Memorandum

U.S. Department
of Transportation

**Federal Railroad
Administration**

Date: MAY 6 1996 Reply to Attn of: T-96-01

Subject: Improper Application of Uniform Section Rail Joint Bar
Original Issue Number and Date: TB-82-56, 9/3/82
Reissued: 1/1/83 and 7/1/85

From: Edward R. English
Director, Office of Safety
Assurance and Compliance

To: All Regional Administrators, Deputy Regional Administrators,
Supervisory Railroad Safety Specialists (Track), and
Federal and State Track Inspectors

Technical Instructions:

In 1996, the Track Technical Resolution Commitee recommended that FRA, together with its industry partners, form a task force to review the interchangeability of joint bars. In the meantime, this bulletin is in effect.

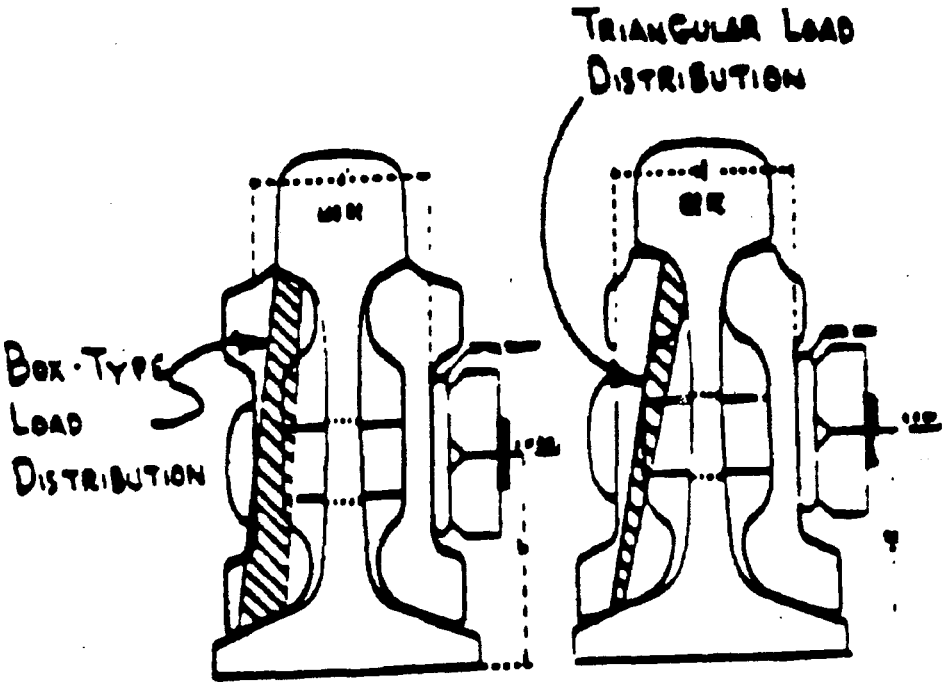
The use of a uniform section joint bar of headfree design on a rail section other than for designed constitutes a deviation from Standard: Title 49 CFR 213.121(a); "Each rail joint, insulated joint, and compromise joint must be of the proper design and dimensions for the rail on which it is applied."

The use of a uniform section joint bar of head contact design on a rail section other than for designed may constitute a deviation from Standard. Specifically, the use of a 112-pound RE section head contact bar on 115 pound RE and 119-pound RE section rail is a deviation from Title 49 CFR 213.121(a).

Definitions:

1) Head Contact Joint: The head contact bar supports the rail ends by a box-type construction, carrying the load between the underside of the head and the base of the rail, (see Figure 1).

2) Head Free Joint: The head free joint bar does not contact the underside of the rail head, but instead contacts the rail in the fillet area. The load distribution is referred to as a triangular load distribution (see Figure 2).



Head Contact Joint
Figure 1

Head Free Joint
Figure 2

The differences between the head contact joint bar and the head free joint bar are significant.

It is evident the joint bar and the rail do not bend or flex exactly with each other along their length. Tests and measurements show that for Positive Bending (Figure 3), there exists a downward bearing pressure of the under side of the head of the rail on the top surface of the joint bars for some distance along the bar away from the rail end, (approximately 2 inches), and also an upward bearing pressure of the upper surface of the base of the rail at parts of the length of the bar further away from the rail end, (bearing distance approximately 3 inches). The converse is true for Negative Bending, (Figure 3).

Consequences:

The headfree joint bar accepts bearing and shear forces from vertical loads in the rail's upper fillet. A head contact bar is not designed to fit into the filet.

The head contact joint bar accepts bearing from vertical loads on the flat underside of the rail's head: generally on a 1 to 4 slope. It is not designed to seat into the rail's upper filet.

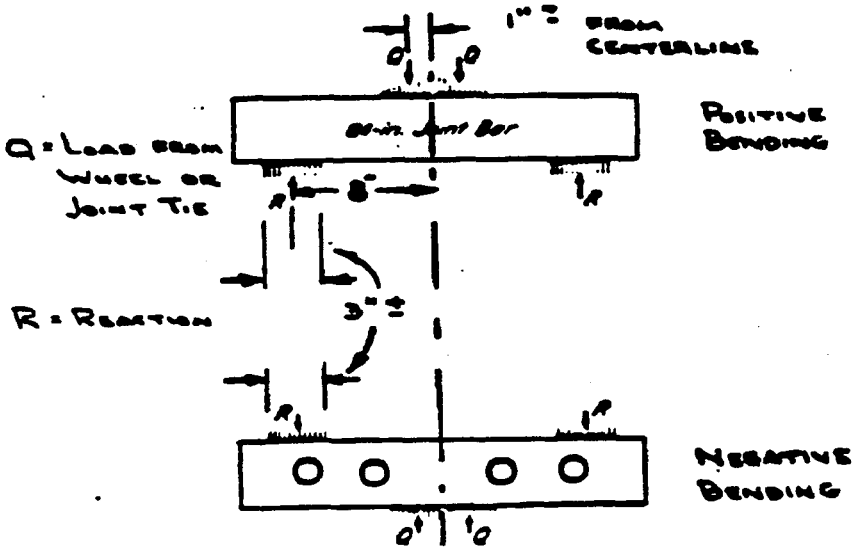


Figure 3

Although the vertical fishing dimension for the 112 and 115 RE rail sections is identical (3 3/16 inches), the head filet radius is different:

For the 115-pound section, radius equals 3/4 inch
For the 112-pound section, radius equals 3/8 inch

As shown in Figures 4 and 5 the 112 headfree bar fits the 115 rail filet practically at a point, most probably inducing joint bar stresses in excess of design. The 115 headfree bar does not fit into the 112 fillet but bears in a very small area beneath the head of the rail, most probably inducing joint bar stresses in excess of design and exerting a wedge action between the rail head and rail web, promoting head-web defects.

In addition, the joint bar may experience a twist, or torsional force from the tightening of the track bolts. The torsional stress from twist will be the greatest at the head and toe of the bar at the rail ends.

Figure 6 depicts an exception to the non-use of a uniform section joint bar of head contact design on a rail section other than for designed. A 131-pound or 132-pound head contact joint bar may be used in lieu of a 131/132 or 131/136 compromise joint bar if rail drilling and joint bar punching are similar. The width of the rail head is sufficient to allow full contact in the upper fishing wear surface.

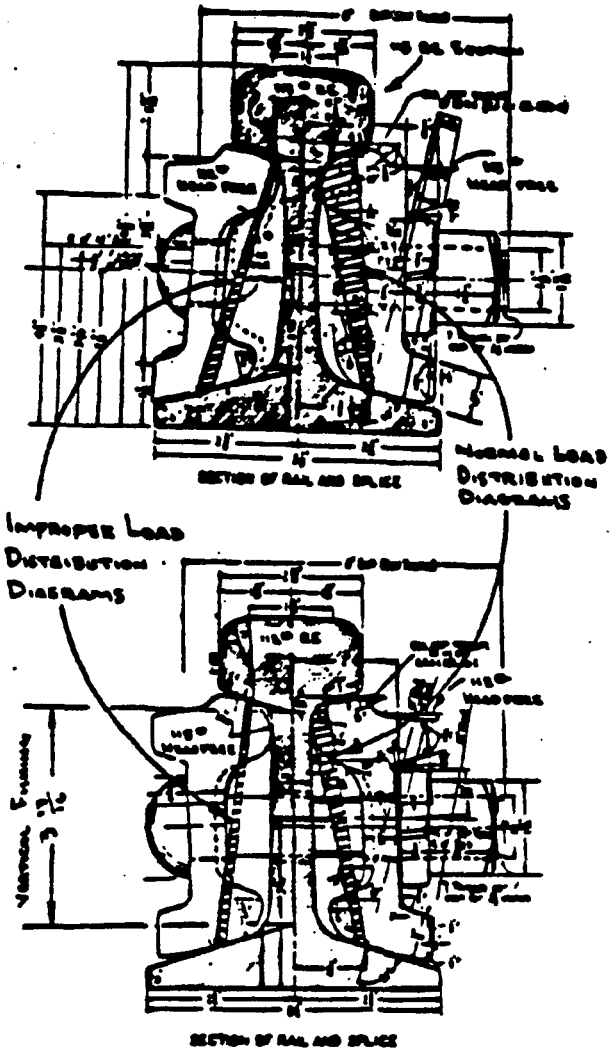


Figure 4

And Figure 5

Summary

1) 112-pound RE joint bars should not be used as compromise joint bars between 112 RE and 115 RE rail.

2) 115 pound RE joint bars should not be used as compromise joint bars between 112 RE and 115 RE rail.

3) 131 RE head contact bars or 132 RE head contact bars may be used as compromise joint bars between 131 RE and 132 RE rail or 136 RE rail where rail drilling and joint bar punching are similar. (Note: FRA Standards do not prohibit the track owner from field drilling bolt holes to fit).

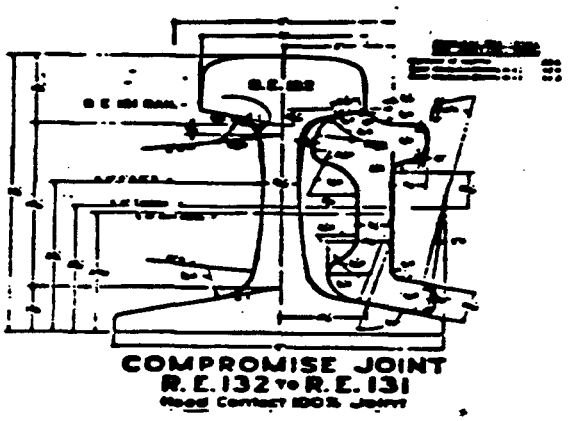


Figure 6

Refer to the following Table for variances in rail sections, giving particular attention to dimension H, height of rail, and dimension F, vertical fishing dimension. The table does not contain the rail section filet radius. Refer to the track owner's standard plan for filet dimension. The attached drawings provide examples of head free and head contact bar designs.

Epilog

While this bulletin directly discusses compromise joint bars, it is stressed that 112 RE bars are not to be used on 115 RE and 119 RE rail and vice versa. 131 RE headfree and 132 RE headfree joint bars, or 131 RE headfree and 136 RE headree joint bars are not interchangeable and are not to be intermixed.

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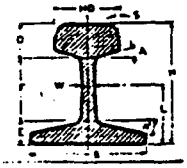
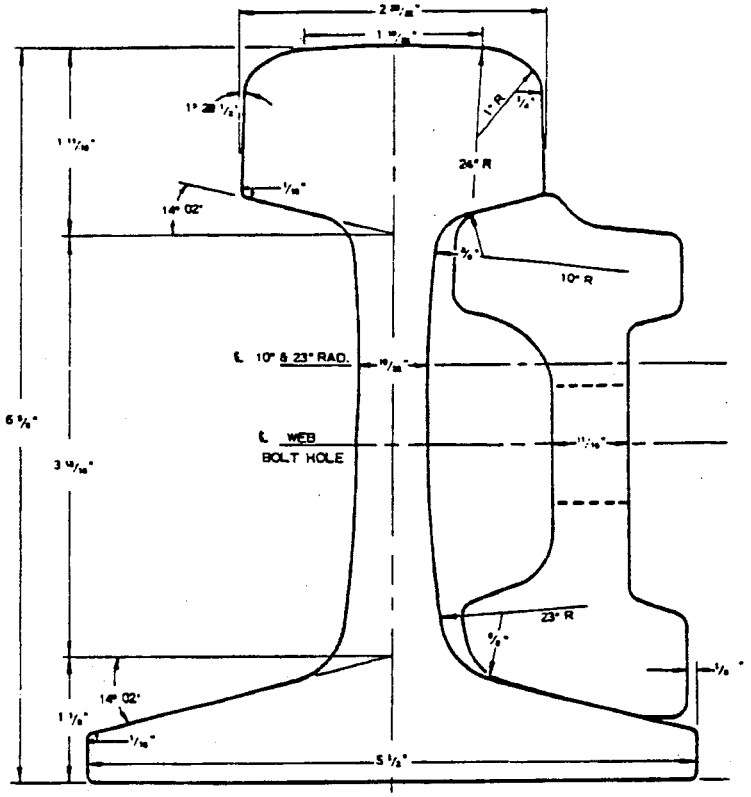
Attachment

cc. D. Hollingsworth, Louisville
S. Fender, Denver

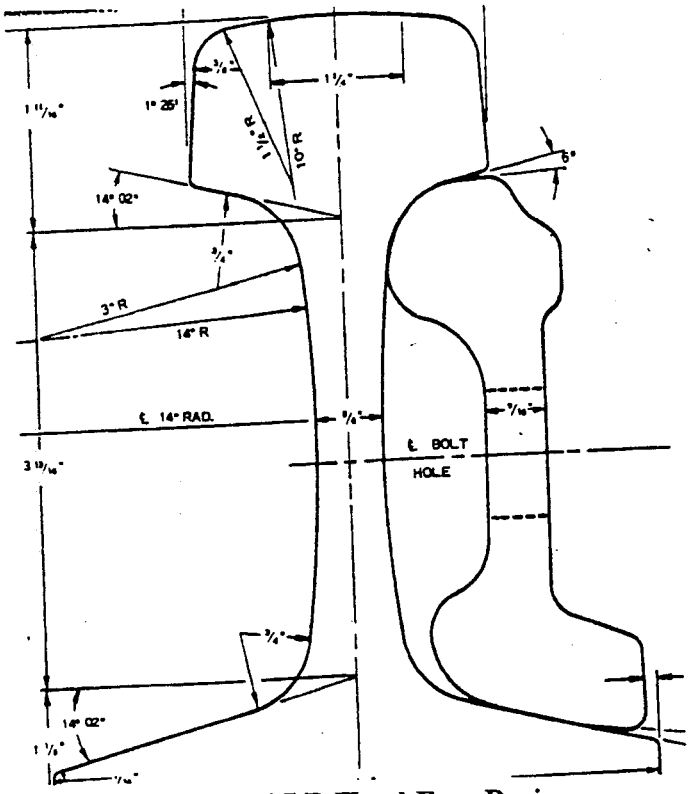
Type	Wgt. per Yard	Height H	Base B	Head HD	Web W	Depth of Head D	Fishing F	Depth of Base E	Head Angle A	Base Angle A^2	Slope of Head S	Bottom of Rail to C. L. Web Rad. L.	U. S. Steel Corp. and T.C.I. Div.	Bethlehem Steel Co.	Colorado F. & I. Co.	Inland Steel Co.
A R E A *	136	7 5/16	6	2 15/16	11/16	1 15/16	4 3/16	1 3/16	1 to 4	1 to 4	1 to 4					
A. R. E. A.	140	7 5/16	6	3	5/8	2 1/16	4 1/16	1 3/16	1 to 3	1 to 3	14°	4	14031	140-RE	.....	.....
"	133	7 1/16	6	3	11/16	1 15/16	3 15/16	1 3/16	"	"	"	3 3/4	13331	133-RE	1330	13331
" *	132	7 1/8	6	3	21/32	1 3/4	4 3/16	1 3/16	1 to 4	1 to 4	1 to 40	3 7/8	13225	132-RE	1321	13225
"	131	7 1/8	6	3	21/32	1 3/4	4 3/16	1 3/16	"	"	"	4 1/4	13128	131-RE	1311	13128*
"	130	6 3/4	6	2 15/16	21/32	1 27/32	3 11/16	1 7/32	"	"	1 to 16	3 3/8	13025*	130-RE	1300*	13025*
" *	115	6 5/8	5 1/2	2 23/32	5/8	1 11/16	3 13/16	1 1/8	"	"	1 to 40	3 1/4	11525	115-RE	1150	11525
"	112	6 5/8	5 1/2	2 23/32	19/32	1 11/16	3 13/16	1 1/8	"	"	"	3 3/4	11228	112-RE	1121	11228*
"	110	6 1/4	5 1/2	2 25/32	19/32	1 23/32	3 13/32	1 1/8	"	"	1 to 16	3 1/8	11025	110-RE	1100	11025*
" *	100	6	5 3/8	2 11/16	9/16	1 21/32	3 9/32	1 1/16	"	"	"	2 31/32	10025	100-RE	10025	10025
A. R. A.-A.	100	6	5 1/2	2 3/4	9/16	1 9/16	3 3/8	1 1/16	1 to 4	1 to 4	"	2 15/16	10020	100-RA	1003	10020*
" *	90	5 5/8	5 1/8	2 9/16	9/16	1 15/32	3 5/32	1	"	"	"	2 29/32	9020	90-RA	902	9020
"	80	5 1/8	4 5/8	2 1/2	33/64	1 7/16	2 23/32	31/32	"	"	"	2 9/16	8020*	80-RA	801*	.....
"	70	4 3/4	4 1/4	2 3/8	1/2	1 11/32	2 1/2	29/32	"	"	"	2 13/32	7020*	.....	.....	.....
"	60	4 1/2	4	2 1/4	15/32	1 15/64	2 29/64	13/16	"	"	"	2 17/64	6020*	.....	.....	.....
A. R. A.-B.	100	5 41/64	5 9/64	2 21/32	9/16	1 45/64	2 55/64	1 5/64	13°	13°	3°	2 65/128	10030	100-RB	1002	10030
"	90	5 17/64	4 49/64	2 9/16	9/16	1 39/64	2 5/8	1 1/32	"	"	"	2 11/32	9030	90-RB*	905*	.....
"	80	4 15/16	4 7/16	2 7/16	35/64	1 15/32	2 15/32	1	"	"	"	2 15/64	8030*	80-RB*	802*	.....
"	70	4 35/64	4 3/64	2 3/8	33/64	1 23/64	2 17/64	59/64	"	"	"	2 7/128	7030*	.....	.....	.....
"	60	4 3/16	3 11/16	2 1/8	31/64	1 1/4	2 1/16	7/8	"	"	"	1 29/32	6030*	.....	.....	.....
A. S. C. E.	100	5 3/4	5 3/4	2 3/4	9/16	1 45/64	3 5/64	31/32	13°	13°	Str.	2 65/128	10040	100-AS	.....	.....
"	90	5 3/8	5 3/8	2 5/8	9/16	1 19/32	2 55/64	59/64	"	"	"	2 45/128	9040	90-AS	.....	9040
"	85	5 3/16	5 3/16	2 9/16	9/16	1 35/64	2 3/4	57/64	"	"	"	2 17/64	8540	85-AS	851*	8540
"	80	5	5	2 1/2	35/64	1 1/2	2 5/8	7/8	"	"	"	2 3/16	8040	80-AS	800*	8040
"	75	4 13/16	4 13/16	2 15/32	17/32	1 27/64	2 35/64	27/32	"	"	"	2 15/128	7540	75-AS	799*	.....
"	70	4 5/8	4 5/8	2 7/16	33/64	1 11/32	2 15/32	13/16	"	"	"	2 3/64	7040	70-AS	701*	.....
"	65	4 7/16	4 7/16	2 13/32	1/2	1 9/32	2 3/8	25/32	"	"	"	1 31/32	6540	65-AS	653*	.....
"	60	4 1/4	4 1/4	2 3/8	31/64	1 7/32	2 17/64	49/64	"	"	"	1 115/128	6040	60-AS	603*	.....
A. T. & S. Fe.	90	5 5/8	5 3/16	2 9/16	9/16	1 15/32	3 5/32	1	1 to 4	1 to 4	1 to 16	2 29/32	9021*	90-SF*	903*	9021*
Can. Pac.	85	5 1/8	5	2 1/2	9/16	1 7/16	2 11/16	1	"	"	1 to 32	2 11/32	8524*	85-CP	.....	8524*
C. & N. W.	100	5 45/64	5 9/64	2 9/16	9/16	1 39/64	2 61/64	1 9/64	13°	13°	3°	2 79/128	10035*	100-OM	.....	10035*
"	90	5 17/32	5 3/32	2 1/2	1/2	1 17/32	2 31/32	1 1/32	"	"	3/64 : 3/4	2 33/64	9035	90-OM*	.....	.....
C. B. & Q.	85	5 3/16	5 3/16	2 21/32	9/16	1 35/64	2 3/4	57/64	"	"	5°	2 17/64	8545*	85-CB*	852*	.....
C. F. & I. - A.R.E.A.	136	7 5/16	6	2 15/16	11/16	1 15/16	4 3/16	1 3/16	1 to 4	1 to 4	1 to 40	3 7/8	13637	.....	1360	.....
" *	119	6 13/16	5 1/2	2 21/32	5/8	1 7/8	3 13/16	1 1/8	"	"	"	3 1/4	.....	.....	1190	11987
" *	106	6 3/16	5 1/2	2 21/32	19/32	1 3/4	3 3/8	1 1/16	"	"	"	2 15/16	.....	.....	1060	.....
D. L. & W.	118	6 1/2	5 3/8	2 7/8	5/8	1 29/32	3 1/2	1 3/32	13°	13°	3 1/4°	3 13/32	.....	118 DL-M	.....	.....
"	105	6	5 3/8	2 3/4	5/8	1 23/32	3 1/4	1 1/32	"	"	4°	.....	10533*	105-DL	.....	.....
"	101	5 7/16	5 3/8	2 3/4	5/8	1 23/32	2 11/16	1 1/32	"	"	"	2 3/8	10139*	101-DL*	.....	.....
D. R. G. W.	115	6 5/8	5 1/2	2 23/32	3/4	1 11/16	3 13/16	1 1/8	"	"	"	3 1/32	.....	.....	1153*	.....
D. & R. G.	90	5 1/2	5 1/8	2 9/16	9/16	1 5/8	2 7/8	1	14°	14°	4°	2 5/8	.....	.....	906*	.....
"	85	5 1/4	5 1/4	2 1/2	9/16	1 3/4	2 5/8	7/8	13°	13°	"	Str.	.....	.....	850*	.....
Grt. Nor.	110	6 1/2	5 1/2	2 3/4	19/32	1 5/8	3 3/4	1 1/8	1 to 4	1 to 4	1 to 16	3 1/4	11036*	110-GN*	.....	14036*
"	100	5 3/4	5	2 3/4	9/16	1 5/8	3	1 1/8	"	"	"	2 13/16	10036*	100-GN*	.....	.....
"	90	5 3/8	5	2 5/8	9/16	1 15/32	2 7/8	1 1/32	13°	13°	"	2 53/64	9024*	.....	908*	9024*
"	90	5 3/8	5	2 5/8	5/8	1 1/2	2 7/8	1	"	"	5°	2 5/8	9034*	90-GN*	904*	.....
"	85	5	5	2 21/32	21/32	1 19/32	2 1/2	29/32	14°	14°	"	2 5/32	8553*	854*	.....	.....
Headfree	132	7 5/16	6	2 31/32	21/32	1 15/16	4 3/16	1 3/16	1 to 4	1 to 4	1 to 40	4 1/4	13227	132RE-T*	1320	.....
" A. R. E. A.	131	7 1/4	6	2 31/32	21/32	1 7/8	4 3/16	1 3/16	"	"	"	4 1/4	.....	.....	.....	.....
" "	130	6 15/16	6	2 27/32	21/32	2 1/32	3 11/16	1 7/32	"	"	1 to 16	3 3/8	13027*	130RE-T	.....	13027*
" "	113	6 13/16	5 1/2	2 13/16	19/32	1 7/8	3 13/16	1 1/8	"	"	1 to 40	3 3/4	11327	113RE-T*	1130	.....
" "	112	6 3/4	5 1/2	2 11/16	19/32	1 13/16	3 13/16	1 1/8	"	"	"	3 3/4	11227*	.....	.....	11227*
" "	110	6 7/16	5 1/2	2 11/16	19/32	1 29/32	3 13/32	1 1/8	"	"	1 to 16	3 1/8	11027*	110RE-T*	.....	11027*
" "	100	6 1/16	5 3/8	2 39/64	9/16	1 23/32	3 9/32	1 1/16	"	"	"	2 31/32	.....	100RE-T	.....	.....
" A. R. A.-A.	100	6 5/32	5 1/2	2 11/16	9/16	1 23/32	3 3/8	1 1/16	"	"	"	2 15/16	.....	100RA-T*	.....	.....
" "	90	5 25/32	5 1/8	2 31/64	9/16	1 5/8	2 57/64	1	"	"	"	2 29/32	9027	.....	909*	.....
Interb'gh	100	5 3/4	5 3/4	2 7/8	9/16	1 45/64	3 5/64	31/32	13°	13°	8°	2 65/128	10005*	100-RT*	.....	.....
"	90	5	5	2 7/8	11/16	1 25/32	2 11/32	7/8	"	"	"	2 1/16	9050*	90-RT	.....	.....
K. Cy. Sou.	85	5 3/8	4 7/8	2 17/32	17/32	1 29/64	2 15/16	63/64	1 to 4	1 to 4	1 to 16	2 23/32	8521*	85-NK*	.....	8521*

*Not rolled now—Rolls destroyed.

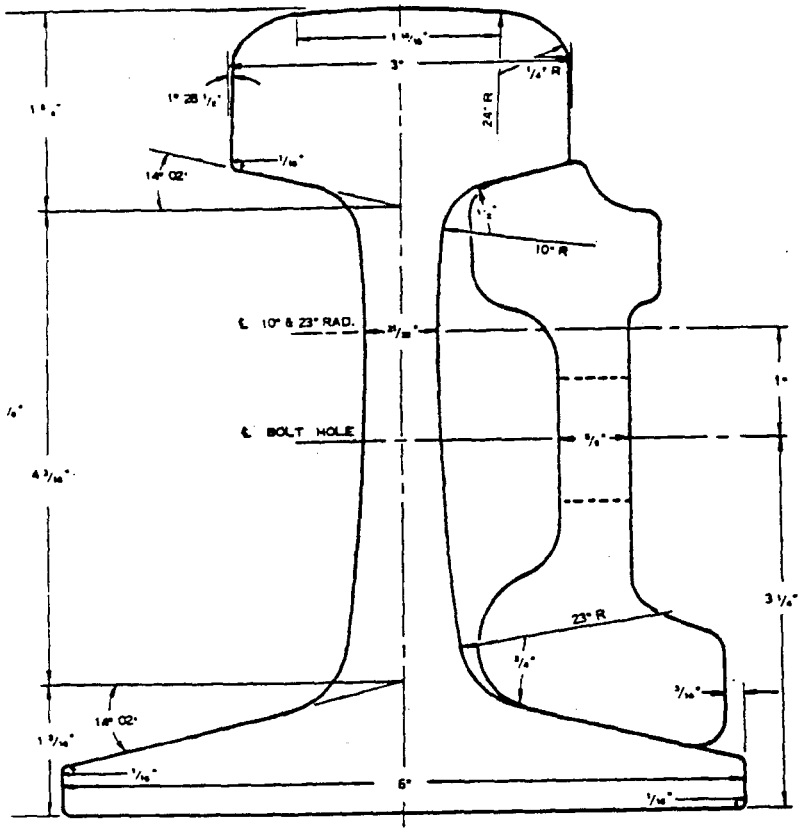




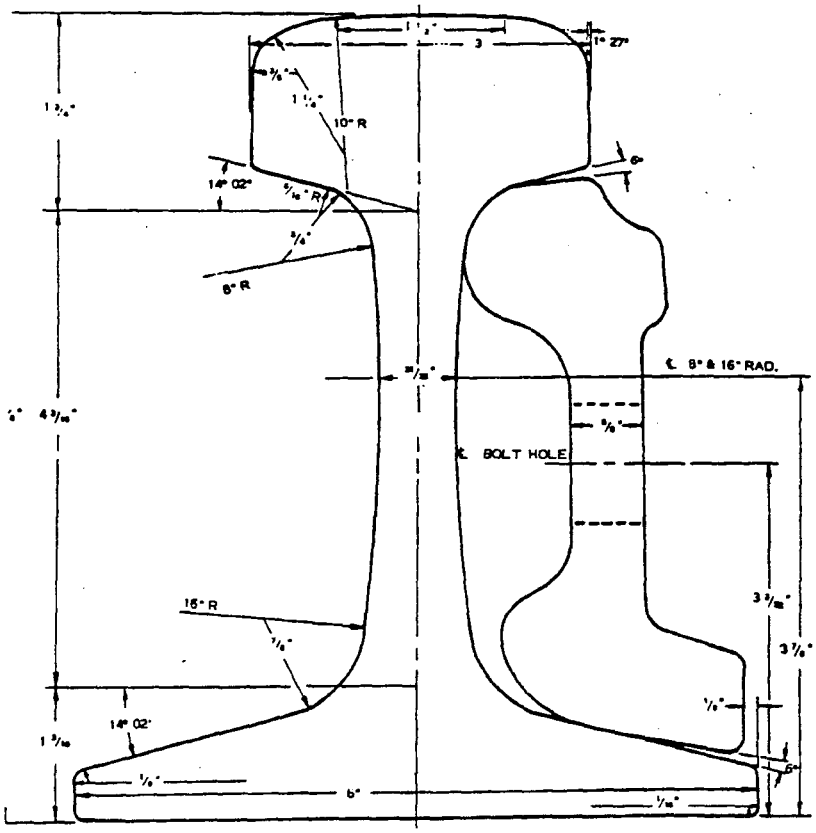
Typical 112 LB Head Contact Design



Typical 115 LB Head Free Design



Typical 131 LB Head Contact Design



Typical 132 LB Head Free Design