NMRA Recommended Practices

HO Scale

Curved Switch Turnout

TURNOUT DIMENSIONS

Revised: February 2015 | **RP-12.32**

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	1.940	1.952	2.001	3.317	3.411	3.492	3.512	3.564	5.240
(3)	Switch Point Angle (deg.)	1.640	1.629	1.589	0.958	0.932	0.910	0.905	0.892	0.607
(4)	Switch Heel Spread	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105
(5)	Switch Heel Angle (deg.)	4.568	4.539	4.428	2.671	2.597	2.537	2.523	2.485	1.690
(6)	Switch Rail Radius	37.948	38.441	40.395	110.961	117.352	123.019	124.393	128.146	276.984
(7)	Switch Mid-Ordinate	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
LEAD TO THEORETICAL POINT OF FROG										
(8)	Lead	4.937	5.572	6.206	8.638	9.376	10.019	10.625	11.227	14.233
CLOSURE DISTANCE										
(9)	Straight Rail Length	2.446	3.017	3.551	4.513	5.082	5.443	6.001	6.448	7.646
(10)	Curved Rail Length	2.499	3.060	3.588	4.543	5.109	5.467	6.023	6.468	7.664
(11)	Curved Rail Radius	14.792	25.476	40.311	47.322	64.253	81.936	107.764	136.266	142.503
GAGE LINE OFFSETS ON CURVED CLOSURE RAIL										
(12)	1st Point Y1	0.167	0.176	0.184	0.171	0.175	0.177	0.182	0.185	0.174
(13)	1st Point X1	2.551	2.706	2.889	4.445	4.681	4.853	5.012	5.176	7.151
(14)	Mid-Point Y2	0.254	0.270	0.282	0.264	0.271	0.271	0.279	0.283	0.269
(15)	Mid-Point X2	3.163	3.461	3.777	5.573	5.952	6.214	6.512	6.788	9.063
(16)	3rd Point Y3	0.368	0.387	0.401	0.385	0.392	0.388	0.398	0.401	0.390
(17)	3rd Point X3	3.774	4.215	4.664	6.701	7.222	7.574	8.012	8.400	10.975
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	1.218	1.384	1.550	1.854	2.020	2.462	2.559	2.892	3.144
(20)	Toe Length	0.552	0.603	0.654	0.809	0.883	1.084	1.112	1.215	1.347
(21)	Heel Length	0.666	0.781	0.896	1.045	1.137	1.378	1.447	1.677	1.797
(22)	Toe Spread	0.137	0.120	0.109	0.115	0.110	0.120	0.111	0.110	0.112
(23)	Heel Spread	0.165	0.155	0.149	0.149	0.142	0.153	0.145	0.152	0.150
(35)	Wing Rail Extension	0.408	0.462	0.517	0.571	0.626	0.680	0.735	0.790	0.844
(36)	Wing Rail Flare Length	0.207	0.207	0.207	0.207	0.276	0.276	0.367	0.367	0.413
(37)	Wing Rail Flare Width	0.028	0.028	0.028	0.028	0.026	0.026	0.025	0.025	0.025
(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	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
POINT OF FROG TO INTERSECTION OF CENTERLINES										
(24)	PF to ICL	2.596	3.245	3.894	4.543	5.192	5.841	6.490	7.139	7.788
DATA FOR CROSSOVERS: PF TO PF ON PARALLEL TRACKS										
	For Track Centers of:	1.791	**(13 prototype feet)**							
(25)	Straight Track Dist.	1.861	2.377	2.885	3.389	3.891	4.390	4.889	5.386	5.883
(26)	Crossover Track Dist.	2.085	2.556	3.035	3.517	4.003	4.490	4.978	5.467	5.957
	For Track Center Increment of:	0.138	**(1 prototype foot)**							
(28)	Straight Track Incr.	0.543	0.682	0.821	0.960	1.098	1.236	1.375	1.513	1.651
(29)	Crossover Track Incr.	0.560	0.696	0.833	0.969	1.107	1.244	1.381	1.519	1.656
GUARD RAILS										
(30)	Parallel End Setback	0.092	0.098	0.103	0.109	0.115	0.121	0.126	0.132	0.138
(31)	Bevel Length	0.149	0.149	0.149	0.149	0.149	0.149	0.149	0.149	0.149
(32)	Flare Length	0.333	0.333	0.333	0.333	0.379	0.379	0.379	0.379	0.379
(33)	Overall Length	1.137	1.137	1.137	1.137	1.516	1.516	1.516	1.516	1.516
(34)	Parallel Length	0.471	0.471	0.471	0.471	0.758	0.758	0.758	0.758	0.758
(37)	Flare Width	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022
(38)	Plane Width	0.013	0.013	0.013	0.013	0.012	0.012	0.012	0.012	0.012
(39)	End Chamfer	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034

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(1)	**FROG NUMBERS**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
PROPERTIES OF CURVED SWITCHES									
(2)	Switch Rail Length	5.296	5.363	5.446	5.524	6.792	6.890	6.962	7.042
(3)	Switch Point Angle (deg.)	0.600	0.593	0.584	0.575	0.468	0.461	0.456	0.451
(4)	Switch Heel Spread	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105
(5)	Switch Heel Angle (deg.)	1.673	1.652	1.627	1.603	1.304	1.286	1.272	1.258
(6)	Switch Rail Radius	282.923	290.101	299.153	307.866	465.379	478.889	488.960	500.210
(7)	Switch Mid-Ordinate	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
LEAD TO THEORETICAL POINT OF FROG									
(8)	Lead	14.900	15.568	16.225	16.909	19.329	20.015	20.701	21.387
CLOSURE DISTANCE									
(9)	Straight Rail Length	8.178	8.698	9.141	9.723	10.740	11.194	11.785	12.369
(10)	Curved Rail Length	8.194	8.714	9.155	9.736	10.753	11.206	11.797	12.380
(11)	Curved Rail Radius	171.812	204.695	239.341	282.255	298.317	338.511	387.870	441.583
GAGE LINE OFFSETS ON CURVED CLOSURE RAIL									
(12)	1st Point Y1	0.177	0.179	0.181	0.184	0.178	0.179	0.182	0.184
(13)	1st Point X1	7.340	7.537	7.731	7.955	9.477	9.688	9.908	10.134
(14)	Mid-Point Y2	0.273	0.277	0.279	0.283	0.276	0.277	0.281	0.284
(15)	Mid-Point X2	9.385	9.712	10.016	10.386	12.162	12.487	12.855	13.226
(16)	3rd Point Y3	0.394	0.397	0.398	0.404	0.397	0.398	0.402	0.406
(17)	3rd Point X3	11.429	11.886	12.301	12.816	14.847	15.285	15.801	16.318
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	3.396	3.649	3.786	4.039	4.291	4.543	4.684	4.824
(20)	Toe Length	1.427	1.507	1.639	1.662	1.796	1.931	1.954	1.976
(21)	Heel Length	1.969	2.142	2.147	2.377	2.495	2.612	2.730	2.848
(22)	Toe Spread	0.110	0.108	0.109	0.104	0.106	0.107	0.103	0.099
(23)	Heel Spread	0.151	0.153	0.143	0.148	0.147	0.145	0.144	0.142
(35)	Wing Rail Extension	0.936	1.028	1.082	1.194	1.249	1.303	1.395	1.487
(36)	Wing Rail Flare Length	0.539	0.610	0.636	0.713	0.738	0.763	0.835	0.907
(37)	Wing Rail Flare Width	0.024	0.024	0.024	0.024	0.024	0.023	0.023	0.023
(38)	Wing Rail Bend Width	0.024	0.024	0.024	0.024	0.024	0.023	0.023	0.023
(39)	Wing Rail End Chamfer	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
POINT OF FROG TO INTERSECTION OF CENTERLINES									
(24)	PF to ICL	8.437	9.086	9.735	10.384	11.033	11.682	12.331	12.980
DATA FOR CROSSOVERS: PF TO PF ON PARALLEL TRACKS									
	For Track Centers of:	1.791	**(13 prototype feet)**						
(25)	Straight Track Dist.	6.379	6.875	7.370	7.865	8.360	8.855	9.350	9.844
(26)	Crossover Track Dist.	6.448	6.939	7.430	7.921	8.413	8.905	9.397	9.889
For Track Center Increment of:		0.138	**(1 prototype foot)**						
(28)	Straight Track Incr.	1.789	1.927	2.065	2.203	2.340	2.478	2.616	2.754
(29)	Crossover Track Incr.	1.794	1.932	2.069	2.207	2.345	2.482	2.620	2.758
GUARD RAILS									
(30)	Parallel End Setback	0.144	0.149	0.155	0.161	0.167	0.172	0.178	0.184
(31)	Bevel Length	0.149	0.149	0.149	0.149	0.149	0.149	0.149	0.149
(32)	Flare Length	0.413	0.413	0.413	0.413	0.471	0.471	0.471	0.471
(33)	Overall Length	1.791	1.791	1.791	1.791	2.274	2.274	2.274	2.274
(34)	Parallel Length	0.965	0.965	0.965	0.965	1.332	1.332	1.332	1.332
(37)	Total Flare at End	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022
(38)	Bevel Cut at End	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
(39)	End Chamfer	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034