

Rail Transport - Rail transport is essential for the shipment and deployment of oversize and overweight equipment, for the land deployment of all equipment transported farther than 400 miles and when many items are to be shipped as rail transport is often cheaper than highway transport. Rail transport of tactical vehicles reduces wear and tear, maintenance, and the time the vehicles must operate during deployment. It minimizes en-route support and places them in the front lines in top operational condition. When railcar-mounted equipment exceeds the maximum limits and restrictions of the clearance diagrams or envelopes, it may be possible in limited cases to transport by rail, but the number of capable rail routes may be severely limited and special train operations might be required.

- **CONUS**

The two CONUS rail clearance diagrams or envelopes of interest are the **Association of American Railroads (AAR) Outline Diagram** for Single Loads, without End Overhang on Open-top Cars, and the **DOD Clearance Profile** for the Strategic Rail Corridor Network (STRACNET). (*see below*)

For generally unrestricted movement in North America, the height and width of a loaded railcar shall remain within the limitations of the AAR clearance diagram or envelope. Loads wider than the flatcar, or combined load plus flatcar heights greater than 15 feet 1 inch above the top of the rails, are considered "dimensional loads." All involved railroad companies will perform clearance checks on "dimensional loads" for the entire distance of shipment before such shipments will begin. Clearance checks may delay rail transport because they are performed during normal working hours.

When railcars are requested from a railroad company on short notice, the railroad company will furnish what is readily available. Deck heights of flatcars can vary. For these reasons, unrestricted rail transport is based on a standard worst-case flatcar deck height of 51 inches. When unrestricted North American rail transport is a requirement, new items of equipment shall be designed such that the item outline is within the AAR diagram or envelope when placed on a 51-inch-high flatcar.

The DOD STRACNET connects all major Army installations, depots and ports of embarkation. The DOD STRACNET clearance profile accommodates 86% of DOD types of equipment and 99% of individual pieces of equipment in the DOD inventory. However, it's only valid for selected routes and sometimes only at severely restricted speeds. Designing exclusively to the DOD STRACNET profile may result in deployment delays.

Typical CONUS flatcar physical characteristics may be found in [MIL-STD-1366 Transportability Criteria](#). Data sheet on typical CONUS flatcar physical characteristics may be downloaded, US Flatcar Reference (see *below*). TTX has authorized the sharing of their video on the capabilities and characteristics of the new TPDx car that is equipped with new 1/2" diameter universal chains. Click [here](#) to view the video.

In addition to meeting CONUS rail clearance diagrams, the AAR requires that military vehicles that will be secured to flatcars for rail transport must also meet the rail impact test requirements outlined in [MIL-STD-810, test method 526](#). This testing simulates "rail humping operations" that could occur during the life of the rail transport of the vehicle. If during rail impact testing a vehicle requires securement that deviates from the general rules or a specific figure in the [AAR's Open Top Loading Rules \(OTLRs\)](#), those testing results must be submitted to the AAR OTLR committee for review and possible generation of a new figure within the OTLRs. If you desire a copy of the Section 6 of the OTLRs that covers Military Equipment and Materiel please contact usarmy.scott.sddc.mbx.tea-dpe@mail.mil.

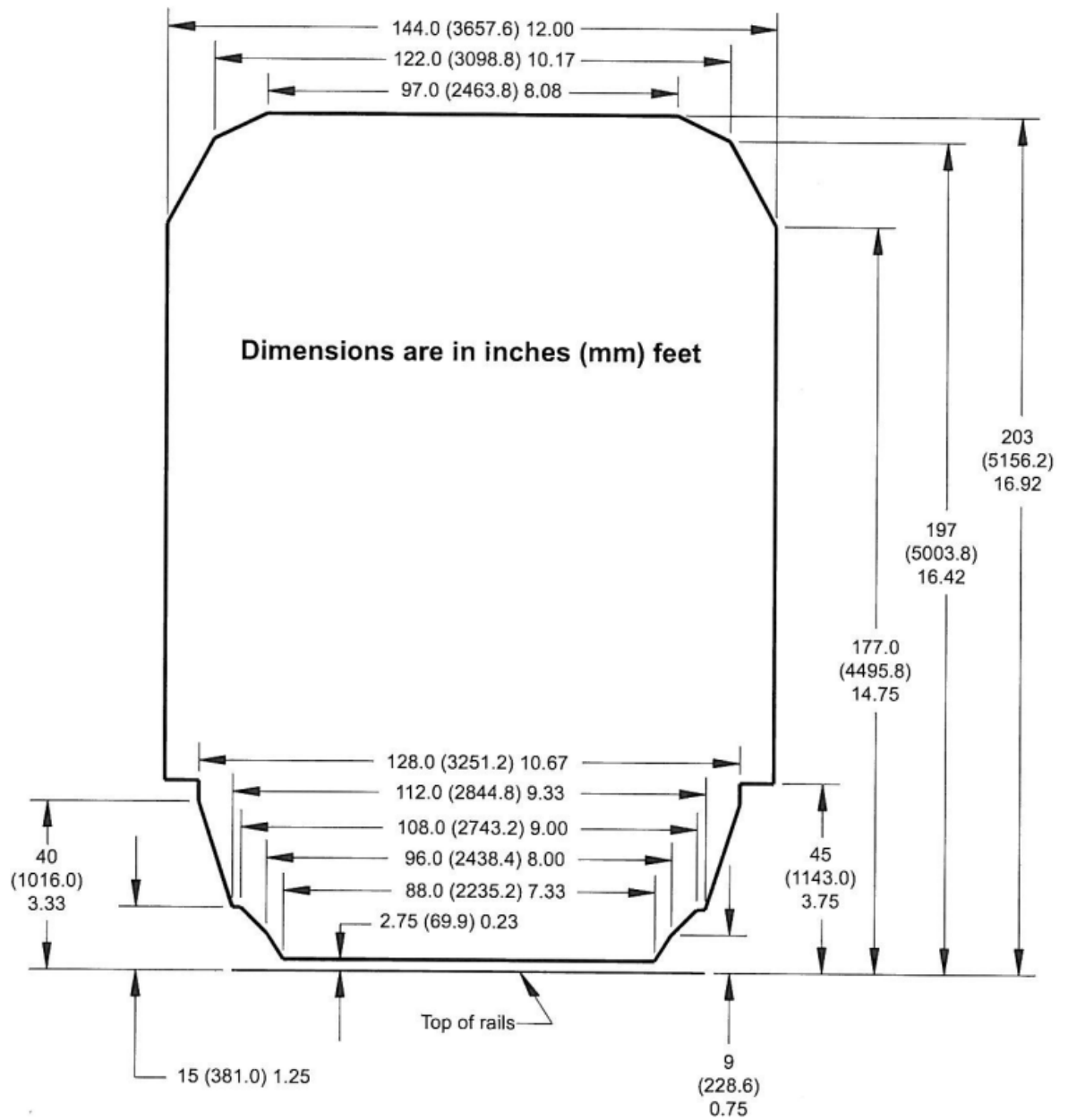


Figure 3. DOD rail clearance diagram.

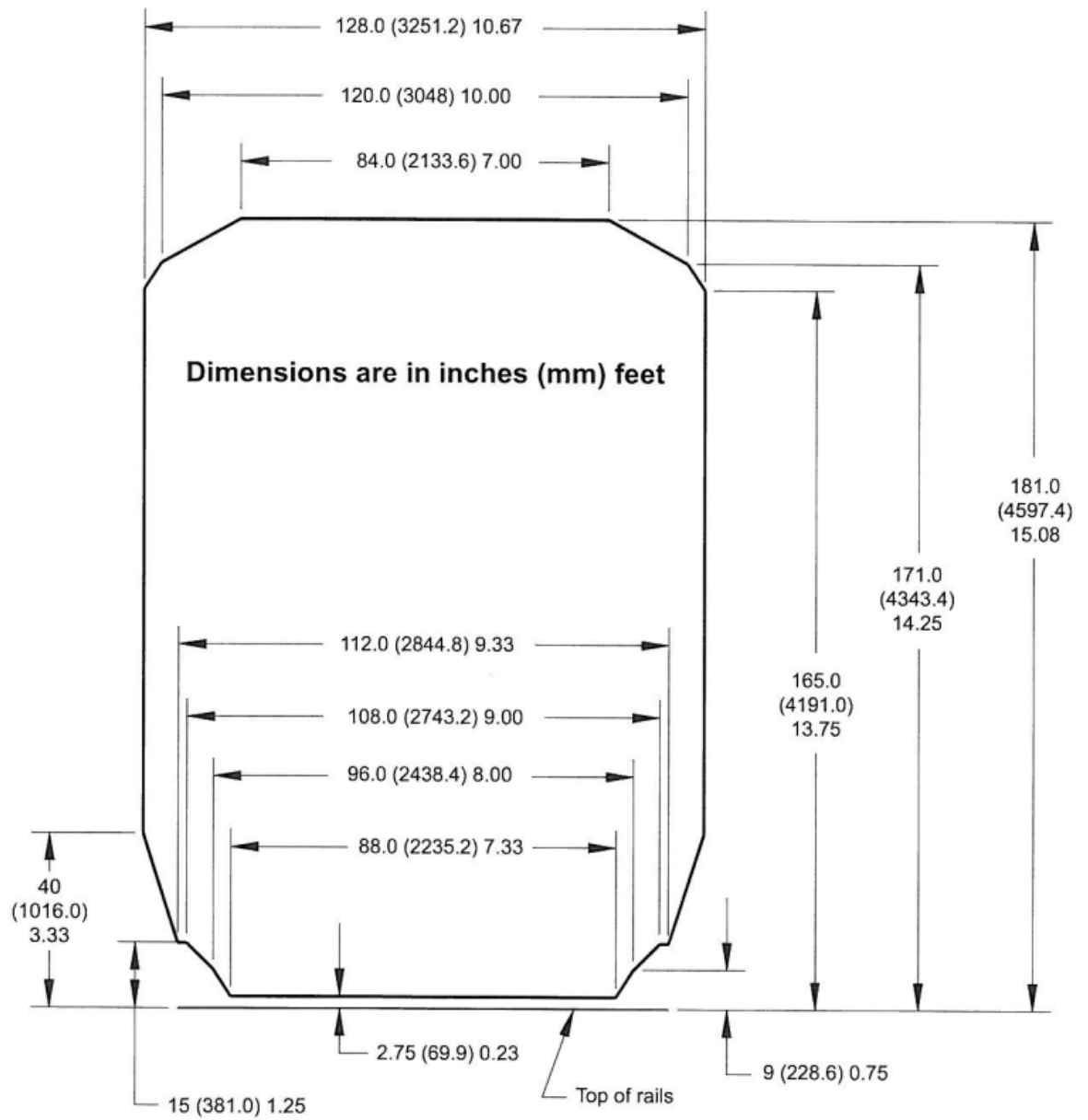
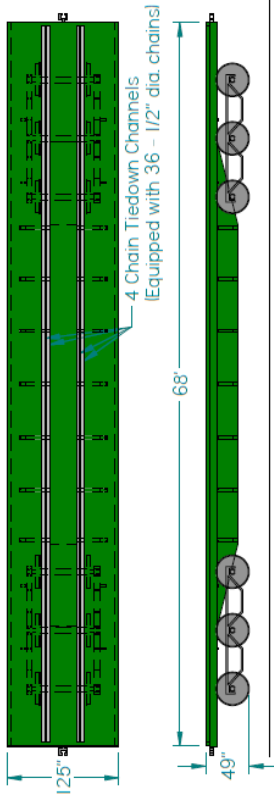


Figure 2. AAR outline diagram of single loads, without end overhang, on open-top cars (AAR diagram).

UNCLASSIFIED

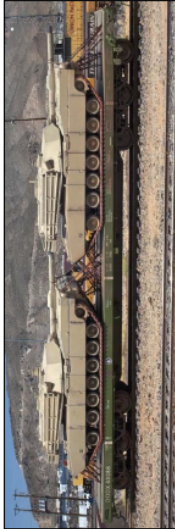


DODX 40000 SERIES

Metal Deck

Capacity: 298,000 lbs

Typical Load: Two Abrams Tanks, Other wide or heavy tracked vehicles such as M88s, Bradleys, etc.

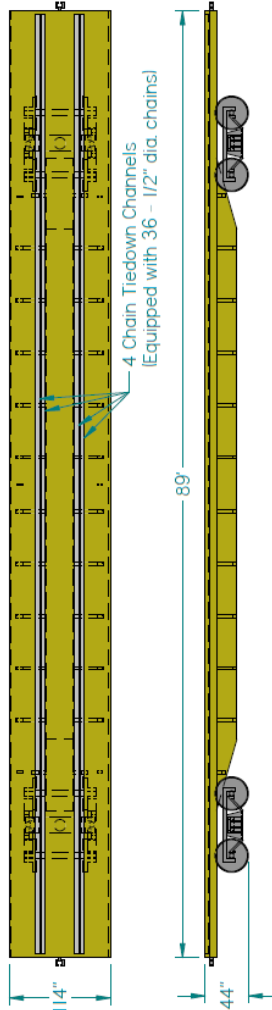
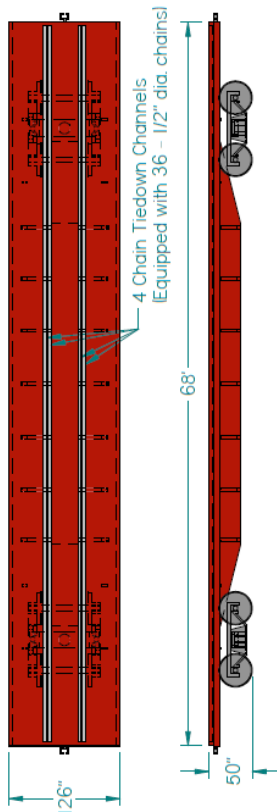


DODX 41000 SERIES

Metal Deck

Capacity: 180,000 lbs

Typical Load: Single Abrams Tanks, Other wide or heavy tracked vehicles such as M88s, Bradleys, or Tracked Construction Equipment



DODX 42000 SERIES

Metal Deck

Capacity: 164,000 lbs

Typical Load: Wheeled Vehicles, Long system equipment, PLS/HEMTTs coupled with trailer, etc.



Notes:

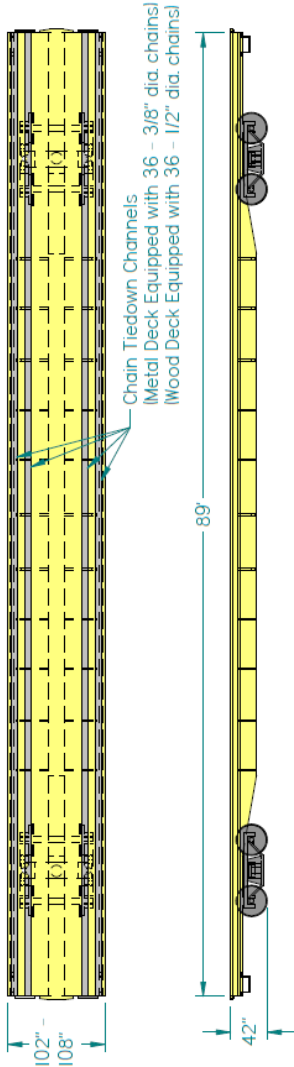
- DODX Flatcars have no above deck obstructions (i.e. hand rails and/or side rub rails) that make them ideal for circling loading vehicles onto them to support more rapid deployments.
- Only the DODX 40000 and 41000 series cars can move the Abrams tanks. No standard commercial flatcars have the capacity to move our modern Abrams tanks.



Military Surface Deployment and Distribution Command

TITLE	
DOD & Commercial Flatcars	
SIZE	DWG NO
B	
REV	
FILE NAME: Flatcar Reference rev2.dft	
SCALE: 1/2"=1' WEIGHT: N/A SHEET 1 OF 3	

UNCLASSIFIED



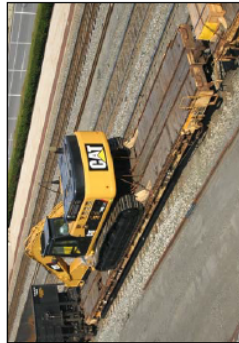
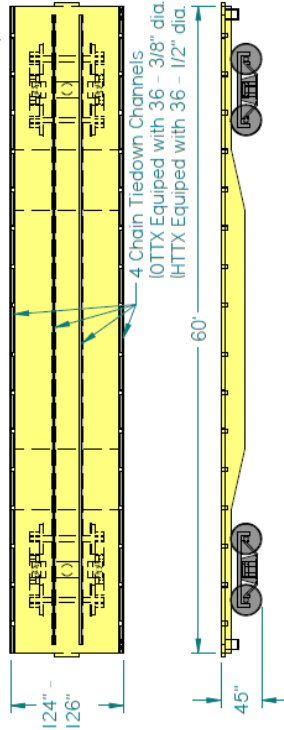
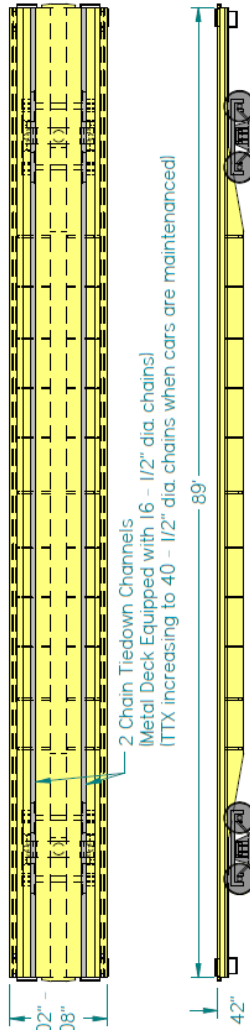
ITTX

Metal Deck with Side Rub Rails
Capacity: 140,000 lbs
Typical Load: Wheeled Vehicles, Long equipment, prime movers coupled to trailers, etc.
Wood Deck (No Side Rub Rails)
- Four chain tiedown channels
"Side rub rails prohibit loading of vehicles with wheel track wider than 100 inches.



ITDX

Metal Deck
Capacity: 140,000 lbs
Typical Load: Wheeled Vehicles, Long equipment, prime movers coupled to trailers, etc.
"Side rub rails prohibit loading of vehicles with wheel track wider than 100 inches.



Wood Deck
OTTX Capacity: 144,000 lbs
HTTX/TPAX Capacity: 146,000 lbs
Typical Load: Wide or heavy tracked vehicles such as M88s, Bradleys, or Tracked Construction Equipment.

OTTX/HTTX/TPAX

Notes:

- Commerical TTX flatcars have above deck obstructions (i.e. hand rails and/or side rub rails) that limits which vehicles can be circus loaded on them.
- No standard commercial TTX flatcars have the capacity to move our modern Abrams tanks.



Military Surface Deployment and Distribution Command

TITLE

DOD & Commercial Flatcars

SIZE DWG NO

REV

FILE NAME: Flatcar Reference rev2.dft

SCALE: 1:125 WEIGHT: N/A SHEET 2 OF 3

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UNCLASSIFIED

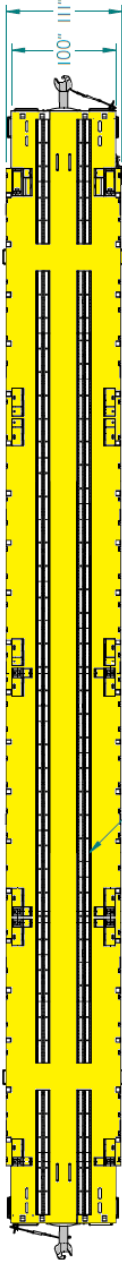
TPDX

Metal Deck

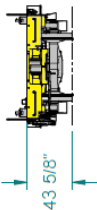
Capacity: 200,000 lbs

Typical Load: Wheeled Vehicles,
Long equipment, prime movers
coupled to trailers, etc.

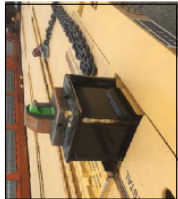
"Raise hand holds prohibit loading
of vehicles with wheel track wider
than 100 inches.



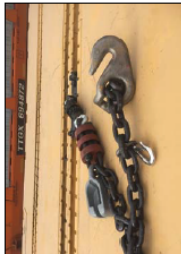
4 Chain Tiedown Channels
(Equipped with 40' - new 1/2" dia. chains)



"TPDX cars have raised
handholds on opposite corners
of the railcar. Ensure vehicles
with central tire inflation
systems clear the raised
handholds during circus style
loading operations.



TPDX cars interbox connectors
to secure up to four 20 ft ISO
containers



TPDX cars have new 1/2" chains



Military Surface Deployment and
Distribution Command

TITLE		
DOD & Commercial Flatcars		
SIZE	DWG NO	REV
B		
FILE NAME: Flatcar Reference rev2.dft		
SCALE: 1:125 WEIGHT: N/A SHEET 3 OF 3		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES

UNCLASSIFIED

- **OCONUS**

Rail transport in Europe is more important to military planners because military equipment is predominant, and the rail network is extensive in the region. Korea also has a standard-gauge rail network. The three rail clearance diagrams or envelopes of greatest interest are **the Gabarit International de Chargement (GIC)**, **NATO Envelope M**, and the **Korean clearance diagram**. (See below)

The GIC applies to rail lines in Europe. Equipment that is mounted on 51.4-inch high railcars and is within the limitations of the GIC diagram or envelope will be capable of essentially unrestricted movement worldwide on standard-gauge rail lines.

Envelope M applies to rail lines in NATO countries on the European continent. Envelope M provides for preplanning for rail movement of equipment exceeding the GIC. Measurements and equipment sketches are completed before the first rail movement to support planning for future movement. The equipment Envelope M rail network is not as extensive as the GIC equipment network. If equipment exceeds Envelope M, it may require special routing and provisions. This may result in deployment delays during crisis contingencies. This may result in deployment delays during crisis contingencies.

STANAG 2175 that used to define ordinary and exceptional rail transport has been withdrawn and has been replaced with AMovP-4(A) - The Technical Aspects of the Transport of Military Materials by Railroad. This document was developed to provide one allied publication to document the procedure and all technical rules applicable to loading/unloading and transport of military equipment on railway wagons.

Military vehicles for rail transport in Allied NATO countries must consider the following:

- The size and capacity of the flat wagons.
- The axle or bogie load distribution of the wagon, its ratio cannot exceed 2/1 for a non-bogie wagon, and 3/1 for a bogie wagon in the longitudinal direction while staying under the maximum load per axle. The ratio of 10/8 must also not be exceeded in the lateral direction between the wheels of a same axle.
- The width of the equipment. The usable loading width determines the supporting width of the equipment. If it is tracked equipment on double

rollers, the outer half of each track must be for at least 65mm on the wagon floor. If it is tracked equipment on single rollers, its tracks must be for at least $\frac{2}{3} + 15\text{mm}$ of its width on the wagon floor. Tires of wheeled vehicles must in principle stand completely on the wagon floor.

- Fitting within Loading gauges/envelopes. The loaded flat wagon must definitely fit inside the loading gauge or envelope as defined by the Forces.

Items of equipment that do not meet GIC diagram clearances may still be transported on the major NATO rail lines provided they meet Envelope M.

The **Korean clearance diagram** applies to the rail line in the Republic of Korea (ROK), also known as South Korea. As with Envelope M, equipment exceeding the diagram may require special routing and provisions resulting in deployment delays.

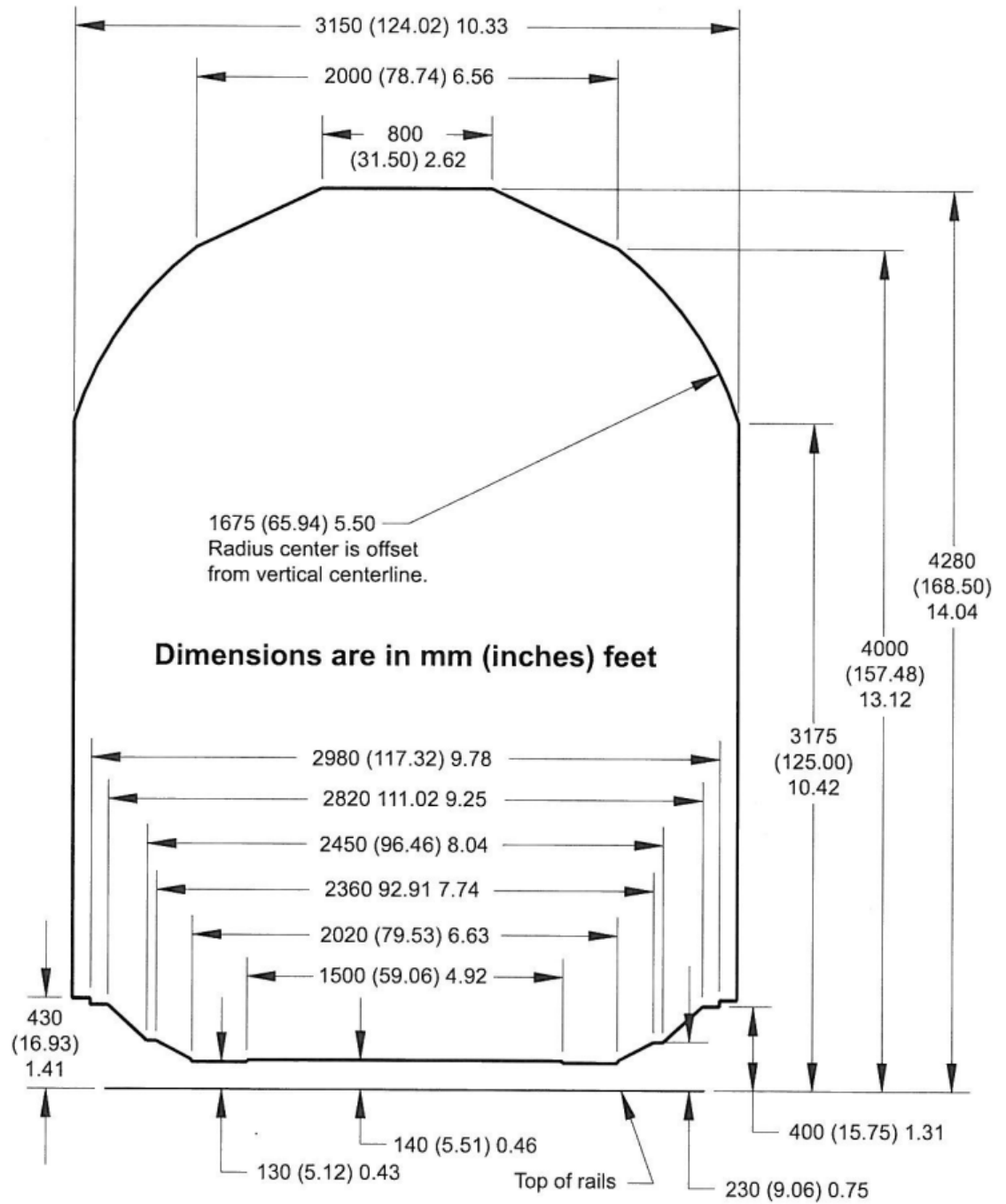


Figure 6. GIC Diagram.

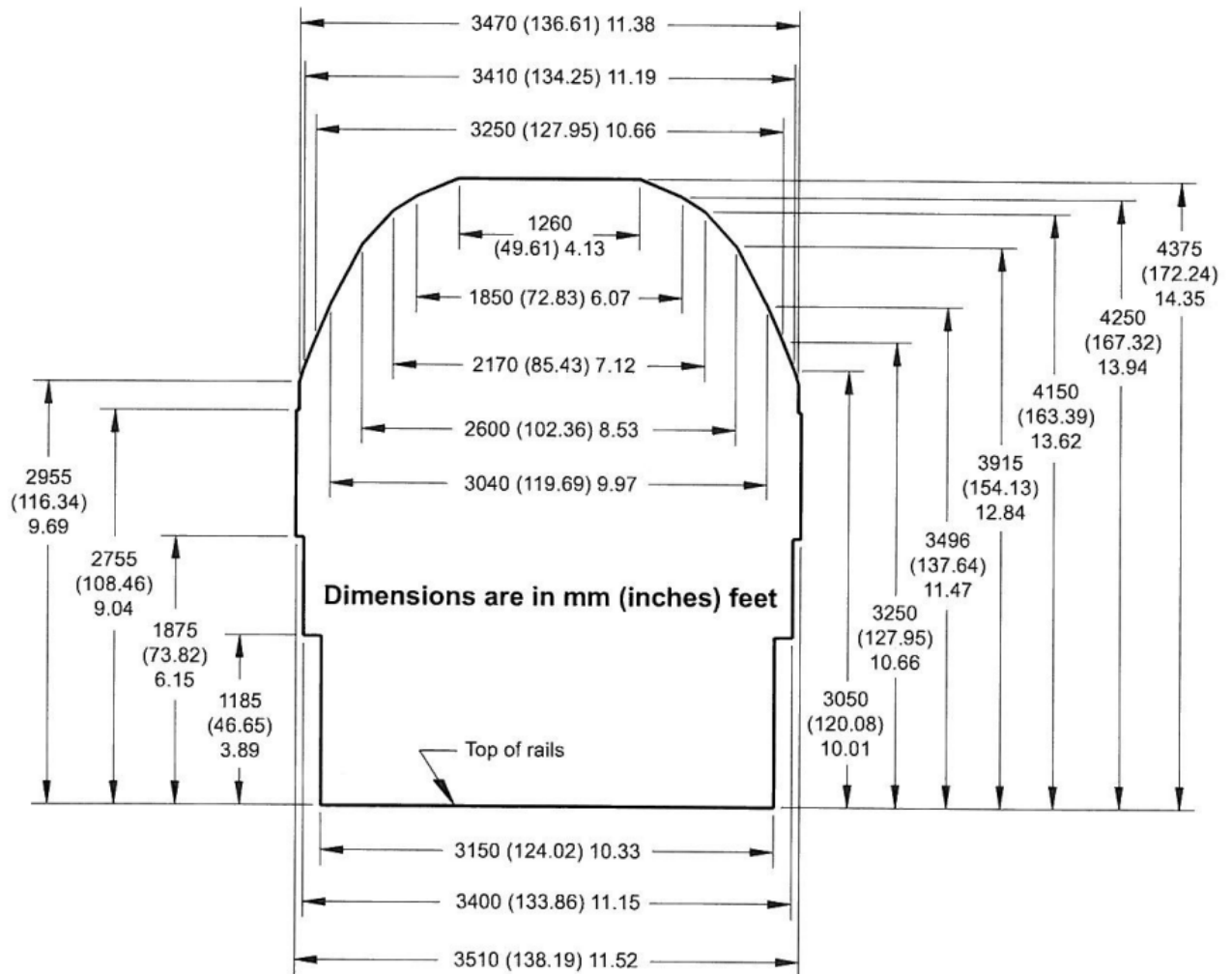


Figure 7. NATO Envelope M (formerly Envelope B).

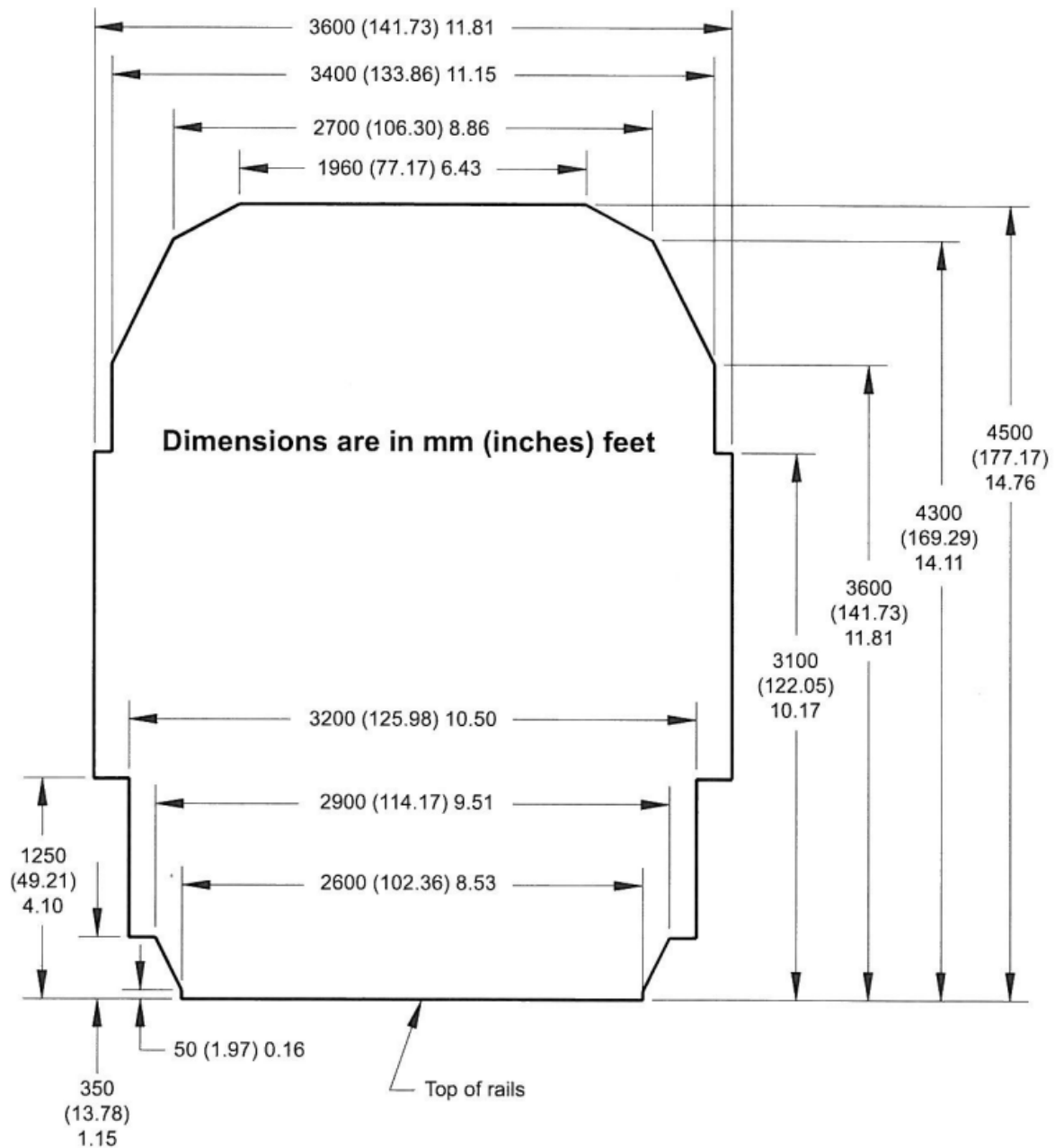


Figure 8. Korean clearance diagram.

- **Nylon Tiedowns**

Why nylon tiedowns are not acceptable for CONUS transport.

A description and comparison of the rail transport shock environment in US (North America), Europe, and Korea.

29 September, 1998

- Purpose: To explain why the shock level in CONUS precludes the use of nylon straps as tiedowns for rail movement (and a cursory look at other factors).
- Facts: The shock environment is more severe in North America than in Europe because of several factors:
 - Railcars in North America use automatic couplers while in Europe railcars are linked together manually. Automatic couplers tend to encourage impacts to ensure engagement of the coupler mechanism. The railroad companies admonish their employees not to impact cars faster than 4 mph, but higher impacts sometimes occur. (The Association of American Railroads (AAR) impact test, used to verify the safe loading procedures for most commodities, calls for impacts of 4, 6, and 8 mph and then 8 mph in the opposite direction. Military vehicles must pass the MIL-STD-810 version of the AAR test to receive transportability approval.)

The automatic couplers are attached to the car frame through a draft gear that may be standard or cushioned. While the division between standard and cushioned is travel of less than 5 inches for standard and greater than 5 inches for cushioned, standard draft gear travel is usually about 2 to 3.5 inches and cushioned is 9 to 15 inches. The draft gear provides shock mitigation in both buff (compression) and draft (tension) but also adds slack to a train. Slack is the difference in length of a train between being bunched together and being stretched out.

The European cars do not have automatic couplers. Instead, the European cars are coupled by hand using a turnbuckle-like device that draws the cars together. European cars have buffers, one at each corner on the ends, which are pulled together and compressed by the coupling device. This arrangement limits the slack in European trains. The Korean railroad uses automatic couplers similar to those in North America, but the flatcars are typically loaded and unloaded as a unit train, so the cars are not as likely to be uncoupled and coupled as in North America.

- Railroads in North America operate significantly longer trains than in Europe. The longer trains combined with the major difference in coupling systems lead to higher shocks in moving trains. As a train goes up and down hills, accelerates, and applies the brakes, the slack runs in and out propagating shocks as the cars rapidly change velocity. In some areas of North America,

trains are limited to 60 cushioned cars because of the severity of the shocks produced by the terrain and the slack. Those cushioned cars are typically used for military moves. For other operational reasons the railroads would run trains of over 100 cars. We believe European trains usually consist of 20 to 40 cars. Korean trains are typically limited to 22 cars due to the length of passing sidings, so in-train shocks due to slack would be significantly less than in North America.

- Heavier loads are transported on trains in North America. Allowable axle loads in North America are roughly twice as high as those in Europe and Korea. That means that the mass (weight) of each car in North America may be significantly higher than in Europe or Korea, therefore, contributing to higher shock levels. This is true of military trains, since a North American 89-foot car will hold more vehicles than a typically used European 61-foot (18 500-mm) flatcar with the same number of axles. Korean cars are shorter than North American cars, also having the effect of lowering the total mass of a train.
- Hump operations can cause severe shocks. A hump is a hill down which cars are allowed to roll into one of multiple tracks and is used to sort cars based on destination. Several humps do exist in Europe. Perhaps, the biggest difference is that in North America the cars are expected to couple and in Europe excess impact could cause the cars to bounce apart.
- The distances traveled by rail in North America are vastly greater than those in Europe and Korea, therefore, the cumulative effect of shocks is greater.
- Most of the flatcars that the military uses in North America are equipped with integral tiedown chains (and cushioned draft gear). Because the chains are available and compare favorably with nylon straps for ease of application, nylon straps would not be economically justified in North America. Wire rope tiedown for vehicles in North America has virtually disappeared, leaving only the threat of use in the case of a general deployment, which may bring plain, non-chain-equipped flatcars back into military use. In Europe and Korea the shipper provides tiedown materials.
- Nylon straps have been used (though not officially recognized nor approved by the AAR) as secondary cargo tiedown in the beds of trucks transported by rail in North America. The rail officials in North America (AAR) are worried about stretching,

cutting, ultraviolet degradation, and theft while still in use, leaving cargo unsecured. Therefore, they are not inclined to approve the use of nylon straps.

- Since no AAR rules exist governing the use of nylon straps, the widespread use of nylon straps for rail tiedown would require changes to the AAR rules. The rules for loading flatcars are written and maintained by the Open Top Loading Rules Committee of the AAR, and all North American railroads accept these rules for unrestricted interchange. The military is bound to follow these rules in order to procure railroad transportation. When the military needs a rule change or a new rule, the request should be sent to the DOD-AAR Representative for coordination with the AAR. We would expect rail impact testing and extensive over-the-road testing would be required to support a change in the AAR rules.
- For more information, contact the DOD-AAR Representative at usarmy.scott.sddc.mbx.tea-dpe@mail.mil.

- **Rail Tiedown Lessons Learned**

1. Date Added: 8/30/2014

Issue: During circus loading of wider vehicles on commercial railcar, wheels can catch on hand hold rails that extended above the top of the deck on the sides of the flatcars.

Picture:



Resolution: Be advised of above deck obstructions prior to circus loading when using commercial flatcars. Have drivers/spotters aware of hand holds that stick above the deck on the sides of flatcars for wider loads. Use commercial flatcars with hand holds for narrower vehicles to help avoid damage to vehicles during loading and unloading operations.

2. Date Added: 8/30/2014

Issue: Unarmored wheeled vehicles that weigh over 40,000 lbs were secured with 3/8" chains. Chains were also not applied at 45 degrees.

Picture:



Resolution: Unarmored wheeled vehicles are NOT permitted to use 3/8" chains once vehicles exceed 40,000 lbs according to AAR OTLRs Section 6 Figure 88B. IF the vehicle was 40,000 lbs, it would require 12 chains instead of the 8 chains shown. Additionally, the M1070 tractors shown have a specific page in TEA MI-19, 8th Edition, page A-8 which states to use only 8 of the 1/2" chains. Additionally the chains need to be applied at 45 degrees per TEA MI-19, page 5, Figure 2.

3. Date Added: 7/1/2014

Issue: Door was not properly secured, swung open during rail transport and struck a bridge.

Picture:



Resolution: This was primarily an issue with up-armored PLS and HEMTT vehicles but this occurred on an unarmored vehicles as well. A SDDC Customer Advisory (CA-12-05/07-

0082) has been issued and recommends securing doors on retrograde vehicles with web straps. Web straps need to be at least 10,000 lbs breaking strength straps. Appears straps have worn on edges in route and failed and doors therefore open in route. Suggest using edge protectors on all edges when using straps.

4. Date Added: 6/25/2015

Issue: Secondary Loads for rail transport are possible, but unlikely because many conditions need to be met.

Picture:



Resolution:

In general, there are four things to consider:

1. Has the vehicle or trailer been tested and approved to carry a payload for rail transport?
2. Is the secondary cargo or vehicle within the approved payload capacity of the vehicle or trailer?
3. Can the secondary cargo be adequately secured to the primary vehicle or trailer?
4. Is the load on the vehicle or trailer still within the transport envelopes required?

See [OTLR Section 6, Appendix A](#) for more information.

5. Date Added: 6/25/2015

Issue: The HIPPO (Load Handling System Compatible Water Tank Rack System) does not have holes in the frame to allow it to accept the PLS/LHS (Palletized Load System/Load Handling System) transport pin.

Picture:



Resolution:

The HIPPO Water module is **only approved** to be rail transported when empty or full on a COFC (Container on Flatcar) or DODX railcar using the 20ft ISO locks.

- The HIPPO cannot be transported by rail while on a PLS/LHS truck or trailer.
- The HIPPO on PLS/LHS truck or trailer has not passed a rail impact test.
- The Program Office clarified that the HIPPO only has a requirement for rail transport on a COFC.

6. Date Added: 6/25/2015

Issue: Tank skirts got loose, swung out, and damaged side train signals.

Picture:



Resolution:

Replace six spring locking pins on the end of the skirt mounting pins with approved anti-pilferage seals.

1. The approved anti-pilferage seals for purchase are identified as NSN 5340-01-260-9935 and cost roughly \$2.00.

2. Ensure vertical skirt hinge pins are present and secure.
3. Ensure the bolt on the swing latch on skirt one is tensioned properly.
4. See TMs 9-2350-264-20-1-1 or 9-2350-388-23-1-2 for more details.

More details can be found in TEA MI-19, page B-14.

7. Date Added: 3/31/2016

Issue: Recently trailers and towed howitzers have been lost off the side of the flatcars during circus loading.

Picture:



Resolution:

Below is the Railway Operations Safety Tips of the Month for March 2016. Also listed are the width specifications on railcars that are used to deploy our Soldiers.

1. Ensure a thorough safety brief is conducted and ensure all Soldiers understand the risk involved.
2. Ensure all drivers are certified and experienced on the equipment.
3. Ensure the last railcar is chalked to prevent movement.
4. Ensure spanners are properly positioned and secure.
5. Ensure there are a minimum of three ground guides present. One on the railcar ahead of movement and one on each side observing the spanners.
6. Never move a vehicle without ground guides present.
7. Ensure that the railcar is wide enough for the equipment being loaded.
8. If the prime mover is narrower than the towed equipment ensure that the spanners are repositioned to accommodate the wider equipment.

Railcar Widths:

DODX 40000's - 10' 5" or 10' 3"

DODX 42000's - 9' 6" or 9' 4"

DODX 41000's - 10' 6"

HTTX - 10' 4" or 10' 6"

ITTX - 9' 0"

TTX - 10' 4" or 10' 6"

TTDX - 8' 6" or 9' 0"

8. Date Added: 2/28/2017

Issue: Improper spotting of flatcars caused wheel damage to military vehicles. Commercial flatcars can have above deck obstructions (side rub rails, raised hand holds, etc.) that need to be accounted for when planning a rail movement. Commercial flatcars that were ordered for lighter/smaller vehicles but were improperly spotted close to the rail loading ramp and numerous vehicles were damaged rolling over these narrower cars with side rub rails.

Picture:



Resolution:

The narrower flatcars can be spotted together behind one ramp. If that is not practical, the narrow cars can be spotted the farthest away from the rail loading ramp. Wider flatcars without obstructions should be next to the ramp.

MI-19, 8th Edition states under Section XII. Practical Tips:

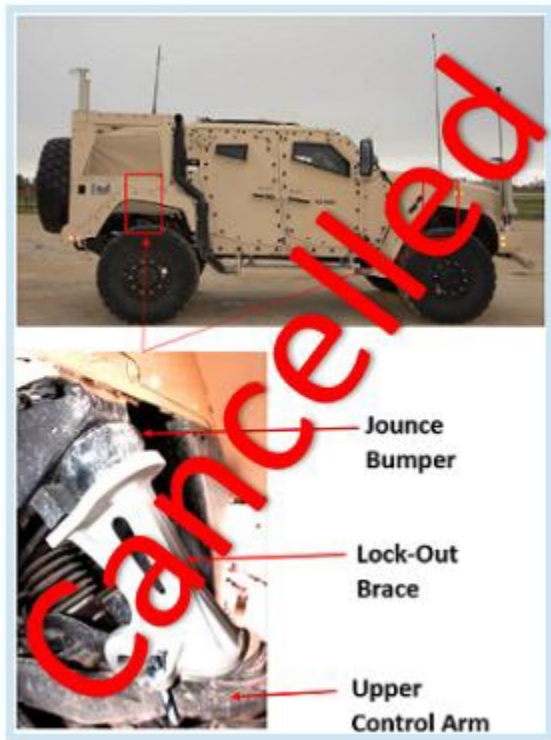
D. Ramp Spotting Guidelines for Loading

3. Some commercial flatcars have side sills, handholds, and so forth, that project above the deck. These hinder loading and may prevent loading these flatcars with central tire inflation system (CTIS) vehicles. Flatcars without projections above the deck should be placed next to the ramp, so that CTIS vehicles can be loaded on them without being damaged.

9. Date Added: 8/28/2019

Issue: The JLTV suspension lock-out braces shall no longer be utilized.

Picture:



Resolution:

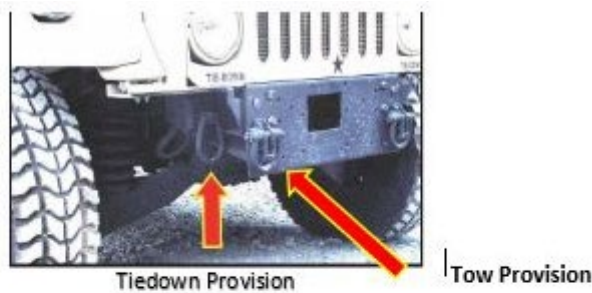
As of January 2021 the JLTV **NO LONGER** requires suspension lock-out braces between the upper control arms and the jounce bumpers at each corner of the vehicle suspension (4 total) prior to tiedown for rail transport. These Lock-Out braces should not be used for rail transport as further testing has shown that the JLTV can be transported safely without the brace. Four 1/2 inch chains are required for JLTV's up to 17,500 lbs and eight 1/2 inch chains are required for JLTVs over 17,500 pounds. Refer to Open Top Loading Rules, Section 6, Figure 88K for more details:

https://my.aar.org/OTLR/Documents/Section%206/Section6p2Fig88-K_20210323.pdf

10. Date Added: 9/24/2021

Issue: HMMWVs being tied down using tow hooks for tiedown provisions instead of the pear-shaped provisions.

Picture:



HMMWV Passenger Front View



HMMWV Passenger Rear View

Resolution:

The HMMWV has front pear-shaped tiedown provisions located behind the front bumper used to secure the vehicle for transport. There are older HMMWVs still in the field that do not have these pear-shaped tiedown provisions. For those older HMMWVs, use the tow hook for tiedown securement. If the pear-shaped provision is on the vehicle, use it for tiedown securement. The misuse of the tow hook is a common mistake when affixing chains on HMMWVs that are shipped out of installations and a quick check behind the bumper can save rework time for the tiedown crew. **Caution: If the tow provisions are used for rail transport, the provisions may deform or become damaged.**

The HMMWVs rear pear-shaped tiedown provisions are located on the rear bumper, but should not be confused with the rear lift provisions. The lift provisions are located on the side of the bumper as shown and are not used for tiedown.

11. Date Added: 10/6/2021

Issue: M967A2 and M969A3 5,000 gallon Fuel Semitrailers utilizing wood stanchions have failed during rail transport. When the wood stanchion fails, it causes the chains to go slack

resulting in a dangerous load that is unsecured on the railcar. If the train operators notice this happening, the train is stopped until the load is secured properly

Picture:



Resolution:

The 5,000-gallon Fuel Tanker Semitrailers are not approved for transport with wood stanchions. The M967A2 and M969A3 are approved for rail transport coupled to a prime mover tractor or in a trailer-on-flatcar (TOFC) coupled to the center of the rail car's stanchion configuration.

Wood stanchions are NOT approved for use on steel deck railcars since wood stanchions cannot be nailed down and secured to steel deck cars. The wood stanchions therefore can shift and come free from the railcar. Approved and tested trailer landing legs or TOFCs are needed to support uncoupled trailers for rail movement.

With the tanker coupled to a prime mover, utilize 12 chains on a full trailer, 3 for each provision. If the trailer is empty, utilize 8 chains on the trailer, 2 for each provision. Use 8 chains total to secure the prime mover 2 for each provision, whether the trailer is full or empty.

When the fuel semitrailer is shipped TOFC, it is secured by locking the kingpin into the fifth-wheel assembly of the railcar with no chains. The fuel semitrailer cannot exceed 39,150 pounds in order to use a TOFC.

If the tanker is to be transported with fuel then the tanker must have a Federal Railroad Administration (FRA) Approval per Title 49 Code of Federal Regulations (CFR) 174.61 and 174.63.

If there are questions regarding the tiedown of military equipment, please contact SDDC TEA

Questions

For questions or more information, please contact the DoD AAR (Association of American Railroads) representative at usarmy.scott.sddc.mbx.tea-dpe@mail.mil or by phone 1-800-722-0727.

AAR Open Top Loading Rules

To view and download the Association of American Railroads Open Top Loading Rules, Section 6 - Military Materiel, click [here](#).