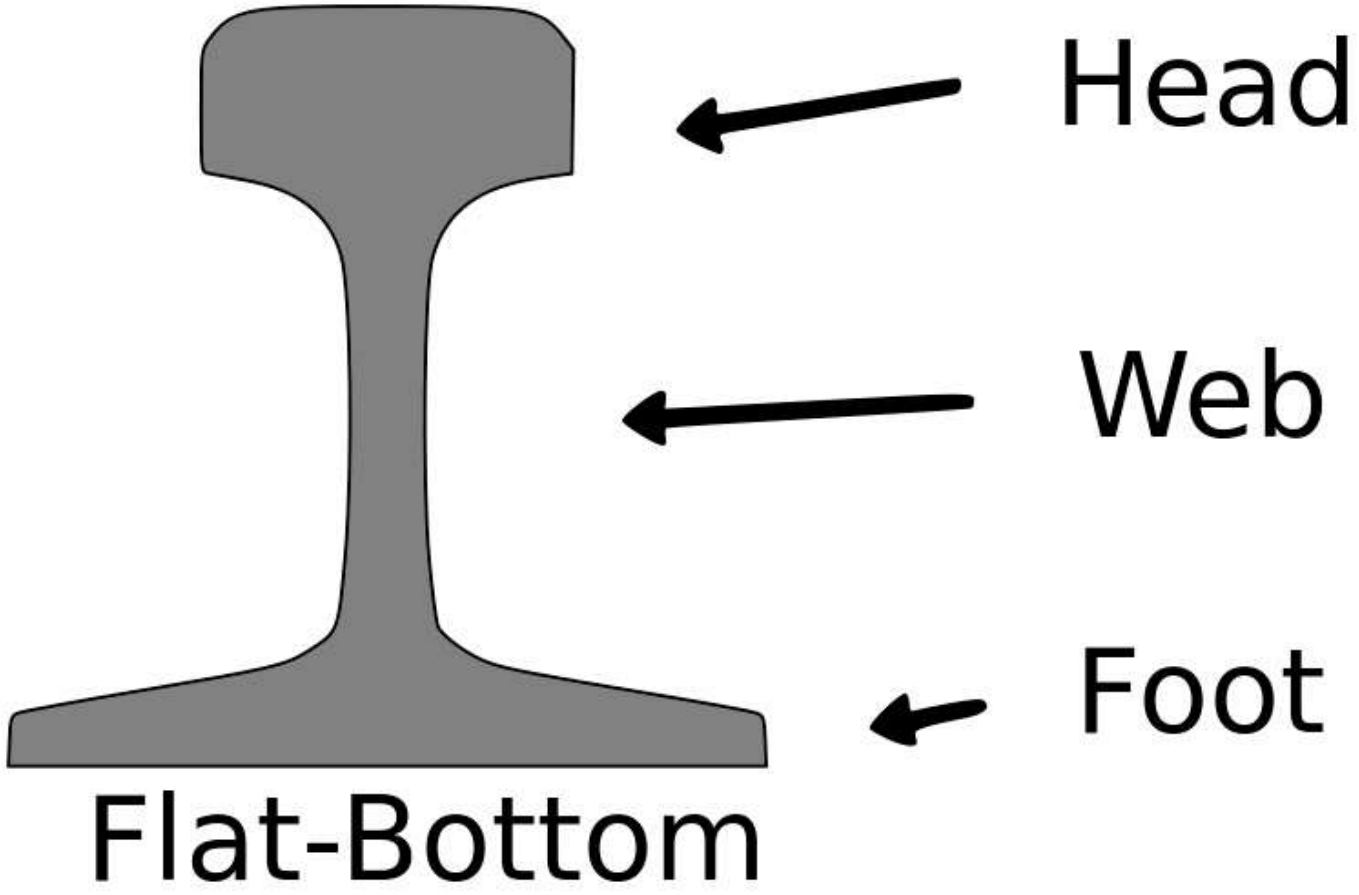
Wheels and Track

Bob Sorenson

Objectives

- Rail Profile
- Track Structure
- Track Geometry
- Why 4’ - 8 1/2”?
- Switches
- Wheels Profile
- Gauge 1

Rail Profile

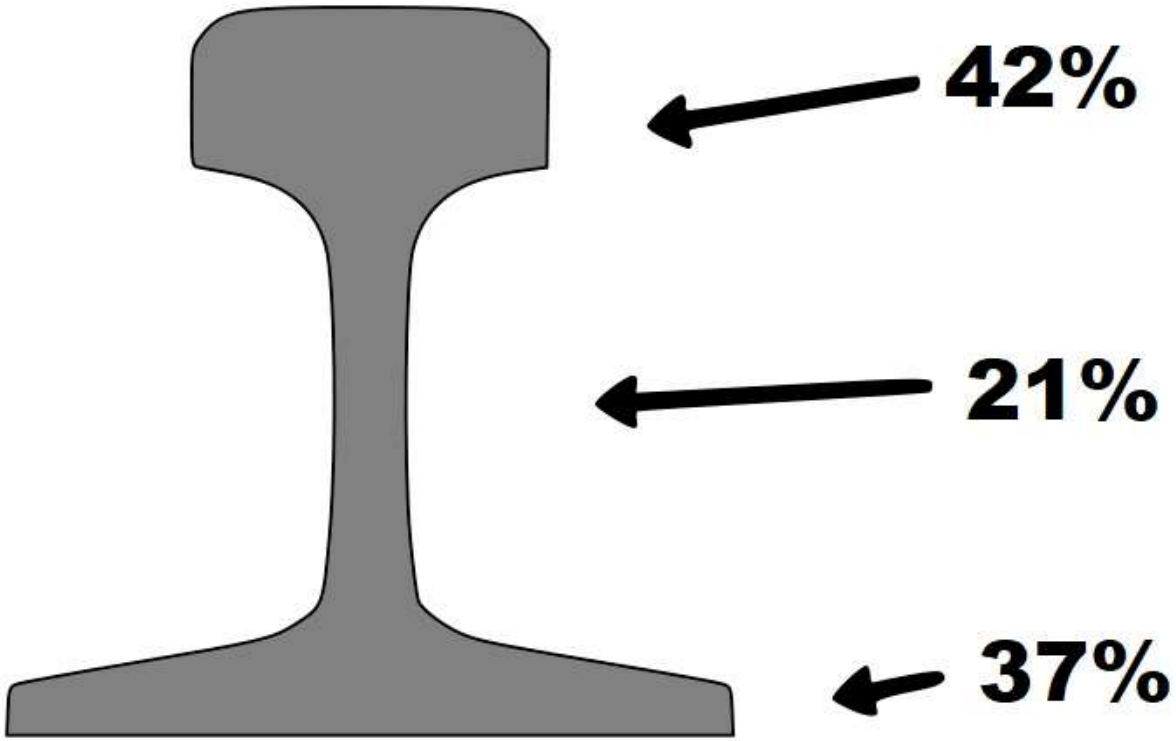


Rail Weights and Sizes

Expressed as weight (pounds) per yard

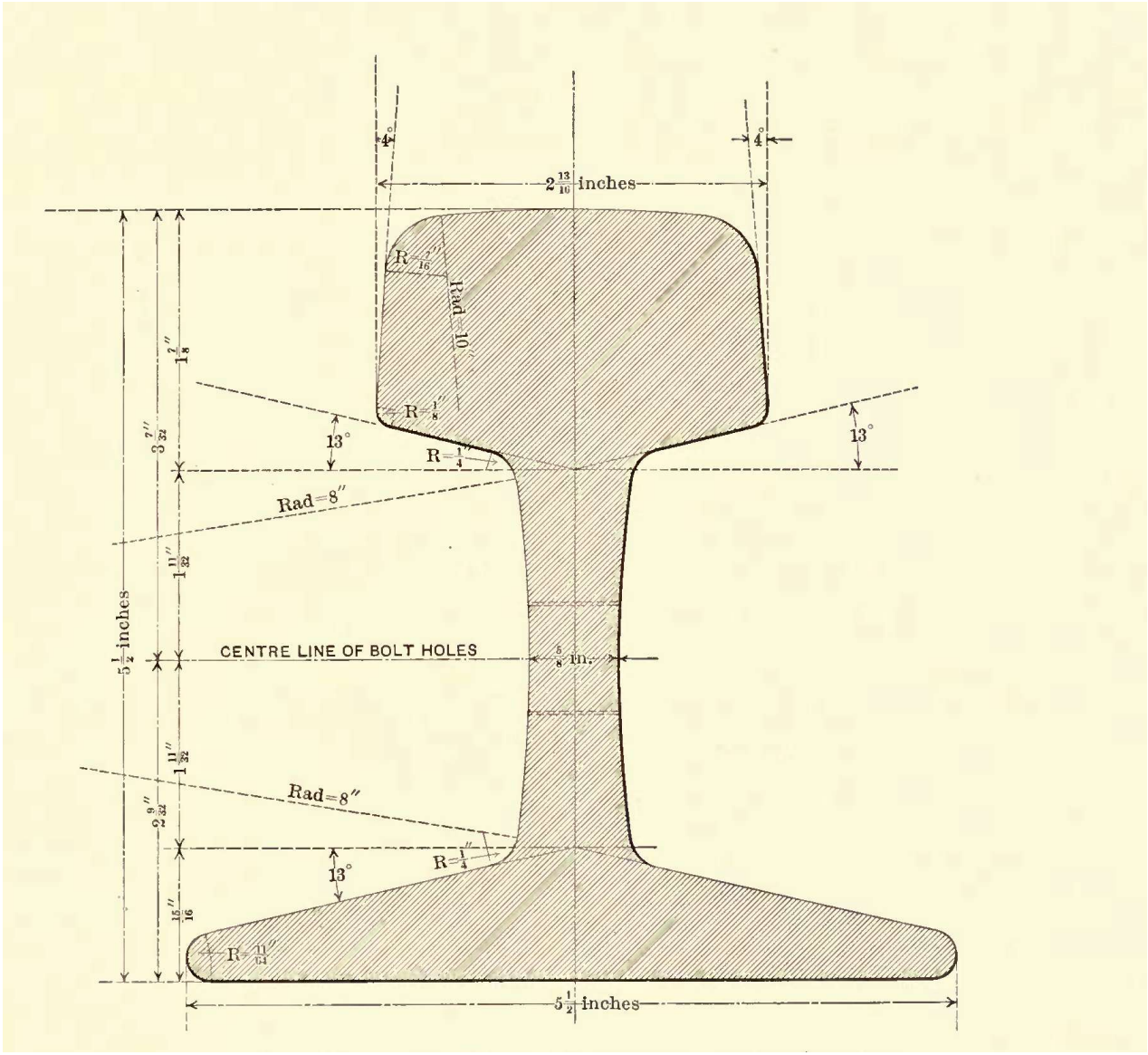
100 lb/yd	Light freight, low use, light rail
120 lb/yd	Lower speed freight, branch lines or rapid transit
127 lb/yd	New York Central Railroad main line
130 lb/yd	Main line service
155 lb/yd	Pennsylvania Railroad

Rail Weights and Sizes

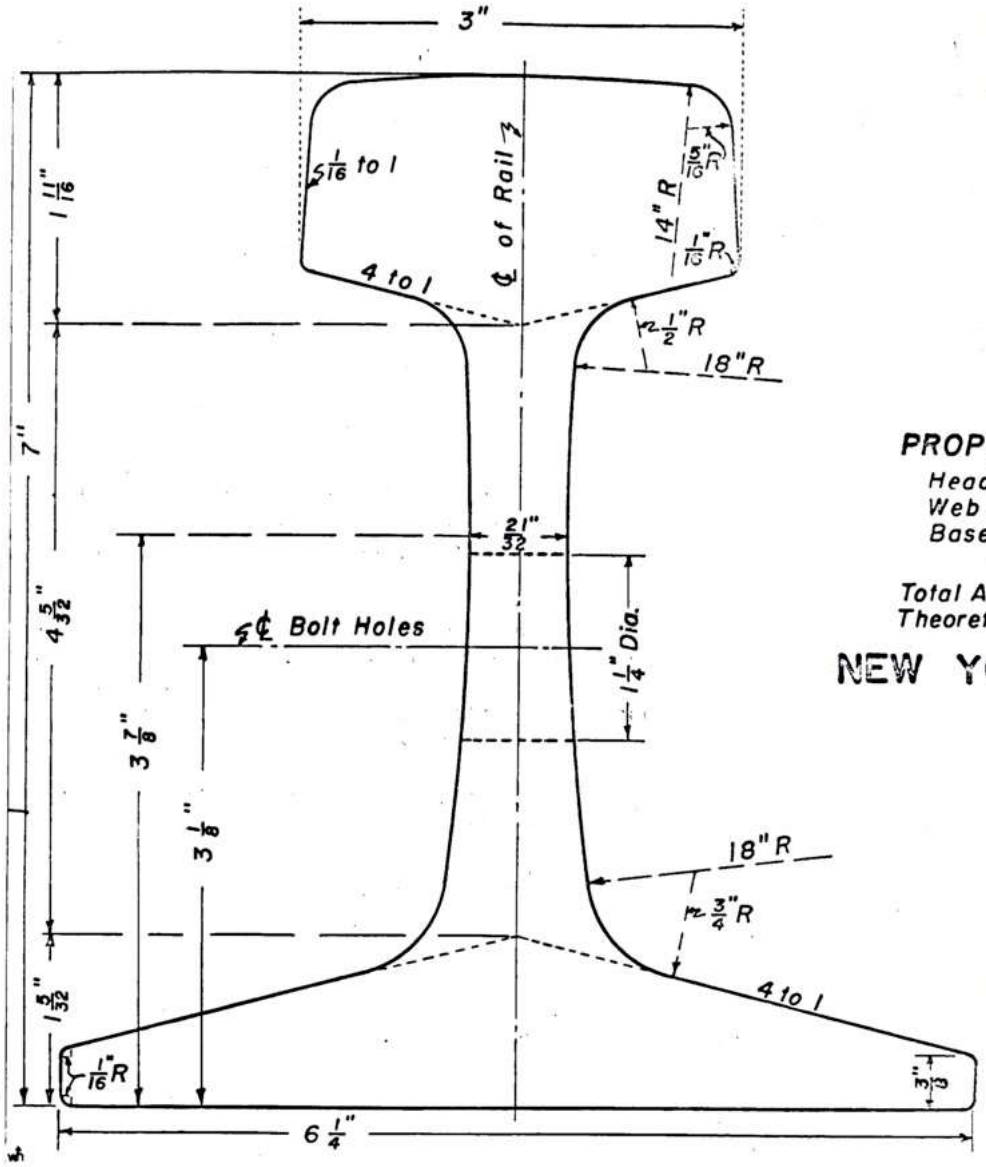


Rail Height = Foot Width

Pennsylvania Railroad profile



New York Central profile



PROPORTIONATE AREAS

Head	35.1 %
Web	25.1 %
Base	39.8 %
Total	100.0 %
Total Area	12.48 sq in
Theoretical Weight	127.0 lbs.

NEW YORK CENTRAL SYSTEM

STANDARD

127 Lb RAIL

Track Structure

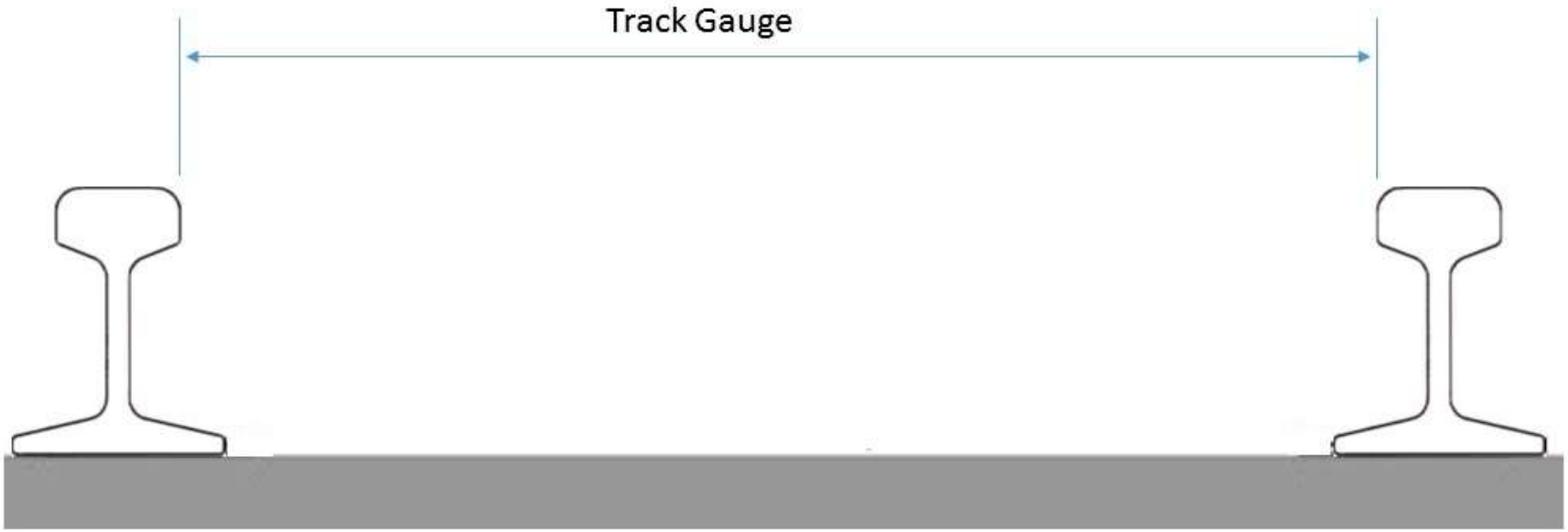
Track Structure

Rail length -- 39 feet in 1880, 75 feet in 1940

Track Structure

Rail length -- 400 yards

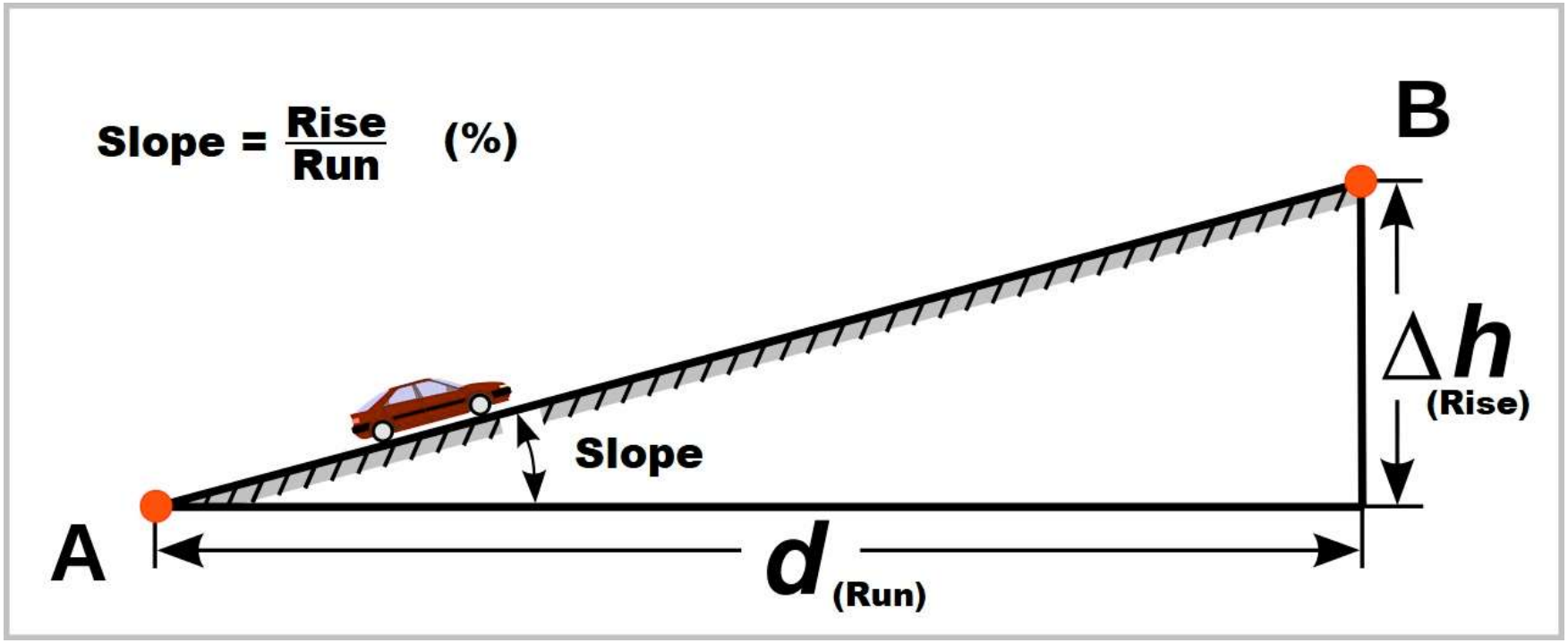
Track Geometry, Gauge



Track Geometry, Common Gauges

Gauge	Installation (miles)	Usage	% world
4 ft, 8 1/2 in	450,000	North America, Central and Northern Europe, Middle East, Northwest Africa, China, Australia, Japan (Shinkansen)	55
4 ft, 11 27/32 in	140,000	Russia, Central Asia	17.2
5 ft, 6 in	83,000	India, South Asia, Agentina, Chile, San Fransisco	11.4
3 ft, 6 in	70,000	Southern and Central Africa, Indonesia, Japan, Taiwan, Philippines, New Zealand, Australia	9
3 ft, 3 3/8 in	59,000	Brazil, South America, Spain, Switzerland, Thailand, Indochina, Bangladesh, East Africa	7

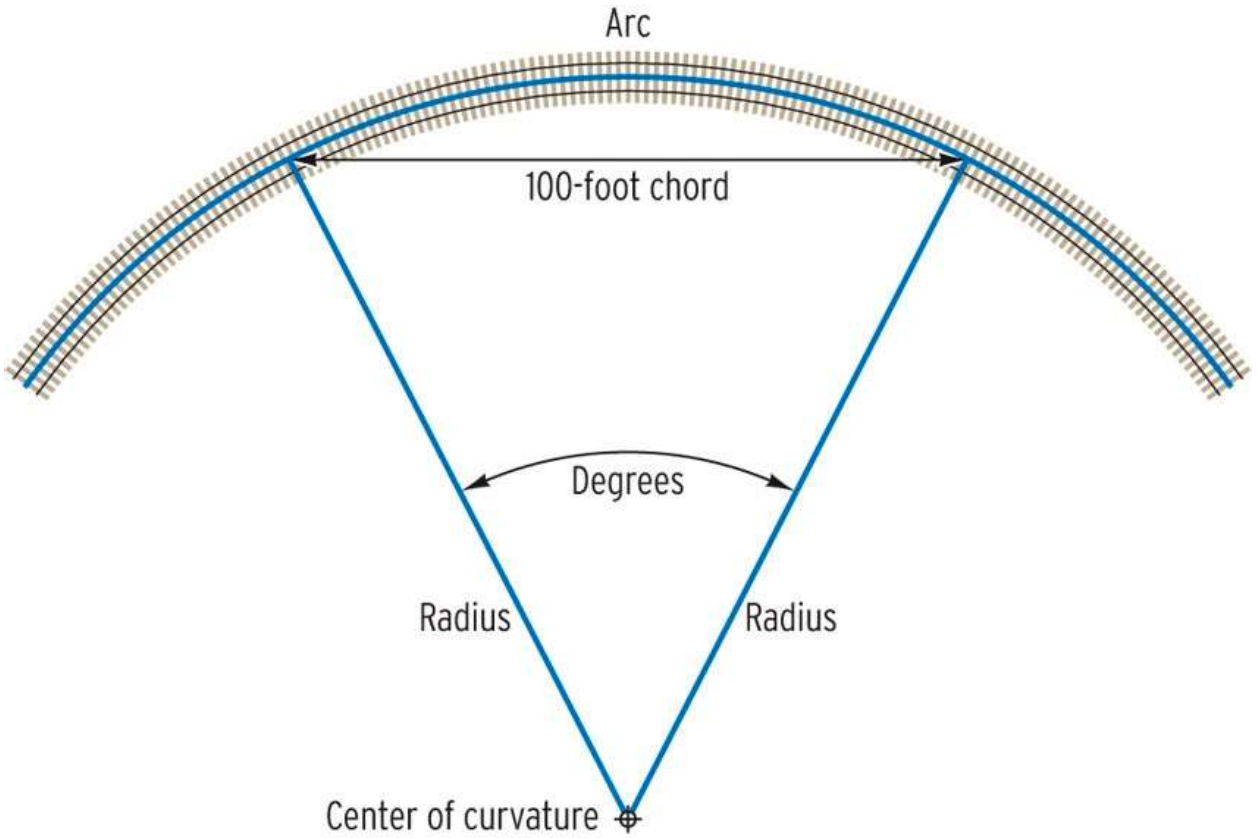
Track Geometry, Grades



Example: 100 foot run with 3 feet rise is 3/100 = 0.03 or 3.0%

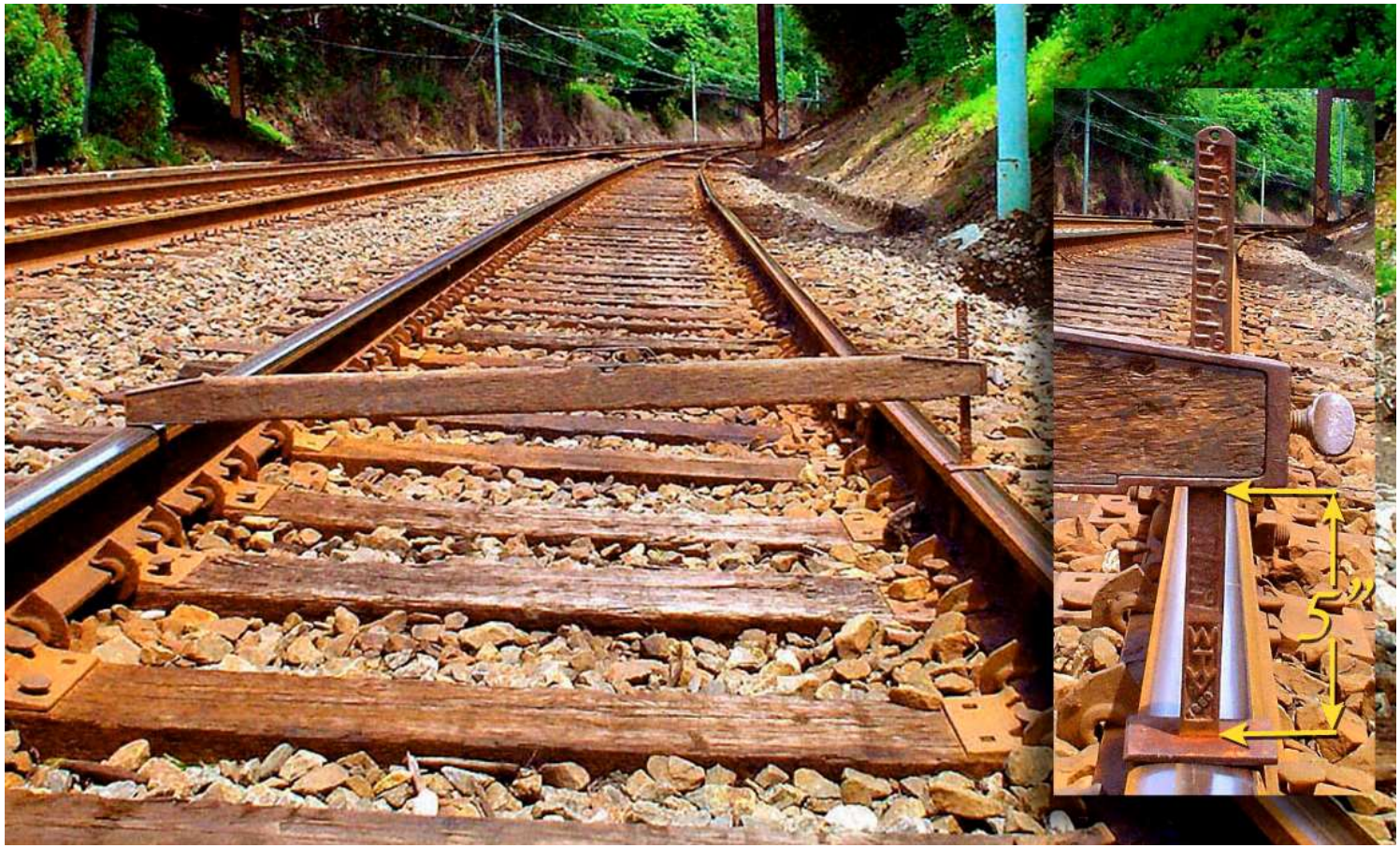
Steepest mainline grade in the US is the Saluda grade NC at 5.1%

Track Geometry, Curves



Degree of curve	Radius	Application
1° 00'	5730 feet	Mainline Freight
7° 30'	764 feet	Yards
12° 30'	459 feet	Slow Speed Spurs

Track Geometry, Cant



-- Improve distribution of the load across both rails
-- Reduce wear on rails and wheels
-- Neutralize the effect of lateral forces
-- Improve passenger comfort

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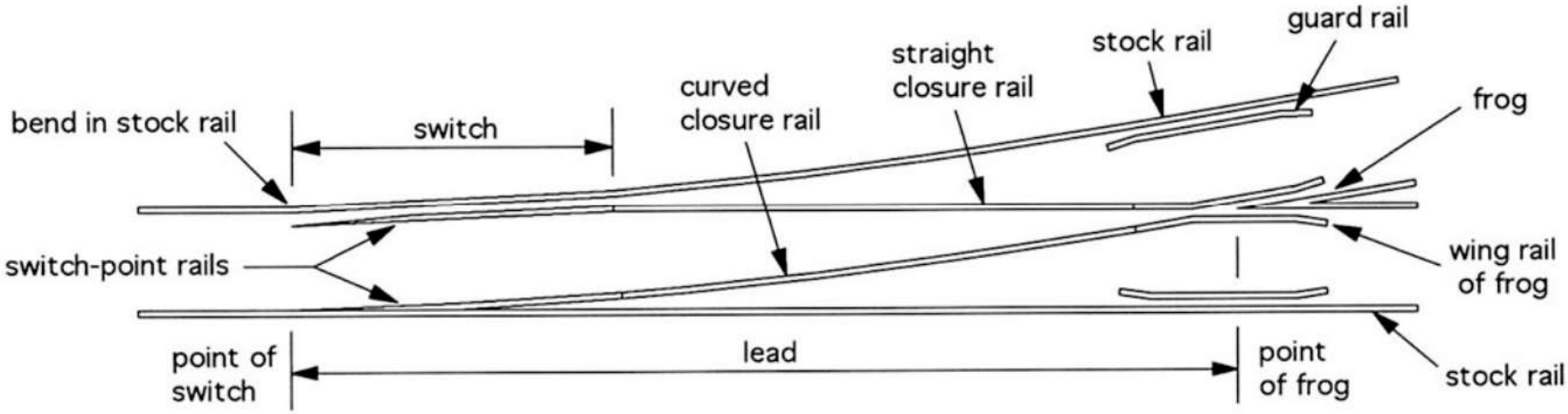
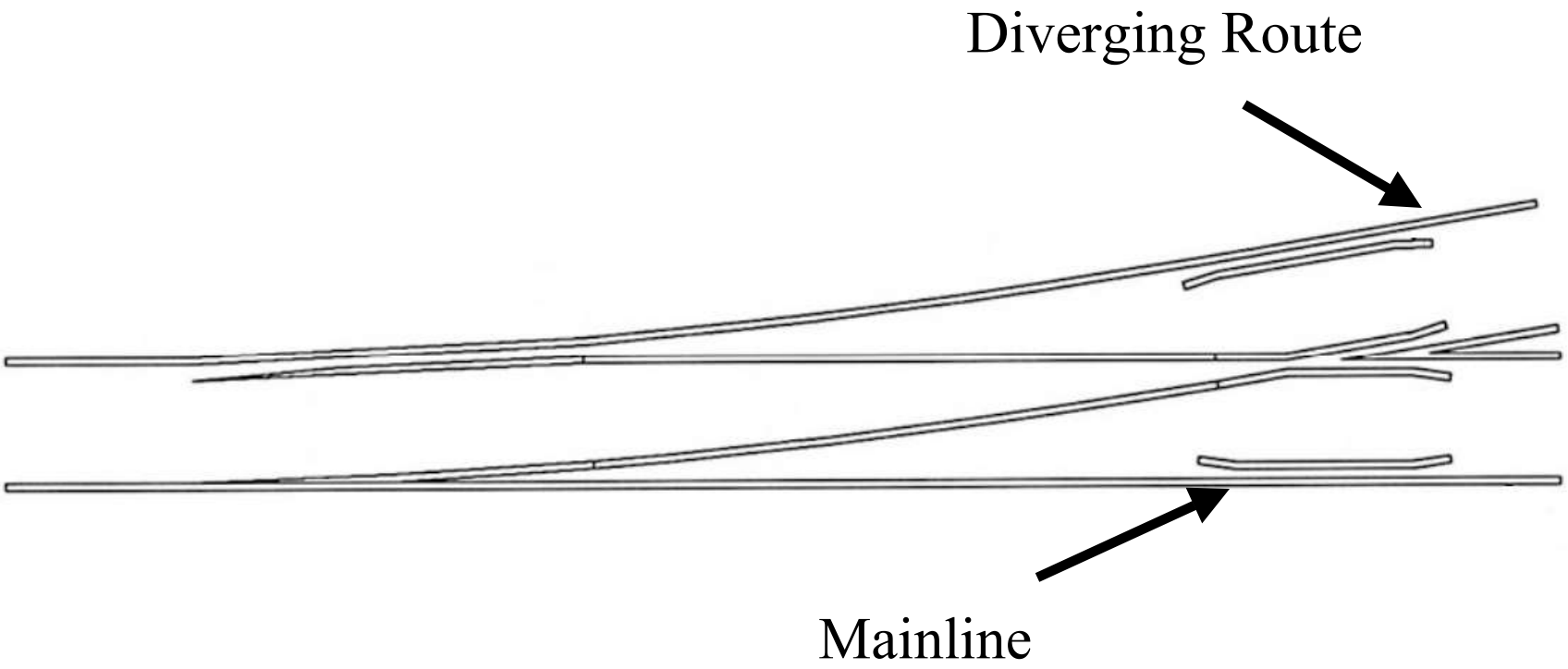
- Narrow gauge tried and failed

Switches (a.k.a. Turnouts)

Parts of a Switch



Direction of Travel



Switch Frog

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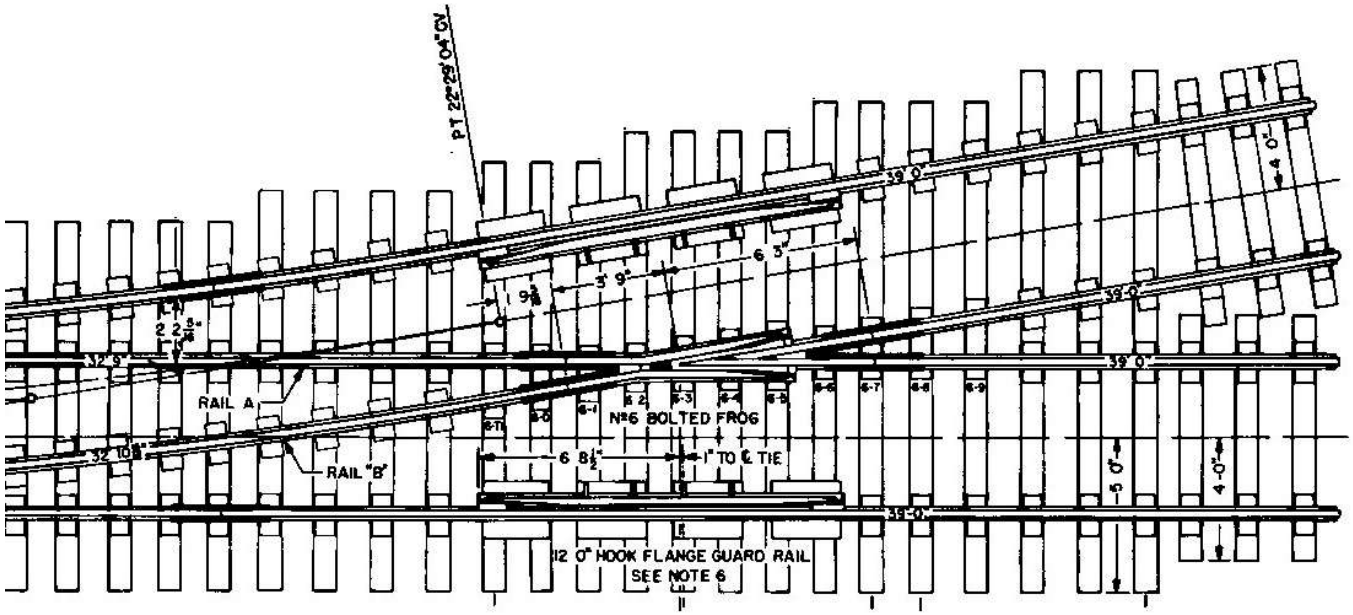

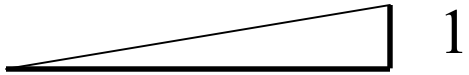

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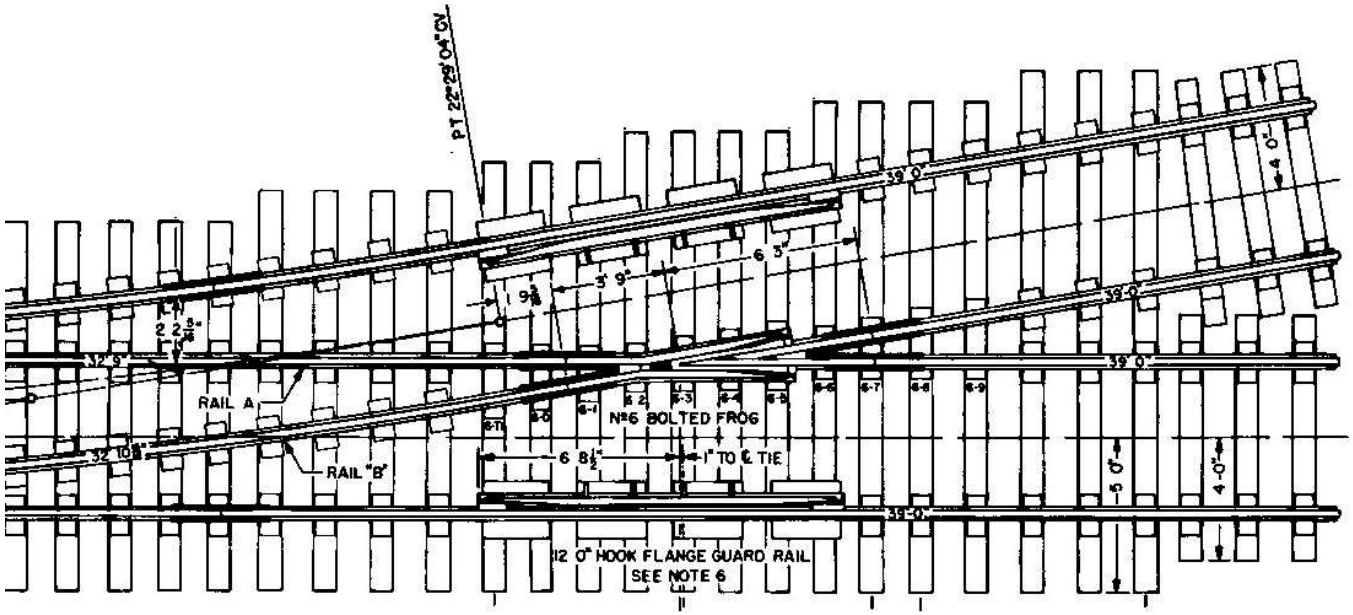
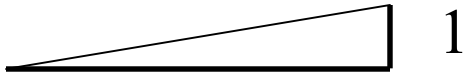
6

#6 Frog

Switch Frog





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6

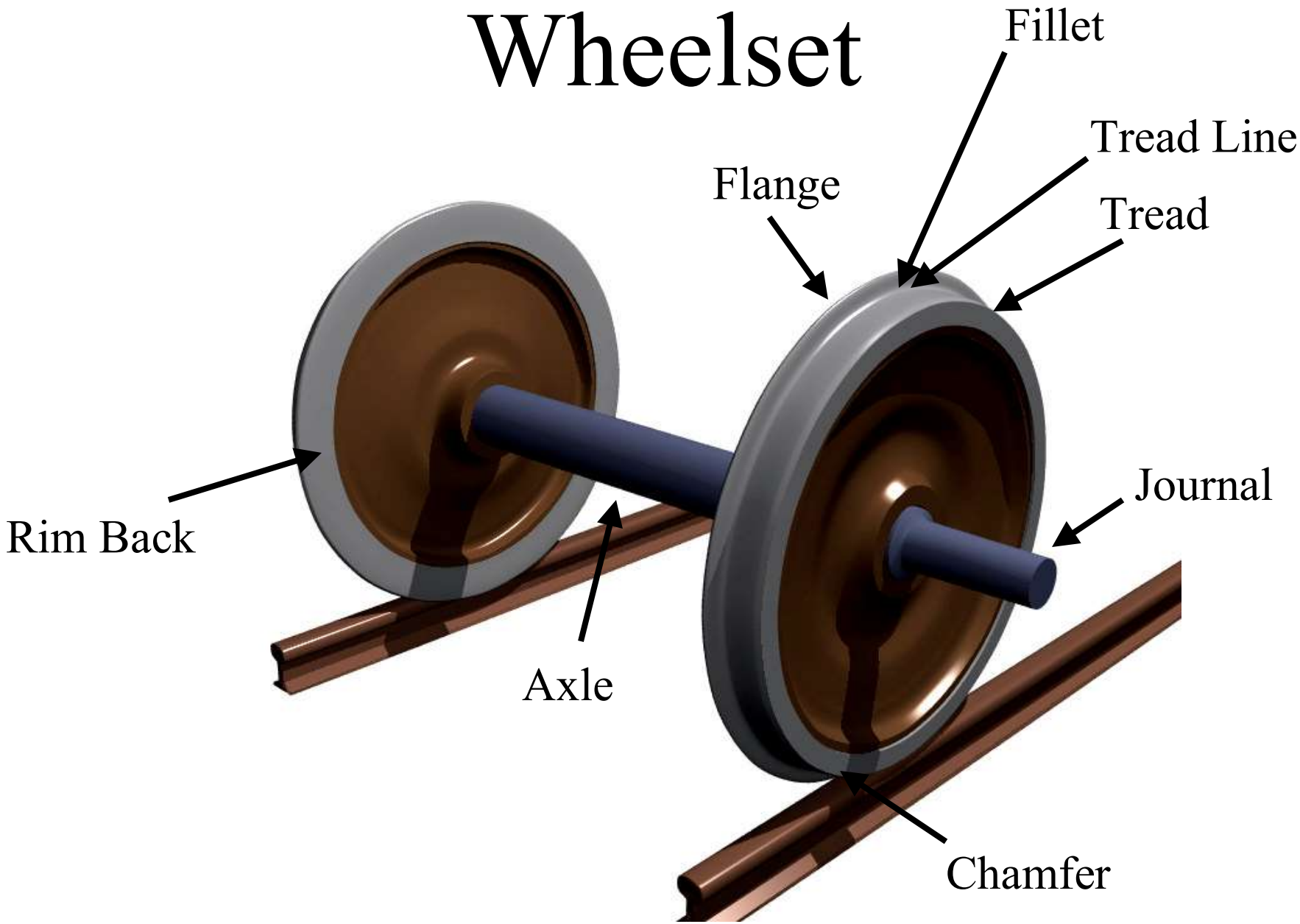
#6 Frog

Frog #	Angle in degress	Radius in inches G Scale	Radius in feet prototype
4	14.04	56	151
6	9.46	126	339
8	7.13	224	603
10	5.71	350	942
12	4.76	504	1356

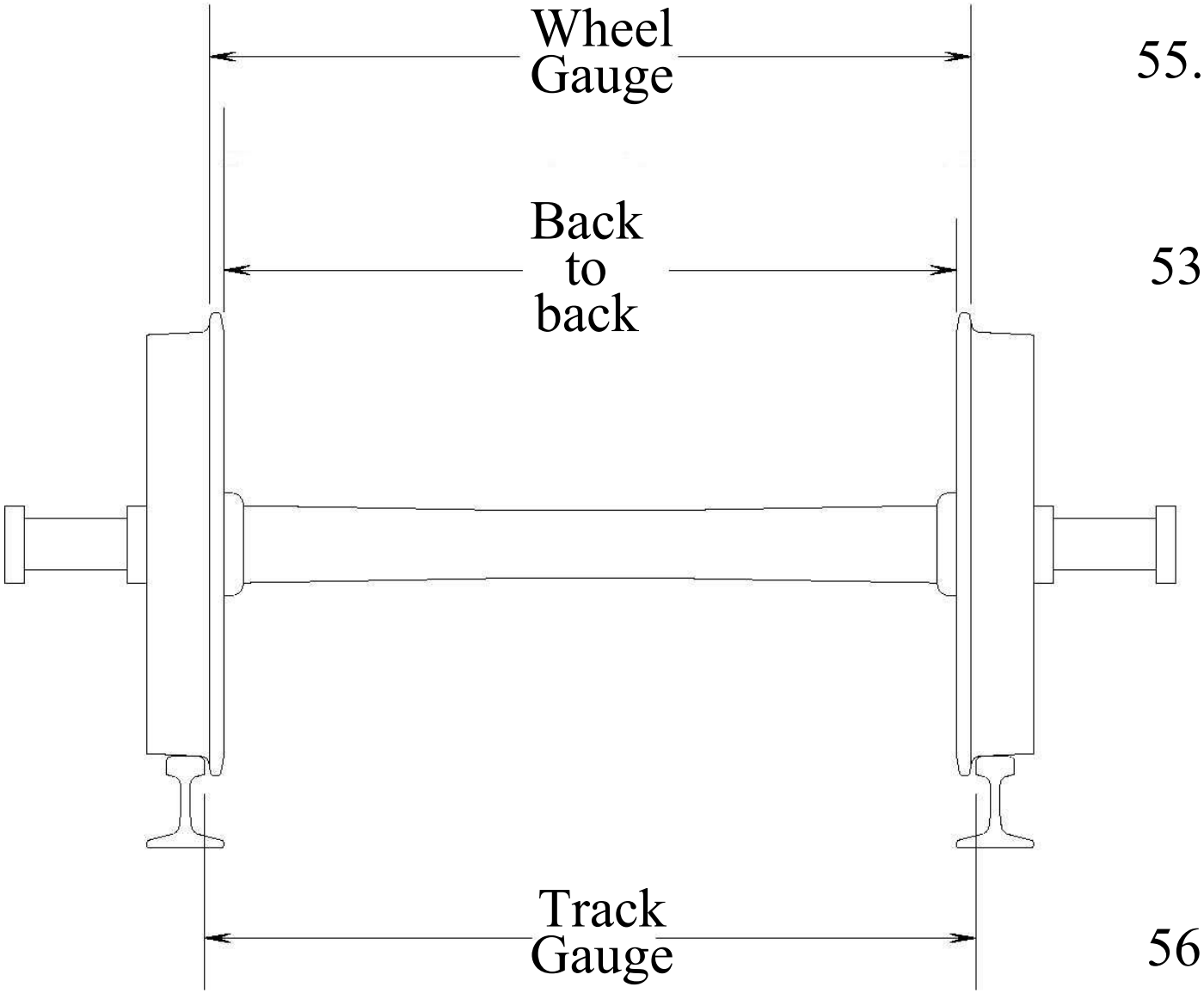
Stub Switch

Wheels

Wheelset

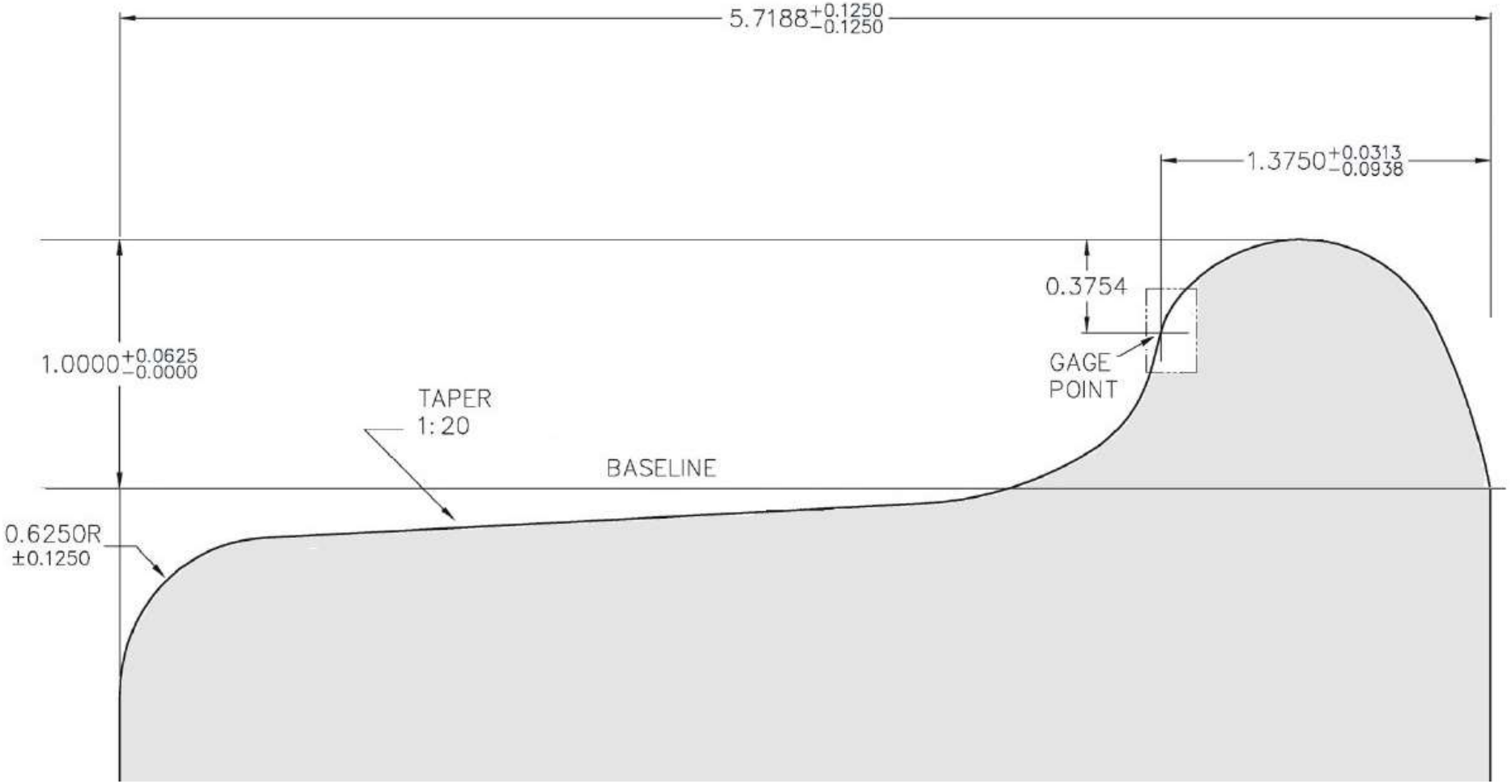

Fillet
Tread Line
Flange
Tread
Journal
Rim Back
Axle
Chamfer

Wheel Gauge



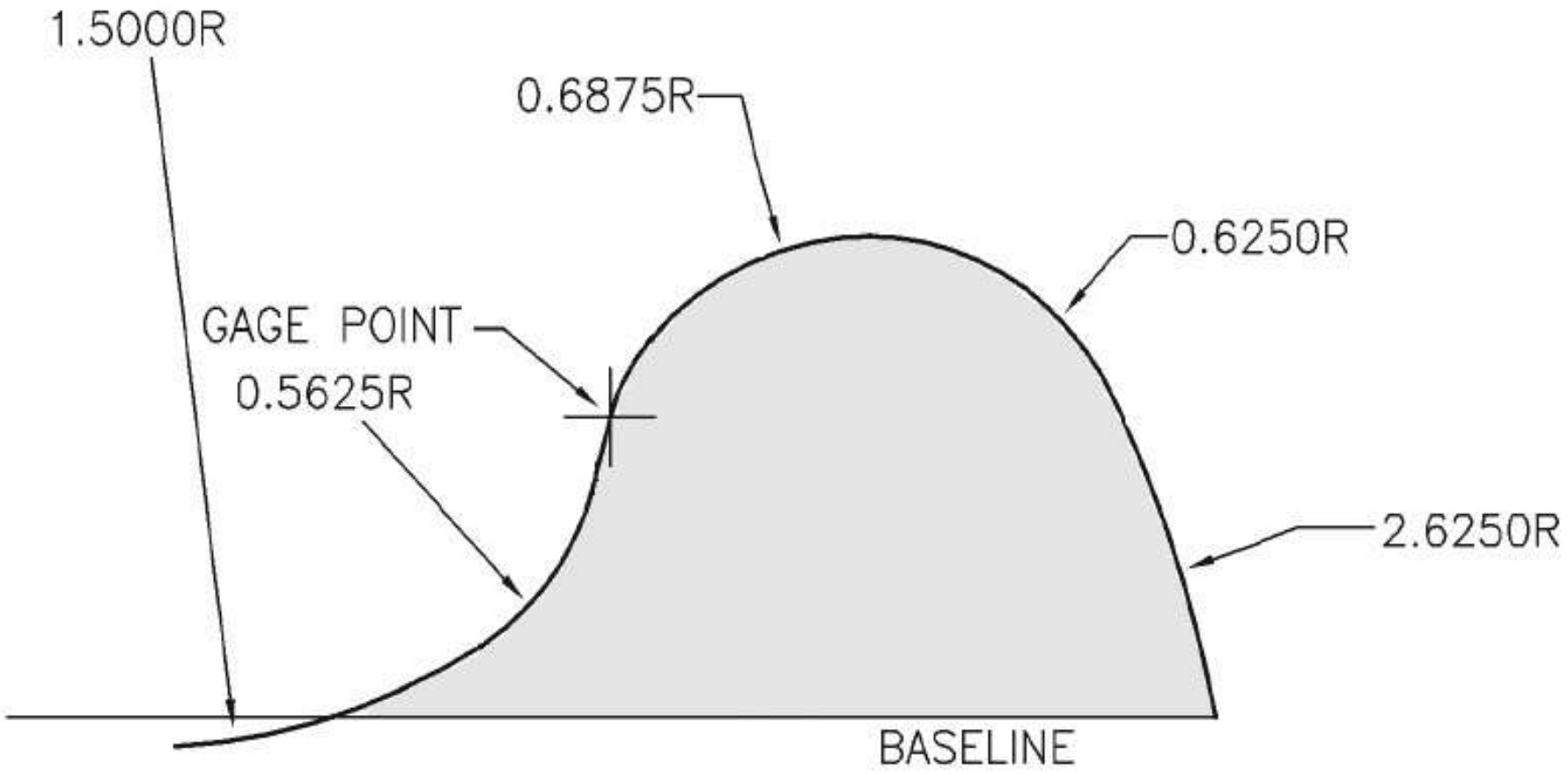
Wheel Profile

wide flange

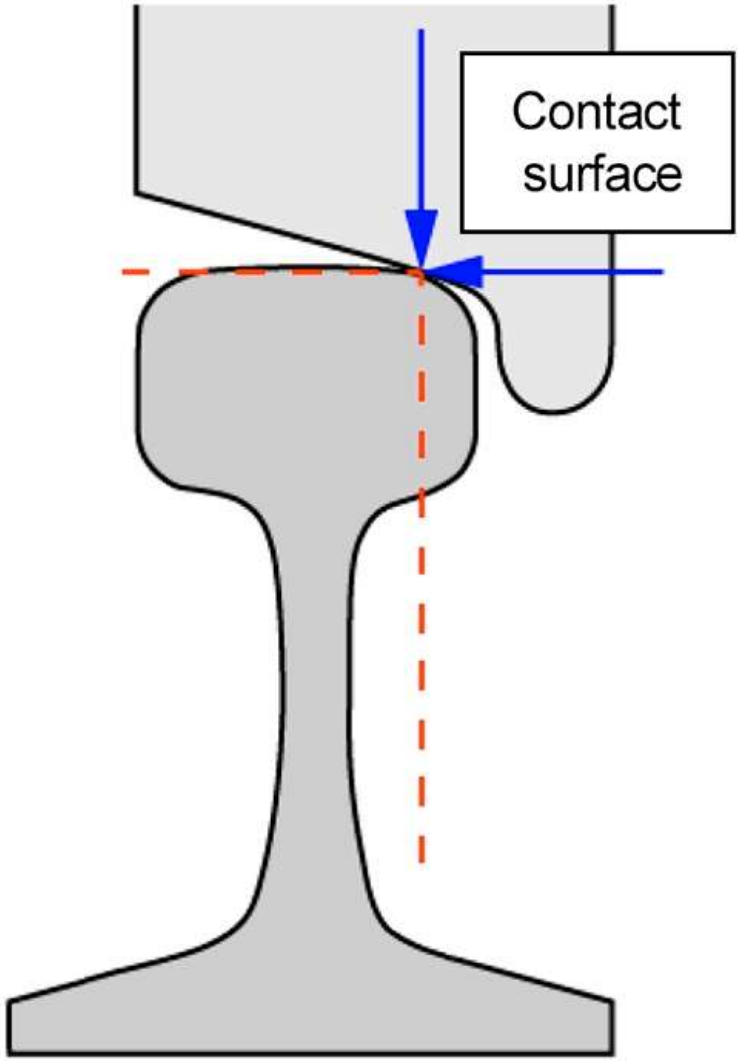


Wheel Flange

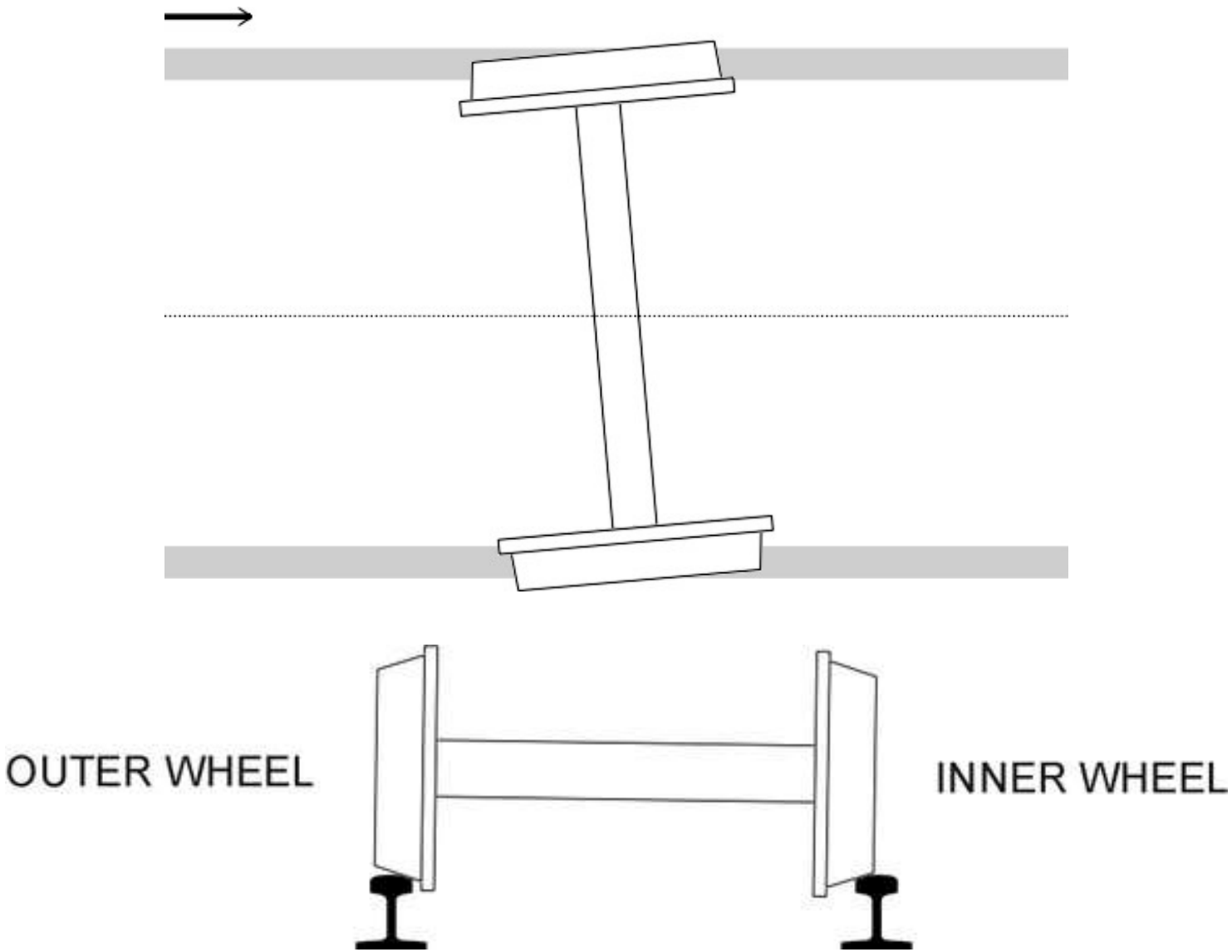
wide



Wheel Contact



Hunting Oscillation

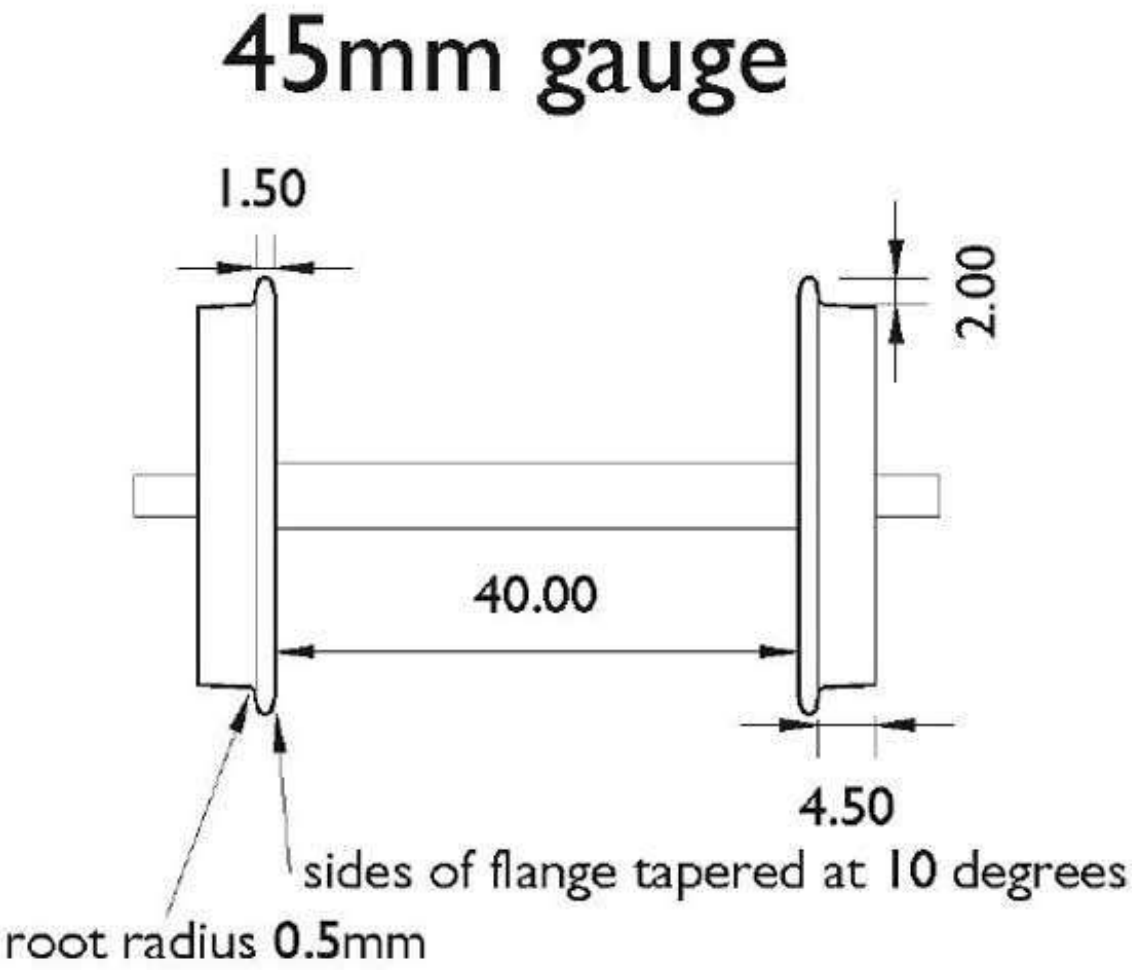


“Garden” Gauge Practice

Published Practices

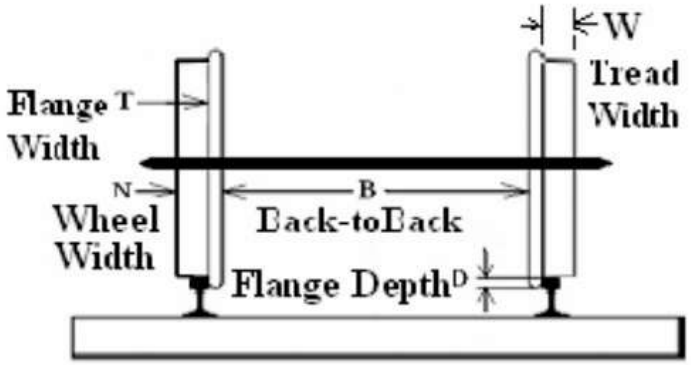
- Association of 16mm Narrow Gauge Modelers (16mm)
- National Model Railroad Association (NMRA)
- Gauge One Model Railway Association (G1MRA)

16mm Practice



NMRA Practice

Standard S-4.2, Regular Flange

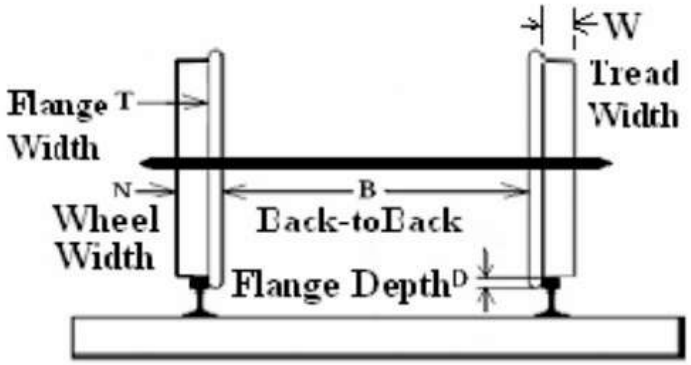


Scale	Scale Ratio	Standard S-4.2 Wheels using (inch) Tolerance								
		B			N		D	T		
		Target	Plus	Minus	Min	Max	Max	Nom	Plus	Minus
LS	Varied	1.575	0.019	0.005	0.236	0.271	0.066	0.059	0.002	0.018

Scale	Scale Ratio	Standard S-4.2 Wheels using Metric (mm) Tolerance								
		B			N		D	T		
		Target	Plus	Minus	Min	Max	Max	Nom	Plus	Minus
LS	Varied	40.01	0.48	0.13	5.99	6.88	1.68	1.50	0.05	0.46

NMRA Practice

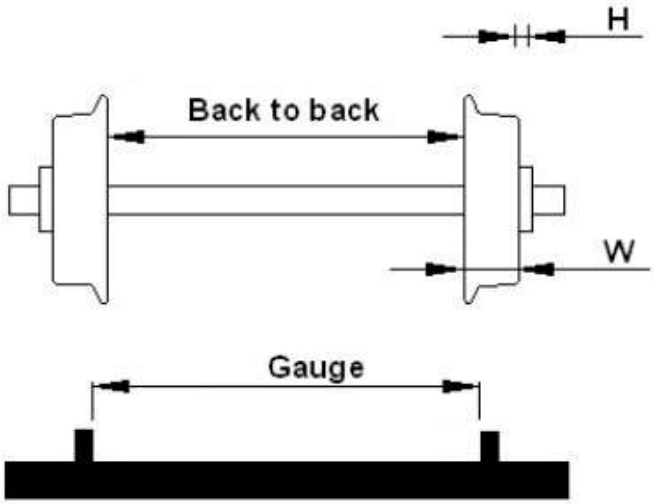
Standard S-4.3, Deep Flange

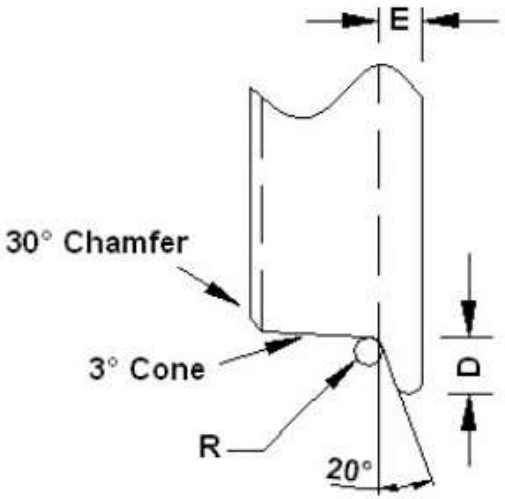


Scale	Scale Ratio	**Standard S4.3** Wheels using **Imperial (inch)** Tolerance								
		B			N		D	T		
		Target	Plus	Minus	Min	Max	Max	Nom	Plus	Minus
LSdf	Varied	1.575	0.019	0.015	0.236	0.271	0.118	0.074	0.002	0.014

Scale	Scale Ratio	**Standard S4.3** Wheels using **Metric (mm)** Tolerance								
		B			N		D	T		
		Target	Plus	Minus	Min	Max	Max	Nom	Plus	Minus
LSdf	Varied	40.00	0.48	0.38	6.00	6.88	3.00	1.88	0.05	0.36

G1MRA Practice





Description	MM		Inches	
Gauge	45.0	+0/-0.5	1.772	+0 / -0.020
Back to Back	40.0	+0.5/-0	1.574	+0.020/-0
W - Wheel width	6.0	+0/-0.5	0.236	+0/-0.020
H - Hub projection	0.5	+/- 0	0.020	+/-0
D - Flange depth	2.0	max	0.079	max
E - Flange width	1.5	+0/-0.5	0.060	+0/-0.020
R - Root Radius	0.5	min	0.020	min

Conclusion

- Back to Back, tread width and flange widths are all nearly identical
- Flange depths vary
- Only G1MRA specifies tread angle and flange angle

- G1MRA preferred.

Questions??