

THE NEWEST FROM GREENBRIER

High-Strength Steel Turns a Corner



The advent of mass-produced steel in the 19th century helped enable the rail industry's rapid growth. In the 21st century, The Greenbrier Companies is leveraging continuous improvements in steel to produce innovative designs that drive increased productivity, equipment utilization and safety, while reducing life-cycle costs. We're proud to spotlight two of our most recent innovations, the Ultra-High-Strength Steel Gondola™ and Titan Series Doors™.

Ultra-High-Strength Steel Gondola™

Designed as part of a joint initiative with Norfolk Southern, our Ultra-High-Strength Steel Gondola™ uses an innovative formula for ultra-high-strength, wear- and abrasion-resistant steel with a yield strength close to 175 KSI, which allows the tare (unloaded) weight to be reduced by up to 15,000 pounds. A unique tub design reduces product hangup during loading/unloading.

"While advanced and ultra-high-strength steels provide significant

proof load case benefits, they don't provide an equivalent benefit to the fatigue life of welded joints," says Greenbrier Senior Vice President, International Engineering, Product Development and Automation Peter Jones. "You need to use a different design philosophy to ensure welds are only placed in lower stress areas of the car structure. Rather than having traditional straight 90-degree side-to-floor angles, we've formed a tub section using a continuous piece of steel through the bottom of the car, eliminating welds in those areas. This

allows us to use the full properties of the steel at 175 KSI while maintaining the car's fatigue resistance."

Restricting welds to low-stress areas is a much different design from a traditional gondola. The shape of the tub eliminates loading and unloading problems with slab steel, for example. A traditional design uses a rolled steel angle to make the joint between the floor and the side. Sometimes when slabs are loaded, they will catch the top of that angle and sit at an odd angle—not perfectly flat. When the car starts moving, they move, and then



they're harder to unload. With this design, the slab self-centers, reducing damage and failure. This shape also allows for much easier car cleanout for other services such as scrap. There is no need to get into corners, because lading settles into the middle.

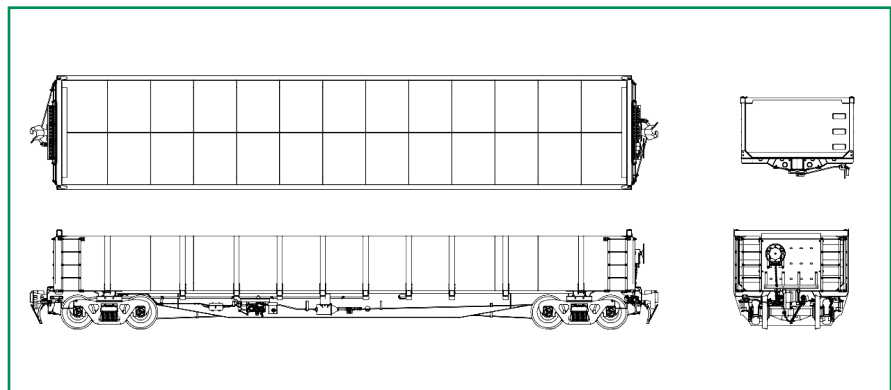
"These problems are of concern to the railroads, so our new tub design was one of the things that Norfolk Southern has been pleased with, because it has eliminated them," says Jones.

New or improved technology like this almost always originates from a need to solve a problem, often more than one. For Norfolk Southern, the Ultra-High-Strength Steel Gondola™ provides utilization and capacity gains as well as lower life-cycle costs. NS Assistant Vice President Equipment, Fleet and Capacity Planning Stefano Rieppi is the point of contact for logistics, providing feedback on how these cars are performing in service with actual customers at numerous loading and unloading points. "We've been a big part of the design process," he says.

"Gondolas are a strategic fleet, meaning we have high time-sensitive demand most months of the year for this car type across a large network of origins," says Rieppi. "It's essential that we maximize fleet availability, which means minimizing repair time. These railcars are subject to very heavy wear and tear due to the type of commodities they carry and how they're loaded and unloaded. They can't experience much down time, because the markets they serve don't fluctuate between very slow months and very heavy months. Traffic levels are consistent, year-round."

"We maximize the loading capacity of each available railcar, especially when the fleet is naturally tight because of demand," notes Rieppi. "Because of our availability and loading capacity maximization objectives, as we looked to replace assets that are aging out—and we're talking hundreds of cars—we needed a gondola that could help us meet our objectives. If we need to replace hundreds of assets every year

DIMENSIONS (APPROX.)	
Length, inside	52'-6"
Length, over couplers	57'-11 ½"
Width, inside	9'-6"
Width, extreme	10'-6 ¾"
Height, inside	5'-6"
Height, extreme	9'-2 5/16"
Clearance	AAR Plate C
WEIGHT/CAPACITY (EST.)	
Light weight	54,000 lbs.
Load limit	232,000 lbs.
Gross rail load	286,000 lbs.
Capacity	2,796 cu. ft.
CURVE NEGOTIABILITY RADIUS	
Uncoupled	150'
Coupled to base car	216'
Coupled to like car	218'



that are at the 50-year mark, why not go for a more durable, higher-capacity asset? The timing was good because as we were looking to replace a lot of assets, we started working with Greenbrier on this concept."

This gondola is primarily carrying HBI (hot briquetted iron), pig iron and steel slabs. NS has also done some tests with scrap metal. "Those are very heavy commodities that maximize the utility of an increased loading limit," Rieppi says. "This

gondola provides the ability to fully utilize the load limit. The ultra-high-strength lightweight steel takes the tare weight way down and provides 10% to 15% more capacity. That's a big thing for us because at the end of the day, especially if fleet capacity is very tight, we need fewer cars to move the same amount of product."

The smooth carbody interior features transitions with fewer 90-degree angles. This increases durability, the car's ability to withstand punishment



in continuous service at multiple locations. “There’s nothing gentle about loading or unloading gondolas,” notes Rieppi. “We’re talking grapples and magnets, and operators don’t gently lower magnets. This design means the car is less subject to natural stresses. A weld is a potential failure point, and it doesn’t matter how good the weld is. Greenbrier reduced the number of welds during car assembly. Fewer failure points coupled with the overall design makes this car potentially more durable, which goes back to the optimal objective of needing it to stay available. Looking ahead, when these cars undergo a mid-life overhaul, we’re anticipating having to do less work on them because they’re subject to less structural fatigue.”

The Ultra-High-Strength Steel Gondola™ earned Greenbrier Norfolk Southern’s Thoroughbred Sustainability Partner Awards for Innovation. This first iteration was based on our standard 52-foot, 6-inch mill gondola with 5-foot, six-inch sides. We have now designed and released to production engineering a 52-foot, 6-inch

mill gondola with up to 8-foot, 8-inch sides. We can build any iteration in that length, with different sides.

Titan Series Doors™

Out of all the components that go into a boxcar, the doors take the most punishment in service. Our Titan Series Doors™ don’t look any different from our classic boxcar door design, and they feature our standard door mechanism, with all the associated parts: replacement hasps, anti-spin/anti-drift devices and our patented worm drive. That’s where the similarity ends, because these doors use an advanced high-strength Grade 100 weathering steel that provides twice the yield strength of a traditional boxcar door, sliding or plug. This is based on Industry Standard AAR Test S-213, the maximum impact of force before permanent steel deformation occurs, making a door difficult or even impossible to open, or to close and lock.

Average plug door lifetime repair-related costs are 55% lower than traditional steel plug doors, based on

a 2024 internal standard boxcar door repair model derived from interviews with boxcar repair experts.

“With the Titan Series, reducing weight is secondary, even though this design does reduce weight somewhat,” says Greenbrier Director, Product Development and Fleet Engineering Tyler Chambers. “Our goal is to strengthen the door and prevent damage from incidents like forklift strikes, and we’re able to use advanced high-strength steel for that purpose. We can take this technology and implement it on any size door that we’ve done in the past, in any size the customer needs.”

Ten car sets, five with Norfolk Southern and five with TTX, have been in service for about a year. “We’ve had zero reports of damage to these new doors now,” notes Peter Jones. “We’re optimistic that we have addressed many of the problems associated with traditional boxcar doors. We’re monitoring these new doors very closely.”

Titan Series Doors™ are also offered in an Ultra-High-Strength steel Grade 175 weathering.

INNOVATIVE DESIGNS. LIFETIME SAVINGS. LIFETIME PARTNER.

Greenbrier's innovative Titan Series Doors™ are built from an advanced high-strength steel and provide twice the yield strength of standard steel—increasing the durability and longevity.

The Titan Series Doors™ reduce the average lifetime plug door repair-related costs by

55%

when compared to regular steel boxcar plug doors.*

*Based on a 2024 internal standard boxcar door repair model derived from interviews with boxcar repair experts



LEARN MORE AT
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