



BUILDING AMERICA®

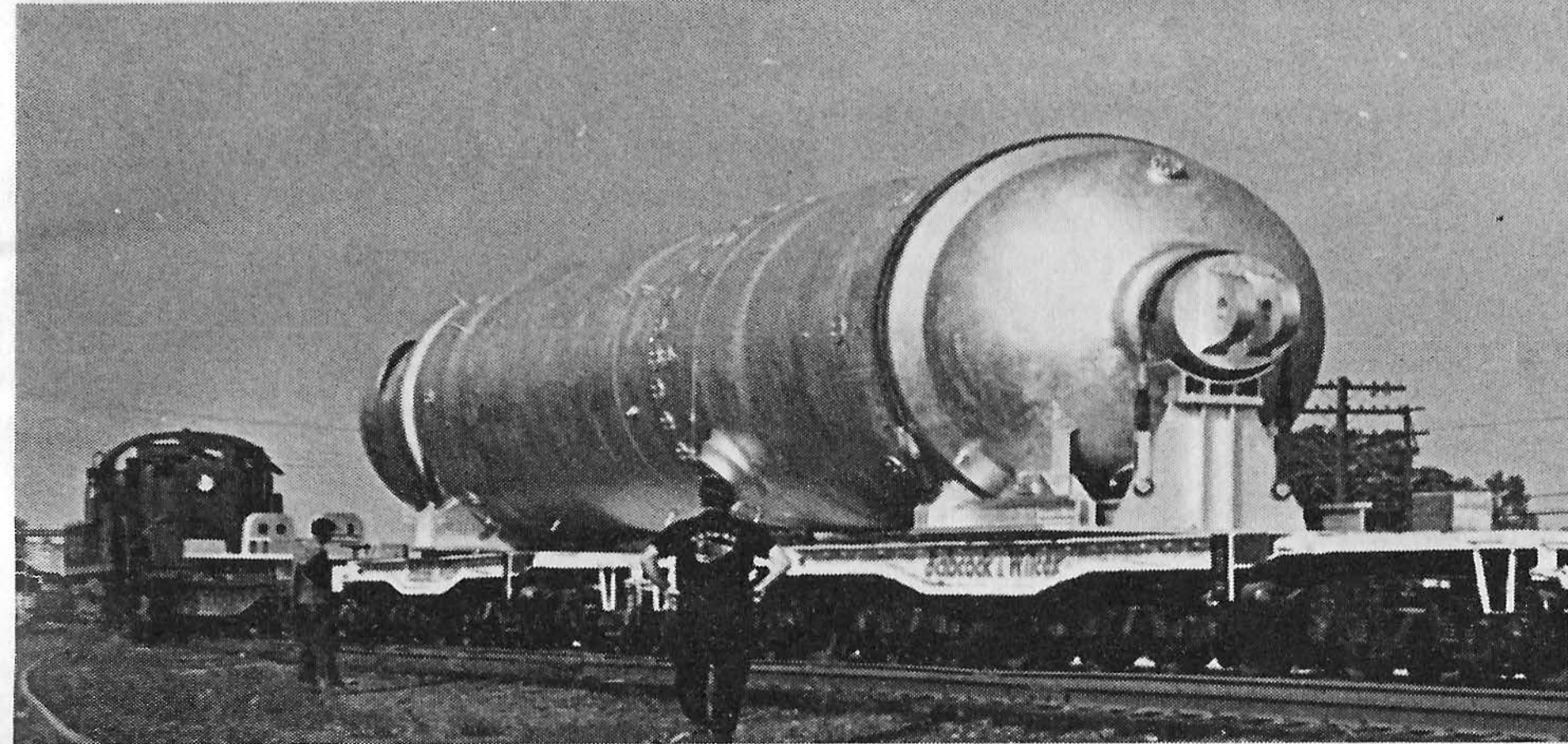
July 9, 2019

Railroad Clearances

Evolution in our
Industry

Ben Duvall

Sr. Consultant – Rail Clearances,
Union Pacific Railroad



The giant vessel moves in a special train with speed restricted to 20 miles per hour.

This Babcock & Wilcox nuclear steam generator moved in a special train (restricted to 20 mph) via the Penn Central Railroad and Southern Railway from Barberton, Ohio to a Duke Energy site in Oconee, S.C. This generator weighs 1,140,000 lbs and is a record shipment for the Railroad at that time (1970). Source: Wikipedia.org

Challenges for Rail Clearances



- Clearance: the distance from the outer edge of load to structures on railroad right-of-way
 - Height measured at top of rail (ATR)
 - Width measured from centerline of track
- Every railroad has their own minimum clearance distances to structures before they will allow movement
 - Ex. – the load must have a minimum 3 inches clear between the load and the steel bridge structure
- The greater the clearance, the higher speed allowed through the structure

3" or less = "Walking Speed"

4" or less = 5 mph

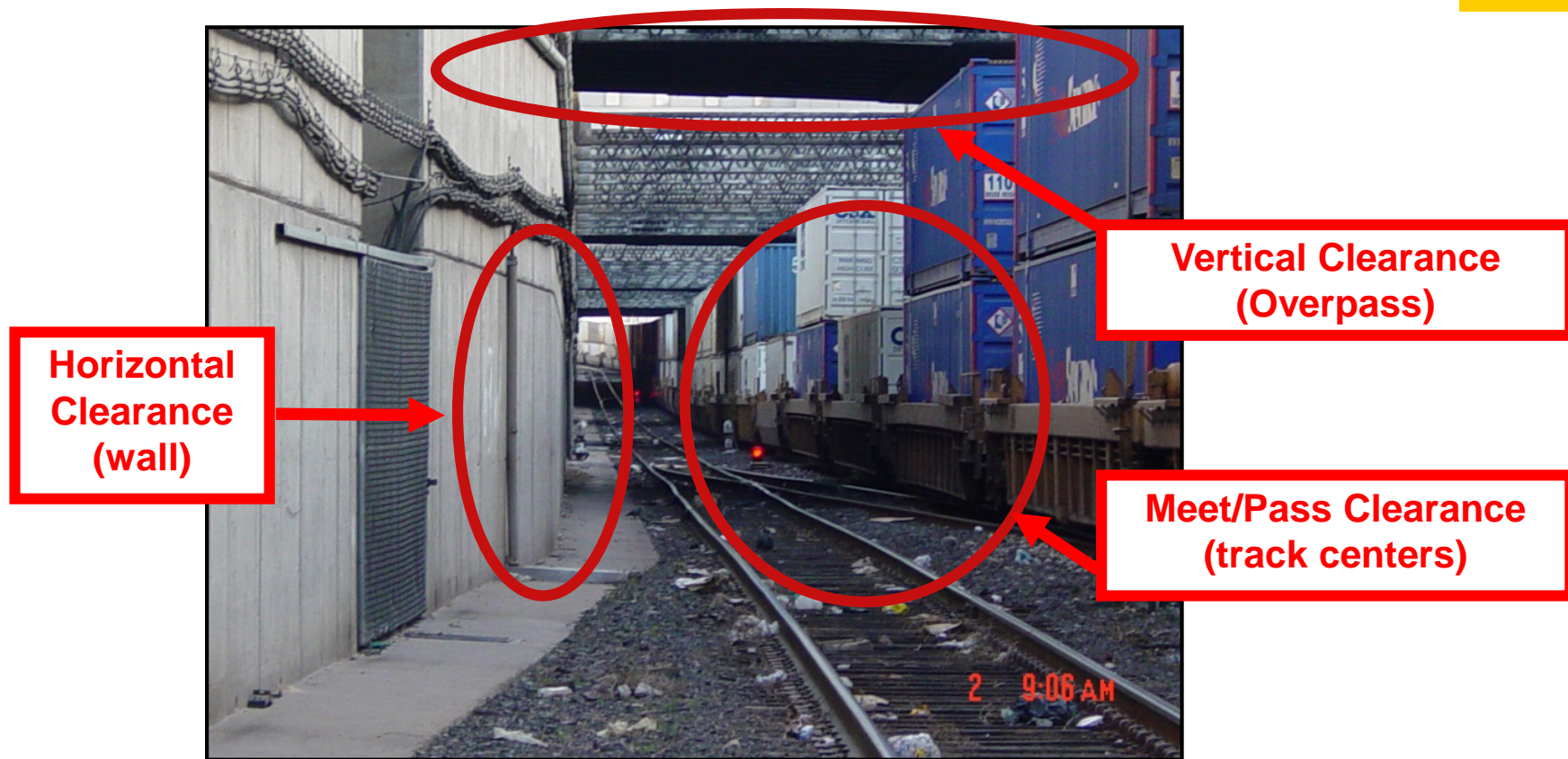
5" or less = 10 mph

6" or less = 25 mph

6" or more = Track Speed



Challenges for Rail Clearances



Most tunnels are very old.
*Loads 13 - 14 - 15 feet wide
 were not a consideration.*

Even more modern
 structures, *some were not
 built tall enough...*

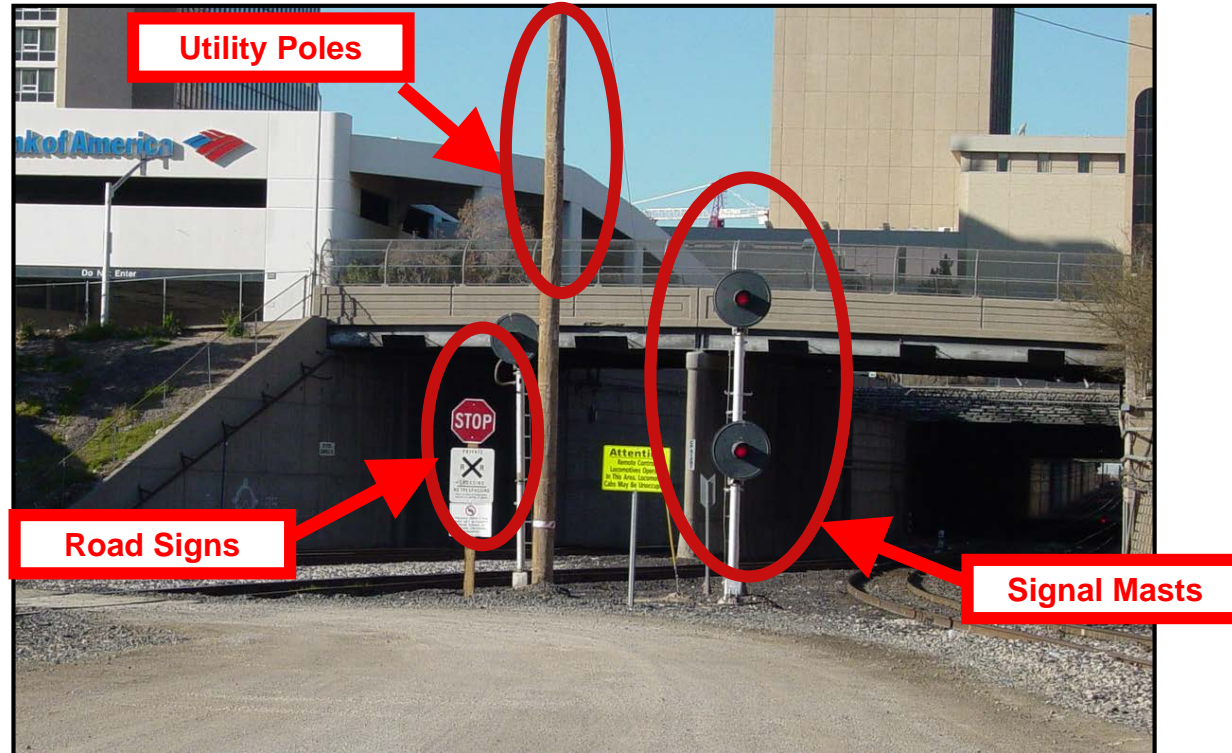


Moffat Tunnel, Colorado – Union Pacific
 Constructed in 1920's.



20'-8' tall canopy load
 Dimensional loaded & empty;
 won't clear Moffat Tunnel at left.
 Also won't fit into repair track facility.

We must protect ALL physical items along our right-of-way

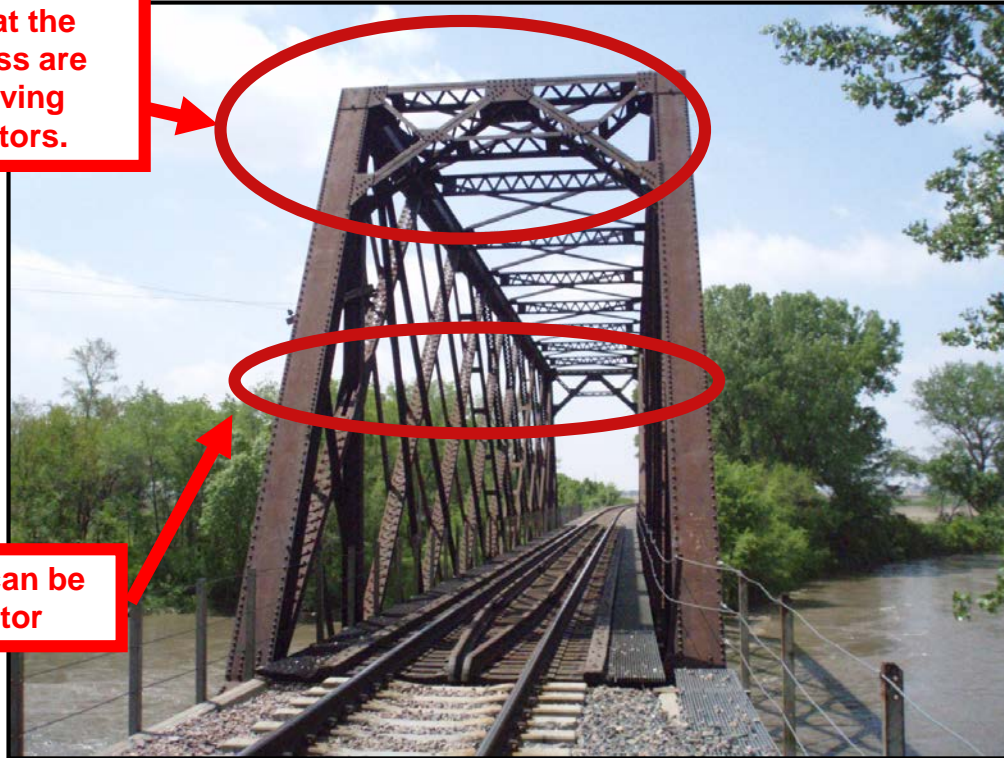


Challenges for Rail Clearances: a steel thru-truss bridge



The angled steel wing braces at the top of the truss are one of the driving clearance factors.

Overall width can be the limiting factor



Another potential clearance hurdle: a thru-plate girder bridge



This type of bridge is especially a problem for depressed (low deck) flat cars

Some moves require the train to move at walking speed through structures



Eight to Ten degree curve into a bridge, under an overpass; the signal can be adjusted to allow clearance, but must be returned to it's original location for normal train movement.

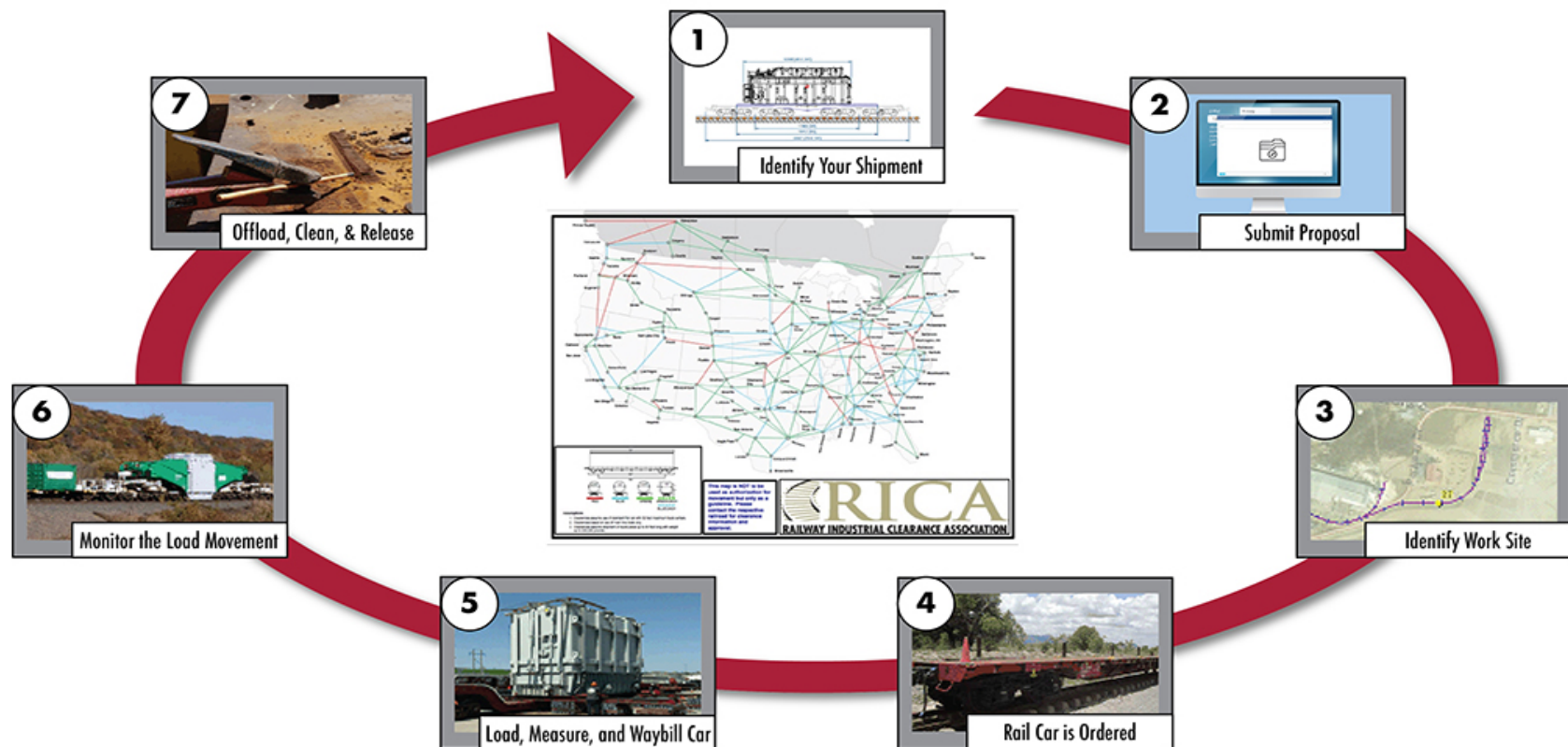
Challenges for Rail Clearances

Moving Your Shipment



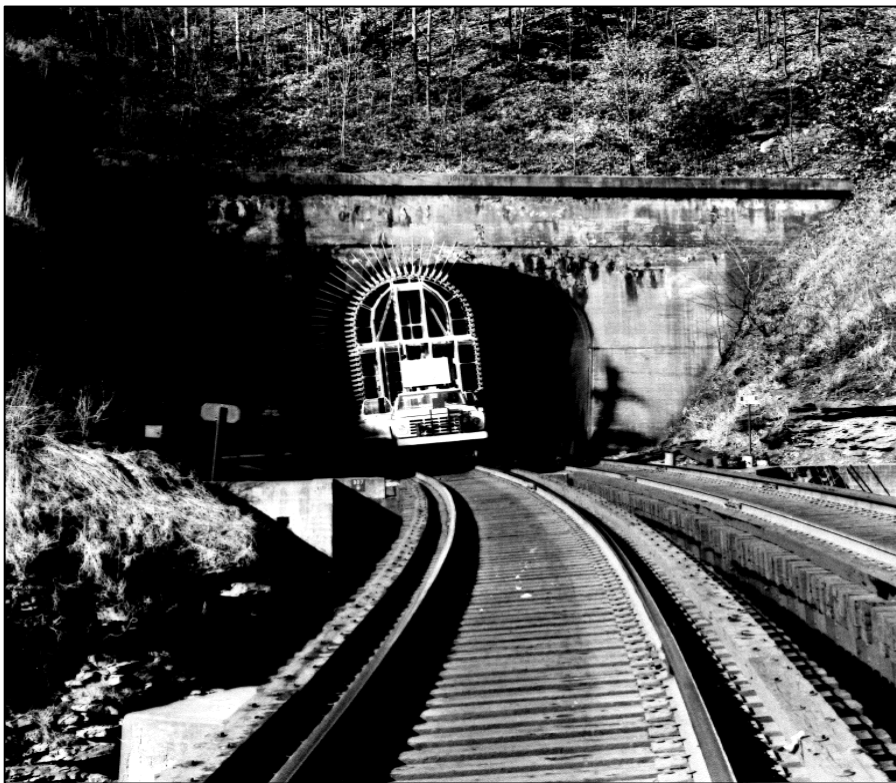
- We are fortunate to have a vast, interconnected rail system in North America
 - There are very few restrictions on a state-by-state basis for moving large shipments by rail
- Railroads have been around for over 100 years
 - Well-established but creates challenges as some infrastructure is based on 100 year old designs
 - Railroad Clearance, Engineering, and Operating teams are responsible for ensuring the safe transit of your shipment
- We wish that all loads could clear
 - Takes considerable time, effort, and investment to maintain clearance data on all the physical structures on railroad right-of-way

CLEARANCE PROCESS/TRANSPORTATION ISSUES



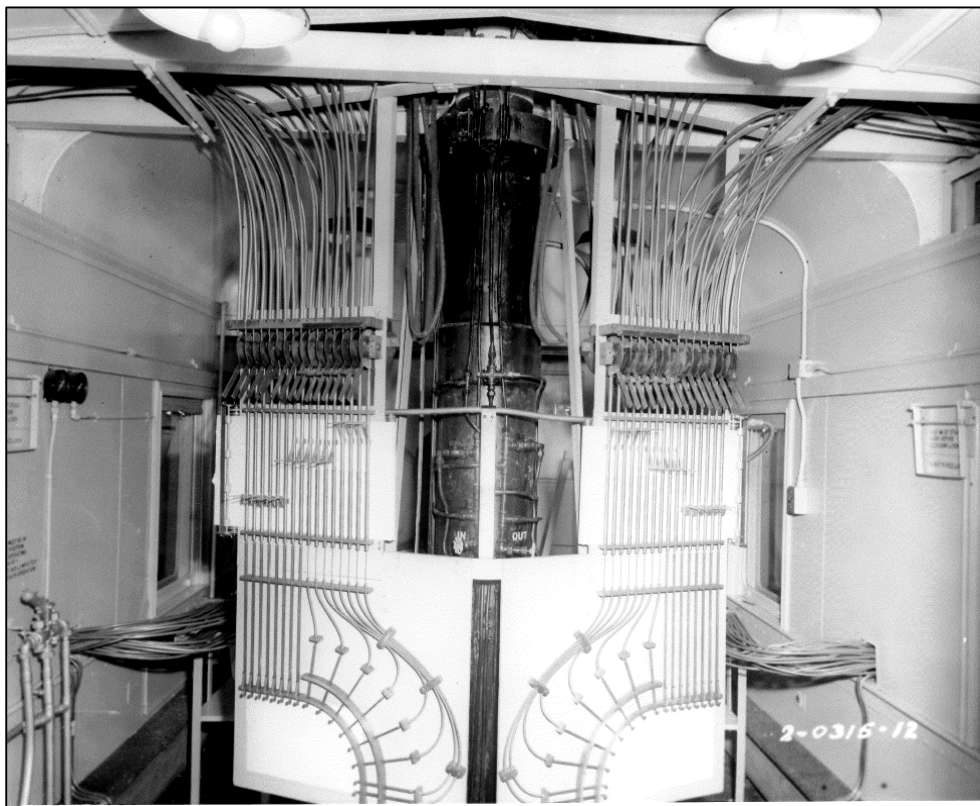
Measuring Clearances

“Finger” Truck – Circa 1970s



Measuring Clearances

“Finger” Truck – Circa 1970s



Measuring Clearances

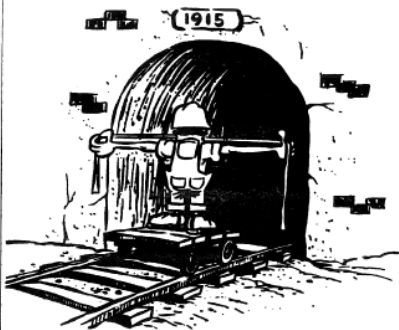
CL-1: Circa 1989 – 1 train every 15 seconds





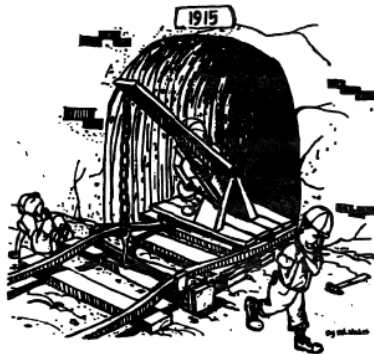
DAY 1

New oversize load ?
No problem !
It will fit !!!!
2 1/2" Inches to spare!



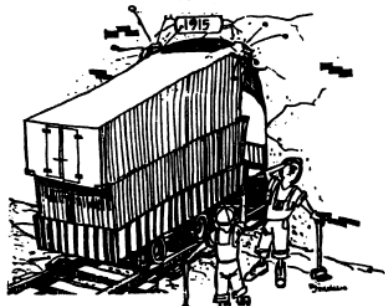
DAY 2

LOW JOINTS - BAD TIES
DIRTY BALLAST
We fix and raise the track.
Beautiful smooth track !!!!



DAY 3

BIG PROBLEM !!!!
Maybe If we let the air
out of the tires ??
(Omaha suggestion!)





CL-3 - Clearance Car SICK Laser Measuring Device

Range 328'

Field of Vision 360

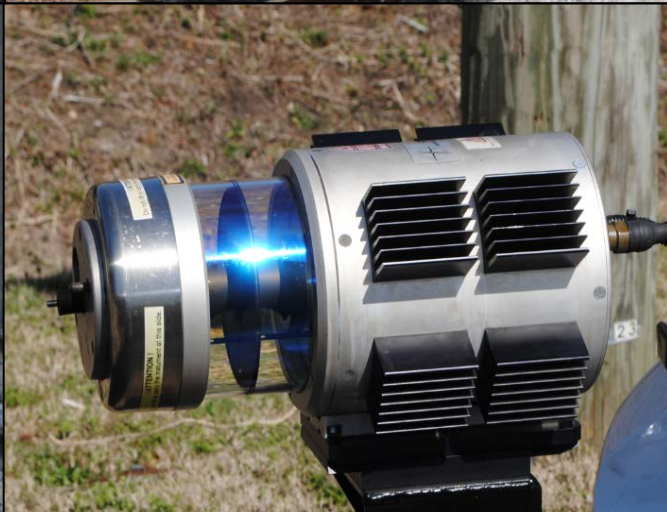
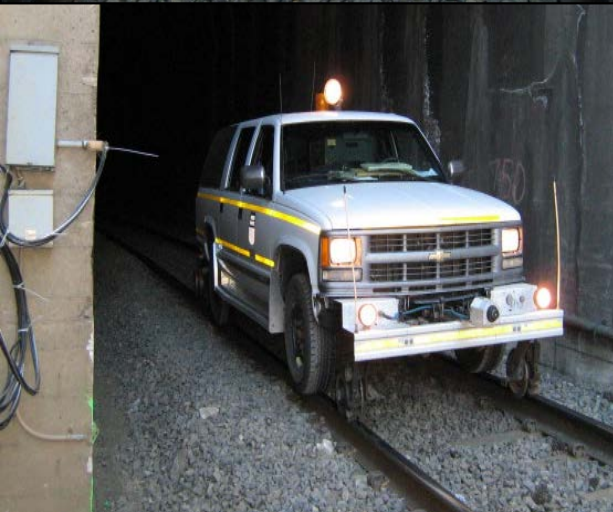
Rotation Rate

30 times per second



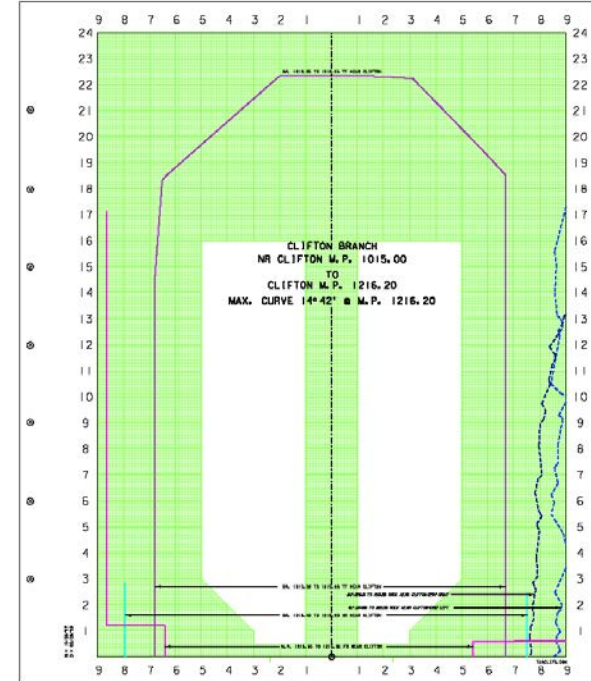
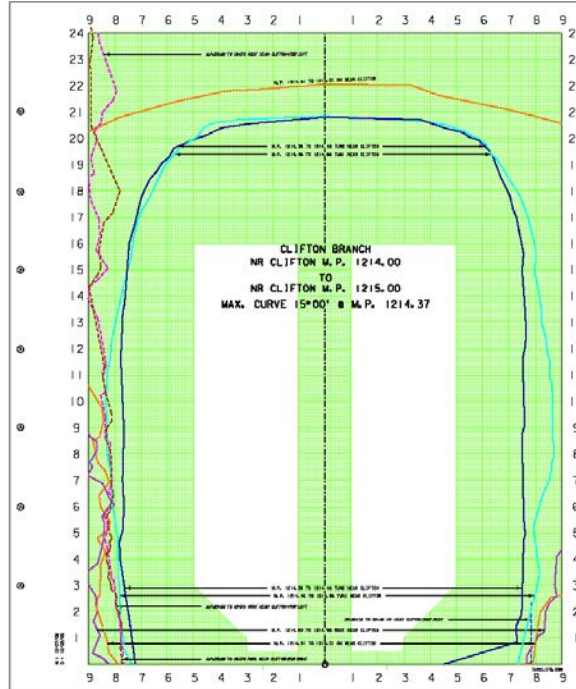
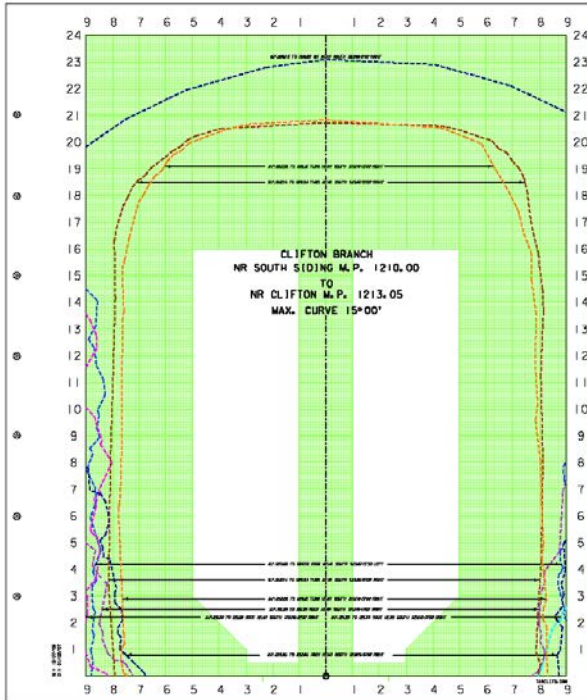
Clearing the Way

UP's cars annually measure 4,000 miles of track and 2,300 structures.



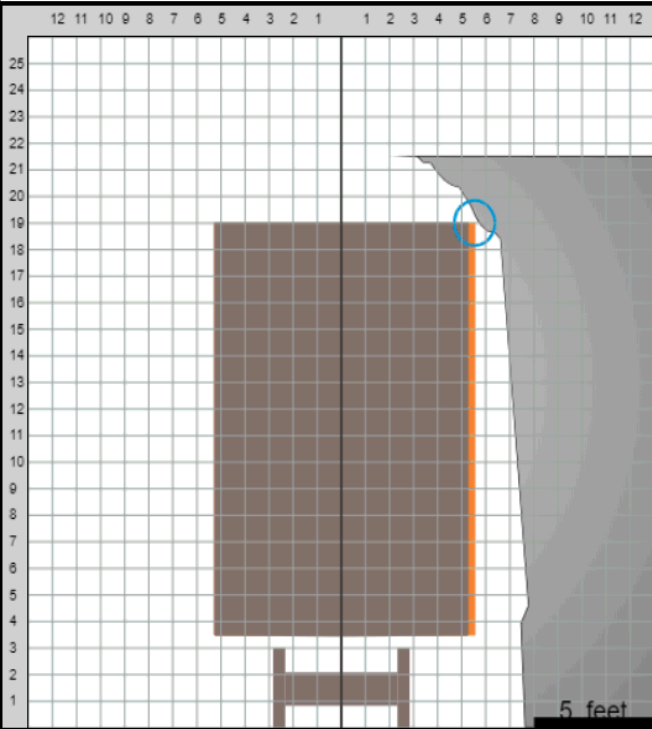
Load Clearance

Clearance Diagrams used to clear High/Wide Loads



Load Clearance

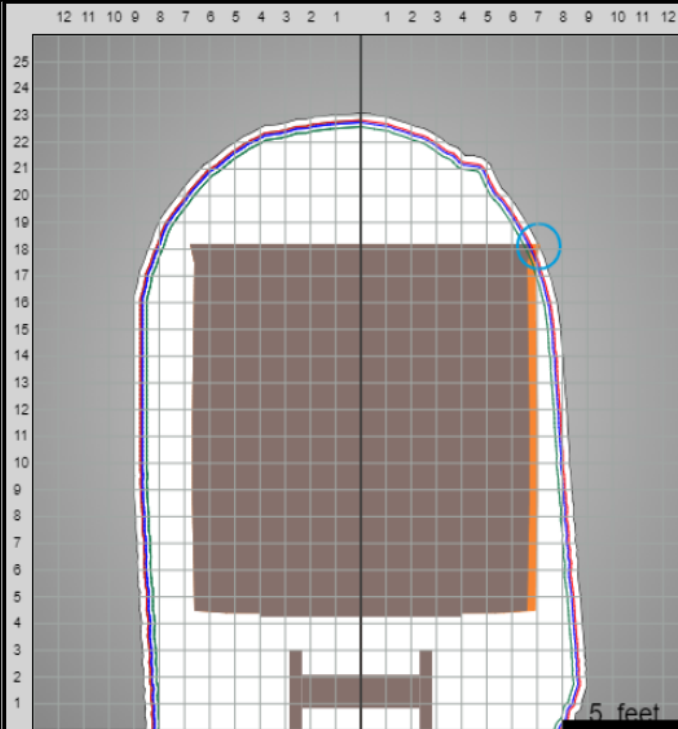
Modern Computerized Clearance



Restriction
Slide Fence
Subdivision SANDERSON SUB
SegNbr 1346 MP 447.54
Track Type SIMN
1.92" Clearance
IMPASSE speed restriction
☒ Highlight Restriction

Car Profiles
■ Car Profile
■ Effective width profile (3.0°)

Obstruction Profiles
■ Actual Profile
☐ 3" Profile (Impasse)
☐ 4" Profile (10 MPH restriction)
☐ 6" Profile (25 MPH restriction)



Restriction
Tunnel
Subdivision ELKO SUB
SegNbr 6810 MP 636.84
Track Type NO 2
0.00" Clearance
IMPASSE speed restriction
☒ Highlight Restriction

Car Profiles
■ Car Profile
■ Effective width profile (4.6°)

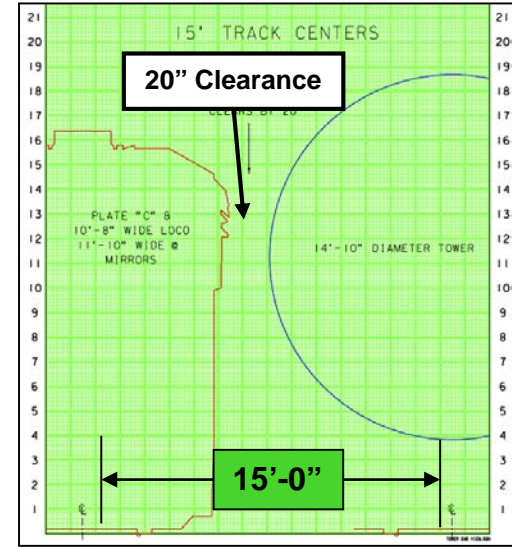
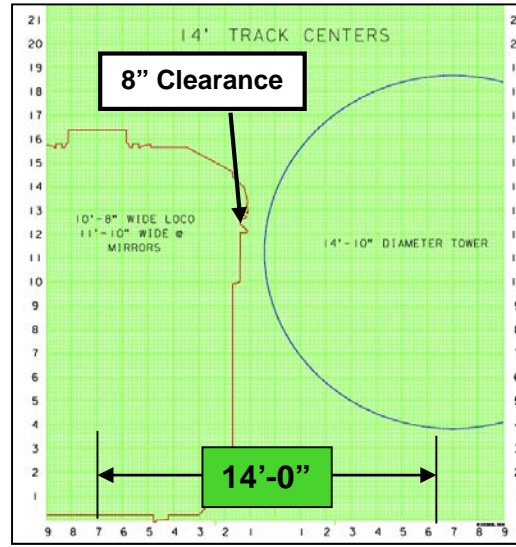
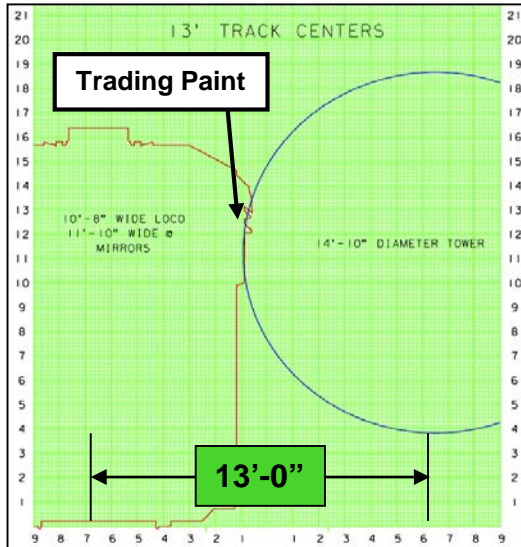
Obstruction Profiles
■ Actual Profile
☒ 3" Profile (Impasse)
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Meeting & Passing Dimensional Loads

- Track Centers - Clearance

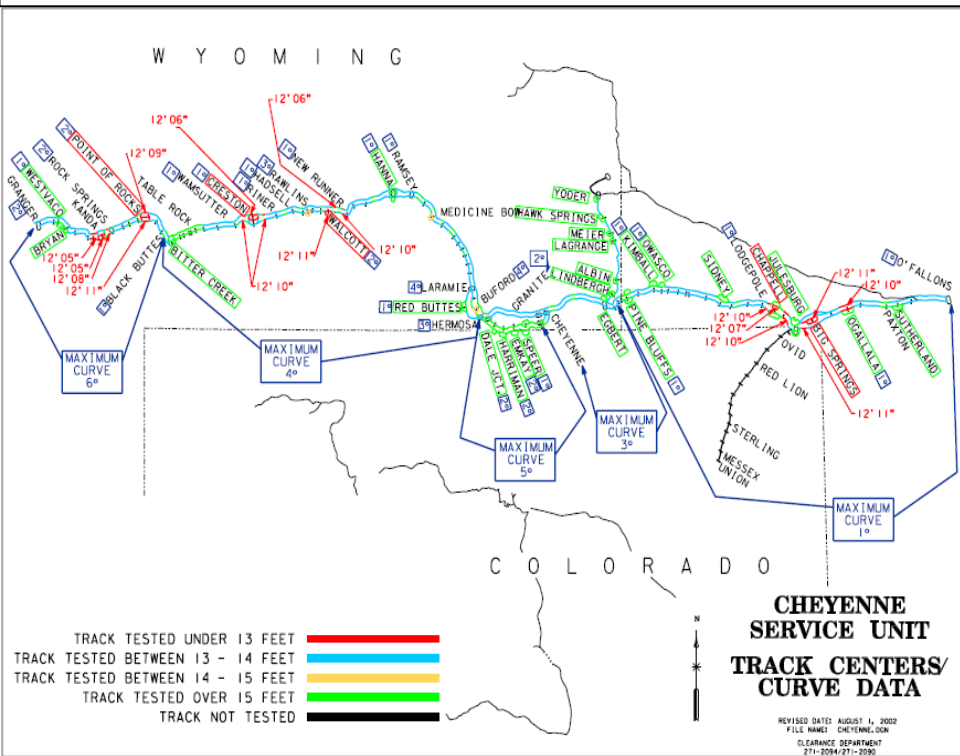
- The distance from the center line of one track to the centerline of adjacent track(s)

5" or less = No Train Meets
5" to 9" = 10 mph
9" to 12" = 25 mph
Greater than 12" = Track Speed



Track Center Measurements

Meet/Pass Clearance Data



Track Center Measurements

Meet/Pass Clearance – High/Wide Load Meets



Source: UP

Load Measurements

From Plumb Bobs to Lasers



Load Measurements

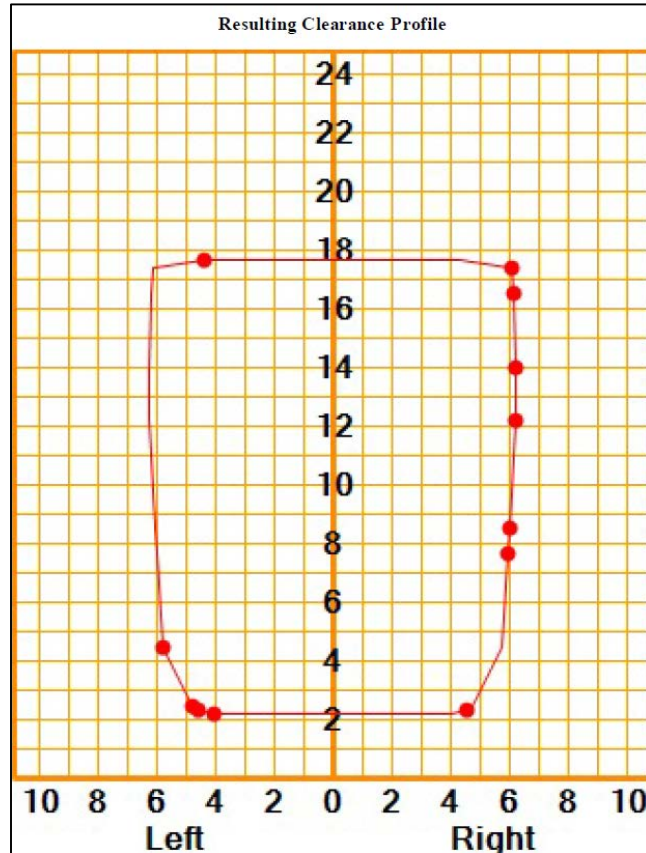
From Plumb Bobs to Lasers



Dimensions

Height from Rail Side	Side	Equivalent Width	
17' 7 3/8"	L	8' 8 5/8"	
17' 4 3/8"	R	12' 2 1/4"	
16' 5 7/8"	R	12' 4 5/8"	
13' 11 3/4"	R	12' 5 3/8"	
12' 1 3/4"	R	12' 5 1/4"	
8' 5 3/4"	R	12' 0 3/4"	
7' 7 3/4"	R	11' 11 5/8"	
4' 5 3/8"	L	11' 5 7/8"	
2' 5 1/2"	L	9' 5 3/4"	
2' 3 1/2"	R	9' 2 1/8"	
2' 3 1/2"	L	9' 1 3/4"	
2' 2 1/4"	L	8' 1 5/8"	L DECK

Width values are in reference to car deck centerline



Old Meets New

UP 4014 “Big Boy”



Dimensions

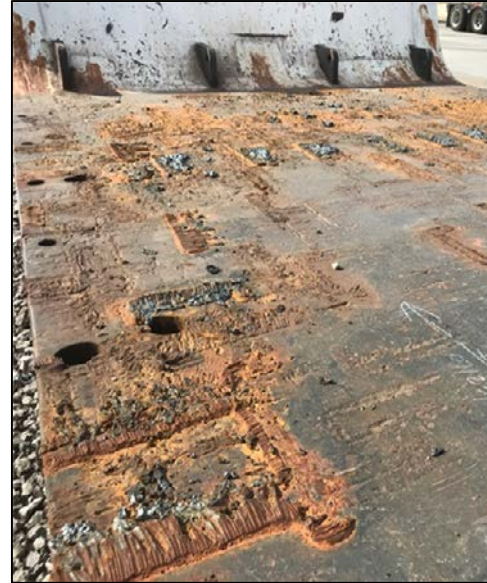
Height from Rail	Side	Equivalent Width	Description
16' 8 5/8"	L	1' 9 7/8"	TOP RELIEF VALVE
16' 4 1/2"	L	4' 2 3/8"	TINDER TOP BOX
16' 2 1/2"	R	0' 0 5/8"	TOP FRONT FEEDLINE
16' 2 3/8"	L	6' 1 1/8"	PRESSURE EXHAUST TUBE
16' 0 1/8"	L	2' 0"	TOP OPERATORS HATCH
15' 8 7/8"	L	6' 8 7/8"	ID TAG TOP
15' 4 3/4"	L	7' 9 1/4"	DOME HANDRAIL
14' 11 3/4"	L	6' 8 3/8"	ID TAG BOTTOM
14' 0"	L	9' 7 3/8"	SIDE HANDRAIL BRACKET
13' 0 3/4"	L	11' 3 3/8"	TOP FIREMAN WINDOW
10' 3 3/8"	L	11' 9 1/2"	FIREMANS ARM REST
10' 0 7/8"	L	10' 11 3/4"	Side running board
9' 9 7/8"	L	10' 6 1/2"	TINDER SIDE MIDDLE
9' 9 1/2"	L	10' 1 1/8"	L SIDE RUNNINGBOARD FRONT
8' 5 1/2"	L	11' 1 1/2"	L SIDE FRONT DECK
7' 9 7/8"	L	11' 0"	FIREMANS RUNNING BOARD
6' 6 1/4"	L	11' 0 3/8"	Boiler fill valve
5' 11 1/2"	L	10' 6"	FIREMANS PLATE HUCK
5' 8 7/8"	L	10' 8 7/8"	FRONT STEPS L SIDE TOP
4' 0 3/8"	L	11' 2 5/8"	DRIVE CYLINDER COVER L
3' 4 1/8"	L	9' 9 7/8"	L7 DRIVE KNUCKLE
2' 10 7/8"	L	10' 7 3/4"	OIL PUMP HOUSING
1' 5 5/8"	L	8' 9 7/8"	BOTTOM FRONT STEP L

Securement Considerations

Safely Shipping Dimensional Loads



- Railroads will gladly review your securement plans ahead of shipping
- Ensure product is suitable for the rigors of rail transportation
- All securements, fasteners, straps, tarps, bands, etc. are all considered part of the load and will be measured
- Adequate tie-downs prevent load shift and minimize rock & roll
- Consider railcar camber/settling due to weight
- Always remember to clean your railcars



Rail can handle that...



- 21'2" ATR
- 16'1" Wide
- 73' Long
- 876,650 lbs net
- 1,276,650 lbs gross
- 24 Axles
- 53,193 lbs per axle

Rail can handle that...



- 126' Long
- 14'2" Diameter
- 641,000 lbs net
- 981,000 lbs gross
- 16 Axles
- 61,312 lbs per axle

Rail can handle that...



- 139' Long
- 13'10" Diameter
- 993,000 lbs net
- 1,395,000 lbs gross
- 24 Axles
- 58,125 lbs per axle

Rail can handle that...



- 153'-8" Long
- 12'-7" Diameter
- 297,200 lbs net
- 617,200 lbs gross
- 16 Axles
- 38,575 lbs per axle

Allowable Gross Weight on Rail

268K & 286K Standards



4 Axle Railcar Gross Weight:

- 263/268K lbs (restricted)
- 286k lbs (normal today)
- 315 lbs (future)

Allowable Gross Weight on Rail

Factors for consideration



- Railcar length (>42 feet)
- Axle Spacing and truck centers
- Cooper E Rating
- Bridge type and conditions
- Track/tie conditions (rail profile)
- Train speed



Summary

Dimensional Shipping Made Easier



- Railroads are well prepared to move over-sized commodities and heavy tonnages
 - Our locomotives already weight 400,000 lbs
- Railroads are working to provide better service to our dimensional shipment customers
 - Most new track construction is done at 15 feet track centers or wider
 - New bridges have concrete open decks, the narrow thru-truss bridge design is a thing of the past
 - New technology is being embraced to push the limitations of rail transportation
 - We are working together through organizations like AREMA and RICA to streamline our processes and improve the handling of dimensional loads



Questions?

Thank you for your time.