NMRA Recommended Practices

Z Scale

Curved Switch Turnout

TURNOUT DIMENSIONS

Revised: February 2015 | **RP-12.38**

Design and calculations by Van S. Fehr

(1)	**FROG NUMBERS**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
PROPERTIES OF CURVED SWITCHES										
(2)	Switch Rail Length	0.846	0.864	0.894	1.450	1.501	1.545	1.564	1.595	2.303
(3)	Switch Point Angle (deg.)	1.781	1.744	1.685	1.038	1.003	0.974	0.962	0.944	0.654
(4)	Switch Heel Spread	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
(5)	Switch Heel Angle (deg.)	4.960	4.859	4.693	2.894	2.794	2.715	2.682	2.630	1.822
(6)	Switch Rail Radius	15.243	15.887	17.027	44.775	48.009	50.870	52.104	54.183	112.948
(7)	Switch Mid-Ordinate	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
LEAD TO THEORETICAL POINT OF FROG										
(8)	Lead	1.954	2.206	2.457	3.419	3.711	3.966	4.206	4.444	5.634
CLOSURE DISTANCE										
(9)	Straight Rail Length	0.869	1.077	1.272	1.613	1.819	1.945	2.149	2.311	2.736
(10)	Curved Rail Length	0.890	1.094	1.287	1.624	1.829	1.954	2.158	2.319	2.743
(11)	Curved Rail Radius	5.487	9.551	15.249	17.635	24.046	30.714	40.634	51.600	53.264
GAGE LINE OFFSETS ON CURVED CLOSURE RAIL										
(12)	1st Point Y1	0.073	0.076	0.079	0.075	0.076	0.077	0.078	0.080	0.076
(13)	1st Point X1	1.063	1.133	1.212	1.853	1.956	2.031	2.101	2.173	2.986
(14)	Mid-Point Y2	0.105	0.111	0.115	0.109	0.111	0.111	0.114	0.116	0.111
(15)	Mid-Point X2	1.280	1.402	1.530	2.256	2.411	2.518	2.639	2.750	3.670
(16)	3rd Point Y3	0.146	0.153	0.158	0.153	0.155	0.154	0.157	0.159	0.155
(17)	3rd Point X3	1.498	1.671	1.848	2.659	2.865	3.004	3.176	3.328	4.354
PROPERTIES OF FROGS										
(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	0.503	0.574	0.645	0.770	0.841	1.021	1.065	1.202	1.307
(20)	Toe Length	0.240	0.265	0.290	0.357	0.391	0.476	0.492	0.538	0.596
(21)	Heel Length	0.264	0.309	0.355	0.414	0.450	0.545	0.573	0.664	0.711
(22)	Toe Spread	0.059	0.053	0.048	0.051	0.049	0.053	0.049	0.049	0.050
(23)	Heel Spread	0.065	0.062	0.059	0.059	0.056	0.061	0.057	0.060	0.059
(35)	Wing Rail Extension	0.161	0.183	0.205	0.226	0.248	0.269	0.291	0.313	0.334
(36)	Wing Rail Flare Length	0.082	0.082	0.082	0.082	0.109	0.109	0.145	0.145	0.164
(37)	Wing Rail Flare Width	0.011	0.011	0.011	0.011	0.010	0.010	0.010	0.010	0.010
(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	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
POINT OF FROG TO INTERSECTION OF CENTERLINES										
(24)	PF to ICL	1.028	1.285	1.542	1.799	2.056	2.313	2.570	2.827	3.084
DATA FOR CROSSOVERS: PF TO PF ON PARALLEL TRACKS										
	For Track Centers of:	0.709	**(13 prototype feet)**							
(25)	Straight Track Dist.	0.736	0.940	1.141	1.340	1.539	1.736	1.933	2.130	2.326
(26)	Crossover Track Dist.	0.825	1.011	1.200	1.391	1.583	1.776	1.969	2.162	2.356
	For Track Center Increment of:	0.055	**(1 prototype foot)**							
(28)	Straight Track Incr.	0.215	0.270	0.325	0.380	0.435	0.489	0.544	0.599	0.653
(29)	Crossover Track Incr.	0.222	0.275	0.330	0.384	0.438	0.492	0.547	0.601	0.656
GUARD RAILS										
(30)	Parallel End Setback	0.036	0.039	0.041	0.043	0.045	0.048	0.050	0.052	0.055
(31)	Bevel Length	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059
(32)	Flare Length	0.132	0.132	0.150	0.150	0.150	0.150	0.164	0.164	0.164
(33)	Overall Length	0.450	0.450	0.600	0.600	0.600	0.600	0.709	0.709	0.709
(34)	Parallel Length	0.186	0.186	0.300	0.300	0.300	0.300	0.382	0.382	0.382
(37)	Flare Width	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
(38)	Plane Width	0.005	0.005	0.005	0.005	0.005	0.005	0.004	0.004	0.004
(39)	End Chamfer	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014

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(1)	**FROG NUMBERS**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
PROPERTIES OF CURVED SWITCHES									
(2)	Switch Rail Length	2.337	2.376	2.421	2.464	3.002	3.053	3.094	3.137
(3)	Switch Point Angle (deg.)	0.644	0.633	0.622	0.611	0.501	0.493	0.486	0.480
(4)	Switch Heel Spread	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
(5)	Switch Heel Angle (deg.)	1.794	1.765	1.733	1.703	1.397	1.374	1.356	1.337
(6)	Switch Rail Radius	116.402	120.287	124.829	129.296	191.999	198.587	203.922	209.687
(7)	Switch Mid-Ordinate	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
LEAD TO THEORETICAL POINT OF FROG									
(8)	Lead	5.898	6.162	6.423	6.693	7.651	7.923	8.194	8.466
CLOSURE DISTANCE									
(9)	Straight Rail Length	2.928	3.117	3.275	3.488	3.849	4.011	4.228	4.442
(10)	Curved Rail Length	2.935	3.123	3.281	3.494	3.854	4.016	4.233	4.446
(11)	Curved Rail Radius	64.401	76.934	90.133	106.635	111.974	127.236	146.161	166.804
GAGE LINE OFFSETS ON CURVED CLOSURE RAIL									
(12)	1st Point Y1	0.077	0.078	0.078	0.079	0.077	0.078	0.079	0.079
(13)	1st Point X1	3.070	3.155	3.239	3.336	3.964	4.056	4.151	4.248
(14)	Mid-Point Y2	0.112	0.114	0.114	0.116	0.113	0.114	0.115	0.116
(15)	Mid-Point X2	3.802	3.935	4.058	4.208	4.927	5.059	5.208	5.358
(16)	3rd Point Y3	0.156	0.157	0.158	0.160	0.157	0.158	0.159	0.161
(17)	3rd Point X3	4.534	4.714	4.877	5.080	5.889	6.062	6.265	6.469
PROPERTIES OF FROGS									
(18)	Frog Angle (deg.)	4.405	4.091	3.818	3.580	3.369	3.182	3.015	2.864
(19)	Overall Length	1.412	1.517	1.577	1.682	1.787	1.892	1.953	2.014
(20)	Toe Length	0.633	0.670	0.727	0.741	0.800	0.858	0.872	0.887
(21)	Heel Length	0.780	0.848	0.850	0.941	0.988	1.034	1.081	1.127
(22)	Toe Spread	0.049	0.048	0.048	0.046	0.047	0.048	0.046	0.044
(23)	Heel Spread	0.060	0.061	0.057	0.059	0.058	0.057	0.057	0.056
(35)	Wing Rail Extension	0.370	0.407	0.428	0.473	0.494	0.516	0.552	0.589
(36)	Wing Rail Flare Length	0.213	0.241	0.252	0.282	0.292	0.302	0.330	0.359
(37)	Wing Rail Flare Width	0.010	0.009	0.009	0.009	0.009	0.009	0.009	0.009
(38)	Wing Rail Bend Width	0.010	0.009	0.009	0.009	0.009	0.009	0.009	0.009
(39)	Wing Rail End Chamfer	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
POINT OF FROG TO INTERSECTION OF CENTERLINES									
(24)	PF to ICL	3.341	3.598	3.855	4.112	4.369	4.626	4.883	5.140
DATA FOR CROSSOVERS: PF TO PF ON PARALLEL TRACKS									
	For Track Centers of:	0.709	**(13 prototype feet)**						
(25)	Straight Track Dist.	2.523	2.719	2.915	3.110	3.306	3.502	3.697	3.893
(26)	Crossover Track Dist.	2.550	2.744	2.938	3.133	3.327	3.521	3.716	3.911
For Track Center Increment of:		0.055	**(1 prototype foot)**						
(28)	Straight Track Incr.	0.708	0.763	0.817	0.872	0.926	0.981	1.036	1.090
(29)	Crossover Track Incr.	0.710	0.765	0.819	0.874	0.928	0.983	1.037	1.092
GUARD RAILS									
(30)	Parallel End Setback	0.057	0.059	0.061	0.064	0.066	0.068	0.070	0.073
(31)	Bevel Length	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059
(32)	Flare Length	0.186	0.186	0.186	0.186	0.186	0.186	0.209	0.209
(33)	Overall Length	0.900	0.900	0.900	0.900	0.900	0.900	1.064	1.064
(34)	Parallel Length	0.527	0.527	0.527	0.527	0.527	0.527	0.645	0.645
(37)	Total Flare at End	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
(38)	Bevel Cut at End	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
(39)	End Chamfer	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014