

NMRA Recommended Practices  
**Proto:20.32 Scale**  
 Straight Switch Turnout

**TURNOUT  
 DIMENSIONS**

Revised: February 2015

RP-12.1

Design and calculations by Van S. Fehr

(1)	FROG NUMBERS	4	5	6	7	8	9	10	11	12
<b>PROPERTIES OF STRAIGHT SWITCHES</b>										
(2)	Switch Rail Length	7.493	7.270	7.244	11.134	11.435	11.369	11.920	15.062	15.110
(4)	Switch Heel Spread	0.386	0.386	0.386	0.386	0.386	0.386	0.386	0.386	0.386
(5)	Switch Heel Angle (deg.)	2.954	3.045	3.055	1.987	1.935	1.946	1.856	1.469	1.464
<b>LEAD TO THEORETICAL POINT OF FROG</b>										
(8)	Lead	22.096	24.999	27.903	36.491	39.960	42.470	46.260	53.974	56.791
<b>CLOSURE DISTANCE</b>										
(9)	Straight Rail Length	12.735	15.763	18.594	22.751	25.723	27.560	30.800	35.052	37.379
(10)	Curved Rail Length	12.959	15.943	18.746	22.878	25.835	27.662	30.891	35.134	37.454
(11)	Curved Rail Radius	65.726	109.050	165.956	211.973	283.690	359.102	457.507	538.780	648.783
<b>GAGE LINE OFFSETS ON CURVED CLOSURE RAIL</b>										
(12)	1st Point Y1	0.628	0.667	0.700	0.660	0.676	0.686	0.701	0.682	0.692
(13)	1st Point X1	10.677	11.210	11.892	16.822	17.866	18.259	19.620	23.825	24.455
(14)	Mid-Point Y2	1.027	1.093	1.145	1.087	1.113	1.120	1.145	1.121	1.134
(15)	Mid-Point X2	13.860	15.151	16.541	22.509	24.296	25.149	27.320	32.588	33.799
(16)	3rd Point Y3	1.585	1.664	1.723	1.669	1.697	1.686	1.720	1.703	1.710
(17)	3rd Point X3	17.044	19.092	21.190	28.197	30.727	32.040	35.019	41.351	43.144
<b>PROPERTIES OF FROGS</b>										
(18)	Frog Angle (deg.)	14.250	11.421	9.527	8.171	7.153	6.360	5.725	5.205	4.772
(19)	Overall Length	4.723	5.314	5.904	7.085	7.675	9.446	9.741	11.045	12.005
(20)	Toe Length	1.868	1.967	2.065	2.606	2.803	3.540	3.540	3.860	4.303
(21)	Heel Length	2.855	3.347	3.839	4.479	4.872	5.906	6.201	7.185	7.702
(22)	Toe Spread	0.463	0.391	0.343	0.371	0.350	0.393	0.354	0.351	0.358
(23)	Heel Spread	0.708	0.666	0.638	0.638	0.608	0.655	0.619	0.653	0.641
(35)	Wing Rail Extension	1.748	1.981	2.215	2.449	2.682	2.916	3.150	3.384	3.617
(36)	Wing Rail Flare Length	0.886	0.886	0.886	0.886	1.181	1.181	1.575	1.575	1.772
(37)	Wing Rail Flare Width	0.118	0.118	0.118	0.118	0.112	0.112	0.107	0.107	0.106
(38)	Wing Rail Bend Width	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
(39)	Wing Rail End Chamfer	0.172	0.172	0.172	0.172	0.172	0.172	0.172	0.172	0.172
<b>POINT OF FROG TO INTERSECTION OF CENTERLINES</b>										
(24)	PF to ICL	11.124	13.905	16.686	19.467	22.248	25.029	27.810	30.591	33.372
<b>DATA FOR CROSSOVERS: PF TO PF ON PARALLEL TRACKS</b>										
<b>For Track Centers of:</b>		7.677	<b>(13 prototype feet)</b>							
(25)	Straight Track Dist.	7.981	10.192	12.371	14.532	16.681	18.823	20.960	23.092	25.222
(26)	Crossover Track Dist.	8.940	10.960	13.011	15.080	17.161	19.250	21.344	23.441	25.542
<b>For Track Center Increment of:</b>		0.591	<b>(1 prototype foot)</b>							
(28)	Straight Track Incr.	2.325	2.923	3.519	4.113	4.706	5.299	5.891	6.483	7.074
(29)	Crossover Track Incr.	2.399	2.982	3.568	4.155	4.743	5.331	5.920	6.509	7.099
<b>GUARD RAILS</b>										
(30)	Parallel End Setback	0.394	0.419	0.443	0.468	0.493	0.517	0.542	0.566	0.591
(31)	Bevel Length	0.640	0.640	0.640	0.640	0.640	0.640	0.640	0.640	0.640
(32)	Flare Length	1.427	1.427	1.427	1.427	1.427	1.427	1.427	1.427	1.427
(33)	Overall Length	4.872	4.872	4.872	4.872	4.872	4.872	4.872	4.872	4.872
(34)	Parallel Length	2.018	2.018	2.018	2.018	2.018	2.018	2.018	2.018	2.018
(37)	Flare Width	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095
(38)	Plane Width	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056
(39)	End Chamfer	0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148

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(1)	FROG NUMBERS	13	14	15	16	17	18	19	20
<b>PROPERTIES OF STRAIGHT SWITCHES</b>									
(2)	Switch Rail Length	15.278	15.487	20.939	20.860	20.942	21.056	21.299	21.570
(4)	Switch Heel Spread	0.386	0.386	0.386	0.386	0.386	0.386	0.386	0.386
(5)	Switch Heel Angle (deg.)	1.448	1.429	1.057	1.061	1.056	1.051	1.039	1.026
<b>LEAD TO THEORETICAL POINT OF FROG</b>									
(8)	Lead	59.836	62.881	74.262	77.165	79.983	82.800	86.023	89.247
<b>CLOSURE DISTANCE</b>									
(9)	Straight Rail Length	40.035	42.649	48.135	51.142	53.423	55.672	58.677	61.654
(10)	Curved Rail Length	40.105	42.715	48.195	51.198	53.476	55.722	58.725	61.700
(11)	Curved Rail Radius	777.067	919.288	999.855	1164.406	1324.707	1497.796	1702.644	1922.816
<b>GAGE LINE OFFSETS ON CURVED CLOSURE RAIL</b>									
(12)	1st Point Y1	0.704	0.714	0.681	0.693	0.700	0.706	0.715	0.724
(13)	1st Point X1	25.286	26.149	32.973	33.646	34.297	34.973	35.968	36.983
(14)	Mid-Point Y2	1.150	1.166	1.120	1.141	1.148	1.156	1.171	1.185
(15)	Mid-Point X2	35.295	36.812	45.007	46.431	47.653	48.891	50.637	52.397
(16)	3rd Point Y3	1.727	1.741	1.705	1.729	1.732	1.735	1.753	1.771
(17)	3rd Point X3	45.304	47.474	57.040	59.217	61.009	62.809	65.306	67.810
<b>PROPERTIES OF FROGS</b>									
(18)	Frog Angle (deg.)	4.405	4.091	3.818	3.580	3.369	3.182	3.015	2.864
(19)	Overall Length	12.964	13.923	14.391	15.350	16.309	17.269	17.748	18.228
(20)	Toe Length	4.524	4.745	5.188	5.163	5.618	6.073	6.048	6.023
(21)	Heel Length	8.440	9.178	9.203	10.187	10.692	11.196	11.700	12.205
(22)	Toe Spread	0.348	0.339	0.346	0.323	0.330	0.337	0.318	0.301
(23)	Heel Spread	0.649	0.655	0.613	0.636	0.629	0.622	0.616	0.610
(35)	Wing Rail Extension	4.011	4.405	4.638	5.118	5.352	5.586	5.979	6.373
(36)	Wing Rail Flare Length	2.308	2.613	2.728	3.056	3.162	3.269	3.578	3.887
(37)	Wing Rail Flare Width	0.103	0.102	0.102	0.101	0.101	0.101	0.100	0.100
(38)	Wing Rail Bend Width	0.103	0.102	0.102	0.101	0.101	0.101	0.100	0.100
(39)	Wing Rail End Chamfer	0.172	0.172	0.172	0.172	0.172	0.172	0.172	0.172
<b>POINT OF FROG TO INTERSECTION OF CENTERLINES</b>									
(24)	PF to ICL	36.153	38.934	41.715	44.496	47.277	50.058	52.839	55.620
<b>DATA FOR CROSSOVERS: PF TO PF ON PARALLEL TRACKS</b>									
<b>For Track Centers of:</b>		7.677	<b>(13 prototype feet)</b>						
(25)	Straight Track Dist.	27.350	29.475	31.600	33.723	35.845	37.966	40.087	42.207
(26)	Crossover Track Dist.	27.645	29.749	31.855	33.963	36.071	38.180	40.289	42.399
<b>For Track Center Increment of:</b>		0.591	<b>(1 prototype foot)</b>						
(28)	Straight Track Incr.	7.666	8.257	8.848	9.440	10.031	10.622	11.213	11.804
(29)	Crossover Track Incr.	7.689	8.278	8.868	9.458	10.048	10.638	11.228	11.818
<b>GUARD RAILS</b>									
(30)	Parallel End Setback	0.615	0.640	0.665	0.689	0.714	0.738	0.763	0.788
(31)	Bevel Length	0.640	0.640	0.640	0.640	0.640	0.640	0.640	0.640
(32)	Flare Length	1.427	1.427	1.624	1.624	1.624	1.624	1.624	1.624
(33)	Overall Length	4.872	4.872	6.496	6.496	6.496	6.496	6.496	6.496
(34)	Parallel Length	2.018	2.018	3.248	3.248	3.248	3.248	3.248	3.248
(37)	Total Flare at End	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095
(38)	Bevel Cut at End	0.056	0.056	0.051	0.051	0.051	0.051	0.051	0.051
(39)	End Chamfer	0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148