

DEPARTMENT OF TRANSPORTATION  
Federal Railroad Administration



**RAILWORTHINESS DIRECTIVE**



Pre-1974 GATX-Built Tanks with Reinforcement Bars ) Railworthiness Directive: HM-04 )

**INTRODUCTION**

Since the beginning of this year, FRA (Federal Railroad Administration) has investigated four failures of GATX-built tank cars that were either built or modified to include reinforcing bars. As a result of an incident at New Martinsville, West Virginia, on February 21, 2002, representatives of GATX met with FRA Associate Administrator for Safety George A. Gavalla and members of his staff and reviewed the history of GATX cars that have failed in transit. According to information presented at that meeting, there are three separate designs of cars with reinforcing bars applied as part of new construction and four separate designs for cars retrofitted with bars.

The review at the February meeting included a discussion of cracks and shell failures apparently related to welding or other workmanship issues. GATX assured FRA that it would develop a plan to comprehensively inspect, and repair (or scrap) as necessary, cars in the affected portion of the GATX fleet. FRA and GATX met again in Chicago on March 24, 2002, and GATX indicated that a plan for dealing with the growing number of cracks would be presented by the first week of April. FRA has not received such a plan from GATX and, in the weeks since the February meeting, there have been three additional cars found with cracks at the terminations of the reinforcement bars.

This Railworthiness Directive requires all pre-1974 GATX-built cars having reinforcing bars to have an inspection, according to an FRA-approved maintenance plan, before they are next loaded. FRA estimates this fleet at about 4,500 cars.

**Previous History**

The issue concerning reinforcing bars had its beginning when stub-sill tank cars operated in longer and heavier trains showed a tendency of the tank to buckle under compressive and dynamic loads. In 1974, the AAR (Association of American Railroads) increased the design load

requirements for all freight cars and as a result, GATX was required to modify its fleet of non-pressure, non-exterior coiled, general service tank cars. In 1975, AAR allowed owners of affected cars to modify tanks to conform to the new standards and to achieve “certified” status upon a demonstration of the structural integrity of the tank. The original mandatory compliance date was July 1, 1989, later extended to the end of that year. On May 31, 1990, AAR issued a circular letter prohibiting interchange of cars not meeting the new design load requirements.

GATX addressed the problem by applying reinforcing bars along the bottom longitudinal centerline of the tank on both new and existing tanks. On existing tanks, the reinforcing bars were applied by overhead welding and, to eliminate the need for localized post-weld stress relief of the tank, AAR granted approval for GATX’s proposed “skip welding technique” to minimize heat input into the tank.

At least three GATX bar cars have suffered total shell failures when undetected cracks at the termination of a reinforcing bar propagated into a complete circumferential shell failure. These events, and their Tank Car Committee file reference are:

- 1991 at Grand Forks, North Dakota (T200.61-91);
- 1996 at Sweetwater, Tennessee (T200.86-96); and
- 1999 at Wilmar, Minnesota (T200.102-99).

As briefly mentioned above, since 2002 began, there have been four cars discovered with cracks at reinforcing bar weld terminations:

- GATX 15927, on January 15, 2002, at New Martinsville, West Virginia, while under load carrying toluene;
- GATX 22690, early in March, 2002, at Edmonton, Alberta, while under load in methanol service;
- GATX 27606, on February, 12, 2002, at Grafton, West Virginia, while under load in fuel oil service; and
- GATX 73374, on April 3, 2002, at Erwein, Tennessee, while under load in xylene service.

The last three cars on this list came to FRA’s attention since the February meeting with GATX representatives.

## Requirements for Tank Cars

Federal regulations, at 49 CFR § 180.509(c), require tank cars to be inspected periodically during their service life and, at .509(b), require inspections upon the happening of certain events. One of those defining events is the discovery, by the FRA Associate Administrator of Safety, that a car or class of cars may be in an unsafe operating condition, as set forth below:

§ 180.509 Requirements for inspection and test of specification tank cars.

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(b) Conditions requiring inspection and test of tank cars. Without regard to any other periodic inspection and test requirements, a tank car must have an appropriate inspection and test according to the type of defect and the type of maintenance or repair performed if:

\* \* \*

(4) The Associate Administrator for Safety, FRA, requires it based on the existence of probable cause that a tank car or a class or design of tank cars may be in an unsafe operating condition.

## FRA's Findings and Directives

The long history of problems with GATX-built and modified tank cars with reinforcing bars, coupled with what could be an accelerating number of cars with tank cracks associated with reinforcement bar welding, compels FRA to issue this Railworthiness Directive.

The cars to which this Directive applies are all pre-1974 GATX cars built or modified with reinforcing bars. FRA determines that the subject cars constitute a "class ... of tank cars" that "may be in an unsafe operating condition." Pursuant to 49 CFR 180.509(b)(4) and effective with the date of service of this Railworthiness Directive, the subject cars may not be loaded until they have been inspected, and repaired as necessary, following maintenance procedures submitted to and approved by FRA. It is anticipated that inspections will focus on the area of reinforcement bar terminations, but analysis of key structural elements of the car (described below) may expand the area of focus.

No subject car may be restored to service until it is in full compliance with DOT and AAR standards and with the program required by this Railworthiness Directive.

The issues associated with the subject cars are greater than mere crack detection and repair. Until more is known about the way in which these cars respond to their service environment, the public cannot be certain that cracks will be found before they have grown to incipient failure. Therefore, this Railworthiness Directive requires the owners of the subject cars to develop a maintenance program, to include inspections and repairs using reliability-based,

damage-tolerance engineering principles, of all structurally significant items. The program must involve an understanding of such elements as:

- A determination of the key structural members on each of the designs of the subject cars;
- The loads on key structural members encountered in transportation service.
- The stress levels of key structural members, a process that may require finite element modeling;
- Fracture mechanics;
- Critical material properties; and
- Crack growth rate (based on the material properties, environment, and temperature).

A key element in the success of this Railworthiness Directive is the establishment of confidence in the non-destructive methods used to inspect the subject cars. Accordingly, this Directive requires owners of the subject cars to validate any nondestructive examination method chosen for the required inspections by quantifying that method's ability to find a flaw for each structurally significant item during an inspection. Specifically, owners of the subject cars must validate each method chosen with respect to the minimum crack size the method can be expected to detect. In addition to validating the method, car owners are required to validate the ability of the employee to use the method chosen.

In order to ensure that approved methods are used by qualified personnel, owners of the subject cars are required to furnish copies of the maintenance procedure approved by FRA to each facility performing any function under it. Further, owners of the subject cars are required to ensure that the personnel of the facility performing any work under the approved procedure understand and follow the requirements of such procedure. Owners of the subject cars are required to monitor the performance of any facility performing work under the approved procedure. Using the data gathered through monitoring, owners must amend or modify either the way the work is done or, in consultation with FRA, the approved procedure itself. This is vital in order to achieve both the desired reliability and the greatest confidence in the procedure, and the application of the procedure, to return safe tank cars into the transportation of hazardous materials.

If GATX is not the owner of a subject car, GATX shall, as soon as possible, notify the respective owner or lessee of this Directive and instruct the owner or lessee not to load the car or offer it for transportation until the owner complies with this Directive. All owners of the subject

cars are included in this “inspect before loading” Directive. Any owner not cooperating in this program may be subject to civil penalties of up to \$27,500 for each day of violation.

Owners of subject cars are required to inform FRA on a weekly basis of their progress in developing a maintenance program and in inspecting the subject cars affected by this Directive. Contact with FRA may be made to

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Hazardous Materials Division  
Office of Safety  
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Washington, DC 20590  
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Regardless of compliance with these Directives, FRA reserves the right to seek civil penalties for violations of the hazardous materials regulations.

Issued in Washington, DC, on April 19, 2002,

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George A. Gavalla  
Associate Administrator for Safety