Chapter 10

Hauling Equipment

The most common hauling equipment used for Army construction work are the 5- and 20-ton dump trucks, both of which are organic to most engineer units. Equipment trailers are used to transport heavy construction equipment not designed for cross-country travel. They are also used to haul long, oversize items and packaged items.

DUMP TRUCKS

USE

10-1. The 5-ton family of medium tactical vehicles (FMTV) *(Figure 10-1)* and the 20-ton *(Figure 10-2, page 10-2)* dump trucks can be used for a variety of purposes. This manual, however, discusses dump trucks used primarily for hauling, dumping, and spreading earth, rock, or processed aggregates.

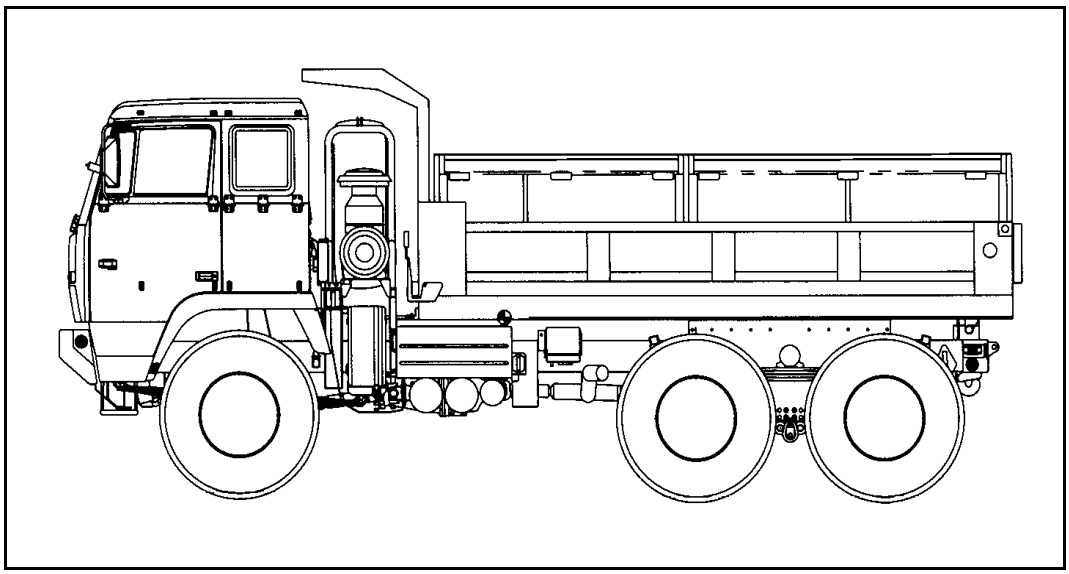

Figure 10-1. Dump Truck (5-Ton) FMTV

CAPACITY

10-2. The capacity of hauling equipment is expressed in one of three ways: gravimetrically by the weight of the load it will carry (in tons), by its struck rear-dump body volume (in cubic yards), or by its heaped rear-dump body capacity (in cubic yards). The hauling capacity of Army dump trucks is

normally expressed gravimetrically: 5-ton and 20-ton. Conversely, the capacity of loading equipment is normally expressed in cubic yards. The unit weight of the various materials to be transported may vary from as little as 1,700 pounds per LCY for dry clay, to 3,500 pounds per LCY for trap rock (see *Table 1-2, page 1-4*, for weights of common materials). Always make sure that the volumetric load does not exceed the gravimetric capacity of the truck.

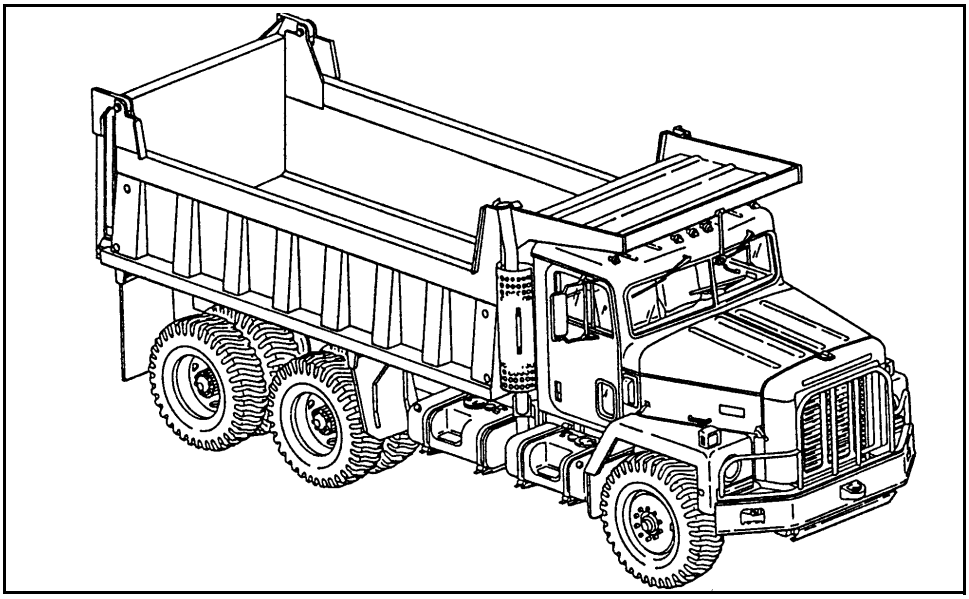

Figure 10-2. Dump Truck (20-Ton)

OPERATION

Loading

10-3. For maximum efficiency, fill trucks as close to their rated hauling capacity as practical. Adjust the load size if haul roads are in poor condition or if the trucks must traverse steep grades. Overloading will cause higher fuel consumption, reduced tire life, and increased mechanical failures.

10-4. Use spotting markers when trucks are hauling from a hopper, a grizzly ramp, or a stockpile. Spotting markers are also beneficial when excavators (such as a dragline, a clamshell, a loader, a backhoe, or a hoe) are used to load hauling equipment. They facilitate prompt and accurate vehicle spotting which improves loading efficiency.

10-5. Spot trucks as close to the bank as possible when loading with an excavator. Ensure that the trucks are within the working radius of the dragline, the clamshell, or the hoe bucket. When using a loader, position the truck and loader so that the two machines form a V. This arrangement will reduce the loader cycle time *(Figure 10-3).*

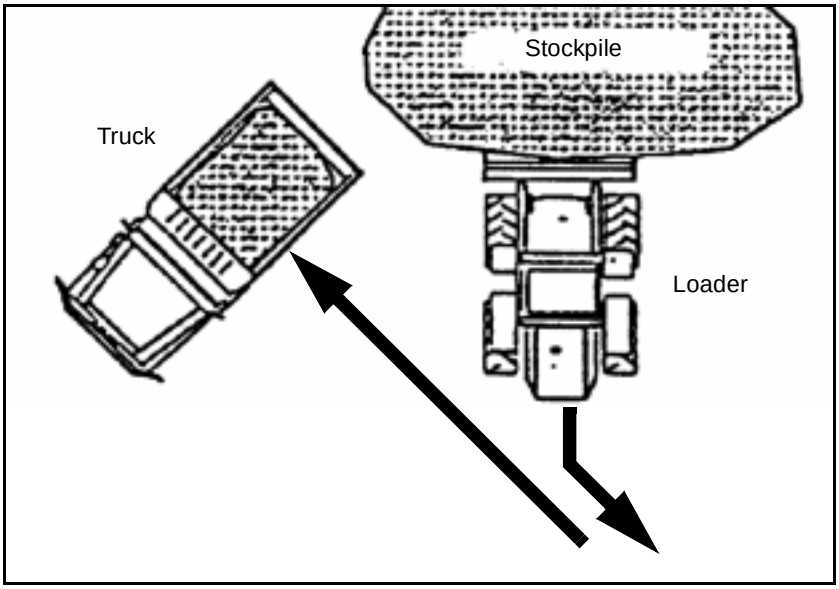

Figure 10-3. Truck and Loader V-Positioning for Loading

Maintaining Proper Speed

10-6. Haul at the highest safe speed and in the proper gear, without speeding. Speeding is unsafe and hard on equipment. When several trucks are hauling, it is essential to maintain the proper speed to prevent hauling delays or bottlenecks at the loading and dumping sites. Use separate haul roads to and from the dump site, if possible. Keep haul roads well maintained, with a minimum grade. Use one-way traffic patterns to increase efficiency.

Dumping (Unloading)

10-7. Always use spotters to control dumping operations. When dumping material that requires spreading, move the truck forward slowly while dumping the load. This makes spreading easier. Establish alternative dumping locations to maintain truck spacing when poor footing or difficult spotting slow the dumping operation.

Preventive Maintenance

10-8. Keep truck bodies clean and in good condition. Accumulations of rust, dirt, dried concrete, or bituminous materials hamper production. Consider the time spent cleaning and oiling dump bodies, particularly for asphalt or concrete hauling, when computing transportation requirements.

- Clean truck bodies thoroughly at the end of the day. When used to haul wet concrete mix, spray the dump beds with water before loading and clean them thoroughly as soon as practical after dumping.
- Coat the walls and sides of truck bodies with diesel fuel or oil to prevent bituminous materials (plant-mix asphalt) from sticking.

PRODUCTION ESTIMATES

10-9. The production capacity of the loading equipment is normally the hauling operation's controlling factor. Never keep loading equipment waiting. If there are not enough trucks, there will be a loss in production.

Number of Trucks Required

10-10. Use the following formula to estimate the number of trucks required to keep loading equipment operating at maximum capacity:

$$\text{Number of trucks required} = 1 + \frac{\text{truck cycle time (minutes)}}{\text{loader cycle time (minutes)}}$$

- The numeral 1 in the formula is a safety factor against the necessity for closing down loading equipment due to lack of hauling equipment. If all operations are on schedule, one truck will always be standing by at the loader, ready for spotting.
- The truck cycle time is the time required for a truck to complete one cycle of operation. One complete cycle is the time a loaded truck takes to travel to the dump site, unload, return to the loading unit, and be reloaded.
- The loader cycle time is the time it takes the loading equipment to load the truck, plus any time lost by the loading equipment while waiting for the truck to be spotted.

NOTE: After the job has started, the number of trucks required may vary because of changes in haul road conditions, reductions or increases in haul length, or changes in conditions at either the loading or unloading areas.

Number of Standby Trucks Required

10-11. Identify, based on the normal cycle time, the number of standby trucks that should be available to replace trucks that develop mechanical trouble. The number of standby trucks needed depends largely on the mechanical condition of the active trucks as well as the size and importance of the job. In the case of a small fleet and a single loading unit, the ratio of standby trucks to active trucks may be as high as 1:4. On larger jobs, the ratio is smaller. Standby trucks need not be idle; use them on lower priority tasks from which they can easily be diverted.

EXAMPLE

How many 5-ton FMTV trucks (hauling 3 LCY per load) will it take to support a wheel loader having a 2-cubic-yard heaped-bucket capacity? The haul-unit cycle time is 20 minutes excluding loading time. The loader cycle time per bucket load is 0.5 minute. Consider a 60-minute working hour.

Step 1. Determine the number of bucket loads required to fill a truck.

$$\textbf{Bucket loads} = \frac{\textbf{haul-unit capacity}}{\textbf{bucket capacity}} = \frac{\textbf{3 LCY}}{\textbf{2 LCY}} = \textbf{1.5 bucket loads}$$

Using only one bucket load would mean that the truck would only haul 2 LCY per trip. Using two bucket loads would mean that the truck would haul 4 LCY per trip and the extra material would spill out during the loading process.

Step 2. Determine the loading time per haul unit.

Loading time per haul unit = bucket cycle time x number of bucket loads

Considering one bucket load per truck—

Loading time per haul unit = 0.5 minute x 1 = 0.5 minute

Considering two bucket loads per truck—

Loading time per haul unit = 0.5 minute x 2 = 1 minute

Step 3. Determine the number of hauling units needed to support the loading unit.

Considering one bucket load per truck—

$$\textbf{Truck cycle time} = \textbf{20 minutes} + \textbf{0.5 minute} = \textbf{20.5 minutes}$$

$$\textbf{Number of trucks required} = \textbf{1} + \frac{\textbf{truck cycle time (minutes)}}{\textbf{loader cycle time (minutes)}} = \textbf{1} + \frac{\textbf{20.5 minutes}}{\textbf{0.5 minute}} = \textbf{42 trucks}$$

Considering two bucket loads per truck—

$$\textbf{Truck cycle time} = \textbf{20 minutes} + \textbf{1 minute} = \textbf{21 minutes}$$

$$\textbf{Number of trucks required} = \textbf{1} + \frac{\textbf{truck cycle time (minutes)}}{\textbf{loader cycle time (minutes)}} = \textbf{1} + \frac{\textbf{21 minutes}}{\textbf{1 minute}} = \textbf{22 trucks}$$

Step 4. Determine the production based on the number of hauling units used.

The loader will control the production because of the one extra truck added to the formula. Therefore, there is always a truck waiting at the loader.

$$\textbf{Production} = \textbf{haul-unit load} \times \frac{\textbf{minutes per working hour}}{\textbf{loader cycle time in minutes}}$$

Using one bucket load per truck will require 42, 5-ton FMTV dump trucks.

$$\textbf{Production} = \textbf{2 LCY} \times \frac{\textbf{60}}{\textbf{0.5}} = \textbf{240 LCY per hour}$$

Using two bucket loads per truck will require 22, 5-ton FMTV dump trucks.

$$\textbf{Production} = \textbf{3 LCY} \times \frac{\textbf{60}}{\textbf{1}} = \textbf{180 LCY per hour}$$

With an understanding of the effect of the different choices, determine the number of trucks to use on the haul and how many bucket loads to place on each truck. This illustrates that the capacity of both the loader and the trucks are set numbers. Therefore, there is a relationship between bucket loads and haul-unit capacity, which in practice must be an integer number.

EQUIPMENT TRAILERS

USE

10-12. Use equipment trailers *(Figure 10-4)* to transport heavy construction equipment such as cranes, dozers, or any equipment not designed for long-distance movement by their own power. Also use the trailers to haul long items such as pipes or lumber, or packaged items such as landing mats or bagged cement.

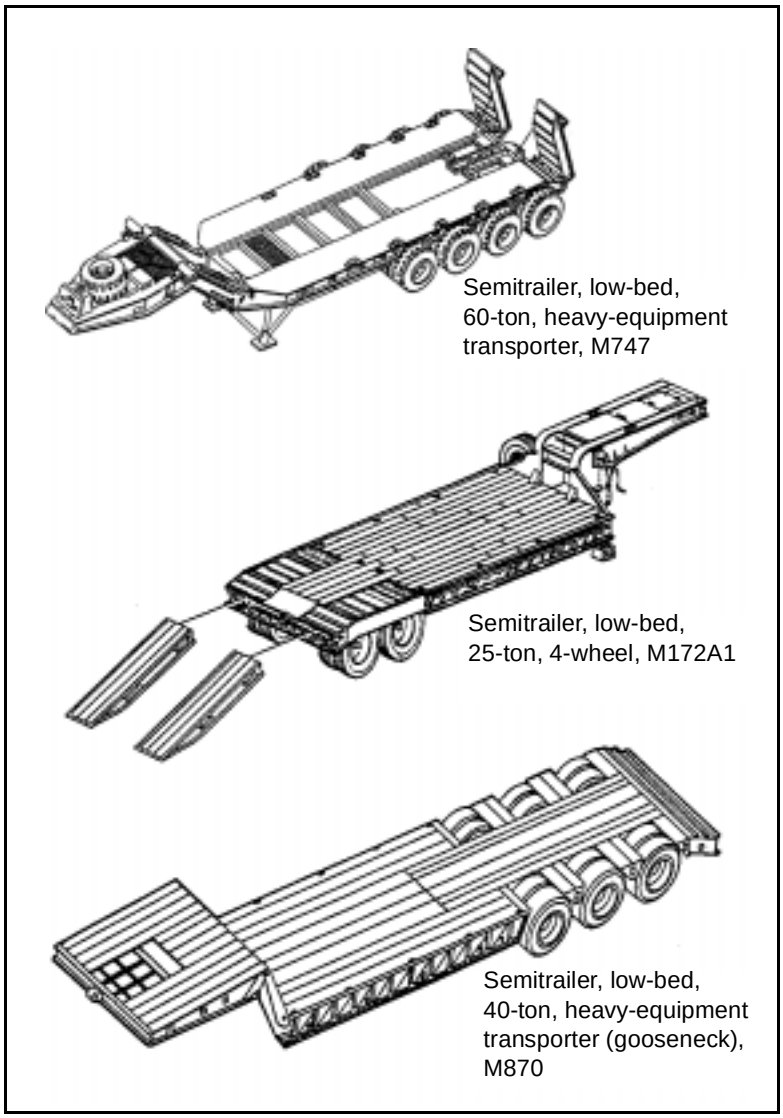

Figure 10-4. Equipment Trailers

OPERATION

Loading

10-13. For maximum efficiency, load trailers as close as possible to their rated loading capacity. When loading, always station a spotter on the trailer to direct the equipment operator and to keep the machine centered on the ramps and trailer.

10-14. With rear-loading trailers, use low banks or built-up earth ramps where possible. Some trailers carry loading ramps for loading from level ground. When using loading ramps to load a dozer, run the machine slowly up the ramps (with the blade raised) and as the balance point is reached, reduce speed or stop, then lower the blade and allow the front of the tracks to settle gently onto the trailer bed. Then move the dozer slowly ahead onto the trailer. Some low-bed trailers are designed for front-end loading.

10-15. In areas that restrict rear loading, load the trailer from the side. Take care not to damage the trailer bed.

NOTE: Refer to the unit's SOP or to the appropriate technical manual for proper techniques for loading and securing equipment.

Positioning and Securing

10-16. After positioning the equipment on the trailer bed, block and chock it and chain it to the trailer. Properly distribute the weight of large equipment on the trailer. Trailers have their load-weight centering position marked.

Unloading

10-17. Unload heavy equipment slowly to prevent damage to the trailer or the equipment. Always use ramps to load and unload.