strands No. 8-gage black-annealed wire. Attach to each corner of unit and through stakepockets, or underneath item D.
G	As required	Frame, built up of two lengthwise and two crosswise 2-in. x 6-in., length and width to fully equal inside dimensions of body of unit. Locate inside of truck bodies between each top and bottom unit.
H	As required	1½-in. x .035-in. high-tension bands. Locate two crosswise and one lengthwise, or one crosswise and two lengthwise, around bodies of each top and bottom unit.

Item G must be of sufficient height to extend at least 2 inches inside truck body of top unit. Suitable cushioning material must be used between item C and tires to prevent chafing. See General Rules for further details.

Figure 1.7. Securing 1/4-Ton Trailers on Flatcar.

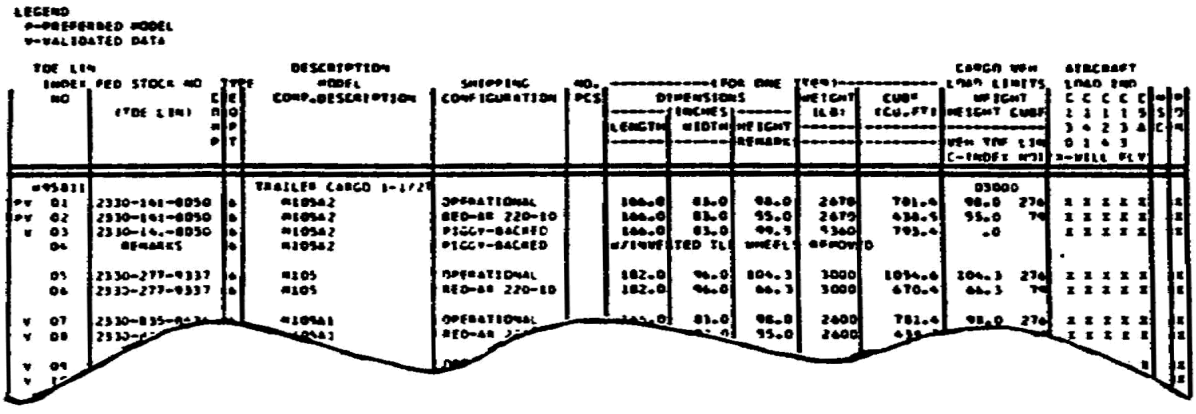


Figure 1.8. Shipping Data for 1 1/2-Ton Cargo Trailers.

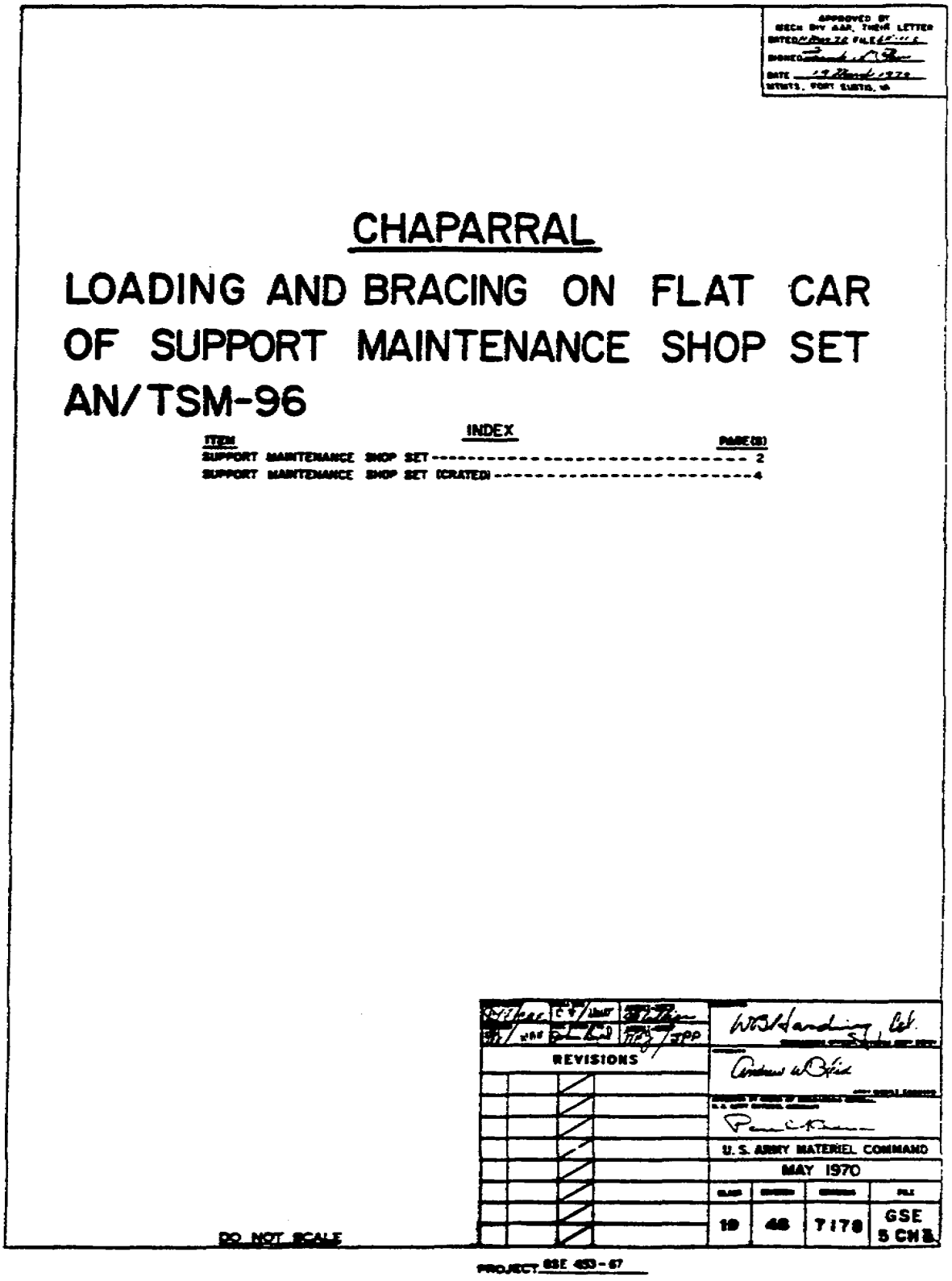
tops, folding windshields, etc; these reductions are made in accordance with AR 220-10. The designation PIGGY-BACKED applies only to data for cargo trailers; one trailer with wheels removed is inverted and placed on top of the bottom trailer; they are then securely lashed together. When reporting the INDEX NO. for this data listing, it must be recognized that the data include the dimensions and weight of two trailers.

d. Loading drawings. In paragraph 1.17, you read that proposed rules or specifications for shipping DOD materiel must be submitted to Headquarters, Military Traffic Management and Terminal Service (MTMATS) where they are taken up with the AAR's Mechanical Division. Among the many new items developed for the Army for which shipping specifications must be established are missiles and their supporting equipment. The XM48 Chaparral full-tracked, self-propelled missile is an example. Responsibility for specifying how this equipment shall be loaded and braced rests with the U. S. Army Materiel Command whose Savanna Army Depot prepares the appropriate drawings. You see their loading and bracing diagrams for the Chaparral's support maintenance shop set in figure 1.9. Notice that note "E" in figure 1.9 (3) refers you to the AAR manual for applicable loading rules. Also, note the box in the upper right corner of figure 1.9 (1) showing approval by the Mechanical Division of the AAR and the signature of an authorized official at MTMTS.

1.19. SUMMARY

In this country, where railroads are privately owned, the Association of American Railroads is the final authority on how shipments are to be loaded on rail cars. The Army follows AAR rules and, when necessary, requests changes or additions to them. New specifications are often needed to accommodate new equipment. So important is observance of loading rules that the Army makes it a command responsibility, with the shipper himself directly responsible for the actual loading. Proper car loading procedures are designed to prevent damage, avoid delays, and safeguard property and employees.

Sections 1 and 6 of the AAR's Rules Governing the Loading of Commodities on Open Top Cars are of particular importance to the military shipper. Section 1 has general rules and section 6 has rules for loading specific military equipment. The general rules essentially limit dimensions and weight of the load and specify how the load will be positioned on a car. Section 6 contains drawings showing how individual military items are loaded and listing how much of what materials are needed to load them.



CHAPARRAL

LOADING AND BRACING ON FLAT CAR OF SUPPORT MAINTENANCE SHOP SET AN/TSM-96

INDEX

REVISIONS

U. S. ARMY MATERIEL COMMAND

MAY 1970

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Figure 1.9. (1) Loading Support Maintenance Shop Set, Chaparral, XM48, Full-Tracked, Self-Propelled Missile.

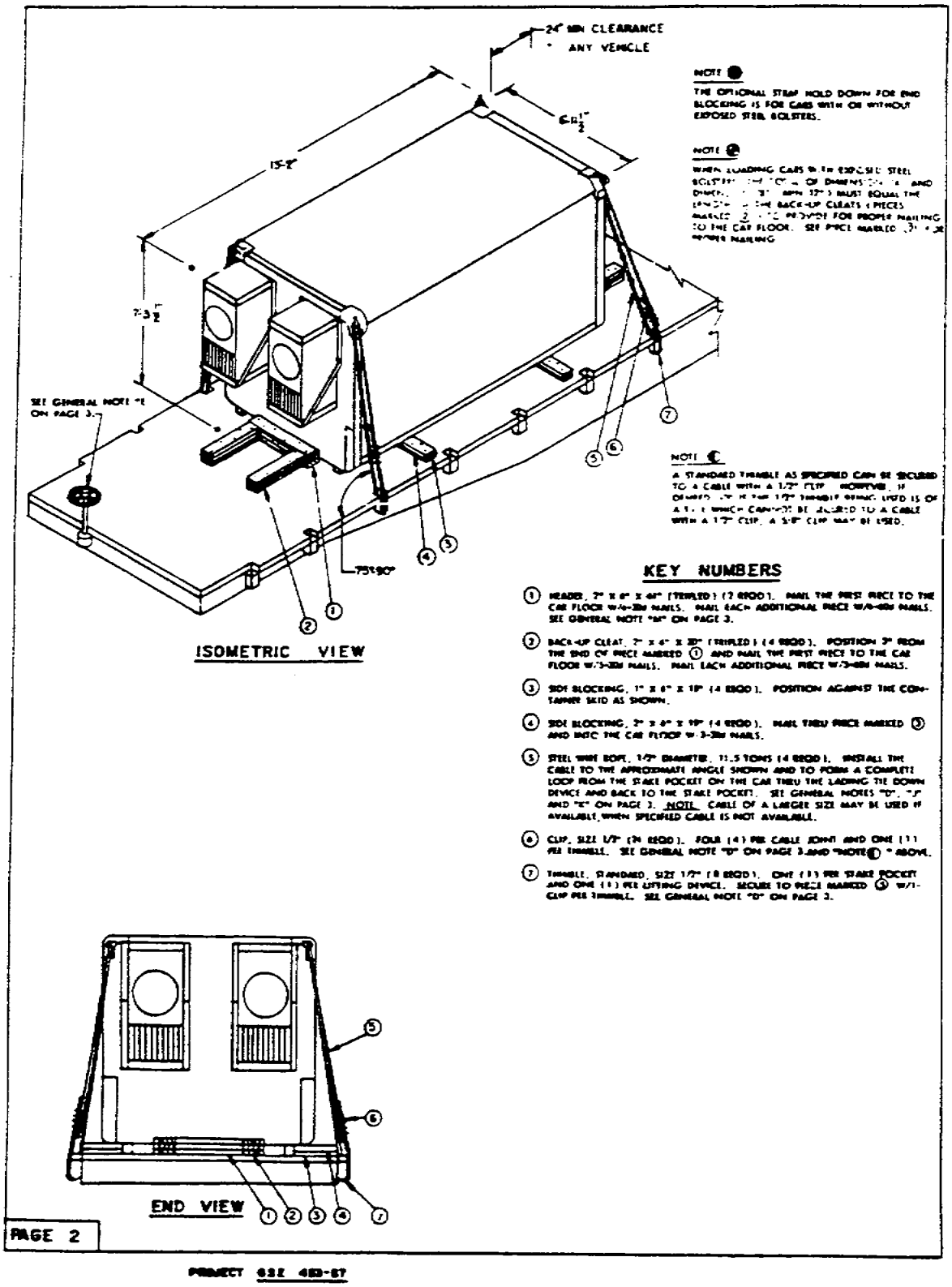


Figure 1.9. (2) Loading Support Maintenance Shop Set, Chaparral, XM48, Full-Tracked, Self-Propelled Missile.

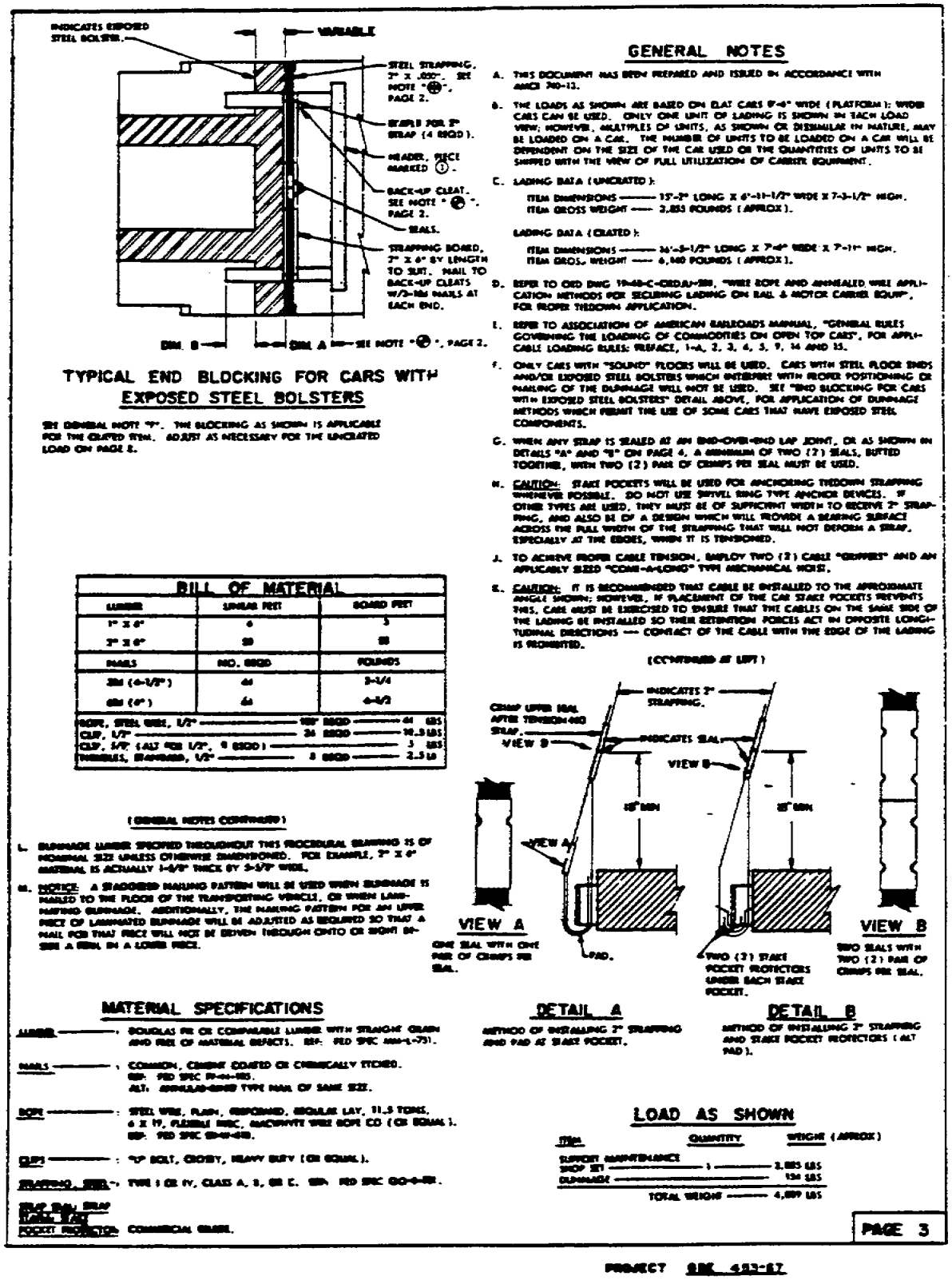


Figure 1.9. (3) Loading Support Maintenance Shop Set, Chaparral, XM48, Full-Tracked, Self-Propelled Missile.

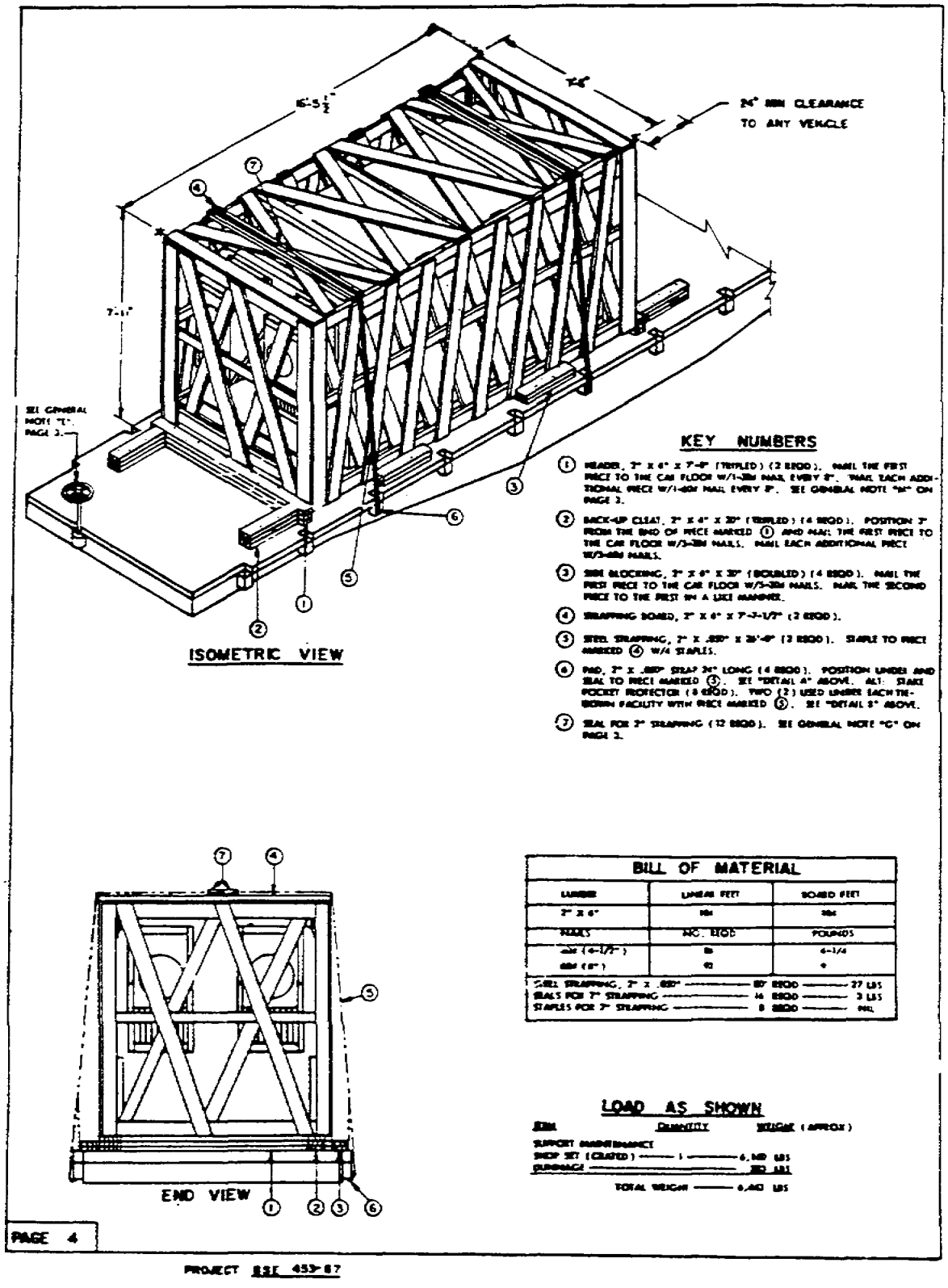
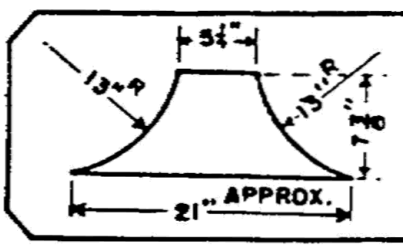


Figure 1.9. (4) Loading Support Maintenance Shop Set, Chaparral, XM48, Full-Tracked, Self-Propelled Missile.

Various Army publications based upon AAR rules guide the shipper. Field Manuals 55-15 and 101-10 contain planning data: loading tables, specifications of rail cars, etc. Technical manuals pertaining to individual equipment and others devoted only to transportability guidance show how equipment is to be loaded. One technical bulletin, TB 55-46-1, gives valuable transportability information on specific items. And loading drawings approved by the AAR are published for such special items as missiles.

Now that you have been introduced to the more important loading rules, chapter 2 gives you the principles and procedures used to carry out these rules.



Chapter 2

PRINCIPLES AND PROCEDURES

2.1. INTRODUCTION

Military equipment is constantly moving by rail--some headed for maneuvers; some on its way overseas; and some traveling to new posts, depots, or maintenance facilities. And somebody had to load it. Because you may be that somebody someday, you should find it profitable to learn exactly how such equipment is loaded: what size nails are used, where cable is attached, and so on. Chapter 1 discusses the fundamentals of rail shipments: the physical equipment and the rules for using it. Now chapter 2 shows how that equipment is put to use, observing those rules, in the shipment of some typical Army items. Whereas chapter 1 illustrates the loading of a 5-ton truck to show what could be found in a particular publication, chapter 2 takes a closer look at the loading process and the blocking and bracing materials themselves. Section I takes up principles and procedures; section II applies those principles aid procedures to specific loading problems.

Section I. Loading, Blocking, and Bracing of Military Equipment

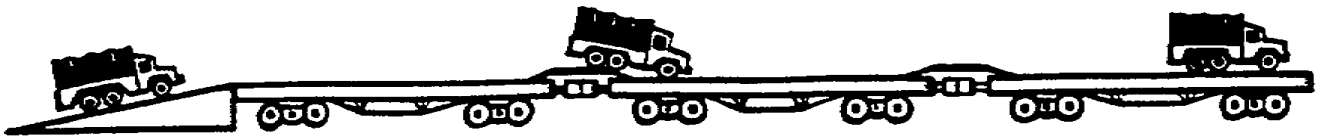
2.2. GENERAL

As valuable as "learning by doing" may be under some circumstances, in loading military equipment it can be both time consuming and dangerous. For this reason, the Army spells out precisely how a particular item will be loaded, blocked, and braced on rail cars. This section discusses ramps and spanners used in getting vehicles onto the car, techniques employed in loading, and materials used in blocking and bracing selected items.

2.3. RAMPS AND SPANNERS

Have you ever wondered how trucks get from the ground onto flatcars? Although several means can be used, the customary method is to drive vehicles up a ramp to the desired position on the car. When several vehicles are being loaded onto more than one car, spanners are used to bridge the distance between the cars, making one continuous roadbed of the train. In this way, each vehicle is

driven up the ramp onto the rear car and moved forward across spanners to the car on which it is to be shipped. This so-called circus method, pictured in the sketch, is the quickest and most common way of loading



vehicles. What, exactly, are ramps and spanners? Subparagraphs a and b explain both of these loading aids.

a. A ramp must be constructed or improvised if none is on hand, and a stretch of the roadbed leveled so that equipment can be maneuvered onto the ramp. The roadbed can be raised to the top of the rails by using 6- by 8-inch timbers or dirt and cinders. Although construction of the ramp will vary with the required capacity, figure 2.1 shows a ramp that will support most vehicles.

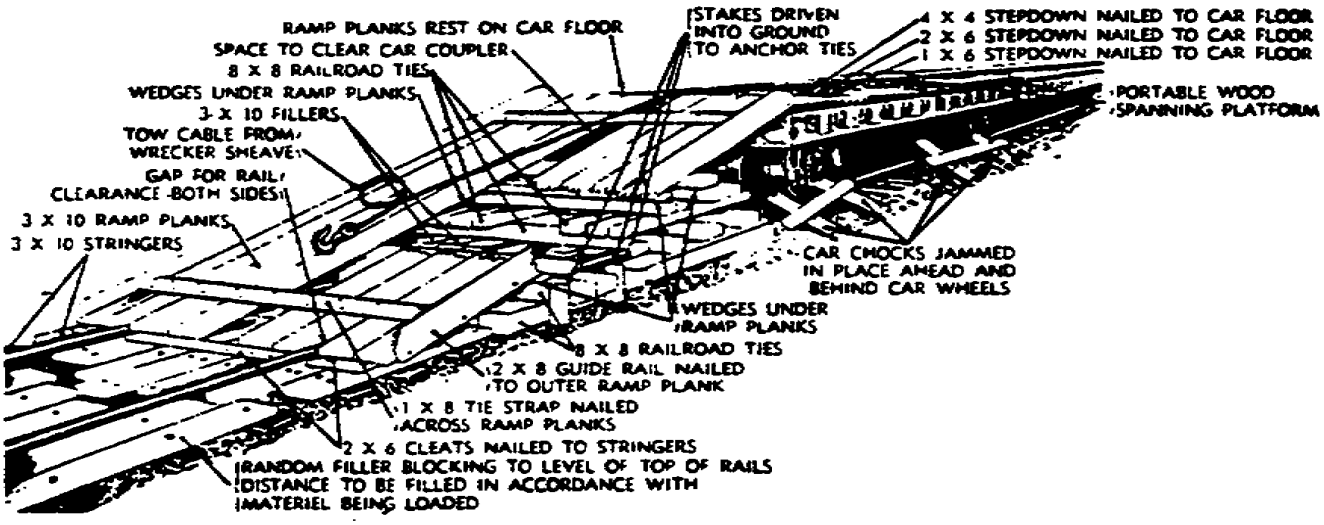


Figure 2.1. Vehicle Loading Ramp.

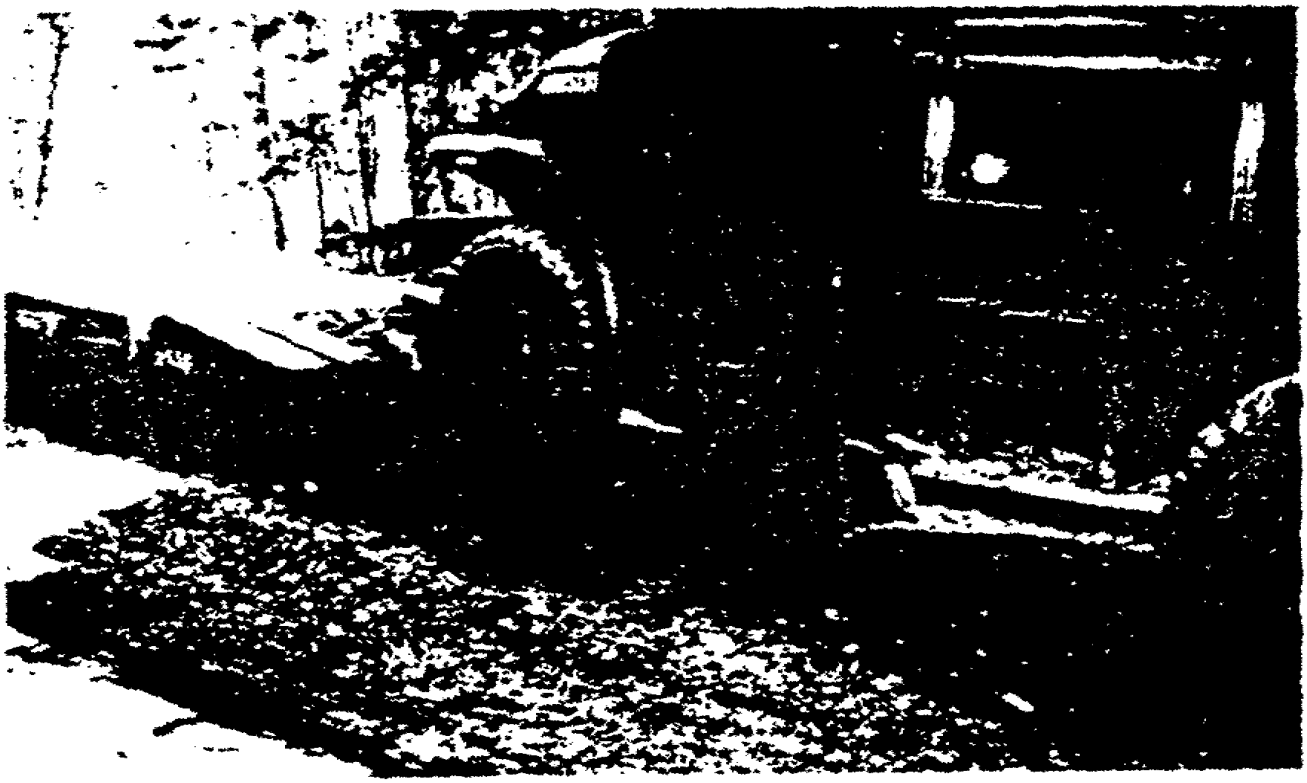
As a field expedient, a ramp may be improvised by using the last flatcar itself as a ramp. Without going into the details of how this is done, essentially what happens is that the end truck is temporarily detached from the flatcar body and the body lowered onto a supporting wooden block. With one end of the flatcar deck close to the ground, only a few timbers are needed to form a runway, as shown in the two views in figure 2.2. Ramps should be carried with the shipment if no unloading facilities will be on hand at the destination. When the ramps are shipped, their weight must be figured as part of the weight of the load.

A. END VIEW.

b. Spanners are used to bridge the space between flatcars so that vehicles can be driven forward to their designated blocking positions. Spanners are simple to fabricate and are built to take the heaviest vehicle being loaded. Figure 2.3 shows spanners of different capacities and a pair of spanners placed between cars.

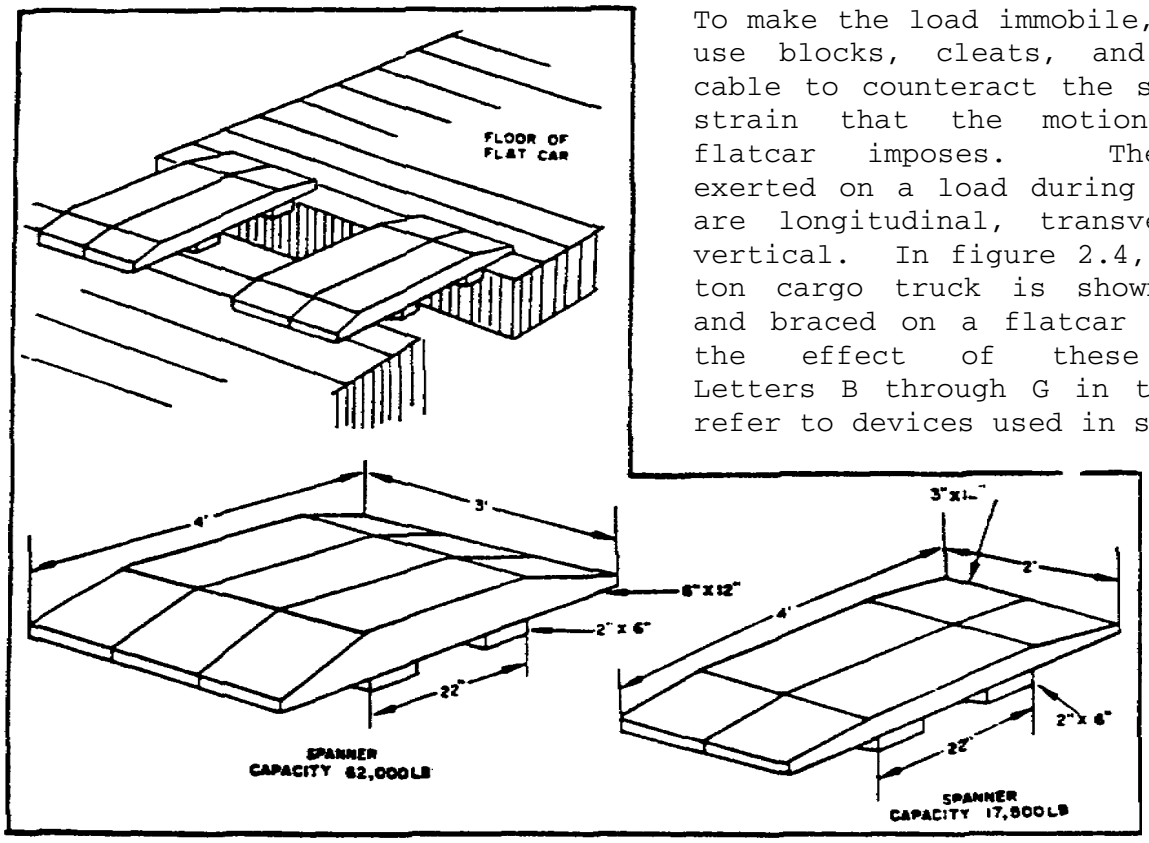
2.4. BLOCKING AND BRACING

The main objective of blocking and bracing an item is to insure that it will be immobile during transit and arrive at its destination in good condition.



B. SIDE VIEW.

Figure 2.2. Improvised Ramp.



To make the load immobile, you must use blocks, cleats, and wire or cable to counteract the stress and strain that the motion of the flatcar imposes. The forces exerted on a load during transport are longitudinal, transverse, and vertical. In figure 2.4, a 2 1/2-ton cargo truck is shown blocked and braced on a flatcar to lessen the effect of these forces. Letters B through G in the figure refer to devices used in securing

Figure 2.3. Spanners.

the truck and are discussed in connection with longitudinal, transverse, or vertical forces in the subparagraphs that follow. The letter A refers to brake wheel clearance which, as you know, must be at least 12 inches between the end of the car and the load.

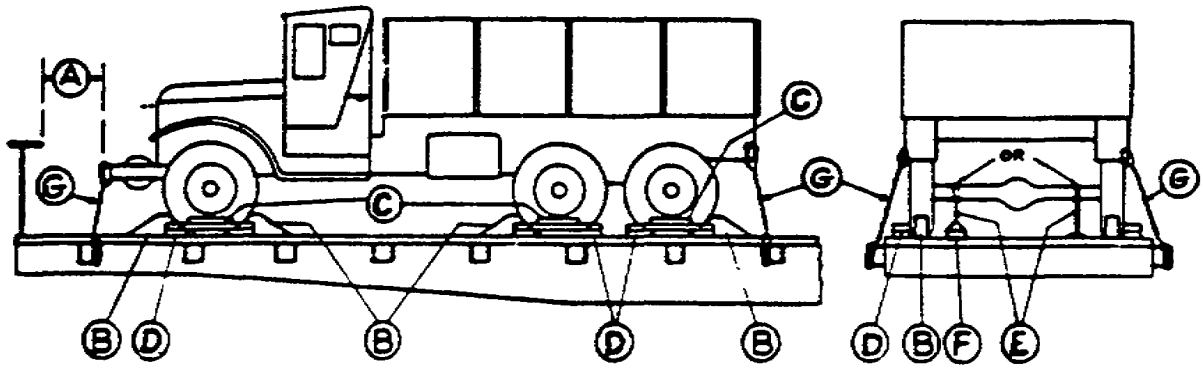
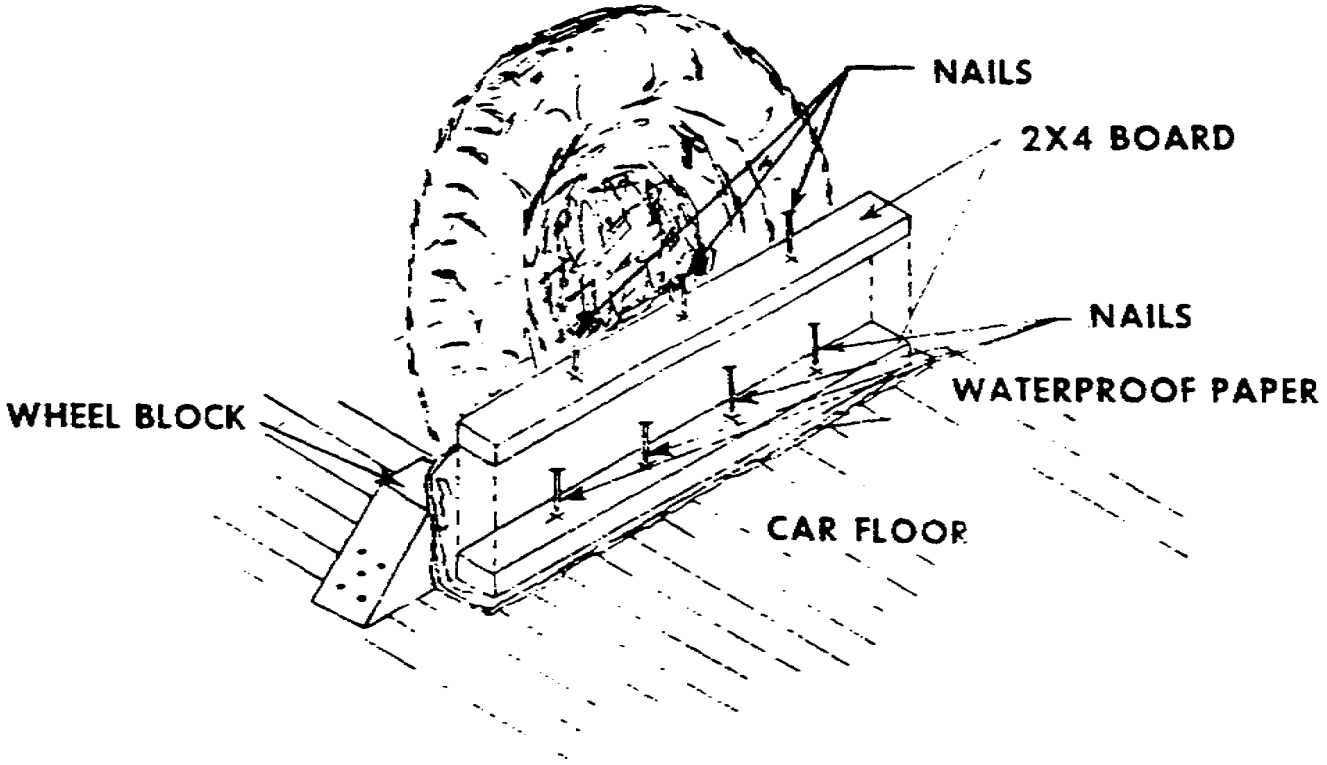


Figure 2.4. Blocked and Braced 2 1/2-Ton Truck.

a. Longitudinal force. When a flatcar comes to a sudden stop, the load--in this example, the 2 1/2-ton cargo truck--tends to

keep moving in the same direction and at the same speed. This is called longitudinal force. This force is also exerted on the load when the flatcar lurches as it starts moving. To counteract this force, the load must be restrained from moving lengthwise on the car. Blocks (item B) are placed against the wheels as shown in figure 2.4. This block is the same one shown in paragraph 1.17 and is designated pattern 16 in the AAR rule book. The 45-degree angle is inserted against the front and rear of front wheels, in front of intermediate wheels, and in back of rear wheels. The heel of the block is nailed to the car floor with three fortypenny (40d) 5-inch nails in a triangular pattern and the sides of the block are nailed down with two fortypenny nails, one on either side.

b. Transverse force. When a train is going around a curve, centrifugal, or transverse, force will push the load off the side of the flatcar unless the load is restrained. Cleats, shown as item D in figure 2.4, are used to counteract this transverse force. A cleat is simply two 2- by 4- by 36-inch boards nailed, one on top of the other, along the outer face of each wheel, as shown in the inset. Secured with 4 1/2-inch



thirtypenny nails, the bottom cleat is nailed to the car floor and the top one to the bottom one. Unless otherwise specified, nails must be driven into the deck at right angles to the board, for maximum holding power. Note the waterproof paper in the sketch above and at item C in figure 2.4. Either waterproof paper or burlap

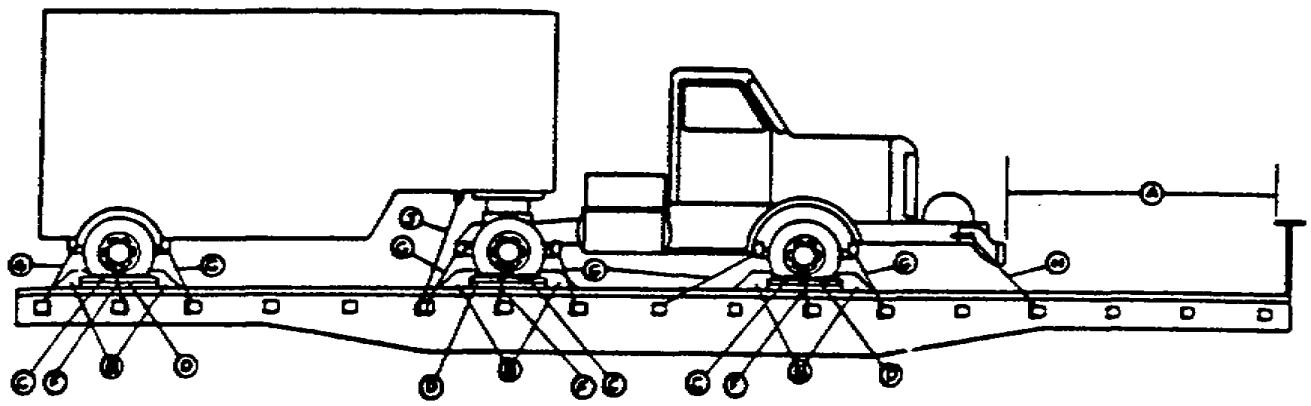
is placed between the wheel and the cleat to prevent chafing the tire. The material is put under the bottom cleat and extended 2 inches above the top one.

c. Vertical force. A load is subject to vertical force, or bouncing, to a degree depending upon the roughness of the roadbed. To keep this bouncing motion to a minimum, wire is used to tie the truck down to the side stake pockets. To do so, four strands of No. 8-gage black annealed wire, or wire of equivalent strength, are twisted into cables (two cables per wheel), then run through holes in the vehicle wheel, and finally secured to the stake pockets. Note item G in figure 2.4.

Other tiedowns are also used to hold down the bouncing motion; note item E in figure 2.4. They may be located over the axle, spring, or spring shackles. The tiedowns consist of 1-inch 14-gage black annealed wire and pattern 19 anchor plates secured to the floor with eight twentypenny cement-coated nails.

2.5. TRUCK TRACTOR-SEMITRAILER

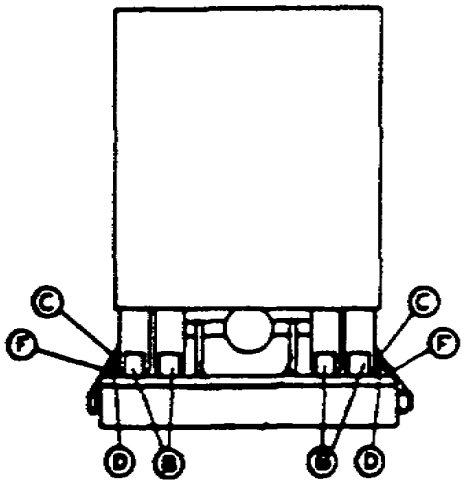
Blocking and bracing a lightweight semitrailer with its truck tractor on a flatcar is not as complicated as you might expect. In fact, you are already familiar with most of the requirements. To prove this to yourself, look over the sketch inserted here and try to identify the lettered items.



The space labeled A, of course, refers to brake wheel clearance. Here the distance exceeds the normal requirement of 12 inches between brake wheel and load. Since the truck tractor-semitrailer is the total payload on this car, centering the vehicle's heaviest point in the middle of the car necessarily moved the truck farther back. The items labeled B, although you can't be sure from the sketch, are pattern 16 blocks. Other patterns are required for blocking other kinds of vehicles. The waterproof paper is labeled C; this is applied after blocks are in place and before

cleats are nailed down. Cleats, 2 by 4 by 36 inches, are at D. Label E has been purposely omitted from both drawings in this paragraph.

For a moment, study this end view of the semitrailer. At each point marked F are four strands of the same No. 8-gage black annealed wire you see in use in previous sketches, but notice that it is attached to the wheel. The twisted strands are actually passed around spokes or through holes in a disc wheel and also through stake pockets. Only the outside wheels are braced in this way. To prevent the wire from chafing the tire where the two come in contact and to prevent the wire from becoming chafed where it touches the stake pocket, put some cushioning material at those points. Waterproof paper, a piece of old inner tube, or rags can be used.



Now back to the first sketch in this paragraph--the side view. The braces labeled G, H, and J are used to lessen vertical movement. Each brace consists of eight strands of No. 8-gage wire. Brace G is attached to front and rear spring shackles and to stake pockets, each pair of wheels getting four strands. Brace H is attached to the pulling hook on each side of the frame near the front of the truck tractor and to stake pockets. Brace J--there is no I because it might be mistaken for the numeral 1--is attached to a 1/2-inch bar specially made for bracing the semitrailer. Wire is passed through a hole at each end of the bar and then attached to the stake pockets.

2.6. OUTSIZE EQUIPMENT

Some military equipment may be wider or longer than the flatcar it must travel on. Provided that the items when loaded on the cars do not exceed limits already discussed, decks can be widened and additional cars used to take care of the overhang. One other restriction: vehicles must not be so wide that more than one-half the surface of tires or tracks extends beyond the side sill.

a. Widening car floor. To provide a bearing surface for wheels or tracks, the flatcar floor can be widened by attaching a plank over the stake pockets nearest the overhang. The plank must be long enough to extend beyond the chocks and thick enough to be

level with the floor. Cleats are used to secure the plank, as can be seen in figure 2.5.

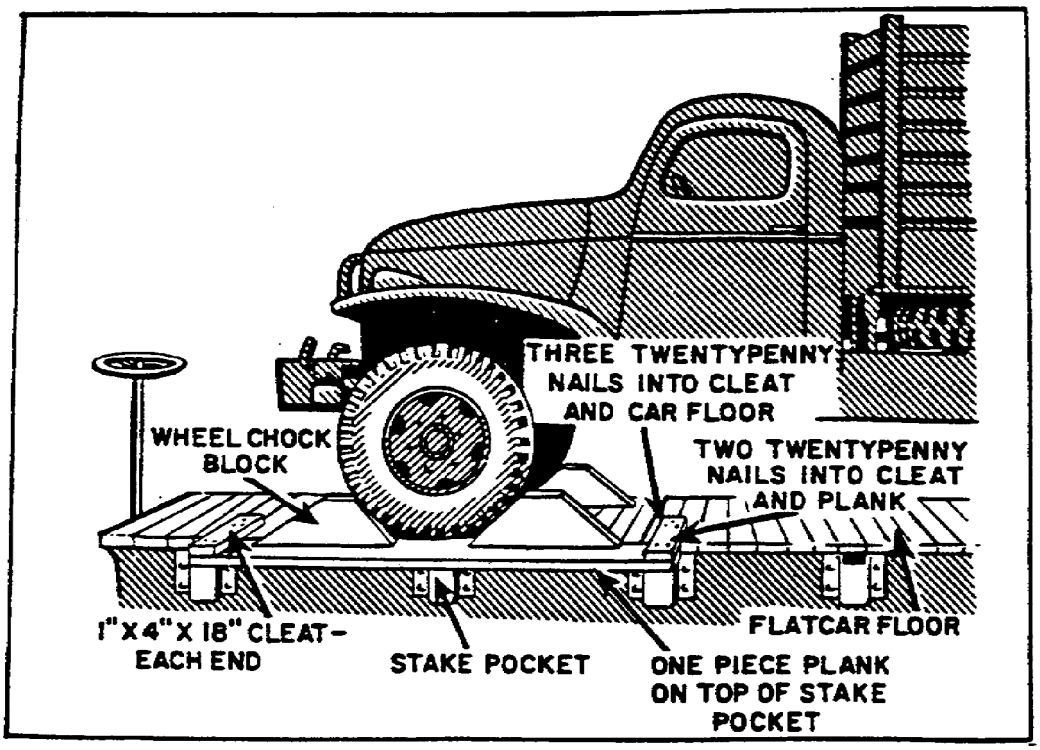


Figure 2.5. Widening Flatcar Floor.

b. Using idler car. Some items are so long that they extend beyond one flatcar, requiring an additional or "idler" car to protect the overhang. The extra car is called an idler only if it carries none of the weight, as when a boom extends behind a crane whose entire weight, including boom, is borne by the car preceding or following the idler. Take a look at figure 2.6.

Rules 8 and 16 of AAR cover the use of idler cars, giving permissible lengths of overhang by length of flatcar, width limits for various lengths of overhang, etc. As the length of overhang increases, the allowable width decreases. Compare the two examples tabulated here.

Length of Load	Length of Flatcar	Length of Overhang	Width of Allowable Overhang
50 ft	46 ft	11 ft	8 ft 8 in.
60 ft	46 ft	21 ft	7 ft

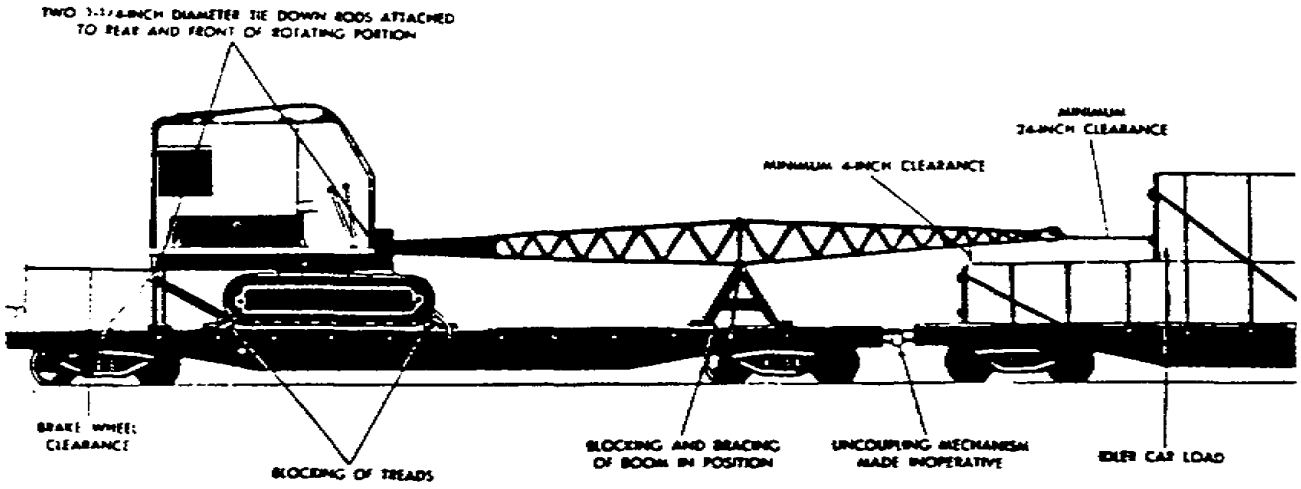


Figure 2.6. Use of Idler Car.

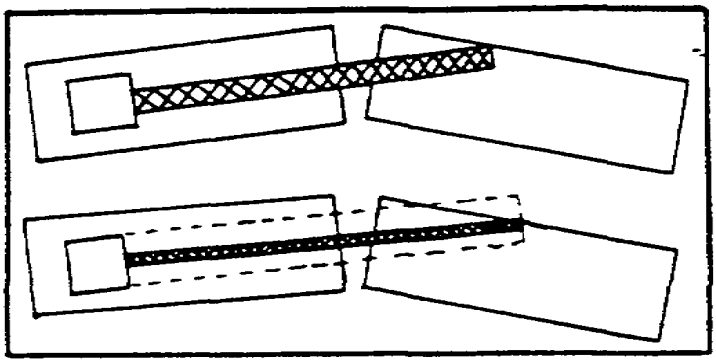
The reason for the decreased width is that when a train goes around a curve, the overhang turns with the car carrying the weight instead of remaining centered above the idler car. The free end of the load swings toward the outside of the curve. If the overhang is so wide that it sticks out over the side of the idler during a turn, it might strike something and cause an accident.

The inserted sketches illustrate what happens; you can see why the width of overhang must be decreased when the length is increased. Also, you can see why the load must not be fastened to the idler car; it must be free to move when the train is going around a curve.

Certain clearances must be observed when using idler cars. The overhanging portion of a load must be at least 4 inches above any part of the idler car or its load. Also space on idler cars may be used to load other materials provided that they are at least 24 inches from the end of the overhanging load. Clearances are illustrated in figure 2.6. The uncoupling mechanism between the load-bearing car and the idler car must be made inoperative though still connected.

2.7. SUMMARY

Army procedures for loading, blocking, and bracing equipment leave nothing to guesswork. Following the basic AAR rules, military vehicles and other equipment are secured on rail cars in



prescribed ways using required materials. Vehicles are normally driven aboard flatcars over ramps on hand at the site either already constructed or fabricated on the spot using field expedient methods and materials. When several vehicles must be loaded on more than one car, the circus method is used. Vehicles are driven forward from one flatcar to another over spanners, or bridges, until the first car in the train and then successive cars are occupied. The position of each vehicle will have been determined in advance.

Items must be blocked and braced on rail cars to keep them from moving in transit and being damaged or from damaging other items. Several forces act upon the unsecured load from the motion of the flatcar. Longitudinal force moves it lengthwise, transverse or centrifugal force pushes it sideways as the car rounds a curve, and vertical force bounces it up and down. Chocks nailed at the front and back of wheels keep trucks, trailers, etc., from moving lengthwise on the flatcar. Cleats, or boards, nailed along the outside of outer wheels prevent centrifugal force from flinging vehicles off the car on curves. And wire connecting the vehicle wheels and the stake pockets cuts down on some of the bouncing.

Although different bracing techniques take care of design differences between vehicles, all wheeled vehicles are blocked and braced in essentially similar ways. All use chocks of one pattern or another to keep vehicles immobile; and all use wire or cable, in varying combinations, to help vehicle bodies resist longitudinal, transverse, and vertical forces.

Equipment too long or too wide to fit on a flatcar may be carried if special provisions are made. If truck wheels or tank treads extend over the edge of the side sill, the car floor can be extended by nailing a plank over the stake pockets for the wheel or tread to rest on. And an idler car can be used ahead of or behind the car that actually carries the equipment so that the extended portion, such as a boom, may be protected in transit. Rules issued by the AAR specify how long and how wide the protruding part may be to make use of an idler car.

Section II applies the loading, blocking, and bracing principles set forth in section I to various examples of military shipments.

Section II. Applying Principles

2.8. GENERAL

In this section, you are a transportation officer faced with shipping a given number of specific kinds of vehicles by rail. It is up to you to select the rail cars for the shipment. The selection made, you must then determine the blocking and bracing materials it will take to secure your vehicles properly on those rail cars. Throughout this simulated situation, rules, references, and techniques covered in previous sections of the text are brought into play so that you can see almost at firsthand the precise requirements for shipping military equipment by rail.

2.9. SPECIAL SITUATION

Fort Charles is to furnish several vehicles for the forthcoming maneuvers in North Carolina. Sixteen vehicles are to be shipped by rail:

8 trucks, utility, 1/4-ton, M151
5 trucks, cargo, 2 1/2-ton, 6x6, M135
3 carriers, personnel, full tracked, M113

Vehicles will be placed in service immediately upon arrival at the destination so that they will have to be shipped in their operational configurations. No lifting devices are on hand at the unloading site in the maneuver area.

Imagine yourself the Transportation Officer of Fort Charles with responsibility for shipping the required trucks and carriers to North Carolina. You have at your disposal the following rail equipment:

Quantity	Type	Ld lmt, lb	Distance between truck centers
14	40-ton flatcar, nonfishbelly	92,000	30 ft 4 1/2 in. (364 1/2 in.)
3	50-ton flatcar, nonfishbelly	118,600	32 ft 9 in. (393 in.)
3	50-ton gondola	126,700	30 ft 4 1/2 in. (364 1/2 in.)

2.10. FIRST REQUIREMENT

Your first problem is to select from the rail equipment on hand the ones that can carry your vehicles. To make a proper choice, you must know the characteristics of the trucks and the personnel carrier as well as of the rail cars themselves. Ordinarily you might consult FM 55-15 or TB 55-46 to find the length, width, height, weight, capacity, etc., of this equipment. In the absence of these and other references, and for this exercise, equipment characteristics are included in appendix II to the text.

Gondolas can be eliminated at once because, as you will recall, there is no lift capability at the destination and hence no means of lifting vehicles out of those high-sided rail cars. Your choice of cars is now limited to the 40- and 50-ton flatcars, totaling 17 cars. Also in appendix II you will find all essential equipment characteristics. On the equipment outlines, truck centers are shown by broken lines. You will need to know where the centers are because placing the load on the car is affected by the distance between truck centers, as you read in paragraph 1.14. Now you are ready to do some simple figuring to come up with the answer as to how many of which vehicles can be loaded on how many of what size flatcars.

Will height or width be a problem? The tallest of the vehicles, the 2 1/2-ton truck, is 116.3 inches, or 9 feet 7 1/2 inches. The table in paragraph 1.6 tells you that any load up to 10 feet 1 inch high can be as wide as 10 feet. And since the personnel carrier, the widest of the three vehicles, measures 105.6 inches, or slightly under 9 feet, you know that height and width are within specified limits, and under the 108-inch width of both flatcars. This leaves only length and weight. To help you determine how many of the same type of vehicle will fit lengthwise on the two flatcars, make a simple table, like the one shown here. As you study the tables and discussions

LENGTH OF VEHICLES, INCHES

Vehicles	Number of vehicles		
	1	2	3
1/4-ton truck	131.8	263.6	(395.4)
2 1/2-ton truck	(266.8)	533.6	800.4
Personnel carrier	191.5	(383)	574.5

to follow, note that certain numbers have been circled, to show that each represents a group of vehicles that could fit on a car.

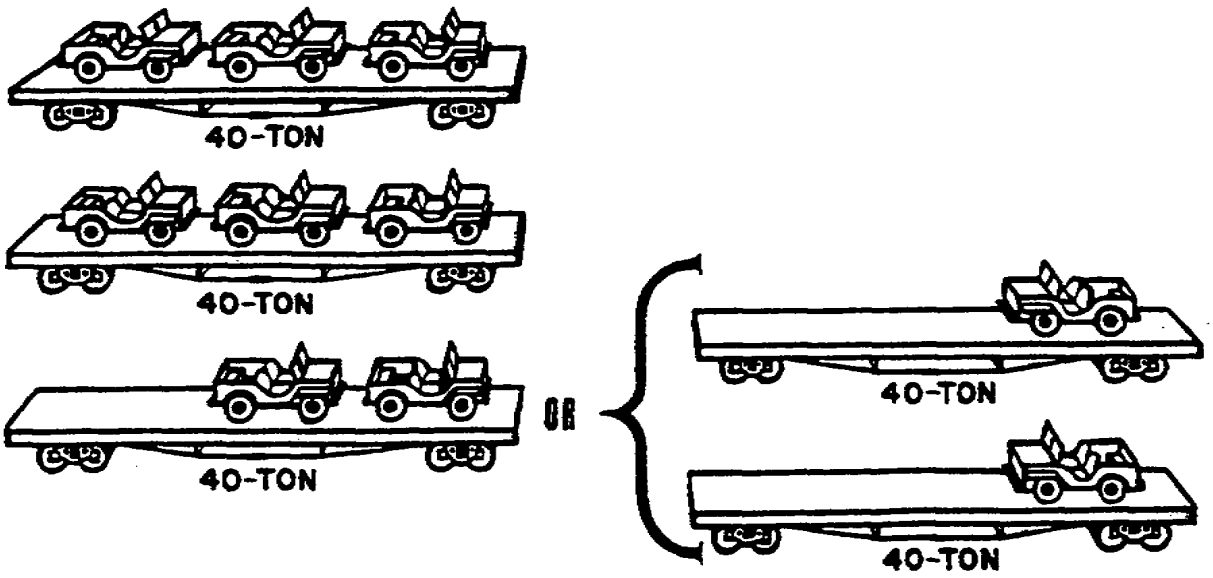
Analyzing your table, you note that three 1/4-ton trucks can fit on either car and still leave enough brake wheel clearance--12 inches. You circle the total length for the three trucks (359.4) to show it is a possible combination. Only one 2 1/2-ton truck will go on either flatcar. Although two 2 1/2's fit on a 50-ton car, not enough clearance remains for the brake wheel. Circle the (266.8). The length of the personnel carrier is 191 1/2 inches. Twice that length, (383), could fit on either car, so that you circle it tentatively, remembering a possible weight or center of gravity limitation.

How about vehicle weight? Again you make a table, this time showing the combined weights of multiples of the same kind of vehicle:

WEIGHT OF VEHICLES, POUNDS

Vehicle	Number of vehicles		
	1	2	3
1/4-ton truck	2,350	4,700	(7,050)
2 1/2-ton truck	(12,840)	25,680	38,520
Personnel carrier	19,755	(39,510)	59,265

Three 1/4-ton trucks are still a good combination on either flatcar. Circle (7,050) because its weight is under both load limits. Since not more than one 2 1/2-ton truck can fit on either car, as you have seen, circle (12,840). And now for the personnel carriers. Even though, as you can see in the table, the weigh of three of them (59,265) does not exceed the load limit of either the 40- or 50-ton flatcar, their length, 574.5 inches, would be too much for a 40-ton car. Circle (39,510). Now, on paper, start loading your flatcars, filling up the 40-ton ones, for economy, before going to the 50-ton.



The extra space on flatcars makes you question whether different kinds of vehicles can be combined on the same car. First, you try this using the 40-ton:

Vehicle	Length, in.	Weight, lb
1/4-ton truck	131.8	2,350
2 1/2-ton truck	266.8	12,840
Total	398.6	15,190

This combination works. Next, you try combining carriers with the two truck types on 40-ton cars:

Vehicle	Length, in.	Weight, lb
1/4-ton truck	131.8	2,350
Carrier	191.5	19,755
Total	323.3	22,105

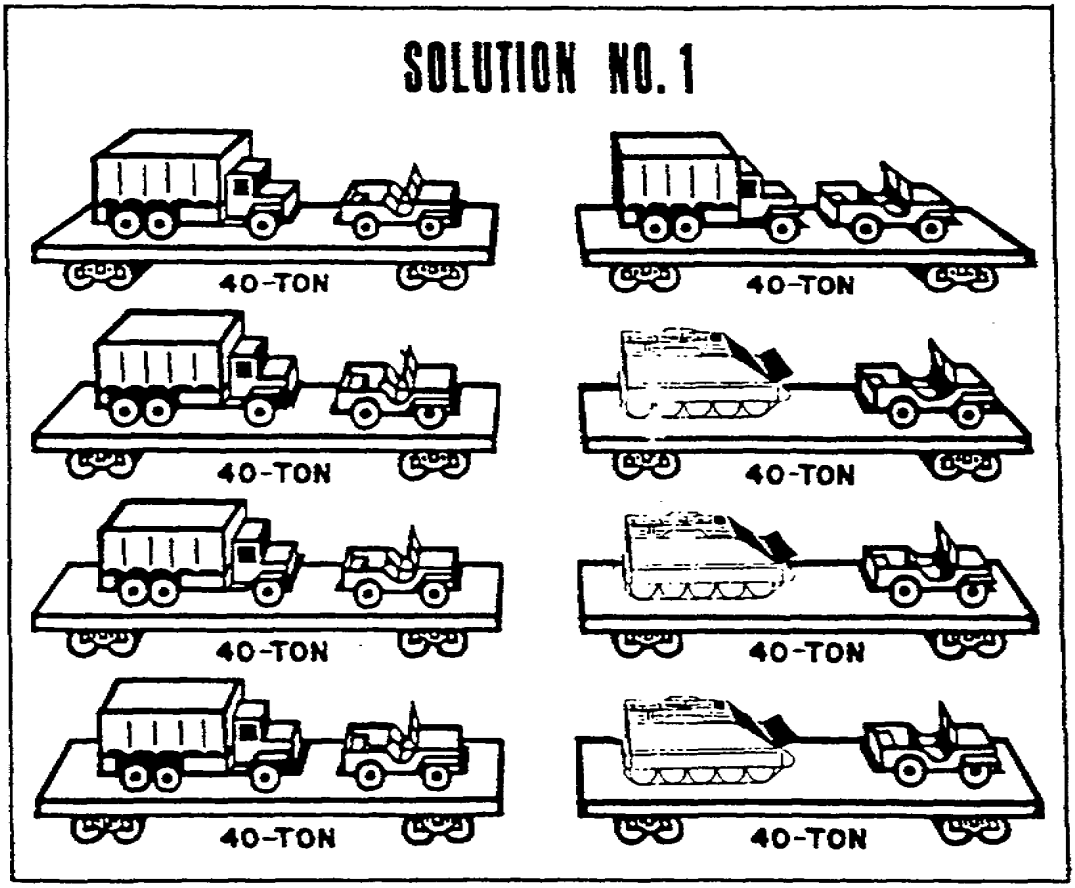
This combination also works.

Vehicle	Length, in.	Weight, lb
2 1/2-ton truck	266.8	12,840
Carrier	191.5	19,755
Total	458.3	32,595

The 2 1/2-ton truck-carrier combination won't fit on the 40-ton flatcar and leave the necessary brake wheel clearance and room for the blocking. But it will fit on the 50-ton.

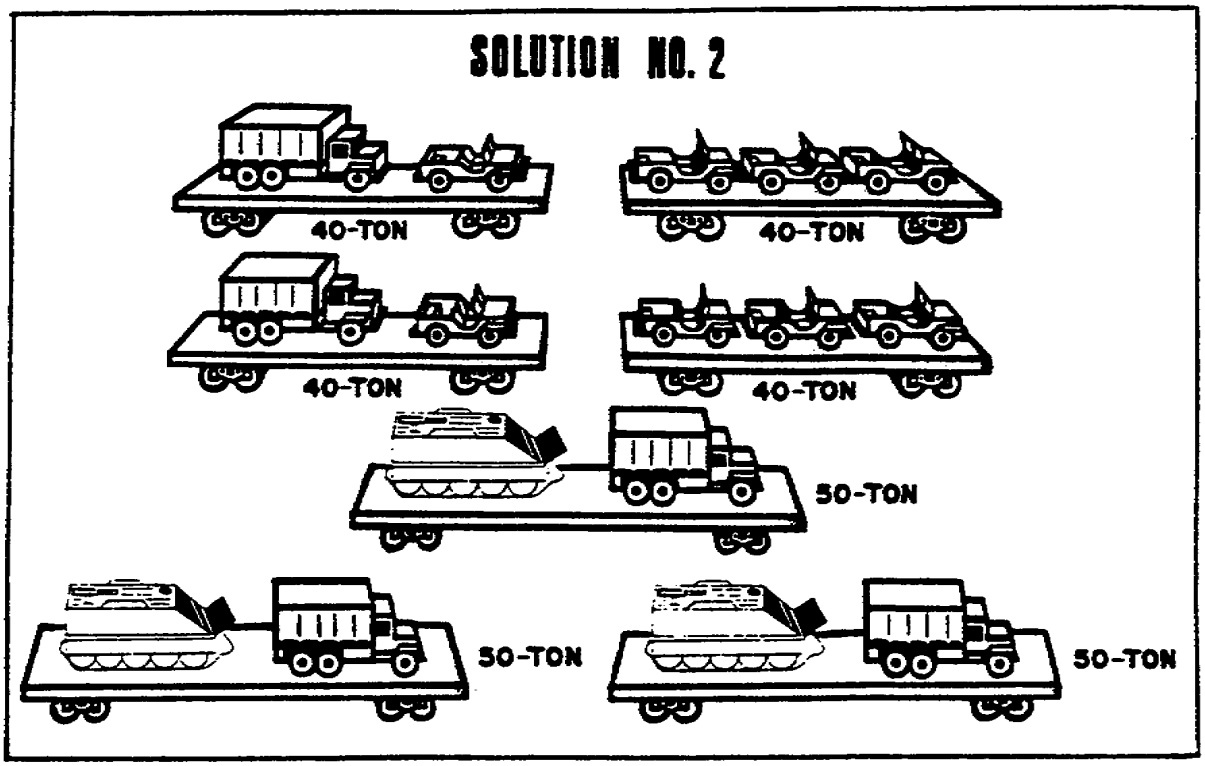
2.11. SOLUTION TO FIRST REQUIREMENT

With the data you have just developed about which kinds of vehicles in what combination can be loaded on which flatcars, you are now ready to select the cars you will need. Actually, you find that at least two combinations are possible:



You have accommodated all your vehicles on eight 40-ton flatcars.

Here you have used four 40-ton and three 50-ton flatcars for your shipment. You are now ready to make up a firm loading plan using either of



these solutions. But you must still determine the materials you will need to block and brace the equipment.

2.12. SECOND REQUIREMENT

As part of this simulated situation, you must now determine what materials will be needed to block and brace the vehicle on the selected flatcars. Again, since you may not have access to TM 55-601, several loading diagrams and material patterns from that publication are reproduced in appendix II for your convenience.

To compute the materials you need for blocking and bracing, you look up the loading drawing for each item you are shipping. If you will turn to appendix II, where the loading diagram for the 1/4-ton truck is given, you will find drawings of the truck with circled letters on them.* The letters refer to points where blocking or

---

* Note that the loading drawing in appendix II shows two 1/4-ton trucks side by side. While they could be loaded that way on a 10-foot car, remember you're using 9-foot cars in this situation.

bracing must be applied, as detailed in the description immediately following the drawings. Look at circled letter (C). Now find item C in the description. It tells you that you will need one block of pattern 25, shown under material patterns in the same appendix, for each wheel of the 1/4-ton truck. Multiplying by 4 for the total number of wheels (on the ground) per vehicle and by 8 for the total number of 1/4-ton trucks you are shipping, you find that you will need a grand total of 32 blocks of pattern 25 to block all of your 1/4-ton trucks. When the description calls for "2 each unit," as for (E) it means only two are needed for each vehicle. Your total for (E) would be 16, since you are shipping 8 such trucks (8 x 2). While it is not difficult to compute these material requirements, great care must be taken not to overlook any of the items called for. Patterns are usually made to order for the shipment and a shortage discovered at the last minute may delay the loading while the missing items are made.

2.13. SUMMARY

In a sense, each shipment of military equipment by rail is different from all others. This is so because the numbers and kinds of equipment to be loaded are seldom the same, and rail cars furnished to the military shipper often differ not only in tonnage classification but also in design and dimensions. The route, too, is changeable. With all of these differences, however, the basic rules remain the one dependable guide for rail shipment. And using these rules, the military shipper of freight works out the best possible combinations of his equipment on the rail cars he can get.

Instead of attempting trial-and-error loading on the actual rail car, the military shipper plans ahead of time exactly where each item will be positioned on which car. Using paper and pencil, he may make scale drawings of rail cars and the items to be shipped. And he may prepare tables showing various dimensions of his equipment in multiples and in varying equipment combinations. Satisfied at last that his equipment "fits" the rail cars at his disposal, both physically and within the limits of the AAR rules, the military shipper makes up a firm loading plan to guide those who will do the actual loading.

In determining what materials will be needed to block and brace items on rail cars, the military shipper refers to published loading drawings for the specific items. Those drawings show where blocking and bracing are needed, what materials are called for, and how to apply those materials.

CORRESPONDENCE COURSE OF THE
U. S. ARMY TRANSPORTATION SCHOOL
SOLUTIONS

TRANS SUBCOURSE 690.....Loading, Blocking, and Bracing on Rail Cars.

(All references are to Reference Text 690.)

LESSON 1

Weight	Exercise			Weight	Exercise		
2	1.	T.	(par. 1.12)	3	15.	T.	(par. 1.5b)
2	2.	F.	(par. 1.18d fig. 1.9)	3	16.	T.	(par. 1.17)
				3	17.	F.	(par. 1.11)
2	3.	T.	(par. 1.4)	3	18.	T.	(par. 1.17)
2	4.	F.	(par. 1.13)	3	19.	T.	(par. 1.17)
3	5.	F.	(pars. 1.4, 1.8)	3	20.	T.	(par. 1.17)
3	6.	F.	(par. 1.4)	2	21.	B.	(par. 1.3b)
3	7.	T.	(par. 1.4c; fig. 1.4)	2	22.	E.	(par. 1.3d)
				2	23.	A.	(par. 1.3c)
3	8.	F.	(par. 1.5b)	2	24.	D.	(par. 1.3a)
3	9.	T.	(par. 1.4a)	4	25.	E.	(par. 1.12)
3	10.	F.	(par. 1.5b)	4	26.	C.	(par. 1.13)
3	11.	F.	(par. 1.5a)	4	27.	A.	(par. 1.14)
3	12.	F.	(par. 1.5a)	4	28.	D.	(par. 1.15)
3	13.	F.	(par. 1.5)	4	29.	B	(par. 1.16)
3	14.	T.	(par. 1.5b)				

Supersedes Trans 690, Loading, Blocking, and Bracing on Rail Cars, November 1970.

Weight	Exercise		
4	30.	B.	(par. 1.18)

Exceeding AAR requirements is at the discretion of Army officials, not because military equipment needs extra support.

4	31.	C.	(par. 1.6)

Since tunnels are narrowest at the top, the higher the load is, the narrower it must be.

4	32.	A.	(par. 1.10)
4	33.	A.	(par. 1.4a, b)

LESSON 2

3	1.	F.	(par. 2.6b)
3	2.	F.	(par. 2.5)
3	3.	T.	(par. 2.4b)
3	4.	T.	(par. 2.5)
3	5.	F.	(par. 2.4a)
3	6.	T.	(par. 2.3)
4	7.	F.	(par. 2.4b)
4	8.	T.	(par. 2.4c)
4	9.	T.	(par. 2.4b)
4	10.	F.	(par. 2.4a; app II)
4	11.	T.	(par. 2.4a; fig. 2.4)
3	12.	F.	(par. 2.3)
3	13.	T.	(par. 2.3b; fig. 2.3)
3	14.	F.	(par. 2.3a)

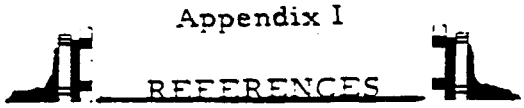
Weight	Exercise		
3	15.	T.	(par. 2.3a; fig. 2.1)
3	16.	T.	(par. 2.3a; fig. 2.1)
3	17.	T.	(par. 2.3b)
4	18.	C.	(app. II)
4	19.	E.	(app. II)
4	20.	B.	(app. II)
4	21.	D.	(app. II)
4	22.	A.	(app. II)
4	23.	A.	(app. II)
4	24.	C.	(app. II)
4	25.	B.	(app. II)
4	26.	D.	(app. II)
4	27.	C.	(par. 2.6b)

The longer the overhang, the narrower it must be.

4 28. B. (pars. 2.6, 2.6a)

Not more than half of the tire width may overhang the side of a car.

Appendix I



Army Regulations

AR 220-10	Preparation for Oversea Movement of Units (POM)
AR 310-25	Dictionary of United States Army Terms
AR 310-50	Authorized Abbreviations and Brevity Codes

Field Manuals

FM 55-15	Transportation Reference Data
FM 101-10 (Part 1)	Staff Officers' Field Manual, Organizational, Technical, and Logistical Data

Technical Manuals

TM 9-2320-211-20	Truck, Cargo, 5-Ton, 6x6 Series
TM 55-601	Railcar Loading Procedures
TM 55-2330-207-20-1	Transportability Guidance, Semitrailer, Stake, 12-Ton, 4-Wheel, M127A1C and M127A2C
TM 743-200	Storage and Materials Handling

Technical Bulletins

TB 55-46-1	Standard Characteristics (Dimensions, Weight, and Cube) for Transportability of Military Vehicles and Other Outsize/Overweight Equipment

Supply Bulletins

SB 9-156 — Publications for Packaging Army General Supplies

Commercial Publications

Association of American Railroads, Rules Governing the Loading of Commodities on Open Top Cars

The Railway Equipment and Publication Company, The Official Railway Equipment Register

Appendix II

VEHICLE LOADING DATA

EQUIPMENT CHARACTERISTICS

I. TRUCKS AND PERSONNEL CARRIER*

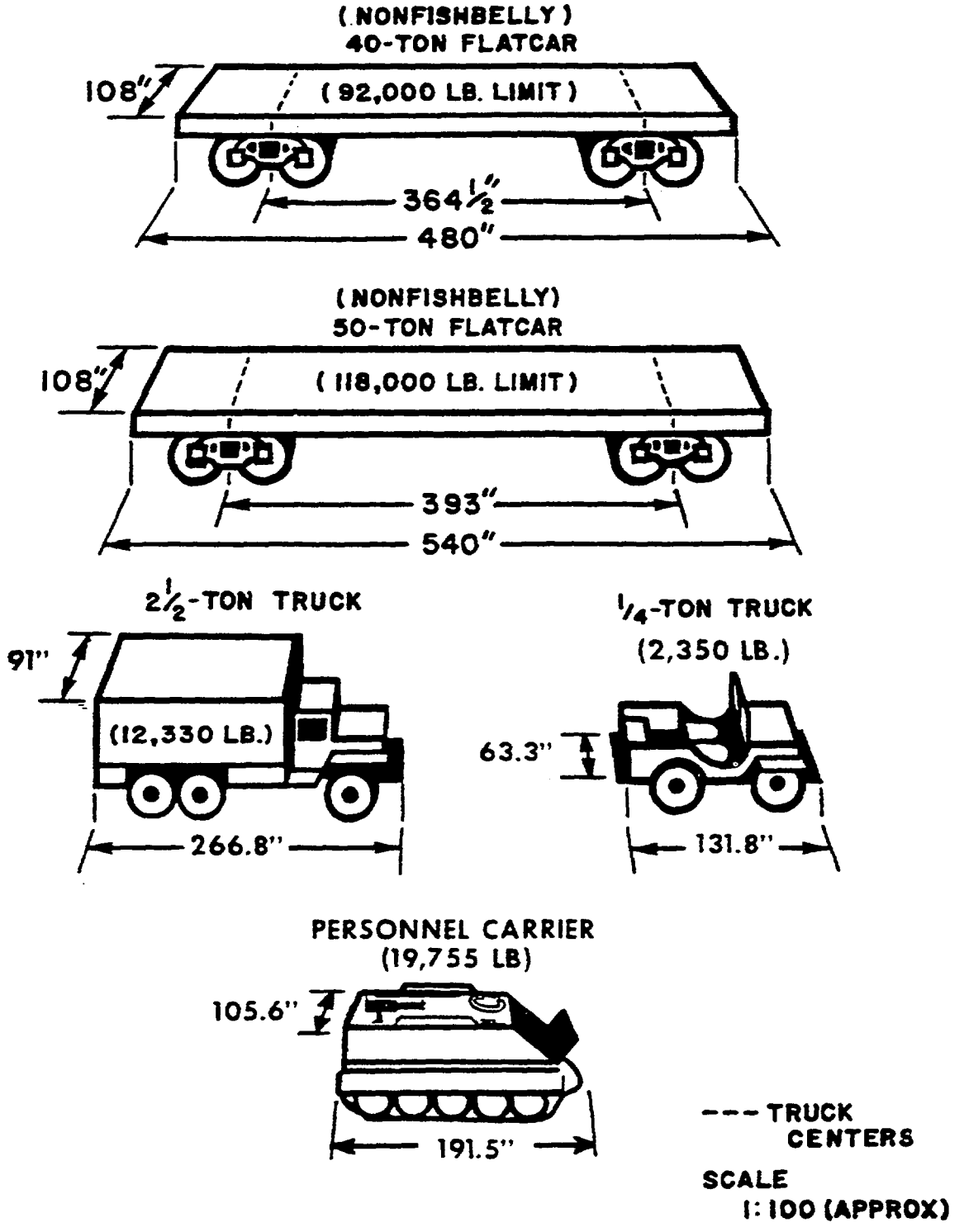
	Configuration	Length	Width	Height	Weight	Cube	Loaded Height
Trk Cargo 2 1/2-Ton							
M135	Operational	266.8	91.0	116.3	12840	1634.0	81.0
M135	Reduced	266.8	88.0	79.8	12840	1084.2	
Trk Utility 1/4-Ton							
M151	Operational	131.8	63.3	71.0	2350	342.8	
M151	Reduced	131.8	63.3	52.5	2350	253.5	
Carrier Pers Ftrac							
M113	Operational	191.5	105.6	86.5	19755	1012.3	
M113	Reduced	191.5	100.0	86.5	19755	958.6	

*Data extracted from TB 55-46

II. RAIL CARS

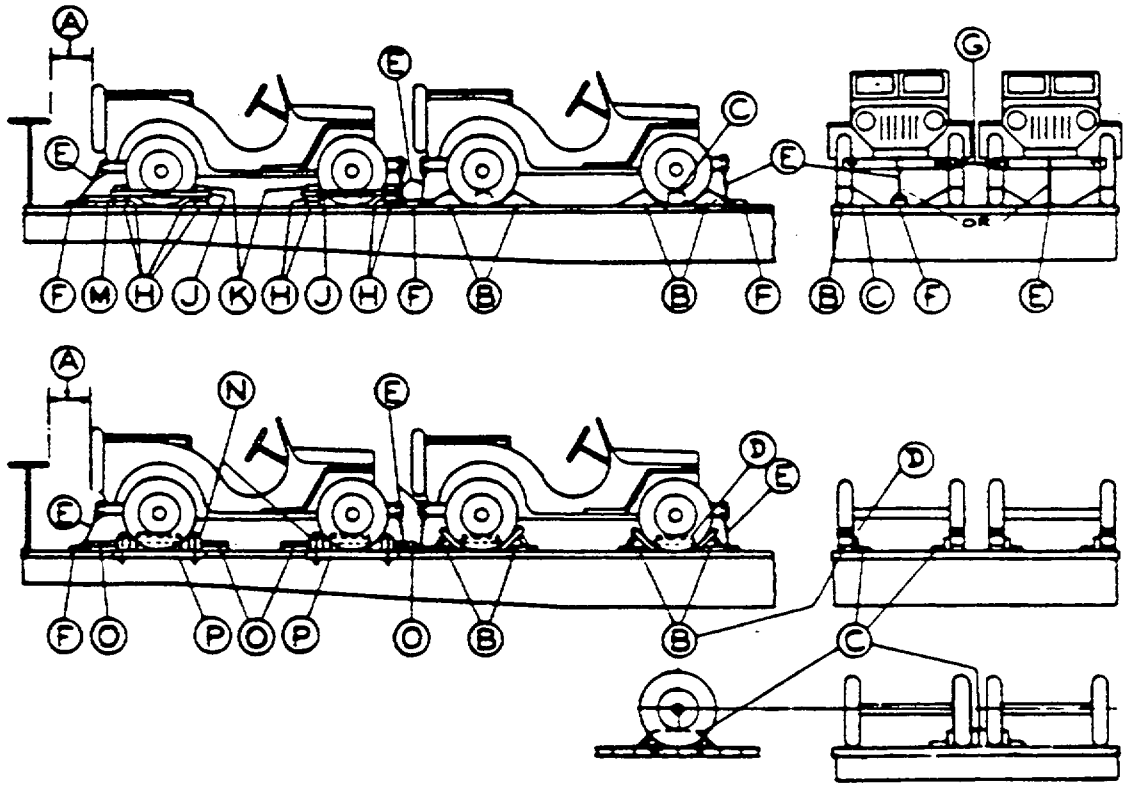
Type	Capacity				Weight empty (tons)	Inside dimensions (ft)		
	Tons	Men (8 sq ft per man and equipment)	Animals (horses, mules, oxen—avg. width, 22 inches)	Cubic feet		Length	Width	Height
Automobile	40	45	22	3,100	20	40.5	8.5	9
	50	58	27	4,702	25	50.6	9.2	10.1
Baggage					45	60	9.1	8
Box	30	38	20	2,750	18	36	8.5	9
	40	43	22	3,100	20	40.5	8.5	9
	50	43	22	3,100	24	40.5	8.5	9
Caboose					20	27.5	8.2	7
Diner					90	78.5	8.5	8.5
Flat	40				18	40	9	
	50				20	45	9	
	70				25	50	9	
Gondola	50			1,570	22	40	9.9	4
	70			1,920	25	48	10	4
Refrigerator	*30			2,570	28	40.5	8.2	7.2

III. EQUIPMENT OUTLINES



IV. LOADING DIAGRAMS

1/4-TON TRUCK



1/4-TON TRUCK (Cont)

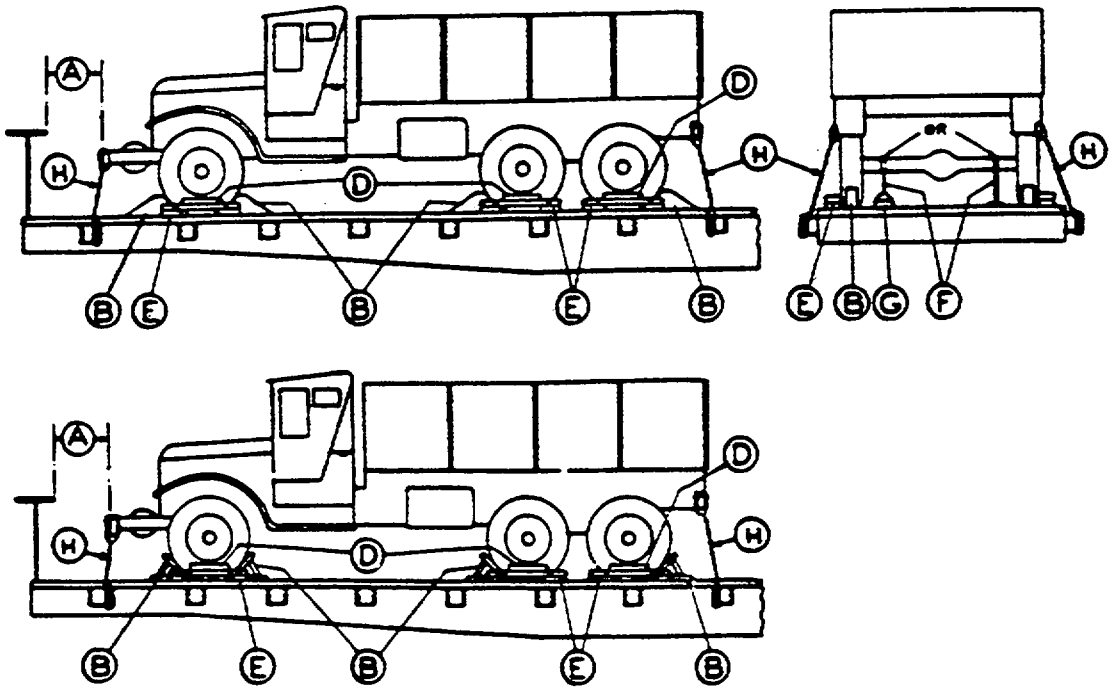
Item	No. of pieces	Description
A	----------	Brake wheel clearance. See figure 18.
B	8 per unit	Blocks, pattern 25. Locate 53° portion of block against front and rear of wheels. Secure heel of block to floor with three 40d nails and toe-nail that portion under tire to floor with two 40d nails. Substitute, if desired, at each location, blocks pattern 24, or blocks, pattern 18. When units are loaded, side by side on flatcars, item B not required against inside of inside front and rear wheels. Item B not required when items H, J, K, and L, or N, O, and P are used.
C	1 each wheel	Blocks, pattern 25. Locate 35° portion against inside of each wheel and secure heel of block to floor with three 40d nails and toe-nail other end to floor with one 40d nail. Substitute, if desired, at each location, blocks, pattern 20. Secure to floor with four 30d nails at each location. If desired, each block, pattern 25, or pattern 20, located against wheels nearest side of car may be omitted, provide double 2-in. x 4-in. x 24-in. block is used between inside wheels of side by side units to prevent contacting each other. Secure lower piece to floor with four 20d nails and top piece to one below with four 30d nails in each. Not required when items H, J, K, and L are used.
D	1 each wheel	Suitable material, such as waterproof paper, burlap, etc. Locate bottom portion under item C, top portion to extend 2-in. above item C. Not required when blocks, pattern 25 or items H, J, K, and L, or N, O, and P are used.
E	2 each unit	1 in. No. 14 B. W-gage hot-rolled steel, with anchor plates, pattern 19. Locate over bumper at front end and through pulling hook at rear end and secure each plate to floor with eight 20d cement-coated nails. Substitute, if desired, at each location, 4 strands No. 8-gage black-annealed wire. Pass over bumper or through pulling hook, underneath and around item F. After car springs have been compressed as much as possible, bring both ends together, and twist taut after item F has been nailed in place.
F	1 each item E	2-in. x 4-in. x 18-in. Locate one under front bumper at center of unit and one under rear pulling hook. Secure each to floor with four 30d nails. Not required when steel straps, pattern 19, are used.
G	1 each end of each unit	6 strands, 3 wrappings, No. 8-gage black-annealed wire. Pass around pintle hook of one unit and around frame of adjacent unit, or around pintle hooks or frames of adjacent units.
H	4 each unit	Each to consist of two pieces of 2-in. x 4-in. long enough to extend to outside face of outside tires of unit loaded side by side and long enough to admit of application of item J on units loaded in single row. Locate so that item K will contact tires of wheels. Secure lower piece to floor with ten 30d nails and top piece to one below in like manner. Not required when items B and C or N, Q, and P are used.
J	1 each outside wheel	2-in. x 4-in., long enough to extend 2-in. beyond outside face of item H, or item N when used on units loaded in single row. Locate against wheel and secure to each item H or item N with three 20d nails. Not required when items B and C or N, O, and P are used.
K	4 each unit	2-in. x 4-in., length equal to length of item H. Locate against tires, on top of items J and L. Secure items J and L with three 20d nails at each location. Not required when items B and C or N, O, and P are used.
L	2 each item J	2-in. x 4-in. x 12-in. Locate between items H and K with one end against item J. Secure to item H with two 20d nails in each. Not required when items B and C or N, O, and P are used.
M	2 each end of load	Each to consist of two pieces of 2-in. x 4-in. x 18-in. Locate on floor with one end against item H. Secure lower piece to floor with four 30d nails and top piece to one below with four 20d nails. Not required when items B and C or N, O, and P are used.

1/4-TON TRUCK (Cont)

Item	No. of pieces	Description
N	4 each single or side by side row	4-in. wide, 6-in. high, long enough to extend to outside face of outside tires of units loaded side by side and long enough to admit of application of item J on units loaded in single row. Locate against front and rear tires. Toe-nail to floor with four 30d nails. Not required when items B or H, J, K, and L are used.
O	4 each item N	Each to consist of two pieces of 2-in. x 4-in. x 18-in. Locate one near each end and two near center of item N. Secure lower piece to floor, lengthwise of car, with four 30d nails and top piece to one below in like manner. Not required when items B, or H, J, K, and L are used.
P	1 each item N	2-in. x 4-in. long enough to extend 1-in. beyond outside face of item N. Locate 2-in. edge against end of floor, under item N. Secure each end to item N with one ½-in. diameter bolt. Multiple length pieces may be used provided they protect two or more complete units and are secured to each item N throughout their length. Not required when items B or H, J, K, and L are used.

Handbrakes must be set and levers wired or blocked. See General Rules for further details.

2 1/2-TON TRUCK



Item	No. of pieces	Description
A		Brake wheel clearance. See figure 22.
B	8	6-in. x 8-in. x 24-in. blocks, pattern 16. Locate 45° portion of blocks against front and rear of front wheels, in front of outside intermediate wheels and in back of outside rear wheels. Nail heel of block to floor with three 40d nails in a triangular pattern and toe-nail that portion under tire to floor with two 40d nails one on either side before items D and E are applied. Substitute, if desired, at each location, pattern 17, or blocks, pattern 18, secured to floor as shown.
D	1 each outside wheel	Suitable material, such as waterproof paper, burlap, etc. Locate bottom portion under item E, top portion to extend 2 inches above item E.
E	6	Each to consist of two pieces of 2-in. x 4-in. x 36-in. Nail lower piece to floor with four 30d nails and top piece to the one below with four 30d nails.
F	2 each axle	1-in. No. 14 B. W-gage hot-rolled steel, with anchor plates, pattern 19. Locate over axle, springs, or spring shackles and secure each plate to floor with eight 20d cement-coated nails. Substitute, if desired, at each location, four strands No. 8-gage black-annealed wire, or wires of equivalent strength. Pass over axle, springs, spring shackles, underneath and around item G and twist taut after item G has been nailed in place.
G	1 each item F	2-in. x 4-in. x 18-in. cleats. Nail to floor lengthwise of car, with four 30d nails. Not required when steel straps are used, per pattern 19.
H	4 each unit	Four strands No. 8-gage black-annealed wire, or wires of equivalent strength. Attach to each corner of machine and to stakepockets and twist taut with rod.

TANKS AND SIMILAR UNITS 60,000 POUNDS AND UNDER

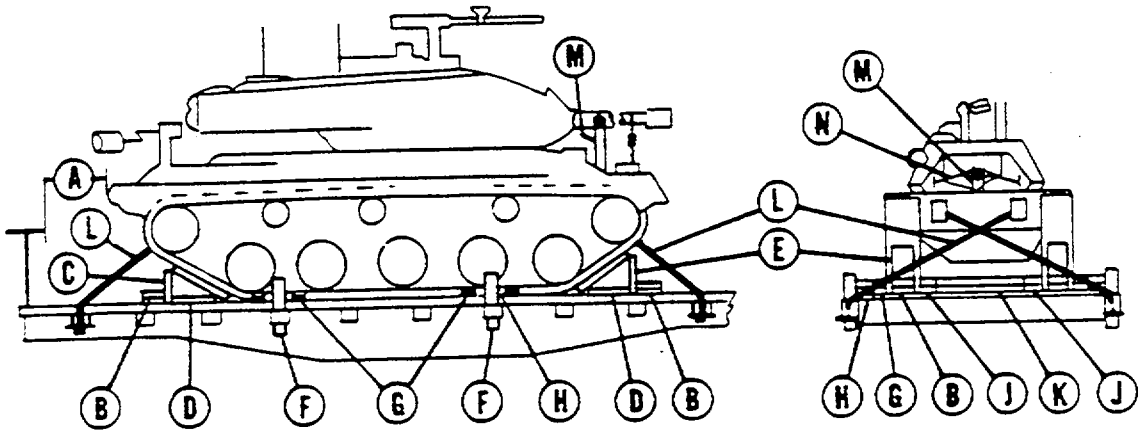


Figure 35. Loading tanks and similar units, 60,000 pounds and under, flatcars.

Item	No. of pieces	Description
A	----------	Brake wheel clearance. See figure 35.
B	2	Blocks, pattern 30. Locate one against each front crawler tread.
C	2	Blocks, pattern 31. Locate one against each rear crawler tread.
D	2 each items B and C	2-in. x 4-in. x 20-in. Locate one on each side of items B and C and secure each to floor with six 30d nails.
E	1 each items B and C	Each to consist of two pieces of 2-in. x 4-in. x 12-in. Locate against ends of items B and C. Secure lower piece to floor with four 30d nails and top piece to one below in like manner.
F	2 each side of unit	Side stakes. Must extend 2 inches below stakepocket and 8 inches above car floor. Locate one each in first stakepocket to the right of and to the left of stakepocket nearest center of tank. Not required when items J and K are used.
G	2 each side of unit	Each to consist of two pieces of 2-in. x 4-in. x 24-in. Locate against crawler treads, with centers opposite item F. Secure lower piece to floor with six 30d nails and top piece to one below in like manner. Not required when items J and K are used.
H	As required	2-in. x 6-in. x 12-in. Center on item F and toe-nail each to floor with one 30d nail in each end. Use sufficient pieces to completely fill space between items F and G. Not required when items J and K are used.
J	2 each unit	Each to consist of two pieces of 2-in. x 4-in. x 14-ft. Locate on floor against inside of each crawler tread and secure lower piece to floor with twelve 30d nails and top piece to one below in like manner. Not required when items F, G, and H are used.
K	3 each unit	Each to consist of two pieces of 2-in. x 4-in. long enough to fill space between item J. Secure lower piece to floor with four 30d nails and top piece to one below in like manner. Not required when items F, G, and H are used.
L	4 each unit	Tie rods, size as indicated in note to figure 17.* Attach to lifting lugs and pass through stakepockets and ½-in. x 4-in. x 10-in. plates underneath stakepockets on opposite sides of car. Substitute, if desired, ⅝-in. x 6-in. x 19-in. steel cable, doubled.

* 7/8-inch in diameter for vehicles weighing 10,000 to 20,000 pounds.

TANKS AND SIMILAR UNITS 60,000 POUNDS AND UNDER (Cont)

Item	No. of pieces	Description
M	1 each unit ------	2-in. x 6-in., length to suit. Apply to top of tank, under turret gun barrel, and secure with one piece of ¾-in. high-tension band over gun barrel and secured to each side of brace with two 6d nails. Not required when gun is secured with built-in gun brace.
N	2 each unit ------	¾-in. high-tension bands. Apply one to each side of gun barrel. Not required when gun is secured with built-in gun brace.

When necessary to extend floor for the application of item G on units loaded on car floor, see figure 1-B, section I, AAR Loading Rules.

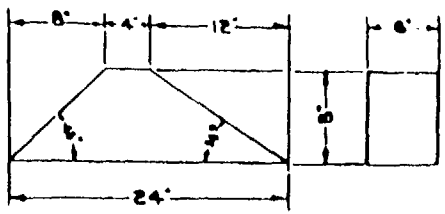
For loads superimposed above the car floor follow method illustrated in figure 37.

Turret gun should be straightforward position, and turret lock handwheel and elevating mechanism handwheel must be wired to prevent rotating.

When tiedown rods are found slightly loose in transit, they need not be tightened.

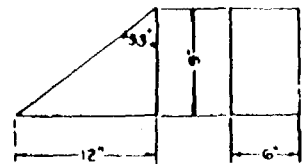
Handbrakes must be set and levers wired or blocked.

See General Rules for further details.

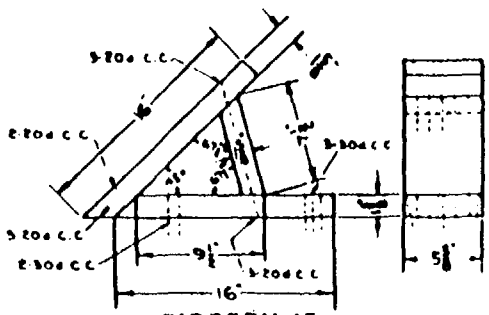


PATTERN 16

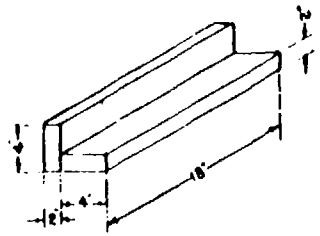
PATTERN 19



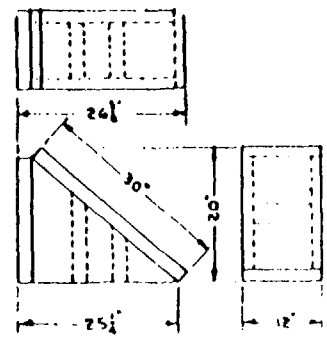
PATTERN 25



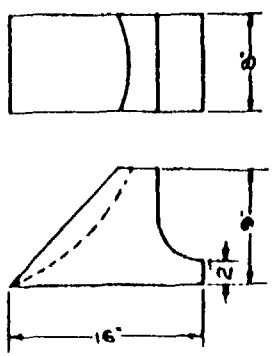
PATTERN 17



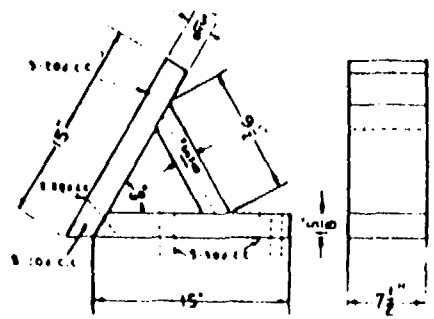
PATTERN 20



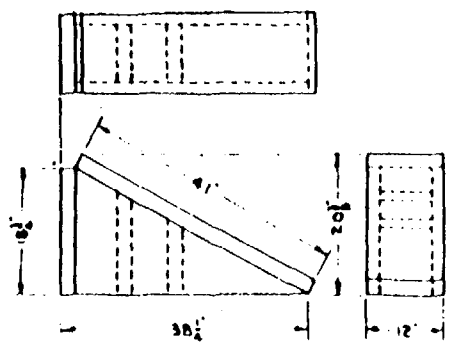
PATTERN 30



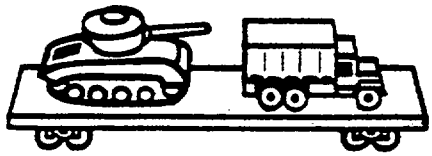
PATTERN 18



PATTERN 24



PATTERN 31



Appendix III

GLOSSARY

Brake wheel--wheel located at one end of a flatcar to operate the handbrake, which holds the car on a siding or slows the car down in certain yard and road operations.

Capacity--nominal rating, in multiples of a thousand pounds, that gives the maximum load in pounds or the tonnage class of a flatcar, and is stenciled on the car after the abbreviation CAP.

Center of gravity--center of load weight, or that point in the load about which all the parts of the load exactly balance each other.

Center plate--one of a pair of plates which fit one into the other and support the car body on the trucks, allowing the car body to swivel freely under the car. Also called Center casting.

Center sill--central longitudinal member of the car underframe.

Chock--concave or mitered wooden block cut to a prescribed pattern and nailed to the deck of a flatcar in front of and behind the wheels of a vehicle being shipped to keep the vehicle from moving longitudinally. Also called wheel block.

Circus method--procedure used in loading vehicles on a train of flatcars by driving them up a ramp to the end car and then forward to the first and successive cars of the train over spanners.

Clearance, brake wheel--necessary clearance of the brake wheel to permit safe operation of handbrakes by trainmen.

Cleat--wooden piece nailed to floor to reinforce blocking. Also piece nailed to floor or blocking against lading to retain lading in position.

Deck--wooden platform of a flatcar on which the load rests.

End sill--transverse member of the underframe extending across ends of all the longitudinal sills.

Fishbelly--flatcar design in which center and side sills dip downward between trucks, giving the car added weight-bearing capacity between truck centers over conventional, or nonfishbelly, flatcars.

Gross weight--total of the car weight (light weight) and the total weight of lading permitted (load limit) which is the maximum weight permitted on the rail car.

Idler car--extra flatcar used to protect the overhang of a load on an immediately preceding or following flatcar.

Light weight--empty weight of the rail car as shown in pounds stenciled on the side of the car after the abbreviation LT WT.

Load limit--maximum load in pounds a flatcar can carry, as shown after the abbreviation LD LMT stenciled on the car.

Longitudinal force--forward or backward motion of the load caused by a sudden stopping or starting of the rail car it is riding on.

Nonfishbelly--flatcar design in which center and side sills are straight rather than dipped, as in fishbelly design.

Sill, side--outside longitudinal member of the car underframe.

Spanner--bridging in the space between flatcars permitting vehicles to be driven from one to the other in loading operations.

Stake pocket--metal receptacle attached to side or ends of flatcar to receive end of stake used in securing load.

Transverse force--centrifugal or outward pushing force exerted on a load when the rail car it is riding on rounds a curve.

Truck--wheel unit of a rail car containing two or more pairs of wheels, the center casting, brake components, etc.

Truck center--midpoint of the truck, used as a guide in loading a flatcar correctly.

Underframe--skeleton or framework of a rail car to which trucks and deck are joined.

Vertical force--bouncing motion that an object secured to a flatcar is subjected to because of roadbed roughness.

Wheel block--same as Chock.

INDEX