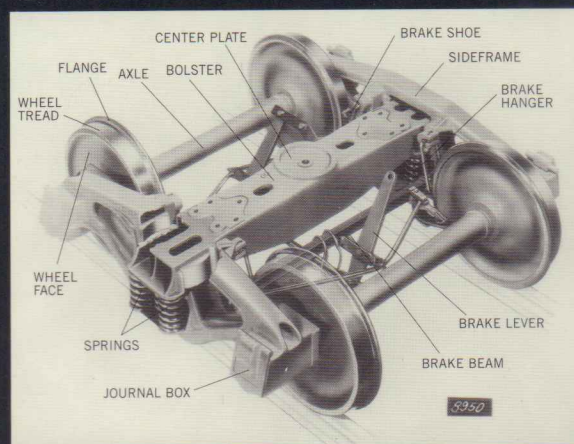
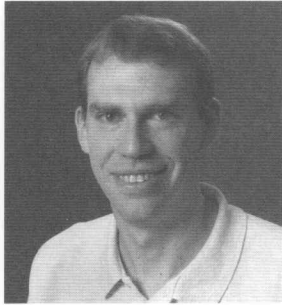


THE MODEL RAILROADER'S GUIDE TO **FREIGHT CARS**



About the author



This is Jeff Wilson's twelfth book on railroads and model railroading. He models the circa-1964 Chicago, Burlington & Quincy in HO scale, and enjoys both model and prototype photography. He served as an associate editor for *Model Railroader* for ten years, and is still a frequent contributor to the magazine. He is also a columnist for *Model Retailer* magazine.

THE MODEL RAILROADER'S GUIDE TO FREIGHT CARS

JEFF WILSON



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Printed in the United States of America

05 06 07 08 09 10 11 12 13 14 10 9 8 7 6 5 4 3 2 1

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Publisher's Cataloging-In-Publication Data
(Prepared by The Donohue Group, Inc.)

Wilson, Jeff, 1964-

The model railroader's guide to freight cars / Jeff Wilson.

p. : ill. ; cm.

ISBN: 0-89024-585-1

1. Railroads—Freight-cars—Models. 2. Railroads—Freight-cars—Design and construction. 3. Railroads—Freight-cars—History—20th century. I. Title.

TF197 .W55 2005
625.19

Managing Art Director: Mike Soliday
Book Design: Sabine Beaupré

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INTRODUCTION

Modelers have long paid special attention to locomotives and cabooses, but freight cars often don't receive the same care in modeling. That needn't be the case, as the last few years have seen an explosion in the number of highly detailed, realistic freight car models available in all scales.

With so many models available, it can be difficult to determine the types of cars appropriate for different eras or types of service. This goal of this book is to make freight car selection less of a mystery.

Each chapter provides a brief history of a type of freight car, then shows through photos how car designs have evolved from the World War I era to the present. This book is designed as a guide for modelers, illustrating the spotting features that make cars unique and making it easier to choose and detail appropriate models.

In addition to the cars themselves, the book also examines the evolution of freight car components: wheels, trucks, and brake equipment. An overview of how air brakes work.

This book is not meant to be a complete guide to every freight car ever produced, or to examine the myriad detail differences present on every sub-class of car—space simply doesn't allow that. Much of the information was culled from hundreds of articles in dozens of modeling, railfan, and trade magazines, including *Model Railroader*, *Trains*, *Freight Car Journal*, *Mainline Modeler*, *Modern Railroads*, *Model Railroad*, *RailModel Journal*, *Railroad Model Craftsman*, and *Railway Age*. Also invaluable were reference guides, including various issues of the *Car Builders' Cyclopedia* and the *Official Railway Equipment Register*, and books too numerous to mention.

Other sources include clinics and seminars, photographs, and personal observation. As with any work of this scope, sources sometimes conflict regarding dates, figures, and facts. I did my best to sort through these for the most accurate information; any mistakes made in sorting out this material are my own, and not of those who assisted me. I hope this book serves as a handy reference for your modeling and railfanning.

Projects like this would not be possible without the help and work of others. I would like to thank the many people who provided information and/or searched their photo collections to find materials, including Scott Chatfield, Bob Gallegos, Jim Hediger, Richard Hendrickson, J. David Ingles, Keith Kohlmann, Brian Kreimendahl, Marty McGuirk, Hol Wagner, and Jay Williams. I also want to thank the many photographers whose photos reside in the David P. Morgan Library at Kalmbach Publishing Co. Without that library's collection, this book would not have been possible.

Jeff Wilson
January 2005

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Book Design: Ashlee Deary

BOXCARS



The ubiquitous boxcar was the dominant freight car throughout much of the history of railroading. Boxcars were *the* general-purpose car on the rails into the 1970s.

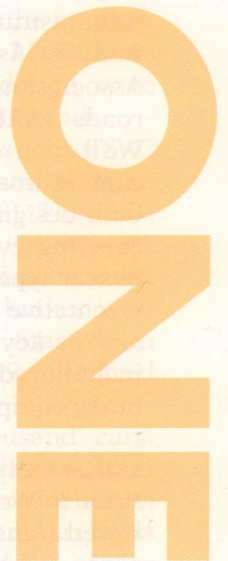
Although today much of what was once carried in boxcars now rides in containers, plenty of boxcars remain in service carrying auto parts, paper, canned goods, and other products (fig. 1-1).

Boxcars have evolved significantly since World War I. Part of that evolution relates to size. The 40-foot, 40-ton cars of the 1910s grew longer and taller over the years, resulting in the 50-foot cars in the 1950s and the 86-foot excess-height cars introduced in the 1960s.

Materials played a big role in development as well. Wood gave way to steel. Improved designs for roofs, ends, and other components made cars stronger, more durable, and weather-tight.

1-1 Even though boxcars are no longer the most numerous freight car type on the rails, modern boxcars, such as this 60-foot TBOX car, still a play vital role in hauling freight.

Jeff Wilson





1-2 This single-sheathed USRA-variation boxcar was built in 1925. It has Murphy ends with a 7/8 pattern. The underbody brake gear is readily visible on these cars. *David P. Morgan Library collection*



1-3 Double-sheathed USRA cars had heavy fishbelly underframes and straight side sills. This car has the 5/5/5 Murphy ends found on true USRA boxcars, and it rides on Andrews trucks. *David P. Morgan Library collection*



1-4 The original deep fishbelly underframe is still visible on this rebuilt USRA boxcar. The wood sides have been replaced with steel, the Murphy ends extended to make the car taller, and a new power hand-brake (Miner) has been added. *David P. Morgan Library collection*

Regardless of the era you model, boxcars will be a key element of your mix of freight cars. To help you determine what cars are appropriate for your era and industries, we'll start by taking a look at how cars have evolved with the United States Railroad Administration (USRA), American Railway Association (ARA), and Association of American Railroads (AAR) standard designs. We'll then examine other significant railroad- and manufacturer-built designs. Space doesn't allow covering every variation of every boxcar type, but we'll look at representative samples of key types and at key differences in detail, including doors, roofs, ends, and brake equipment.

USRA designs

Prior to World War I, boxcars followed many designs. Each order—whether built by a manufacturer or a railroad—tended to be custom made, as each railroad had its own idea of what constituted an ideal car design.

That changed in 1917 with government control of the railroads

during World War I by the United States Railroad Administration. The USRA developed standardized designs for several types of locomotives and freight cars, including boxcars. Railroads were for the most part against the idea of standardization, but the USRA deemed the concept necessary to increase manufacturing efficiency and speed delivery of needed cars for the war effort.

The USRA formulated two designs for 40-foot boxcars. Both were wood cars with steel underframes, but one was single-sheathed and the other was double-sheathed. Single-sheathed boxcars had exposed body framing, with a single layer of sheathing applied on the inside. Double-sheathed cars had two layers of sheathing—one inside, one outside—giving the car a smooth-sided appearance.

The USRA single-sheathed car (fig. 1-2) had a 50-ton capacity and used a Howe-truss design for the steel framing on its sides, with four panels on each side of the door and the diagonals meeting at the top of the door opening. These

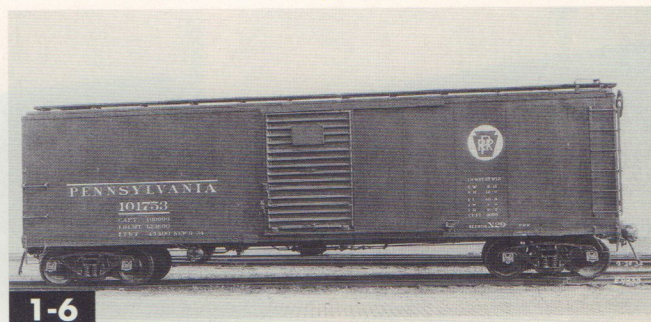
cars had steel underframes, three-piece Murphy ends with a 5/5/5 corrugation pattern (see the sidebar on page 9 for more information on car end features), and vertical brake staffs.

About 25,000 USRA single-sheathed cars were built, and several thousand more cars were built to the same or similar design after USRA control ended.

The double-sheathed cars (fig. 1-3) had 40-ton capacities, with wood framing (instead of steel) inside the sheathing. This was an important distinction because double-sheathed cars tended to deteriorate much faster than the steel-framed single-sheathed cars.

The double-sheathed cars had distinctive steel fishbelly underframes, which were very strong (overly so) and made the double-sheathed cars prime candidates for rebuilding. As with single-sheathed cars, double-sheathed USRA cars featured Murphy 5/5/5 ends.

The designs proved themselves worthy, and many railroads built or bought copies of the designs into the 1920s. A characteristic of most of the copies—and a way to



1-5 Mather cars were 40-foot, 40-ton single-sheathed boxcars with wood ends. *David P. Morgan Library collection*

1-6 The Pennsy X-29 boxcar was the first mass-production steel boxcar built. This is a late X-29, built in 1934. It has a Youngstown door, AB brakes, and a power handbrake. *Pennsylvania RR*

1-7 This 1932 ARA boxcar (built in 1936) has early Dreadnaught 4/4 ends with square corner posts, Youngstown doors, and an earlier-style horizontal brake wheel. The tabs extending below the sides cover the ends of the bolsters and cross-bearers. *Pullman-Standard*

tell them from the original USRA cars—is their improved Murphy ends with the 7/8 pattern (fig. 1-3).

Many USRA cars were rebuilt with steel sides in the 1930s and 1940s. Some single-sheathed cars were rebuilt, but most of the rebuilds were double-sheathed cars because of their weaker all-wood body construction.

Figure 1-4 shows one of the rebuilt cars. Rebuilds generally retained their deep fishbelly underframes and Murphy ends (although the ends were often extended to make a taller car), both of which are good spotting features. Another feature to look for is the side sill, which is set in from the bottom of the sides.

Rebuilds received various types of roofs, doors, and ladders, and had either eight- or ten-section side panels. Most had their older K style brake equipment replaced with AB brakes, and many had their vertical brake staffs replaced with vertical brake wheels on the car ends.

Another common wood boxcar that lasted through the steam era was the Mather patent car, shown in fig. 1-5. The Mather Co. built

and leased these cars to many railroads. Although dated (the cars looked older than they actually were), Mather cars were simple and inexpensive to build. They were single-sheathed, with three panels on each side of the door, and had wood ends.

Many other styles of single- and double-sheathed boxcars were built through the 1920s, including many that were unique to a single railroad. Spotting features to watch for include number and spacing of the vertical posts; type of truss (direction of the diagonal members); car height and width; roof, door, and end type; ladder or grab iron style; side sill; and underframe type.

Standard steel cars

Steel gained in popularity as a building material in the early 1920s and had been widely used for other car types—such as hoppers—since the turn of the century.

An ARA design of 1923 proposed a steel car, and although resistance among some member railroads kept it from becoming a standard, the design became the

first widely used steel boxcar.

The most famous of these was the Pennsylvania Railroad's X-29 boxcar (fig. 1-6). The Pennsy built about 30,000 X-29s through the early 1930s, making the design significant because so many of the cars could be found traveling on railroads throughout the country. In addition, another 21,000 cars based on the ARA design were built by or for other railroads.

The original X-29s were 8'-7" inside height (IH) cars, with an 8'-9" inside width (IW). They had lap-seam roofs, and most were built with flat riveted-plate ends, Creco doors, and K brakes with vertical brake staffs. Starting in 1928 most new X-29s received Youngstown doors.

The last few thousand cars, built in the early 1930s, had Dreadnaught ends (see sidebar on page 9), AB brakes, and Ajax handbrakes. Also, many of the earlier cars were eventually rebuilt with AB brakes and power handbrakes. (See chapter 8 for more information on brake equipment.) Most cars rode on Pennsy's own 2D-F8 trucks.



1-8



1-9



1-10

1-8 The AAR 1937 cars were taller than the 1932 cars, as witnessed by their 4/5 Dreadnaught ends. This car has square corner posts—note the sharp angle of the corner. Vertical brake wheels were now standard on these cars. *W.C. Whittaker*

1-9 Later AAR 1937 cars had improved W corner posts, which resulted in ends with rounded corners as on this M&StL car. *Minneapolis & St. Louis*

1-10 Modified 1937 cars, such as this 1942-built Southern car, had 5/5 Dreadnaught ends and an increased IH of 10'-6". The car has a Murphy panel roof and steel running board. *Don Phillips*

1-11 Cars began appearing with improved Dreadnaught ends in 1944. On these the small triangular protrusions are replaced with long slender corrugations. Monon No. 1 has Superior seven-panel doors and eight-rung ladders. *David P. Morgan Library collection*



1-11

The cars proved to be solid but had a design flaw in that moisture could be trapped behind the sides at the floors, causing the lower areas of the sides to rust out over time. Most of these cars that were still in service in the 1950s and later were modified with thin plates over the lower sides to fix this problem.

The 1932 ARA steel boxcar

In 1932 the American Railway Association (ARA) introduced a standard design that ranks among the most revolutionary in the evolution of the boxcar. It was the first steel car accepted as a standard by American railroads, and its design would lead directly into the next generation of standard cars (fig. 1-7). The car introduced the basic appearance that all ARA/AAR cars would follow for the next 25 years, with tabs extending below the sides to hide the ends of the boxcar's underframe crossbearers.

The design relied on steel sheathing—the carbody itself—for strength, whereas earlier cars relied more on their underframes. This allowed the car to be lighter than previous designs. It was also larger than the older cars, with a 9'-4" interior height and 8'-9" interior width standard (although some cars varied from these dimensions).

The design was a standard, but it allowed for many options in components—a factor that helped increase its popularity. Most 1932 cars had Dreadnaught 4/4 ends and panel roofs, although some were equipped with lap-seam, radial, or Viking roofs and 4/5 Dreadnaught, Murphy, or flat plate ends.

About 14,000 cars were built to the 1932 design, and, even with the upgraded standard that came in 1937, some cars were built to the 1932 design into the early 1940s. Major builders of 1932 cars were American Car & Foundry

(ACF) and Pullman-Standard, but several other companies also built cars to this design.

Later AAR steel cars

The 1937 Association of American Railroads (AAR) standard design was based heavily on the 1932 design, but was taller and wider: 10'-0" and 9'-2", respectively (fig. 1-8). A spotting feature of these cars was their 4/5 Dreadnaught ends, which allowed for the increased height.

Another spotting feature was the corners on the Dreadnaught ends. The 1932 cars and the first 1937 cars had ends (figs. 1-7 and 1-8) that wrapped at a right angle around square internal corner posts. The corner posts were later changed to a W shape, which resulted in a rounded corner as fig. 1-9 shows.

Other details to watch for are the ladders, which have seven or eight rungs. There were also several different designs and patterns

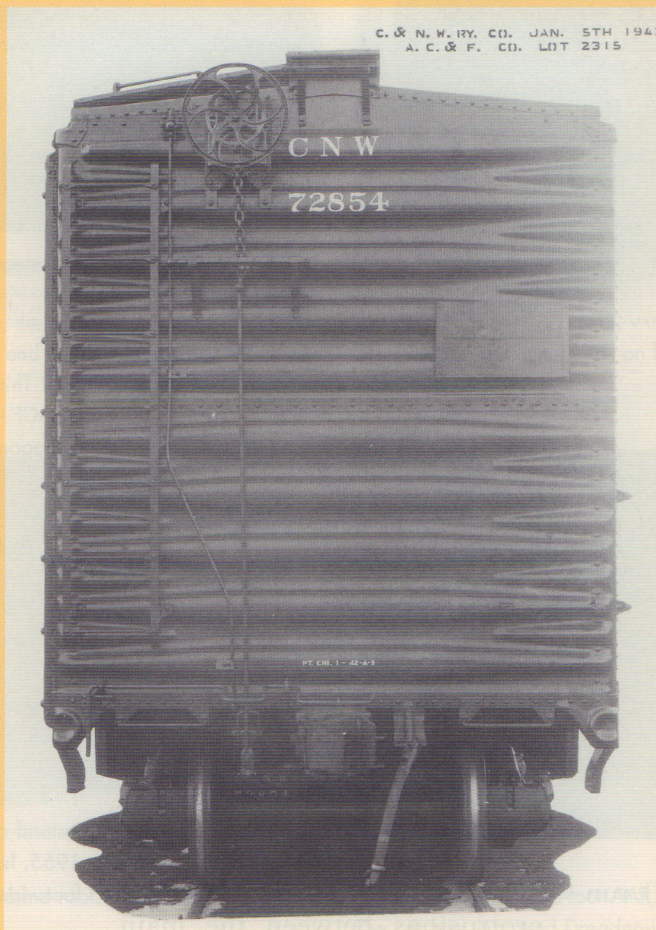
Boxcar ends

Several types of steel ends were used on boxcars and other house cars (reefers and stock cars) from World War I to the present. Among the earliest was the Murphy design, which had thin horizontal corrugations (as in figs. 1-1 and 1-3).

Since ends are made of two or three panels that are riveted or welded together, the number of corrugations on each panel is an identifying feature. Thus, a Murphy end with 7 ribs on the top section and 8 on the bottom has become known as a Murphy 7/8 end.

The other main type of end is the style made by the Standard Railway Equipment Mfg. Co. called "Dreadnaught" (see photo at right). This distinctive design originally had a series of heavy corrugations (thicker than the Murphy) with a series of small triangular shapes—often called "darts"—at the ends. The number of corrugations varied with the height of the car, with 3/3 ends common on refrigerator cars, moving to 4/4, 5/4, and 5/5 on AAR boxcars.

A spotting change occurred in 1940. Earlier ends had sharp angles at the corners, as seen in the photo of the Soo Line car in fig. 1-7. Later cars had rounded corners (fig. 1-9), as the



Dreadnaught ends were the most commonly used through the 1960s. This is a 4/4 pattern end on a boxcar built in 1942. ACF

end wrapped around a newly designed W-shaped corner post.

In 1945 the design changed again, with the introduction of the improved Dreadnaught end. With these, as fig. 1-11 shows, the small triangles were replaced by long narrow corrugations. In 1948 this was further modified with an additional thin corrugation at the top (which became heavier in later years), as fig. 1-18 shows.

For a time in the early 1950s the thin corrugations were eliminated, creating what many modelers have termed the "Dartnaught" pattern (fig. 1-12).

The Dreadnaught end continued to evolve. The design was used on some cars until the 1970s (by then Standard Railway Equipment had become Stanray, part of Abex Corp.), as fig. 1-32 shows.

When Pullman-Standard introduced its

PS-1, it used its own proprietary steel end. The PS end is marked by several wide corrugations of a different shape when compared with Dreadnaught ends as fig. 1-13 shows. PS ends originally featured poling pockets, which were eventually eliminated. Until the mid-1950s, the top and bottom sections of the ends were riveted together (fig. 1-13); after that they were welded (fig. 1-14).

Slab ends—with two or more flat pieces of steel riveted together—were popular on some early boxcars (fig. 1-16) including notables such as Pennsy's early X-29 and some early AAR steel cars.

Most modern boxcars have corrugated ends with overlapping sides (called non-terminating ends), as fig. 1-27 shows. These can be found with varying number (and size) of corrugations.

Many other end patterns—too many to describe here—have also been used over the years, but are in the minority.



1-12



1-13



1-14

of steel (rather than wood) running boards.

The AAR standard cars were built by a number of manufacturers, notably ACF and Pullman-Standard (PS), but also Bethlehem, General American, Magor, Mt. Vernon Car Mfg. Co., and Pressed Steel Car Co. In addition, several railroads built their own cars to the standard design, many using kits available from ACF and PS.

In 1941, the AAR modified the 1937 car design, creating what became known as the 1937 ARA Modified car. The main difference was an increase in interior height to 10'-6" (although many 10'-4" cars were also built), with 5/5 Dreadnaught ends (fig. 1-10). However, many 10'-0" IH cars continued to be built.

Another update came in 1944 with the introduction of the improved Dreadnaught end (fig. 1-11). As the sidebar on page 9

explains, the small triangular protrusions between the main ribs of the Dreadnaught ends were gone, replaced by long slender corrugations.

The last AAR standard for boxcars, calling for a lightweight welded car, came in 1951, but none were actually built. By the late 1950s production of 40-foot cars was declining as 50-foot cars became more popular. Wider doors and welded construction were the norm as 40-foot production wound down. Figure 1-12 shows a late AAR 40-footer with a diagonal-panel roof and Dreadnaught ends without small corrugations.

Pullman-Standard's PS-1

A revolution was brewing in the boxcar world in the late 1940s. Pullman-Standard, which had built a large number of AAR-design cars, had pioneered many concepts for welded construction.

1-12 This Missouri-Kansas-Texas car, built by ACF in 1950, has welded side panels, a diagonal-panel roof, and Dreadnaught ends without the small corrugations (a version sometimes called the "Dartnaught" end. *ACF Industries*

1-13 Pullman-Standard's PS-1 had welded sides and the company's own ends and roof. This 1951-built 40-foot car has Youngstown doors and a Miner brake wheel. *Pullman-Standard*

1-14 Later PS-1 ends were welded together instead of riveted. This 50-foot car, built in 1955, has Youngstown doors with eight-foot-wide openings. *Pullman-Standard*

Based on those techniques, in 1947 the company unveiled its welded PS-1 boxcar (fig. 1-13).

The PS-1 was based on the latest AAR design, with inside heights of 10'-5" or 10'-6" and a 9'-2" inside width. However, the PS-1 used ends and roofs of Pullman-Standard's own design. About the only notable differences among orders of PS-1 box-cars were the doors—with Youngstown, Superior (seven- and five-panel), and (after 1956) PS's own design—and the type of brake used. The PS-1 featured welded construction (although some riveted cars were built).

Key spotting features are the ends and roof. The ends consisted of several wide horizontal corrugations, without the intermediate corrugations of the Dreadnaught ends. Some features on the ends



1-15

1-15 Milwaukee Road's rib-sided boxcars are tough to miss. This 1940-built car has straight side sills, the early rib pattern that extends to the end of the car, and the small end (lumber) doors used on some cars. *Milwaukee Road*



1-16

1-16 Baltimore & Ohio's wagon-top boxcars had side panels that wrapped around to the roof, with no seam between roof and side. Note the flat slab steel ends on this car, which was built in 1938. *Roy H. Hammond*



1-17

1-17 This DT&I car has a separate round roof. It is a former automobile-service boxcar. *Jim Hediger*



1-18

1-18 ACF built this 50-foot AAR car for Atlantic Coast Line in 1960. The car has improved Dreadnaught ends and a nine-foot Youngstown door. Note the roller-bearing trucks. *Atlantic Coast Line*

changed over time. Ends initially featured poling pockets in the lower corners, which were eventually eliminated. Until the mid-1950s, the top and bottom sections of the ends were riveted together (fig. 1-13); after that they were welded as fig. 1-14 shows.

Milwaukee Road's rib-sided cars

Another series of cars that deserve special mention are the welded rib-side boxcars built by the Milwaukee Road (fig. 1-15). These cars were notable for their welded construction when first built in 1937. Their distinctive appearance (with horizontal ribs) makes them stand out among other boxcars.

The railroad built more than

13,000 40- and 50-foot versions of these cars through 1949, and they could be found across the country. Early cars had ribs extending to the ends of the car sides; after 1944 the ribs stopped short of the sides. Early cars had Hutchins roofs and a 10'-6" interior height; later cars had Murphy panel roofs and were taller (10'-9"). The cars used a variety of doors, including Youngstown and Creco.

B&O wagon-top cars

Round-roof cars stand out in trains. There were two types: Baltimore & Ohio's cars (fig. 1-16) were known as "wagon-tops," because the side panels continued uninterrupted to the roof. This style is distinguished from

round-roof cars, such as the Detroit, Toledo & Ironton boxcar in fig. 1-17.

On round-roof cars (also owned by the Pennsylvania RR, Northern Pacific, and others) the roof is a separate piece, with a seam between the sides and roof.

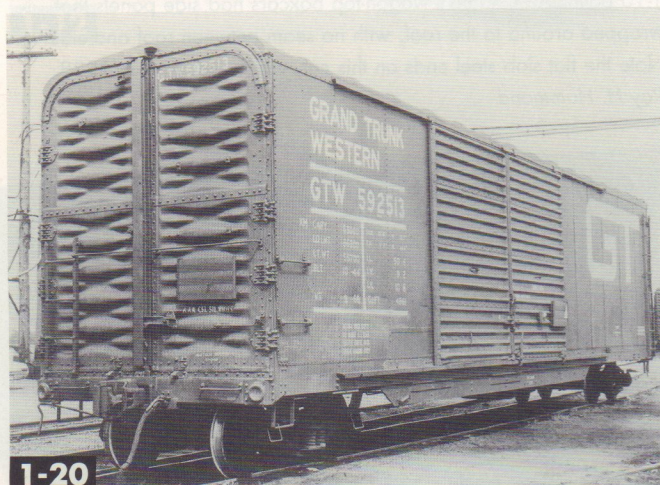
50-foot cars

Before World War II, most 50-foot cars were dedicated-purpose cars used for automobiles, lumber, and furniture. Not many were in general service. In fact, there was no AAR 50-foot standard until recommendations were issued in 1942.

The AAR cars of 1942 followed the general appearance of contemporary 40-foot cars. Plans allowed both single- and double-door ver-



1-19



1-20

1-19 This 40-foot double-door car was built for automobile service in 1937. It has straight side sills and 4/5 Dreadnaught ends with square corner posts. It was in general service by the time of this 1959 photo. *Jeff Wilson collection*



1-21

1-20 This end-door, double-door boxcar was built in 1944 for auto service but, by the late 1960s, was in service hauling cereal out of Battle Creek, Michigan. *Jay Williams collection*

1-21 High-cube 86-foot cars were built specifically for carrying auto parts. Greenville was the major builder of these cars, including this 70-ton double-door car. *Louisville & Nashville*

sions, with 16-panel sides, tabs extending below the sides at the crossbearers as with the 40-foot cars (although many 50-foot cars were built with straight side sills or dropped sills), 5/5 Dreadnaught ends, panel roof, and door openings 6, 7, or 8 feet wide (fig. 1-18).

The 1950s saw a growing use of 50-foot cars, especially late in the decade. By this time, cars typically had 4/3/1 improved Dreadnaught ends, diagonal panel roofs, and welded sides. Single-door cars had wide doors—usually 8 or 9 feet.

Pullman-Standard's PS-1 production also shifted to a 50-foot design, with about 24,000 built through 1961, when the car's design changed (fig. 1-14).

Automobile cars

Through the 1950s boxcars provided the primary means of hauling new automobiles from assembly plants to their final destinations. Into the 1930s cars used for this purpose were primarily 40-foot wood single- or double-sheathed cars (single-sheathed 50-footers began appearing in the late 1920s) with double doors to make it easier to load and unload. Both full double-door and door-and-a-half designs were used.

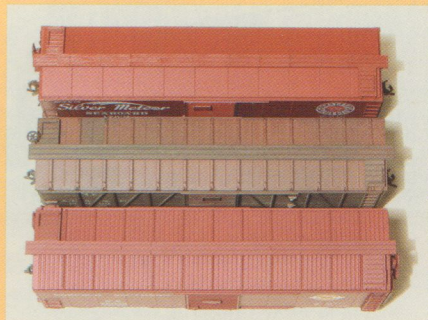
Steel cars became more common in the 1930s, following basic ARA patterns but taller (fig. 1-19). Many cars used Evans auto racks, which allowed two levels of autos to be loaded in each car. These racks folded to the roof when not

in use, so the cars could be used in general service on return trips.

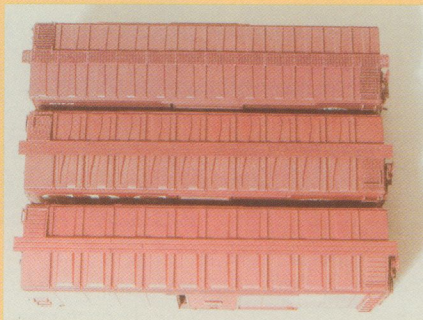
End doors were common on auto boxcars, especially into the 1930s (fig. 1-20). These were a mixed blessing: They made it easier to load autos into the cars but, since cars had doors on one end only, required a great deal of switching to get each boxcar into position for loading. The doors could also be maintenance headaches, especially after a car had been in service for a few years. Many of these cars eventually had their end doors welded shut.

Auto cars usually had special markings to indicate their service: generally they were stenciled "automobile" with a white stripe on the right-hand side doors.

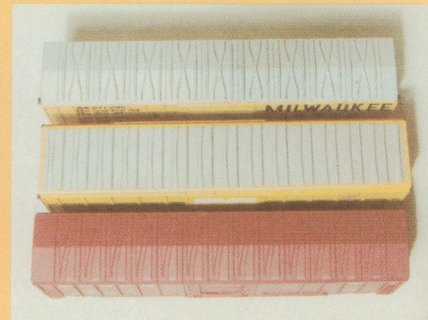
Roofs and running boards



Early boxcar roofs (from the top) included flat seam (as on this HO Red Caboose X29 car), Hutchins (on an Accurail single-sheathed boxcar), and Viking (on a Red Caboose boxcar). *Jeff Wilson*



The most popular roofs from the late steam era through the 1960s were (from top) Pullman-Standard PS (on an HO Kadee PS-1 boxcar), diagonal panel (on an InterMountain AAR boxcar), and Murphy panel (on an InterMountain car). *Jeff Wilson*



Modern roof styles (from top) include the X-panel (on an Athearn HO SIECO boxcar), Pullman-Standard (on an Athearn PS 5,344 car), and diagonal panel (on an Accurail exterior-post 50-foot car). *Jeff Wilson*

Early boxcar roofs were made of wood covered with tarpaper and were prone to leaking and rotting. Metal roofs were the answer to both of these problems.

Roofs were applied in panels that were riveted together. Popular early designs (used into the 1930s) included flat panels of various types: the Viking, with its corrugated panels, and the Hutchins, which had a raised ridge in the middle of each panel.

The roof that would become most common was the Murphy panel roof. Introduced in 1932, it was used through the 1940s. It is characterized by raised seams joining the panels and raised sections in each panel.

An improvement on the Murphy was the diagonal-panel roof, which first appeared in 1948 and can still be found today. This design provided greater

strength for the roof.

As with its boxcar ends, Pullman-Standard came up with its own roof design with the introduction of the PS-1. At first glance, the roof looks like a Murphy, but the raised sections are narrower and taper in at the roof peak.

A modern roof design that debuted in the 1980s is the Stanray X-panel roof, which uses an X pattern instead of diagonal raised panels.

Roofs are typically made of galvanized steel. Most modern roofs are unpainted; many early cars had roofs painted the car color, or painted black (or coated with black roof cement). Peeling paint was common, as paint does not adhere well to galvanized metal.

Roofs are probably the most difficult car feature to identify, simply because most photos are taken from track level. If you're

concerned about accuracy on a model, track down the most reliable information possible, whether it be prototype photos, books, or magazine articles.

Running boards

Running boards (not roofwalks) on house cars were once made of wood, with three stringers down the center of the car and panels, called laterals, reaching to side ladders at two corners. These were generally painted the car color.

As they were exposed to the elements, running boards wore out quickly and required a great deal of maintenance. Thus new boards can often be found on older cars. Steel running boards came into use in the late 1930s and became mandatory on new equipment starting in 1945.

Steel running boards came in various patterns, the most common of

which was a rectangular grid. Some running boards had a diagonal grid, and others had perforated holes.

Running boards fell out of favor and were no longer required on new cars as of 1966 (although high-cube boxcars had been exempted from the requirement in late 1964). All running boards were to be removed from existing cars by 1974, although this date was extended to 1979.

As cars came in for servicing, their running boards were removed. At the same time, their ladders would be cut down to four rungs. Moving the brake wheel down was optional; if it was left in the high position, the ladders on that corner would remain in place.

Cars so modified are noticeable, as they generally kept their running board supports and ladder brackets.



1-22 Sixty-foot cars in auto parts service carry higher-density items such as castings. David P. Morgan Library collection



1-23 Thrall was second in 86-footer production. Note the recessed side sills on this four-door car built in 1966. Thrall



1-24 Pullman-Standard modified its PS-1 with a continuous-tapered sill in the early 1960s. This 50-foot car has the company's Hydroframe-60 cushioned draft gear and nine-foot-wide doors. Milwaukee Road

As auto racks began taking over auto service in the early 1960s, most double-door cars were reasigned to general service.

Auto parts boxcars

In the early 1960s the auto industry, looking for better and more efficient ways of shipping parts to assembly plants, worked with railroads and car builders to develop new freight cars. The goal was to build a boxcar that could handle a variety of parts, without custom-built loading racks or permanent interior fixtures.

The result was the massive 86-foot high-cube boxcar (fig. 1-21) and its little brother, the 60-foot auto parts car. The big cars were designed to carry low-density items, like stampings, while the 60-foot cars (fig. 1-22) carried heavier, higher-density parts like engines, transmissions, and other castings.

Large doors enable easy loading. The racks are unloaded by forklift and often taken directly to the assembly line. Various parts

are made to fit in the standard-sized racks, thus the cars can carry racks holding any type of part.

The 89-foot cars first hit the rails in 1964, and more than 11,000 were built through 1978—mainly by Greenville, Thrall, and Pullman-Standard. The cars have either double doors (fig. 1-21) or four doors per side (fig. 1-23). Most of them are 70-ton cars, although some have 100-ton capacity. Greenville and Thrall cars both used Dreadnaught ends, while Pullman used a version of its PS-1 end. Thrall cars had a recessed straight side sill (fig. 1-23), while Greenville cars had a stepped/tapered sill (fig. 1-21).

The 60-foot cars were built by Pullman, ACF, and other manufacturers. Key spotting features include the type of end, side sills, and door style and number.

Modern boxcars

The 1960s saw changes in boxcar design and a move away from the general-purpose AAR boxcars that

had dominated the market since before World War II. The overall trend toward larger cars, seen in dramatic fashion with auto-parts cars, would apply to general service and other boxcars, with larger door openings to accommodate forklifts. Pullman-Standard kept making its PS-1, but modified the design, as fig. 1-24 shows.

Specialized boxcars began appearing in larger numbers. One of these types was the short high-cube boxcar (fig. 1-25), a 40-foot cousin of the 86-foot auto-parts car. These shorter cars were often used in appliance service in dedicated service for specific shippers.

Another specialized boxcar was the all-door car, shown in fig. 1-26. These cars, built mainly by Thrall (as the Thrall-Door car) and Evans (as the Side Slider), facilitated loading and unloading of lumber and lumber products while protecting loads from the elements. The Evans cars are slightly longer (52'-5" IL) than the Thrall cars (50'-6" IL), and they differ slightly in design as well. The cars were built from the late 1960s into the 1970s.

Insulated boxcars with plug doors came into wide use through-



1-25

out the 1960s. Although they didn't have refrigeration equipment, many were classified as refrigerator cars (RBL). You can read about them in chapter 4.

The 1970s saw a shift in general-purpose boxcars to 50-foot exterior-post designs, typified by the Railbox car shown in fig. 1-27, with door openings to ten feet. Railbox provided a pool of cars to

member railroads, and although it's tempting to lump them together, the company's cars had many differences as they were built by several companies.

Railbox cars were grouped in three basic classes: XF10 were plate B cars (fig. 1-27); XF20 were plate C cars; and XF30 cars were plate C cars (lettered ABOX) with combination plug/sliding

1-25 Short high-cube boxcars, such as this Pullman-Standard 40-footer, were often in appliance service. Russ Goodwin

doors (fig. 1-28). In addition, Railbox cars were built by several companies, including American Car and Foundry, Pacific Car & Foundry, Pullman-Standard, and FMC.



1-26



1-27



1-28

1-26 All-door boxcars, such as this Thrall-Door car, greatly simplified the process of loading and unloading lumber products compared with standard boxcars. Jeff Wilson collection

1-27 ACF built this Railbox class XF10 car, a Plate B car. Note the non-terminating ends: corrugated ends with the sides extending past the corrugations. S.H. Mailer

1-28 This former Railbox (ABOX) car has a combination plug door and sliding door. Jeff Wilson



1-29 The Pullman-Standard 5,344 cubic-foot boxcar was a common 1970s car. It had a flat roof that wrapped around the tops of the sides and posts, and non-terminating ends with closely spaced corrugations. *Jeff Wilson collection*



1-30 This FMC-built car has non-terminating ends, a peaked roof, and a different sill design than the ACF car in figure 26. *Jim Hediger*

Along with Railbox, several railroads bought 50-foot cars, including many short lines trying to capitalize on incentive-per diem (IPD) regulations that made investing in boxcars attractive.

Many details of Railbox (and other cars) varied among builders: the number, style, and spacing of side posts; side sill style; ends; roofs, whether flat or peaked, diagonal panel, X-panel, or PS pattern; and door style.

A number of manufacturers built cars during this time, including ACF (fig. 1-27), Pullman-Standard (fig. 1-29), FMC (fig. 1-30), Pacific Car & Foundry (fig. 1-31), Southern Iron & Equipment Co., or SIECO (fig. 1-32), and others.

A variation on these cars was the “waffle-side” car (fig. 1-33), with stamped protrusions in the steel between the exterior posts.

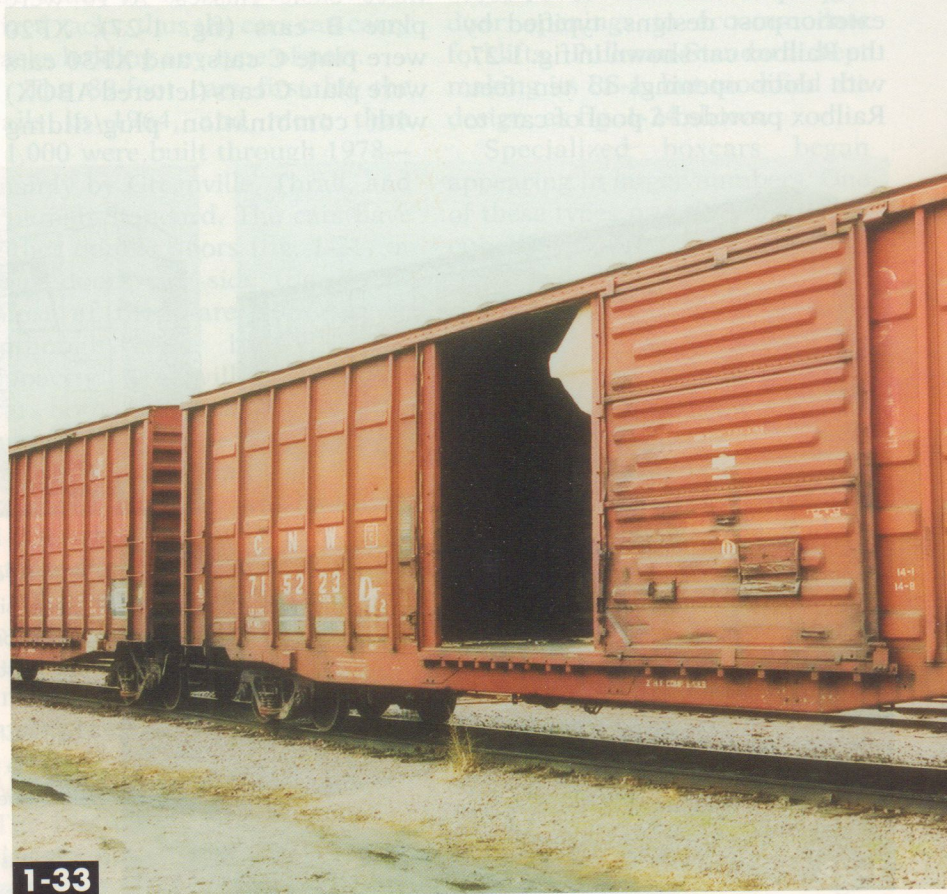
Most of the above companies produced variations of their cars to match either Plate B or Plate C clearances. Plate C cars could be taller (often just over 11 feet). Spotters should check the *Official Railway Equipment Register* for

details on individual car dimensions and capacity to verify the specific model of a boxcar.

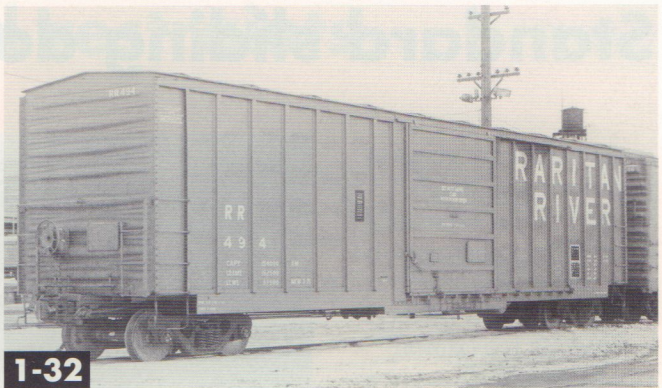
Boxcars today

The recession of the late 1970s and early '80s created an overabundance of boxcars. Along with a shift to container traffic, this caused

boxcar production to drop substantially from the pace of the late 1970s, a trend that continues to the present. For example, in 1977 more than 450,000 boxcars were in service; that number dropped to 190,000 by 2003, placing boxcars behind covered hoppers, tank cars, and gondolas in number.



1-33 Waffle-side cars, like this 1973-built PS car, were built with many waffle pattern variations. This car has non-terminating ends and Pullman's modern sliding doors. *Jeff Wilson*



1-31 Pacific Car & Foundry built this Plate C car for Boston & Maine with a flat roof and non-terminating ends. The car has 14 posts per side. *Tom Nelligan*

1-32 This SIECO car has Dreadnaught ends, a Superior Door, and a straight sill with squared-off ends. Raritan River was one of many short lines to acquire large fleets of boxcars in the 1970s. *George Drury*

Many of the boxcars in service today are the 50-footers of the 1970s, many of which have been rebuilt and refurbished. Some earlier specialized cars, such as the 60- and 86-foot auto parts cars, also still ride the rails.

Although they've slipped in number, boxcars are still being

built to replace older cars that are scrapped or no longer fit for paper loading, which requires clean, weather-tight cars (fig. 1-34). With their external-post design, new cars resemble the cars of the 1970s but are larger. Among the newest cars on the rails are TTX's TBOX cars (fig. 1-35), built by

Gunderson and National Steel Car, which hearken back to the Railbox cars of the 1970s.

Paper and wood products, as well as food and other packaged products, are the most common loads for boxcars today.



1-34 Gunderson built several excess-height 60-foot cars in the 1990s, including this Norfolk Southern car. *Jeff Wilson*



1-35 Among the newest cars on the rails in 2005 are TTX's TBOX cars, such as this one built by National Steel Car. They're primarily used to transport paper and paper products. *Jeff Wilson*

Standard sliding doors

As steel cars grew in popularity, so did several major types of doors. The most popular was the Youngstown door, identified by its numerous horizontal ribs. Early Youngstown doors had a 5/7/5 rib pattern (fig. 1-9); this was changed to a 4/5/4 pattern in 1946 (fig. 1-12). Some doors had an alternate 3/5/5 pattern.

Another popular door type was the Superior, marked by its wide panels with fewer horizontal partitions (fig. 1-11). These doors originally had seven panels, with the spacing even on early cars and then uneven on later cars. Starting in 1952, five panel doors were frequently used.

Although rarer, Creco doors also deserve mention. Used mainly in



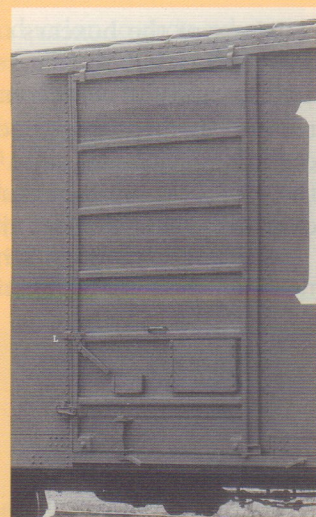
Creco doors were similar in appearance to Superior doors, but had three panels. *J. Parker Lamb Jr.*

Pullman's own PS doors had five raised panels, giving them a different appearance from Superior doors. *Pullman-Standard*

the 1920s and '30s, these look like a three-panel Superior door (see photo above left).

Most PS-1 boxcars had Youngstown or Superior doors, but many were also equipped with Pullman-

Standard's proprietary PS door (shown above right). At first glance these look like Superior doors, but the panels are raised slightly, giving them a unique appearance.



Capacity and Gross Rail Load

It's common to refer to car size in terms of capacity, such as a 50-ton boxcar or a 70-ton boxcar. Each car's rated capacity was once stenciled on the car; this hasn't been required since the 1980s. Instead, the stenciled load limit indicates the maximum weight allowed for the load itself.

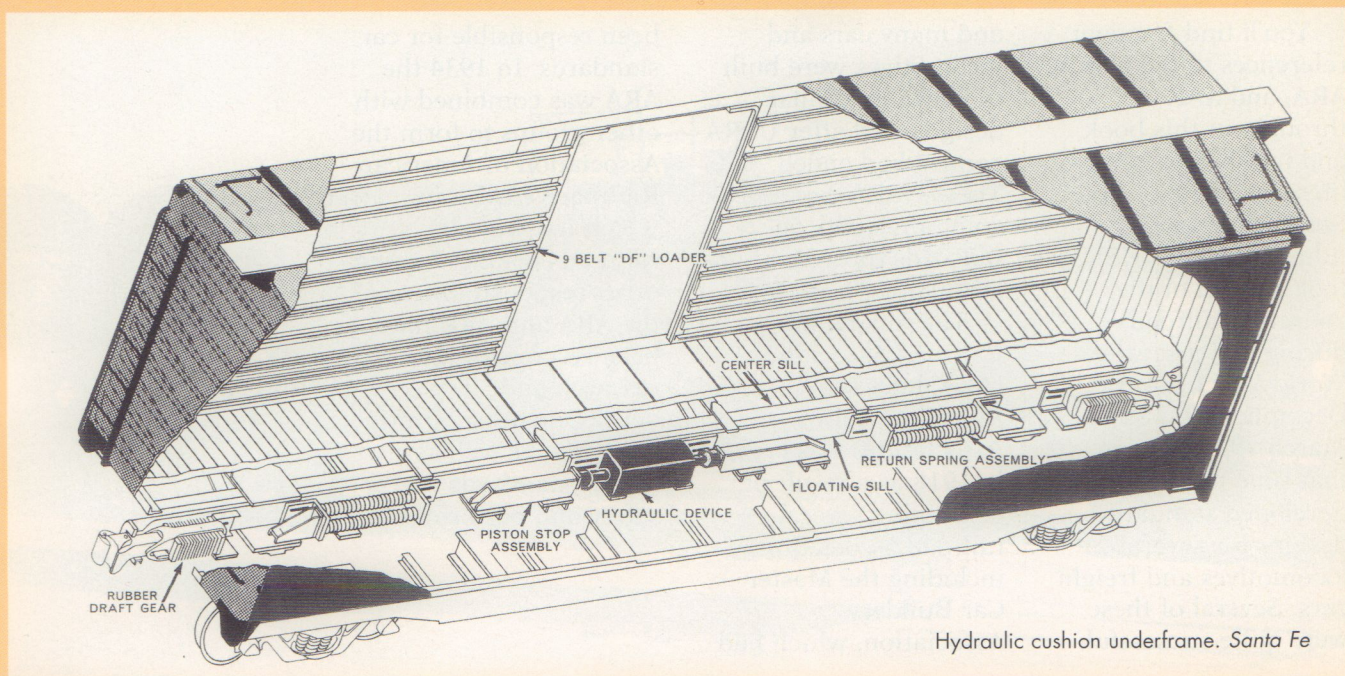
Gross Rail Load (GRL) is the maximum weight for the car allowed on the rail, figured by adding the car's light weight to the weight of the load. The current maximum GRL for unrestricted interchange of cars is 263,000 pounds (nominal 100-ton cars), although since the late 1990s most major

routes have allowed a GRL of 286,000 pounds (110-ton cars).

For example: Look at the TTX boxcar in fig. 34. It has a load limit of 207,600 pounds and its light weight is 78,400 pounds. By adding the two we find that this is a 286,000 GRL car.

For more on freight car data and lettering, see page 89.

Cushioning and load restraints



A problem that grew along with train size in the early 1900s was shifting or damage to loads caused by rough slack action or by hard coupling during switching. A solution to this was the cushion underframe, which became popular in the late 1940s and into the 1950s, first on boxcars, then other freight cars.

The drawing above shows how a cushion

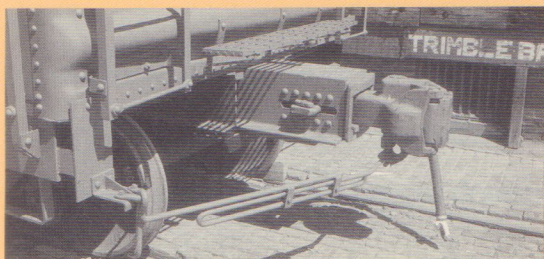
underframe system works. There are two types: Some have sprung draft gear that moves in and out; others, as depicted in the drawing, have a hydraulic device in the center sill that absorbs the shock instead of the car itself. The photo below left shows how the couplers on these cars extend from the car end. You can identify cushioned cars by these

extended draft gear housings, and many cars have lettering indicating these devices (see figs. 1-22, 1-23, and 1-24).

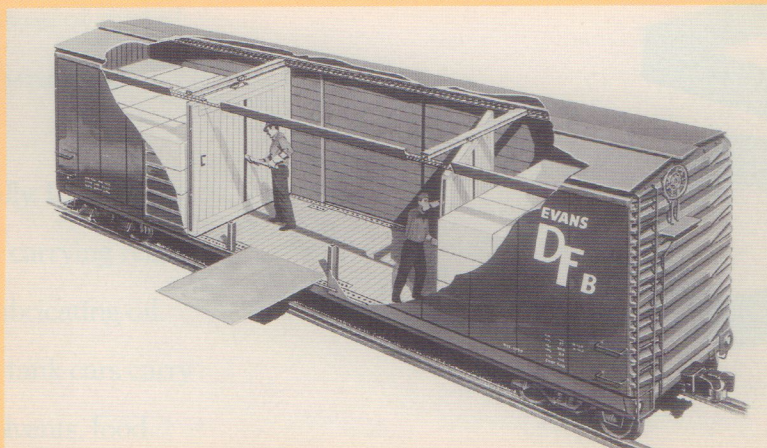
Cushion underframes are found on many boxcars, auto-rack cars, piggyback flats, and coil cars. They are not used on cars carrying bulk products, such as tank cars, hoppers, and covered hoppers.

Load restraining

devices are another common way of preventing damage to lading in boxcars and reefers. The illustration below right shows how these systems use moveable walls, partitions, belts, or other devices to hold loads securely in place inside the car. As with cushion underframes, lettering and stenciling on the car often indicate their presence.



The draft gear on cushion underframe cars extends from the body, allowing for spring travel as the coupler and draft gear travel in and out. Linn Westcott



Adjustable partitions and dividers are used to hold loads securely in place. Evans Products

USRA, ARA, AAR

You'll find frequent references to the USRA, ARA, and AAR throughout this book and in other freight car literature. The United States Railroad Administration (USRA) took control of the country's railroads during and just after World War I: from December 1917 to March 1920. During that time the USRA developed standard designs for several locomotives and freight cars. Several of these were quite successful,

and many cars and locomotives were built to USRA or similar designs well after USRA control had ended. These USRA cars were common sights on railroads throughout the steam era.

The American Railroad Association (ARA, later the American Railway Association) was created in 1918 as a result of combining several railroad associations, including the Master Car Builders Association, which had

been responsible for car standards. In 1934 the ARA was combined with other groups to form the Association of American Railroads (AAR), to which individual railroads belong. Among other responsibilities, the ARA and AAR have been responsible for research and development of various car types, as well as setting standards for safety and performance.

Boxcar classifications

The AAR car mechanical designation—often stenciled near the capacity data on a car and listed in the Railway Equipment Register—will tell you the type of service a boxcar is in. The most common classes include:

XM—General service boxcar

XAP—Boxcar with permanent racks for carrying auto parts

XMP, XP—Boxcar equipped for a specific commodity

XML, XL—Boxcar equipped with loading devices

XMR, XAR, XR—Boxcar with automobile loading racks or devices

The letter "I" appearing after the above codes indicates an insulated car

TANK CARS



Tank cars have been part of railroading since the 1860s.

Their numbers have grown since then to make them the second-most-common car type on the rails today, trailing only covered hoppers. By World War I, tank cars had taken on the basic look that they have today. However, they have evolved significantly, with larger tank sizes, welded instead of riveted construction, and the use of the tank itself for structural strength instead of a separate underframe.

Tank car uses have also changed dramatically. In the early 20th century, the primary job of tank cars was carrying refined oil products such as gasoline, motor oil, and lubricating oil. Today pipelines carry much of that traffic, but tank cars carry hundreds of products, including petroleum, solvents, food products, sulfur, clay slurry, acids, ethanol and methanol, and many other chemicals (fig. 2-1).

2-1 Tank cars have evolved from simple petroleum carriers into specialized cars that carry hundreds of petroleum, chemical, and food products. This modern car is carrying asphalt.

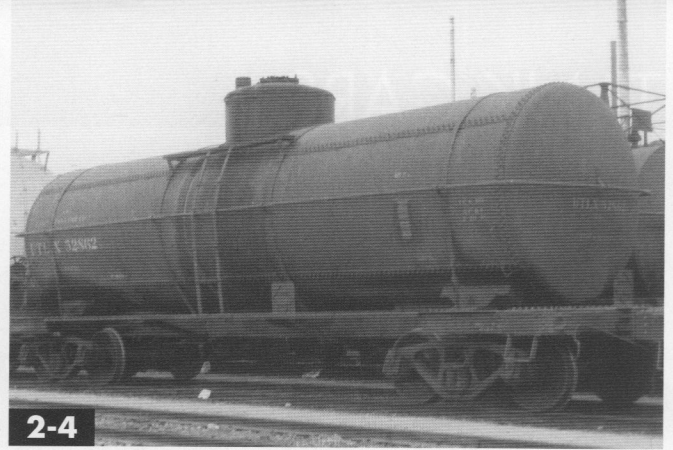
Jeff Wilson

TWO



2-2

2-2 Jordan Car Line no. 1917, built in 1916, is typical of cars built in the teens. It has a riveted steel tank, steel through-center frame, K brakes, and two safety valves built into the expansion dome. This car has interior steam heating coils—the connector for the coils is visible under the car at center. *David P. Morgan Library collection*



2-4

2-4 The X-3, a non-pressure, uninsulated ICC103 tank car, was the mainstay of the UTLX fleet from the 1930s through the 1960s. This car, built by ACF, has a 12,000-gallon capacity; X-3s come in other sizes as well. *Richard H. Hendrickson*

Regardless of the era or region you model, tank cars should be a vital part of your traffic mix. Understanding the differences among the various types will help you more accurately model both the cars and operations.

Early tank cars

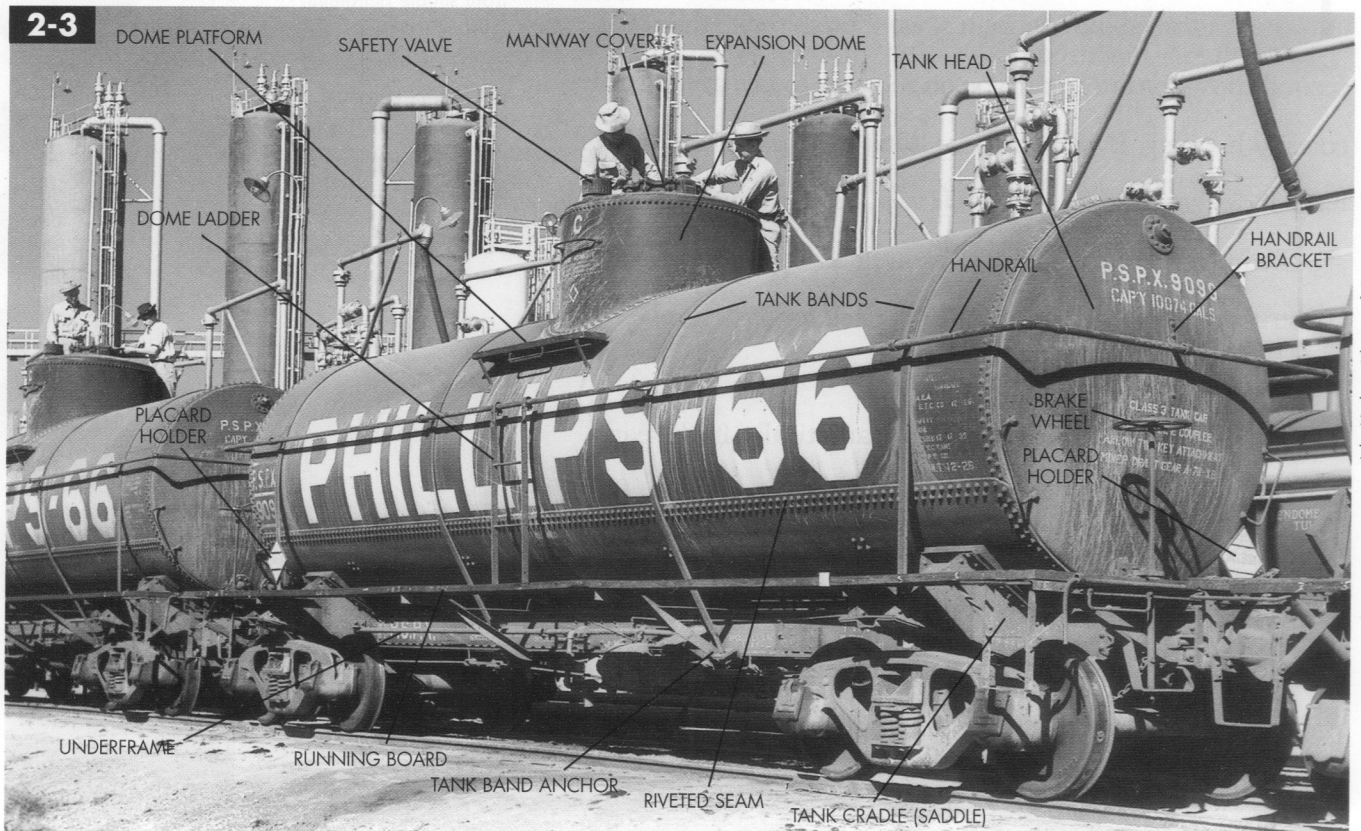
Figure 2-2 shows a state-of-the-art car for the World War I era. It follows the basic construction pattern of cars built into the 1950s. The main feature is the riveted steel tank, with an 8,000-gallon

size the most common into the 1920s, and 10,000-gallon tanks becoming more widely used in the 1930s and later.

Figure 2-3 illustrates the major components of a typical riveted tank car. Through the 1950s, tank cars had steel underframes, with the tank resting in saddles above each truck. A series of steel bands passed over the tank to secure it to the frame. Running boards (wood into the 1940s; steel thereafter) were located around the car, including the sides and ends.

Large domes were prominent features on tank cars through the 1950s. These allowed for expansion of the liquid. Safety valves allowed venting of internal pressure. These valves were outside the dome on early cars (as in fig. 2-2), and built into the dome on later cars.

Tank cars were (and still are) either insulated or uninsulated, and tanks could have either internal (inside the tank itself) or external (outside the tank but covered by the outer shell) steam heating coils.



2-3



Uninsulated cars without heating coils are used for loads not affected by outside temperatures and ones that flow freely in normal temperatures. Cars carrying thick, heavy liquids that don't flow readily ride in insulated cars with heating coils. These include products such as heavy oils, asphalt, and corn syrup.

Ownership and builders

Many companies have built tank cars over the years. American Car & Foundry (ACF) has been a significant builder, supplying its own Shippers' Car Line as well as cars for Union Tank Line (UTLX) and many other companies. In 1955 Union, which until that time had designed its own cars but had other companies build them, bought Graver Tank Co., of East Chicago, Ind., and began building its own cars. Another major builder was General American (GATX), which built thousands of tank cars for its own GATX fleet as well as for other owners through 1984. Current tank car builders include ACF, Union, and Trinity.

Most tank cars were (and still are) privately owned. Railroads were reluctant to build cars for

specialized service, leaving it to the shippers and leasing companies to supply the cars. Railroads do own some tank cars, but these are non-revenue cars used for fuel and other company service.

Currently the largest tank car owners include UTLX and its Canadian subsidiary, Procor, as well as GATX, both of which lease cars to many different companies. Other major owners over the years have included ACF's Shippers' Car Line (SHPX) and North American, now part of GE Railcar Services. Many petroleum and chemical companies have operated their own large fleets of cars over the years.

Tank cars are classified by type, which specify the kinds of products they are allowed to carry. The sidebar on page 30 explains tank car classifications, from the early American Railway Association (ARA) standards through the current Department of Transportation (DOT) classes.

Common early designs and spotting features

Over the years tank cars have been built to many different designs, some based on builders' stan-

2-5 Texaco no. 6811, built in 1929, is a 10,000-gallon ACF Type 21 tank car. It was one of the most popular tank cars built through the 1920s. Type 21s are shorter with larger-diameter tanks than the later Type 27s. *Frank Taylor*

2-6 Shippers no. 6028 is a 6,000-gallon ACF Type 27 car. Type 27 cars were built from the late 1920s through the 1940s, with 8,000- and 10,000-gallon tanks common. *Roy C. Meates*

2-7 This ICC103 car was built by General American in 1930. Note the visible ends of the bolsters and the different style of saddle compared to the ACF-built cars. *Rail Data Services collection*

dards, some on users' specifications. The most visible variations include the tank length and diameter, along with the dome and top fittings. Underframes also vary widely in design. A USRA tank car design was developed, but no cars were built to the design—either during or after USRA control.

Figure 2-4 shows a Union Tank Line X-3 car, which—because of the sheer number of cars operated by UTLX—was the most common tank car in service from the 1930s through the 1960s. This car was designed by Union, but since Union didn't build its own tanks at the time, it was built by several manufacturers. The X-3 was built with several sizes of tanks.

The other most common early tank car designs were ACF's Type 21 (fig. 2-5) and Type 27 (fig. 2-6) cars. Type 21 cars (so named because they were designed in



2-8

2-8 This 4,000-gallon welded (ICC103W) car, built by ACF in 1949, was designed for hauling vegetable oil. Note how small the tank appears compared to the trucks.

American Car & Foundry

1921), built through the 1920s, can be identified by their shorter, larger-diameter tanks compared with Type 27s, which were built from the late 1920s through the 1940s. They also had different styles of underframes and tank saddles. Each car was available with several sizes of tanks, with

8,000- and 10,000-gallon capacities the most common.

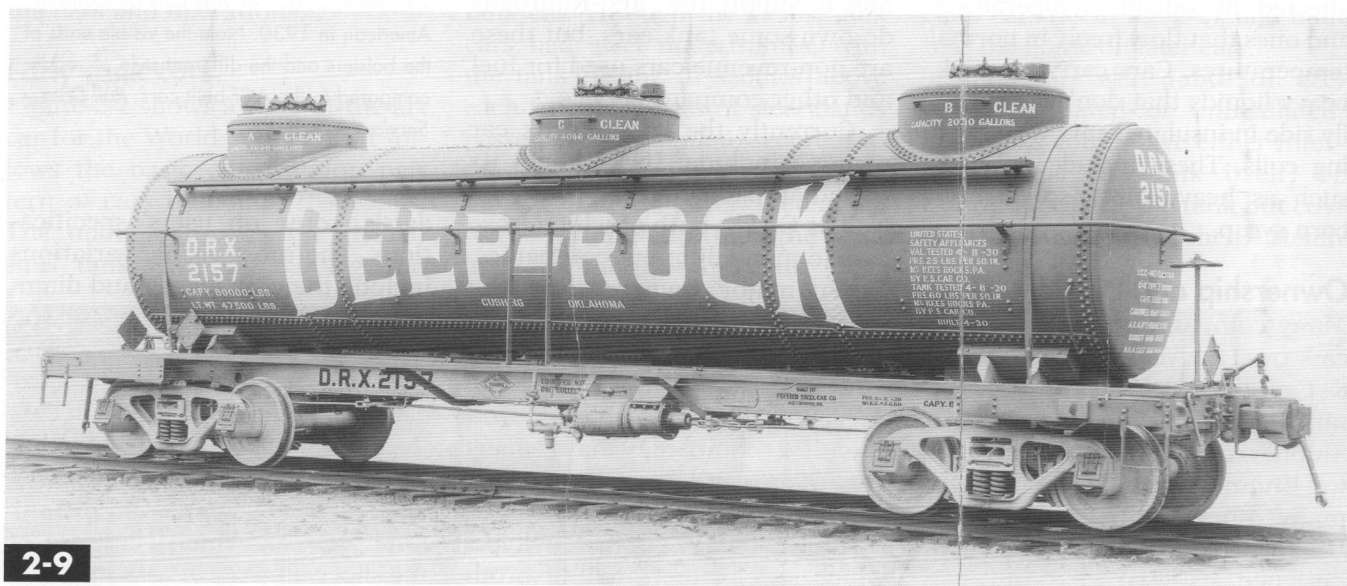
Figure 2-7 shows a car of the same period built by General American. Note the exposed ends of the bolsters and the different frame style compared with the ACF cars.

Tanks with 8,000-gallon capacities were common through World

War II, although 10,000-gallon cars were built in the 1920s and later (and 12,000-gallon tanks in the 1930s). In addition, some cars were (and are) built with much smaller tanks to haul small lots or heavier (denser) products. Figure 2-8 shows one example.

Cars with multiple compartments were also common through the 1950s (fig. 2-9). These were often used to ship multiple products (different grades of gasoline to a fuel distributor, for example). A detail to note is that the expansion dome for each compartment is smaller than the dome on a single-compartment car, because each compartment is smaller.

Many early riveted tank cars stayed in service into the 1960s and even into the '70s. Spotting features on these early tank cars include the tank length and diameter, rivet seams (tank courses)



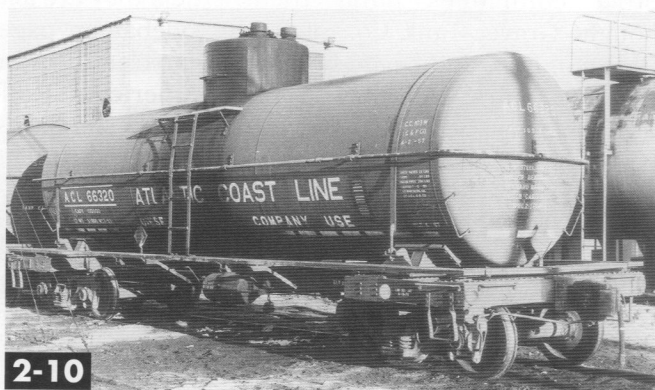
2-9

2-9 Many early tank cars had multiple compartments, such as this ICC103 riveted car built by Pressed Steel Car Co. for Deep-Rock in 1930. Note the rivet lines showing the two bulkheads separating each compartment. The car's K brakes are quite visible.

Pressed Steel Car Co.

2-10 The first ICC103W (welded) cars, built starting in the late 1940s, looked much like earlier ICC103 cars, just without the rivets. Some were built quite late—this ACF diesel fuel car was built in 1957, after Union had introduced frameless/domeless cars.

Mike Small



2-10

and patterns, style of tank saddles, number and type of tank bands, underframe style, and styles of ladders and grab irons.

Through the 1940s most tank cars were riveted, though forge-welded tanks began appearing in the mid-1920s, almost exclusively for high-pressure cars. Fusion welding became more common in the 1940s, first on pressure cars, then on non-pressure cars, and by the late 1940s welded cars had become standard (fig. 2-10). The first welded non-pressure cars looked much the same as the earlier riveted cars, but without the rivets. Not many welded non-pressure cars of this style were built, however, because of the surplus of tank cars after World War II and the dropoff in shipping refined petroleum products by rail due to the petroleum industry's growing pipeline network.

Pressure and insulated cars

The growth in use of propane and butane (now usually blended as liquefied petroleum gas, or LPG) for home heating in the 1930s led to a dramatic increase in the number of high-pressure tank cars, especially following World War II. Other products carried in these cars include anhydrous ammonia, chlorine, and methyl chloride.

Figure 2-11 shows a typical early pressure tank car. These cars had welded tanks, though the outside jacketing was sometimes riveted. They were insulated to protect the lading in case of an accident or external fire. The key spotting feature of early cars is the lack of a large expansion dome. Instead, the small housing atop the tank contained valves and fittings for loading and unloading.

Instead of going around the outside jacket, the tank bands

pass through the outer jacket and through the insulation to wrap around the tank itself. Insulated cars built through the 1950s typically had a lip around the rim at each end. Into the 1950s these ICC-105 cars typically had capacities of 10,500 or 11,000 gallons.

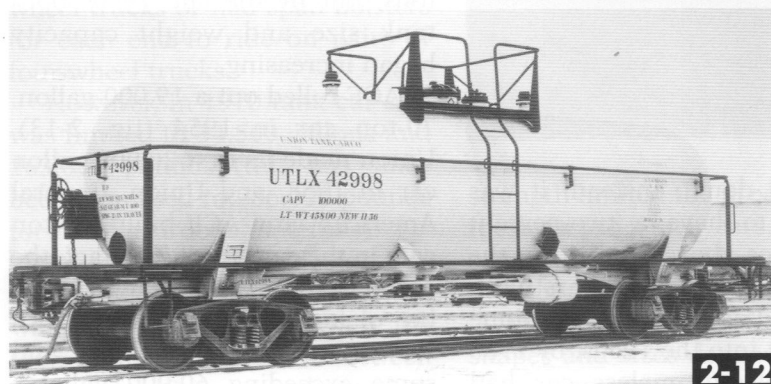
Modern frameless cars

The modern tank car era began in 1954 when Union introduced its frameless tank car (fig. 2-12). Union called it the HD car, for "hot dog," because that's what it resembled. The car was revolutionary because it relied on the tank itself for strength and had no underframe. The idea of a frameless car actually dated back to the turn of the century, but it took Union's introduction of the HD car for railroads to buy into the idea.

The HD car also debuted without running boards, though the



2-11



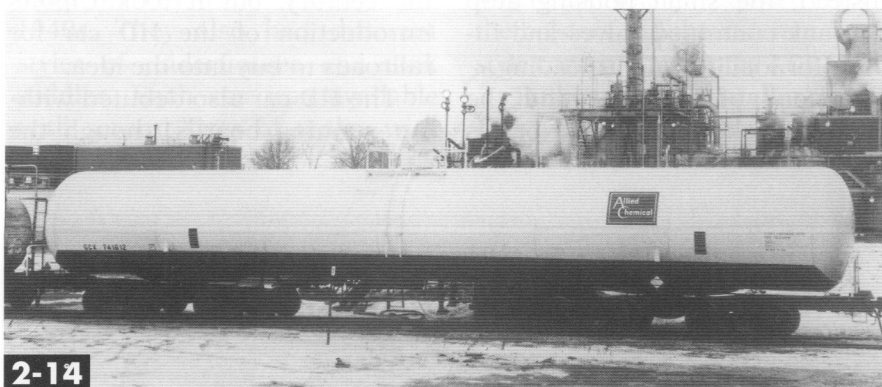
2-12

2-11 ACF built this ICC105A300W car for Dow in 1949 to carry methyl chloride. Similar cars were used for LPG, anhydrous ammonia, and chlorine. Note the lip around the end where the jacket overlaps the end. Pressure cars are often insulated but lack expansion domes, bottom outlets, or heating coils. *American Car & Foundry*

2-12 Union Tank Line ushered in the era of the modern tank car in 1954 with its frameless HD car. The car also did away with expansion domes. *Union Tank Car Co.*



2-13 Tank car size began increasing in the 1950s. ACF built this welded 70-ton, 19,000-gallon ICC103W car in 1954 for Union Pacific. *Union Pacific*



2-14 Allied Chemical bought this (and several similar) 42,000-gallon DOT112A340W cars from Union Tank Car in 1968. The 150-ton capacity car, designed to carry vinyl chloride, has a pair of trucks on each end. *Allied Chemical Corp.*



2-15 "Pregnant whales" such as this 70-ton car were popular in the 1960s. This 30,000-gallon General American car was designed for carrying LPG and anhydrous ammonia. *Timken Roller Bearing Co.*

Interstate Commerce Commission (ICC) did not approve this innovation until 1961. The frameless design was also used on insulated pressure cars.

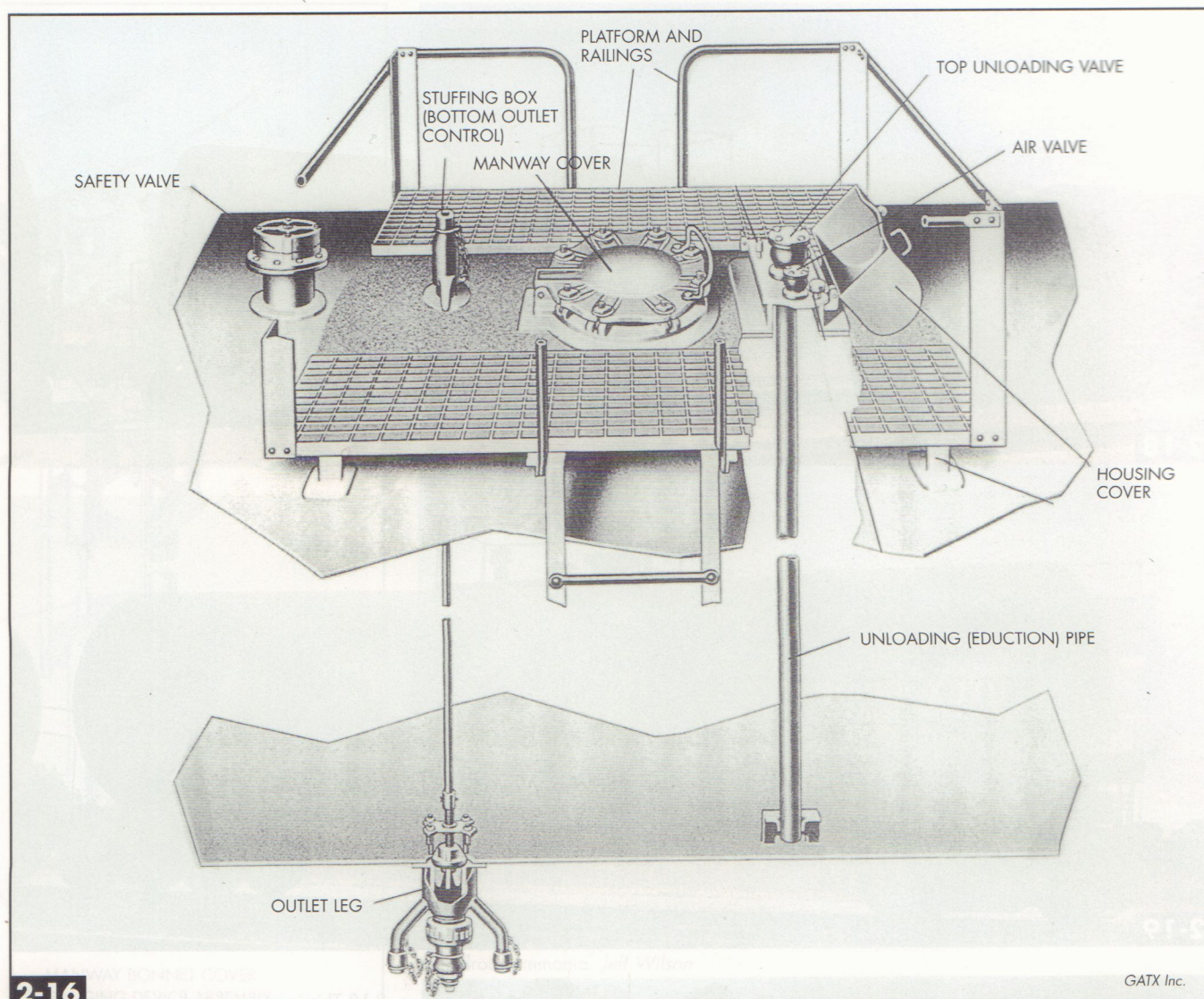
The all-welded car was also significant in that it didn't have an

expansion dome. Instead, it was designed to have a two-percent vapor space above the load in the tank itself. Although cars with frames and domes would continue to be built into the 1960s, by 1960 the domeless/frameless car had

become standard for new cars.

Through the 1950s most tank cars had a capacity of 40 or 50 tons, but by the late 1950s both tank size and weight capacity began increasing.

ACF rolled out a 19,000-gallon, 70-ton car in 1954 (fig. 2-13), Union made its first 20,000-gallon car in 1958, and Union, General American, and ACF built 100-ton cars in the early 1960s. In fact, the early and mid-1960s saw a number of huge tank cars built, with many over 50,000 gallons and some exceeding 60,000 gallons,



2-16

GATX Inc.

2-17 This modern 17,000-gallon non-pressure car (DOT111A100W) is designed for carrying corn syrup. Jim Hediger

with 150-ton capacity (fig. 2-14). These cars rode on heavy-duty six-wheel trucks or had span bolsters for each end to ride on pairs of four-wheel trucks.

However, in 1970 tank car size was limited to 34,500 gallons and 263,000 pounds (this has since been increased to 286,000 pounds for non-hazardous materials).

A popular 1960s design for larger tank cars was the "pregnant whale" style (fig. 2-15), where the tank diameter increases between the trucks. Concerns about tank



strength limited the production of these cars to a few years, although some were still riding the rails into the 2000s.

Modern cars come in many shapes and sizes depending upon their use. Spotting features to

watch for are the tank diameter, end style, and tank saddle style.

Non-pressure cars have several fittings on top (fig. 2-16), including a manway, a spring-held safety valve (this can be a single-use frangible disc for food



2-18



2-19



2-20

2-18 This is an insulated non-pressure DOT111A100W3 car used for carrying asphalt (note the "HOT" placard).
Jeff Wilson

2-19, This AAR 211A100W1 is a general-purpose uninsulated car. The "2" indicates a car for non-hazardous commodities; otherwise it conforms to DOT111 specifications. *Jeff Wilson*

2-20 Funnel-Flow and similar cars have ends that slope toward the middle of the car. This insulated car is in molten sulfur service. *Jeff Wilson*

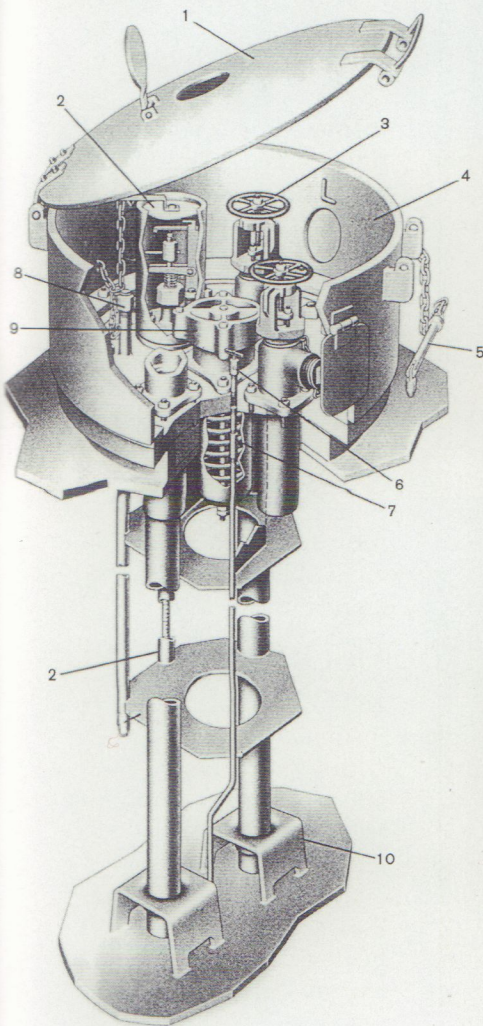
or other sealed products), loading valves, and a cap for the bottom unloading valve. Many non-pressure cars have bottom unloading valves (with the exception of acid cars), and a connec-

tor for heating line if the car is so equipped.

These cars come in a variety of styles and configurations for carrying various products. Figure 2-17 shows a modern non-pres-

sure car designed for carrying corn syrup, and fig. 2-18 shows an insulated non-pressure car used to haul asphalt.

Figure 2-19 shows a general-purpose uninsulated car. Note



- 1 MANWAY BONNET COVER
- 2 GAUGING DEVICE ASSEMBLY
- 3 ANGLE VALVE
- 4 MANWAY BONNET
- 5 SEAL PIN
- 6 SMALL ANGLE VALVE
- 7 CHECK VALVES
- 8 THERMOMETER WELL
- 9 SAFETY VALVE
- 10 PIPE GUIDE

GATX Inc.

2-21

how the tank saddles are welded directly to the tank, compared to the insulated car in fig. 2-18, where the saddle passes through the exterior sheathing (and has a plate above it to keep water out).

Union introduced the Funnel-Flow car in 1967 (fig. 2-20). These cars have bodies that slope down toward the middle from each end, giving them a swaybacked look. These non-pressure cars are



2-22



2-23

2-22 Pressure cars for chlorine are smaller than LPG cars. This DOT105J500W car has modern matrix stenciling as well as the appropriate placards for chlorine. *Jeff Wilson*

2-23 The biggest tank cars today are the 30,000- to 33,500-gallon cars carrying LPG and anhydrous ammonia. *Jeff Wilson*

designed to make unloading easier by routing liquid to the middle of the car. This design can be found in several car sizes, and with varying slope angles. Other manufacturers are now building their own versions of this design.

Pressure cars have a single housing on top of the tank to cover fittings (fig. 2-21). These cars don't have bottom outlets or heating coil connectors. Figure 2-22 shows a modern car designed for carrying chlorine.

The biggest tank cars in service today are pressure cars carrying anhydrous ammonia and liquefied petroleum gas (fig. 2-23), both of which are comparatively light. These cars have a capacity of 33,000 gallons and are 65 feet long.

All tank cars built in 1971 and later must have shelf-style couplers (see chapter 8). These are designed to keep couplers aligned in case of a derailment, preventing the coupler from an adjoining car from separating and then puncturing the end of a tank.

Spotting features and variations on modern tank cars include the styles of the various roof details; end shape; style of tank saddle; style of side safety railing supports; style of side ladder; location of brake gear; and style of top platform and railing.

You can often tell what a tank car is carrying by the stenciling found on its sides. See the sidebar on page 31 for more information.

Tank car classifications

Tank cars are classified by their construction. In 1917, the Master Car Builders Association (MCB), one of the predecessors to the American Railway Association, updated standards for tank cars. These became ARA classes in 1919. They were:

ARA I—Cars not built to the 1910 standard

ARA II—Cars built to the 1910 standard

ARA III—Cars built to the more stringent 1917 standard

ARA IV—Insulated, for flammable volatile liquids

ARA V—Insulated (pressure) heavy-duty for dangerous liquids

(Class I-IV cars were riveted; Class V were forge welded)

Cars built to the 1917

standards kept their ARA ratings, even after later ICC standards were adopted. All ARA tank cars were to be removed from service by January 1, 1975.

In 1927 the Interstate Commerce Commission redefined tank car classifications, which applied to cars built after that point.

Classification numbers included the basic car type, special characteristics (letter suffixes), and, for pressure cars, psi rating. These would be modified over the years, but most remained in force through the 1960s.

The most common types were 103 (general purpose, non-pressure, with dome), 104 (insulated, non-pressure, with dome), and 105

(insulated, pressure, welded). Common letter suffixes included A (acid cars), AL (aluminum tank), C (corrosion-resistant), and W (welded).

Thus an ICC-103 car was an uninsulated, non-pressure, riveted general-purpose car, and an ICC-105W300 car was a welded, insulated high-pressure car tested at 300 psi.

The Department of Transportation assumed the role of issuing tank car classes in 1967.

Common classes include DOT103 (non-pressure, can be insulated or uninsulated), DOT104 (non-pressure, insulated, carbon steel tank with dome), DOT105A (insulated pressure car), and DOT111A (non-pressure domeless car,

insulated or uninsulated). The "A" after the number class has no significance. Special materials are indicated after the test pressure: CS (carbon steel), AA (aluminum alloy), N (nickel), AS (alloy (stainless) steel), and CSEL (carbon steel rubber or elastomer lined). A suffix W indicates a fusion welded tank, and F stands for a forge-welded tank.

Thus, a DOT-105A500W car is an insulated pressure car with a test pressure of 500 psi and a fusion-welded tank. Other letters (for example, the 105J chlorine car in fig. 2-22) indicate reinforced head shields and other features.

More information

For more information on tank cars, see the book *Tank Cars, American Car & Foundry Co., 1865 to 1955*, by Edward S. Kaminski (Signature Press, 2003). The book includes a history of tank cars with information on construction and use. Another handy reference is the *GATX Tank Car Manual* (General American Transportation Corp., 1972), which includes DOT and AAR data for commodities along with drawings of various tank equipment.

Tank car lettering



Jeff Wilson

You can find a great deal of information on tank car types and loads in the lettering. Shortly after World War I, car class labeling (ARA, AAR, ICC, DOT) was required on the tank, usually on the right side. The builder's initials were also located here, along with other information, including pressure-test dates.

Today, tank cars carry

this information in a tank qualification matrix as shown above. These began appearing around 2000.

Tank cars have hazardous-material placard holders on each end and side. Placards on loaded cars are color-coded based on lading, with numerical codes that identify the specific product in the car (for example, 1017 for

chlorine and 1075 for LPG). You can see these in figs. 2-18, 2-20, 2-22, and 2-23.

Cars are often stenciled with their lading; examples are shown in figs. 2-8, 2-11, 2-17, 2-20, 2-22, and 2-23.

COVERED HOPPERS



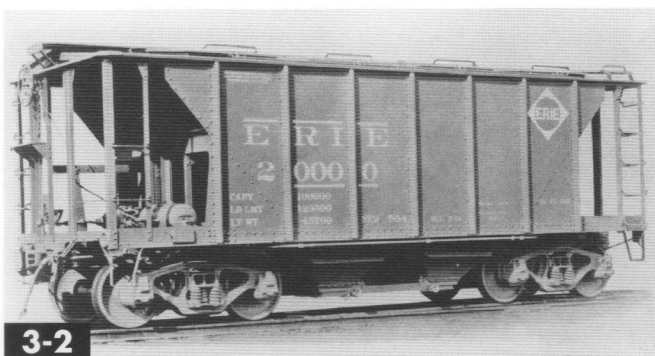
3-1 Covered hoppers revolutionized the handling of grain and many other dry bulk products. Covered hoppers have rooftop hatches and bottom outlets for easily loading and unloading lading. This modern cylindrical covered hopper is in potash service.

Brian C. Nickle

The covered hopper has grown from an experimental car in the early 1930s to the most common car type in service today. Covered hoppers haul almost any dry bulk commodity, including grain, fertilizer, plastic pellets, potash, lime, cement, sand, flour, sugar, carbon black, various chemicals, and many other products (fig. 3-1).

Grain and cement industries are popular subjects on model railroads, and modeling them accurately requires an understanding of the differences among various types of covered hoppers. We'll start with a history of the car type, then look at the various spotting features and show how covered hoppers have evolved over the years.

THREE



3-2 Among the first purpose-built covered hoppers was Erie 20000, a 50-ton, two-bay cement hopper built in 1934 by Greenville Steel Car Co. *Greenville Steel Car Co.*

3-3 Built by ACF from about 1940 through 1953, this car had eight roof hatches and a 1,958-cubic-foot capacity, the most common size for early two-bay cars. *ACF Incorporated*

3-4 The new PS-2 from Pullman-Standard featured welded construction, a staggered post pattern, round roof hatches, new roof design (overhanging the sides) and a unique end design. This 2,003-cubic-foot car was built in 1954. *Pullman-Standard*

Early covered hoppers

Bulk products not affected by the elements—such as coal and gravel—have been shipped in open-top hoppers or gondolas since the early days of railroading. Into the 1930s, moisture-sensitive bulk products like grain and flour were usually shipped in bags or other containers placed in boxcars, or they were loaded in the boxcars in bulk.

Bagging, loading, and unloading products this way was cumbersome and time-consuming, and railroads and shippers both began looking for ways to haul bulk products more efficiently. The answer was to add a roof with tight-sealing hatches to a hopper car and redesign the bottom outlets.

American Car and Foundry (ACF) began building covered hoppers in 1932, and Pullman-Standard, Greenville, and others soon followed. The first cars were largely for heavy, dense products such as cement, lime, and sand. These 50- and 70-ton cars generally had capacities from 1,700 to

1,900 cubic feet. Figure 3-2 shows an early car built by Greenville for the Erie RR in 1934. Some other early cars were larger, designed for hauling carbon black.

As more and more covered hoppers were built, standard designs and sizes began emerging. The most common size for a car became 1,958 cubic feet, with a 70-ton capacity. Cars generally had riveted steel construction (although some were welded), with two unloading bays, and square roof hatches (either 30" or 36" square). Figure 3-3 shows a common ACF car, built in 1951 and reflecting a style common from around 1940 through about 1953. Many early cars such as this one had triangular openings in the sides between the bays; later cars lacked these openings. Pullman-Standard built many cars to a similar design, but with side braces that were beveled on top.

Pullman-Standard revised and improved the covered hopper with the introduction of its PS-2. Pullman had been building cov-

ered hoppers for many years, and—as with its PS-1 boxcar—wanted to build cars using its own components in a standard design.

Introduced in 1952, the PS-2 covered hopper featured all-welded construction (see fig. 3-4). Cars had circular (30" diameter) roof hatches, and the roof extended over the sides. These 2,003-cubic-foot, 70-ton cars had a distinctive look, with a 4/4 side brace pattern.

Car size increases

By the mid-1950s, covered hoppers were no longer rare, but they hadn't yet been used much to haul the commodity that would eventually be transported primarily by them—grain. At the time, railroads were reluctant to invest in single-purpose cars, especially for a seasonal product. However, boxcars—although plentiful and relatively easy to convert to grain service—were labor-intensive to load and unload, and their relatively small capacity meant it took a lot of them to haul a bumper crop.

3-5 The first true grain covered hoppers were the three-bay 3,219-cubic-foot PS-2s (shown here) and the earlier and similar—but slightly shorter and narrower—2,893-cubic-foot cars. These 70-ton cars shared common details with their shorter two-bay cousins.

Pullman-Standard

3-6 One of the most popular grain cars of the 1960s was the 100-ton, 4,427-cubic-foot PS-2. This car, built in 1964, has the tall sides of cars built until 1966.

Pullman-Standard

3-7 Later versions of the 4,427-cubic-foot PS-2 had 13 side posts and smaller side sheets. These are known as “high-side” cars. Note how the bottom of the side is taller than the older 4,427-cubic-foot car at right. *Jeff Wilson*

A car that would help solve the problem was Pullman’s 2,893-cubic-foot PS-2, introduced in 1953. (A later version of this car is shown in fig. 3-5.) These three-bay cars had a capacity of 70 tons, compared with 50 tons for most other boxcars of the time. Their increased capacity made them ideal for lighter-density products such as grain, feed, sugar, and potash. Plastic pellets—a fairly new product in the 1950s—could also be shipped in these larger covered hoppers.

Thousands of these cars would be built by PS (along with copies built by Greenville Steel Car and others) into the early 1960s. Key spotting features are the 4-3-4 side bracing pattern and a low profile compared with the more modern 100-ton cars.

This basic three-bay car grew over the years, to 3,219 cubic feet (thanks to a 5" increase in height and a 6" increase in width) in 1958 (fig. 3-5) and to 3,500 cubic feet in 1960. These latter cars were noticeably taller (by about a foot) than the 2,893-cubic-foot cars, but the basic design remained the same. These cars still had the round roof hatches, paired along the sides of the roof, with the running board down the center of the car.



3-5



3-6



3-7

The trend continued toward bigger cars with higher weight limits along with a corresponding increase in cubic capacity. In 1962, a 4,000-cubic-foot PS-2 debuted with a 190,000-pound capacity. The car still has the 4-3-4 rib pattern and three bays of earlier cars, but it was substantially larger than the earlier 2,893-cubic-foot and similar cars. It also introduced a center trough loading hatch, developed to make grain loading faster and easier (see the sidebar on page 39).

The 100-ton, 4,427-cubic-foot PS-2 (fig. 3-6), introduced in 1964,

was among the most popular early grain haulers, with more than 23,000 purchased by several railroads and private owners. Later versions of this car had 13 evenly spaced side braces instead of the 4-3-4 rib pattern of earlier cars.

In 1966, the 4,427-cubic-foot model had its sides revised so that the bottom portion of the hopper bays were exposed (fig. 3-7). These later cars became known as “high-side” cars; earlier cars were termed “low-side” cars.

Among the most popular grain cars of the late 1960s and 1970s were the PS-2 4,740-cubic-foot



3-8

3-8 The 4,740-cubic-foot PS-2s, such as this former Union Equity car, can be spotted by their 16 evenly spaced side posts.

Jeff Wilson



3-9

3-9 The best-selling PS-2 of all time was the 4,750-cubic-foot car, distinguished from others by its 18 side posts. This Milwaukee Road car was built in 1973.

David P. Morgan Library collection



3-10

3-10 Later versions of the 4,750-cubic-foot PS-2, such as this former Peavey car built in 1979, have an angle piece across the middle 12 side posts.

Jeff Wilson

(fig. 3-8), introduced in 1966, and 4,750-cubic-foot (fig. 3-9). The 4,740-cubic-foot cars can be distinguished by their 16 side braces; the 4,750-cubic-foot cars (the best-selling PS-2) have 18 braces. Later versions of the PS-2 4,750-cubic-foot car have a long, angled strip above the middle 12 braces as fig. 3-10 shows.

ACF Center Flow cars

As covered hoppers got larger in the early 1960s, ACF came up with a revolutionary design: the Center Flow car (see fig. 3-11). The first Center Flow cars looked almost

like tank cars, but their cross section was an inverted-pear shape. The goal of the design was to enable the cars to be loaded and emptied more readily than a conventional covered hopper with vertical sides.

ACF's cylindrical cars were built to a number of different sizes, with round or trough-style roof hatches and from three to six bays. The first cars in 1962 were 3,960-cubic-foot cars with three compartments and six bays, and 3,510-cubic-foot cars with three bays (both types had round 30" hatches). They had capacities

from 70 to 90 tons. Later cylindrical cars built into the mid-1960s were 3,700-cubic-foot, 100-ton cars with trough hatches.

As with the PS and other covered hoppers, Center Flows kept getting larger. To increase cubic capacity, ACF modified the design by flattening the car's sides more and extending the ends of the hopper bays.

Figure 3-12 shows a 4,650-cubic-foot Center Flow car, introduced in 1964. This car and the PS-2 4,750-cubic-foot hopper were the most popular grain cars of the 1960s and 1970s. ACF called these "high cubes" (referring to the cubic capacity). More than 15,000 4,650-cubic-foot cars would eventually be built.

ACF also made a 4,600-cubic-foot Center Flow car, which was popular for hauling grain. These cars, introduced in 1965, were longer but lower than the 4,650-cubic-foot cars, accommodating the tighter Plate B clearance (see explanation on page 16) desired by some railroads.

Figure 3-13, showing a later version of the 4,600-cubic-foot car, illustrates a spotting feature that differentiates early and late Center Flow cars. Center Flow cars built until August 1971 have a single long horizontal stiffener along the side, with a smooth area

3-11 ACF's first Center Flow cars were cylindrical, with an inverted pear shape cross section. This 3,960-cubic-foot car has six round roof hatches. ACF Industries

3-12 In 1964, ACF began offering a Center Flow that looked more like a conventional covered hopper. The three-bay 4,650-cubic-foot version, like this New York Central car, would be among the most popular grain cars of the 1960s.

ACF Industries

3-13 The 4,600-cubic-foot Center Flow was longer and shorter than the 4,650-cubic-foot car. This is a late Center Flow (built in 1977), identified by the pair of ribs along the top where the roof meets the sides.

Jim Hediger



3-11



3-12



3-13

where the side meets the roof (see fig. 3-12). Cars built later don't have this horizontal piece, but do have a pair of thin horizontal ribs where the side meets the roof.

Other types of Center Flow cars included the 4,460, which was the same length as the 4,650 but not as tall, and the 4,700, which had shallower end sheets. Always check the *Official Railway Equipment Register* if in doubt about a particular car type.

ACF also makes shorter versions of Center Flow cars for cement and other high-density products, as fig. 3-14 shows. It has the early single horizontal stiffener along the side, as well as a high brake wheel, marking it as an early car.

Other spotting features of Center Flow cars involve the number of pieces of steel used to form the sides (the seams are often visible in photos). On 4,650-cubic-foot cars, the sides were originally made of two pieces; later cars used four. In 1972 ACF went to six-foot-wide pieces for all cars, so 4,650-cubic-foot cars have six panels (plus end sheets); 4,600-cubic-foot cars have seven. These cars originally had 13 running board supports on each side, but after 1975, they had nine supports.

Through 1968, ACF cars had truck-mounted brake cylinders. After that, the cylinders could be truck- or body-mounted.

A late-1970s variation of the Center Flow is the Pressureaide

(see fig. 3-15). These cars, designed for flour and other powdered commodities, are pressure-differential cars that use an internal pressure of 15 psi to force lading out of the car. They look like standard Center Flow cars, but with additional piping along the unloading bays and with an extra-wide stiffener at the top of the sides.

Plastic pellet and chemical hoppers

Grain products will hit the 100-ton weight limit in cars of around 4,800 cubic feet, but other commodities—notably plastic pellets, carbon black, and some dry chemicals—are less dense and thus can fill a larger capacity car before they hit the car's weight limit.



3-14

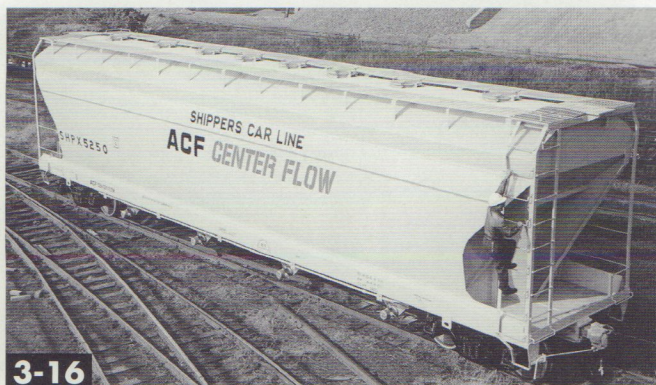


3-15

3-14 Several two-bay Center Flow cars have been made for carrying cement, lime, and other dense materials. This Burlington Northern Santa Fe car has a 3,200-cubic-foot capacity and elongated roof hatches. The high-mounted brake wheel marks it as an early (1966 or before) car. *Jeff Wilson*

3-15 Pressureaide cars are Center Flow cars that use internal pressure to force the lading out of the car. Note the extra piping along the four bays of this 5,000-cubic-foot car. *ACF Industries*

3-16 This 5,250-cubic-foot Center Flow car is designed for carrying plastic pellets. Built in 1965, it has four pneumatic outlets and small round roof hatches. *ACF Industries*



3-16



3-17

3-17 Early single-bay Airslides had boxy ends with diagonal bracing from the bottom of the ends to the top of the body. This car was built in 1958. *Jim Hediger*

To more efficiently carry these commodities, companies began building jumbo covered hoppers with capacities of 5,000 cubic feet and larger. Figure 3-16 shows a 5,250-cubic-foot Center Flow car built in 1965. Typical of plastics cars from other manufacturers, it has individual round roof hatches

and four pneumatic unloading outlets. (See the sidebar on page 42 for information on different types of outlets). The later 5,701-cubic-foot Center Flow was among the most popular cars for plastics service.

A spotting feature of all covered hoppers is the brake wheel location. Brake wheels on cars built until

September 1966 were mounted high, as on the ACF two-bay car in fig. 3-14. Cars built after that date had brake wheels mounted low, as on the car in fig. 3-13. Older cars sometimes had their brake wheels relocated during rebuilding.



Airslide covered hoppers

Another covered hopper that deserves special mention is the Airslide, introduced in 1954 by General American Transportation Corp. (fig. 3-17). Airslides are specialized covered hoppers designed for carrying powdered or granulated commodities.

What sets an Airslide apart is its finely perforated fabric lining. When the car is unloaded, air flows through the lining, effectively "liquifying" the lading, enabling it to flow out completely and efficiently. Airslide cars are commonly used for flour and sugar, and have also been used for grain and other products.

Airslides were built in several sizes over the years, from small single-bay cars to larger double-bay cars (fig. 3-18). Early single-bay cars had open "porches" over each truck, with angled braces running from the end sills to the top of the end (see fig. 3-17). Cars

built in 1965 and later eliminated the angle braces and had triangular gussets added at the top of these openings, making the car look more like a conventional covered hopper from the side (see fig. 3-19). The vertical side braces also changed in shape and style over the years.

Other modern covered hoppers

Although Pullman-Standard and ACF captured the lion's share of covered hopper production through the 1970s, other companies also built large numbers of covered hoppers.

FMC Corp. built almost seven thousand 4,700-cubic-foot cars (fig. 3-20) between 1971 and 1981. At first glance, these look like PS cars, but they can be distinguished by their tall sides and the horizontal groove that runs down the center of the side. FMC also made a 4,692-cubic-foot car that looks like the 4,700-cubic-foot car,

3-18 Long two-bay Airslides are boxy, without the open end bracing of other covered hoppers. *Jeff Wilson*

3-19 Later single-bay Airslides had diagonal gussets at the top of the sides at the ends. This Union Pacific car was built in 1966, just before low brake wheels became mandatory. *Jim Hediger*

3-20 This 4,700-cubic-foot car was built by FMC. These tall-sided cars have a horizontal groove down the middle of each side. FMC also built a similar 4,692-cubic-foot car that had a staggered post pattern. *Jeff Wilson*

but has a 5/4/5 side brace pattern.

Thrall and Trinity both turned out large numbers of 4,750-cubic-foot cars that resemble PS cars. Figure 3-21 shows one such car built by Thrall. Spotting features include side braces (style and number) and the design of the end bracing, steps, and ladder.

Thrall also turned out many

Roof hatches

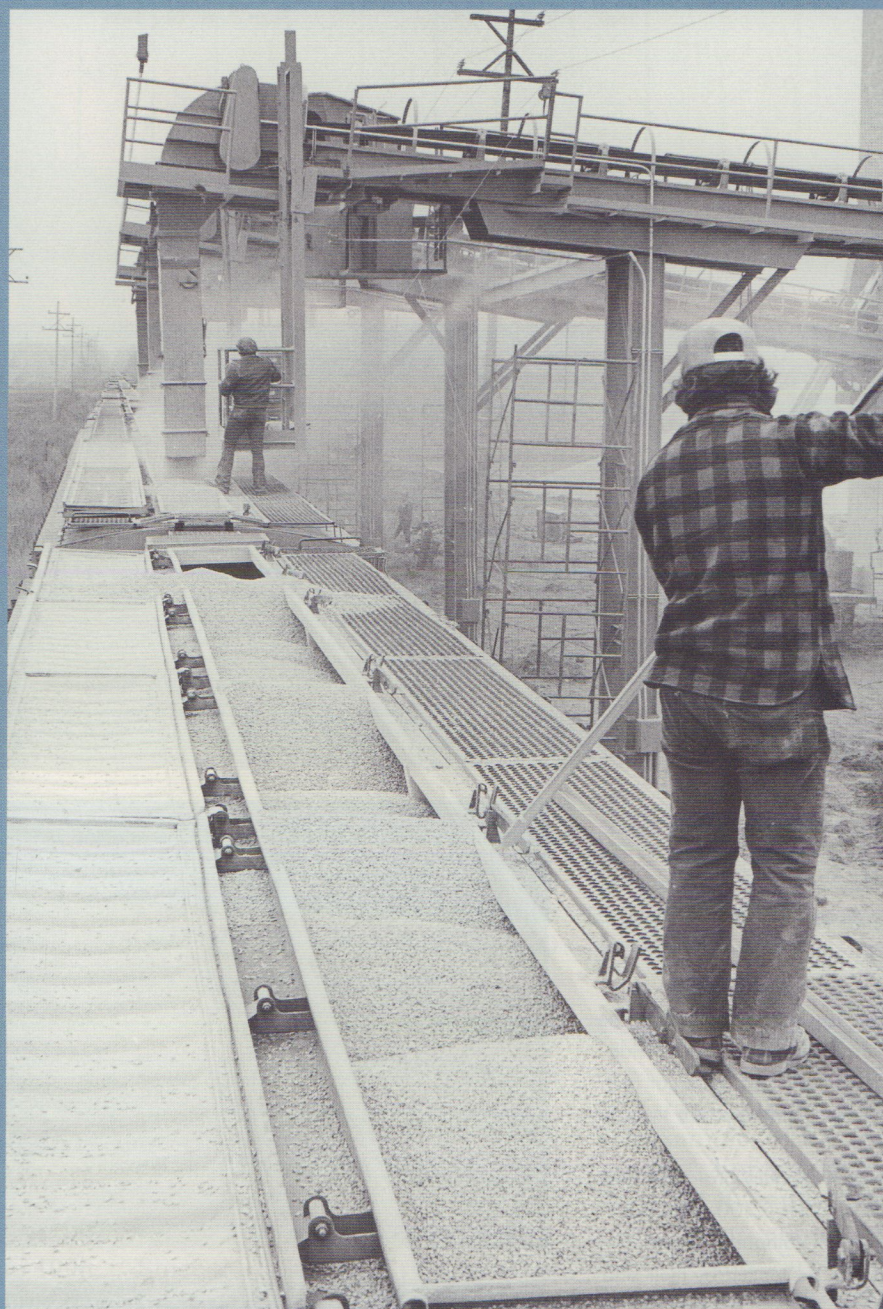
Most covered hoppers built through 1960 were equipped with round individual roof hatches for loading, as fig. 3-4 shows. Square on early cars and round starting in the 1950s, these hatches can be found in different sizes.

Individual hatches can be made to seal tightly and so do a good job of protecting the load. However, it can take a long time to load a car, as the loading spout must be positioned over each hatch in turn.

The solution was to equip cars with long, trough-style hatches on cars designed for grain and other commodities that don't need an airtight seal, as the photo at right shows. Among the variations are multiple long openings or a single continuous long opening with four overlapping lids.

These hatches greatly speed loading and have been used almost exclusively on grain cars since the early 1960s. Cars designed for plastic pellets, powders (such as cement), food products, and many chemicals still have round hatches that can be sealed tightly. Hatches on plastic pellet cars are typically 20" (fig. 3-15), with 30" hatches on cars for food products and chemicals.

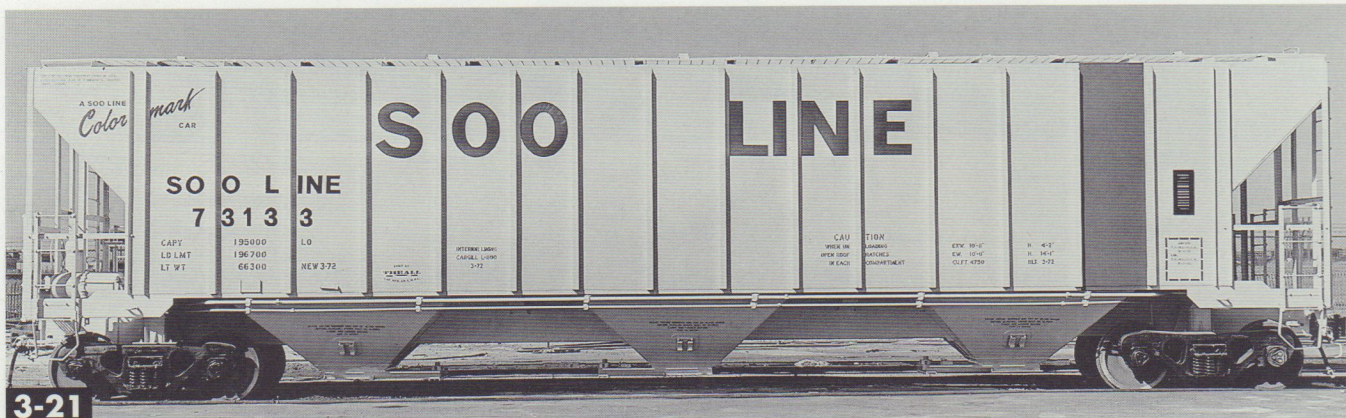
Early covered hoppers with individual hatches had center-mounted running



The move to continuous trough openings in the early 1960s made it much easier to load grain cars. The hatches are flipped open to the left. *Chessie System*

boards with the hatches near the sides. When center-mounted trough-style hatches came into use, the running boards were moved to both sides and ends and were open in the middle.

Modern cars with individual hatches can be found with either style of running board, depending on whether the hatches are mounted along the roof center line or along the sides.



3-21



3-22

3-21 This 4,750-cubic-foot car looks like a PS-2, but it was built by Thrall in 1972. The shape and pattern of the side posts are different, as is the end bracing. *Thrall*

3-22 Another Thrall design resembles a Center Flow car. The shape of the ends, the width of the side sheets, and the roof/side joint of this 5,150-cubic-foot Thrall car are all different from ACF's design. *Jeff Wilson*

3-23 An early high-capacity grain car, built in the mid-1990s, is the 5,400-cubic-foot Johnstown-America Grainporter. These aluminum cars can be spotted by their slab sides. *Jeff Wilson*



3-23

3-24 Trinity's 5,161-cubic-foot car is the most popular of the modern 286,000-pound gross rail load grain cars. Note the shape of the ends and the design of the roof that overhangs the sides. *Jeff Wilson*



3-24



cars that resembled the ACF design. Figure 3-22 shows a 5,150-cubic-foot Thrall car. Compared with a Center Flow car, there is a notable difference in the shape of the sides at the ends and the shape of the fillets), as well as the shape of the side where it meets the roof.

Another unique modern car, and one of the largest built for grain, is the 5,400-cubic-foot aluminum Grainporter built by Johnstown-America (fig. 3-23). About 1,000 of these flat-sided cars were built from 1994 to 1996.

The most popular modern grain covered hopper is Trinity's 5,161-cubic-foot car, shown in fig. 3-24. This three-bay car has a roof that slightly overhangs the sides and a unique shape to the ends of the sides and the running-board supports. Almost 20,000 of these cars have been built since the late 1990s. Variations include the number of side panels (eight or ten) and the number of running-board supports.

The 5,161-cubic-foot and similar hoppers have sidelined many older 4,427-cubic-foot and other smaller cars, since the move toward 110-ton cars (286,000 pounds gross rail load) in the 1990s. The larger hoppers are especially popular for hauling corn, which isn't as heavy as wheat or soybeans.

Another commonly seen car is the Canadian-style cylindrical covered hopper (fig. 3-25), used for hauling grain and potash. Since the mid-1960s, thousands of these cars have been built by the Canadian companies Hawker Siddeley, Marine Industries, and National Steel Car Co.

Future

Covered hoppers remain the dominant car type, with (in 2003) more than 455,000 in service. Compare this with the next most numerous type of car, the tank car, some 265,000 of which currently ride the rails.

3-25 Canadian railroads have long favored cylindrical covered hoppers for hauling grain and potash. This car, with four outlet bays and round roof hatches, was built by Marine Industries. *Brian C. Nickle*

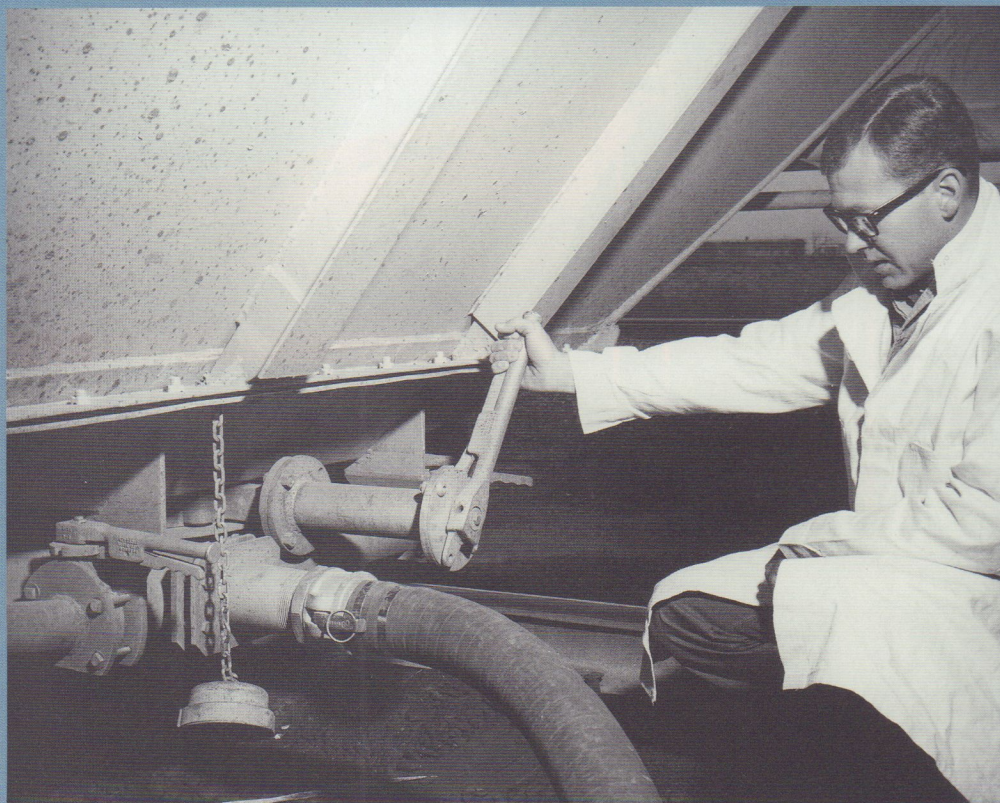
Builders continue to offer cars in a variety of sizes to match shippers' needs for specific products. For example, ACF currently offers covered hoppers in nine sizes from 3,140 cubic feet to 5,700 cubic feet, along with three Pressureaide cars from 5,000 to 5,750 cubic feet. Counting all variations, Trinity has 22 different covered hoppers in its line.

More and more of the larger grain cars will hit the rails as smaller, older cars reach retirement age, and plenty of two-bay covered hoppers are being built to haul cement, sand, and other dense products.

Unloading gates

Hopper cars are equipped with one of three types of bottom unloading gates: gravity, pneumatic, or combination gravity-pneumatic. Gravity gates (as on cars in figs. 3-9 and 3-21) have a bottom plate that slides away, allowing the load to be dumped straight down between the rails. This is the most common outlet for grain and general-purpose cars. Early covered hoppers (such as figs. 3-3 and 3-5) had pairs of gates at each hopper—one at each side. Center-discharge gates became popular in the early 1960s (the “CD” designation in a PS-2CD car, and the “Center” in Center Flow). The most common today, these have a single gate at each hopper at the center of the car.

Pneumatic-unloading gates are characterized by a horizontal pipe at the bottom of the hopper. When viewed from the side, these hoppers have a V-shape, with the pipe at the bottom of the V (gravity hoppers have a flat area at the bottom). To unload these cars, a vacuum hose is attached to the pipe to draw out the load. Pneumatic-unloading gates are most often found on cars carrying plastic pellets as well as food products (such as flour or sugar), chemicals,



Pneumatic outlets (this is an ACF Pressureaide car) are closed systems, allowing a hose to connect to the outlet pipe. The load is either emptied by vacuum pressure or by pressuring the load to force it out (as on a pressure-differential car). *ACF Industries*

Cars with combination gravity-pneumatic outlets have a standard large center-discharge outlet bay, with a pipe across the bottom. The crank mechanism for moving the gravity gate is visible at right. *Gordon Odegard*

and other commodities that would be easily damaged by outside contamination.

Gravity-pneumatic gates can be unloaded

either way. They have flat bottoms like standard gravity outlets, but also have an unloading pipe across the bottom.

There are many manufacturers of unloading gates, so styles of each can vary greatly from car to car.

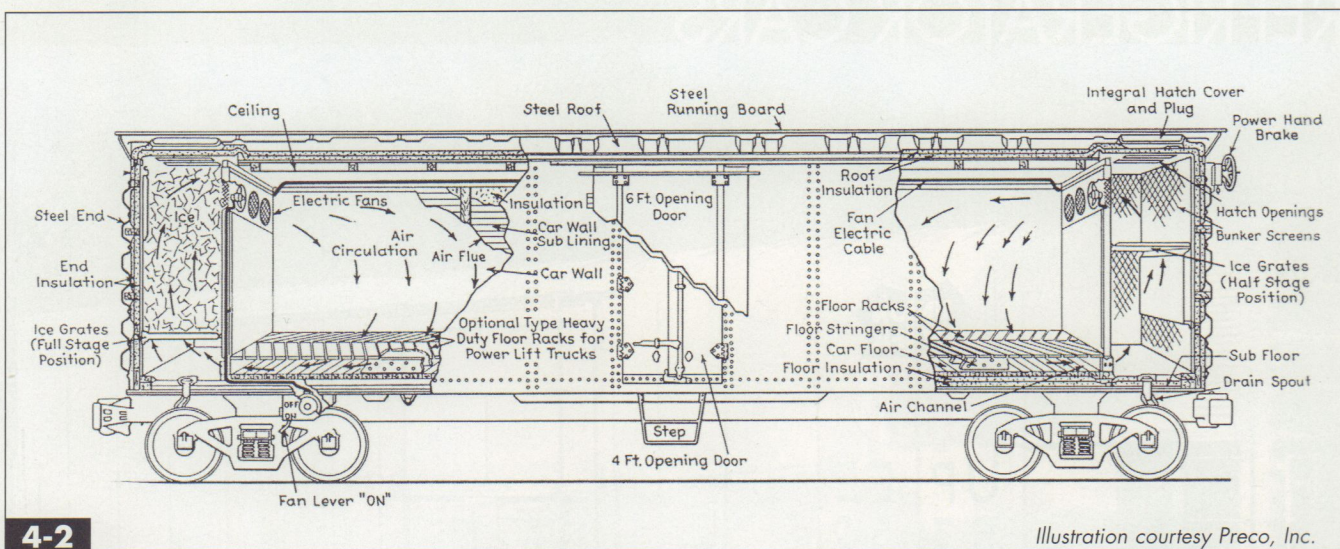
REFRIGERATOR CARS



The refrigerator car—or “reefer,” as it came to be known—was among the earliest specialized cars to appear on railroads. Largely a development of the meat-packing industry in the late 1800s, refrigerator cars allowed fresh meat to be shipped throughout the country from meat-packing centers such as Chicago. The produce industry quickly adopted refrigerator cars as well, allowing people around the country to have fresh fruits and vegetables regardless of season—something not previously possible (fig. 4-1).

4-1 Refrigerator cars have been around since the late 1800s and are used to carry produce, meat, and frozen foods. Mechanical reefers such as this one have on-board diesel engines and compressors to keep loads cool or frozen. Jeff Wilson

FOUR



4-2

Illustration courtesy Preco, Inc.

Figure 4-2 shows how an ice-bunker refrigerator car works. The design is similar to a boxcar, but with insulated sides, ends, floor, and roof. Cooling is provided by ice, which is placed in bunkers (through roof hatches) at each end of the car. As important as the ice itself is air circulation. It's vital that cold air flow throughout the car and the load, or else part of the load can spoil. Slatted floor racks help cold air penetrate through the entire car. Air-circulating fans came into use in the 1940s.

No United States Railroad Administration (USRA) or American Railroad Association (ARA) standards existed for refrigerator car construction as there were for boxcars and other cars, so reefers were built to many different designs. As with tank cars, railroads were reluctant to build or buy cars for specialized service, so for the most part they left the job of developing them to private owners and leasing companies.

The leader in design, by sheer number of cars operated, was Pacific Fruit Express (PFE), a joint operation of Union Pacific and Southern Pacific. Many other companies would build cars to similar designs. Other sizable car fleets with distinctive designs included Fruit Growers Express (FGE), Santa Fe Refrigerator

Department (SFRD), American Refrigerator Transit (ART), and Union Refrigerator Transit (URT). Some private owners (mainly packing companies) acquired or leased large fleets of cars, including Armour, Swift, and Wilson.

Car sizes and features

By the post-World War I era most new refrigerator cars were 40 feet long, with a 30- to 40-ton capacity. Since the cubic capacity of refrigerator cars was significantly less than a comparable boxcar (due to the thicker insulated sides and the space taken up by the end bunkers), a full load would rarely approach a car's weight limit. Thus, reefers didn't require the 50-ton capacity of most contemporary boxcars. Figure 4-3 shows a typical wood reefer of the 1920s.

Although steel underframes were essentially standard on new refrigerator cars by the 1920s, reefer bodies generally featured all-wood construction, including framing (albeit with steel tension rods), sides, and ends. This was partly because the wood sheathing served as an insulation layer, and some thought that steel sides (or even steel framing) would transmit too much heat through the sides.

As improved insulation materials became available, internal steel framing became popular in

the 1920s, although cars with wood ends and sides would continue to be built through the 1930s. Underframes varied in design from fish-belly to various other types.

Wood roofs, used into the 1910s, gave way to steel. Reefer roofs followed the same designs as boxcars, with the lap-seam roofs common in the 1920s giving way to Hutchins and Viking roofs, Murphy panel roofs, and eventually diagonal-panel roofs by the 1940s. (See chapter 1 for more information on roofs.)

Steel ends began appearing on refrigerator cars in the mid-1920s (fig. 4-4). Dreadnaught ends were common, as with boxcars, but since reefers were usually shorter the patterns varied, with 4/4 and 4/5 patterns common. Also, starting in the 1930s many older wood cars were rebuilt with steel ends. These ends followed the same designs as boxcars, with square corner posts through 1940, and the rounded W-corner post ends thereafter. (See the sidebar on boxcar ends on page 9.)

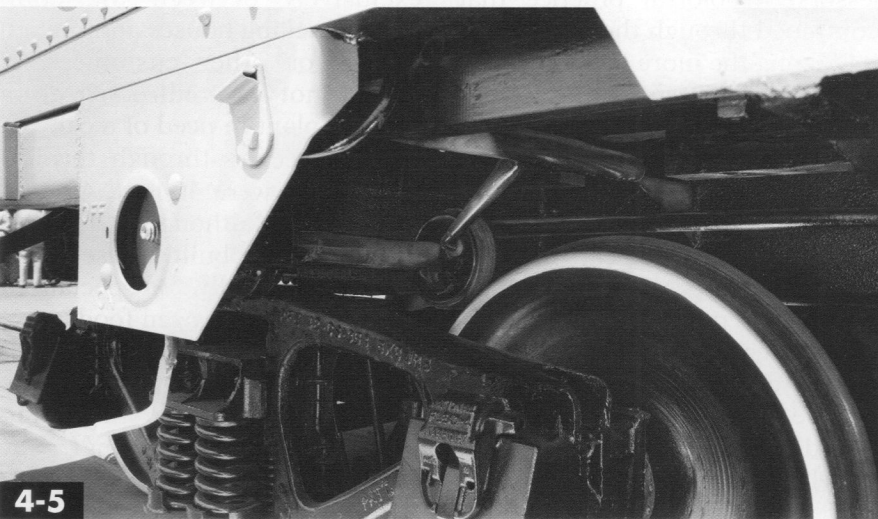
All-steel refrigerator cars began appearing in 1936, with PFE's R-40-10 cars. By then, steel cars were considered viable, made possible by improvements in insulation materials that negated any extra insulation benefits from the wood sheathing. However, many



4-3 This 40-foot Union Refrigerator Transit RS car is typical of reefers built into the 1920s. It has a steel fishbelly underframe and wood body, including ends and sides. *Hol Wagner collection*



4-4 Refrigerator cars began receiving steel ends around 1930. This PFE car originally had an all-wood body; it was rebuilt with steel ends (Dreadnaught 4/4), fans, convertible bunkers and stage icing in 1946. *R.F. Herold*



4-5 Air-circulating fans on ice cars were powered by generators that in turn were powered by the wheels. *Preco, Inc.*

wood-sheathed reefers had long service lives (more so than wood boxcars), resulting in some lasting into the 1960s and even the '70s.

Through this time spotting features on reefers were much the same as with boxcars: type of ends, roof, and sides; side-sill style (straight or notched); roof hatch

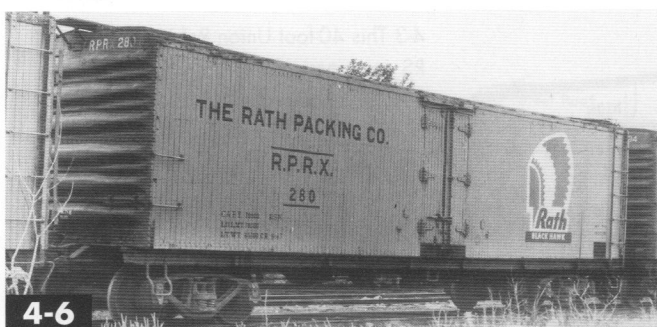
size and style; door height and width; and trucks.

A major design improvement was the addition of air circulating fans beginning in 1941. Although the fans were internal, cars with fans can be spotted by a disk on the lower-left corner of the side (fig. 4-5). These fans greatly

improved air circulation inside the cars and were pretty much standard on ice-bunker cars built for produce service in the 1940s and later.

Early fans were directly belt driven using a rubber wheel in contact with one of the car's wheels. Mechanical problems led to the use of electric fans powered by a wheel-driven generator.

Other features that appeared in the 1940s included collapsible bunkers, which could be folded out of the way to increase capacity if ice wasn't being used; and stage icing, which used grates to limit space in the bunkers for lading requiring a smaller ice load. Although these features weren't visible from the outside, stenciling



4-6

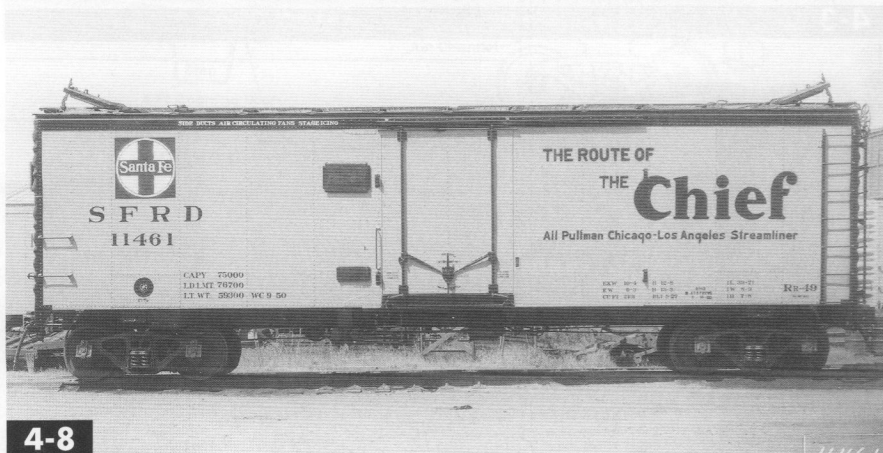
4-6 Wood remained popular for meat reefers quite late, as shown by this Rath car built in 1947. *Bill Raia collection*



4-7

4-7 General American's steel ice reefers had a horizontal strip along the side and improved Dreadnaught ends. *Jay Williams collection*

4-8 This SFRD-class RR-49 reefer, built in 1927, was rebuilt in 1950 with steel sides and ends and a sliding plug door in 1950. *Santa Fe*



4-8

on the car sides often indicated both features.

For the most part refrigerator cars were used either for produce or meat service. Packing companies generally owned or leased their cars, and produce shippers relied on companies such as PFE, ART, or FGE for cars.

There were differences between reefer types. For example, meat reefers were equipped with overhead rails to secure meat hooks holding sides of beef. They often had brine tanks instead of ice bunkers, to better hold the salt/crushed ice mix (instead of chunk ice) used to keep the cars at colder temperatures. Although this feature wasn't visible from the outside, stenciling on the car sides indicated the presence of brine tanks instead of bunkers.

Also, meat reefers did not have internal air circulating fans, as the increased air flow would dry out hanging beef. Meat reefers were not set up to run in ventilator service (see the sidebar on page 50), so their roof hatches were either open or closed.

Figure 4-6 shows a typical meat reefer of the post-World War I era. Meat reefers usually wore the colors and logos of their owners or lessors, a colorful practice that continued through the 1960s.

Among the more common steel reefers for meat and other service in the 1950s and later was the URTX car built by General American (fig. 4-7). Since URTX had one of the largest refrigerator car fleets, and leased cars to many railroads and packing companies, these cars could be found across the country. The URTX cars had a horizontal rivet strip along the middle of each side, improved Dreadnaught ends, and diagonal-panel roofs.

Operations for meat reefers differed as well. By and large produce reefers were distributed by their controlling companies (for example, FGE, PFE, and SFRD) to any on-line packing shed in need of a refrigerator car. A PFE car might haul a load of oranges from California to Chicago, then get sent to Texas to be loaded with vegetables.

Meat reefers, on the other hand, were owned or leased by specific companies. Thus, a car leased to Armour would travel exclusively between the company's packing houses and branch houses or other customers. It would not be redirected to a Morrell plant in need of a car.

Most reefers through the ice-bunker era were 40-foot, 40- and 50-ton cars, although a few 50-foot cars were built. These larger cars were usually for specialized service, such as frozen foods.

Most refrigerator cars built through the 1950s had double swinging doors, with either four- or five-foot door openings. The smaller door openings were preferred, since the smaller the opening, the less potential for loss of cold air.

A major visual change began appearing around 1950 with the use of sliding plug doors to replace swinging doors (fig. 4-8). These doors, came in various sizes and designs (six-foot openings were common initially), sealed tightly but allowed easier access



4-9 The refrigeration equipment in this 1958-built Pacific Fruit Express R-40-30 mechanical reefer is clearly visible in this photo. The 40-ton, 40-foot car has sliding plug doors. William Harwood



4-10 This Santa Fe publicity photo shows the parts that go into a mechanical reefer. The car, built in 1963, is 60 feet long with exterior posts, cushion underframe, and a nine-foot plug door. Santa Fe

for lift trucks and forklifts, greatly speeding loading and unloading.

Ice-bunker cars began falling in number by the late 1950s, as mechanical refrigerator fleets were growing and railroads were losing produce traffic to trucks. Few ice-bunker cars were built after the mid-1950s (PFE acquired its last ice car in 1957).

By 1973, most icing platforms were gone; the few ice reefers remaining in service had their bunkers removed and were put into top-ice vegetable (TIV) service, where produce loads were covered with a thick layer of crushed ice, but no bunker ice was needed. Other existing reefers simply served as insulated cars. Most ice-bunker cars were off the rails by 1980.

Spotting features of ice-bunker cars include construction material (wood or steel); style of roof and ends; door width and type; roof hatch style; side sill style; and underframe.

Mechanical refrigerator cars

Many experiments in mechanical refrigeration had been conducted through the first half of the 20th century, but it wasn't until the growth of the frozen-food industry in the 1950s that mechanical refrigerator cars began appearing in great numbers. Fruit Growers Express purchased 25 mechanical cars in 1949, with PFE and SFRD following in 1952 (fig. 4-9).

Compared to early mechanical cars, ice-bunker cars were relatively inexpensive to operate and did a very good job of keeping produce and meat cool. Frozen foods, however, required temperatures below zero to stay frozen solid. The initial solution was to use heavily insulated ice-bunker

4-11 This UPFE reefer is from the next-to-last group of PFE mechanical cars built, class R-70-20. The 60-foot car has a 10'-6"-wide door. *Jeff Wilson*

4-12 This 65-foot smooth-side FGE mechanical reefer has a 10'-6" door. The car was built in 1972. *Jeff Wilson collection*

4-13 Early insulated boxcars, like this Minneapolis & St. Louis car built in 1957, looked like standard 50-foot boxcars with plug doors. *Jack Pfeifer*

cars with large quantities of salt added to the ice. This kept car temperatures in the single digits but couldn't produce the necessary sub-zero temperatures.

Mechanical reefers use a small diesel engine to drive an alternator, which provides electricity for operating the compressor (fig. 4-9). Fans then distribute the cold air throughout the car. Starting in the 1950s some ice-bunker cars were converted to mechanical refrigeration, but the bulk of mechanical reefers were new cars. Figure 4-10 shows all of the parts used in building a Santa Fe mechanical reefer.

These new mechanical cars were used almost exclusively for frozen goods. Although some early ones were 40-footers, most were 50 to 60 feet long and longer with 70-ton capacity. Figure 4-11 shows a 60-foot exterior-post PFE reefer; fig. 4-12 is a smooth-side Fruit Growers Express car. Other improvements included internal load restraint devices and movable bulkheads as well as the use of cushion underframes. Sliding plug doors of various designs were used. Six-foot door openings were common on early cars, with eight-, nine-, and ten-foot doors on later cars.

Ice-bunker cars continued to be the primary mode of shipping produce through the 1950s and early 1960s, but in the 1960s mechanical reefers with wide-range tem-



4-11



4-12



4-13

perature controls allowed produce to be hauled in mechanical cars. As an example, in 1962 PFE operated about 3,000 mechanical cars and 22,000 ice cars, but by 1969 mechanical cars made up about half of the PFE fleet.

To identify variations among these cars, look at the car length, exterior posts (number, spacing, and style), door style and width, location of vents and screens for refrigeration equipment, style of the car ends, and roof style.

Insulated boxcars

Although insulated boxcars (AAR code RBL) don't have ice bunkers or mechanical refrigeration units, they are classified as refrigerator cars (fig. 4-13). By 1960 vast improvements in insulating materials, namely urethane foam, made insulated boxcars with plug doors very popular.

When loaded with pre-cooled goods, these cars could maintain their internal temperature within a couple of degrees for several



4-14

4-14 This Fruit Growers Express bunkerless reefer is among the most common insulated boxcars of the late 1960s through the 1990s. This car was built in 1970.

Jim Hediger



4-15

4-15 This huge modern UPFE reefer has a composite fiberglass body and an end-mounted refrigeration unit. *Jeff Wilson*



4-16

4-16 Cryogenic reefers, used for hauling frozen foods, use dry ice instead of mechanical refrigeration. *Jeff Wilson*

carry canned goods and products that require cool temperatures above freezing.

As insulating materials have improved and refrigeration units have become more efficient, the trend in newer reefers has been toward larger cars with increased cubic capacity, allowing them to be filled to their weight limits—something that rarely happened with ice-bunker cars.

Figure 4-15 shows a modern composite body car with an end-mounted refrigeration unit. These huge cars, built by Trinity for the Union Pacific, have a 71-foot inside length (83 feet long overall) and were built beginning in 1998. They feature a composite fiberglass and urethane foam body on a heavy steel frame.

Another common large modern refrigerator car for hauling frozen foods features cryogenic refrigeration (fig. 4-16). Although experimental dry ice cars had been tried many times through the 20th century, these huge cryogenic cars, built since the late 1980s, have made the concept practical. The cars are virtually maintenance-free and can keep their loads well below zero without the need to replenish ice and no refrigeration units to run out of fuel or break down.

days. Their larger capacities also made them more attractive to shippers, and during the 1960s they became standard for carrying canned goods, beer, and other products sensitive to heat. As with reefers these cars continued to grow in size.

Figure 4-14 shows one of the most common styles of RBL cars, built by Fruit Growers Express from 1968 to 1974. Along with FGE, many cars were leased or sold to many other railroads.

Spotting features are the same as with boxcars: number of panels and style of ends, roof, door, and sill.

Modern refrigerator cars

Most of the refrigerator cars operating today are mechanical reefers built in the 1960s and 1970s, along with insulated boxcars. Although some produce and vegetable traffic still travels by rail, reefers today mainly carry frozen foods, while the RBL cars

Ventilator service



Reefers operating in ventilator service had their hatches open to allow air to flow in and through the car. This steel MDT reefer, built

in 1947, has 3/4 Dreadnaught ends, Murphy roof, and circulating fans. *New York Central*

Ice-bunker cars did not always have their bunkers filled with ice. If the outside temperature was at or slightly below the desired temperature for the load, the cars would be run in ventilator service, with the ice hatches propped open (ventilator hatch bars could be set

at different heights). As the car moved, air would flow in through the lead hatches, through the load, and out the rear hatches. Ventilator service was an economical method to keep cars cool.

Many early refrigerator cars included large side

lettering such as "VENTILATOR—REFRIGERATOR" to indicate they could be used for either service. By the 1930s, most cars in produce service could be used as ventilators, so such lettering disappeared.

Ventilator service was used most often for

products that required cool, but not cold temperatures, including potatoes and bananas.

Reefers were also often used for canned goods, beer, and other products that didn't require refrigeration but needed protection from heat.

Refrigerator car classifications

The AAR refrigerator car class can provide insight into the type of service a car was designed for. Designations can be found in the *Official Railway Equipment Register* and are often stenciled on

the side of the car.

Here are the most common designations:

RS—Ice-bunker reefer

RSM—Ice-bunker reefer with meat rails

RA—Reefer with brine tanks

RAM—Reefer with brine tanks and meat rails

RB, RBL—Bunkerless reefers; RBL cars have adjustable loading devices

RP—Mechanical reefer

RPL—Mechanical reefer with adjustable loading devices

RPM—Mechanical reefer with meat rails

RC—Cryogenic reefer

HOPPERS AND GONDOLAS



The hopper car—nearly synonymous with “coal car”—was the staple car for hauling coal from before World War I through the 1970s. Today, bathtub-style gondolas dominate unit coal trains, but plenty of hopper cars still work hauling coal and other bulk commodities (fig. 5-1).

The gondola is a cousin to the hopper. A common early coal hauler as well as the dominant high-capacity modern coal car, gondolas are also used at steel mills, hauling both finished products and scrap.

In addition, many specialized hoppers and gondolas have been built for hauling products such as iron ore, wood chips, and aggregate. We'll start with a look at hopper cars, then move to gondolas.

5-1 Hopper cars and gondolas are among the oldest freight car types. Primarily used for hauling coal, these cars can also carry aggregate and other bulk commodities not affected by the elements. This Coalveyor gondola was built in the late 1970s. ACF Industries



Early hopper cars

Hopper cars were among the earliest all-steel cars, entering service in significant numbers at the turn of the 20th century. Hoppers were also among the heaviest early cars, with 50-ton capacity common before World War I.

The hopper was one of the standard designs implemented by the United States Railway Administration (USRA) during World War I. A total of 25,500 USRA 50-ton twin-bay cars were built, with many additional cars built to the USRA or similar designs through the 1920s (see fig. 5-2). These steel cars were 30 feet long with a capacity of 1,880 cubic feet. USRA hoppers are exterior-braced cars, with seven posts on each side.

The USRA cars had long service lives, many lasting through the 1950s. Many were rebuilt over the years. Some retained their original appearance, but with updated brake equipment: AB brakes replaced K brakes, and various types of brake wheels and mechanisms replaced the original vertical brake staffs with horizontal wheels.

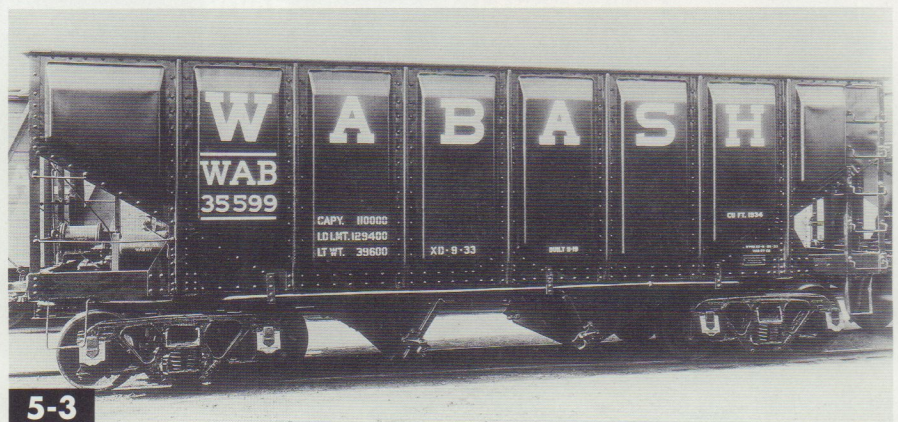
A common USRA variation included cars rebuilt with panel sides as fig. 5-3 shows. The panels, applied between the vertical posts, increased the cubic capacity of the cars and made them visually interesting and quite noticeable.

During the teens and 1920s some coal-hauling railroads built larger cars; cars with 70- to 90-ton capacities were fairly common. Some 100-ton (and even larger) cars were also built.

In the 1920s the American Railway Association (ARA) worked to develop standard designs for hoppers. These cars introduced what is known as the offset-side design (fig. 5-4). Instead of visible external vertical posts (as on the USRA cars), the posts were inside and the side sheathing was on the outside. At the top the side angled back in, with triangular braces on the outside. This design—with



5-2



5-3



5-4

bracing on the inside—increased the cubic capacity of the cars.

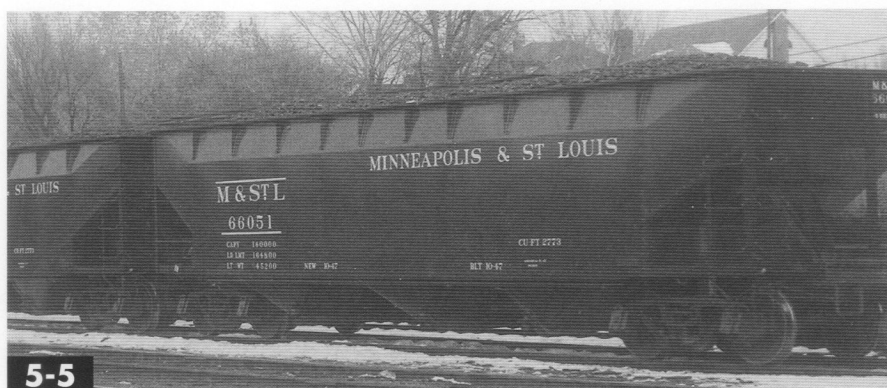
The first ARA design, submitted in 1926, was for a four-bay 70-ton car (fig. 5-4). The 70-ton car had a 41'-3" inside length and was 10'-6" tall; this was revised in 1929 to a 40'-5" inside length and 10'-8" height. About 14,000 quad hoppers were built to ARA or similar designs through 1930.

In 1930, the initial ARA design for a 50-ton car (34 feet inside length) called for three bays, but few were built. Instead, in 1934 the 70-ton design was changed to a three-bay configuration (fig. 5-5), and the 50-ton car was modi-

5-2 Hoppers built to the USRA design were among the most common coal cars through the 1930s. These 30-foot, 50- and 55-ton cars offered two outlet bays and featured seven exterior vertical posts. *David P. Morgan Library collection*

5-3 Many USRA hoppers were rebuilt with panel sides between posts to expand the capacity. This Wabash car was built in 1919 and rebuilt in 1933. *Wabash*

5-4 This Baltimore & Ohio hopper, a four-bay, 70-ton ARA car, was among the earliest offset-side designs. *Jim Shaughnessy*



5-5



5-6



5-7

5-5 The AAR three-bay, 70-ton car was built in large numbers, especially after World War II. This Minneapolis & St. Louis car was built in 1947. *Minneapolis & St. Louis*

5-6 Offset-side cars had interior posts to maximize cubic capacity. The AAR 50- and 55-ton offset-side car was perhaps the most popular coal car of the steam era. This Reading car, built by Bethlehem in 1955, has angled stiffeners at the top of the sides. *Reading Railroad*

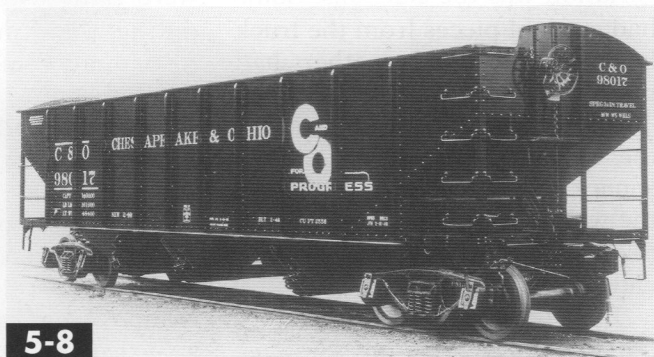
fied to have two bays (fig. 5-6).

Both cars would prove to be popular. The 70-ton car had a 40'-8" inside length (the height remained 10'-8") and 10 stiffeners along the top of each side.

The 50- and 55-ton two-bay cars were 34 feet long (33'-0" inside length)—four feet longer than the USRA twin cars—with a standard height of 10'-8". About 127,000 of these 34-foot cars were built through the mid-1950s, when production shifted to 70-ton and larger cars. Many remained in operation into the 1970s.

Spotting features include the stiffeners running along the tops of the sides. The Association of American Railroads (AAR) design called for nine of them, and they were not evenly spaced (see fig. 5-6); however, an alternate design used more even spacing (fig. 5-7). Also, these stiffeners had different designs. Early cars had shaped stampings (sometimes called "hat-shaped") as in fig. 5-7; most later cars had metal angles, as fig. 5-6 shows, but some later cars received hat-shaped stiffeners.

Ends also varied. Most cars had straight ends as figs. 5-6 and 5-7 show, but some cars had ends with angled or oval tops as in fig. 5-8.



5-8

5-7 Some AAR cars were built to an alternate standard with a 10'-5" height and even spacing of the stiffeners. This Minneapolis & St. Louis car, built in 1936 by General American, has stamped ("hat-shaped") stiffeners. *Minneapolis & St. Louis*

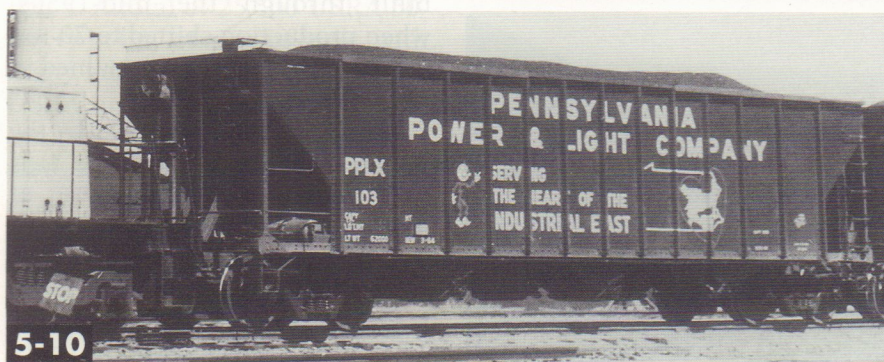
5-8 Some railroads favored outside-braced cars. This three-bay 70-ton Chesapeake & Ohio car, built in 1949 by Bethlehem Steel, has ends with oval heap shields. *Chesapeake & Ohio*

5-9 This Chicago & Eastern Illinois car follows the AAR standard for a 70-ton, three-bay, outside-braced hopper. It was built by Pressed Steel Car Co. in 1952. *Chicago & Eastern Illinois*



5-9

5-10 This Pennsylvania Power & Light car was among the first modern 100-ton hoppers. It's a three-bay, outside-braced car built for unit train service. *David P. Morgan Library collection*



5-10

These peaked ends were known as "heap shields." These came in different shapes, with ovals, ovals with notches above the end ladder, and angled ends all employed at various times.

Other variations included side rivet patterns, brake gear, make and style of hopper doors and door locks, and trucks. Another variation was the side sills: Some had straight pieces from the truck bolster to the end, but others had pieces that angled upward.

Yet another variation was in the end panels on the sides. On some cars the taper extended all the way to the end of the car (fig. 5-7); on other cars, the taper ended on the panel (fig. 5-6).

In 1946 the AAR modified both the two- and three-bay designs, making each car larger. The revised two-bay car had an inside length measuring 35'-0", and the three-bay car was stretched to a 41'-8" inside length.

The offset-side hopper was the dominant style of car built into the 1950s (although many outside post cars were also built), but the design had its flaws. The main

problem was that the sides tended to bow out and separate from the posts. Many offset-side cars were rebuilt at least once, and many were rebuilt with outside braces.

Outside-braced cars

Although offset-side cars were the dominant hoppers from the 1920s through the 1950s, many hoppers were built using outside braces during that time (see fig. 5-8). Also, many coal-hauling railroads wanted cars larger than the 50-ton standard of the teens and even the 70-ton cars of the 1920s and '30s.

Large cars, of 90- and 100-ton capacity, were used on the Norfolk & Western and Virginian (which even ran some 120-ton, six-axle coal gondolas) as early as the 1910s. However, cars that large didn't become popular for interchange and general service until the 1960s.

Even with the availability of larger cars, 50-ton cars remained very popular through the 1940s. The reason was that many buyers of coal—such as small-town coal dealers—didn't want or need

shipments larger than 50 or 55 tons. This would change in the 1940s and '50s, as natural gas and fuel oil replaced coal for home heating, and more coal was transloaded to ships or transported to large coal-fired electrical power plants.

Through the 1950s railroads increasingly opted for 70-ton cars, which led to the adoption of an AAR alternate standard for a 70-ton, three-bay, outside-braced car, as fig. 5-9 shows. The standard called for a 40'-8" inside length with 10 side posts, but many railroads and manufacturers built variations of these cars. Spotting features to look for are the number of posts and car length and height.

Modern hoppers

As with other car types, the 1960s brought a growth in car size and capacity for hopper cars. Figure 5-10 shows an early 100-ton hopper: a three-bay, 3,366 cubic-foot car built by Bethlehem in 1964 for unit-train service for Pennsylvania Power & Light Co. (among the earliest unit coal trains). Unit coal trains—solid trains bound for a single customer—increased dramatically in number during the early 1970s.

Through the 1960s and '70s, many companies built 100-ton hopper cars, including Pullman-Standard, Bethlehem, Evans, Greenville, Portec, Trinity, Ortner, and Paccar. Details vary among them; spotting features include the number of bays, car length, num-

War-emergency hoppers

Steel was in short supply during World War II, so the AAR approved a design for a composite hopper car with steel ends, floor, and bracing, but wood

sides (you can see the individual planks in the builder's photo of the B&O car). These cars were known as war emergency hoppers, and were quite distinctive in

appearance. About 10,000 of these 50-ton cars were built.

These cars were designed to have their wood sides replaced with steel, which many

did through the 1950s and '60s as shown by the C&O car. However, some continued running with their original wood sides into the 1960s.



War emergency hoppers had steel frames and ends with wood planks for sides. Bethlehem built this car for B&O in August 1943.

Baltimore & Ohio

Many war emergency cars were later rebuilt with steel sides, keeping their distinctive side bracing, as with this Chesapeake & Ohio car.

Chesapeake & Ohio



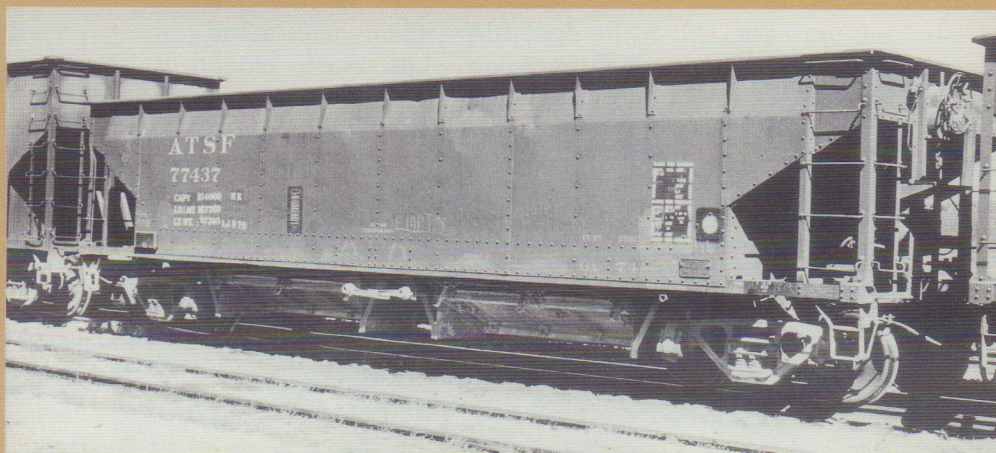
Ore cars

Ore cars are specialized hopper cars in dedicated duty hauling iron ore. Because iron ore is very heavy and dense, a small car can carry a 70- or 100-ton load. Ore cars are short (about 21 feet) compared to a standard hopper car. Variations include the side shape, end shape, and bracing. Early cars were 70- or 75-ton capacity, with 100-ton cars common in the 1960s and later.



Ore cars are significantly smaller than standard hoppers because of the high density of iron ore. This 70-ton car was built in 1930. *Pressed Steel Car Co.*

Ballast cars



Ballast cars have gates that open to the sides of the rails, and many—like this ACF Hart Selective ballast car—can dump to either side or between the rails. *Andy Sperandio*

A variation of the standard hopper car is the ballast car. Designed for dumping ballast on the tracks, these cars have doors that open to the side or lengthwise compared to the car.

The photo shows a Hart ballast car (built by ACF), one of the most common ballast car designs. Its bottom gates allow lading to be dumped to either side as well as in the center.

Although designed for maintenance service, these cars can sometimes be found hauling revenue loads of aggregate, sand, or gravel between maintenance duties.



5-11

5-11 This four-bay 100-ton hopper was built in 1976. Spotting features include the end style, angle of the slope sheets, and number and spacing of exterior posts. *David P. Morgan Library collection*



5-12

5-12 Ortner's distinctive Rapid Discharge hoppers are characterized by their five bays and peaked ends. This 3,800 cubic-foot Santa Fe hopper was manufactured in 1978. *Ortner*

5-13 Hoppers in unit train service with rotary couplers, such as this 100-ton Burlington Northern car, have one end painted a contrasting color. *Jeff Wilson*



5-13

5-14 Aluminum is a popular material for modern coal hoppers and gondolas. This 4,300 cubic-foot Johnstown America Auto-Flood hopper has interior bracing and electrically operated doors. *Jeff Wilson*



5-14

ber and style of side posts, and style of the ends and end bracing.

Figure 5-11 shows a four-bay 100-ton car built for the Rio Grande. Hoppers (and later, coal gondolas) built for service in the West were generally slightly larger than cars built to haul Eastern coal, since a given amount of Western coal isn't as heavy as its Eastern counterpart.

Figure 5-12 shows an Ortner Rapid Discharge hopper. These 100-ton cars were popular 1970s and '80s coal haulers; their five

bays and peaked ends make them stand out.

Rotary dumpers came into wide use at electrical utilities through the 1970s, greatly speeding unloading times. Manufacturers began building hopper cars with rotary couplers at one end, allowing the train to remain coupled while loads are dumped. Cars with rotary couplers are marked by painting one end a contrasting color, as fig. 5-13 shows. All cars in a unit train will have their rotary ends facing the same direction (some cars have

rotary couplers—and markings—on both ends). If they're not, then the train is not bound for a plant with a rotary dumper.

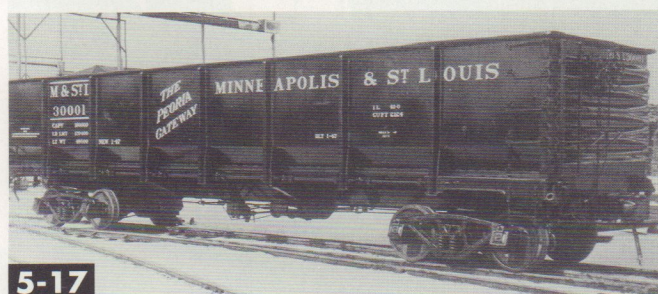
Aluminum came into wide use for coal gondolas and hoppers in the 1980s and '90s. Figure 5-14 shows a modern aluminum inside-post hopper, a Johnstown-America Auto-Flood car with electrically operated outlet doors, another feature found on many unit train cars starting in the 1970s.

There are still plenty of hopper cars around, but most unit coal



5-15 Thousands of 50-ton USRA composite gondolas were built, featuring a steel underframe, ends, and bracing, with wood sides. *David P. Morgan Library collection*

5-16 This 42-foot Michigan Central gondola was typical of steel gondolas built in the 1920s. *New York Central*



5-17 This drop-bottom GS gondola, with 16 drop doors, was typical of coal-hauling gons built through the 1940s. Minneapolis & St. Louis no. 30001 was built in 1947 by General American. *Minneapolis & St. Louis*

5-18 Among the most common mill gondolas of the late steam/early diesel eras was the drop-end, 53'-6", 70-ton car first built by Greenville. This Rock Island car was built by Pullman-Standard in 1957. Drop-end gons have lever-style brake handles. *Rock Island*

trains are now made up of 100- or 110-ton coal gondolas, which will be discussed later in this chapter.

Early gondolas

Gondolas, often called "gons," are multi-purpose cars that can haul a number of products. They were major coal haulers early in the 20th century, and remained so on Western railroads through the late steam era. Gondolas also carried other bulk commodities such as gravel and crushed rock, along with virtually any other items too bulky to fit into a boxcar.

There are many types of gondolas, but through the early diesel years they fell into two basic categories. Mill gondolas—as the name implies—serve steel mills and

related industries. These cars are longer (at least 50 feet) with low sides and solid bottoms, and many have end doors that fold down.

General-service gons are generally shorter (around 42 feet) and often have higher sides and fixed ends. Many have drop-bottom doors of various types, making it easier to dump loads of coal and other bulk materials.

The AAR code (listed in the *Official Railway Equipment Register* and often stenciled on the car side) will tell you the type of any given car. The most common types are the GB, which has a solid bottom, fixed or drop ends, and low sides; GT, which has high sides, fixed ends, and solid floor (made for coal hauling with rotary dumping); and

GS, which has fixed ends but a drop bottom with doors hinged at the center sills.

The USRA specified three different gondola designs during its time of control. Most common was a high-side 50-ton composite-side car with 41'-6" inside length (see fig. 5-15): 20,000 of these steel-braced, wood-sided cars were built, many of which lasted through the steam era. An all-steel version of the car was also designed, but only 4,500 were built. Plans for a 70-ton low-side (mill) car were also developed, but none of them were built under USRA control.

Following the USRA cars, there were no ARA or AAR standards for gondolas until just before World

War II. Thus, cars tended to follow many different designs depending upon the builders and railroads.

Steel became the primary building material for gondolas after World War I (see fig. 5-16), although some cars were built with composite sides following USRA and similar designs into the 1920s.

Figure 5-17 shows a steel drop-bottom GS gondola, typical of coal-hauling cars through the mid-1900s. This one was built in a 1941 AAR-recommended configuration. Other AAR designs included a 42'

fixed-end car, as well as 52'-6" and 65'-6" mill gondolas.

As with hopper cars, World War II brought about AAR designs for war emergency composite-side general service and mill gondolas (see the sidebar on page 62).

Figure 5-18 shows perhaps the most common mill gondola design used from the end of World War II through the 1950s. The 70-ton, 52'-6" cars were originally built by the Erie RR and Greenville Steel Car Co., but nearly identical cars were made by PS, ACF, and

Bethlehem. About 16,000 of these cars were eventually produced.

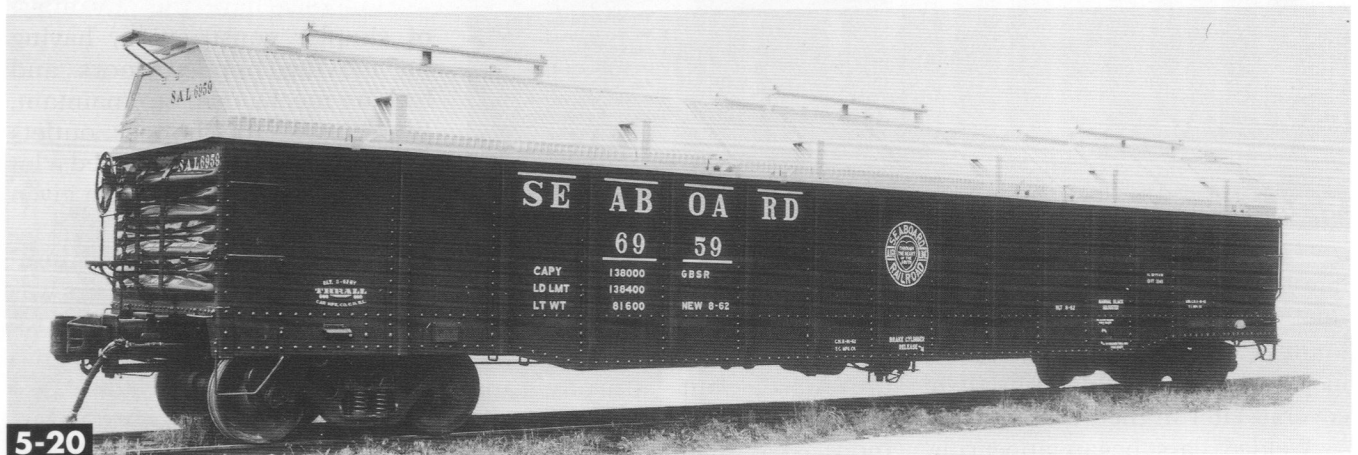
Longer mill gons were also built, such as the 65-foot style in fig. 5-19. The car follows the same basic lines as the 52'-6" car (with a deeper drop in the sides), but the longer car has fixed ends.

Covered gons began appearing in the 1960s and were used primarily for shipping coiled steel, which requires protection from the elements (see fig. 5-20). These removable covers came in many different designs. Gondolas were used for coiled steel until the advent of the specialized coil-steel car (discussed in chapter 6) in the



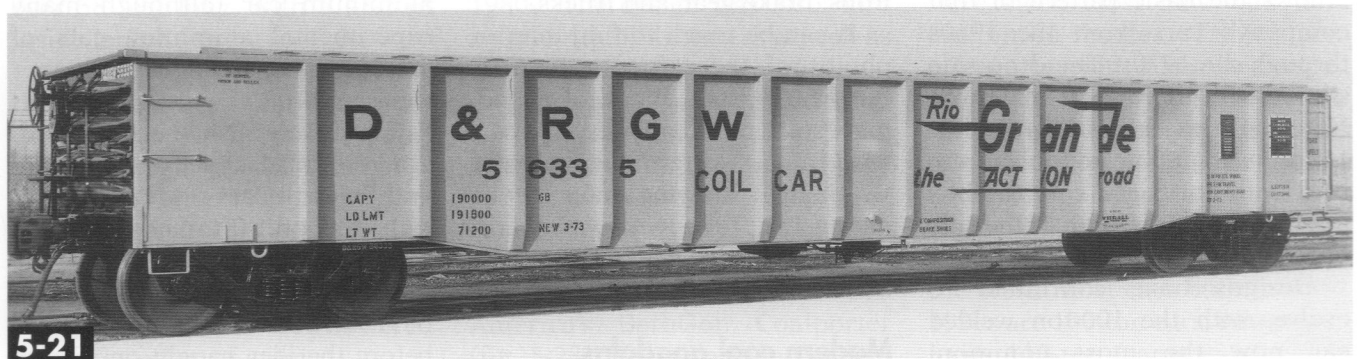
5-19

5-19 Long mill gondolas, such as this 65-foot Chicago & Eastern Illinois car, were also common. This one was built by Bethlehem in 1957.



5-20

5-20 Covered gondolas, like this 1962 Thrall car, were used to ship products that needed protection from the elements. *Seaboard Air Line*



5-21

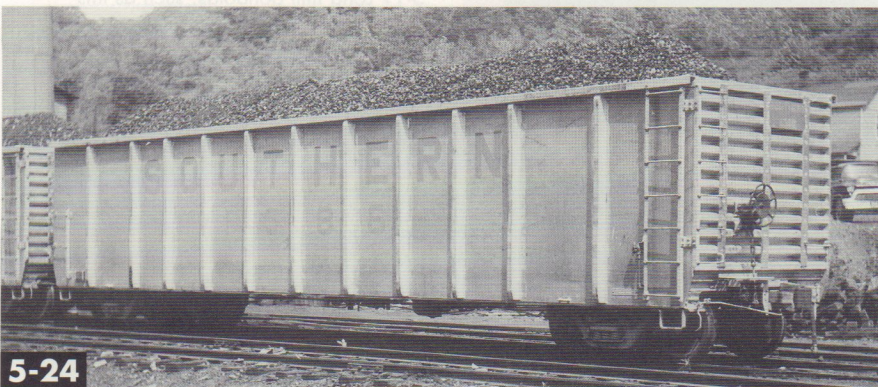
5-21 Welded gondolas, such as this 100-ton Thrall car, began appearing in large numbers in the mid-1960s. This Rio Grande car, built in 1973, is equipped for hauling coiled steel. *Thrall*



5-22 A popular 1980s variation was the use of horizontal corrugations for extra strength in the panels. This is a 100-ton Burlington Northern Santa Fe car. *Bob Gallegos*



5-23 Modern gondolas usually have straight sills as on this 100-ton welded Dakota, Minnesota & Eastern car. *Jeff Wilson*



5-24 Southern's aluminum "silversides" cars, 100-ton gons with roller-bearing trucks, were revolutionary when built in 1960. *Steve Patterson*

late 1960s, and many continued in this service through the 1970s. Many of these cars could be found in general service—without their covers—later in their careers.

Welded cars began appearing in the 1960s. Figure 5-21 shows a welded Thrall gondola that follows the basic pattern of that company's cars from the 1960s through the 1970s. The drop side sill is still there but shallower. Note the heavier posts, typical of 100-ton cars. Some gondolas were built with horizontal corrugations to increase the strength of the side panels (fig. 5-22).

Designs have continued to evolve, with the 100-ton welded car now the most common. Straight side sills have been the norm on cars built since the early 1980s (see fig. 5-23).

Spotting features on gondolas include the number and style of posts, type of ends (various styles are used, but Murphy and Dreadnaught are the most common), side sill (straight or fishbelly, with varying amounts of taper), corner ladders or grab irons, brake gear, and trucks.

It can be tough to find interior photos of these freight haulers, but you'll find floors of wood, plate steel, or nailable steel (crosswise pieces resembling planks, with gaps allowing nails to be driven in). Tie-down loops, rods, or straps on the tops of the sides are found on some cars.

Modern coal gondolas

Although a couple of railroads—notably Virginian and Norfolk & Western—had high-capacity coal

gondolas early in the 1900s, it wasn't until the 1970s that big coal gondolas became popular for interchange service.

The shift toward larger coal-fed plants for generating electricity, together with the increased use of rotary dumpers for unloading, increased the popularity of gons over hopper cars for coal service.

Gondolas have the advantage of simpler construction, having no moving hopper doors and locking mechanisms to maintain. Eliminating the hopper outlets and slope sheets also allowed a lot more coal to be carried in a given car of the same length.

Among the first modern unit-train applications of coal cars was in 1960, when the Southern Ry. acquired 750 aluminum coal gondolas from Pullman-Standard (see fig. 5-24). These cars—known as "silversides" on the Southern—were notable in that they marked the first large-scale order for an aluminum car (although many experimental aluminum cars of various types had been built over the years).

They were also the first modern 100-ton capacity coal cars, and the first cars ordered specifically for unit-train coal service. Most lasted in service through the 1980s and into the 1990s.

It was several more years before the idea caught on. Figure 5-25 shows the first of the modern-styled coal gondolas, built in 1969 for Canadian Pacific. These



5-25

5-25 Canadian Pacific's unit-train gondolas of 1969 were the first to be built with "bathtubs" that extended below floor level. *Canadian Pacific*



5-26

5-26 This 4,240 cubic-foot Coalveyor was the largest of four sizes offered by ACF. This car was built in 1978. *ACF Industries*

5-27 Evans built many 100-ton gondolas for unit train service. Thrall offered similar cars, all characterized by distinctive outside posts that matched the crossbearers. *J. David Ingles*

5-28 Bethlehem's BethGon Coalporter is the most popular modern coal hauler. The 100- and 110-ton cars have ends that resemble hopper cars, but with tubs below floor level. They're made in steel and aluminum versions. *John Harvey*



5-27



5-28

4,760 cubic-foot cars were just over 58 feet long, with a 48-foot inside length.

The car was the prototype for the Youngstown Bathtub gondola, which had tub-shaped bins on either side of the center sill (thus the term "bathtub gondola") instead of hoppers. The tubs allowed the cars to carry more coal than a standard flat-bottomed gon and also lowered the car's center of gravity.

Other coal gondola designs soon followed. The Coalveyor (fig. 5-26) was an ACF coal gondola

built in the late 1970s and early 1980s. The design was also built by other manufacturers as well as the Union Pacific.

Evans and Thrall offered similar high-side gondolas (fig. 5-27). These non-tub cars have heavy vertical posts and cross bracing at each end.

The most popular of the modern coal gons is Johnstown-America's BethGon Coalporter (fig. 5-28). These cars, in production since 1978, are distinguished by their angled end slope sheets, with two lengthwise tubs below

frame level. Early Coalporters were steel; most new cars have aluminum bodies. Trinity also offers a car with a similar design.

Spotting features of coal gons include the number and pattern of side posts, end design, tub design, and body material (aluminum or steel). Most are available in different sizes, with larger cars used in the West. Most cars built into the 1990s are 100-ton cars; newer cars have 110-ton capacities and a 286,000-pound gross rail load.

War-emergency gondolas



This war-emergency gondola has six drop doors and an inside length of 41'-6". It was built in July 1943. Mt. Vernon Car Manufacturing Co.

As with hopper cars, the AAR designed war-emergency gondolas as well. Designs included 50-ton high-side cars

with either 41'-6" inside length and six or eight drop doors (the Southern car has six drop doors) or 41'-0"

cars with 16 drop doors. A 70-ton mill gondola with a 52'-6" inside length was also designed and built.

Wood-chip cars



Modern wood-chip cars are excess height (note the white end panel) with an end door for dumping. Note the mesh screen covering the load.

Jim Hediger

Another type of specialty gondola is the high-volume wood-chip car, used to transport wood chips from mills to paper manufacturers. Since wood chips are a very light-density item, wood-chip cars have the

highest cubic capacity of any gon. Many designs have been made over the years; most are long, excess-height cars.

Purpose-built wood-chip cars first appeared in the 1960s; prior to that, wood

chips were carried in older gondolas or hoppers modified with high side extensions to increase the capacity.

Spotting features include the side post pattern, depth and placement of side ribs

and braces, and end design. Most of these cars have a door at one end, allowing them to be emptied one at a time by tipping them on end.

FLATCARS

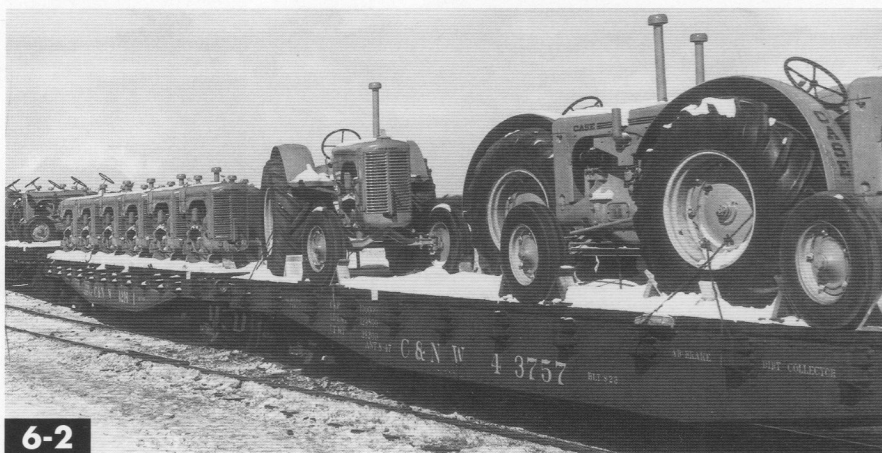


Flatcars have long been used to haul bulky items that won't fit into boxcars and that don't need the sides and ends of gondolas. Common flatcar loads over the years have included tractors and other machinery, pipe, lumber, rail, railcar wheelsets, automobile frames, electrical transformers, wire spools, tanks, and many other items.

Flatcars are often modified to carry specific loads. Specialized flatcars that have been developed from the 1960s through today include piggyback flats (discussed in chapter 7), auto rack cars, coil steel cars (fig. 6-1), and center-beam flats for carrying wood products.

6-1 Along with general service flatcars, long used for hauling bulky items, many specialized types of flatcars have evolved, such as this covered car for hauling coil steel. *Jeff Wilson*

SIX



6-2

6-2 Although no USRA flatcars were built during World War I, many railroads (such as the Chicago & North Western) later ordered cars based on the USRA design. *Chicago & North Western*

6-3 The 50-ton AAR 1941 flatcar was based on this 52'-6" Union Pacific car. The riveted car has fishbelly sides, wood deck, and 15 stake pockets. This car has been modified for dedicated service, carrying Kaiser automobile bodies. *Kaiser-Frazer Corp; Jack Mueller collection*



6-3

Flatcars with steel frames and underframes were common by World War I, and the United States Railroad Administration (USRA) approved a design for a 55-ton, 42-foot steel flatcar. Although none were built while railroads were under USRA control, many railroads built or ordered flatcars of this or similar designs after the war (fig. 6-2). These cars were riveted and had fishbelly sides, separate stake pockets riveted in place, and wood

decks. Vertical brake staffs with horizontal brake wheels were located at one end.

From the late 1920s into the 1930s, railroads began seeing the versatility of longer flatcars with increased capacity—up to 70 tons. In 1941, the Association of American Railroads (AAR) recommended three flatcar designs, including two 53'-6" cars (one 50-ton, one 70-ton) and a 70-ton, 50-foot car with a cast underframe. The 50-ton car was based

on a Union Pacific car built by Pullman-Standard (fig. 6-3). The 53'-6" 70-ton car followed a Pressed Steel Car Co. design for Erie, and the cast underframe car was patterned after Pennsylvania RR's home-built F-30A car.

Flatcars have several key spotting features to watch for. The side sill can be either straight (usually with a prominent center sill) or tapered (fishbelly), with either a one- or two-step taper. Also watch for rivet patterns (no rivets on

welded or cast cars) and the number and style of the stake pockets.

One of the most common flatcars built in the 1950s and '60s was the Commonwealth 53'-6" car (the most common length for general service flatcars through the 1960s), based on a one-piece casting made by General Steel Castings (fig. 6-4). These cars were built from the early 1950s through the early 1970s, with few changes during production. Many railroads built their own cars using the GS castings, and GS also sold finished cars under its General Steel Industries division.

Commonwealth cars can be spotted by their lack of rivets, double-tapered side sills, and stake pockets that are integral with the car. Many of these cars were equipped with bulkheads. General Steel offered its own distinctive bulkheads for these cars (fig. 6-4).

As the photos show, most flatcars through this period had a vertical brake staff with horizontal brake wheel at one end. These could be dropped to deck level (fig. 6-5) to make it easier to load and unload the car. Other cars had vertical brakewheels mounted on posts along the side at one end.

Bulkhead flats were common for carrying pulpwood, finished wood products, and pipe. Lengths of 55 and 60 feet were common. Figure 6-6 shows a bulkhead flatcar with a straight side sill.

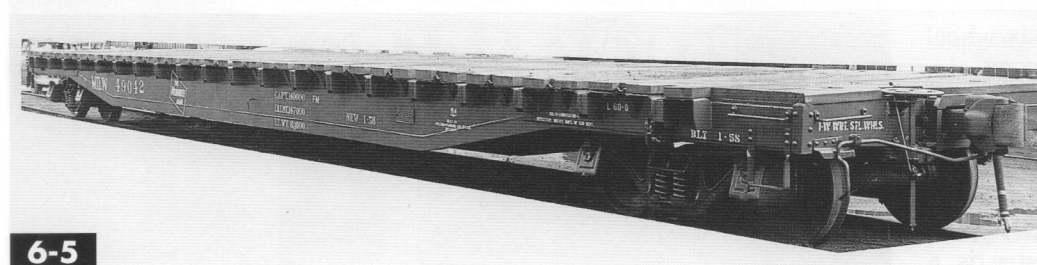
Along with operating a substantial fleet of piggyback cars, TTX Co. (formerly Trailer Train) has become a leading owner of general-purpose flatcars since the 1960s. TTX owns several types of 60- to 89-foot cars, some of which are converted piggyback cars, and some of which are purpose-built. They are used for many types of loads, including machinery, pipe



6-4

6-4 Commonwealth welded flatcars had stake pockets integral to the casting, flat ends, and sides with a multiple-step taper. This car is equipped with the distinctive bulkheads unique to Commonwealth cars.

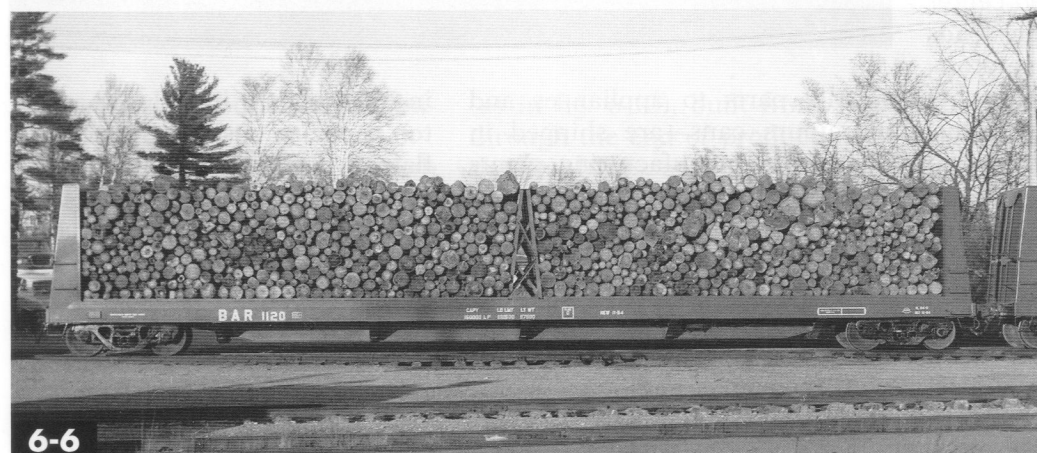
David P. Morgan Library collection



6-5

6-5 Pullman-Standard built this welded PS-4 car for Milwaukee Road in 1958. Note how the brake wheel (next to the coupler) drops down to clear the deck.

Pullman-Standard



6-6

6-6 This welded bulkhead flat, built in 1964, has a straight side sill and a prominent fishbelly center sill. It is 64 feet long between bulkheads.

George F. Melvin



6-7 TTX has converted many former piggyback cars for other uses. One example is this car for hauling pipe, a Pullman-Standard car with S-shaped side channels.
Jeff Wilson



6-8 Gunderson built this 100-ton bulkhead flatcar for TTX in 1997. Jeff Wilson

6-9 This 92-foot long Pennsylvania RR car has a 250-ton capacity and rides on four six-wheel trucks. It is hauling a General Electric steam turbine generator.
General Electric

6-10 Evans pioneered the idea of dedicated coil-steel cars. This Type 4 coil car, built in 1975, has a pair of angled hoods. Jim Hediger

(fig. 6-7), and auto frames. Bulkhead flats are also part of the TTX fleet (fig. 6-8).

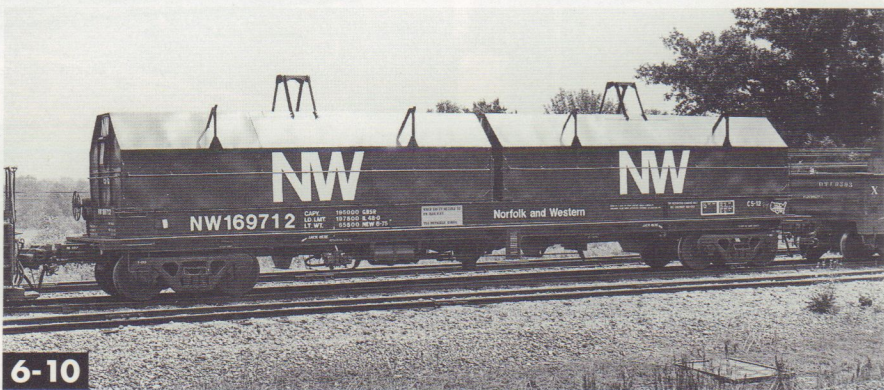
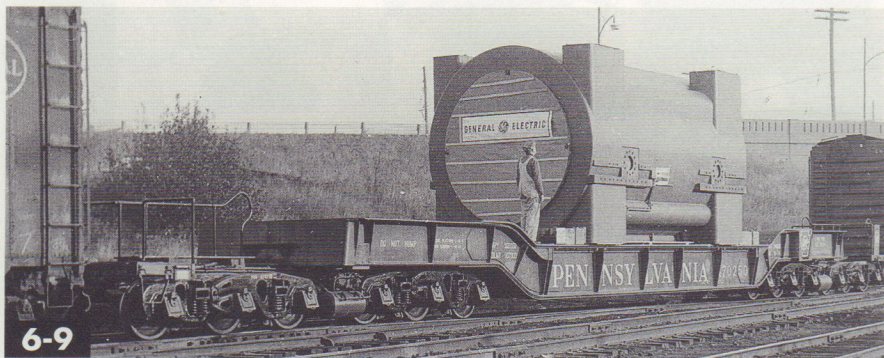
Heavy-duty flatcars

Heavy-duty flatcars are a special class of flats. These sometimes have straight decks but often have depressed centers (between the trucks) to allow taller loads (fig. 6-9). They follow many different designs, and many are custom-built by railroads for specific customers. To provide the increased capacity, these cars have six-wheel trucks or multiple four- or six-wheel trucks on span bolsters at each end.

These cars are used for exceptionally heavy and large loads (some cars can carry up to 250 tons). The electric industry is a prime user of depressed-center heavy-duty flats, shipping loads such as transformers, generators, turbines, and boilers. These cars often travel as their own trains, requiring restricted speeds and routes carefully planned to ensure adequate clearance.

Coil cars

The coil-steel car is another type of flatcar that evolved to carry a specific product. Thin sheet steel and other metals—used in manufacturing everything from auto-



mobile parts to appliances and aluminum cans—are shipped in coils from manufacturing plants to end users. Coiled metal is easily damaged and needs protection from the elements. Covered gondolas were an early solution to the shipping problem, but gondolas carry a lot of extra tare weight with their ends and sides, which weren't necessary for the load.

Evans came up with a solution

in 1964 when it introduced a 100-ton capacity, cushion-underframe flatcar designed specifically for carrying coiled steel (fig. 6-10). A V-shaped center trough or saddle down the center of the car holds the coils securely, with steel hoods that fit over each half of the car. The idea was a hit with the steel industry, and coil-steel cars have grown in popularity through the 1960s to today. Thrall (now



6-11

6-11 This modern Trinity coil car has a car-length hood. *Jeff Wilson*



6-12

6-12 "Opera window" cars are so named for the oval openings in the center partition. Gunderson built this CSX car in 1987. CSX Corp.



6-13

6-13 Some center beam cars use trusses for strength and for anchoring loads. This car was built by NSC in 1993. *Jeff Wilson*

glass or insulated aluminum, and differences in design now prevent the swapping of covers that was done with early cars. Some modern cars are designed with single car-length covers (fig. 6-11).

Spotting features of these cars include the shape and design of the sides and ends, and the styles of the hoods.

Center-beam flatcars

The center-beam flatcar is a modern solution to the challenge of shipping lumber and lumber products by rail. For the first half of the 20th century the usual method of shipping lumber was standard boxcars—a very laborious approach, as cars were loaded and unloaded board by board.

Flatcars and gondolas (sometimes with bulkheads) were also used, with the load built up board by board. This made loading easier, but the load would then be framed to hold it in place. Excessive force in switching could still shift the loads quite dramatically.

The 1960s saw the all-door boxcar, discussed in chapter 1), which protected loads and made loading and unloading faster. However, all-door boxcars were expensive and complex with lots of moving parts to break down and need repair, especially as the cars grew older.

Trinity) has also built a large number of coil cars.

The Evans cars went through several versions, known as Type 1, 2, 3, and 4 cars. The earliest are Type 1s, with a 45'-6" inside length; followed by the slightly longer (48 feet) Type 2s. Both had drop side sills and lacked side running boards. Type 3 cars (starting in 1967) were like Type 2s, but with running boards. Type 4 cars

(as in fig. 6-10), built from 1968 through the end of production in the late 1970s, are the most common, and have straight side sills.

Early cars had interchangeable steel covers, and into the 1990s it was not uncommon to see these cars running with mismatched covers, often with two different styles of covers (rounded or angled) or different road names. Many modern covers are fiber-

The eventual solution came in the form of the center-beam flatcar, which is basically a long bulkhead flat with a center partition or frame. The open design makes loading a car much faster and simpler, and the center partition provides stabil-

ity for loads, allowing them to be strapped securely in place.

Center beam cars can be found carrying bundled loads of lumber (wrapped or exposed), drywall, hardboard, and many other lumber products.

Canadian National first came up with a design for a center-beam car in the 1960s, licensing the idea to Thrall, although relatively few of them (under 1,000) were built through the 1970s. However, the cars gained in popularity from the mid-1980s to the present.

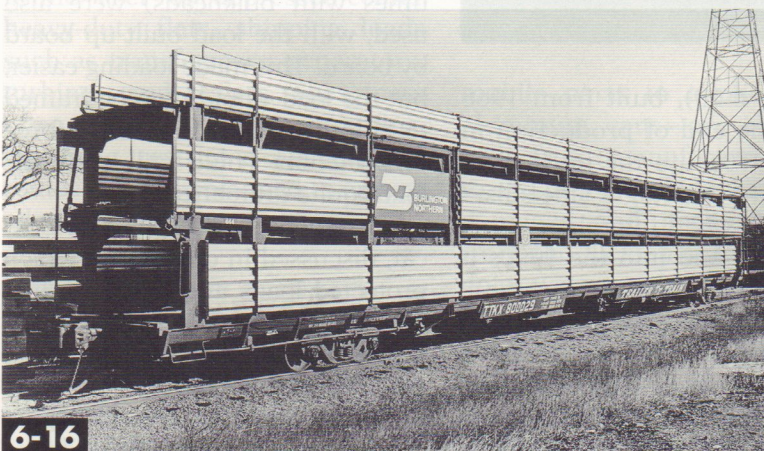
These cars, built mainly by Thrall and Gunderson (but also by NSC and others), come in two basic styles: the so-called "opera window" (fig. 6-12), which has a solid center wall with oval openings in most panels; and the truss (fig. 6-13). The two common inside lengths for these cars are 60 feet (used for drywall, green lumber, and other heavy products) and, more commonly, 73 feet



6-14



6-15



6-16

6-14 Cables running from the side sills to the top of the car hold loads securely in place. This is an NSC-built truss car. *Jeff Wilson*

6-15 Early auto racks were open. This Whitehead & Kales rack, mounted on an 85-foot flatcar, carried a full load of 15 Corvairs in 1960. *Whitehead & Kales*

6-16 Railroads covered open auto racks with corrugated metal to cut down on damage from vandalism. The flatcar is one of ACF's distinctive cars with visible cross bearers. *Burlington Northern*

(used for most dried lumber and finished products, fig. 6-14).

Along with the length and beam style, spotting features include the number, shape, and arrangement of the oval openings; bulkhead style; number of vertical posts; and type of truss (Howe or Pratt; check the location of the diagonals).

Auto rack cars

Auto racks are so common today that it can be hard to remember that through the 1950s automobiles shipped by rail traveled almost exclusively in boxcars (see chapter 1). However, boxcars were not an efficient way of carrying autos, and by the end of the 1950s railroads had lost most of the long-haul auto carrying business to trucks.

Enter the 85-foot piggyback flatcar. Although designed for carrying truck trailers, the long platform was ideal for holding an auto rack, as automobiles are a comparatively light load for a freight car. The first auto rack cars appeared in 1960, manufactured by American Car and Foundry and Whitehead & Kales (fig. 6-15). Two- and three-level racks were used: Tri-levels carried most standard autos; bi-levels were used for pickup trucks and vans.

The coming of the 89-foot flatcar in the early 1960s provided even more capacity. Racks could be found mounted on any builders' cars (see chapter 7 for differences among 89-foot flats).

Spotting features of open racks include the number, spacing, and style of vertical posts; the location and size of any diagonal bracing;

and the location of lettering panels.

The most common arrangement through the 1990s was for TTX (formerly Trailer Train) to own the flatcars themselves, while individual railroads owned the auto racks. Although TTX has the largest fleet, several railroads operated their own cars with racks. Among them were Santa Fe and Southern Pacific.

Auto racks won the long-distance traffic back from trucks to the rails, and open racks were the standard auto carriers into the mid-1970s. A growing concern by the end of the 1960s was damage to autos by both vandalism (namely rock throwing) and the elements. Railroads and shippers began looking for ways to better protect the autos.

The ultimate solution was the fully enclosed auto rack, but investing in all-new equipment would have been prohibitively expensive, and many open racks were still relatively new. Thus, the first solution was to cover the exposed sides of open auto racks (fig. 6-16). The covers were typically made from corrugated metal, though screen and fiberglass were also tried. Since these conversions were done on a wide scale by a number of railroads, many variations in appearance existed, including corrugation spacing, panel width (based on the type and manufacturer of the open rack), and height of the metal panels.

Throughout the 1970s more and more open cars were covered, and new production shifted to enclosed



6-17 This tri-level W&K/Thrall rack is noticeably taller (and has an extra row of metal side panels) than the bi-level car at left. Both have W&K end doors with notches for the decks. *Jeff Wilson*

6-18 Portec/Trinity racks, such as this bi-level, have folding doors of a different style than the W&K racks. *Jeff Wilson*



6-19



6-20

racks. Enclosed racks have been built by Whitehead & Kales (fig. 6-17), which was bought by Thrall in 1982—the most common—and Portec (later built by Trinity), fig. 6-18. Cars with bi-level racks have standard 33" wheels, while cars with tri-level racks have special 28"-diameter wheels to improve the clearance for these tall cars.

The W&K/Thrall racks can be spotted by their clamshell doors, which have notches in them to allow the doors to clear the decks (fig. 6-17). The Portec/Trinity racks have folding doors with vertical separations (fig. 6-18). Another

spotting feature is the lettering panel (or panels), which varies in location by road name.

Some early enclosed racks were built without roofs. This lowering of the overall height allowed them to go on routes with tighter clearances (especially in the East). This became less of a factor in the 1980s as railroads improved clearances on major routes to clear double-stack container cars. The open-top cars then quickly faded from use.

Recent years have brought more innovations in carrying autos, with articulated racks now hitting the rails. These include

6-19 The Auto-Max from Gunderson is a two-unit articulated auto carrier. Note how the sides drop down between the trucks. *Bob Gallegos*

6-20 Thrall's new articulated auto carriers have straight decks like conventional auto racks. *Jeff Wilson*

the Auto-Max, introduced by Greenbrier/Gunderson in 1997 and (as of 2005) used in dedicated trains (fig. 6-19), and the ABL (Articulated Bi-Level) from Thrall (fig. 6-20), which can be found on railroads across the country.

INTERMODAL EQUIPMENT



Railroads have been hauling some form of intermodal traffic—trailers and containers that can travel by rail, highway, or ship—since the late 1800s when farm and circus wagons were rolled onto flatcars. The early 1900s saw the birth of intermodal as we now know it, first with railroads hauling less-than-carload (LCL) freight in their own trailers, which they put on flatcars, then with railroads hauling common-carrier trailers, a practice that began in earnest in the 1930s.

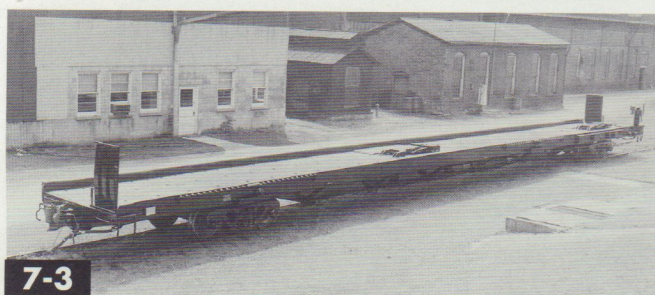
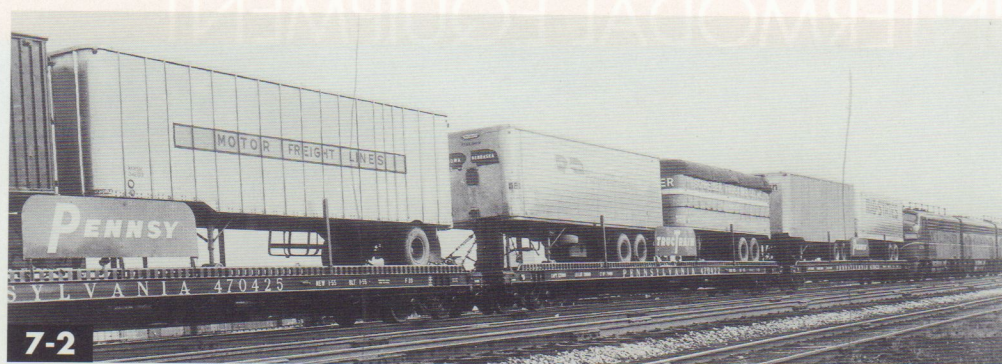
Until the early 1950s, railcars used for carrying trailers were usually older 40- to 50-foot flatcars that had been converted by adding trailer jacks, tie-down rails, and bridge plates. This chapter focuses on the next generation of equipment that began appearing in the mid-1950s: flatcars, spine cars, and well cars designed specifically for hauling trailers and/or containers (fig. 7-1).

7-1 Trailers and containers were once carried on modified general-purpose flatcars and gondolas, but the growth in intermodal traffic led to specialized cars such as this double-stack well car for hauling containers.

Jeff Wilson

SEVEN

7-2 The first purpose-built piggyback cars were these 75-foot cars built for Pennsylvania RR's TrucTrain service. They became Trailer Train's first cars. *Pennsylvania RR*



7-3 Increasing trailer size led to the 85-foot car in 1958. On this Pullman-Standard car—identifiable by the S-shaped channel sides—the top lip projects outward, the bottom lip inward. The collapsible trailer hitches and bridge plates are for circus wagon loading. *Pullman-Standard*

7-4 Bethlehem's channel-side cars were the most common 89-footers in Trailer Train's fleet. This car is carrying a full load of two 45-foot trailers. *Jeff Wilson*

Knowing the types of equipment made (and when various cars were introduced) will help you more accurately model intermodal operations.

Early piggyback flats

In the early 1950s, piggyback traffic was growing: More than 20 railroads offered some type of service. However, trailer size had increased to 32 and 35 feet, meaning existing 50- and 55-foot flatcars could carry only a single trailer. Since a standard flatcar is rather heavy and overbuilt for hauling a single trailer, that meant railroads were pulling a lot of dead weight.

The time had come for flatcars designed specifically for hauling trailers. The first railroad to acquire them was the Pennsylvania Railroad, which ordered 200 75-foot flatcars from Bethlehem (and built another 300 on its own) in 1955 (fig. 7-2). These cars were intended for Pennsy's TrucTrain

service, which hauled trailers in dedicated trains from Chicago to New York and Philadelphia.

Used exclusively for piggyback service, the cars were unique and revolutionary for their time because they had collapsible trailer hitches that locked onto the trailer kingpins. These hitches—American Car and Foundry's (ACF) Model A—eliminated the need for the cumbersome tie-down equipment used on earlier cars. They could accommodate any standard highway trailer without modification.

The cars didn't remain in PRR colors for long, as they became Trailer Train's first cars upon that company's startup in late 1955. The 75-foot cars would be the mainstay of the TT fleet through the late 1950s, when increasing trailer lengths spurred the design of longer flatcars. The Trailer Train concept, advanced by the Pennsy, was to provide a pool of intermodal equipment to member

railroads. The idea was a success, and 32 railroads had joined Trailer Train by 1960.

By that time, longer trailer lengths (40-foot trailers in 1957) had resulted in new car designs. The Trailer Train mechanical advisory committee worked with car builders to develop the 85-foot car, which TT began receiving in 1958 (fig. 7-3). By 1960 TT had about 6,100 flatcars in service, including almost 5,000 85-footers.

The 85-footers were built by ACF (the Hitch Hiker), Pullman-Standard (the PS-4PB and low-profile Lo Dek), General American (G-85), and Bethlehem.

89-foot cars

In addition to piggyback service, the long flatcars were also being used with auto racks (shown in chapter 6). In the early 1960s, auto-rack designers discovered that extending flatcar length just four feet (to 89 feet) increased rack capacity by an auto per level.

Trailer Train chose the 89-foot car as its standard, rather than ordering cars of varying lengths for the two services—a move that would prove fortuitous when trailer lengths expanded in the 1970s.

Along with Trailer Train, many railroads bought their own piggyback cars as well. Since TT was the major buyer of piggyback flats, railroads, when buying their own cars, generally bought cars following TT's standard designs.

The most popular of the new long 89-footers was Bethlehem's (TT class F89F), introduced in 1963 (fig. 7-4). These became known as channel-side cars for the shape of their side sills.

The initial offering from ACF looked like the Bethlehem car, but in 1966 the design changed to a distinctive open-sided configura-

tion with exposed cross bearers. Figure 6-16 in chapter 6 shows one of these hard-to-miss cars, a TT class F89G.

Pullman-Standard's car looked like Bethlehem's, but with an S-shaped side instead of the C shape (figure 7-3 shows the 85-foot version of this car). These were TT class F89E. You can identify these cars by the lower lip on the side turning inward instead of outward as on the Bethlehem cars.

Most of these early cars were set up with hitches for carrying trailers, but a growing number of containers traveling by rail needed space as well.

The solution was the all-purpose flush-deck car—so called because the deck is flush with the top of the side—shown in fig. 7-5. The first ones, built by ACF, were

delivered in 1967, and Bethlehem and PS followed shortly with similar cars. All-purpose cars have collapsible hitches and adjustable container pedestals, allowing them to haul either trailers or containers. The container pedestals fold into the car deck, and they slide in channels on the deck, allowing the car to haul any combination of container lengths.

These flatcars formed the backbone of the piggyback fleet well into the 1980s. Early piggyback cars were equipped with pairs of collapsible hitches—one at the end and one at the middle—to facilitate end or "circus" loading. As lift-on/lift-off facilities became more common in the 1970s and later, many cars were modified with pairs of hitches (often fixed) at the ends, which allowed two 45-foot trailers to ride back-to-back.

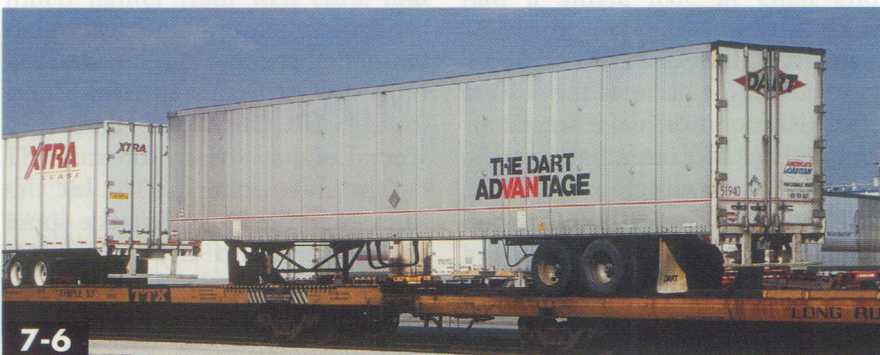
An interesting modification to flatcars appeared in the Long Runner car, made by connecting a pair of 89-foot cars with a drawbar (fig. 7-6). This allows the two-unit pair to carry three 53-foot trailers, with the middle trailer straddling the two cars. Some of these cars also have hitches arranged to allow the car to carry four 45-foot trailers if needed. Trailer Train (which became TTX Co. in 1991), began converting cars for this service in 1987.



Spine cars

The 89-foot flatcar remained the mainstay of piggyback service through the 1970s. However, by that time the number of end-loading (or "circus-style") ramps was rapidly decreasing, replaced by larger terminals with overhead cranes or side-loading forklifts that greatly reduced the loading and unloading time for trailers.

The flatcar deck, a critical part of circus unloading, wasn't needed for lift-off service—a platform was needed only under the trailer wheels. Flatcars were heavy, and, if a good deal of the steel could be removed, railroads would realize

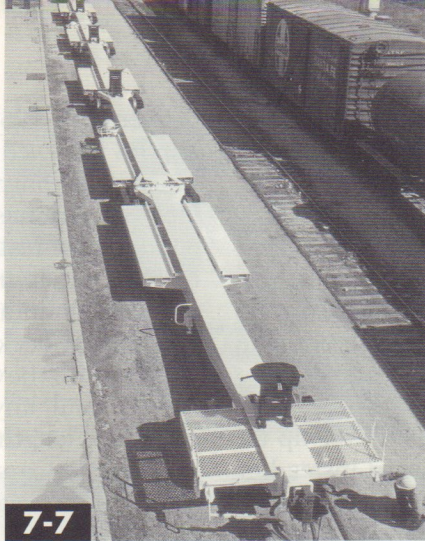


7-5 All-purpose flush-deck cars have collapsible hitches and adjustable container pedestals built into the deck. The slots allow the pedestals to slide to fit any container length.

Jeff Wilson

7-6 Long Runner cars were made by connecting two 89-foot cars with a drawbar. At left is a PS channel-side car; at right is a flush-deck car. Jeff Wilson

7-7 Santa Fe's home-built Ten-Pack Fuel Foilers were the first widely successful spine cars. Santa Fe



7-8 Impack and similar cars can only carry trailers, not containers. The end platforms are equipped so that the end trailers are positioned nose-outward. J. David Ingles

7-9 Container-only (NTTX) spine cars are simple skeleton cars that can be identified by their lack of trailer hitches. Jeff Wilson

7-10 This unit of a 53-foot all-purpose spine is loaded to capacity, hauling a 53-foot J.B. Hunt container on chassis. Jeff Wilson

7-11 Platforms of Twin-28 spines can haul single long trailers or containers or a pair of back-to-back 28-foot trailers. Jeff Wilson

substantial fuel savings from the reduced weight of the railcars.

Thus the spine car was developed. Spine cars are just that: a heavy center beam, or spine, with platforms to support trailer wheels (which could be much lighter than a flatcar deck). Spine cars could also be designed so the trailers sit lower than on a flatcar, lowering the center of gravity and improving the ride and tracking.

The Santa Fe was a pioneer in the development of spine cars. Although several experimental cars had been tried over the years, the Santa Fe developed a winner with its Fuel Foiler articulated spine car

in 1978 (fig. 7-7). The cars were exclusive to the Santa Fe and never traveled off line because they didn't meet Association of American Railroads (AAR) interchange standards for cushioning.

The ITEL Corp. bought the patent rights to the Fuel Foiler design in 1981 and modified it to meet AAR interchange rules. The company began selling the cars, which it dubbed Impacks (short for InterModal Package) in sets (fig. 7-8). Five-unit sets were the most common, but sets from three to ten units were also built.

Along with TTX, which runs the cars with UTTX and TTLX report-

ing marks, several railroads also bought these or similar designs built by ACF (Versa-Deck) and Thrall (ARC-5). All of these cars were designed strictly for trailers.

The next spine car to hit the rails was called just that: the spine car. Delivered in 1987, the five-unit cars built for Trailer Train (NTTX reporting marks) carry containers only (fig. 7-9). Each platform can carry a 40- to 48-foot container, and the middle and end platforms can each carry a pair of 20-foot containers. The 350 cars delivered were the only ones built because well cars soon became the dominant means of carrying containers.



7-12 Front Runner cars are single-unit lightweight platforms with single axles at each end. This car was built by Paccar in 1984. *Jeff Wilson*



7-13 Southern Pacific's first double-stack cars used substantial bulkheads to hold the top containers in place. *Bob MacDonald*

Trailer Train began working with manufacturers on a car that could be used for either piggyback trailers or containers—a cross between the spine and Impack-style cars. The result was the all-purpose spine car, one of the most successful intermodal cars to hit the rails (fig. 7-10). The cars, first delivered in 1988, are versatile, as they can carry either trailers or containers as needed. They are much lighter than well cars, and their low profile made them ideal for routes that couldn't handle the tall double-stack cars.

Built by Bethlehem, Gunderson, Thrall, and Trinity, each platform of the first AP spines (built through 1993) can carry a trailer or container up to 48 feet long, and the end platforms can each carry a pair of 20-foot containers. These cars are simply labeled “all-purpose spine car.”

In 1993, manufacturers began making lengthened versions of the cars, which can handle containers or trailers up to 53 feet long. As fig. 7-10 shows, these cars have “53” lettering on the sides of the platforms.

The newest versions of the cars are the Twin 28 spine cars. Each platform on these cars can carry a single trailer up to 57 feet long or a pair of 28-foot trailers (fig. 7-11).

Two other cars that fit into the spine or skeleton category are the 4-Runner and Front Runner. The 4-Runner was first to enter service, in 1981. The 4-Runner was a set of four drawbar-connected single-platform units, each of which had a single axle at each end. Tracking problems made these cars less than successful; just over 100 were placed in service.

After experiments with that design, a scaled-down single-unit car, the Front Runner, was introduced in 1983 (fig. 7-12). The Front Runner is a low-riding single-unit platform with a single axle at each end. The cars, built by four manufacturers, can carry one trailer from 40 to 48 feet. More than 3,000 had been built by 1990.

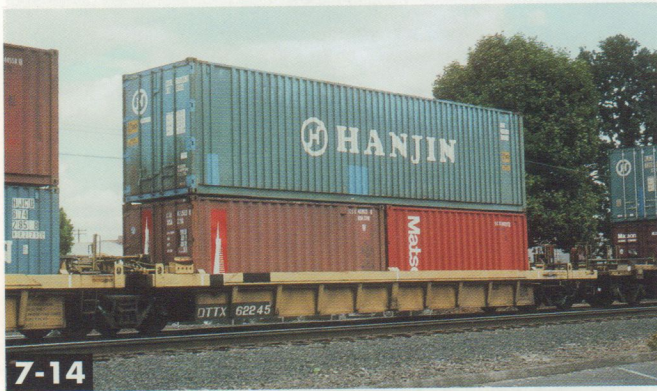
Double-stack well cars

In the 1970s, railroads began looking for more efficient ways of carrying containers than on flat-

car decks. Sea-Land worked with ACF Industries and the Southern Pacific to develop the first double-stack well car, which made its debut in 1977.

The initial single-unit cars could carry either standard ISO (International Organization for Standardization) 40-foot containers or Sea-Land's 35-foot containers, with the top container held by bulkheads (railroads didn't trust standard inter-box connectors, or IBCs, to do the job). The car remained in service for two years. ACF then delivered a three-unit car to the SP, and SP then ordered 42 five-unit sets of the cars, which became known simply as Double-Stacks. They entered service in 1981 (fig. 7-13).

The new cars were successful for many reasons. First, a lot of dead tare weight was eliminated. A five-unit articulated car has just six trucks, compared to ten trucks of the standard flatcars it is replacing. Also, train length is significantly reduced, as is slack action. Eliminating all those couplers results in smoother train



handling and less shock to loads.

The first car to hit the market in significant numbers was Thrall's five-unit Lo-Pac 2000, bought by American President Lines and Maersk in 1985 (fig. 7-14). These didn't have bulkheads, relying instead on standard IBCs to hold the upper containers in place.

Gunderson's first entry in the well car market, in 1985, was the Twin-Stack (fig. 7-15). These five-unit articulated cars are distinguished by their bulkheads. These were followed by a car without bulkheads, the flat-sided Maxi-Stack I, in 1988 (fig. 7-16). Another early well car design was Trinity's Backpacker, shown in fig. 7-17.

Well sizes increase

These early cars were designed with 40-foot wells for carrying 40-foot ISO containers (or pairs of 20-foot containers). However, in the late 1980s, container sizes began to grow, and soon 45- and 48-foot containers became popular. As longer containers were used, weight capacity had to be

addressed: Most early well cars used 100-ton trucks at the articulated joints, with standard 70-ton trucks at the ends. This meant that a pair of fully loaded 20-foot containers could max out the weight for a unit, resulting in an unused top position. To solve the problem, manufacturers lengthened their well cars and using 125-ton trucks at the articulated joints.

Thrall brought out the Lo-Pac II in 1986, which had the same design as the earlier car, but with 40-foot end units and 48-foot intermediate wells. By 1989 the Lo-Pac II had all 48-foot wells.

Gunderson improved its car with the Maxi-Stack II, which had 40-foot wells in the end units and 45-foot intermediate units. Few were built, as production shifted to the Maxi-Stack III (fig. 7-18), which came out in 1989. The Maxi III, with 48-foot, 125-ton capacity wells throughout, became the most popular articulated well car of the 1990s.

Trinity also each came out with longer versions of its Backpacker,

7-14 Thrall's Lo-Pac 2000 can be identified by its exterior braces and squared-off ends. Early cars such as this one had 40-foot wells. *Jeff Wilson*

7-15 Gunderson's first well car was the Twin-Stack, which had 40-foot wells and bulkheads. *Jeff Wilson*

7-16 Gunderson's Maxi-Stack I is basically a Twin-Stack without bulkheads. It can be identified by its deep, flat slab sides. *Jeff Wilson*

7-17 The Trinity Backpacker has angled sides. The end units on this car have 40-foot wells, with intermediate wells at 48 feet. *Jeff Wilson*

and Canadian maker National Steel Car (NSC) developed a car with 48-foot wells.

In the meantime, stand-alone cars became popular in the early 1990s. The main reason was capacity: Even after going to the 125-ton articulated car, it was still possible to surpass the weight limit of a well with three fully loaded containers.

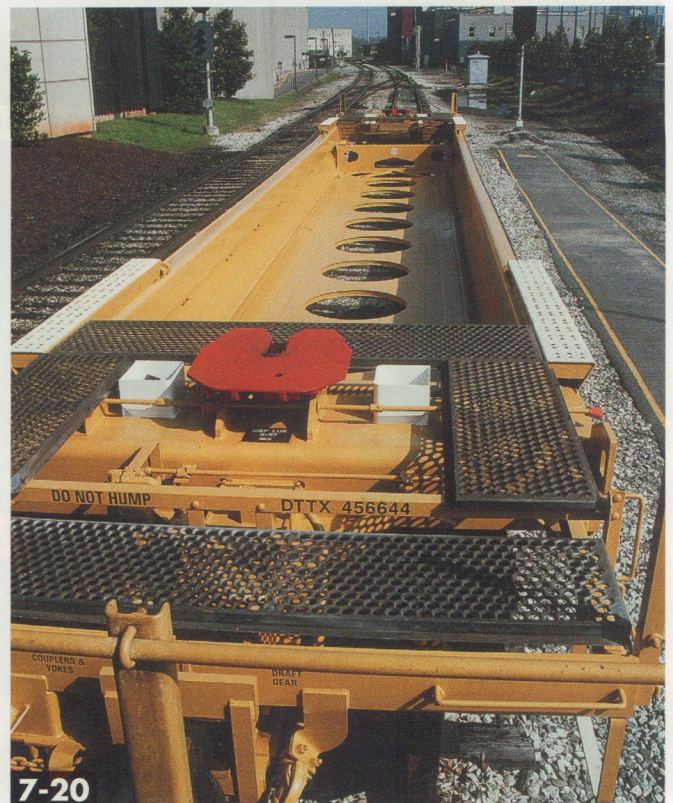
The stand-alone car solved that problem because it can carry any combination of containers. Gunderson's Husky Stack, which first appeared in 1990, was the first popular design to catch on (fig. 7-19). The car was basically a single-well version of the Maxi-Stack III. This was followed in 1993 by the All-Purpose Husky

Stack, which has trailer hitches at each end (fig. 7-20) to increase the flexibility of the car. Thrall and NSC followed Gunderson's lead with their own stand-alone cars based on their articulated cars.

The longest of the double-stack cars is Gunderson's Husky Stack 2+2, built in the mid-1990s, which has a 56-foot well. The car was

designed to carry four 28-foot containers (two down and two up, hence 2+2).

A variation on the stand-alone car is the drawbar-connected sets of stand-alone cars, with three- and four-unit sets the most common (fig. 7-21). Except for their drawbars, the cars are the same as stand-alone cars; the connected



7-18 The most popular articulated well car of the 1990s was Gunderson's Maxi-Stack III. It has 48-foot wells throughout. The car has flat upper sides that angle in at the bottom, and a unique cutout near the ends. Jeff Wilson

7-19 Stand-alone well cars became popular in the 1990s. This is a Gunderson Husky Stack. Jeff Wilson

7-20 Manufacturers increased the flexibility of many of their well cars by adding trailer hitches. This is an All-Purpose Husky Stack. Jeff Wilson

set is assigned a single car number.

As domestic containers followed trailer length to 53 feet in the 1990s, manufacturers again looked for bigger cars. Although longer containers could be carried in the top positions of shorter

cars, more capacity was needed for the bottom positions.

Double-stack cars with 53-foot wells were the answer. The stretch in length meant new designs, generally with deeper side walls. Manufacturers, including Gunder-

son (fig. 7-22), National Steel Car (fig. 7-21), and Thrall (fig. 7-23), developed new articulated, stand-alone, and drawbar-connected cars based on their old ones.

Spotting features of well cars includes the side shape, pattern of bracing and side posts, end shape, and length. The length is easy to spot, as the well length is marked on the side of each unit to make the cars easy to identify for loading.



7-21 This is the end unit of a drawbar-connected National Steel Car 53-foot well car—you can see the drawbar at left. NSC's cars can be spotted by their exterior posts and the curved cutouts near the wheels at the ends. *Jeff Wilson*

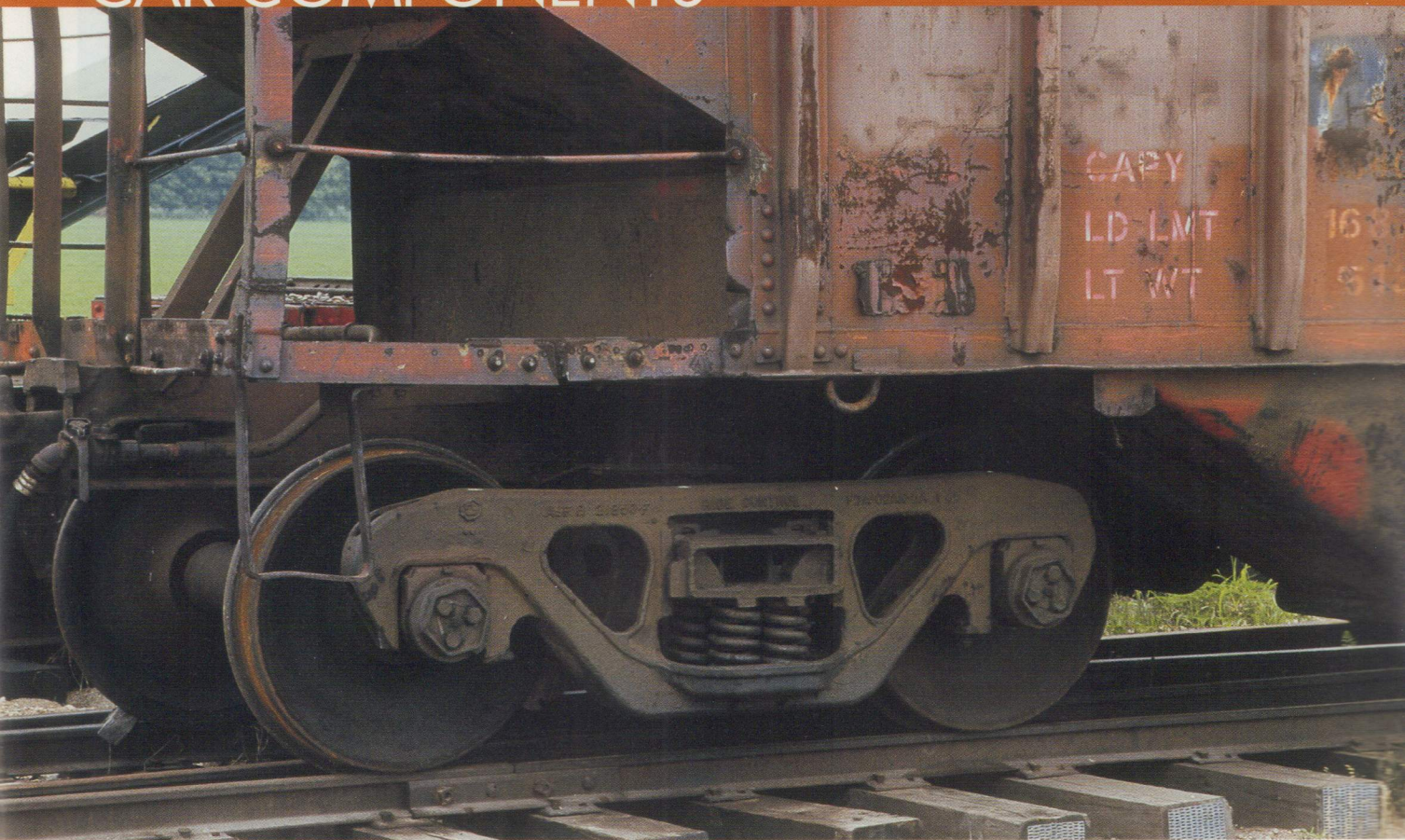


7-22 Gunderson's 53-foot cars resemble its earlier 48-foot cars, but with deeper sides. This is a three-unit articulated car. *Jeff Wilson*



7-23 Thrall's 53-foot articulateds have the same characteristics as the company's earlier cars, with vertical exterior posts and squared-off ends. This is a three-unit car. *Jeff Wilson*

CAR COMPONENTS



Many components are common to all freight cars. These include trucks, wheels, couplers, and brake equipment.

Trucks are a key spotting feature of freight cars (fig. 8-1). They have evolved substantially from the pressed-steel archbar design of the pre-World War I era through early cast solid-bearing trucks to roller-bearing trucks of today. Knowing the differences between the various types of trucks will help you in identifying and modeling freight cars.

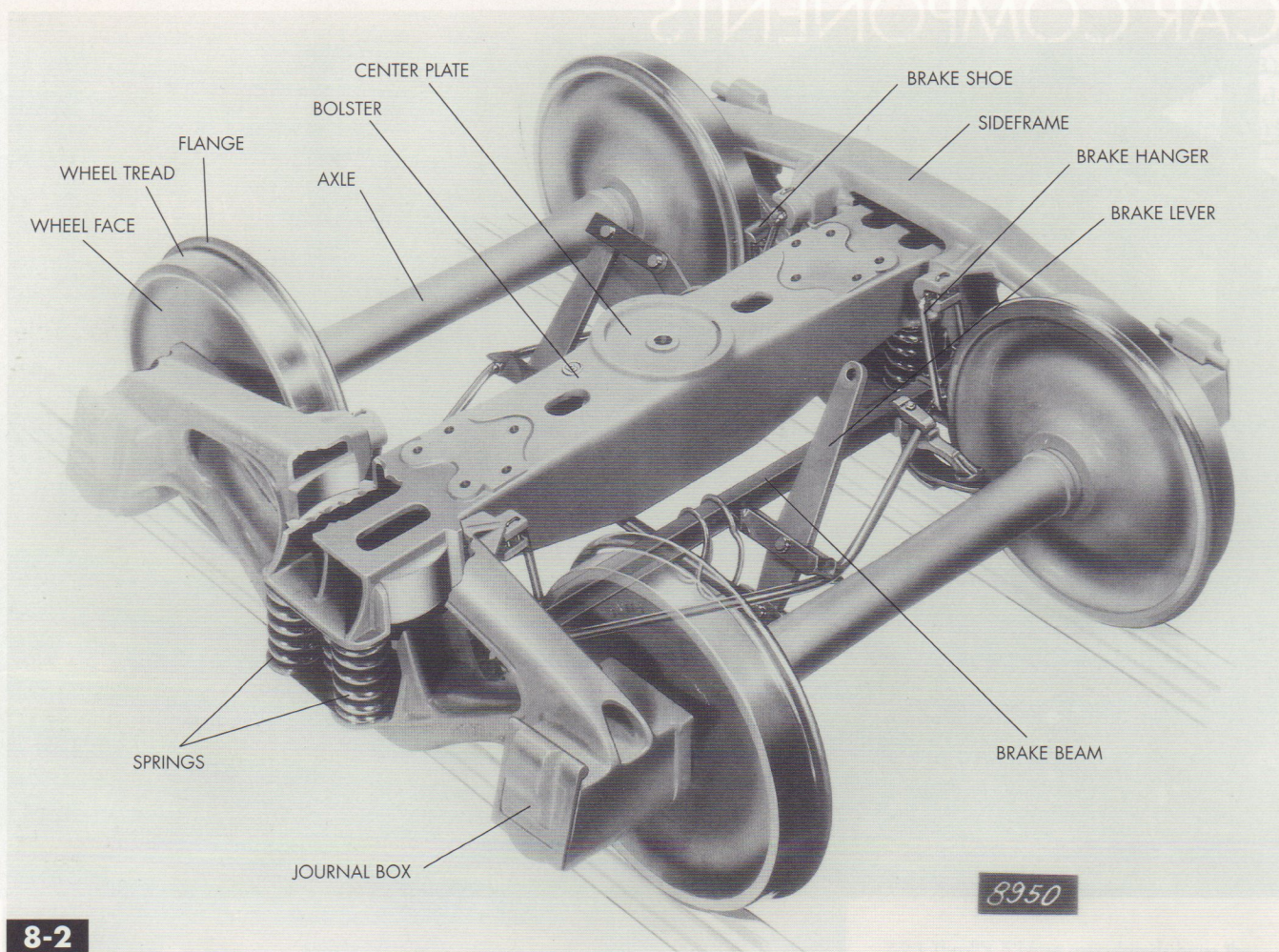
Brake components aren't as visible as trucks or couplers, but their appearance can help identify an era of a car. Understanding how a train's air brakes work will also help you in detailing models.

We'll look at the development, spotting features, and usage of trucks, couplers, and brakes on freight cars.

8-1 At first glance they might look alike, but freight car trucks are not all the same. They have evolved a great deal over the years, from early 20th century archbar designs to modern roller-bearing trucks like this one.

Jeff Wilson

FREIGHT



8-2

Buckeye Steel Castings Co.

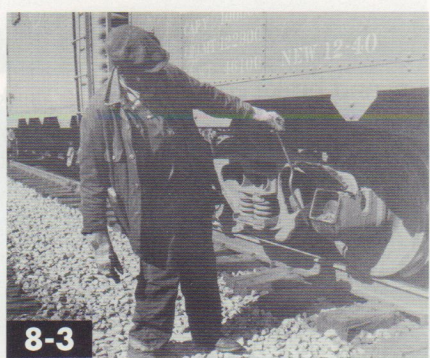
Trucks

It's easy to overlook trucks when studying freight car details. At first glance one truck might look like any other. However, a closer look reveals many differences, from major ones—such as roller- and solid-bearing trucks—to small details. Understanding the types of prototype trucks and wheels will help you choose the proper ones for your models, making them more realistic.

Freight car trucks and wheels have evolved substantially, and railroads have used hundreds of different truck designs over the years. We'll look at the most commonly used trucks from the World War I era through today.

Truck anatomy

Figure 8-2 shows the parts of a typical freight car truck. The car



8-3

8-3 Journal boxes hold cotton waste impregnated with lubricating oil. The oil lubricates the axle end and bearing. *Erie RR*

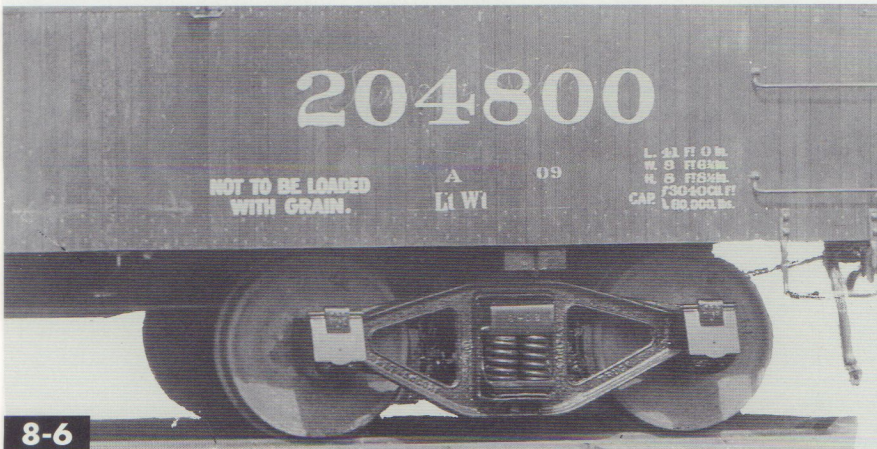
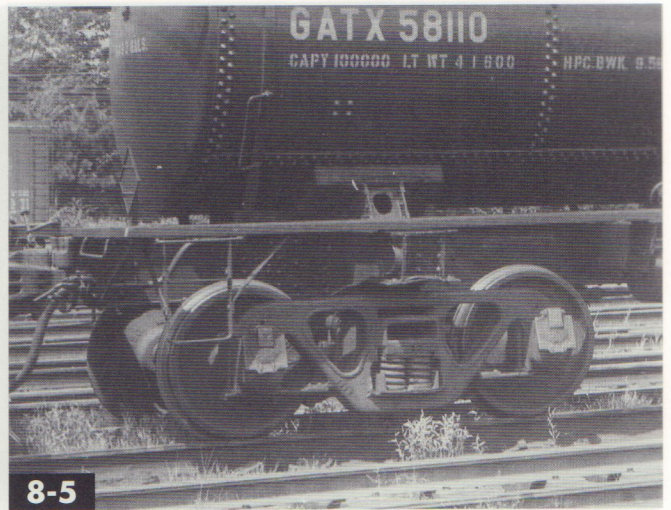
rides on the bolster, held in place by a kingpin that rests in the truck's center plate, the circular pocket on top of the bolster.

The bolster isn't anchored solidly to the sideframe. Instead, it rests atop a series of springs (four or more, called the spring package) in each sideframe. The

size and number of springs vary based on the capacity of the truck: larger springs—and more of them—allow heavier loads. The springs cushion the ride by allowing the bolster to float up and down in the sideframes.

The sideframes, in turn, place their load on the ends of the axles. Early trucks, such as the one in fig. 8-2, are known as solid-bearing trucks (often incorrectly called friction bearings). In these the journal box (fig. 8-3) surrounds the bearing and axle end. The journal box is packed with a fibrous cotton material—called waste—soaked in lubricating oil. The axle and bearing surfaces are lubricated by wicking oil from the impregnated waste.

Later trucks use sealed roller bearings. These roll with much less friction and require no lubri-



8-4 Archbar trucks were made of pressed steel components bolted together.
Jeff Wilson

8-5 Andrews trucks have cast sideframes, but separate journal boxes. A steel bar connects the frame to the bottom of the journal box. *Rail Data Services Collection*

8-6 The Bettendorf T-section truck was the first with journal boxes cast as part of the sideframe. Note the T-shaped cross section of the sideframe. *David P. Morgan Library collection*

cation. We'll look at these trucks later in this chapter.

Trucks have several brake components. Most visible are the brake beam and brake shoes, which can be seen through the sideframes.

Trucks are classified by weight. The weight rating isn't the load that a single truck can carry, but the weight of the car itself. Hence, 50-ton trucks are designed to be used under 50-ton capacity freight cars, and so on.

Archbar, Andrews

The most common trucks used in the early 1900s were archbar trucks (fig. 8-4). These were made of pressed-steel components that were bolted together. Although they worked well, archbar trucks required lots of maintenance. Their bolts needed frequent tightening, as they tended to work

loose with the shocks and jolts of operation.

Although some archbar trucks were built into the 1920s, they had largely been superseded by more advanced designs by the mid-teens. Archbar trucks were eventually banned completely from interchange service in 1941.

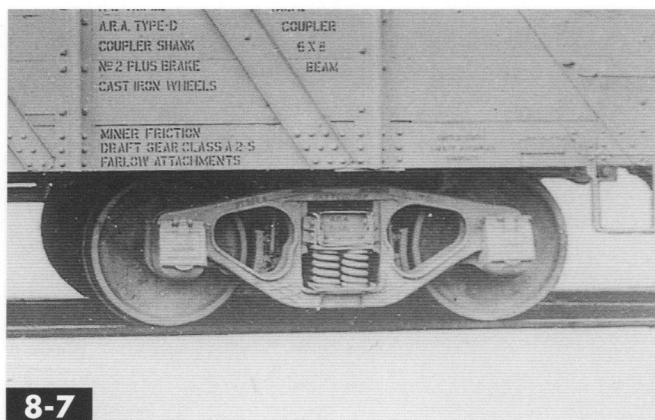
By World War I, state-of-the-art trucks had cast sideframes, which eliminated the problems of the bolts and connectors of the archbar truck. The most popular of these early cast trucks was the Andrews (fig. 8-5). Andrews sideframes still used separate journal boxes and could be identified by the steel bar connecting the sideframe and the bottom of the journal box. Andrews trucks were in production from around 1910 through the 1930s. One of their big selling features was that journal boxes from archbar trucks

could be reused in new Andrews trucks. Andrews trucks could no longer be used in interchange service after 1956.

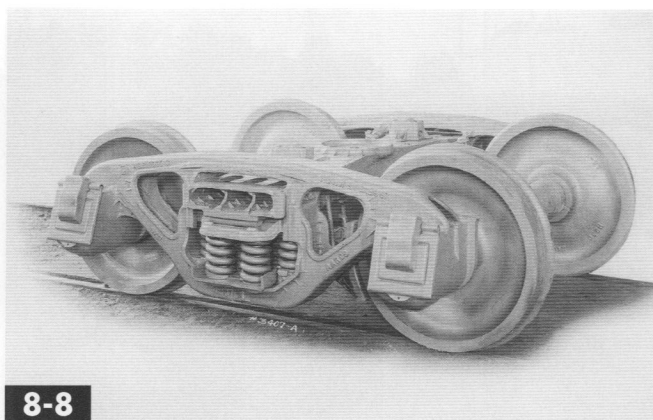
Bettendorf, AAR trucks

The next generation of freight car trucks eliminated the separate journal boxes, instead casting them as integral parts of the sideframe. The Bettendorf Co. was the first to do this (as early as 1903), using a cast sideframe with a T-shaped cross section (see fig. 8-6). The Bettendorf design was popular through the teens.

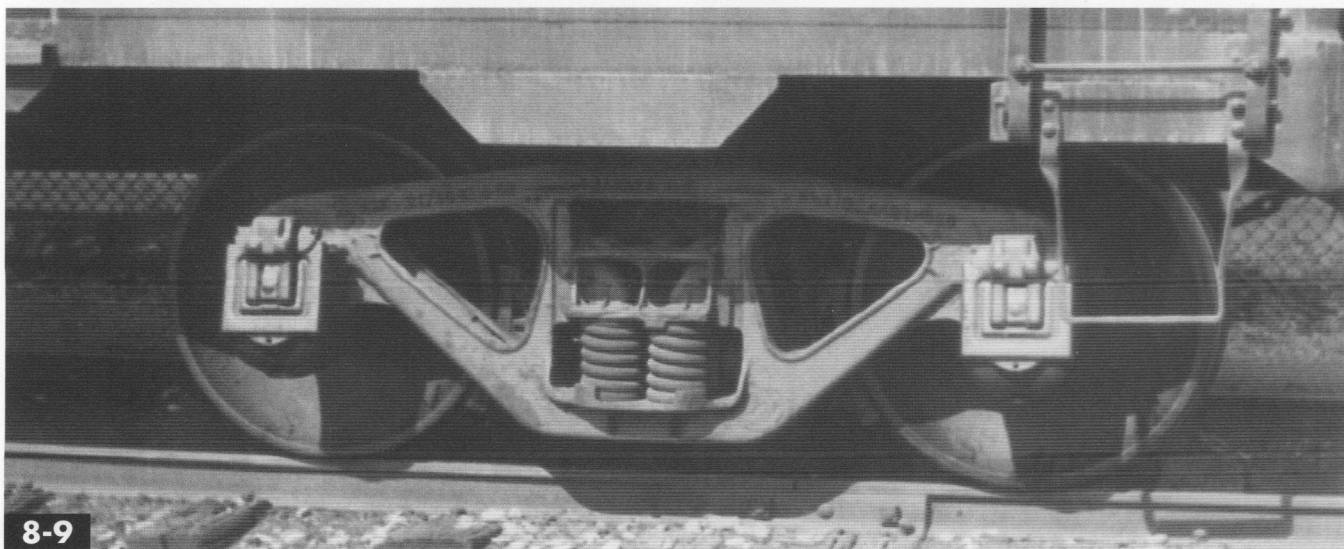
Significantly stronger trucks with U-shaped cross sections eventually superseded T-section trucks. These trucks, which have become most identified with the modern steam and early diesel eras, have become known generically—and incorrectly—as Bettendorf trucks (see fig. 8-7).



8-7



8-8



8-9

8-7 An improvement to the early cast truck was the change to a U cross section sideframe, shown here on a 1923-built car. *Milwaukee Road*

8-8 Dalman trucks had a unique sideframe and multi-level spring package design. *David P. Morgan Library collection*

8-9 The Barber S-2 was a commonly used truck of the late steam and early diesel eras. *Jerry A. Pinkepank*

The cast-steel U-section truck was eventually adopted as an American Railway Association (ARA, later called the American Association of Railroads or AAR) standard: the Type Y truck. Because the Bettendorf Company developed the concept and built thousands of these trucks, the style has become widely known as a Bettendorf truck. However, Bettendorf widely licensed ele-

ments of the design, so trucks of this type were manufactured by many builders.

Each of these trucks follows the AAR standard, but many have varying details, including sideframe shape, spring size and styles, bolster design, and journal-box lids.

Along with improved strength, manufacturers worked to improve the riding characteristics of trucks by cutting down on excess lateral and vertical movement.

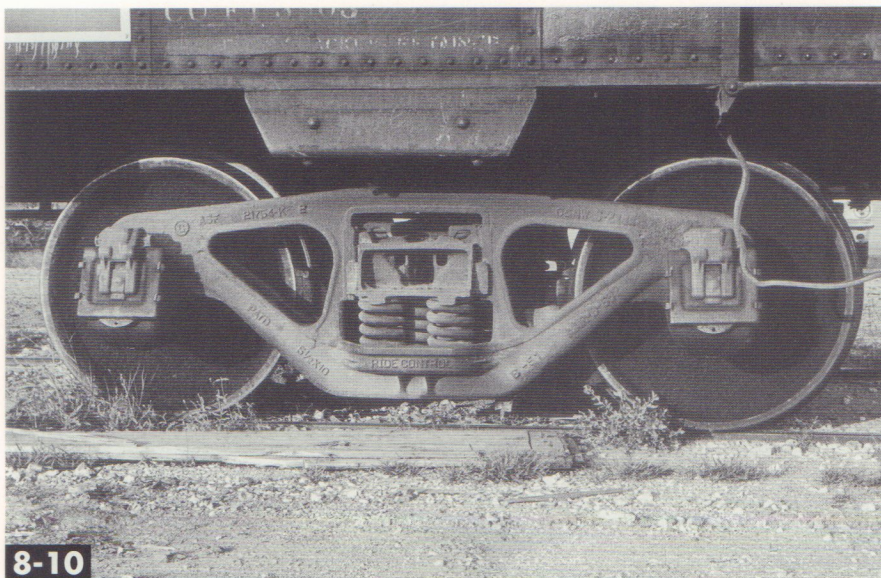
An early (1920s) attempt at improving riding quality was the Dalman truck. This truck had eight springs in each sideframe (compared to five on most other trucks), with springs on different levels. As fig. 8-8 shows, this, along with a unique sideframe, gave Dalman trucks a distinctive appearance.

The two most popular types of improved trucks came along a bit

later: the Barber S-2 (fig. 8-9) and the ASF A-3 Ride Control (fig. 8-10), introduced during World War II. Both were advertised to ride more smoothly, cut down on wheel and spring wear, and be easier on track and roadbed. The A-3 caught on rapidly and became the most popular truck used through the end of the solid-bearing era. The two trucks are similar, but are shaped differently in the bolster end and spring areas.

Many other stabilized trucks were also introduced, including the National B-1. Figure 8-11 shows this truck, which had a unique spring package with stabilizing wedges.

A note on truck manufacturers and designs: Freight-car trucks were built by many manufacturers from the steam era through the 1960s. Major producers included American Steel Foundries (ASF),

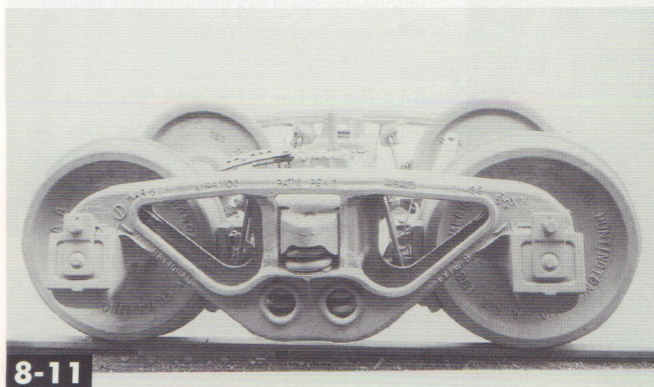


8-10

8-10 The ASF Ride Control truck was the most popular solid-bearing truck from the end of World War II to the end of the solid-bearing era. *Lee Langum*

8-11 The National B-1 truck had a distinctive sideframe, spring package, and bolster design. *David P. Morgan Library collection*

8-12 This cutaway view shows how roller bearings function over the axle ends. *Hyatt*



8-11

Bettendorf Co., Buckeye, National, Symington-Gould, Standard Car Truck Co., and others.

Although most companies had their own truck designs, customers could order trucks of almost any design from any other member of the Four-Wheel Truck Association. Thus a railroad could order an A-3 Ride Control truck from Buckeye as well as ASF. Also, any given design was available in many variations, including different spring packages and journals (and thus different tonnage ratings), standard or double-truss design, and other details.

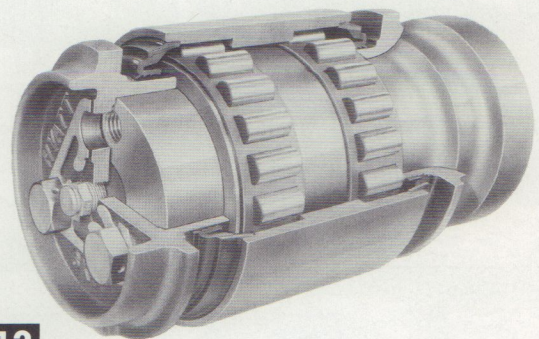
The best way to identify solid-bearing trucks is by reading the information cast into the sideframe. Information generally includes the manufacturer, truck type, spring package, other foundry information, and sometimes the railroad for which the

truck was built. If in doubt, compare details on prototype photos to available truck models to determine the closest match.

Roller-bearing trucks

The main problem with solid-bearing trucks was that the journal boxes required frequent lubrication. This was labor intensive, and the result of a dry bearing was an overheated journal, which could result in a fire or broken axle. The eventual solution was to develop trucks with roller-bearing journals (fig. 8-12).

Roller bearings greatly reduced friction and drag, and didn't require lubrication. Roller-bearing trucks had been around since the turn of the 20th century, and began to see frequent use in the 1930s on passenger equipment. However, because of their additional cost, roller-bearing trucks



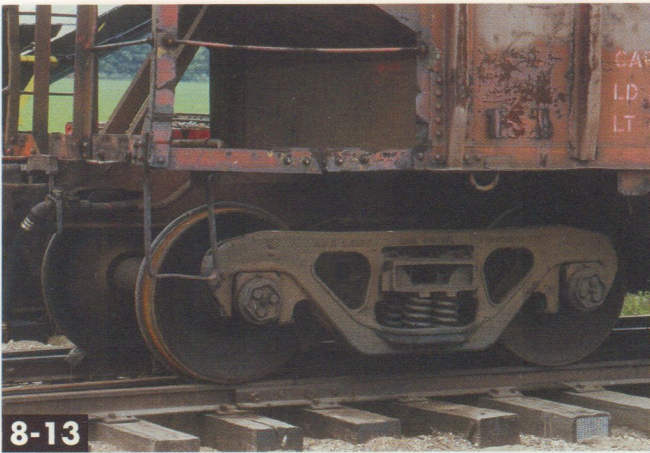
8-12

didn't come into wide use on freight equipment until the late 1950s and 1960s. These trucks are identified by their roller-bearing end caps on the axle ends (figs. 8-12 and 8-13).

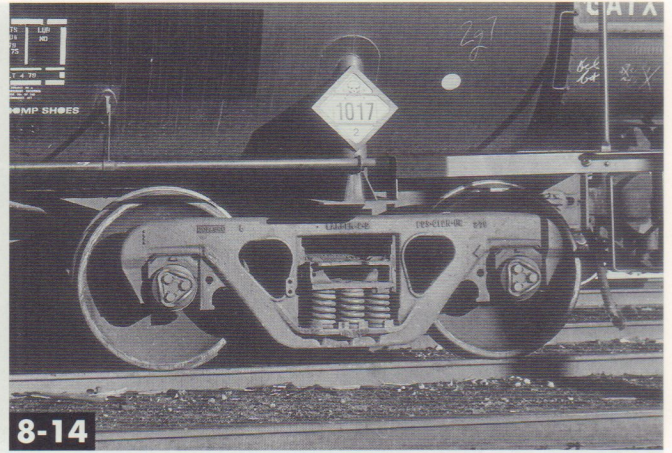
New cars built after 1966 were required to have roller-bearing trucks, and solid-bearing trucks were banned from interchange service in the 1990s.

The two most popular modern trucks are the ASF Ride Control, made by ASF-Keystone, and the Barber S-2, made by Standard Car Truck Co. (fig. 8-14), both of which date back to earlier solid-bearing designs. Other common modern trucks include the ASF Ridemaster and National C-1. Each is made with various spring packages and other options in 70- to 125-ton versions.

As with solid-bearing trucks, the easiest way to identify roller-



8-13



8-14



8-15

8-13 Roller-bearing trucks, such as this 70-ton ASF Ride Control, have end caps that rotate. The end caps have different designs depending upon the manufacturer of the roller bearings. *Jeff Wilson*

8-14 The Barber S-2 is one of the most common modern trucks in service. This is a 100-ton truck on a tank car. *Scott Hartley*

8-15 The ribs on the back mark this as a cast-iron wheel. Cast-iron wheels weren't used on new equipment after 1957, and were banned from interchange use in 1970. *Jeff Wilson*

bearing trucks is on the side-frames, as the manufacturer's name and truck type are stamped on the side. If you can't read the lettering, use the shape of the side-frame in matching it to a model.

Wheels

Wheels on prototype cars have a number of differences, but for modelers the most important detail is probably the size. The 33"-diameter wheel is standard on freight equipment of 70-ton capacity and under. For 100-ton trucks, 36" wheels are used, and for 125-ton trucks, 38" wheels.

An exception is that smaller wheels (28" diameter) are used on triple-deck auto-rack cars. This allows these 70-ton cars to ride lower so they can negotiate tighter clearances.

Many model wheelsets have ribs cast on the back of the wheel (see fig. 8-15). This was a characteristic of many—but not all—prototype cast-iron wheels (known as "chilled" wheels for the heat treatment of the treads). The ribs were designed to better dissipate the heat generated during braking, which could weaken the wheel.

Chilled wheels faded from use in the 1950s and were forbidden on new cars after 1957. They were banned from interchange use in 1970. Modern wheels are cast or wrought steel and don't have the ribs. Also, many steam-era cars didn't have chilled wheels, as steel wheels began increasing in popularity starting in the mid-1920s.

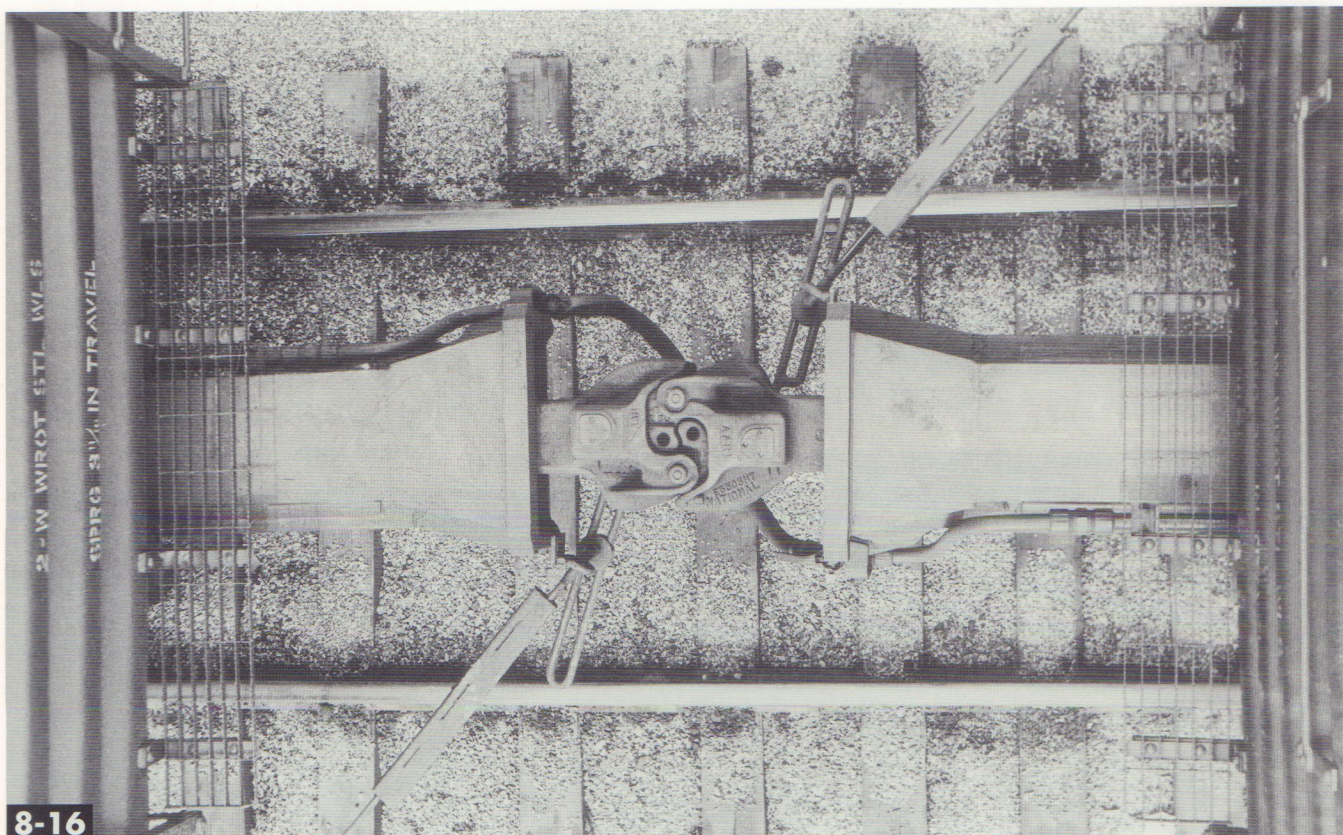
Steel wheels on freight cars are either single-wear (1W), or two-wear (2W). This information is

usually stenciled on the car end. Single-wear wheels (which have 1¼" rims) are designed to be scrapped after the tread profile wears to a certain point. Two-wear wheels have thicker (2") rims that are designed to be turned (recut and reshaped) during the car's life to return the wheel to its proper contour.

From a railroad's economic perspective, 1W wheels are lighter and less expensive. On heavy-duty cars where the wheels will need turning at least once during a car's lifetime, 2W wheels pay for themselves because turning is less costly than buying new wheels.

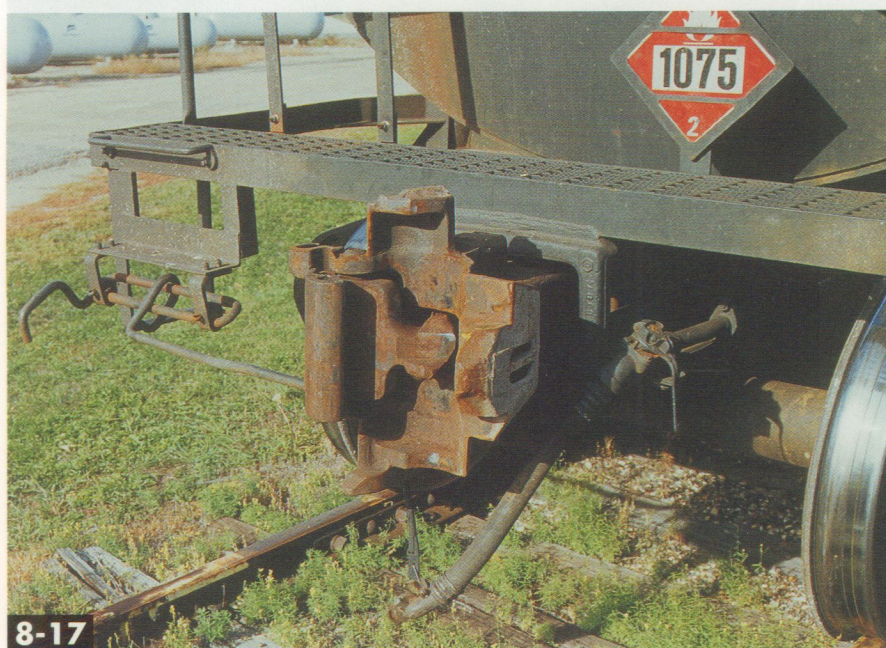
Couplers

The AAR knuckle coupler has been a part of railroading since the turn of the 20th century.



8-16

8-16 Knuckle couplers have been standard equipment since the turn of the 20th century. *Jim Shaughnessy*



8-17

8-17 Shelf couplers, such as this AAR Type SF, are used on tank cars. *Jeff Wilson*

Couplers work by the moveable knuckle, which opens outward to mate with the coupler on the adjoining car (see fig. 8-16).

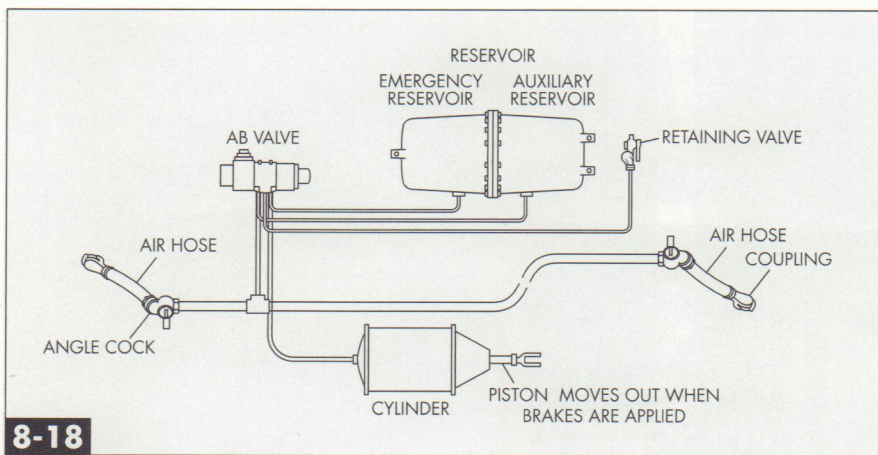
In order to couple cars, the knuckle on one or both cars is opened. Backing one car into another will automatically close the knuckles and couple the cars.

To uncouple cars, a crew member opens a knuckle by pulling the uncoupling lever.

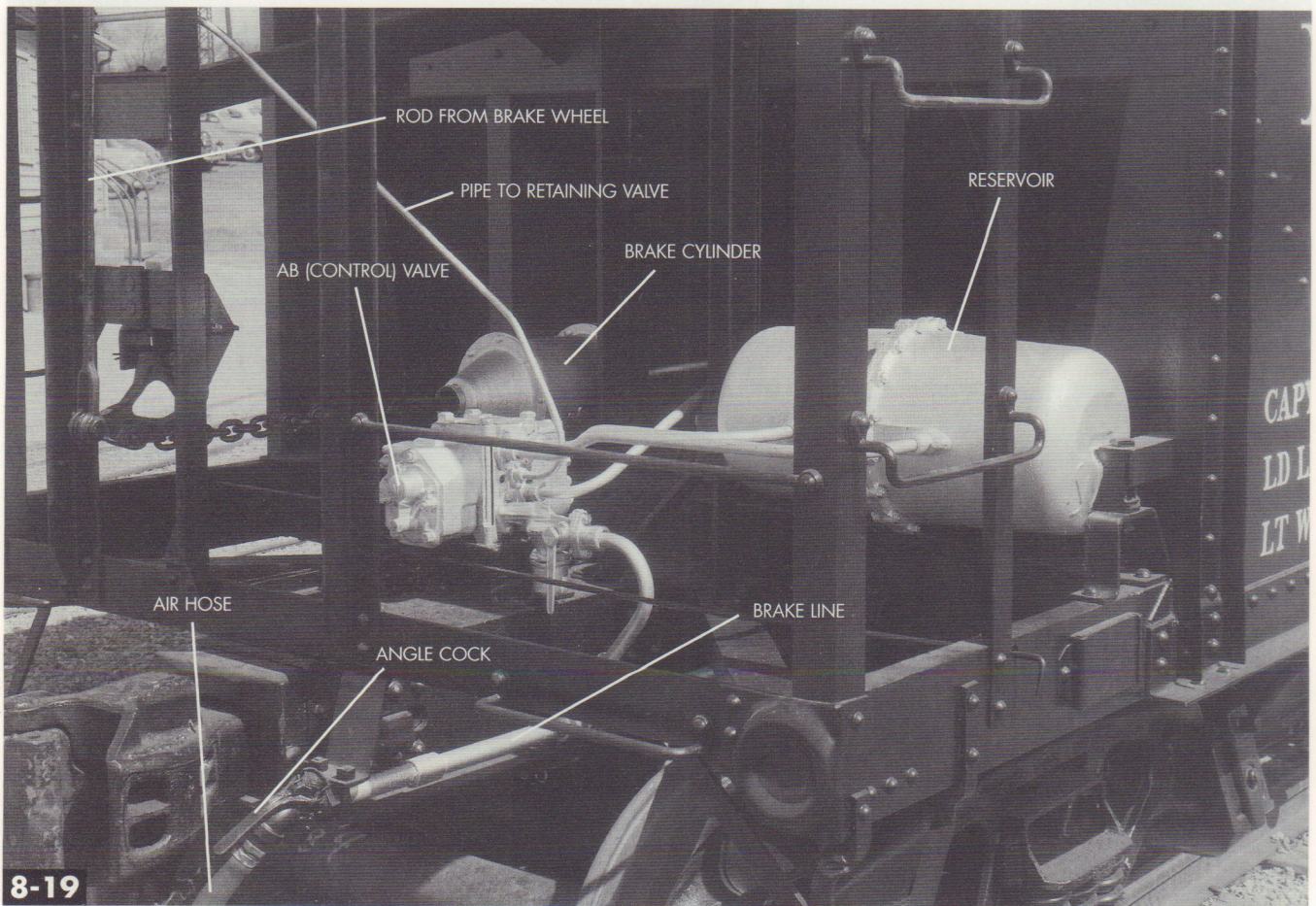
Couplers have evolved in style over the past 100 years, but have retained the same basic appearance. An exception has been the shelf-type coupler (fig. 8-17). These couplers, used since 1978

on tank cars carrying hazardous commodities, are designed to stay together in case of derailments, thus preventing couplers from separating and puncturing the end of an adjacent tank car. An earlier single-shelf coupler, the Type F interlocking coupler, had been used since 1970 on tank cars carrying hazardous materials.

Uncoupling levers come in many shapes and sizes—see photos throughout this book for examples. Each car has an uncoupling lever on each end; they are positioned on the knuckle side of the coupler (so that as you're looking at the side of the car, the uncoupling lever will be at right).



8-19 The AB brake components on this covered hopper are in clear view. Erie RR



Brakes

The brake system is an integral part of every freight car, and understanding its components and how they work can help you make more accurate models. Brake gear is largely hidden on many house cars (such as boxcars and reefers), but it is visible on many other cars, such as tank cars.

Figure 8-18 shows an overview of an AB brake system, which—

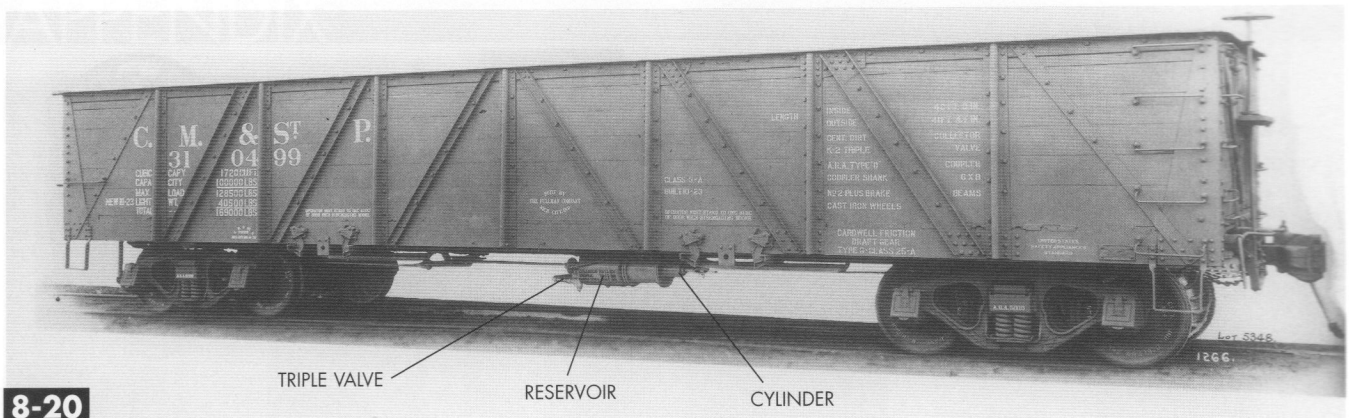
although it has been modernized over the years with the ABD, ABDW, and ABDX systems—has been standard on new equipment since 1933. Figure 8-19 shows the various AB components in view on a covered hopper car.

The air hoses at each end of a freight car, when connected, form a continuous pipeline to the locomotive. This is called the train line. Air pumps or compressors in

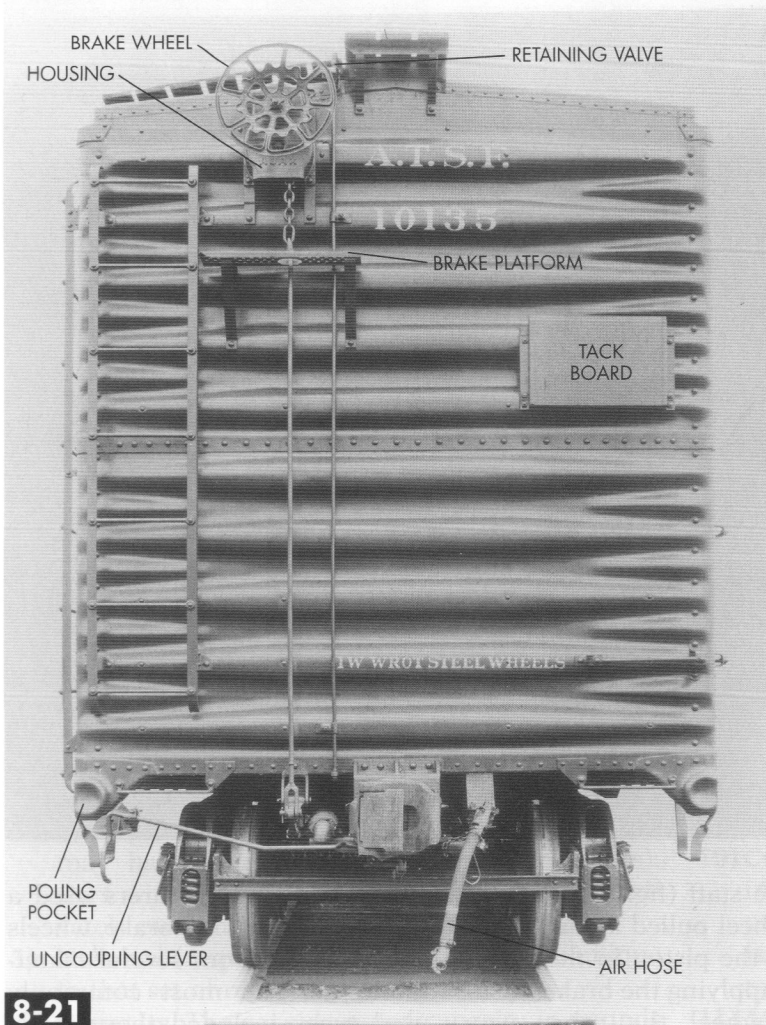
the locomotive pressurize the train line (90 pounds of pressure for most modern freight trains).

The control valve on each car is the heart of the system. The control valve routes air from the train line into the reservoir, keeping the reservoir fully charged.

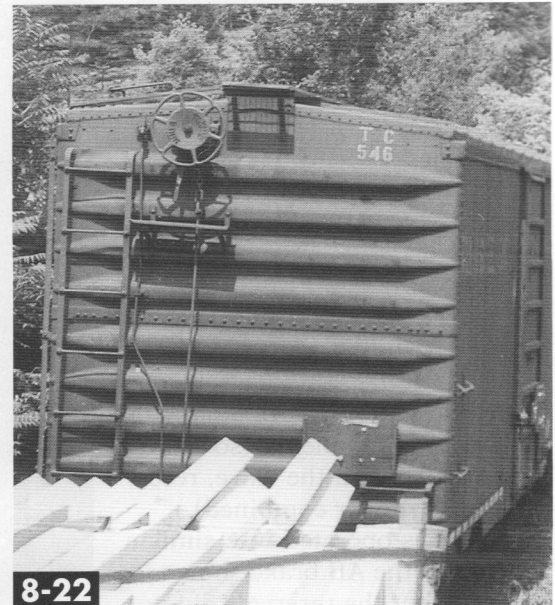
To apply the brakes, the engineer releases air from the train line. The control valve senses the drop in pressure and routes air



8-20



8-21



8-22

8-20 The combined K brake components are quite visible on this 1923-built gondola. *Milwaukee Road*

8-21 Ajax was the most common type of hand brake. Ajax brake wheels were fairly intricate, and the Ajax name was cast on the housing. *Santa Fe*

8-22 Miner brake wheels had solid centers and six spokes. Note the indentations around the outside of the wheel at the spokes. *J. Parker Lamb*

from the reservoir into the cylinder. The piston in the cylinder moves outward, moving linkage which forces the brake shoes against the wheels. The amount of air released regulates the amount of pressure applied to the wheels.

When the engineer releases the brakes, the compressor again charges the air line. The control

valve senses this change in pressure, releases the air from the cylinder, and begins routing air back into the reservoir, recharging the system. This action takes place on every car of the train.

The reservoir has two halves: service and emergency. For a normal (service) brake application, air comes from the service half of

the reservoir. When an emergency application is made (all of the air released from the train line), the control valve routes all of the air from the reservoir to the cylinder.

Another important component is the retaining valve, or retainer. Setting this causes some air to be retained in the cylinder regardless of brake application or release.

8-23 Equipco brake wheels had an intricate spiral pattern. *ACF Incorporated*

8-24 Universal brake wheels had solid cupped centers, with simple spiral-pattern spokes. *Hagley Museum and Library*

8-25 AAR standard wheels resembled the Universal design, but with straight spokes. *Norfolk & Western*

Retainers were often set on cars before descending steep grades. The usual location for the retaining valve is next to the brake wheel on the end of the car.

The layout of brake components varies widely among cars (as fig. 8-19 shows), but the components remain the same.

K brakes

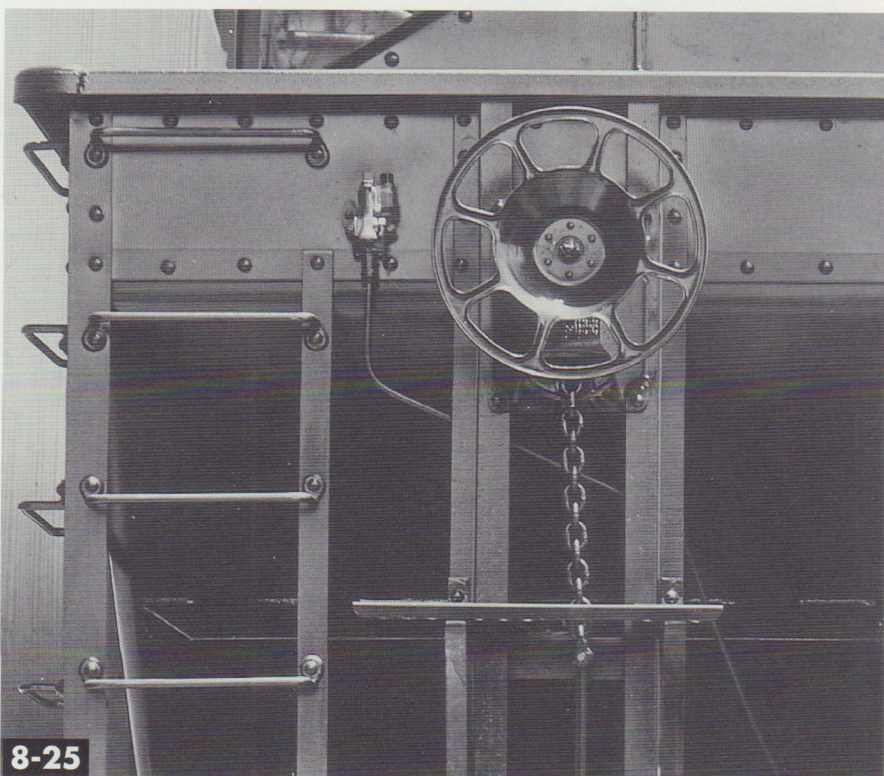
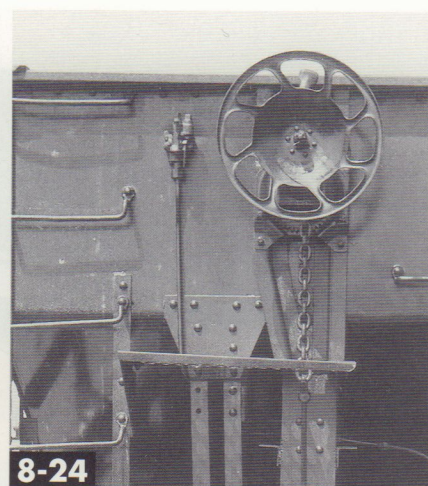
The most common type of air brakes used from World War I through the 1920s was the K brake. Figure 8-20 shows a gondola with KC brake components (so called because they had the valve, reservoir, and cylinder combined).

K brakes operated in a similar manner to the AB brake shown in fig. 8-18, but the reservoir did not have a separate emergency section, and the valve controlling the system (known as the “triple valve”) didn’t have as many functions as the later AB valve. Also, K brakes were slower in responding than AB brakes—a serious drawback as trains became longer and railroad cars grew heavier.

The K system was not allowed on new equipment after 1932, and K brakes were banned on cars in interchange service after 1953. Many cars originally equipped with K brakes were later rebuilt with AB brakes—check prototype photos if you’re modeling a specific era.

Hand brakes

The brake wheel is among the most noticeable brake components. The brake wheel on early (into the 1930s) cars was usually mounted horizontally atop a ver-



tical brake staff (fig. 8-20). Turning the wheel pulled a chain connected to the piston in the brake cylinder, applying the brake; turning the wheel the other way released the brake.

Starting in the 1930s, power hand brakes came into use (fig. 8-21). These were generally mounted vertically on the car, on top of a gear box. Turning the wheel pulled up a rod, which, via a clevis at the bottom of the rod, pulled a rod connected to the cylinder shaft.

From the 1930s through the

1950s, car manufacturers used a variety of styles of brake wheels and housings from several manufacturers. The most commonly used types included those made by Ajax (fig. 8-21), Miner (fig. 8-22), Equipco (fig. 8-23), and Universal (fig. 8-24).

A problem was that brake wheels were not interchangeable, making repairs difficult. In the late 1950s and into the 1960s, an AAR standard design for a brake wheel was developed, which could be used on brake housings from any manufacturer (see fig. 8-25).



Jeff Wilson collection

Freight car lettering

What's required and what it means

- 1) **Road name and herald.** This lettering isn't required, and its use varies greatly among railroads and eras. Many railroads also added slogans, including passenger train promos.
- 2) **Reporting marks (required).** Each railroad or private owner is assigned a unique set of identifying initials (large railroads or corporations may have several different reporting marks). Cars with reporting marks ending in X are privately owned.
- 3) **Number (required).** The car's number is unique to that set of reporting marks.
- 4) **Capacity.** The car's designed capacity in pounds (to the nearest 100). Since 1985 this is no longer required on new cars; many older cars have this line painted out.
- 5) **Load limit.** The maximum weight allowed for the load itself.
- 6) **Light weight.** The car's weight when empty. If the word "new" appears, the weight was taken when built (and the date is the built date). Cars are periodically reweighed, generally after repairs are made. When a new light weight is stenciled, the shop initials and date are added.
- 7) **AAR mechanical code classification.** In this case, XML, which indicates a boxcar equipped with loading devices.
- 8) **Built date.** The date the car left the factory. On newer cars this appears in the consolidated stencil.
- 9) **Dimensional data.** The internal and external measurements of the car.
- 10) **Consolidated stencils.** These began appearing in 1972. Early consolidated stencils were single panels; later, multiple panels were used. On these is stenciled information regarding brake and axle maintenance.
- 11) **ACI (Automatic Car Identification) plate.** ACI was an automated car identification system that used trackside scanners to read colored panels on cars. The system was introduced in 1967; all cars in interchange service were required to have ACI plates by 1970. The system didn't work well (grime and dirt made the panels unreadable) and the requirement for ACI plates was eliminated in 1977. Cars built after that date won't have ACI plates, but plates were often left on older cars. A solution to this problem was the electronic identification tag, shown in the photo on page 90.

12) Wheel inspection dot. These marks began appearing in March 1978 when a type of wheel was found to be defective, and all cars were required to be inspected. Cars without the banned wheels received a black square with yellow dot; cars with the wheels received a white dot, and these wheels had to be replaced by December 1978. Cars built or repainted in 1979 and later won't have this mark.

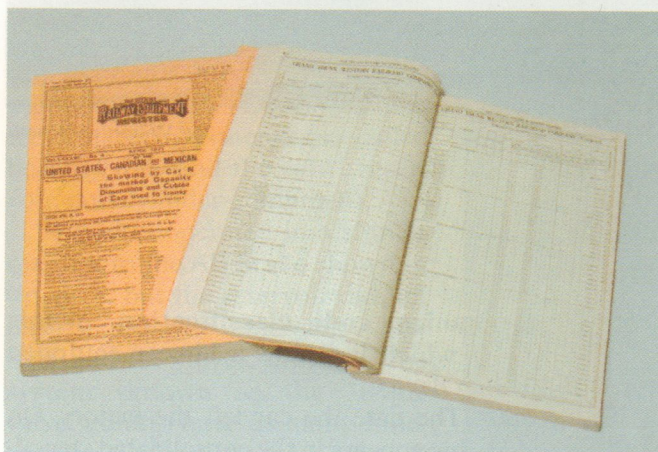
13) Special equipment. If a car is equipped with special equipment (this car has DF-2 loading devices), it will usually be stenciled on the car.

14) Route and tack boards. These wood plates are located on car sides and ends so that notes can be tacked to them. The small boards are known as route boards, and these are for information on car routing. The large tack boards are for other instructions, for example, notes on how to unload a shipment.

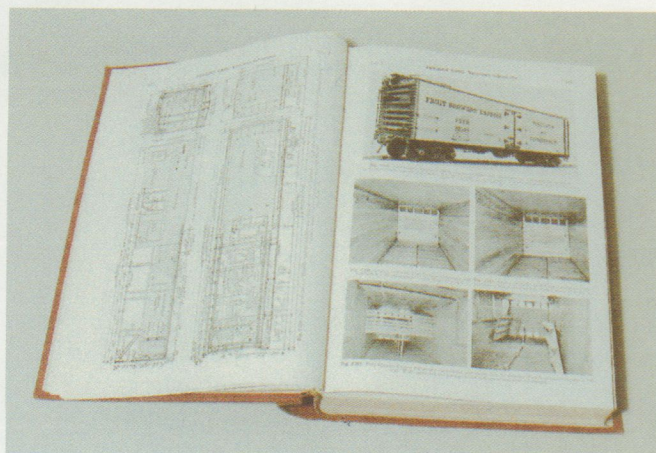


Automatic Equipment Identification (AEI) tags were required on cars as of 1994. These use passive radio signals to transmit data to railside scanners, avoiding the grime problem that plagued the earlier ACI system. You'll find tags on each car side, toward the right end of the car. Jeff Wilson photo

Car Builders Cyclopedia and Official Railway Equipment register



The *Official Railway Equipment Register* lists all the freight equipment in service in North America. Jeff Wilson photo



The *Car Builders Cyclopedia* contains drawings, photos, and other information on all types of freight cars. Jeff Wilson photo

Two of the most important references for freight car spotting and modeling are the *Car Builders Cyclopedia*, often called simply "the 'Cyc,'" and the *Official Railway Equipment Register*, or ORER.

The *Cyclopedia* has been published on an irregular schedule (every few years) since the 1800s, and in the 1960s, it was combined with the *Locomotive Cyclopedia* as the *Car and Locomotive Cyclopedia*. The book includes drawings and photos of all types of cars, and includes ads, explanations, and drawings of ancillary equipment (brakes, trucks, wheels, roofs, ends, etc.). Having one for the era you model will help you model and understand freight cars much better.

The ORER is a railroad-by-railroad listing of all freight equipment in service in North America.

Information provided for each car or car series includes AAR mechanical code; interior and exterior length, height, and width; door size; cubic capacity; bunker capacity (for reefers); and weight capacity—all valuable information when trying to identify a car in a photo. Other information includes summaries of types of equipment in service; construction material (wood or steel); and special equipment (such as drop ends on gons or cushion underframes). Other areas of the ORER define plate clearances and illustrate and list AAR car codes. You'll find an ORER from the era you model to be a valuable reference.

You can find copies of both publications at dealers specializing in railroad publications and collectibles, as well as on eBay.

Freight car timeline

- | | |
|--|--|
| 1917 USRA (United States Railroad Administration) assumes control of U.S. railroads | 1966 Roller-bearing trucks required on all new/rebuilt 100-ton cars |
| 1918 ARA (American Railway Association) is formed | 1966 Running boards no longer on new equipment |
| 1920 USRA control ends | 1966 Brake wheels mounted low on new equipment |
| 1928 Steel center sills required on cars for interchange | 1968 Roller-bearing trucks required on all new cars |
| 1933 AB brakes required on all new cars | 1970 Iron wheels banned from interchange |
| 1934 AAR (Association of American Railroads) is formed | 1970 Roller-bearing trucks required on all rebuilt cars |
| 1941 Archbar trucks banned from interchange | 1972 Consolidated stencils first used |
| 1945 Steel running boards required on new cars | 1979 Running boards to be removed from house cars |
| 1953 KC brakes banned from interchange | 1994 AEI tags required |
| 1956 Andrews trucks banned from interchange | 1995 Solid-bearing trucks banned from interchange |
| 1957 Iron wheels no longer allowed on new equipment | |

Freight car builders

ACF Industries – Currently building cars. Formerly American Car & Foundry (until 1954).

Berwick Foundry & Forge – No longer building cars.

Bethlehem Steel Car Co. – Carmaking facility sold to Johnstown America Corp.

Evans Products Co. – Bought U.S. Railway Equipment Co. in 1960s; no longer building cars.

FMC Corp. – Plant purchased by Greenbrier Companies in early 1980s, which renamed it Gunderson.

General American Car Co. – No longer building cars. Car designs licensed to Trinity.

Greenville Steel Car Co. – Acquired by Trinity in 1986.

Gunderson – Currently building cars. A division of Greenbrier Companies.

Johnstown America Corp. – Currently building cars. Successor to Bethlehem Steel Co.'s Freight Car Division.

Magor Freight Car – Later a division of Fruehauf; no longer building cars.

Marine Industries Ltd. – (Canadian) No longer building cars.

Mt. Vernon Car Manufacturing Co. – No longer building cars.

National Steel Car Ltd. – (Canadian) Currently building cars.

North American Car Co. – Designs sold to Trinity and Thrall in early 1980s.

Ortner Freight Car Co. – Acquired by Trinity in 1984.

Pacific Car & Foundry – Later Paccar. No longer building cars.

Pennsylvania Tank Car Co. – No longer building cars.

Portec Inc. – No longer building cars.

Pressed Steel Car Co. – No longer building cars.

Pullman-Standard – Created by merger of Pullman Co.'s freight car building division and Standard Steel Car in the mid-1930s. Assets acquired by Trinity in 1984.

Southern Iron & Equipment Co. (SIECO) – Acquired by Evans in early 1970s.

Standard Tank Car Co. – Bought by GATC in late 1920s.

Thrall Car Manufacturing Co. – Acquired by Trinity in 2001.

Trenton Works – (Canadian) Purchased by Greenbrier in mid-1990s.

Trinity Industries Inc. – Currently building cars. Acquired General American (1983), Pullman Standard (1984), Ortner Freight Car Co. (1984), Greenville Steel Car (1986), Thrall Car Manufacturing (2001).

Union Tank Car Co. – Purchased Phoenix-Graver (formerly Graver Tank & Manufacturing Co.) in 1957. Currently building cars.

Youngstown Steel Door Co. – No longer building cars.

List of available models

Descriptions include the names of the prototypes the models are based on if applicable. Space prohibits listing all cars and all variations that have been produced. Space also precludes a detailed assessment of each model: Some are very close to their prototypes, others have details that are not accurate. Only plastic mass-produced cars and kits are listed; resin or wood craftsman kits are not included.

Some of the cars listed may not have been in production for some time—several years in some cases—but are included as a reference. Many hobby shops and dealers often have cars in stock that haven't been produced recently, and internet sites such as eBay are also good places to track down rare or out-of-production models.

Key:

DD – double-door

4D – four-door

ED – end-door

PD – plug door

X-post – exterior post

XH – excess height

ft – foot

cf – cubic feet

t – ton

All boxcars are single-door unless otherwise noted.

Prototype/description	Model mfr.	Number series	Prototype/description	Model mfr.	Number series
HO scale					
Boxcars					
USRA 40-ft single-sheathed	Tichy	4026	PS-1 40-ft	Accurail	3400
USRA 40-ft steel-side rebuild	Tichy	4028	PS-1 40-ft	Kadee	4000
USRA 40-ft double-sheathed	Accurail	4600	PS-1 50-ft	InterMountain	45900
40-ft single-sheathed 6-panel	Accurail	7100	PS-1 50-ft	Kadee	6000
50-ft single-sheathed ED	Roundhouse	2100	PS-1 50-ft DD	Kadee	6700
50-ft single-sheathed DD, ED	Roundhouse	2130	PS-1 50-ft DD	InterMountain	45600
Mather 40-ft single-sheathed	Proto 2000	30800	AAR 50-ft	Accurail	5700
PRR X29 40-ft	Red Caboose	7000	AAR 50-ft DD	Accurail	5900
PRR X31 40-ft round-roof	Bowser	55300	50-ft PD SS	Accurail	5800
PRR X31 40-ft DD round-roof	Bowser	55340	50-ft combination-door SS	Accurail	5300
PRR X32 50-ft round-roof	Bowser	55420	Evans 53-ft DD PD	Atlas	1750
PRR X32 50-ft DD round-roof	Bowser	55400	PS 40-ft high-cube	Hi-Tech	7000
PRR X33 50-ft DD ED round-roof	Bowser	55460	ACF 50-ft 5,080-cf X-post	Accurail	5600
AAR 1937 40-ft	InterMountain	45700	ACF 50-ft SS	Atlas	1330
AAR 1937 40-ft	Red Caboose	8000	FMC 50-ft X-post	Roundhouse	1950
AAR 40-ft DD	Red Caboose	8500	FMC 50-ft X-post DD plug/ sliding doors	Roundhouse	1930
AAR 1937 modified 40-ft	InterMountain	45800	PC&F 50-ft, 14-ft	Athearn	4380
AAR ACF 40-ft	Red Caboose	8600	PS 50-ft 5,277-cf	InterMountain	47500
AAR 40-ft, late	Accurail	3500	PS 50-ft 5,277-cf	Roundhouse	1900
AAR 40-ft	C&BT	10100	PS 50-ft 5,344-cf	Athearn	5810
AAR 40-ft	Roundhouse	10600	PS 50-ft waffle-side	Walthers	
AAR 40-ft DD	Accurail	3600	SIECO 50-ft	Athearn	4200
AAR 50-ft	Proto 2000	21500	Berwick 60-ft DD waffle-side	Athearn	4000
AAR 50-ft DD auto	Proto 2000	30350	Gunderson 60-ft X-post XH	Athearn	4100
AAR 50-ft DD ED auto	Proto 2000	30300	Gunderson 60-ft SS XH	Athearn	4130
			Gunderson 60-foot XH	Walthers	932-7100

Prototype/description	Model mfr.	Number series	Prototype/description	Model mfr.	Number series
Thrall all-door	Walthers	932-7000	Airslide 40-ft 1-bay early	Con-Cor	9700
PS 86-ft high-cube DD auto parts	Walthers	932-3500	Airslide 40-ft	Eastern	2600
Greenville 86-ft XH DD auto parts	Athearn	1970	Airslide 40-ft	Walthers	932-4600
PS 86-ft XH 4D auto parts	Walthers	932-3530	Airslide 50-ft. 2-bay	Walthers	932-3680
Thrall 86-ft XH 4D auto parts	Athearn	1980			
PS 60-ft SD auto parts	Walthers	932-3550	Flat cars		
PS 60-ft SD	InterMountain	46900	USRA 42-ft	Red Caboose	2200
PS 60-ft DD auto parts	Walthers	932-3580	ACF 40-ft	Tichy	4021
ACF 60-ft SD auto parts	Atlas	1650	PRR F30 50-ft	Bowser	55950
ACF 60-ft DD auto parts	Atlas	1670	AAR 50t, 53-ft	Proto 2000	21900
			SIECO 50-ft bulkhead pulpwood	Walthers	932-5780
Covered hoppers			GSC Commonwealth 53-ft	Tichy	1000
ACF 2-bay early cement	Atlas	1800	GSC Commonwealth 53-ft	Walthers	3750
ACF 2-bay early cement	Eastern	2000	TTX 60-ft	InterMountain	46400
ACF 2-bay early cement	Kato	380000	72-ft center beam, truss	Walthers	932-4100
Enterprise 2-bay cement	Eastern	2020	72-ft center beam, opera window	Walthers	932-4104
Greenville 2-bay modern cement	Walthers	932-5400	Evans Type 4 coil cars	Walthers	932-3820
NSC 64-ft 4-bay plastic pellet	Walthers	932-7150	89-ft bi-level open auto rack	Accurail	9200
PS-2 2-bay cement	Kadee		89-ft tri-level open auto rack	Accurail	9300
PS-2 3,219-cf 3-bay	Con-Cor		W&K 89-ft encl. tri-level auto rack	Walthers	932-4850
PS-2 4,427-cf 3-bay low-side	Walthers	932-5700	Auto-Max articulated auto rack	Athearn	4400
PS-2 4,427-cf 3-bay high-side	Proto 2000	30100			
PS-2 4,740-cf 3-bay	Athearn	7150	Gondolas		
PS-2 4,750-cf 3-bay	InterMountain	45300	USRA steel 46-ft	Walthers	932-7450
ACF Center Flow 2-bay cement			USRA composite drop-bottom	InterMountain	46600
(post-1971)	InterMountain	46500	USRA Composite drop-bottom	Red Caboose	5100
ACF Center Flow 3,500-cf			40-ft steel GS	Roundhouse	1360
cylindrical 3-bay	Atlas	1930	40-ft steel GS	Bowser	55900
ACF Center Flow 3,960-cf			Steel drop-bottom	Red Caboose	50000
cylindrical 6-bay	Atlas	1950	52-ft 70t drop-end mill	Proto 2000	23700
ACF Center Flow 4,600-cf 3-bay			54-ft riveted steel mill	Con-Cor	9000
(post-1971)	Accurail	2000	65-ft welded steel mill	Walthers	932-3270
ACF Center Flow 4,650-cf 3-bay			AAR 65-ft steel mill	Eastern	3010
(pre-1971)	Atlas	1450	AAR war-emergency mill	Tichy	1040
ACF Center Flow 4,650-cf 3-bay			ACF Coalveyor	Atlas	1000
(post-1971)	InterMountain	47000	Bathtub 100t	InterMountain	47100
ACF Center Flow 5,250-cf 4-bay			Bathtub 100t	Roundhouse	1660
(pre-1971)	Athearn	1900	BethGon Coalporter	LBF	1400
ACF Pressureaide 4-bay	Atlas	1500	BethGon Coalporter	Walthers	932-5300
FMC 4,700-cf 3-bay	Roundhouse	35200	Johnstown AeroFlo	LBF	1500
NSC 4,550-cf cylindrical 4-bay	InterMountain	45100	Thrall 100t coal	Roundhouse	1640
Trinity 5,161-cf	Athearn	4250	Trinity Aluminator	LBF	1600
Trinity 5,161-cf	LBF	5100			

Prototype/description	Model mfr.	Number series	Prototype/description	Model mfr.	Number series
Hoppers					
Greenville 7,000-cf wood chip	Walthers	932-5680	Gunderson 48-ft Husky Stack		
Greenville 100t 2-bay aggregate	Walthers	932-7400	AP well	Walthers	932-4300
Ortner 100t aggregate	Walthers	932-7050	Gunderson 48-ft Maxi-Stack III		
USRA 55t 2-bay	Accurail	2600	5-unit well	Athearn	5911
USRA 50t 2-bay	Tichy	4027	Gunderson 48-ft Maxi-Stack III		
USRA 50t 2-bay panel-side rebuild	Accurail	2800	5-unit well	Con-Cor	195500
USRA 50t 2-bay panel-side rebuild	Tichy	4029	Gunderson 48-ft Husky Stack		
PRR H21a 50t 4-bay	Bowser	54050	AP well	Con-Cor	198200
AAR 50t 2-bay offset-side	Atlas	1880	NSC 53-ft stand-alone well	Walthers	932-3945
AAR 50t 2-bay offset-side	Athearn	5400	NSC 53-ft 3-unit drawbar well	Walthers	932-3940
AAR 50t 2-bay offset-side,			Thrall 5-unit well	InterMountain	47300
oval heap shields	Atlas	1890	Impack trailer-only spine car	Athearn	5550
ARA 70t 4-bay offset-side	Athearn	1750	AP spine car, 48-ft, 5-unit	Walthers	932-3932
AAR 70t 3-bay offset-side	Accurail	7500	Refrigerator cars		
AAR 70t 3-bay offset-side	Roundhouse	1600	General American 36-ft wood ice	Atlas	6100
AAR 70t 3-bay offset-side	Stewart	10300	Mather 37-ft wood ice	Red Caboose	31000
AAR 70t 3-bay X-post	Stewart	10000	40-ft wood ice	Accurail	4800
AAR 50t war emergency	Athearn	6100	40-ft wood ice	Red Caboose	4400
AAR 50t war emergency	Proto 2000	23800	PFE R-30-12 40-ft wood ice	Red Caboose	4000
55t fishbelly	Stewart	10100	PFE R-30-12-9 40-ft wood ice	Red Caboose	4100
Ballast car, offset-side	Roundhouse	1580	PFE R-40-4 or R-30-9 40-ft wood ice	Tichy	4024
Ballast car, X-post	Roundhouse	1560	PFE R-40-10 40-ft steel ice	InterMountain	46700
40-ft 3-bay X-post	Roundhouse	1480	PFE R-40-23 40-ft steel ice	InterMountain	45500
PRR H39 12-panel 3-bay	Stewart	10200	PFE R-40-23 40-ft steel ice	Athearn	1600
N&W H11 100t 3-bay	Bowser	55100	URTX 40-ft steel ice	Walthers	932-2570
Greenville 100t coal	Con-Cor	9300	ATSF steel rebuilt ice-bunker	C&BT	7000
Trinity RD4 coal	Walthers	932-7800	ATSF steel ice	InterMountain	46100
Ortner Rapid Discharge 100t 5-bay	Roundhouse	1720	ATSF modern steel PD ice	C&BT	7500
PRR G39 70t ore	Stewart	10600	FGE SS RBL	Walthers	932-4750
70-t ore car, "Minnesota"	Walthers	932-4400	North American 50-foot SS RBL	Walthers	932-3450
Ore car, tapered side	Roundhouse	1400	North American 50-foot X-post RBL	Walthers	932-3600
Ore car, rectangular side	Roundhouse	1420	PFE R-50-6	Athearn	1610
Intermodal cars			PFE R-70-12 50-ft mechanical	Athearn	1630
Bethlehem 75-ft flat	Walthers	932-3950	PFE R-70-16 57-ft mechanical	Con-Cor	9800
PS 85-ft flat	Athearn		PFE R-70-20 57-ft mechanical	Athearn	5470
Bethlehem 89-ft flat	Walthers	932-4950	Tank cars		
All-purpose 89-ft flush-deck flat	Accurail	8900	ACF Type 21 8,000-gal	Proto 2000	21800
Gunderson Twin-Stack 5-unit well	A-Line	27103	ACF Type 21 10,000-gal	Proto 2000	23100
Gunderson 48-ft Husky Stack well	A-Line	27200	ACF Type 27 8,000-gal	InterMountain	46300
Gunderson 48-ft Husky Stack well	Athearn	7260	ACF Type 27 10,000-gal	InterMountain	46200
All-purpose 89-ft flush-deck flat	Accurail	8900	10,000-gal welded	Red Caboose	3000

Prototype/description	Model mfr.	Number series	Prototype/description	Model mfr.	Number series
11,000-gal early LPG	Atlas	1060	PS 50-ft waffle-side	Roundhouse	81700
Trinity 19,000-gal corn syrup	InterMountain	47800	86-ft DD auto parts	Con-Cor	555650
Funnel-Flow 30-ft, 12,000-gal	Walthers	932-5100	86-ft 4D auto parts	Con-Cor	555600
Funnel-Flow 40-ft, 16,000-gal	Walthers	932-7200	ACF 60-ft auto parts	Atlas	37200
Funnel-Flow 54-ft, 23,000-gal	Walthers	932-7250	ACF 60-ft DD auto parts	Atlas	36800
65-ft, 33,000-gal, LPG/anhydrous	Walthers	932-7300			
14,000-gal Kaolin	Atlas		Covered hoppers		
17,360-gal	Atlas	1550	Airslide, 40-ft (early version)	Atlas	38600
23,500-gal	Atlas	1620	Airslide, 50-ft	Delaware Vy.	2300
30-ft frameless non-pressure	Roundhouse	3300	3,000-cf 2-bay X-post	Red Caboose	15000
50-ft frameless non-pressure	Roundhouse	1370	PS-2 2-bay	Atlas	3150
Gen. Am. 50-ft TankTrain unit car	Roundhouse	1390	PS-2 3,219-cf 3-bay	Bachmann	73800
			PS-2 4,427-cf 3-bay	Walthers	932-8650
			PS-2 3-bay	Con-Cor	1950
			PS-2 4,740-cf 3-bay	Red Caboose	15400
			PS-2 4,750-cf 3-bay	InterMountain	65300
			PS-2 4,750-cf 3-bay	Red Caboose	15600
			FMC 4,700-cf 3-bay	Red Caboose	15200
			ACF X-post 2-bay early cement	Kato	1860200
			ACF Center Flow 2-bay cement	InterMountain	66500
			ACF Center Flow 2,970-cf		
			2-bay cement	Micro-Trains	92100
			ACF Center Flow cylindrical 3-bay	Delaware Vy.	3000
			ACF Center Flow 4,650-cf 3-bay	InterMountain	67000
			ACF Center Flow 4,650-cf 3-bay		
			(post-1971)	Micro-Trains	94100
			ACF Center Flow 4-bay pellet	Bachmann	70500
			ACF Pressureaide	Atlas	40100
			NSC 4,550-cf cylindrical	InterMountain	65100
			Trinity 5,161-cf 3-bay	LBF	5100
			Flat cars		
			USRA 42-ft fishbelly	Red Caboose	16000
			50-ft steel fishbelly	Micro-Trains	45000
			62-ft bulkhead	Micro-Trains	54100
			AAR 53-foot	deLuxe	190400
			GSC Commonwealth 53-ft	Walthers	8200
			Six-axle depressed-center		
			heavy-duty	Micro-Trains	109000
			Thrall 61-ft center beam	Micro-Trains	53000
			Gunderson 61-ft center beam		
			opera windows	Micro-Trains	53500
			Thrall 61-ft center beam, I-beam	Micro-Trains	53700

N scale

Boxcars

USRA 40-ft single-sheathed wood	Atlas	41700
USRA 40-ft single-sheathed modernized	Micro-Trains	28100
40-ft double-sheathed wood	Micro-Trains	39000
50-ft single-sheathed DD	Walthers	8350
X29 40-ft	Red Caboose	17000
AAR 1937 40-ft	InterMountain	65700
AAR 1937 modified 40-ft	InterMountain	66800
AAR 1944 40-ft	deLuxe	14000
AAR 40-ft 12-panel	InterMountain	66000
AAR 50-ft	InterMountain	65600
PS-1 40-ft	Micro-Trains	20600
PS-1 50-ft	Micro-Trains	31200
PS-1 50-ft	Roundhouse	81800
PS-1 50-ft PD	Roundhouse	81900
40-ft PD	Micro-Trains	21400
50-ft PD	Micro-Trains	38300
50-ft DD PD	Micro-Trains	75100
Thrall all-door	Red Caboose	17400
Evans 53-ft DD PD	Atlas	31000
ACF Precision Design 50-ft X-post	Atlas	45200
50-ft X-post	Micro-Trains	25600
Berwick 50-ft X-post	Roundhouse	83100
FMC 50-ft X-post	Roundhouse	8250
FMC 50-ft PD X-post	Roundhouse	8360
FMC 50-ft DD plug/sliding	Roundhouse	82300
PC&F 62-ft PD X-post	Red Caboose	17200
PS 50-ft X-post	Roundhouse	8130

Prototype/description	Model mfr.	Number series
73-ft center beam, truss	Red Caboose	16500
73-ft center beam, opera windows	Red Caboose	16600
Evans 100t coil car Type 4	Red Caboose	17600
100t coil car	Walthers	932-8250
89-ft bi-level open auto rack	Micro-Trains	112500
89-ft tri-level open auto rack	Micro-Trains	112000
89-ft tri-level enclosed auto rack	Micro-Trains	111000
Thrall articulated auto rack	Atlas	40900

Gondolas

USRA composite drop-bottom	InterMountain	66600
40-ft GS drop-bottom	Dimi Trains	1106
50-ft steel	Micro-Trains	105000
50-ft steel drop-end	Micro-Trains	46300
Thrall 100t 50-ft mill	Roundhouse	8400
Gunderson wood chip, deep-rib	deLuxe	100000
Gunderson wood chip, shallow-rib	deLuxe	160000
Wood chip, smooth-side	deLuxe	170000
Thrall high-side 100t coal	Roundhouse	8100
ACF Coalveyor 100t	Atlas	43800
BethGon Coalporter	deLuxe	120000
BethGon Coalporter	LBF	5400
Trinity Aluminator	LBF	5700
Johnstown AeroFlo 100t	LBF	5800

Hoppers

Ortner 3-bay aggregate	Micro-Trains	12500
55t fishbelly 2-bay	Atlas	41000
AAR 55t 2-bay offset-side	Micro-Trains	55000
USRA 50t 2-bay	Micro-Trains	56000
50t 2-bay peaked end	Con-Cor	175200
50t 2-bay composite-side	Micro-Trains	57000
ARA 70t 4-bay offset-side	Bachmann	73300
AAR 70t 3-bay offset-side	Roundhouse	8620
AAR 70t 3-bay X-post	Roundhouse	8600
90t 3-bay X-post	Atlas	32600
100t 3-bay X-post	Micro-Trains	108000
Ortner Rapid Discharge 100t 5-bay	Red Caboose	15800
70-ton ore cars	Atlas	32000

Intermodal cars

89-ft all-purpose flat	Micro-Trains	71000
58-ft converted piggyback flat	Micro-Trains	64000
Thrall 48-ft 5-unit well	Walthers	8100

Prototype/description	Model mfr.	Number series
Thrall 48-ft stand-alone well	Walthers	8050
Gunderson Twin-Stack 5-unit well	deLuxe	150000
Gunderson 48-ft Husky Stack well	Con-Cor	603100

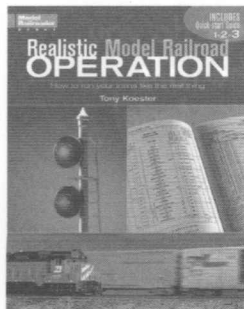
Refrigerator cars

36-ft wood ice	Micro-Trains	58500
36-ft wood ice	Roundhouse	8680
40-ft wood ice	Micro-Trains	49000
40-ft wood ice	Atlas	41400
PFE R-40-10 steel ice	Micro-Trains	59000
PFE R-40-23 steel ice	InterMountain	65500
PFE R-40-23 steel ice	Red Caboose	18000
40-ft steel ice	Model Power	3700
40-ft steel ice PD	Bachmann	105100
40-ft steel ice PD	Red Caboose	18400
40-ft PD ice R-40-26	Micro-Trains	
ATSF 40-ft steel ice	InterMountain	66100
50-ft steel ice PD	Model Power	4000
50-ft mechanical PD	Atlas	36500
52-ft mechanical PD	Micro-Trains	69100
57-ft mechanical PD	Bachmann	148200
57-ft mechanical PD	Red Caboose	18600
FGE PD RBL	Atlas	33600
FMC 50-ft PD RBL	Roundhouse	8360
North American 50-ft PD RBL	Walthers	8950
North American 50-ft X-post PD RBL	Walthers	8800
76-ft cryogenic PD	Walthers	932-8000

Tank cars

ACF Type 27 8,000-gal	InterMountain	66300
ACF Type 27 12,000-gal	Micro-Trains	65000
11,000-gal LPG	Atlas	43300
ACF 23,500-gal frameless	Atlas	30700
ACF 17,360-gal insulated	Atlas	43500
Trinity 17,600-gal corn syrup	Atlas	40200
Kaolin tank car	Atlas	34800
33,000-gal LPG	Atlas	37100
40-ft Funnel Flow	Con-Cor	160100
46-ft Funnel Flow	Con-Cor	160200
56-ft Funnel Flow	Con-Cor	160300
50-ft frameless	Roundhouse	8440
56-ft	Micro-Trains	110000
60-ft	Con-Cor	400556300

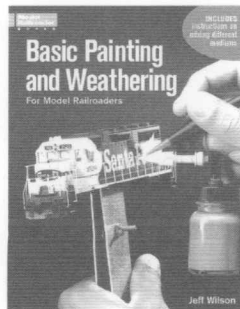
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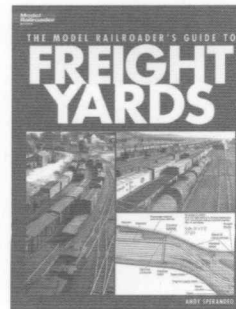
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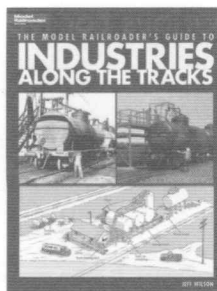
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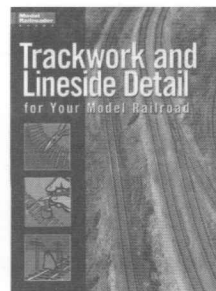
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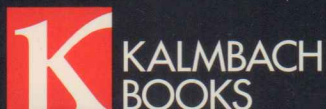
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