

NMRA Recommended Practices  
**Proto:87 Scale**  
**Straight Switch Turnout**

**TURNOUT  
DIMENSIONS**

Revised: February 2015

RP-12.9

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	1.790	1.745	1.745	2.669	2.747	2.737	2.872	3.621	3.638
(4)	Switch Heel Spread	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094
(5)	Switch Heel Angle (deg.)	3.017	3.095	3.095	2.024	1.966	1.973	1.880	1.491	1.484
<b>LEAD TO THEORETICAL POINT OF FROG</b>										
(8)	Lead	5.156	5.833	6.511	8.514	9.324	9.910	10.794	12.594	13.251
<b>CLOSURE DISTANCE</b>										
(9)	Straight Rail Length	2.923	3.621	4.274	5.227	5.911	6.333	7.080	8.056	8.591
(10)	Curved Rail Length	2.975	3.663	4.309	5.256	5.937	6.357	7.101	8.075	8.609
(11)	Curved Rail Radius	15.177	25.206	38.388	48.990	65.590	83.032	105.823	124.579	150.040
<b>GAGE LINE OFFSETS ON CURVED CLOSURE RAIL</b>										
(12)	1st Point Y1	0.150	0.160	0.167	0.158	0.162	0.164	0.167	0.163	0.165
(13)	1st Point X1	2.521	2.651	2.814	3.975	4.224	4.320	4.642	5.635	5.785
(14)	Mid-Point Y2	0.242	0.258	0.270	0.257	0.263	0.264	0.270	0.264	0.267
(15)	Mid-Point X2	3.252	3.556	3.882	5.282	5.702	5.903	6.412	7.648	7.933
(16)	3rd Point Y3	0.371	0.389	0.403	0.391	0.397	0.394	0.402	0.398	0.400
(17)	3rd Point X3	3.983	4.461	4.951	6.589	7.180	7.486	8.182	9.662	10.081
<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	1.108	1.248	1.387	1.664	1.803	2.218	2.288	2.594	2.820
(20)	Toe Length	0.442	0.467	0.491	0.619	0.666	0.840	0.841	0.918	1.022
(21)	Heel Length	0.666	0.781	0.896	1.045	1.137	1.378	1.447	1.677	1.797
(22)	Toe Spread	0.110	0.093	0.082	0.088	0.083	0.093	0.084	0.083	0.085
(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
<b>POINT OF FROG TO INTERSECTION OF CENTERLINES</b>										
(24)	PF to ICL	2.596	3.245	3.894	4.543	5.192	5.841	6.490	7.139	7.788
<b>DATA FOR CROSSOVERS: PF TO PF ON PARALLEL TRACKS</b>										
<b>For Track Centers of:</b>		1.791	<b>(13 prototype feet)</b>							
(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
<b>For Track Center Increment of:</b>		0.138	<b>(1 prototype foot)</b>							
(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
<b>GUARD RAILS</b>										
(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	0.333	0.333	0.333	0.333	0.333
(33)	Overall Length	1.137	1.137	1.137	1.137	1.137	1.137	1.137	1.137	1.137
(34)	Parallel Length	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471
(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	0.013	0.013	0.013	0.013	0.013
(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
<b>PROPERTIES OF STRAIGHT SWITCHES</b>									
(2)	Switch Rail Length	3.683	3.737	5.032	5.019	5.044	5.076	5.139	5.208
(4)	Switch Heel Spread	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094
(5)	Switch Heel Angle (deg.)	1.466	1.445	1.073	1.076	1.071	1.064	1.051	1.037
<b>LEAD TO THEORETICAL POINT OF FROG</b>									
(8)	Lead	13.962	14.672	17.328	18.005	18.663	19.320	20.072	20.824
<b>CLOSURE DISTANCE</b>									
(9)	Straight Rail Length	9.204	9.807	11.063	11.757	12.282	12.800	13.493	14.181
(10)	Curved Rail Length	9.220	9.822	11.077	11.770	12.294	12.811	13.504	14.191
(11)	Curved Rail Radius	179.748	212.688	231.185	269.311	306.417	346.487	393.954	444.975
<b>GAGE LINE OFFSETS ON CURVED CLOSURE RAIL</b>									
(12)	1st Point Y1	0.168	0.170	0.163	0.165	0.167	0.168	0.171	0.173
(13)	1st Point X1	5.984	6.189	7.797	7.958	8.114	8.276	8.512	8.753
(14)	Mid-Point Y2	0.271	0.275	0.264	0.269	0.271	0.272	0.276	0.279
(15)	Mid-Point X2	8.284	8.640	10.563	10.898	11.185	11.476	11.885	12.298
(16)	3rd Point Y3	0.404	0.407	0.399	0.404	0.405	0.406	0.410	0.414
(17)	3rd Point X3	10.585	11.092	13.329	13.837	14.255	14.676	15.259	15.843
<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	3.045	3.270	3.381	3.606	3.832	4.057	4.170	4.284
(20)	Toe Length	1.076	1.129	1.233	1.229	1.337	1.445	1.440	1.436
(21)	Heel Length	1.969	2.142	2.147	2.377	2.495	2.612	2.730	2.848
(22)	Toe Spread	0.083	0.081	0.082	0.077	0.079	0.080	0.076	0.072
(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
<b>POINT OF FROG TO INTERSECTION OF CENTERLINES</b>									
(24)	PF to ICL	8.437	9.086	9.735	10.384	11.033	11.682	12.331	12.980
<b>DATA FOR CROSSOVERS: PF TO PF ON PARALLEL TRACKS</b>									
<b>For Track Centers of:</b>		1.791	<b>(13 prototype feet)</b>						
(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
<b>For Track Center Increment of:</b>		0.138	<b>(1 prototype foot)</b>						
(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
<b>GUARD RAILS</b>									
(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	0.333	0.379	0.379	0.379	0.379	0.379	0.379	0.379
(33)	Overall Length	1.137	1.516	1.516	1.516	1.516	1.516	1.516	1.516
(34)	Parallel Length	0.471	0.758	0.758	0.758	0.758	0.758	0.758	0.758
(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	0.013	0.012	0.012	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