GAO

Requested by the Chairman and Ranking Minority Member, Energy and Commerce Committee, House of Representatives

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RAILROAD SAFETY

DOD Can Improve the Safety of On-Base Track and Equipment

GAO

Report to the Chairman, Committee on Energy and Commerce, House of Representatives

June 1991

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DOD Can Improve the Safety of On-Base Track and Equipment

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Economic Development Division

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The Honorable John D. Dingell
Chairman, Committee on Energy
and Commerce
House of Representatives

Dear Mr. Chairman:

In response to your request, this report addresses the safety of rail equipment owned by the Department of Defense, some of which is used exclusively within military installations and some in regular commercial service. It also addresses the condition of track systems on military installations and the manner in which ammunition and explosives are secured on rail cars for on-base movement.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, we will send copies to interested congressional committees; the Secretary of Defense; the Secretary of Transportation; and the Director, Office of Management and Budget. We will also make copies available to others upon request.

This work was done under the direction of Kenneth M. Mead, Director, Transportation Issues, who can be reached on (202) 275-1000. Other major contributors are listed in appendix III.

Sincerely yours,

J. Dexter Peach
Assistant Comptroller General

Executive Summary

Purpose

The Department of Defense (DOD) owns locomotives and rail cars that are used to haul ammunition, explosives, or other hazardous material. The safe transport of this material both on military installations and over commercial railroads is critical to protect military personnel and property and the public. Concerned about railroad safety, the Chairman, House Committee on Energy and Commerce, asked GAO to determine the overall condition of DOD's rail equipment, track, and operations in relation to the Department of Transportation's (DOT) safety regulations.

Background

DOT's Federal Railroad Administration (FRA) regulates rail equipment and operations in the commercial rail sector. FRA's regulations define minimum standards for equipment and track that are designed to ensure safety under commercial operating conditions. When transporting hazardous materials, cars operating in commerce must also comply with safety requirements established by DOT's Research and Special Programs Administration (RSPA) to, among other things, reduce fire hazards and cargo shifting.

DOD has two rail fleets—"on-base" equipment that never leaves a military installation and "interchange" equipment that is used in commercial service. The on-base fleet consists of 376 locomotives and 4,756 rail cars assigned primarily to 27 Army and 6 Navy installations that produce, maintain, and store hazardous material, including ammunition and explosives. The interchange fleet consists of 2,056 rail cars (no locomotives) that move throughout the country on commercial railroads. Although DOD's interchange cars must comply with FRA and RSPA safety standards, the on-base equipment does not come under FRA's or RSPA's jurisdiction. However, Army and Navy track regulations incorporate FRA track standards. At GAO's request, FRA used its safety standards to inspect a sample of on-base rail cars that carry hazardous material and selected track at seven military installations. Information on inspection and repair of interchange cars was obtained from a DOD data base rather than by physically examining cars. (See ch. 1.)

Results in Brief

A significant number of DOD's on-base cars used for hauling hazardous material do not comply with one or more of FRA's or RSPA's safety standards. FRA officials said that, for the most part, the defects did not pose a serious safety risk because of the reduced stresses experienced by on-base equipment, compared to those experienced during commercial operations. GAO believes that DOD could enhance safety by correcting several types of defects. In particular, improvements are needed in

safety appliances (such as handholds and steps), components to reduce fire hazards, and brake system tests. Currently, DOD does not have safety standards in these or other areas.

GAO also determined, with FRA assistance, that track was generally safe, but that track maintenance and inspection frequency did not comply with FRA standards that have been adopted by Army and Navy. Furthermore, Army does not have adequate procedures for securing hazardous material for on-base movement by rail.

In contrast to the on-base fleet, DOD maintains its interchange fleet comparably to cars in the commercial sector. Although FRA has cited DOD cars for defects over the last 6 years, FRA officials said that DOD's record was comparable to similarly sized commercial fleets.

Principal Findings

DOD Cars Are Generally Safe, but Greater Safety Is Possible

DOD on-base rail equipment operates under less stressful conditions than commercial equipment (speeds of 25 miles per hour or less, distances of 1 to 15 miles, and only a few cars per train). Because of these conditions, FRA officials said that on-base equipment is generally safe, even though GAO estimates that 68 percent (± 30 percent) of the cars carrying hazardous material at 33 installations had at least one defect (variance from the standards). In addition, all 24 locomotives that were examined did not comply with one or more standards. These variances from the standards must be viewed in context, however, because many of the standards are designed for operations more rigorous than those experienced by DOD's on-base fleet.

Even under the less stressful on-base operating conditions, safety would be enhanced if DOD followed certain minimum standards applicable to safety appliances, brake systems, and components to protect against fire hazards. However, DOD has not developed overall standards to ensure safe operation and maintenance of its on-base fleet.

Safety appliances are devices that allow train personnel to safely mount, dismount, and uncouple rail cars. GAO estimates that 37 percent (± 33 percent) of the DOD cars at 33 installations do not meet FRA safety

appliance standards. FRA officials said that compliance with the standards for uncoupling levers, end handholds, and sill steps with corresponding handholds is necessary to ensure crew safety under DOD's on-base operating conditions.

FRA standards require that brakes be periodically cleaned, oiled, and tested to ensure that they will operate properly and that the date of the test be stenciled on the cars. GAO estimates that, at the seven installations visited, 42 percent (± 2 percent) of the cars had brake system defects, most involving testing and stenciling requirements. FRA officials said that DOD should comply with brake system standards to ensure that trains can always be stopped.

Cars that transport the most dangerous explosives (class A) in the commercial sector must be equipped with certain components to reduce potential fire hazards. DOD does not have a policy requiring such equipment for on-base cars and has not determined whether class A explosives can be moved safely on-base without it. Both FRA and RSPA officials said that DOD's cars should have one safety component—spark shields—to protect against fire hazards. GAO estimates that less than 30 percent of the cars at six of the seven installations visited had these devices.

RSPA also requires that hazardous material be secured (blocked and braced) to prevent movement during commercial transport. Although DOD does not have a policy for securing hazardous loads for on-base movement, Army and Navy require such loads to be effectively secured. Navy provides detailed blocking and bracing instructions, and all the loaded Navy cars GAO examined were properly secured. Army does not provide detailed loading instructions to its installations. One of the three Army installations that GAO visited did not secure hazardous cargo in any manner, and one of three loads GAO examined at this installation had shifted dangerously. Furthermore, none of the seven installations verified that hazardous materials were properly secured.

Army and Navy officials believe that on-base cars are safe because the fleet operates under less stressful conditions than commercial equipment. Nevertheless, both plan to upgrade their aging on-base fleets to conform to FRA and RSPA requirements, but this may take as long as 10 years for Navy and 17 years for Army. (See chs. 2 and 3.)

Track Safety Can Be Improved

Army and Navy data identified track defects as the most common cause—76 percent—of on-base train accidents. FRA inspectors found that track conditions were adequate for posted speed limits but that routine preventive maintenance was generally not performed. Some defects, such as chipped or broken rails and excessive distance between rails, were serious. GAO also found that inspection frequency was less than required by FRA standards that have been adopted by Army and Navy. Army and Navy officials said they do not have the funds or staff to inspect and maintain track to meet the requirements. (See ch. 4.)

Maintenance of Interchange Fleet Comparable to Commercial Cars

DOD's interchange cars, like other commercial cars, must comply with FRA and RSPA regulations. By requiring safety inspections before accepting a car for transport, FRA holds commercial rail carriers rather than owners, such as DOD, responsible for ensuring car safety. However, DOD has established a program to inspect, maintain, and repair its cars to ensure that they comply with federal regulations. Although GAO found that some of the cars were overdue for FRA-required tests, only four cars were operated in commercial service after the due dates had passed. In addition, over the last 6 years, FRA inspections identified safety defects on DOD cars. According to FRA officials, DOD's record was about average compared to similarly sized commercial fleets. (See ch. 5.)

Recommendations

To ensure that DOD's on-base rail equipment is operated and maintained in a safe manner, GAO recommends that the Secretary of Defense (1) develop and implement DOD-wide equipment standards that ensure safety under on-base operating conditions, (2) determine the specific equipment needed to reduce fire hazards and require that all on-base cars transporting ammunition and explosives have such components within a reasonable period of time, (3) implement procedures to verify that hazardous cargo is properly secured, and (4) ensure that track maintenance and inspection frequency are consistent with FRA's requirements.

Agency Comments

As requested, GAO did not obtain official comments on this report. However, GAO discussed the facts in this report with DOD, Army, Navy, and FRA officials, who generally agreed with the findings, and has included their comments where appropriate.

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Abbreviations

AAR	Association of American Railroads
AMCC	Army Armament, Munitions and Chemical Command
DOD	Department of Defense
DOT	Department of Transportation
FRA	Federal Railroad Administration
GAO	General Accounting Office
MTMC	Military Traffic and Management Command
RSPA	Research and Special Programs Administration

Introduction

The Department of Defense (DOD) owns and operates rail equipment on 144 military bases in the continental United States. DOD's on-base fleet consists of 4,756 cars and 376 locomotives that operate on about 4,500 miles of track. On-base operating conditions generally include slow speeds (25 miles per hour or less), small trains (usually only a few cars per train), and short distances (1 to 15 miles) traveled in a single trip. This equipment does not leave the bases to which it is assigned. Army and Navy have 97 percent of this equipment; the remaining 3 percent is assigned to the Air Force, Marine Corps, and Defense Logistics Agency.[1] No single DOD-level organization is responsible for safety, maintenance, or operation of on-base rail equipment. Rather, these functions exist within each military service at the service, command, or installation level.

Much of DOD's on-base rail equipment is located at Army and Navy installations that produce and/or store and issue ammunition and explosives. As of May 1990, 33 facilities involved in those activities had on-base rail equipment (see app. I, table I.1). The facilities were under the control of one of the following three commands: the Army Armament, Munitions and Chemical Command, the Army Depot Systems Command, and the Naval Sea Systems Command.

Although on-base equipment does not move off military property, the tracks at one installation we visited were located on a government-owned corridor that ran 12 miles between two segments of the installation. This 100-foot-wide corridor was often bounded by residential neighborhoods. The posted speed limit was 25 miles per hour. The tracks were in adequate condition for the speeds traveled, and security personnel blocked all road crossings with vehicles while the trains moved along the corridor.

DOD also has 1,344 flat cars, 667 tank cars, and 45 cars of other types (box, refrigerator, and caboose) that are hauled by rail carriers over commercial track. These cars are transferred from one carrier to another, or "interchanged," as they move to their destination. This interchange fleet supplements commercial rail cars and meets unique DOD shipping requirements. It includes unique pieces of equipment generally not available, or available in short supply, from commercial sources, such as specialized flat cars for military tanks. This fleet is managed by the Army Military Traffic Management Command for all of DOD.

[1]Henceforth, this report will address only the on-base rail equipment assigned to Army and Navy.

DOT Rail Safety Standards

Within the Department of Transportation (DOT), two agencies are responsible for regulating rail safety and the transport of hazardous materials by rail: the Federal Railroad Administration (FRA) and the Research and Special Programs Administration (RSPA), respectively. Under the Federal Railroad Safety Act of 1970, as amended, FRA regulates all areas of railroad safety. FRA's safety mission includes (1) establishing rules and standards; (2) inspecting track, signals, equipment, and operating practices; and (3) enforcing the rules and standards. Under the Hazardous Materials Transportation Act, as amended, RSPA is responsible for issuing regulations governing the transportation of hazardous materials. FRA enforces the RSPA regulations that apply to rail transportation.

Although FRA has the authority to do so, the agency has elected not to regulate cars and locomotives "operated solely on track inside an industrial or other non-railroad installation . . . ." This exclusion applies to all of DOD's on-base rail equipment but not to the interchange fleet, which must comply with FRA safety regulations. FRA took this position to use its limited resources for regulating the most serious safety problems. At the time, safety problems were most prevalent in the commercial rail sector.

Association of American Railroad Rules

The Association of American Railroads (AAR), an industry organization, facilitates the movement of rail traffic throughout North America, including the United States, Canada, and Mexico. Through its Rules of Interchange, AAR sets minimum standards for maintenance of rail cars that move from one railroad to another as they move across the country. The rules generally must be observed by all carriers and rail car owners that have signed an interchange agreement. All carriers and car owners who operate cars in interchange service, including DOD for its interchange fleet, are parties to this agreement.

Objectives, Scope, and Methodology

The Chairman, House Committee on Energy and Commerce, asked us to determine whether DOD's two rail fleets meet DOT safety standards and, if not, whether they are safe. For the on-base fleet, we determined the overall condition of equipment compared to FRA safety standards and whether equipment used to haul hazardous material met RSPA's requirements. To determine the standards that rail cars should meet to be considered safe, we examined FRA's rail safety regulations in the Code of Federal Regulations, Title 49, Chapter II, and RSPA's regulations for transporting hazardous materials by rail contained in Title 49, Chapter I, Subchapter C. We also reviewed DOD, Army, and Navy policies and

procedures for maintaining and managing rail equipment, maintaining track, and loading and moving hazardous materials. In addition, we interviewed FRA, RSPA, and AAR officials to clarify their standards and requirements and obtained their opinions on DOD's practices and procedures, as well as those of engineers at the DOT Transportation System Center who were developing a new railway operating handbook under contract with the Navy. Although considered a RSPA research organization, the Transportation System Center in this context was operating independently and its views were not representative of RSPA.

We met with and obtained information from officials at the Army Troop Support Command in St. Louis, Missouri; the Army Office of Chief of Engineers, Ft. Belvoir, Virginia; the Army Armament, Munitions and Chemical Command in Rock Island, Illinois; the Naval Sea Systems Command and the Naval Facilities Engineering Command in Washington, D.C.; and seven statistically selected installations (see table 1.1). We selected the Army and Navy fleets because those services had virtually all of the DOD on-base rail equipment.

Table 1.1: Seven Military Installations Reviewed by GAO

Name	City	State	Service	Type
Milan	Milan	TN	Army	Ammunition plant
McAlester	McAlester	OK	Army	Ammunition plant
Hawthorne	Hawthorne	NV	Army	Ammunition plant
Concord	Concord	CA	Navy	Weapons station
Earle	Colts Neck	NJ	Navy	Weapons station
Seal Beach	Seal Beach	CA	Navy	Weapons station
Crane	Crane	IN	Navy	Weapons supply center

To determine whether the on-base fleet complied with FRA safety standards, we

- examined DOD, Army, Navy, and command level policies and guidance with regard to FRA or other safety standards for on-base equipment;
- reviewed records maintained by Army and Navy fleet managers on age of the equipment;
- used Army and Navy data bases to identify the number, location, and cause of on-base rail accidents;
- determined current Army and Navy plans to upgrade and modernize the fleet; and
- inspected locomotives and randomly selected rail cars at the 7 installations with the assistance of 19 FRA inspectors.

Because we selected both the locations and the cars at each location statistically, we made estimates about all cars at the 7 locations as well as at the 33 installations in our universe. Our statistical methodology, which explains the possible sampling errors (plus and minus figures shown throughout this report), is in appendix I.

To determine whether on-base rail equipment and loading practices complied with RSPA requirements for hauling hazardous materials, we

- examined DOD, Army, Navy, and command level policies and guidance with respect to RSPA or other safety standards for rail movement (within and outside installations) of hazardous material, particularly ammunition and explosives;
- interviewed railroad operating personnel at the seven installations to determine whether the equipment was used outside the installation;
- inspected, with FRA's assistance, randomly selected rail cars at the seven installations; and
- inspected loaded cars to determine whether hazardous cargo was properly blocked and braced.

Finally, because Army and Navy rail accident data indicated that most accidents were attributable to track conditions, we asked FRA inspectors to examine the track at the seven locations to determine whether it was adequate for posted speeds.

With respect to the interchange fleet, we conducted our review at the Army's Military Traffic Management Command (MTMC), Falls Church, Virginia; and at the Eastern Area office, Bayonne, New Jersey. To determine whether the interchange fleet complied with FRA's safety standards, we

- examined DOD, Army, and MTMC policies and guidance with respect to FRA safety standards;
- reviewed records maintained by MTMC managers on the age of the rail cars;
- identified and tested MTMC's controls for ensuring that equipment meets FRA standards; and
- used FRA's equipment inspection data base to determine the frequency and nature of safety defects identified in DOD interchange cars.

To determine whether interchange rail equipment complied with RSPA safety standards, we

- established the types of cargo usually hauled in the cars;
- reviewed records maintained by MTMC managers dealing with car requirements established by RSPA;
- identified and tested MTMC's controls for ensuring that tank cars receive periodic tests required by RSPA; and
- used FRA's hazardous material inspection data base to determine the frequency and types of noncompliance with RSPA's hazardous materials shipping regulations found on DOD's interchange cars.

We also obtained information on whether the interchange fleet met the age requirements of FRA and AAR and whether certain periodic tests and procedures required by DOT, AAR, or MTMC were being conducted within prescribed intervals. We used automated data from the MTMC rail car tracking system as of September 19, 1990, rather than physically inspecting cars. We assessed the reliability of these data by comparing them with information in the case files for a probability sample of cars. Although we identified some discrepancies, we concluded that the data were sufficiently reliable to be used in this report. (See app. II for reliability assessment results.)

We discussed the facts in this report with DOD, Army, Navy, and FRA officials, who generally agreed with our findings, and have included their comments where appropriate. As requested, we did not obtain official comments on this report. Our work was performed from September 1989 through April 1991 in accordance with generally accepted government auditing standards.

DOD Cars Are Generally Safe, but Greater Safety Is Possible

DOD on-base cars and locomotives are not part of the general transportation system and, therefore, are not regulated by FRA. However, DOD has neither adopted FRA's safety standards nor developed its own uniform safety criteria. FRA inspections conducted at our request identified numerous safety defects on the equipment at seven military installations.[1] On the basis of that information and FRA's explanations of the seriousness of the defects, we believe that DOD rail equipment does not pose a risk of equipment failure even though it does not comply with FRA standards, but it may pose risks to operating personnel.

Army and Navy officials told us that the on-base fleet is safe despite not meeting FRA safety standards because it is operated under less stressful conditions than commercial equipment. Although this argument may have merit, DOD has not established minimum safety standards commensurate with these less severe operating conditions to ensure safety. Also, DOD's on-base rail operations are similar to commercial dedicated service, where cars operate at slow speeds over short distances on a single railroad. These commercial cars are excluded from compliance with certain FRA equipment and component standards but are required to meet all other FRA safety regulations, including safety appliance and brake system standards.

Further, Army's and Navy's maintenance standards are vague and conflicting, and maintenance personnel do not know which standards to use. DOD has 3,441 rail cars assigned to the 33 installations that handle virtually all on-base rail movements of ammunition and explosives. At least 38 percent and as many as 98 percent of these cars are not roadworthy—free of defects—as measured by FRA safety standards. Also, none of the 24 locomotives we inspected complied with all applicable safety regulations.

No DOD Standards for Safely Maintaining Cars

Because DOD military installations are not part of the general transportation system, DOD on-base rail equipment is not subject to federal safety regulations. DOD has not developed guidance applicable to on-base rail cars for safe operation and maintenance. Army and Navy guidance is often vague and contradictory, leading to inconsistent maintenance and inspection practices.

[1]Throughout this report, the term "defect" is used to mean an instance of noncompliance with FRA or RSPA regulations.

For example, one Army regulation on management of rail equipment states that on-base rail equipment is not subject to FRA but should be maintained to the standards practiced by private industry operating similar fleets. This regulation does not define these standards. Another regulation on maintenance of rail equipment states that on-base rail equipment should be maintained in accordance with FRA safety standards. Other Army maintenance regulations note that on-base rail equipment should be maintained to standards contained in applicable technical publications.

On the other hand, Navy's policy is vague, requiring only that equipment be maintained in a safe and acceptable operating condition. Navy is developing a new operating handbook, which states that Navy installations do not come under FRA's jurisdiction. However, the Navy's contractor used FRA rules and practices to develop the handbook.

On April 29, 1986, the Commander, Naval Facilities Engineering Command, sent a letter to all commands that addressed the applicability of FRA regulations to Navy-owned rail cars. The Commander, U.S. Army Troop Support Command, sent a similar letter for both rail cars and locomotives in March 1989 to all Army commands.[2] Both letters explained that FRA regulations do not apply to on-base rail equipment because such operations involve slow speeds and short distances.

Army and Navy personnel responsible for maintaining, inspecting, and using on-base rail equipment are confused about which standards should apply. Personnel at Concord told us that they maintained equipment on the basis of their personal knowledge of safety requirements. Personnel at McAlester, Hawthorne, and Seal Beach said they used service-level technical manuals as guidance, while at Crane maintenance personnel said that they used both personal knowledge and service manuals. At Earle, personnel said they used technical manuals and personal experience and also occasionally referred to FRA standards. The seventh installation—Milan—used FRA's safety standards as guidance in maintaining rail equipment.

Adding to the confusion, one Army regulation requires that rail equipment be inspected for compliance with FRA standards even though the equipment is not required to be maintained to the standards. Consequently, Army rail inspectors have written inspection reports citing

[2]The Naval Facilities Engineering Command and the Army Troop Support Command provide rail equipment maintenance guidance to the respective services.

defects where FRA standards were not met. Recently, however, Army rail equipment managers removed references to FRA standards from the inspection reports because they were aware that installations were not required to comply with FRA standards.

FRA Finds Numerous Safety Defects in DOD On-Base Cars

FRA's safety regulations are designed to eliminate discernible hazardous conditions and provide a minimum level of safety for rail equipment operating in the commercial sector.[3] Rail cars are not roadworthy unless they comply with FRA's safety standards. Although FRA standards do not apply to DOD on-base cars, we used these standards to evaluate the safety condition of the cars because no DOD standards exist. In doing so, we found that at least 38 percent and possibly as many as 98 percent of the cars DOD used to haul hazardous materials were not roadworthy. FRA inspectors identified cars at the installations that (1) were not properly equipped with personal-injury protection devices, such as ladders and handholds (safety appliances); (2) had brake systems with defective components or that had not been tested as FRA requires; (3) had equipment, such as cracked wheels, whose condition is not acceptable under FRA regulations; or (4) had components that are generally not allowed by FRA because of design. Nevertheless, the inspectors concluded that the on-base equipment was generally safe despite the defects because of the less stressful operating conditions. Table 2.1 shows the estimated number of cars with defects found at the seven installations.

[3]The regulations applicable to rail cars consist of freight car safety standards, safety appliance standards, and brake system standards. For purposes of this report, we will discuss the freight car safety standards in two groups: condition of car components and restricted equipment.

Table 2.1: Estimated Number of Cars Hauling Hazardous Materials With Defects or Restricted Components at Seven DOD Installations

Location	Total cars	Safety appliance	Brake systems	Defective equipment	Restricted components[a]
Concord	424	265 (± 30)	176 (± 31)	115 (± 28)	68 (± 23)
Crane	280	[b] –	34 (± 14)	171 (± 22)	157 (± 22)
Earle	447	143 (± 42)	441 (± 10)	126 (± 41)	395 (± 29)
Hawthorne	76	61 (± 0)	1 (± 0)	11 (± 0)	15 (± 0)
McAlester	146	24 (± 8)	22 (± 8)	38 (± 10)	4 (± 3)
Milan	169	[c] –	[c] –	17 (± 9)	22 (± 10)
Seal Beach	129	127 (± 2)	16 (± 7)	67 (± 10)	78 (± 10)
Total for 7 locations	**1,671**	**620 (± 53)[d]**	**691 (± 37)[d]**	**546 (± 56)[e]**	**739 (± 45)**

[a]Restricted components include cast iron wheels and certain types of air brakes, couplers, axles, bearings, and side frames

[b]Our sample of 100 contained no cars with defects. We estimate that between 0 and 7 of the 280 cars had defects (using a 95-percent confidence interval based on the hypergeometric distribution).

[c]We found no defects in our sample of 70. We estimate that between 0 and 6 of the 169 cars had defects (using a 95-percent confidence interval based on the hypergeometric distribution)

[d]Sampling error may be somewhat misstated because we observed no defects in samples from one or more locations

[e]This number does not add due to rounding.

Safety Appliances

Safety appliances are devices, such as handholds, steps, and ladders, designed to ensure that operating personnel can safely mount, dismount, and uncouple rail equipment. Safety appliance standards mandate consistency in the size of these devices and where and how they are attached so that rail equipment operators can expect them to be the same on every locomotive or car.

We estimate that about 37 percent (± 33 percent) of the DOD cars at the 33 installations did not meet the FRA safety appliance standards. The large sampling error resulted in part from the wide range of conditions we observed at the seven installations. Some had few cars with safety appliance defects, while others had cars that were consistently out of compliance with the standards. For example, Concord, Seal Beach, and Hawthorne had improperly modified the ladders and handholds on most of their rail cars. At these installations, we observed numerous handholds that were incorrectly repaired in such a way that train personnel could get their hands stuck in the handhold.

According to FRA's inspectors, DOD's compliance with safety appliance standards, whether voluntary or mandatory, is necessary to ensure crew safety under any type of rail operating conditions, including the slow speeds and short distances characteristic of military installations. However, FRA headquarters officials said that only defective uncoupling levers, end handholds, and sill steps with corresponding handholds should be considered serious safety appliance defects. The threat posed by other safety appliance defects would be minimal on cars in a captive fleet like DOD's.

Brake Systems

FRA requires that brakes be periodically cleaned, oiled, and tested and that the date of these maintenance procedures be stenciled on the side of the car. Failure to adhere to these regulations may result in brakes that either do not operate when necessary or lock on, heat up, and possibly catch on fire. The seriousness of a brake system violation increases as the length of the train, weight of the load, and speed traveled increase. According to FRA officials, the short trains and slow speeds common to on-base operations greatly reduce the risk associated with this defect.

We estimate that, at the seven installations, 42 percent (± 2 percent) of the cars had power brake defects.[4] Most of these defects involved testing and stenciling requirements. Out-of-date tests or the lack of a brake test stencil date means that crews using the train could not be assured that the brakes would operate properly when applied. Therefore, FRA inspectors said DOD should comply with the brake safety standards to ensure that the train can always be stopped.

Condition of Rail Car Components

FRA's freight car safety standards require that wheels, axles, bearings, car bodies, and couplers meet certain minimum conditions to be considered safe. Wheels, for example, generally cannot be used if they are cracked or broken or have a flat spot more than 2-1/2 inches in length. The danger posed by each defect depends on its type, location, and severity.

We estimate that about 30 percent (± 16 percent) of DOD rail cars at the 33 installations had component-related defects, such as bearing boxes that were not adequately lubricated. Over half of the defects cited by

[4]We did not estimate power brake defects for the 33 installations because we were unable to develop a meaningful sampling error estimate.

FRA inspectors in this category were for defective bearing boxes. However, we estimate that only about 38 of the cars (± 20) at five installations had defects serious enough that, when encountering them in the sample, FRA inspectors said the cars should be removed from service until repaired.[5] Although the inspectors did not believe that the other equipment-related defects posed an immediate safety risk, they said that all the defective components needed to be repaired to ensure long-term safe operations.

Restricted Equipment

The freight car safety standards also restrict the use of any car that is more than 50 years old or is equipped with components, including cast iron wheels and certain types of air brakes, couplers, axles, bearings, and side frames, that have a history of high failure and accident rates. Cast iron wheels, for example, may fracture or shatter during rail operations. The steel wheels now required for commercial cars do not deteriorate in this manner. According to FRA, 50 years is considered the age limit beyond which cars cannot be commercially operated with reasonable safety.

We estimate that 33 percent of DOD's cars (± 24 percent) at the 33 installations are equipped with cast iron wheels. According to FRA officials, these wheels have not been manufactured since the 1950s. All installations now replace damaged cast iron wheels with steel wheels, which are acceptable under FRA's safety standards. FRA inspectors identified relatively few other restricted components on the DOD cars they inspected.

None of the cars in our sample was more than 50 years old. However, our review of records on the age of every rail car in Army's and Navy's inventories, not just those used to carry ammunition and explosives, showed that only 141 of 4,466 cars were more than 50 years old. However, 53 percent (2,357 cars) were at least 40 years old, and within the next 5 years, 2,020 (487 Army and 1,533 Navy) cars will be over 50 years old.

Army and Navy officials said that age should not be considered a safety risk for the on-base equipment because the fleet does not operate under the same conditions as commercial cars. Navy plans to rehabilitate many of its rail cars, including some that are over 50 years old, as long as the

[5]At Hawthorne and Crane, FRA inspectors identified no rail car component defects so serious that the car should be removed from service.

body of the car is in good condition. FRA officials agreed that age is not as high a risk for cars, such as DOD's, that have consistently been used for carrying loads over short distances at slow speeds. Metal fatigue and other complications arise when cars travel hundreds of miles at speeds of up to 70 miles per hour in a single trip.

Relevance to DOD of FRA's Dedicated Service Exemption

Freight cars traveling in commercial service generally must comply with all FRA safety standards. However, FRA regulations exclude cars used in dedicated service from compliance with the freight car safety standards, although they must still comply with the safety appliance and brake system standards. FRA defines dedicated service to include cars that (1) are used primarily on track that is inside an industrial or other non-railroad installation, (2) are moved no more than 30 miles one way or 60 miles round trip, (3) are not freely interchanged among railroads, (4) are operated at speeds that do not exceed 15 miles per hour, and (5) have been examined and found to be safe to operate under these conditions.

FRA added this regulatory exclusion in 1974 after the railroad industry presented evidence that cars could be operated safely under the controlled operating conditions of dedicated service without complying with the freight car safety standards. Without this exclusion, some railroads—particularly small railroads—would have had to modify or replace rail cars at great expense to achieve compliance.[6] An FRA attorney familiar with this regulatory change told us that the agency wanted to maximize safety while not placing an undue burden on the railroads having dedicated service-type operations.

As discussed earlier, we estimate that at least 38 percent of DOD's on-base cars do not comply with all of FRA's freight car safety standards. For example, many cars have restricted equipment, and many will exceed the 50-year age limit in the next few years. DOD's on-base rail operations are in many respects similar to dedicated service, and, like cars in dedicated service, DOD on-base cars are (1) used exclusively within the confines of the installations, (2) not moved more than 30 miles one way or 60 miles round trip, and (3) not moved in interchange. However, two important differences exist between DOD and dedicated service operations.

[6]The American Short Line Railroad Association testified that its 152 members operate trains at an average speed of about 13 miles per hour, over an average distance of 13.5 miles, and that their rail car fleets are closely controlled. The cars operate only on the owning railroads' track and are not interchanged with other railroads.

First, five of the seven installations had sections of track posted for speeds up to 25 miles per hour; only Seal Beach and Concord had speed limits of 15 miles per hour. Second, FRA requires that cars used in dedicated service be examined and found to be safe. DOD does not have uniform safety standards to make such a determination. The inconsistencies in current Army and Navy guidance and the resulting confusion in how the guidance is implemented, as well as the higher speed of some DOD on-base rail operations, indicates that DOD may not be able to ensure safety under its current rail maintenance practices. FRA considers the commercial cars in dedicated service to be safe if they comply with only part of the FRA regulations. Similar compliance by DOD rail equipment would provide greater assurance that cars are safe under on-base operating conditions.

Locomotives Did Not Meet FRA's Standards

DOD has Department-wide guidance for acquiring, managing, maintaining, and operating locomotives.[7] However, this guidance requires only that installations inspect locomotives to ensure they are maintained in compliance with applicable service manuals. The guidance does not state whether on-base locomotives must comply with FRA safety standards nor does it provide an agencywide safety standard in lieu of FRA standards. FRA regulations pertaining to locomotives include the safety appliance standards and the brake system standards (which also apply to rail cars) and a third standard dealing exclusively with locomotive safety. FRA has no restricted components or age limitations for locomotives.

None of the 24 locomotives that FRA inspected complied with all FRA's locomotive safety standards.[8] These standards cover various locomotive equipment, such as suspension systems, electrical systems, cabs, and cab equipment, and require that certain components be inspected or tested periodically and documentation placed in the cab. Some requirements specify minimum tolerances—for example, a chip in a wheel cannot be longer than 1-1/2 inches and wider than 1/2 inch. Others prohibit conditions that might endanger crew members operating the locomotive—for example, moving parts must be covered, warnings must be posted on high-voltage equipment and floors in the cab, and passageway and compartments must be kept free of oil, water, and waste. These crew safety

[7]Management and Standards of DOD Locomotives (DOD 4140.50-R, June 1985).

[8]Our sample was too small to allow us to estimate the condition of all locomotives in the universe with any degree of confidence. Therefore, our discussion of locomotive defects relates only to the 24 that were inspected

requirements differ from safety appliance standards in that the conditions would occur only on locomotives. Table 2.2 shows inspection results for the 24 locomotives.

Table 2.2: Locomotive Inspection Results

	Installations[a]							
	A	B	C	D	E	F	G	Total
Locomotives in inventory	8	9	8	3	7	3	4	42
Locomotives inspected	3	4	3	3	4	3	4	24
Locomotive standard defects								
Mechanical	4	11	4	6	17	5	16	63
Crew safety	4	7	7	11	4	14	3	50
Inspection/testing	3	0	23	0	4	3	19	52
Total locomotive standard defects	11	18	34	17	25	22	38	165
Safety appliance defects	13	2	9	4	9	0	6	43
Brake system defects	0	0	0	0	0	0	0	0
Total defects	**24**	**20**	**43**	**21**	**34**	**22**	**44**	**208**

[a]A = Concord; B = Crane; C = Earle, D = Hawthorne; E = McAlester; F = Milan, and G = Seal Beach.

As shown in table 2.2, FRA identified 165 locomotive standards defects on the 24 locomotives. About 40 percent were mechanical defects that could result in accidents. The remaining 60 percent were evenly divided between defects that endanger crew safety and failure to perform, or document performance of, periodic inspections or tests. FRA inspectors said that most of the mechanical defects did not pose a serious accident threat because of low operating speeds but believed they should be corrected. They said that the crew safety defects were a greater risk because of the potential for injury under any operating conditions. It was also important, they said, to perform the periodic inspections and tests to ensure that components, such as air brake compressors and electrical systems, function properly and to document the results in the cab so that operators could readily determine whether the locomotives are safe to operate. An FRA headquarters official agreed but said that having documentation in the cab was not as important to safety as ensuring that the necessary inspections and repairs were performed as required.

Also, FRA found 43 safety appliance defects. Most involved missing handholds or ladder treads and defective uncoupling levers. The inspectors said that any one of these violations could result in injuries to crew members under any type of railroad operation, including DOD on-base

rail operations. FRA inspectors did not identify any locomotive brake system defects.

Conclusions

Rail cars and locomotives operated on 33 Army and Navy installations do not comply with FRA's safety standards applicable to equipment in the general system of transportation. However, this level of compliance may not directly correspond to a lack of safety. The operating conditions that exist on the installations are significantly different from most commercial railroads. The slow speeds, short trains, and limited distances traveled put less stress on the rail equipment and reduce the risk of accidents. Nevertheless, we believe safety appliance and brake system defects on DOD rail cars are safety risks.

Although the on-base fleet does not have to comply with FRA's standards, DOD has not developed its own rail equipment safety standards. As a result, rail equipment personnel may not maintain cars and locomotives to ensure a minimum level of safety. Maintenance personnel are uncertain or confused about the standards they should follow. Also, Army inspection personnel are required to inspect to FRA standards, yet the standards do not apply. We see no reason why the same organization responsible for Department-wide locomotive standards could not also develop Department-wide rail car standards.

We believe that the lack of overall DOD guidance, the vague and conflicting Army guidance, and the resulting confusion on the part of maintenance and inspection personnel have contributed to the widely varying conditions we observed at the seven installations. Many component and brake defects identified by FRA inspectors should have been eliminated during regular maintenance. For example, the brake test defects occurred because the installations did not perform periodic tests or stencil test dates on the cars.

Although it is not required to comply with FRA regulations, DOD has a responsibility to ensure that its on-base rail fleet is safe. FRA regulations are designed to promote safety in the commercial rail sector, but all of the regulations may not be appropriate for DOD on-base cars. However, we believe that FRA regulations applicable to commercial cars in dedicated service pertain to operating conditions very similar to on-base conditions. If DOD voluntarily followed the regulations and conditions applicable to dedicated service, DOD could better ensure safety.

However, neither Army nor Navy currently comply with all the special requirements imposed by FRA in the dedicated service exclusion. As long as these conditions are not met, particularly the requirement that cars be examined and found to be safe to operate, DOD does not have assurance that the on-base rail cars are safe. In addition, FRA does not recognize the conditions of dedicated service as reasons for excluding cars from safety appliance or brake system standards nor does it recognize any exclusions for locomotives. In our view, no compelling reason exists for DOD's not complying with these standards to ensure the safety of its on-base rail equipment.

Recommendations

To ensure the safe operation of DOD's on-base fleet, we recommend that the Secretary of Defense take the following actions:

- Develop and implement Department-wide safety standards for operating and maintaining on-base rail cars that incorporate FRA's safety appliance and brake system standards. The standards should define operating conditions that are consistent with FRA's dedicated service exclusion.
- Direct rail equipment inspectors in all services to inspect to the Department-wide standards, once they are developed.

The Safety of On-Base Hazardous Material Shipments Is Questionable

RSPA requires that any commercial rail car used to transport the most dangerous class of explosives (class A) over any distance at any speed be equipped with certain components to eliminate potential fire hazards. Although DOD routinely transports class A ammunition and explosives on-base by rail, DOD's on-base cars are not used in commercial service and are not required to comply with RSPA. Neither DOD nor Army and Navy has established equipment safety standards to ensure against fire hazards, however. Navy plans to rehabilitate much of its on-base fleet over the next 5 to 10 years, and Army plans to upgrade its fleet through a gradual purchase program over the next 17 years. According to Navy and Army officials, these upgraded cars should meet RSPA requirements. In the interim, both services will continue to transport ammunition and explosives using cars that are not equipped with components that reduce potential fire hazards.

In addition to equipment requirements, RSPA requires that ammunition and explosives in loaded cars be secured (blocked and braced) to prevent movement during transport. Although DOD does not have a policy for securing such material for on-base transport, Army and Navy do have this requirement. To implement its requirement, Navy has provided uniform blocking and bracing guidance for on-base shipments and requires verification that loads are secured. However, Army has not provided such guidance, holding installation commanders responsible for establishing their own procedures. We found that none of the three Army installations had developed detailed blocking and bracing procedures, and none of the seven installations had established procedures to verify that loads were properly secured. Our examination of 22 loaded cars showed that six installations were doing some blocking and bracing, but Milan was not.

DOD Does Not Comply With RSPA Requirements

In addition to the FRA safety requirements for rail cars and locomotives discussed in chapter 2, RSPA has established special component requirements to reduce potential fire hazards on cars transporting hazardous material. RSPA's requirements are enforced only when hazardous material is shipped "in commerce" and are not binding for on-base movements of such cargo. Neither DOD nor Army and Navy have policies requiring compliance with these RSPA requirements, nor have they established their own component requirements for cars transporting ammunition and explosives on base.

Army and Navy rail equipment officials told us that almost none of the on-base rail cars used to transport class A explosives met RSPA requirements. Our examination of randomly selected cars at the seven installations supported their claims. We estimate that no more than 5.5 percent of the cars at any of the seven installations were equipped with all three of the components most important to reducing fire hazards: (1) roller bearings, (2) high-friction composition brake shoes, and (3) spark shields.

Because less stressful operating conditions exist on the installations, RSPA officials and engineers from the Transportation System Center believed that certain components may not be necessary to ensure safety. However, DOD has not determined whether on-base equipment should meet RSPA requirements or whether DOD can safely move class A explosives on the installations without compliance.

RSPA Requirements for Moving Ammunition and Explosives by Rail

To minimize the risk of fires that might detonate explosive cargos, rail cars used for transporting class A explosives in commerce must meet certain RSPA requirements. Among other things, RSPA requires that cars be equipped with (1) roller bearings that are less likely to overheat, (2) high-friction composition brake shoes that greatly reduce sparking and the possibility of fire, and (3) metal spark shielding above the wheels to prevent fire caused by heat radiated from overheated wheels and burning fragments of brake shoe material that could become lodged in wood floors.

Both FRA and RSPA officials told us that on-base equipment posed a reduced incident or accident risk compared to cars used to transport ammunition and explosives in commercial service. They said, for example, that the relatively slow speeds and short distances traveled on military installations greatly reduced the possibility of sparks from braking or overheated bearings that could cause a fire. Transportation System Center engineers and FRA inspectors told us that (1) friction bearings on on-base cars that move class A explosives do not increase the risk of accidents or fire hazards as long as they receive proper maintenance and (2) the cast iron brake shoes found on many on-base cars are generally safe for the operating conditions. In their opinion, spark shields are a more economical way than roller bearings or composition brake shoes to get a large measure of protection against hot bearing boxes or sparks that may occur in on-base cars.

Transportation System Center engineers and RSPA officials told us that DOD would be prudent to have spark shields on the cars used to transport class A explosives. We estimate that less than 30 percent of the cars at six of the seven installations are equipped with these devices. Although roller bearings and brake shoes afford an extra degree of safety, RSPA officials questioned whether it would be cost effective to perform these alterations on 40- to 50-year-old cars used only for on-base operations, especially if ongoing fleet upgrade plans are completed.

Army and Navy officials told us that, because of the operating environment, safety is not being compromised by using cars that do not meet RSPA's requirements and that no serious incidents attributable to those components have occurred. However, both Army and Navy plan to upgrade their on-base rail cars through rehabilitation or replacement. Navy is planning to rehabilitate many cars as old as 50 years to bring them into compliance with both RSPA and FRA safety standards, and both the Army and Navy are purchasing used rail equipment that already complies with FRA's and RSPA's requirements. Although Navy has no firm deadline to complete its program, it expects to do so in the next 5 to 10 years, depending on funding allocations. Army plans to gradually replace its aging cars over the next 17 years, depending on funding availability. In the interim, both services will continue to use cars that are not equipped with components that reduce potential fire hazards.

DOD Lacks Guidance and Controls for Securing Hazardous Shipments

Without adequate guidance and controls to ensure that ammunition and explosives are properly secured for transport, DOD runs the risk of shifting loads that could damage equipment and cargo or result in an incident (fire or explosion). DOD does not have a policy concerning the manner in which on-base ammunition and explosive shipments should be secured—blocked and braced—inside rail cars. Navy requires shipments to be secured, provides technical instructions on blocking and bracing procedures, and requires installations to have controls to ensure compliance. In contrast, Army requires installation personnel to block and brace on-base loads but does not provide uniform technical instructions on how it should be done. Army holds installation commanders responsible for establishing and implementing such procedures. Also, none of the seven installations had procedures to independently verify that cargo was being properly secured.

During transport, loads in a rail car experience two major forces, vibration and shock. Vibration causes load contents to oscillate and rotate. Shock causes abrupt changes in direction and acceleration. Because of

these forces, RSPA requires that hazardous material or dangerous commodity packages transported over commercial track be securely loaded to prevent them from changing position, falling to the floor, or sliding into each other. For ammunition and explosives, RSPA recommends that loads be blocked and braced in accordance with guidance developed by AAR's Bureau of Explosives. The guidance has been designed and tested to restrain specific types of loads at impact speeds up to eight miles per hour from the front and back, particularly from the impact of hard couplings. Neither DOD nor Army and Navy have determined whether AAR's guidelines are appropriate, either in whole or in part, for on-base movements of explosives.

Navy Policy and Procedures

Navy policy requires that on-base movement of ammunition and explosives be blocked and braced sufficiently to prevent undue movement or shifting of the load and prescribes proper loading and dunnaging techniques to be followed when rail cars are used for such shipments.[1] At our request, an AAR official reviewed Navy's procedures and said that they appeared adequate for the operating conditions prevalent at installations.

Also, in July 1988 the Naval Sea Systems Command required installations to establish procedures for verifying that the blocking and bracing operation has been satisfactorily completed before transit operations begin. Of the four Navy installations we visited, three—Concord, Earle, and Seal Beach—had not established loading control procedures, and the fourth—Crane—had established a procedure requiring only that the individual responsible for loading the car was to certify that the load was properly secured.[2]

We examined between two and five loaded cars at each Navy installation and found no undue movement or shifting of cargo.[3] The loads were blocked and braced with mechanical dunnage and generally appeared to comply with Navy's procedures. However, accident records from the

[1]Dunnaging is the blocking and bracing process to restrain load movement. This may require building special wooden dunnage for each load unless the car is equipped with a mechanical dunnage system. Mechanical dunnage systems are reusable wooden braces with metal fittings used for blocking and bracing cargo. According to a Navy official, most rail cars at Sea Systems installations have mechanical dunnage.

[2]At Crane the Navy owns and operates the rail equipment and track, but the Army is a tenant that produces the ammunition and loads the cargo into cars.

[3]The cars were selected judgmentally. Therefore, our findings are applicable only to the cars examined.

installations indicated that cargo was not always properly secured. For example, Concord experienced two incidents between January and October 1990 where loaded ammunition had shifted dangerously while being moved from storage areas to a ship loading dock. In both instances, class A ammunition fell over 6 feet to the floor of the car. Earle also had experienced at least two similar load shifts over the last 4 years. However, none of these incidents damaged cargo. In addition, at Crane a car loaded with class A explosives was hit hard during coupling, severely damaging high explosives. Officials at the installation determined that the load had not been blocked and braced in accordance with Navy's procedures.

Army Policy and Procedures

Army's guidance on securing hazardous materials is much less specific than Navy's. The Army Materiel Command's safety manual contains only a few sentences about securing hazardous cargo for intraplant rail transport.[4] The manual states that such cargo should be blocked and braced sufficiently to prevent movement or shifting. The manual does not specify how loads are to be "sufficiently" secured or require installations to have procedures to independently verify that the loads were properly secured. In 1985 the Munitions Command issued blocking and bracing instructions to be followed by ammunition plants. However, Command officials rescinded the instruction in 1986 after concluding that compliance was "expensive overkill" and was not justified. Instead, the Command placed responsibility on installation commanders for determining that the methods of blocking and bracing used are adequate to prevent movement or shifting of loads. However, a Command munitions expert said that most installations do not have personnel with the technical knowledge necessary to determine sufficiency. Although installations can request technical assistance from his office, he said none had done so.

None of the three Army installations (ammunition plants) we visited had developed local detailed instructions for blocking and bracing. We examined a total of nine loaded cars at the three installations and found that none had blocked and braced loads as stringently as Navy requires. Although we found no evidence in accident reports that loads were not properly blocked and braced, the methods we observed may not be sufficient. At McAlester and Hawthorne, where the loads had been blocked and braced with mechanical dunnage, we found no undue shifting of

[4]Army Materiel Command Regulation 385-100, August 1, 1985. The Munitions Command and Depot Systems Command are subordinate units of the Army Materiel Command.

loads. However, in most instances only one piece of dunnage was used to restrain loads; Navy requires additional dunnage for loads of similar weight. According to Army Munitions Command officials, these are the only installations that generally have cars equipped with mechanical dunnage.

At Milan, which had cars without mechanical dunnage, the loads were not blocked and braced. Of three cars we examined, one car loaded three rows high with class A explosives had a pallet of ammunition on the top row dangling over the edge. Officials of the contractor operating the munitions plant said that it was not economically feasible to construct wooden blocking and bracing for each load and that, because on-base shipments subject the loads to less movement, blocking and bracing was not essential to safeguard cargo. We question this position because AAR's specifications for commercial loads are designed to prevent load shifts during hard (eight mile per hour) coupling impacts that could occur on a military installation. The contractor officials also said that cargo damage due to movement of loads rarely occurred. Army Munitions Command officials later told us that, in instances where hazardous cargo was not blocked and braced for movement, the cars should be loaded only one row high to increase safety.

Conclusions

DOD does not have a uniform policy for either car component requirements or for securing hazardous loads to ensure the safe transport of hazardous material on-base. Not all car components required by RSPA may be necessary for on-base equipment, considering the way the cars are used. However, DOD has not determined the components that are needed to ensure safety. Although DOD has not experienced any serious incidents attributable to those components, we believe that the Army and Navy cars would be significantly safer if they were equipped at least with spark shields.

We believe it is also important that ammunition and explosives be properly secured while being moved on military installations because dangerous load shifts can occur even during impacts at low speeds. Army appears to require controls for ensuring that hazardous cargo is safely secured on rail cars, but we found that they were not implemented at an Army installation where cars were not equipped with mechanical dunnage. We observed only three loaded cars at this installation, but in one the cargo had shifted dangerously. Responsible contractor officials said it was not economically feasible to properly secure the loads, yet they also did not choose to reduce the size of the load to increase the margin

of safety. In our view, Army's lack of technical guidance, implementing procedures, or independent verification that ammunition and explosives are properly secured constitutes a safety problem. We believe that Army is not giving sufficient attention to safety in this situation and is unnecessarily increasing the risk of an accident that could have serious consequences, such as fires or explosions.

Navy, on the other hand, has established detailed blocking and bracing instructions and has equipped most of its rail cars with mechanical dunnage. Although hazardous loads were adequately secured at the four installations we visited, no evidence could be provided that personnel routinely verified the securing of loads as Navy requires. Navy's own directive that verification procedures be established has not been implemented nearly 3 years after issuance. If this directive were properly implemented, we believe Navy would have adequate controls to secure ammunition and explosives for on-base movement.

Recommendations

To help ensure the safe transport of hazardous material by rail on military installations, we recommend that the Secretary of Defense

- determine the specific RSPA-required rail car components that are needed to provide an adequate margin of fire safety and require that all on-base cars transporting ammunition and explosives have such components within a reasonable period of time,
- direct Army to establish technical guidance for blocking and bracing ammunition and explosives on rail cars and ensure that the guidance is followed at its weapons handling installations, and
- direct Army and Navy to establish and implement procedures to verify that hazardous cargo is properly secured before on-base movement.

Track Safety Generally Adequate but Can Be Improved

Appropriately maintained track is extremely important for safe rail operations, especially when the cargo includes hazardous material. Army and Navy data identify track as the cause of more on-base train accidents than mechanical failures of either locomotives or rail cars. At the seven installations, 76 percent of the derailments (which typically resulted in little damage) or other accidents were attributed at least in part to defective track. Although FRA inspectors said that the overall condition of the track examined was generally adequate for posted speed limits, they found track defects at all installations, including some serious enough to cause derailments.

In addition, we found that track conditions and maintenance ranged from poor to excellent and that routine preventive maintenance was often not performed. We also found serious track defects, such as broken and chipped rails and insecure switches, that indicate poor track maintenance. A large number—about 81 percent—of the defects involved items that would take less than 30 minutes to repair, yet FRA inspectors said the defects had existed for some time. Installation officials said they do not have the funds or staff to properly maintain and repair track. FRA also found that some inspection personnel lacked sufficient knowledge of the FRA track safety standards. In this regard, many of the military track inspectors had not received formal training. Also, inspections were performed less often than FRA requires for equivalent commercial track. Army is revising its regulations to require formal inspector training and more frequent inspections, but Navy has no plans to make similar changes.

Army and Navy Track Problems

Many reportable rail accidents that occurred over the last 5 years at Army and Navy installations were caused by track defects, such as wide gage (excessive distance between two rails) or bad switches.[1] Servicewide statistics show that over 70 percent of the 45 accidents at Army installations and over 55 percent of the 9 accidents at Navy installations were caused by poor track conditions. Although derailments occurred, no serious injuries or incidents, such as fires or explosions, resulted from the accidents. As with rail car, locomotive, and hazardous material regulations, DOD does not have to comply with FRA's track standards. In this instance, however, Army and Navy policies require that track be maintained to standards at least as stringent as FRA's.

[1]Reportable accidents generally are those in which injury or death occurs or damages exceed $10,000 (Navy) or $2,000 (Army). Thirty-six of the 45 Army accidents involved damages of less than $10,000.

At the seven installations, FRA inspectors examined about 155 of the 985 miles of track, measuring compliance with applicable FRA standards for the posted speed limits.[2] The inspectors identified 442 defects. Although the inspectors concluded that track conditions were generally adequate for established speed limits, about 83 (19 percent) of the defects could cause derailments or other accidents. Table 4.1 shows the number and type of track defects found.

Table 4.1: Track Inspection Results

	Installations[a]							
	A	B	C	D	E	F	G	Total
Total track miles	102	175	134	212	212	86	65	986
Miles inspected	20	26	22	29	17	10	32	156
Serious defects[b]								
Switches	0	0	0	29	6	0	0	35
Gage	0	11	15	5	0	1	0	32
Others[c]	9	0	1	1	3	2	0	16
Total	**9**	**11**	**16**	**35**	**9**	**3**	**0**	**83**
Minor defects	51	27	40	139	85	14	3	359
Total	**60**	**38**	**56**	**174**	**94**	**17**	**3**	**442**

[a]A = Concord; B = Crane, C = Earle; D = Hawthorne; E = McAlester; F = Milan; and G = Seal Beach.

[b]FRA considers defects as "serious" if they could cause a derailment if operations continued, without restrictions, over that segment of track.

[c]Other serious defects included rail alignment exceeding tolerance and broken rails.

FRA inspectors found defects that they deemed serious at six installations. Seal Beach, which had no serious defects and only three minor defects, contracted for track inspection, maintenance, and repair services. The seriousness of a defect is based on its location on a segment of track and the degree of use the segment receives. Most of the defects (67) that FRA considered serious involved switches or wide rail gage, either of which could cause train derailments. FRA also found 359 minor defects that would not be serious enough to derail a train but if not repaired could develop into serious defects. These defects included missing, worn, or broken fastening devices, such as cotter pins, bolts, or clamps, on rail joints or track crossings.

[2]The inspected track was selected judgmentally; our findings apply only to the track examined. The sections of track inspected at each installation primarily consisted of main lines—i.e., those that generally receive the most use and have the highest speed limits. We also inspected some active secondary track, such as spurs and sidings.

According to FRA inspectors, any defect, whether serious or minor, should receive timely attention to ensure safety. Although the inspectors believed that the majority of defects should be repaired, they also noted that some defects could be eliminated by lowering the applicable track classification. For example, gage on class 2 track must not be more than 57-3/4 inches wide. If gage was found to be 58 inches (the tolerance for class 1 track) on class 2 track, the defect could be resolved by lowering the track from class 2 to class 1. Of the 32 serious cases of poor gage, 20 could be resolved if DOD reduced the speed limit on that segment of track to 10 miles per hour.

A change of this nature occurred while we visited Milan. FRA inspectors found that the general condition of certain class 3 track met only the class 2 requirements. As a result, the Commanding Officer lowered the speed limit commensurate with the existing conditions. Of the 442 track defects identified during our review, 53 could be brought into FRA compliance by lowering the speed limit.

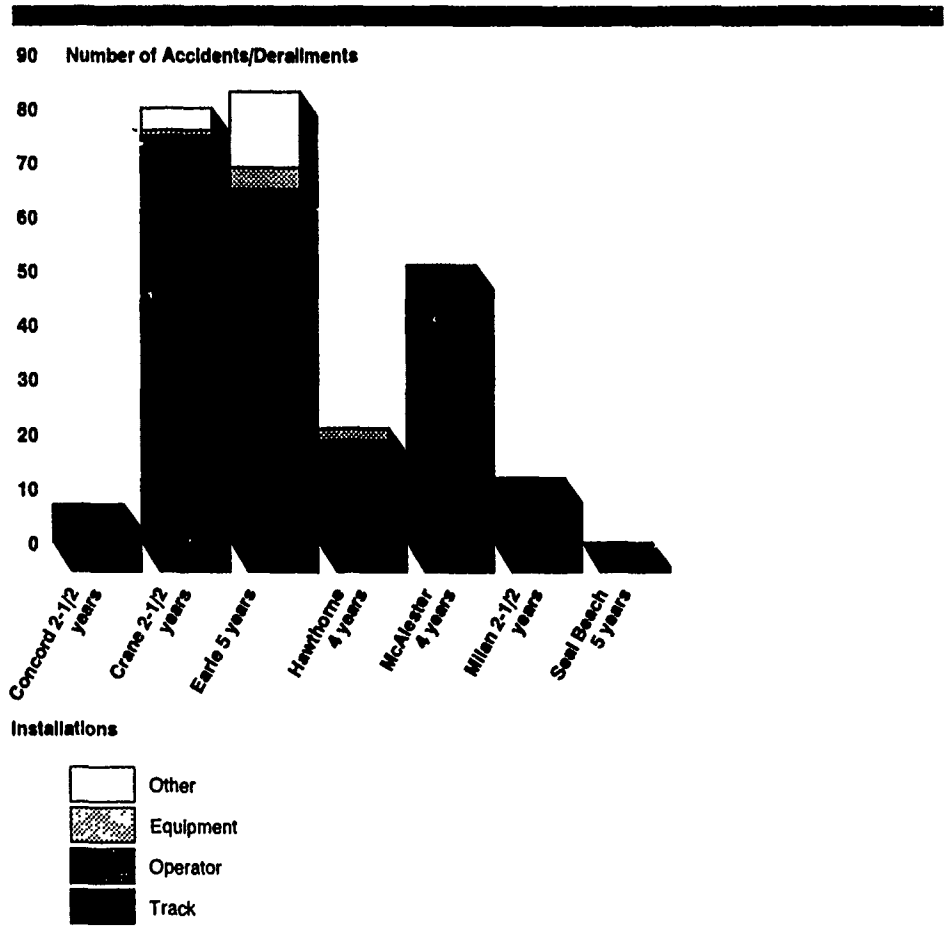
Accidents Have Occurred Because of Track Conditions

With the exception of Seal Beach and Hawthorne, five installations had reportable accidents attributable to track problems over the last 5 years. Milan had five such accidents, two of which involved cars loaded with ammunition. These same five installations and also Hawthorne had several other nonreportable derailments and other accidents attributed to track conditions.

Crane had 54 derailments between January 1988 and June 1990, most attributed to excessively wide gage. FRA inspectors identified 12 locations on 26 (out of 175) miles of track where the gage did not meet FRA's standard. Our review of records at the six installations revealed that track defects were a factor in 76 percent of the 223 derailments and accidents.[3] Although reports on the individual accidents showed damage as high as $15,000, the damage per accident usually was $1,000 or less. Figure 4.1 shows the cause of derailments and accidents at each installation for reportable and nonreportable accidents combined.

[3]We reviewed all available derailment and accident records for the past 5 years. Earle and Seal Beach had documents for the entire 5-year period, Hawthorne and McAlester had information for 4 years, and the other three installations had information for at least 2-1/2 years.

Figure 4.1: Causes of Accidents/ Derailments at Seven Installations



Track Maintenance Programs Need Improvement

Although the Army and Navy policy requires compliance with FRA's track safety standards, the track at six of the seven installations we visited was not maintained to these standards. Most of the defects FRA identified could be corrected quickly and inexpensively, yet they had existed for some time. According to Army and Navy officials, resource limitations precluded their accomplishing needed repairs.

FRA's track standards are designed to provide the minimum necessary requirements for safe track. They identify six classes of track with maximum speed limits set for each class. The maximum speed limit for trains on class 1, class 2, and class 3 track is 10, 25, and 40 miles per hour, respectively. Some FRA requirements vary on the basis of the class of track. For example, each 39-foot section of class 1 track must have at

least five adequate crossties, while classes 2 and 3 must have at least eight. In addition, FRA requires prompt repairs of track defects to maintain track usage at the same level as when the defect was identified. According to an FRA official, track should be maintained to a condition that exceeds the minimum requirements for the applicable class. Repairs should be scheduled when the track deteriorates to the minimum, thus ensuring that it does not drop below the safety threshold for the class. The Army and Navy track maintenance guidance incorporates this philosophy, stating that " . . . work planning should start when a deficiency on a section of trackage exceeds one-half (1/2) the allowable [FRA] deficiency."

According to FRA inspectors, few of the track defects they found would require costly, time-consuming repairs. Instead, almost 81 percent could probably be repaired in less than 30 minutes during routine maintenance. Rail fasteners, such as missing bolts or cotter pins, and insecure switch stands require minimum efforts to repair. Yet, after closely examining areas with such defects at Crane, Hawthorne, and Concord, the inspectors concluded that they may have existed for a long time. Three installations had repair backlogs that would take as much as 2 years to complete.

We did not revisit the installations to determine if defects noted by FRA inspectors were repaired. However, in early 1990 Earle had invited FRA to inspect its track; FRA spent 4 days in March conducting the inspection. The same FRA inspector examined the same track as part of our review in August 1990. The majority of defects identified 5 months earlier, including several cases of wide gage, had not been corrected.

Installation officials in both services told us that funding limitations generally precluded them from maintaining all track in full compliance with FRA standards. An Army headquarters official also said that funds were not adequate to maintain all track to the level recommended in the Army's regulations. A December 1988 Army rail study reported that the 1986 expenditure of $3,369 per track mile for Army Materiel Command installations was less than needed to adequately maintain track and that the majority of Army-owned track was in poor condition. Army officials are seeking increased funding for track repair but do not expect additional funds for the ammunition plants at the present time.

Navy headquarters officials had differing views on the adequacy of funding for track maintenance and repairs. Officials at the Naval Sea

Systems Command, which controls operations at the naval weapons stations, stated that installations receive maintenance funds based on budgets that show adequate resources going to track upkeep as part of the general operations and maintenance budget. They said installation commanders set priorities on how to use these funds and that they should not need additional funding. However, according to Naval Facilities Engineering Command officials, who are responsible for evaluating the condition of track throughout the Navy. the total inventory of track is not adequately maintained because of a lack of money. As a result, the weapons stations generally repair and maintain only the track that is used the most.

Track Inspection Programs Are Not Adequate

In addition to keeping tracks effectively maintained, installations also need to strengthen their track inspection programs. FRA regulations require frequent examinations of track by individuals who have a thorough knowledge of safety standards and, where serious defects are identified, have the ability to place whatever use limitations are necessary on the affected track until repairs are made. The Navy and Army track guidance states that an effective maintenance program must be based on thorough and timely inspections by competent individuals. However, at five installations the inspectors had not received formal training on FRA track safety standards, and inspections were not generally performed as frequently as FRA requires.

FRA track safety regulations require that each track owner have a designated track inspector. These inspectors must have either 1 year of track inspection experience or formal training that allows them to (1) demonstrate knowledge and understanding of FRA's track standards, (2) detect deviations from the standards, and (3) prescribe appropriate remedial action to correct or safely compensate for those deviations. Army and Navy require only that qualified personnel perform the annual track inspections. However, neither requires them to attend formal training that would give them the necessary understanding of FRA standards. We found that, with one exception, track inspectors at six installations had not attended formal training.[4]

FRA inspectors believed that the on-base inspectors at two Army and two Navy installations lacked sufficient knowledge of track standards. At

[4]Seal Beach, which contracted out its track maintenance function in August 1989, requires the contractor's inspectors to be qualified according to FRA standards. In addition, two Seal Beach employees have had formal training.

three of these installations, the track inspectors were not familiar with FRA standards and told us that accompanying FRA inspectors was a valuable learning experience. Most Navy officials told us that it is not necessary for track inspectors to attend formal training to acquire the knowledge needed to effectively carry out their responsibilities. In contrast, Army officials said that track inspectors need such training and beginning in April 1991 Army required its installations to have at least one certified track inspector. To obtain the certification, the inspector must have track inspection or maintenance experience, attend a formal training course, and pass an examination.

Track Inspections Are Less Frequent Than FRA Requires

FRA regulations require either weekly or monthly inspections depending on how a track is used. For instance, FRA requires twice weekly inspections for class 1, 2, and 3 mainline (used to move from one point to another) track and sidings and monthly inspections for other class 1, 2, and 3 track and sidings. According to FRA's Director of Safety Enforcement, nearly all DOD track is equivalent to track used as non-mainline sidings. FRA requires that a qualified individual perform all inspections.

Army and Navy track guidance requires only annual inspections of all track sections regardless of use and recommends that preventive maintenance inspections be conducted on a more frequent basis. Although the guidance specifies that annual inspections be conducted by a track inspector, the same requirement does not exist for the preventive maintenance inspections. Instead, these inspections are performed by maintenance crews whenever they work in a particular area. The preventive maintenance inspections are visual and are much less inclusive and exacting than the annual inspections.

We found that Milan, Concord, and Earle had local policies requiring more frequent inspections than the Army and Navy guidance prescribed. Milan performed monthly inspections on all track. Earle inspected its mainline track monthly and other track quarterly, while Concord performed quarterly inspections of all track. An FRA headquarters official told us that monthly inspections are necessary for ensuring track safety and that the annual inspections required by DOD facilities are not adequate for the type of use they receive.

The four remaining installations followed the service-level guidance by requiring yearly track inspections. Officials at McAlester stated that they could not even inspect all the track annually because of resource constraints. FRA inspectors recommended that McAlester and Crane

inspect the most frequently used track at least weekly because of the poor conditions they found. Track maintenance reports for Crane and Earle stated that inspections were not being done often enough.

Navy officials do not believe they need to increase track inspection frequency. In contrast, Army officials acknowledged that annual inspections were inadequate and in April 1991 began requiring that all active track be inspected (1) monthly on sections with two or more movements per week, (2) every 2 months on sections with at least one movement per month (but less than two per week), and (3) every 6 months on sections with less than one movement per month.

Conclusions

Although no DOD-level safety standards exist for maintaining and repairing track, Army and Navy require installations to follow FRA track safety standards. The actual track conditions at the seven installations were generally safe for the posted speeds, according to FRA track inspectors. However, the inspectors found a number of serious defects that could lead to accidents and derailments. The six installations that performed their own track maintenance had several sections of track that did not meet FRA's minimum requirements.

We believe that Army's and Navy's approach to maintaining track is not adequate to ensure safety. Despite references to FRA standards in their track guidance, Army and Navy deviated from the standards in several important ways: (1) track defects were not repaired in a timely manner, even though such repair would not be costly or time-consuming; (2) most installations formally inspected track only once a year instead of the weekly or monthly inspections required by FRA; and (3) installation inspectors were not familiar with FRA track standards. Army's new track standards, issued in April 1991, require more frequent inspections and more training for track inspectors. If fully implemented, these standards will substantially improve Army's track inspection function.

Recommendations

To ensure the safety of track on military installations, we recommend that the Secretary of Defense direct Army and Navy to inspect and maintain tracks in compliance with FRA standards for the track classes associated with the posted train speeds on military installations. Such compliance should encompass not only the physical condition of the track but also the inspection frequency, repair frequency, and inspector qualification requirements that are contained in FRA regulations.

Maintenance of DOD Interchange Cars Is Comparable to Commercial Rail Industry

DOD has over 2,000 rail cars that are used to transport military cargo, including hazardous material, throughout the country over commercial rail lines. These cars, like commercial cars, must comply with FRA and RSPA regulations. FRA holds rail carriers, rather than car owners, responsible for ensuring that cars comply with safety requirements. When FRA inspectors find defects, the carrier is cited. DOD inspects, maintains, and repairs its cars to increase the likelihood that each car complies with FRA standards and can be used at any time to meet military shipping needs. Although we found that about 11 percent of the cars were overdue for DOD-imposed inspections, tests, and procedures, most were not used in commercial service after the due dates had passed. Over the last 6 years, FRA inspections have identified 742 safety defects on 459 DOD interchange cars; 23 were serious enough to warrant a violation. FRA officials told us that the number and types of defects identified in FRA inspections were about average when compared to similarly sized fleets.

Rail Carriers Primarily Responsible for Rail Car Safety

In 1989 about 1.2 million freight cars were in service on the nation's commercial railroads. About 789,000 were directly owned by railroads and 423,000 by others, such as DOD. Both FRA and RSPA regulations generally do not hold rail car owners responsible for ensuring that cars moved in commercial service meet safety requirements.

Under the regulations the rail carrier is responsible for ensuring that any car it moves complies with federal safety requirements. The carrier must inspect the car when it is accepted for shipment and monitor its safety status while the car is in use. In particular, before a car is accepted, FRA requires the carrier to inspect for any defects (e.g., insecure couplings, cracked wheels) that could cause an accident or casualty before the train arrives at its destination. If the carrier finds a mechanical defect, the carrier must take corrective actions in a manner appropriate to the nature and seriousness of the defect. The action may range from not moving the car until the defect is repaired to placing a tag on the car describing the defect and then moving the car under appropriate safeguards to a repair facility.

FRA enforces its regulations by inspecting cars in the custody of rail carriers. Inspection reports list defects found, and carriers are required to take immediate corrective action. When FRA considers a defect to be a violation of safety standards, the agency initiates a prosecution procedure and may impose a fine against the carrier. In addition, RSPA imposes some mechanical requirements, such as periodic testing of (1) the structural integrity of tank cars and (2) safety valves to ensure they function

properly and do not leak when the tank is filled. RSPA holds both the shipper and carrier responsible for ensuring that cars comply with these requirements. Shippers must inspect a car both during and after loading. As with FRA regulations, the carrier must inspect a car before accepting it for movement and monitor the car's condition while it has custody.

FRA hazardous material inspectors enforce RSPA's regulations at both rail carrier and shipper locations. When the inspectors find defects, such as loaded tank cars that are overdue for tank or valve tests or have leaking cargo, the inspector issues a report to the shipper or carrier having custody of the car at the time of the inspection.[1] The report recipient is required to take appropriate action. When FRA considers the noncompliance serious enough to be a regulatory violation, the agency may impose a fine after giving the carrier an opportunity to show why a penalty should not be imposed.

DOD Interchange Fleet Is Used in Commercial Service

DOD has delegated responsibility for managing and maintaining the interchange fleet to the Army Military Traffic Management Command. The fleet exists to supplement those cars available from commercial sources at times of peak demand and to have cars available that meet special military needs that are not available from commercial sources or are in short supply. MTMC's major concern is military readiness; its controls are designed to keep the cars in compliance with federal and AAR requirements so that a maximum number can be operated in both peacetime and military emergencies.

As of September 1990 MTMC had 2,056 cars, including 1,344 flat cars, 667 tank cars, and 45 cars of other types. Most cars (1,714) are assigned to DOD units or contractors for specific uses, but MTMC retains direct custody of the balance to meet specific shipping demands. For example, many flat cars are assigned to Army and Marine installations to transport combat tanks and other oversized equipment. Generally, only the tank cars are routinely used to transport hazardous material. The 667 tank cars are assigned to 10 different units; most (578) transport aviation fuel. According to a RSPA official, the only commodity carried in the tank cars that, if released, presents an extreme danger to the public is

[1]The inspector may also list any defects involving FRA's safety requirements.

nitrogen tetroxide, a poisonous gas. Eight tank cars carry this commodity.[2] About half of DOD's cars were built between 1951 and 1955; another 40 percent were built in 1975 or later. All the cars are within the 50-year age limit set by FRA. As of December 1990 MTMC had no plans to acquire additional cars.

MTMC is a party to the AAR interchange agreement and therefore must comply with the AAR Interchange Rules. The agreement allows rail carriers having custody of a car that does not comply with AAR requirements to make most repairs specified in AAR manuals without receiving advance authorization from MTMC.[3] The carriers bill MTMC for the repairs at the AAR-established material prices and labor rates.

MTMC Monitoring Program to Increase Compliance With FRA Standards

MTMC relies on carriers to ensure that its cars comply with FRA and RSPA safety regulations when they are placed in commercial service. To increase the chances that the cars comply, MTMC periodically inspects and monitors them to ensure that DOT-required tests and procedures are performed when due.

Under MTMC's procedures each car is inspected at least every 12 months by a MTMC field inspector or other qualified expert, such as a railroad car inspector. Each car also receives a preventive maintenance inspection at least every 5 years. These inspections, conducted in rail equipment repair shops under contract with MTMC, are more detailed than the annual inspection. The rail shop prepares a report showing inspection results and repair recommendations. Fleet managers use inspection reports to arrange for appropriate repairs.

In addition, MTMC uses a computerized system to monitor cars in the fleet to ensure that the 1- and 5-year inspections are conducted when due and that certain tests and procedures are done at intervals specified by FRA, RSPA, or AAR. Several months before an inspection, test, or procedure is required on a car, the tracking system alerts fleet managers, who make arrangements to ensure it is done. The fleet managers also notify the unit to which the car is assigned to remind the unit not to use the car until the inspection, test, or procedure is performed. MTMC's objective is

[2]On December 9, 1987, the Government Activities and Transportation Subcommittee, House Committee on Government Operations, held hearings on the safety of the cars carrying this commodity. Testimony by rail carrier and DOT representatives indicated no serious safety problems with the cars.

[3]AAR requirements include those established by FRA, but some are more stringent than the federal requirements.

to have at least 90 percent of the fleet current on all inspections, tests, and procedures at all times.

MTMC records indicate that 1,828 of the 2,056 interchange cars (89 percent) had up-to-date inspections, tests, and procedures. Table 5.1 shows the cars that were overdue for each inspection, test, or procedure as of September 19, 1990.

Table 5.1: Cars Overdue for Inspections, Tests, or Procedures

Category	Cars applicable	Number (percent) overdue[a]
1-year inspection	2,056	79 (3.8)
5-year inspection	2,056	133 (6.5)
Clean, oil, test, and stencil brakes	2,056	24 (1.2)
Tank test	667	24 (3.6)
Valve test	621	6 (1.0)
Journal lube	118	0 (0.0)

[a]228 cars were overdue for an inspection, test, or procedure. Some cars were overdue in more than one category. For example, 19 cars were overdue for both a 5-year inspection and a tank test

Source: MTMC's computerized tracking system. As discussed in appendix II, we did certain tests to ensure the reliability of information in this data base. Although our tests disclosed some errors, we determined that the data were reliable for this report.

Many of the 228 cars overdue for inspections, tests, or procedures were either in repair shops or had not left the installation where they were located since the due date passed. However, according to the MTMC data base, 52 cars overdue for inspections only, and 4 cars overdue for brake tests and procedures, were moved on commercial track to locations other than repair shops after the due date.

The movement of the cars overdue for inspections did not violate FRA safety standards because the regulations do not require such inspections. However, movement of the four cars overdue for brake tests could constitute a violation of FRA safety standards. FRA's inspection data base indicated that DOD interchange cars have been cited on occasion for overdue brake tests and procedures.

Defects Identified by Carriers and FRA

Although FRA inspectors have identified defects on DOD cars in carriers' custody, the carriers have repaired many cars in the fleet as a result of their own inspections. On the basis of a probability sample of MTMC files on 285 cars, we estimate that 1,716 cars (± 83) had been repaired at

least once between October 1987 and September 1990.[4] Frequent repairs included brake shoe and air hose replacements, brake cylinder repairs, and replacing coupler system parts. FRA told us that the volume and types of repairs experienced by DOD were generally consistent with other commercial cars. AAR said that its records show that 95 percent of the cars in commercial service will be taken to a repair yard for repairs each year.

Nevertheless, FRA inspections have identified safety defects on DOD interchange fleet equipment. Between January 1985 and November 1990, FRA identified 742 safety defects on 459 cars while the cars were in commercial use.[5] FRA found about 70 percent of the cars out of compliance only once during the 6-year period, 21 percent on two occasions, 5 percent on three occasions, and 4 percent on four to six occasions. The 742 defects were evenly distributed among three groups of FRA safety standards—components, safety appliances, and brakes. The major defects in each of these categories were (1) inadequate axle lubrication (components), (2) defective hand brakes (safety appliances), and (3) loose or missing brake systems hardware (brakes).

FRA officials said the number and types of defects are about average when compared to similarly sized commercial fleets. Car parts and lubrication levels often develop deficiencies or drop below tolerance levels while in transit. They also said that the number of defects found is not unusual given the size of the fleet and the period covered. Of the 742 defects, FRA determined that 23 were regulatory violations for which fines could have been imposed on the carrier.

FRA also found 628 defects, primarily involving DOD tank cars, during hazardous material inspections made between January 1985 and October 1990. Most defects, such as failure to properly indicate the hazardous contents (159), failure to adequately secure outlets of empty tank cars (167), or improper unloading procedures (89), resulted from actions by shippers or receivers of the cars and would not be under MTMC's control. FRA did identify 12 cars that were overdue for tank or valve tests and 14 cars that had mechanical defects, such as broken hinges on manway covers, foreign matter in journal boxes, and worn brake shoes that should be identified by carriers prior to acceptance for shipping or by MTMC during 1- or 5-year inspections.

[4]See appendix II for our sampling methodology.

[5]FRA does not compile information that would allow us to determine the total number of cars inspected during that period. FRA keeps data only on the cars with defects.

FRA officials said that the types of defects found on DOD tank cars were typical of those routinely found on commercial cars. The seriousness of the defects would depend on the type of hazardous material being carried in the car. Jet fuel, carried by most DOD cars, is not extremely hazardous if only small amounts escape the container and would not pose a high risk. Nitrogen tetroxide, which is carried by eight of the cars, is extremely hazardous in any amount. They said that the number of defects found on the DOD tank cars over the 70-month period is probably low compared to the rest of the rail industry.

Conclusions

DOD periodically inspects and monitors its cars to increase the chances that they will be in compliance with all DOT safety requirements when they are placed in commercial service. These actions are not required by FRA regulations. Our tests indicated that carriers identified and corrected some, but not all, defects found on DOD cars. According to FRA officials, the defects found were about average for a fleet the size of DOD's.

Selection Methodology for Evaluation of DOD On-Base Rail Cars

In order to determine the condition of DOD's on-base rail cars, we inspected a probability sample of cars from the 33 Army and Navy facilities that were producing, storing, or issuing ammunition and explosives. We first selected facilities for review, then we selected cars to review at each facility. Table I.1 shows the total number of cars and locomotives at each of the 33 facilities.

Table I.1: Total Number of Cars and Locomotives at 33 Army and Navy Facilities as of May 1990

	Rail equipment		
Facility	**Locomotives**	**Rail cars**	**Total**
Army ammunition plants			
Pine Bluff	2	4	6
Hawthorne	3	145	148
Holston	4	44	48
Indiana	2	40	42
Iowa	3	135	138
Kansas	2	24	26
Lake City	2	29	31
Lonestar	0	57	57
Longhorn	2	170	172
Louisiana	2	191	193
McAlester	11	220	231
Milan	6	243	249
Mississippi	2	21	23
Radford	4	23	27
Sunflower	2	0	2
Subtotal	**47**	**1,346**	**1,393**
Army depots			
Anniston	3	8	11
Letterkenny	2	0	2
Lexington-Bluegrass	4	6	10
Pueblo	1	0	1
Red River	3	43	46
Savanna	2	14	16
Seneca	2	1	3
Sierra	2	4	6
Umatilla	2	1	3
Ft. Wingate	2	0	2
Navajo	2	2	4
Tooele	4	55	59
Subtotal	**29**	**134**	**163**

(continued)

Facility	Rail equipment		
	Locomotives	Rail cars	Total
Naval weapons stations			
Concord	24	481	505
Charleston	7	163	170
Crane[a]	15	384	399
Earle	12	530	542
Seal Beach	5	157	162
Yorktown	8	246	254
Subtotal	**71**	**1,961**	**2,032**
33 facility total	**147**	**3,441**	**3,588**

[a]The Naval Weapons Support Center at Crane, IN, has on-base rail equipment that provides rail service to an Army ammunition plant collocated at the installation.

From this list we selected facilities for review on the basis of the proportion of rail equipment at the facility compared to the total at the 33 facilities. For example, a facility that had 10 percent of the rail equipment would have a 10-percent chance of being chosen each time a facility selection was made. We applied this facility selection procedure eight times. This resulted in identifying seven different facilities for review. One facility—Milan—was selected twice using this methodology.

For each of the seven facilities, we reviewed a simple random sample of cars being used to haul hazardous material as of the date of our review. Because Milan was selected twice, we reviewed two independent simple random samples. Because we excluded cars that were not being used to haul hazardous material, the number of cars from which we selected our sample at each facility was sometimes smaller than the number of cars listed in table I.1.

Because we selected both the locations and the cars at each location statistically, we made estimates about all cars at the seven locations as well as at the 33 installations in our universe. Each estimate has a measurable precision, or sampling error, which may be expressed as a plus/minus figure. A sampling error indicates how closely we can reproduce from a sample the results that we would obtain if we were to take a complete count of the universe using the same measurement methods. By adding the sampling error to and subtracting it from the estimate, we can develop upper and lower bounds for each estimate. This range is called a confidence interval. Sampling errors and confidence intervals are stated at a certain confidence level—in this case, 95 percent. For example, a confidence interval, at the 95-percent confidence level,

means that in 95 out of 100 instances, the sampling procedure we used would produce a confidence interval containing the universe value we are estimating.

We reviewed randomly selected locomotives at each facility, but our sample was too small to allow us to estimate the results to the universe. We visited the seven facilities between July 16 and September 28, 1990.

Table I.2 shows the number of rail cars identified as available for hauling hazardous material as of the review date, the number of cars we selected for review, and the number we were able to review. We could not locate five selected cars.

Table I.2: GAO Probability Sample of Hazardous Material Hauling Cars

Facility	Total rail equip[a]	HAZMAT cars	GAO sample		Reviewable HAZMAT cars		
			Selected	Reviewed	Estimate	Lower bound[b]	Upper bound[b]
Concord	505	424	125	122	414	397	421
Crane	399	280	100	100	280	273	280
Earle	542	447	78	77	441	418	446
Hawthorne	148	76	76	76	76	76	76
McAlester	231	146	80	80	146	142	146
Milan[c]	249	169	81	80	167	158	168
Seal Beach	162	129	71	71	129	125	129
Total for 7 locs.	**2,236**	**1,671**	**611**	**606**	1,653	1,638	1,667
Total for 33 locs.	3,588	2,541[d]			2,520	2,204	2,836

[a]Rail equipment includes cars and locomotives.

[b]The lower and upper bounds of the 95-percent confidence interval

[c]In the two Milan samples, we reviewed 39 of the 40 cars selected in the first sample and all of the 41 cars selected in the second sample. Eleven cars were selected into both samples.

[d]The sampling error of this estimate, at the 95-percent confidence level, is ± 329 cars.

On the basis of our sample results, we estimate that 2,541 (± 329) rail cars at the 33 facilities could be used to carry hazardous material at the time of our review. However, since we were not able to locate all selected cars, our sample review results provide information on about 2,520 (± 316) rail cars (approximately 99 percent). The results in this report apply only to those 2,520 cars.

Reliability Assessment Results for Interchange Fleet Information

Our reliability assessment discovered numerous due date discrepancies between the case file information and the automated data base on certain periodic tests and procedures. However, when the due dates in the data base did not exactly agree with those based on case file information, the difference in due dates did not usually affect the determination of whether or not a car was overdue for inspection. Therefore, we concluded that the data were sufficiently reliable to be used in determining whether the tests and procedures were being conducted within the prescribed intervals. We took a probability sample of the 2,056 cars listed in the automated data base as of September 19, 1990, and tested the correctness of the automated data by comparing them with the information in the case files. Due to time and cost constraints, we did not determine whether the data base omitted any cars.

In selecting the cars for review, we first divided all cars listed in the data base into three groups and then selected a simple random sample of cars from each group. Table II.1 shows the number of cars in the data base as well as in the three sample groups.

Table II.1: GAO Sample of Cars

	Number of cars	
Group description[a]	**Data base**	**GAO sample**
A - All cars with friction bearings	372	102[b]
B - Tank cars with roller bearings	524	85
C - All other cars with roller bearings	1,160	100
Total	**2,056**	**287**

[a]Groups were determined on the basis of information in the automated data base.

[b]Because we could not locate two case files, we actually reviewed 100 cars.

This sampling method was chosen to ensure that we would review a reasonable number of cars required to have each of six tests or procedures. Because we took a probability sample of cars, we developed estimates for all cars in the data base. Each estimate has a measurable precision or sampling error.

For sampled cars we determined from the case files whether the car was supposed to receive the six tests or procedures and, if so, the next due date. When the information in the files did not support the due date in DOD's automated data base, we had DOD officials corroborate the accuracy of the due dates we determined from the files. Although the due dates in the case files frequently did not agree with those in the automated data base, the differences were generally small. For example, the

case file might indicate that a test was next due in January 1992 while the automated data indicated February 1992, but both sources indicated that the car was not overdue for inspection as of September 1990. Because we found no evidence that the information system understates the number of cars overdue for inspection, we concluded that DOD's information on cars overdue for inspection was reliable enough for the purposes of this report.

Table II.2 shows our estimate of the percent of cars requiring each of six tests or procedures that have erroneous due dates in the agency's management information system.

Table II.2: Estimated Percent of Cars Requiring Test or Procedure With Erroneous Due Dates in MTMC's Management Information System

Test	Estimated percent	Sampling error (±)
1-year inspection	14.6	4.4
5-year inspection	23.9	5.0
Clean, oil, test, and stencil brakes	17.1	4.2
Journal lube	33.3	11.9
Tank	27.3	7.3
Valve	29 7	7.6

Note: On the basis of GAO's review of a probability sample of cars as of September 19, 1990 Sampling errors represent the 95-percent confidence level.

Even when the due dates in the automated system did not exactly agree with those based on case file information, the difference in due dates did not usually affect the determination of whether or not a car was overdue for inspection. As shown in table II.3, the percent of cars that the agency data base indicated as overdue for inspection as of September 19, 1990, is not outside the range we would estimate on the basis of our file review. The 5-year test was outside the upper bound of our estimate but only by a small amount. In that case, the information system indicates that slightly more cars were overdue than we would have estimated.

Table II.3: Estimated Percent of Cars Requiring Test or Procedure That Were Overdue as of September 19, 1990

		Agency information system			GAO estimate		
		Number of cars		Percent		Lower	Upper
Test	Group[a]	Required	Overdue	overdue	Percent	bound[b]	bound[b]
1-year inspection	A	372	8	2.1	1.0	0.3	4.8
	B	524	6	1.1	3.5	0.8	9.5
	C	1,160	65	5.6	9.0	4.3	16.1
Total		**2,056**	**79**	**3.8**	**6.2**	**3.0**	**9.3**
5-year inspection	A	372	45	12.1	11.8	6.7	18.5
	B	524	21	4.0	1.2	0.2	6.1
	C	1,160	67	5.8	3.0	0.6	8.4
Total		**2,056**	**133**	**6.5**	**4.1**	**2.0**	**6.2**
Clean, oil test, and stencil brakes	A	372	4	1.1	[c]	0.0	2.7
	B	524	6	1.1	[c]	0.0	3.2
	C	1,160	14	1.2	1.0	0.1	5.3
Total		**2,056**	**24**	**1.2**	**0.6**	**−0.5[d]**	**1.6[d]**
Journal lube[e]	A	118[f]	0	0.0	[c]	0.0	6.8
Tank test	A	143[g]	0	0.0	[c]	0.0	5.6
	B	524	24	4.6	2.4	0.4	7.8
Total		**667**	**24**	**3.6**	**1.8**	**−1.2[d]**	**4.9[d]**
Valve test	A	143	0	0.0	[c]	0.0	5.6
	B	478	6	1.3	1.3	0.2	6.5
Total		**621**	**6**	**1.0**	**1.0**	**−0.8[d]**	**2.7[d]**

[a]GAO sample group.

A - All cars with friction bearings
B - Tank cars with roller bearings
C - All other cars with roller bearings

[b]Lower and upper bound of the 95-percent confidence interval.

[c]We found no overdue cars in our sample. Lower and upper bounds of the confidence interval are based on the hypergeometric distribution.

[d]Estimates for totals may be somewhat misstated since we observed no overdue cars in one or more sample groups.

[e]One of the 85 cars we sampled in Group B had friction bearings rather than roller bearings as indicated in the agency information system. The car required bearing lubrication, however, it was not overdue for lubrication as of our review. On the basis of our sample results, we estimate that an additional 1 to 32 cars currently classified by the data base as having roller bearings actually have friction bearings and require lubrication. An estimated 0 to 21 of these misclassified cars may be overdue for such lubrication.

[f]Only cars with friction bearings need lubrication. According to the version of the agency automated data from which we sampled, all 372 cars in Group A had friction bearings. However, as we started reviewing the case files, we found that only 34 of the 100 reviewed cars in our sample still had friction bearings. In the remaining cars the friction bearings had been replaced with roller bearings. When we discussed our findings with agency personnel, they realized they had not updated the automated information for cars as bearing conversions had been done. They indicated that 118 of the 372 cars in Group A still had friction bearings as of the date of our review and were supposed to be lubricated periodically.

[9]Only 143 of the 372 cars in Group A were tank cars that required tank and valve tests. Our sample of cars from Group A had 46 tank cars requiring the tests. This includes the two sampled cars from Group A for which we could not find case files.

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