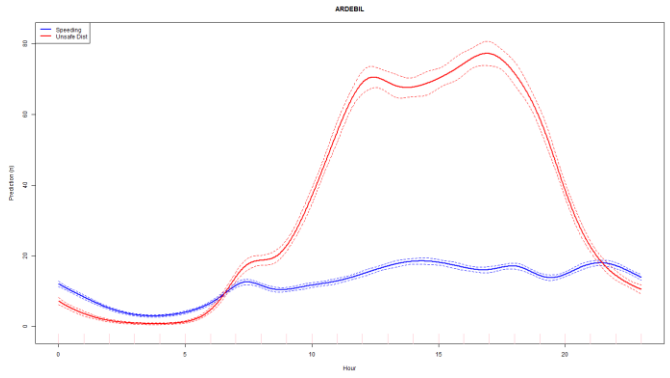
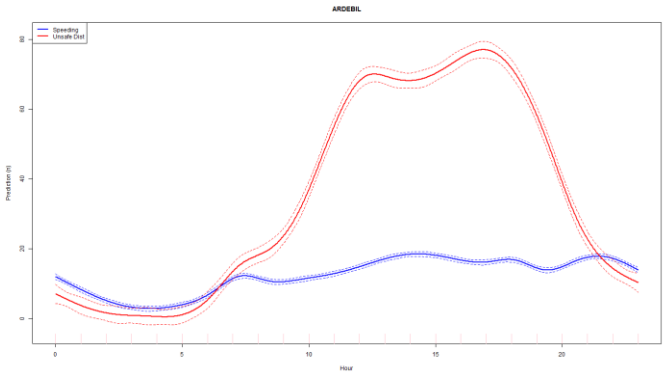
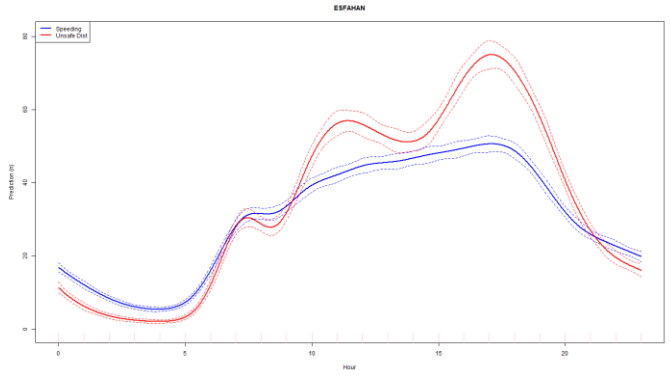
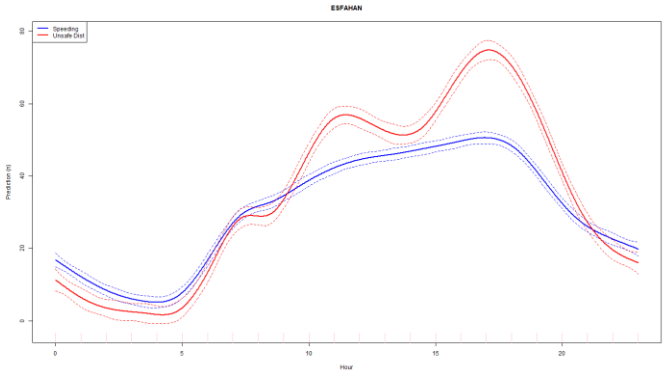
Appendix for
"Studying the Hourly and Spatial Patterns of Traffic Offenses during March-April 2019 in Iran with Bivariate Generalized Additive Models and Integrated Nested Laplace Approximation" – Comparisons between different models (Additional Models)

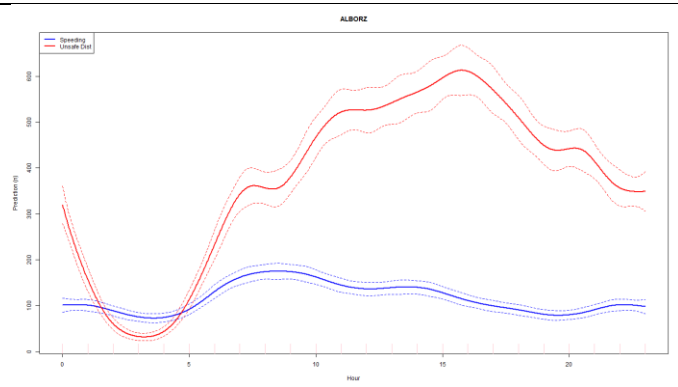
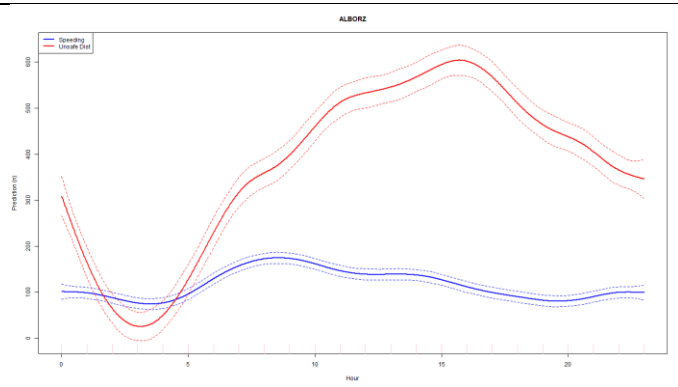
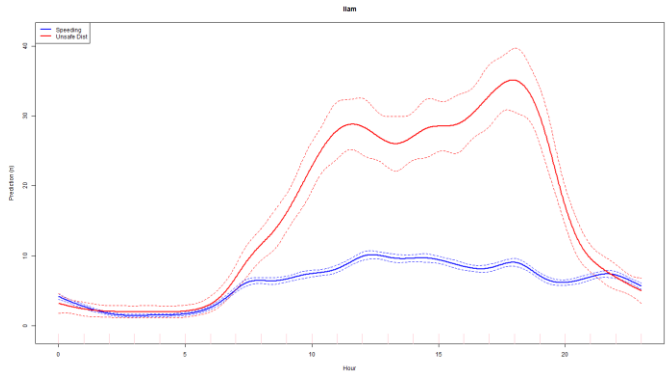
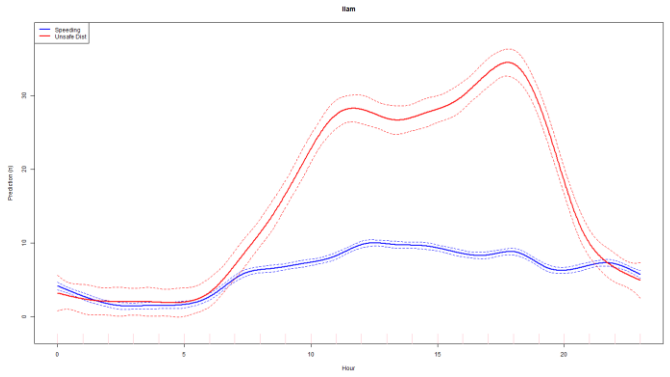
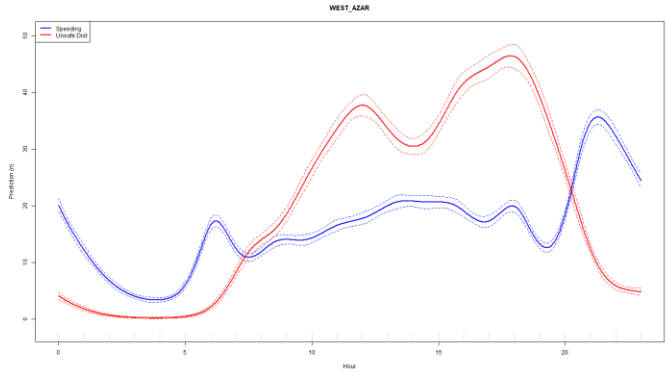
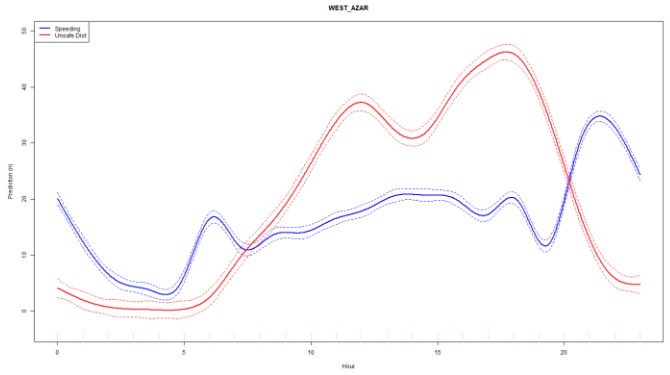
Appendix 1. The Comparisons between univariate Poisson, univariate Gaussian and univariate location-scale Gaussian with MSE and Correlation for Speeding and Unsafe Distance Traffic Offenses group by provinces.

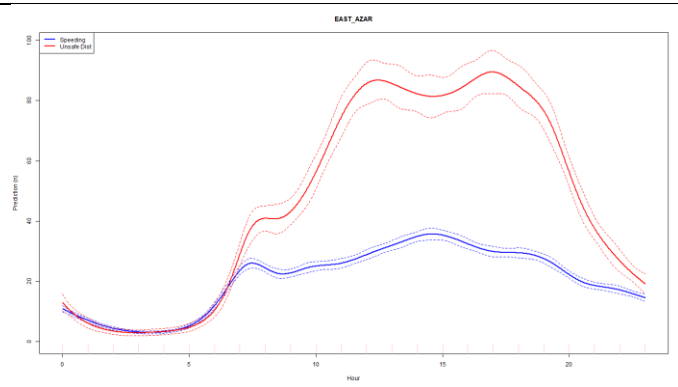
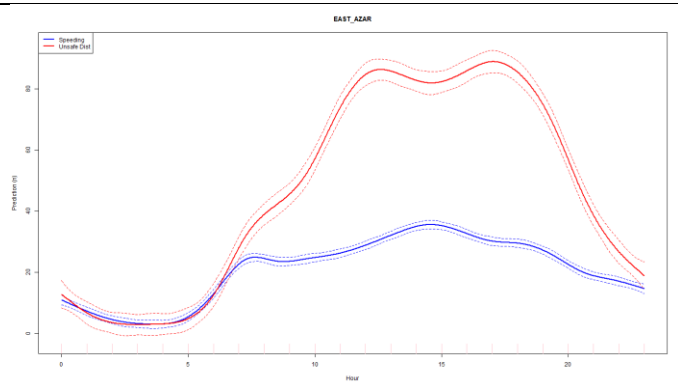
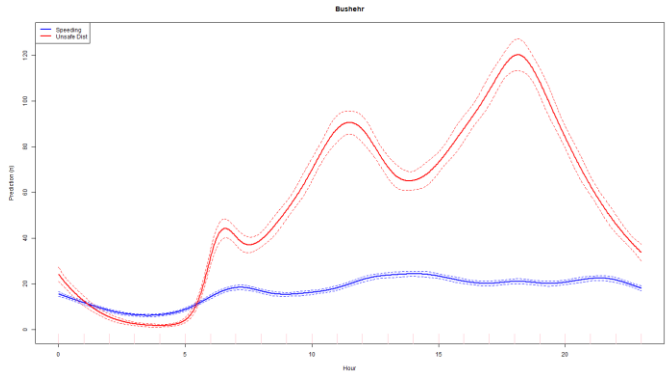
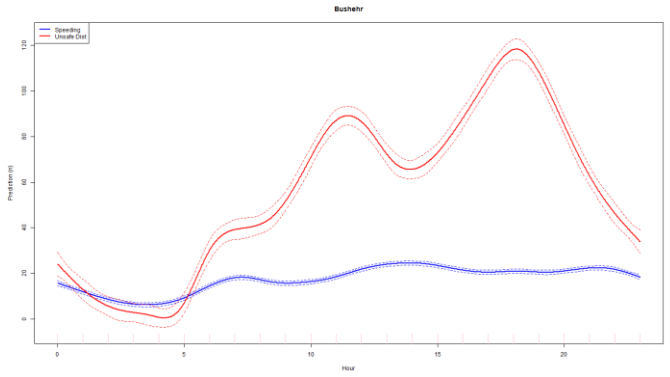
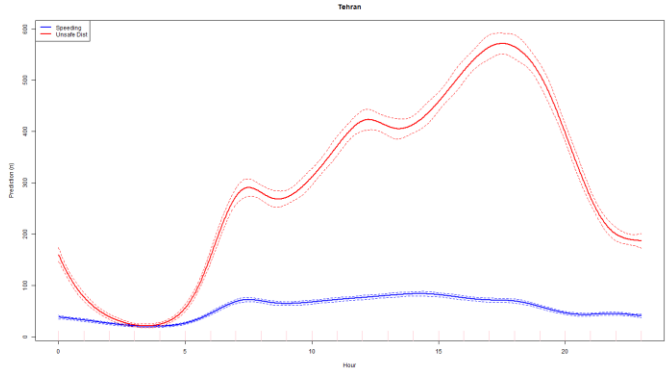
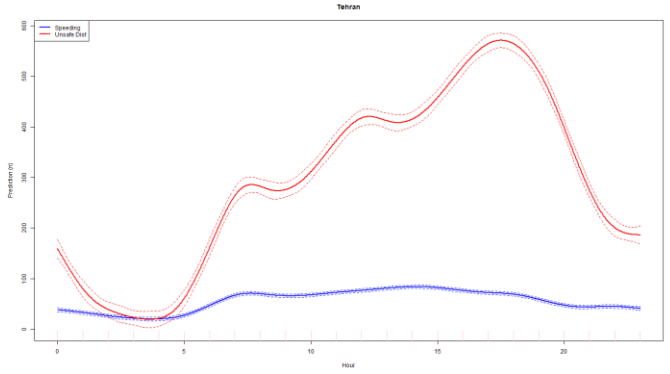
Provinces	**Univariate Poisson**				**Univariate Gaussian**				**Univariate location-Scale Gaussian**			
	MSE		**COR**		**MSE**		**COR**		**MSE**		**COR**	
	Speeding	**Unsafe Distance**	**Speeding**	**Unsafe Distance**	Speeding	Unsafe Distance	Speeding	Unsafe Distance	Speeding	Unsafe Distance	Speeding	Unsafe Distance
Ardebil	431.58	5585.6	0.26	0.37	313.019	3886.744	0.2656	0.4164	313.058	3886.646	0.2654	0.4164
Isfahan	4234.71	9435.8	0.25	0.24	3305.576	7955.155	0.2588	0.2578	3305.573	7955.098	0.2588	0.2578
Alborz	100001.56	741558.09	0.11	0.21	86773.933	576068.156	0.1072	0.2286	86771.498	576057.722	0.1073	0.2286
Ilam	115.86	2336.47	0.28	0.24	84.514	1887.833	0.2717	0.253	84.523	1887.997	0.2715	0.2528
West Azarbayjan	1083.11	2514.1	0.23	0.3	1544.379	12434.324	0.2565	0.2809	1544.454	12434.29	0.2564	0.2809
East Azarbayjan	1943.8	15195.8	0.25	0.26	839.98	1988.451	0.2496	0.3423	840.531	1988.457	0.2484	0.3423
Bushehr	779.4	14589.35	0.22	0.29	540.001	10785.482	0.2257	0.3195	540.003	10786.917	0.2257	0.3193
Tehran	15866.28	354773.12	0.17	0.3	12766.021	242817.795	0.1776	0.3288	12766.396	242813.98	0.1775	0.3289
Chaharmahal va Bakhtiari	1664.66	2716.23	0.3	0.41	1104.991	1736.994	0.3114	0.4543	1105.066	1736.963	0.3113	0.4543
South Khorasan	1319.27	1133.26	0.33	0.32	834.256	873.058	0.3387	0.3355	834.284	873.045	0.3386	0.3355
Razavi Khorasan	2241.12	50497.24	0.18	0.22	1682.328	40516.042	0.1798	0.2487	1682.436	40515.518	0.1796	0.2487
North Khorasan	936.36	5419.71	0.16	0.38	766.87	3592.165	0.1656	0.4067	767.045	3593.059	0.1649	0.4064
Khuzestan	978.81	6959.97	0.2	0.33	737.512	4672.352	0.1984	0.3649	737.57	4672.311	0.1982	0.3649
Zanjan	229.03	19909.56	0.18	0.24	193.584	17284.756	0.1801	0.2557	193.613	17285.61	0.1797	0.2556
Semnan	10017.65	11546.93	0.25	0.24	7480.84	9764.536	0.2609	0.2611	7481.244	9765.212	0.2608	0.261
Sistan va Balouchestan	2478.85	12.48	0.34	0.3	1363.205	10.218	0.353	0.3227	1363.623	10.219	0.3526	0.3225
Fars	5385.19	39761.18	0.21	0.27	4162.37	31543.166	0.2156	0.2845	4162.357	31542.752	0.2156	0.2846

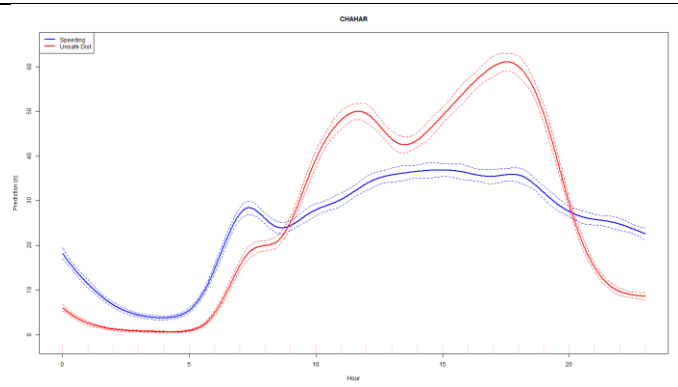
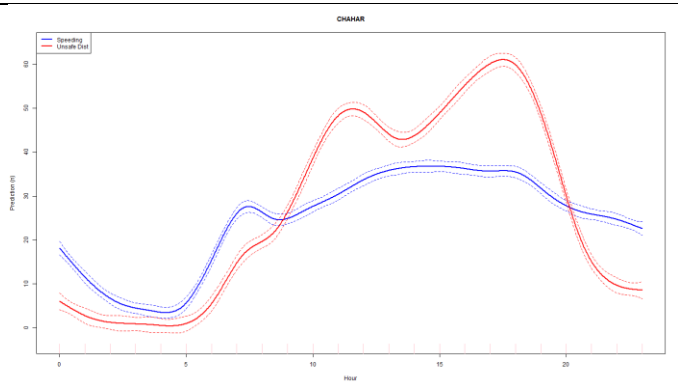
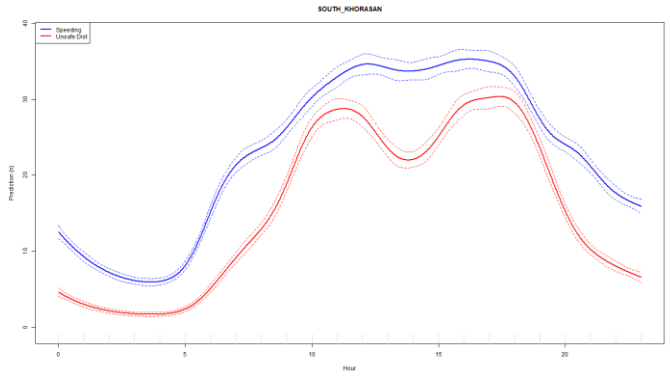
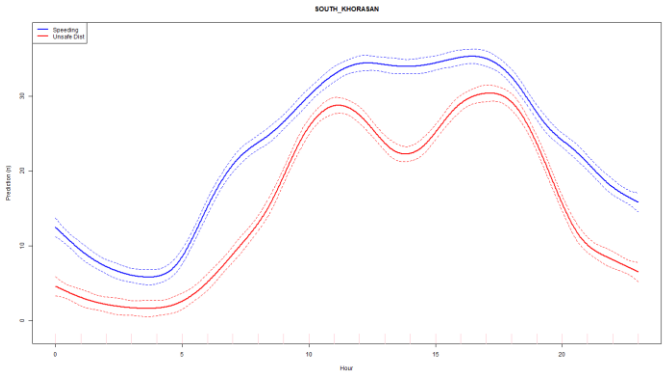
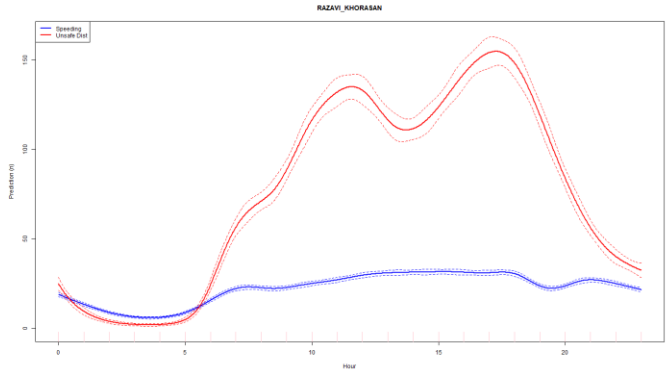
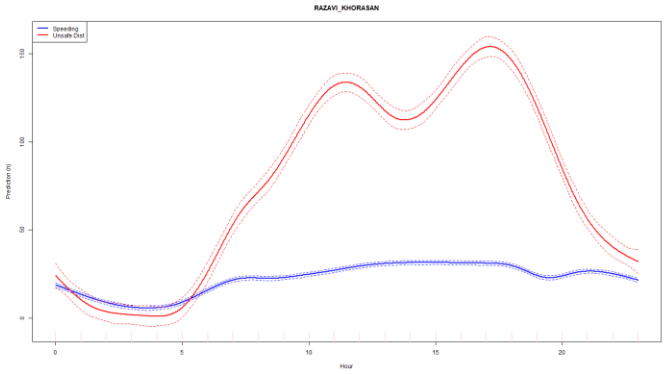
Qazvin	2263.26	360868.19	0.14	0.24	1600.445	244800.565	0.1558	0.2179	1600.432	244807.603	0.1558	0.2179
Qom	16924.46	61534.74	0.23	0.27	13419.063	49203.84	0.2369	0.2833	13418.904	49203.091	0.2369	0.2833
Kordestan	235.64	3365.3	0.17	0.38	197.886	2299.935	0.174	0.4272	197.965	2300.016	0.1729	0.4272
Kerman	659.95	2465.7	0.26	0.34	419.728	1635.261	0.2573	0.3666	419.758	1635.239	0.2571	0.3666
Kermanshah	744.38	11365.2	0.17	0.32	665.74	8546.625	0.1721	0.3574	665.756	8546.87	0.172	0.3573
Kohkilouye va Boyerahmad	339.81	5697.03	0.25	0.39	238.151	3584.541	0.2616	0.4134	238.122	3586.646	0.2619	0.4129
Golestan	1439.63	35333.32	0.18	0.33	1237.546	24183.869	0.1824	0.3728	1237.53	24184.115	0.1824	0.3728
Gilan	508.83	143528.03	0.14	0.37	439.294	88629.532	0.1438	0.4037	439.296	88627.389	0.1437	0.4038
Lorestan	483.89	6004.12	0.24	0.31	365.021	4710.64	0.2409	0.3312	365.04	4710.61	0.2408	0.3312
Mazandaran	4042.82	77117.06	0.14	0.31	3398.599	55020.61	0.1455	0.3335	3398.648	55021.113	0.1455	0.3335
Markazi	3435.27	24601.28	0.28	0.29	2382.307	19329.052	0.2918	0.3174	2382.284	19329.01	0.2918	0.3174
Hormozgan	3159.51	8827.05	0.22	0.29	2208.794	6432.284	0.2176	0.2983	2208.955	6432.162	0.2175	0.2984
Hamedan	1741.21	22891.91	0.22	0.27	1362.791	18492.009	0.2295	0.2981	1362.756	18491.588	0.2296	0.2982
Yazd	2615.34	7838.13	0.16	0.18	2153.379	7174.769	0.1644	0.1895	2153.483	7175.12	0.1643	0.1895

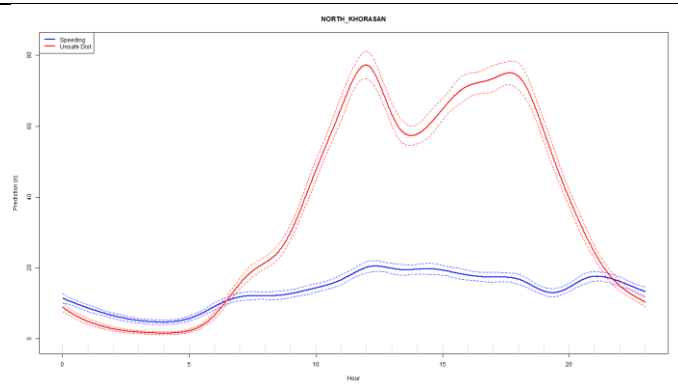
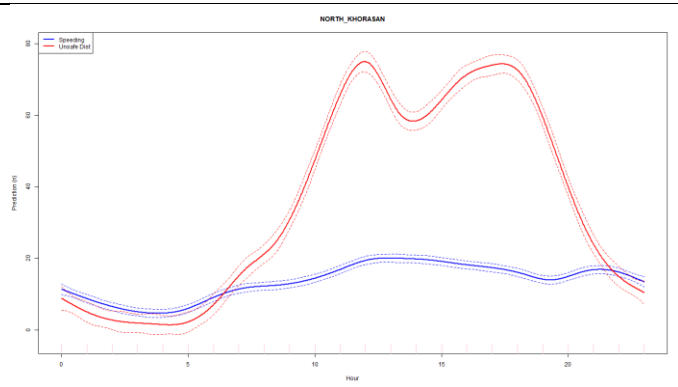
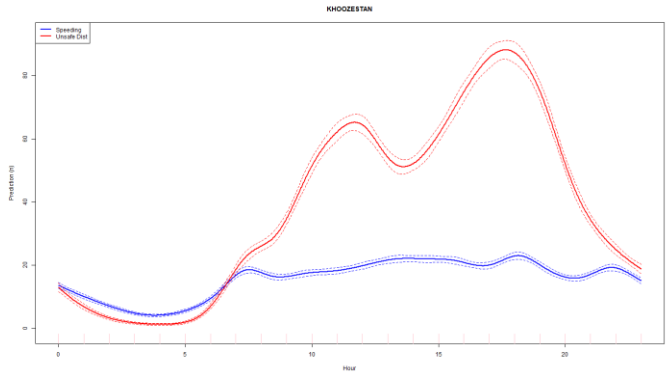
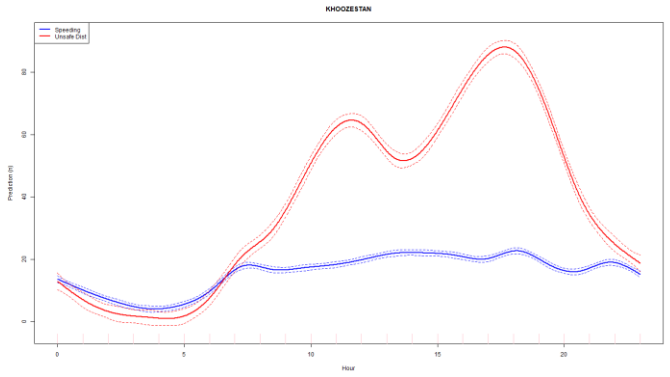
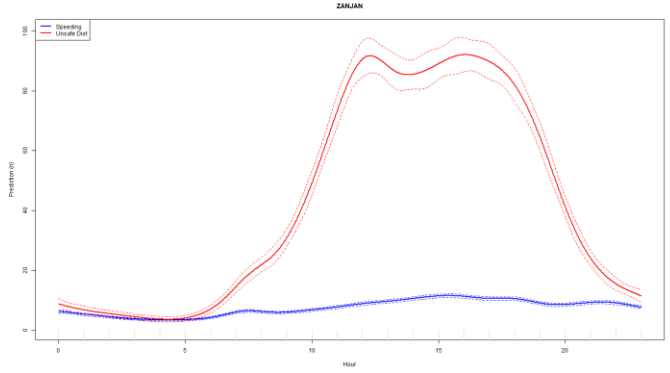
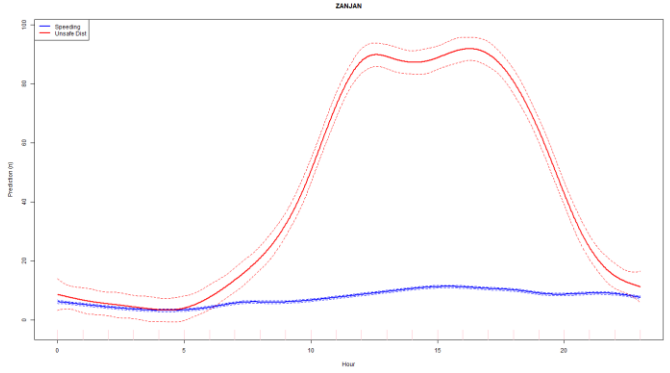
Appendix 2. Comparisons between Predictions for Speeding (Blue) and Unsafe Distance (Red) Traffic Offenses group by province and methods.

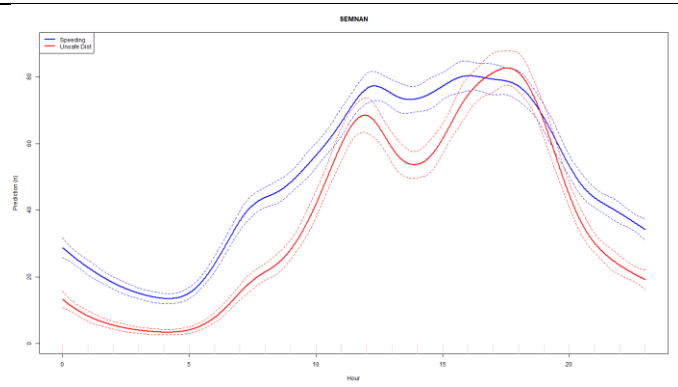
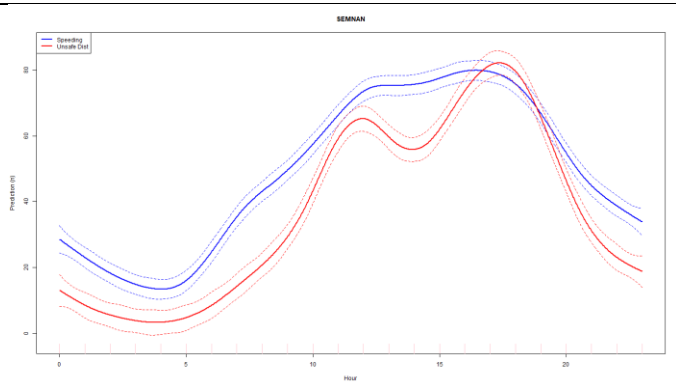
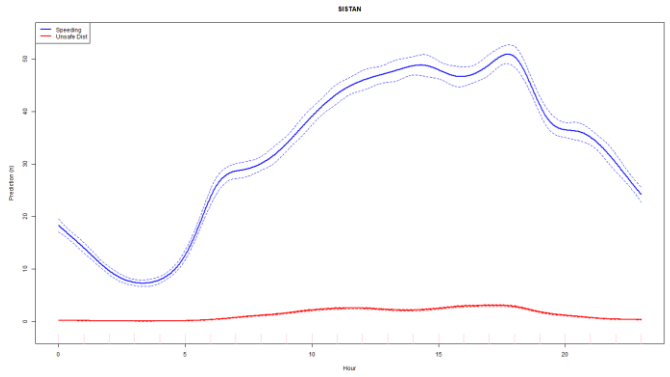
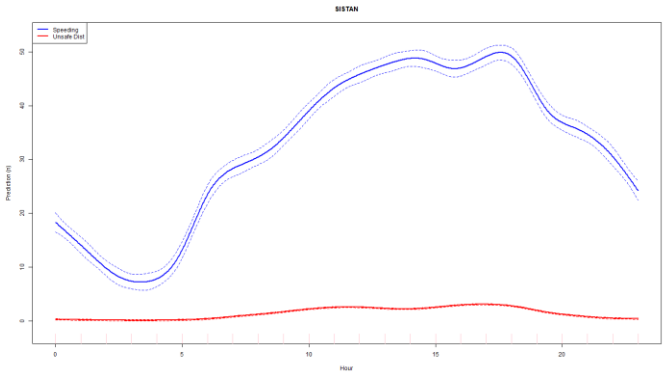
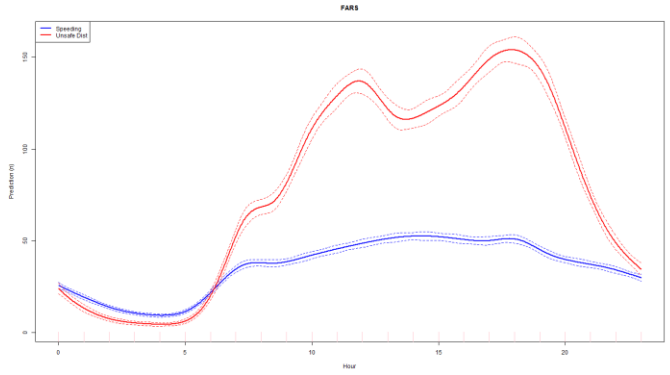
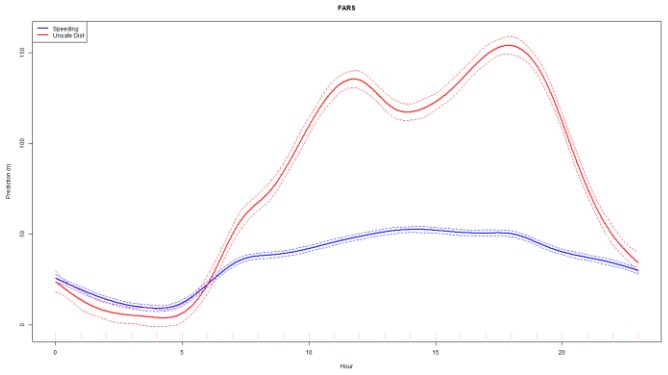
Row	Province Name	Prediction Plot	
		Univariate Quasi-Likelihood Poisson	Bivariate Gaussian
1	Ardebil		
2	Isfahan		

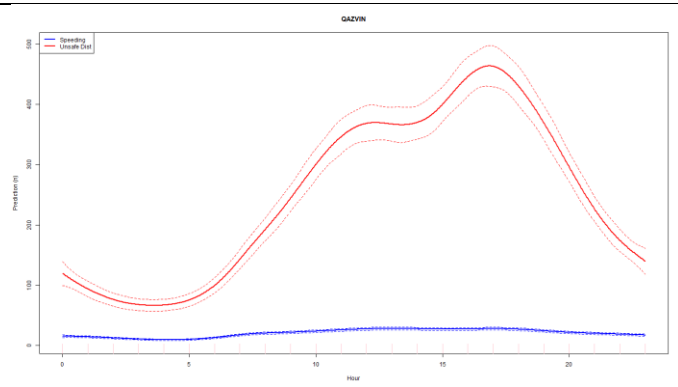
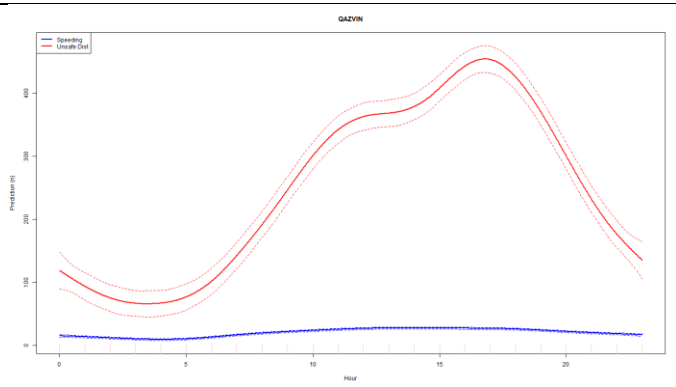
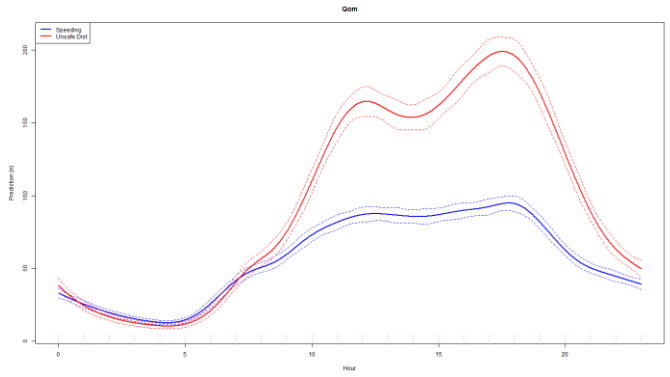
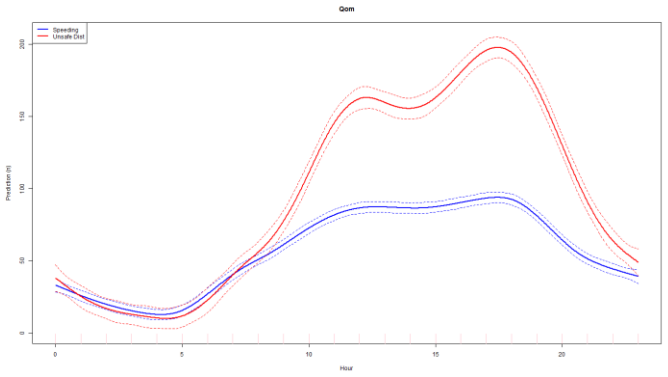
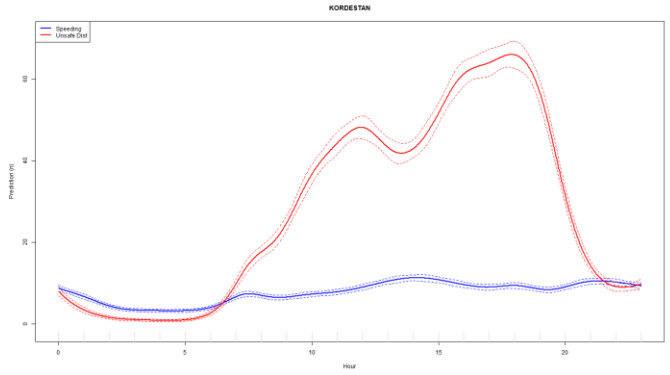
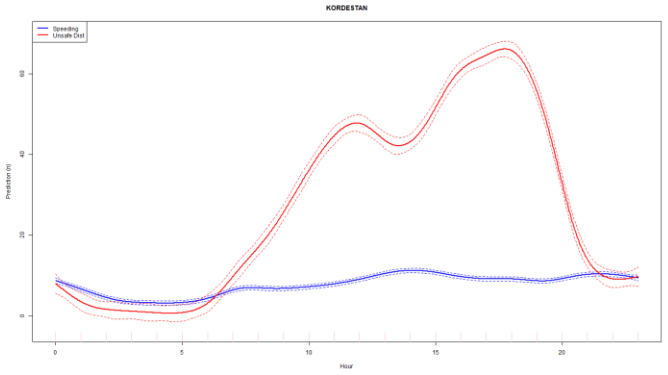
3	Alborz		
4	Ilam		
5	West Azarbayjan		

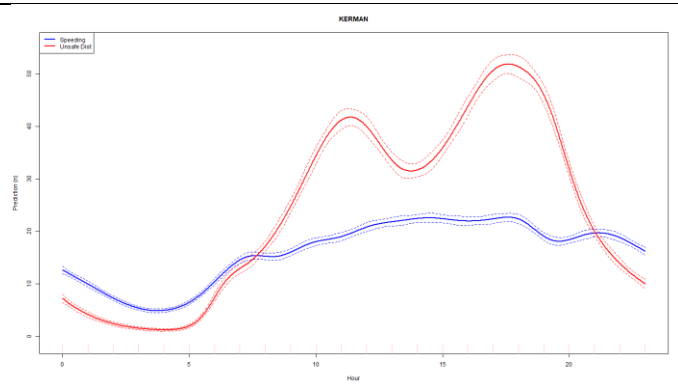
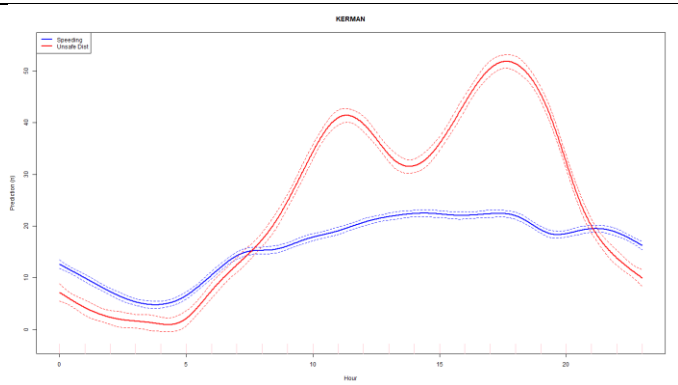
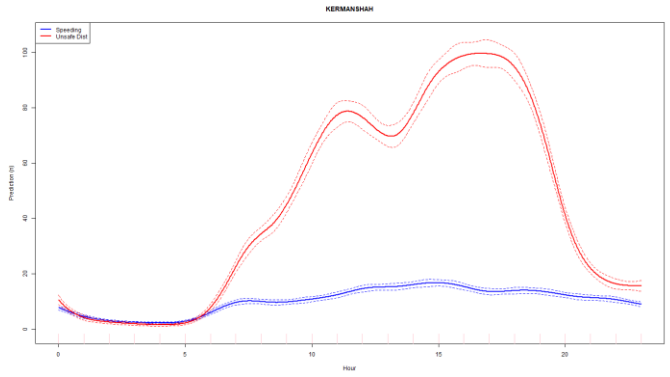
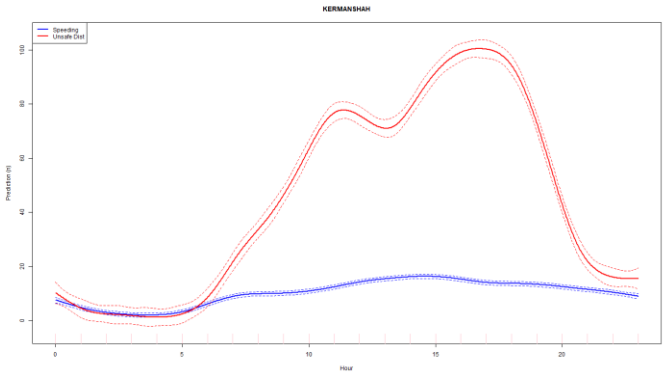
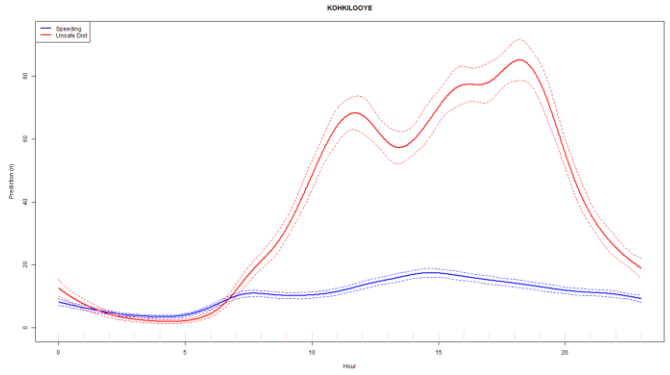
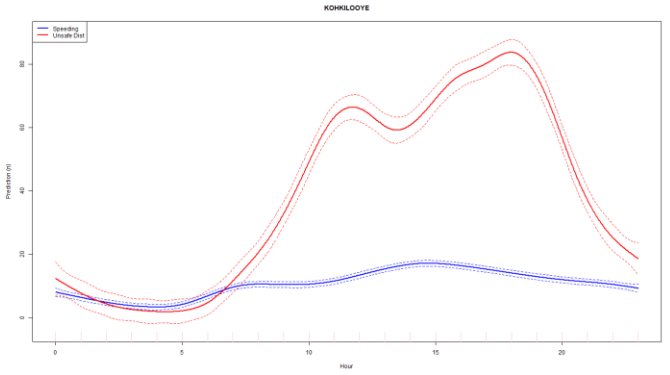
6	East Azarbayjan		
7	Bushehr		
8	Tehran		

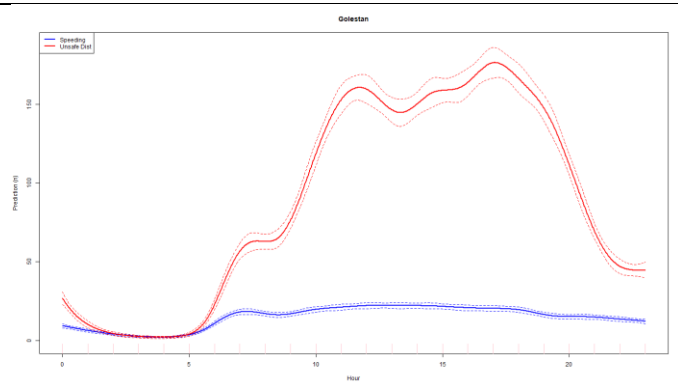
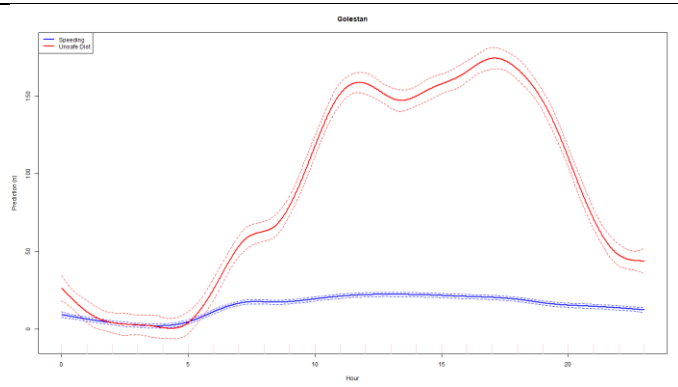
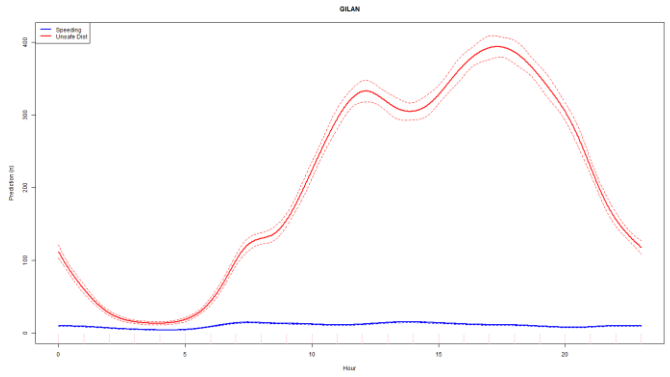
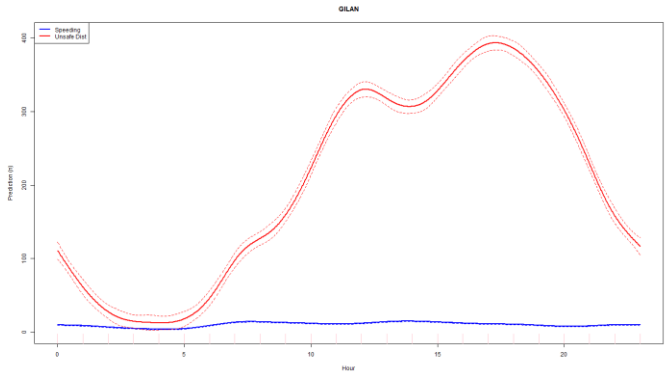
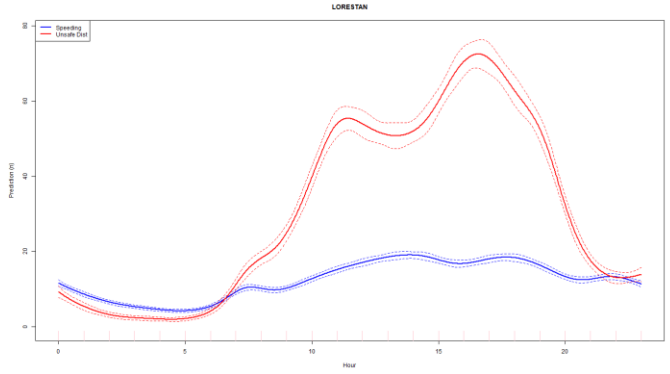
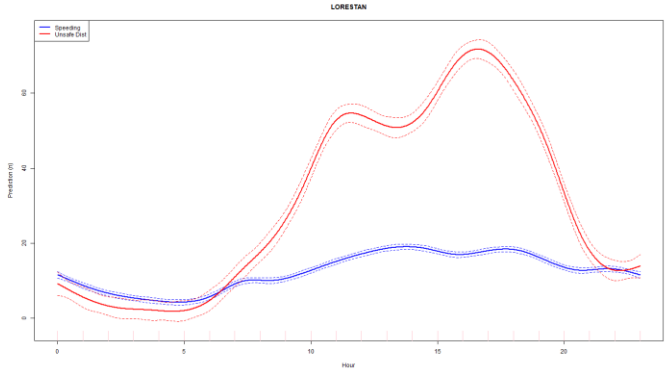
9	Chaharmahal va Bakhtiari		
10	South Khorasan		
11	Razavi Khorasan		

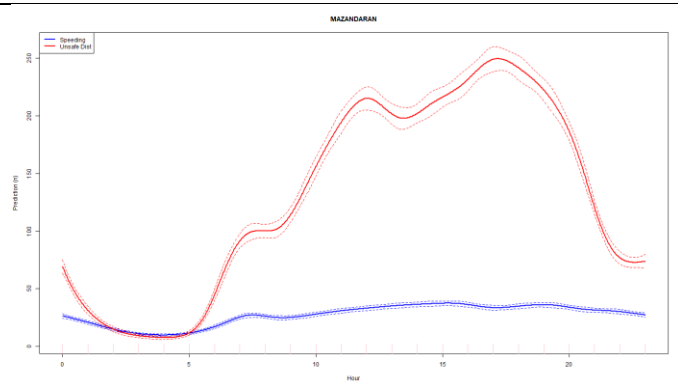
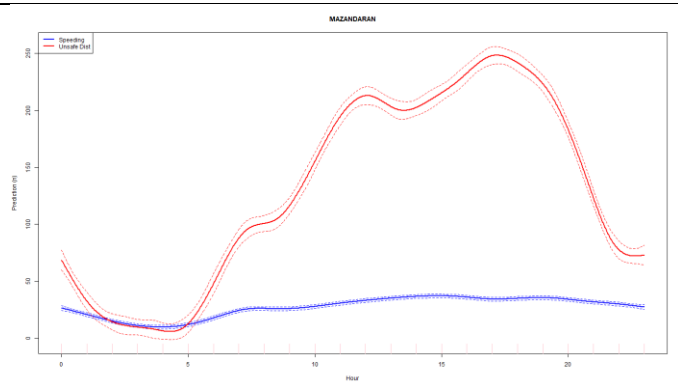
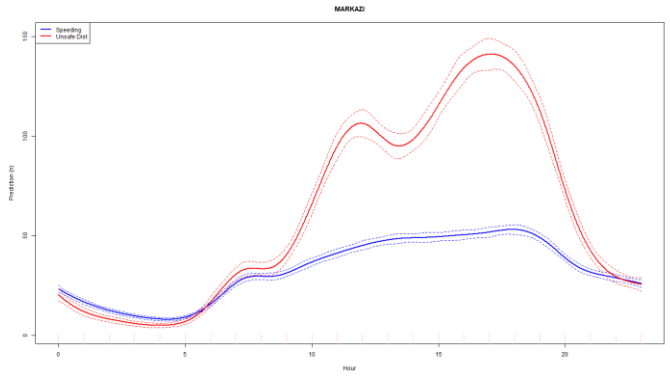
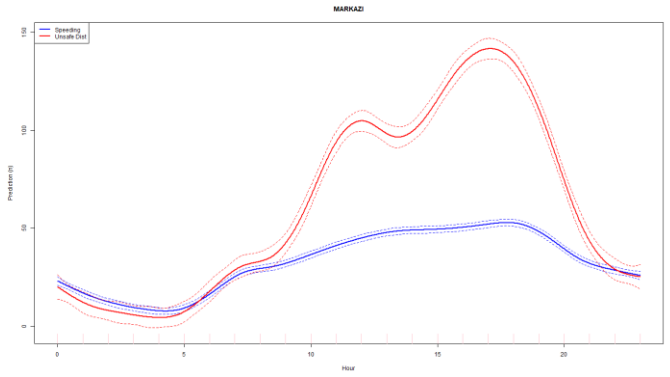
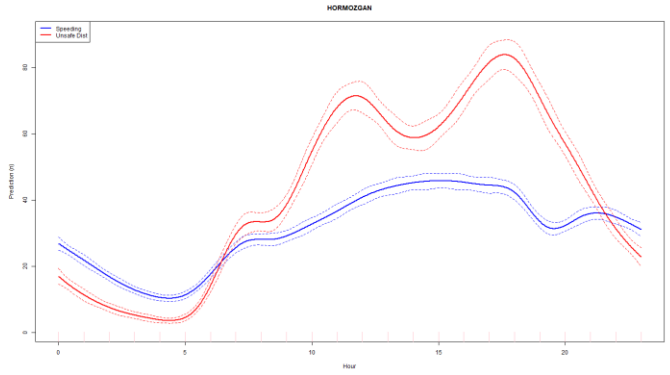
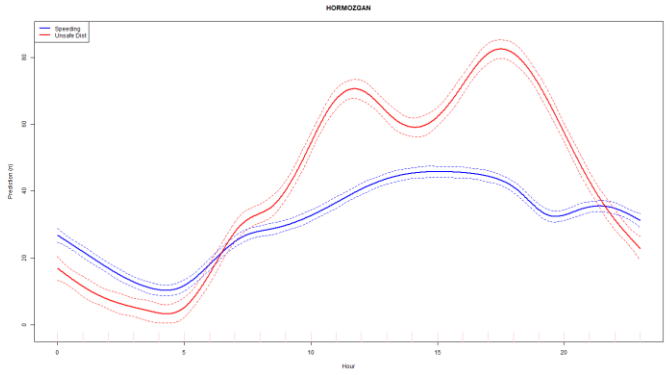
12	North Khorasan		
13	Khuzestan		
14	Zanjan		

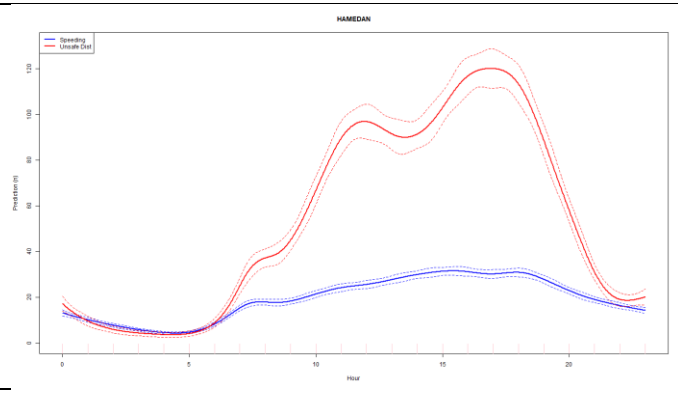
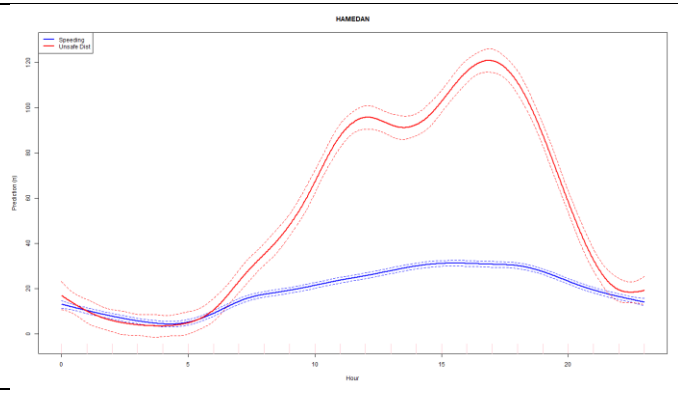
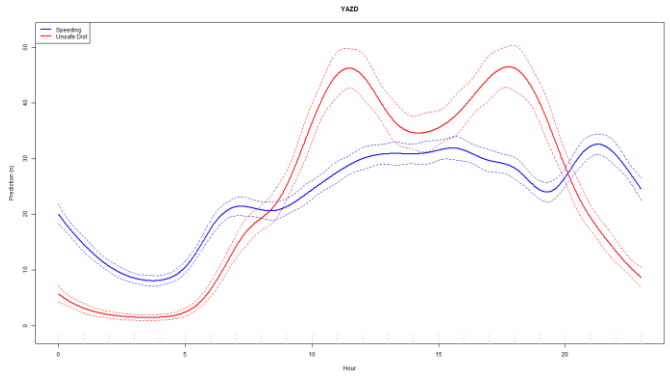
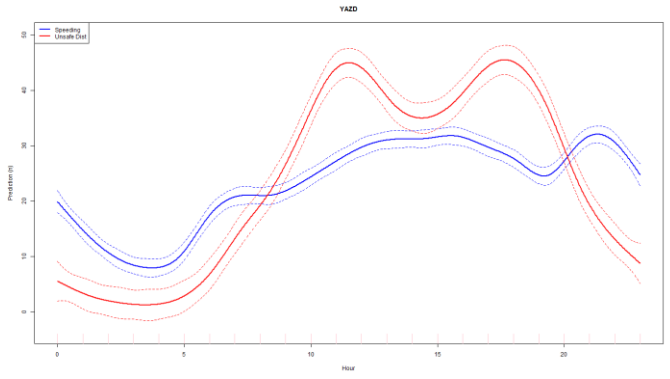
15	Semnan		
16	Sistan va Balouchestan		
17	Fars		

18	Qazvin		
19	Qom		
20	Kordestan		

21	Kerman		
22	Kermanshah		
23	Kohkilouye va Boyerahmad		

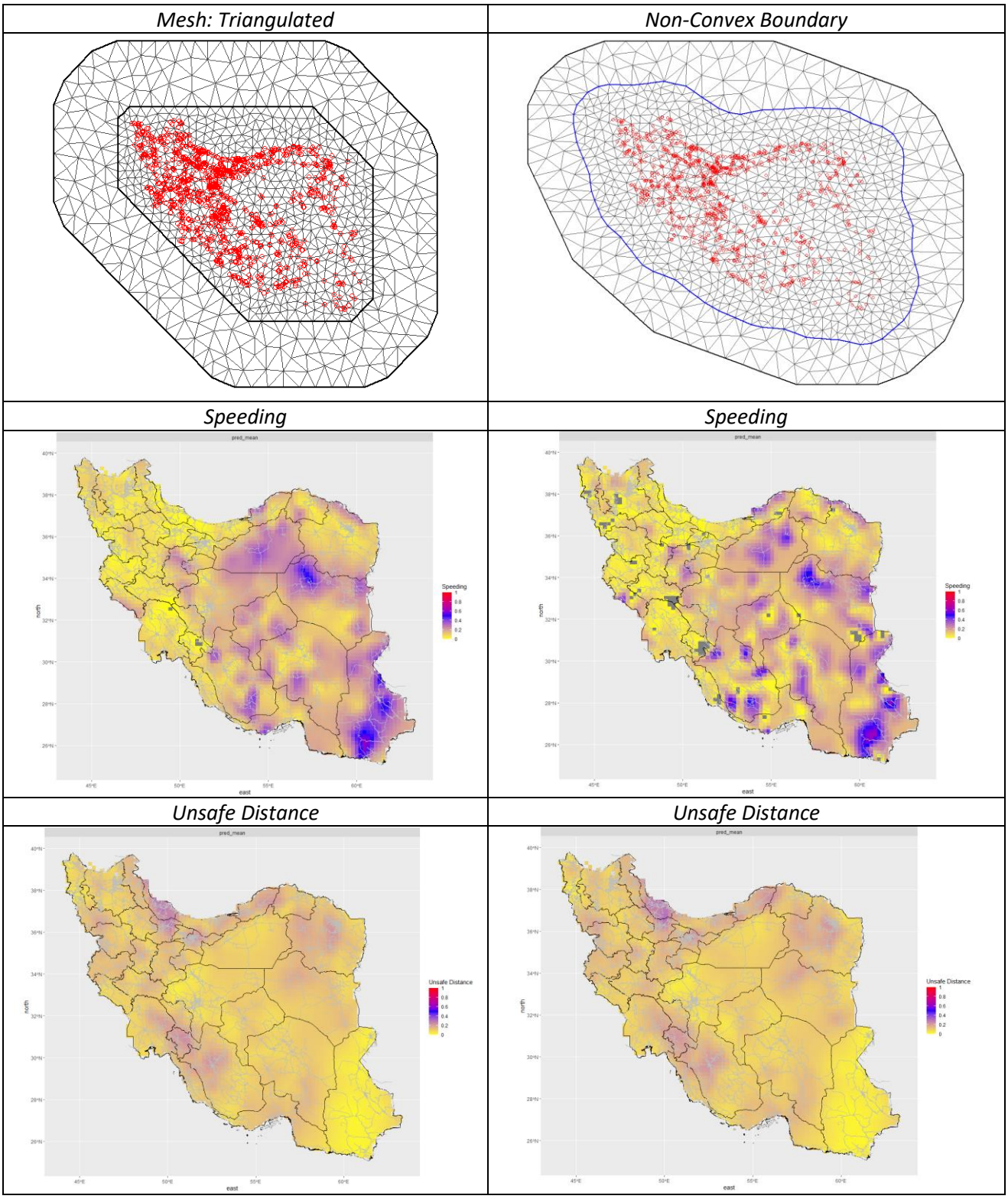
24	Golestan		
25	Gilan		
26	Lorestan		

27	Mazandaran		
28	Markazi		
29	Hormozgan		

30	Hamedan		
31	Yazd		

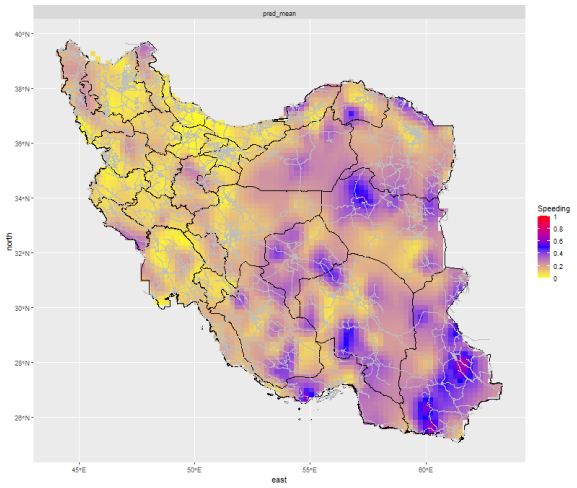
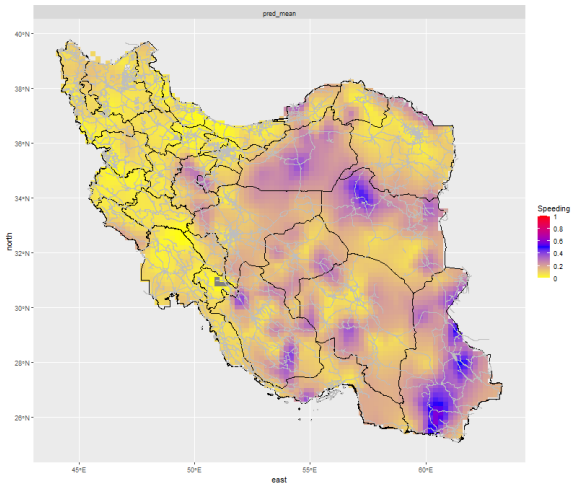
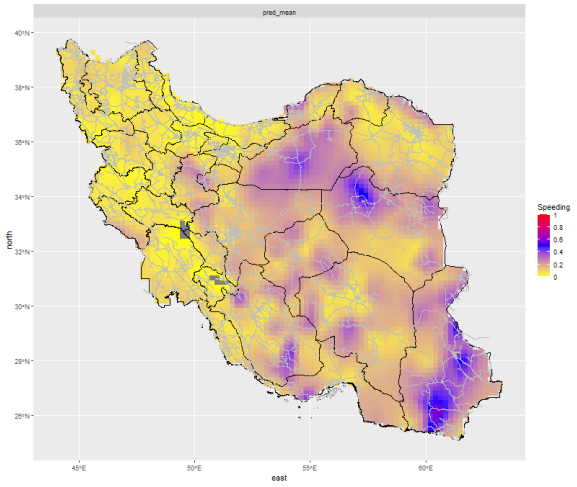
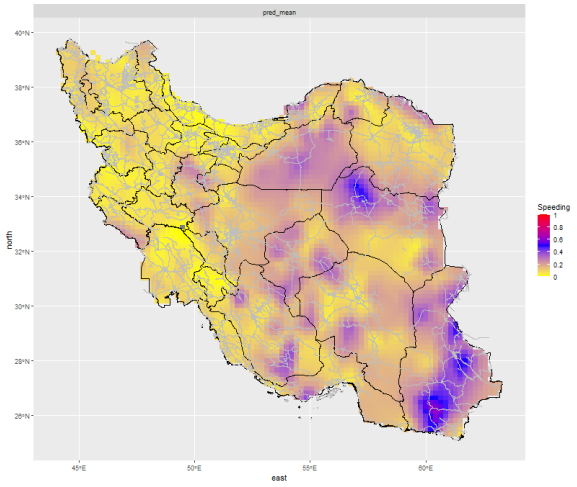
Appendix 2. The predictions of the smoothed spline for two methods. In each panel, there are two plots including (Blue) Speeding, (Red) unsafe distance and two statistical methods. The x-axis is the hour in a day for March-April month and the y-axis is the prediction from the model.

Appendix 3. Comparisons between two mesh methods group by traffic offenses.



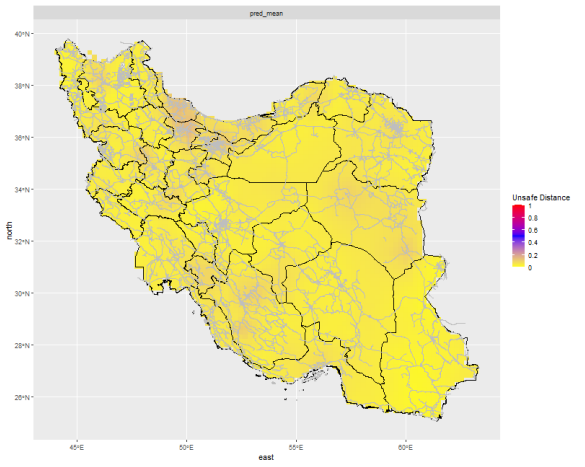
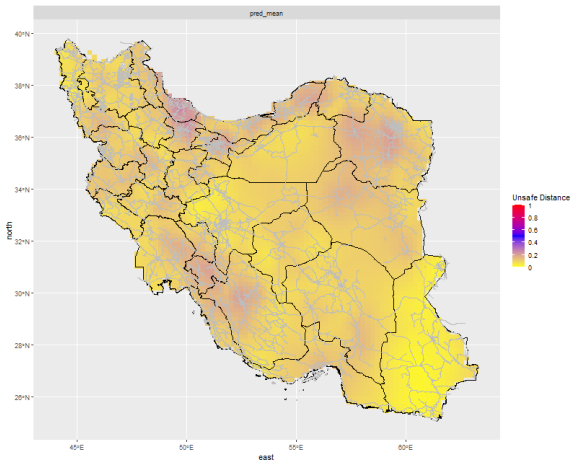
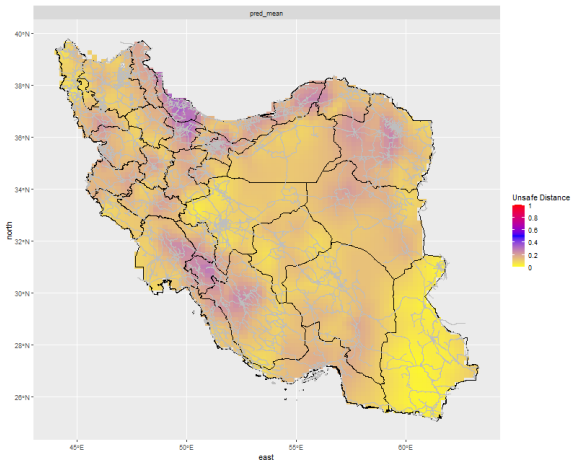
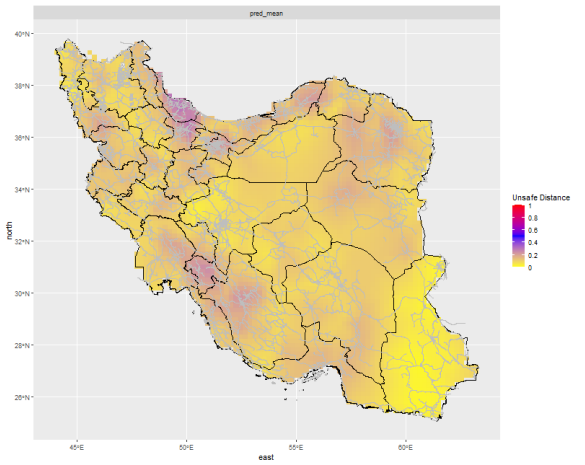
Appendix 3. The triangulated Mesh (left), the Non-Convex Boundary Mesh (right) with red dots are count stations spread the country, the predicted percentage of speeding offenses and unsafe distance offenses. The yellow color is low, blue is middle and red color is high.

Appendix 4.1. Comparisons between four times of the day of predicted percentage for speeding offenses with mesh triangulated.

Speeding	
0-5 hours	6 - 11 hours
	
12 - 17 hours	18 - 23 hours
	

Appendix 4.1. The predicted percentage of speeding offenses group by time of day (including [0,5], [6,11], [12,17] and [18,23] hour) in March-April 2019. The yellow color is low, blue is middle and red color is high.

Appendix 4.2. Comparisons between four times of the day of predicted percentage for unsafe-distance offenses with mesh triangulated.

Unsafe Distance	
0-5 hours	6 – 11 hours
	
12 – 17 hours	18 – 23 hours
	

Appendix 4.2. The predicted percentage of unsafe distance offenses group by time of day (including [0,5], [6,11], [12,17] and [18,23] hour) in March-April 2019.
The yellow color is low, blue is middle and red color is high.