

16.8 MW Wind Farm at Chitradurga

1. The Site

The proposed wind farm is situated on the hill ranges near the village Kennedlu, which is around 20 km south Chitradurga. The proposed site is well connected by a metal road from Chitradurga. The nearest airport from Chitradurga is Bangalore, which is around three hours drive by road. Chitradurga is also connected by rail.

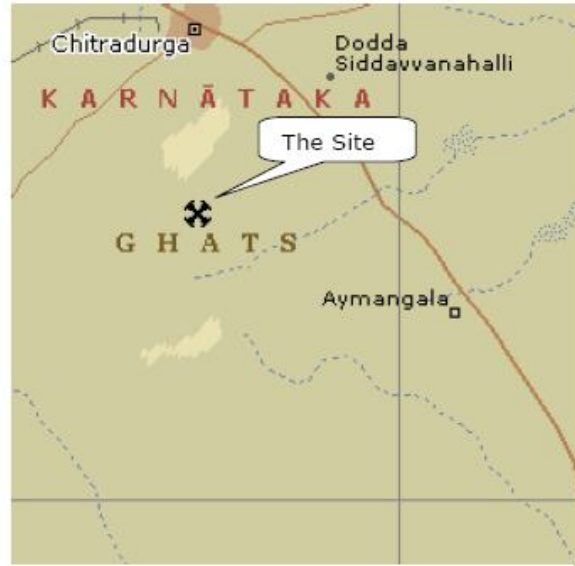


Figure 1: Key map of the site

2. Terrain and Topography

The site terrain comes under the classification of complex terrain. The site for the proposed wind farm is having elevation ranging from 975 m a.s.l to 1075 m a.s.l. The plain on either side of this ridge has an elevation of about 800 m a.s.l. Due to this elevation difference, the proposed site is expected to have a good speed up effect and experience high wind. The top of the ridge in this region is very sparingly vegetated with a few bushes scattered around. The height of these bushes is less than 2 m., which will not have greater impact on the winds.

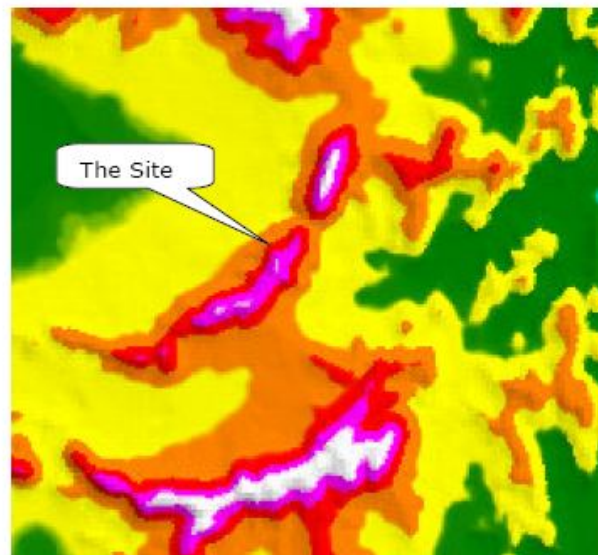


Figure 2: DTM of the site

3. Climate:

The proposed site is near to Chitradurga where the Indian meteorological department is collecting the weather data periodically. Chitradurga has typical tropical climate. Based on the data collected by IMD from Chitradurga, the monthly average temperature, relative humidity, atmospheric pressure and rainfall can be seen in the table given below. The region gets good rainfall in September and October months. The annual average temperature in this region as per the published data is around 25.3°C.

Table: Climatological Table for Chitradurga.

Month	Temp	Rainfall	Humidity	Pressure
	Degree	mm	(%)	Hpa
January	22.9	0.3	52	931
February	25.5	1.5	44	930
March	28.1	6.6	42	928
April	29.3	48.8	51	927
May	28.3	86.5	58	926
June	25.8	50.4	72	925
July	24.3	79.6	79	925
August	24.2	67.7	79	925
September	24.7	105.7	74	927
October	24.7	138.0	69	928
November	23.3	43.0	63	929
December	22.1	11.3	67	930
Annual	25.3	642	62	927

(Source: Climatological Table of IMD)

4. Wind Regime

Enercon India has a wind mast at the proposed site. The data is being collected using a 50 m mast with measurements at 50 m level. Anemometers used for the measuring the wind speed is calibrated. The instrumentation set up used for data collection is of international standards. The wind mast is operational since October 1995. The wind data collected and used from Enercon wind mast have higher wind speed and directional resolution (16 sectors for direction and 1 m/s wind velocity). The wind speed distribution and wind rose as collected from the Enercon wind mast is attached herewith.

The wind mast is on the proposed ridge having an elevation of 1065 m a.s.l. From wind rose diagram we can see that there is a high prevalence of South Westerly winds during the main monsoon period and significant North-East component during the North-east monsoon.

The elevation of the proposed site, the height above the surrounding plains, the near North – South orientation of the ridge prevailing wind direction as explained above is expected to result in the proposed site to be a good windy site.

4.1 Wind Profile

Figure below shows the monthly average wind speed recorded at 50m a.g.l. It shows the general profile of wind pattern in this region. In India the general wind flow is governed by the monsoon season. The main wind season happens to be the southwest monsoon period and it begins to get momentum from the month of May and peaks in the month of July. The effect of the monsoon can be seen in the month of May to September. The monsoon retreat from the northeast shows its effect in the month of November, December, and January. It may be noticed that from the month of May to September the site is experiencing high wind.

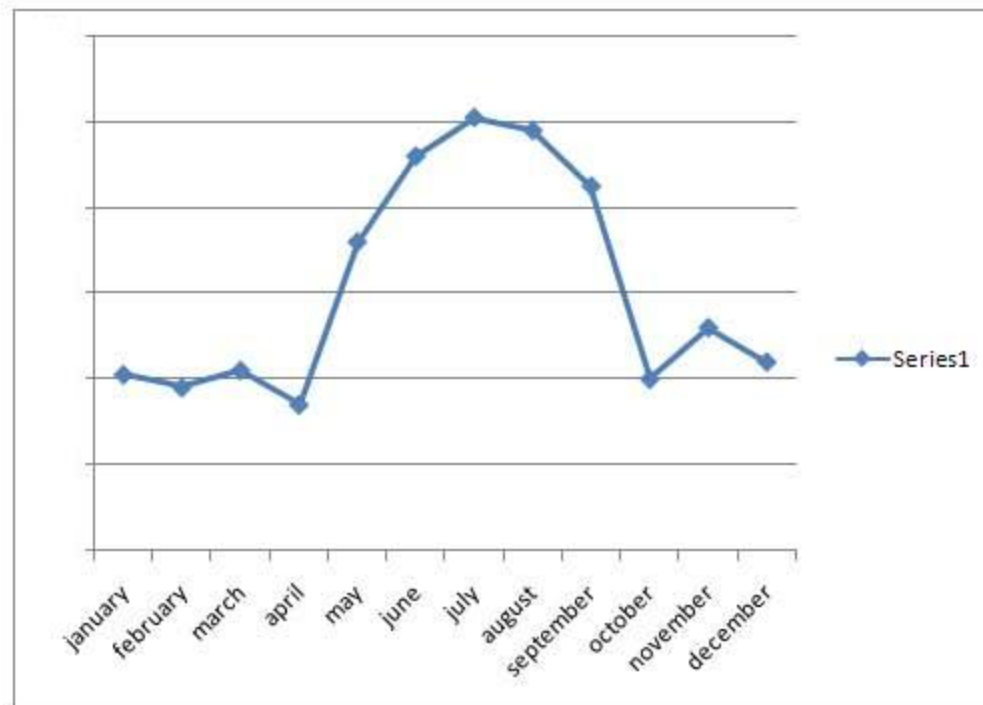


Figure 3: Monthly wind profile
Site EP 1

4.2 Wind Speed Distribution and Wind Rose

Wind data recorded by the EIL wind mast was used for the WasP calculations and is described in the section. Fig below shows the wind speed distribution and wind rose as seen by WasP. The graph clearly indicated that the site experiences quite good winds for a comparably high duration with West-Southwest as the predominant wind direction during high wind season whereas East-Northeast as the mean wind direction for North-East monsoon period.

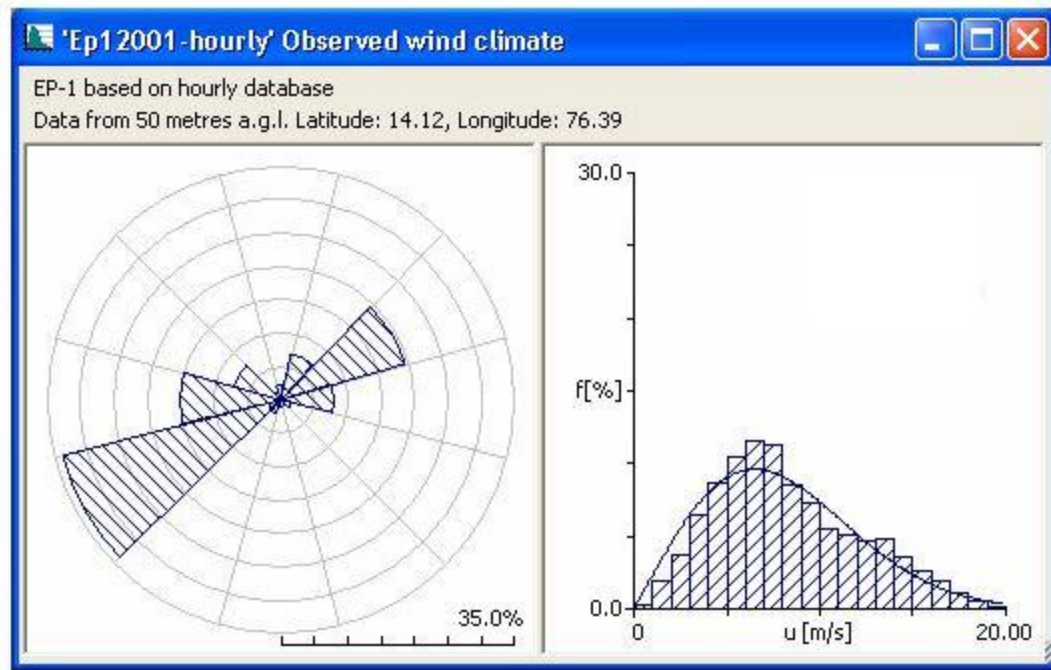


Figure 4: Wind rose and distribution

5. WASP

The wind data collected by Enercon mast was processed and formatted into the “tab” file. The terrain data was obtained by digitizing the topo-map of the site prepared by survey of India. The digitized map was then processed into “map” file after proper verification for input to WasP. The roughness of the site was assigned based on the surface features and the

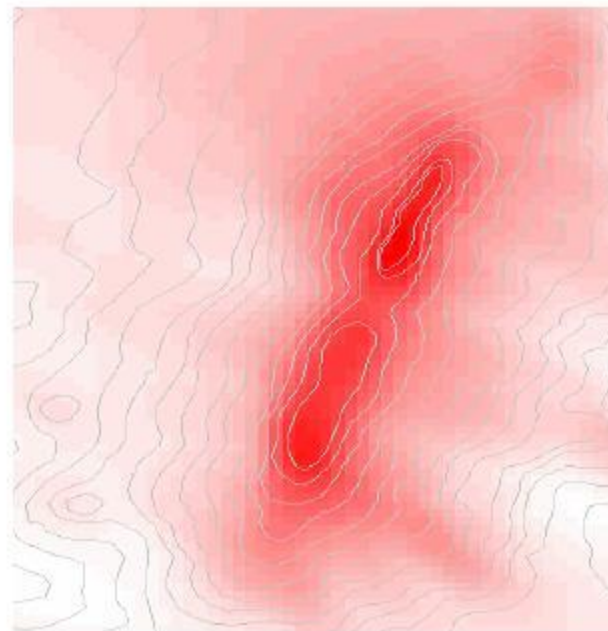


Figure 5: WPD map of the site

guidelines given in the manual. The program was then validated based on the recorded wind data and then run to generate the “Wind Power Density (WPD)” map for the proposed site.

6. Micrositing

In order to have a optimum wind turbine positioning, the optimization tool “WindFarmer” was used in which the topographical features, WPD map and the technical details of the wind turbine were loaded. The optimization process was then carried out for achieving the maximum wind farm output.

7. Estimation Of Generation

After completing the optimization process, the estimation of generation is calculated. The table given as annexure shows the estimated annual generation for EP 1. The net estimated annual generation per turbine is 15.41 lac units i.e. 25.68 lacs per MW.

Appendix 1: The estimated generation per machine per year at EP1 site was found to be as mentioned below:

Estimation of Generation at EP1												
Based on EIL Mast Data at EP 1												
Turbine Type									E-40			
Hub Height									50		m	
Number of Turbines									28			
Turbine Capacity									600		KW	
Site Capacity									16.8		MW	
Estimated annual net energy									43142		MWh	
Estimated annual production/machine									15.41		lacs units	
Estimated Capacity Factor									29.31%			
Customer Name	Microsite Machine Number	Gross Generation (MWh)	Array Loss (%)	Park Generation (MWh)	Availabilities				Transmission Loss	Generation After Adjusting Transmission Losses	Annual Var. Fac.	Net Generation (MWh)
					Machine	Generation After Adjusting Machine Availability	Grid	Generation After Adjusting Grid Availability				
Enercon Wind Farms (India) Limited	1	2325.05	1.54	2289	98%	2243	95%	2131	2.50%	2078	10%	1870
	2	2319.05	2.31	2265	98%	2220	95%	2109	2.50%	2056	10%	1851
	3	1728.05	2.54	1684	98%	1650	95%	1568	2.50%	1529	10%	1376
	4	1523.05	1.35	1502	98%	1477	95%	1399	2.50%	1364	10%	1227
	5	1925.05	2.88	1870	98%	1832	95%	1741	2.50%	1697	10%	1527
	6	1784.05	3.38	1724	98%	1689	95%	1605	2.50%	1565	10%	1408
	7	1932.05	4.62	1843	98%	1806	95%	1716	2.50%	1673	10%	1505
	8	1801.05	3.06	1746	98%	1711	95%	1625	2.50%	1585	10%	1426
	9	2091.05	3.26	2023	98%	1982	95%	1883	2.50%	1836	10%	1653
	10	2118.05	4.75	2017	98%	1977	95%	1878	2.50%	1831	10%	1648
	11	1904.05	4.06	1827	98%	1790	95%	1701	2.50%	1658	10%	1492
	12	1717.05	10.45	1538	98%	1507	95%	1432	2.50%	1396	10%	1256
	13	1767.05	6.76	1648	98%	1615	95%	1534	2.50%	1496	10%	1346
	14	2114.05	3.82	2033	98%	1993	95%	1893	2.50%	1846	10%	1661
CEPCO Industries Limited	27	2136.05	2.77	2077	98%	2035	95%	1934	2.50%	1885	10%	1697
	28	1964.05	3.68	1892	98%	1854	95%	1761	2.50%	1717	10%	1545
	29	2126.05	2.04	2083	98%	2041	95%	1939	2.50%	1890	10%	1701
	30	2080.05	2.92	2019	98%	1979	95%	1880	2.50%	1833	10%	1650
	31	2173.05	4.28	2080	98%	2038	95%	1937	2.50%	1888	10%	1699
	32	2362.05	3.88	2270	98%	2225	95%	2114	2.50%	2061	10%	1855
	33	1562.05	2.42	1524	98%	1494	95%	1419	2.50%	1384	10%	1245
	34	2148.05	6.79	2002	98%	1962	95%	1864	2.50%	1817	10%	1636
	35	1966.05	5.46	1859	98%	1822	95%	1730	2.50%	1687	10%	1518
	36	2426.05	3.35	2345	98%	2298	95%	2183	2.50%	2128	10%	1916
	37	1628.05	2.83	1582	98%	1550	95%	1473	2.50%	1436	10%	1292
	38	1673.05	8.88	1524	98%	1494	95%	1419	2.50%	1384	10%	1245
	39	1911.05	3.03	1853	98%	1816	95%	1725	2.50%	1682	10%	1514
	40	1731.05	2.45	1689	98%	1655	95%	1572	2.50%	1533	10%	1380

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Appendix 2: Probability of Exceedance

Probability of Exceedance	Estimated PLF
P-90	26.00%
P75	27.60%
P50	28.50%
P25	29.60%
P10	29.99%

Appendix 3: Percentage Frequency distribution of Wind Speed data from Wind Mast at Jogimati in Chitradurda, Karnataka

October 1995 to September 1996													
km/hour	m/s	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1.00	0.28	0.12	0.24	0.10	0.11	0.17	0.32	0.00	0.10	0.13	0.00	0.11	0.11
3.00	0.83	0.31	0.73	0.20	0.11	0.33	0.32	0.22	0.11	0.13	0.00	0.11	0.24
5.00	1.39	1.80	1.09	0.30	0.42	1.34	1.38	0.45	0.11	0.38	0.00	0.00	0.61
7.00	1.94	2.95	1.58	0.50	1.15	2.01	2.13	1.45	0.33	0.51	0.00	0.11	1.22
9.00	2.50	3.98	2.55	0.70	1.39	4.24	4.15	2.23	2.40	1.03	0.11	0.11	1.95
11.00	3.06	5.25	3.77	1.71	2.63	6.14	6.60	4.58	5.60	1.07	0.67	0.67	3.41
13.00	3.61	7.18	4.99	2.31	3.47	6.82	6.77	5.58	5.80	1.19	0.67	0.89	3.53
15.00	4.17	7.31	5.36	3.01	5.25	8.14	8.02	6.36	7.80	1.17	0.67	0.78	5.23
17.00	4.72	8.83	6.46	4.82	6.57	8.41	8.74	6.42	7.89	1.23	0.67	1.00	4.99
19.00	5.28	8.88	7.00	6.18	8.48	8.63	9.78	6.01	7.05	2.44	0.97	1.00	4.33
21.00	5.83	9.07	8.36	6.66	7.67	9.75	8.67	5.99	6.94	2.57	1.09	1.00	4.68
23.00	6.39	7.55	7.90	7.82	7.88	8.12	7.62	6.00	6.60	3.21	1.21	1.11	5.03
25.00	6.94	7.34	7.20	8.97	8.76	7.39	6.86	5.91	5.80	3.88	1.09	1.33	5.25
27.00	7.50	7.12	6.89	9.26	7.82	5.53	6.32	5.70	5.61	4.10	1.91	1.97	6.55
29.00	8.06	4.97	6.54	8.63	7.52	5.10	5.33	5.98	5.30	8.52	3.47	3.40	6.13
31.00	8.61	4.55	6.09	8.31	7.42	4.75	3.97	4.93	4.32	8.91	4.55	5.36	6.13
33.00	9.17	4.29	6.18	7.00	6.51	4.32	3.61	5.12	4.30	9.31	6.47	5.79	7.60
35.00	9.72	3.07	5.21	6.60	5.68	3.54	3.25	4.84	4.10	8.46	8.01	7.27	5.27
37.00	10.28	1.76	3.35	5.59	3.35	2.15	2.34	4.35	3.99	9.13	7.97	9.75	5.22
39.00	10.83	1.37	3.00	3.98	3.16	1.20	1.89	3.98	3.50	8.06	8.07	10.65	5.22
41.00	11.39	1.13	2.20	3.20	2.14	1.03	1.17	3.61	2.70	7.70	8.25	8.70	5.10
43.00	11.94	0.41	1.07	1.82	0.83	0.26	0.54	2.81	2.30	4.84	6.67	6.46	4.32
45.00	12.50	0.08	0.53	0.91	0.74	0.26	0.00	2.43	2.05	3.77	6.56	6.30	3.40

October 1995 to September 1996

47.00	13.06	0.00	0.71	0.30	0.09	0.00	0.00	0.00	1.60	1.73	3.01	5.90	6.12	2.00
49.00	13.61	0.00	0.44	0.20	0.00	0.00	0.00	0.00	1.45	1.20	2.10	5.35	5.74	1.13
51.00	14.17	0.00	0.35	0.00	0.00	0.00	0.00	0.00	1.34	1.10	1.26	4.62	4.66	0.43
53.00	14.72	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.79	0.95	3.78	3.76	0.26
55.00	15.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.19	2.26	2.41	0.00
57.00	15.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	2.55	1.70	0.00
59.00	16.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.51	0.62	0.00
61.00	16.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.09	0.00
63.00	17.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33	0.36	0.00
65.00	18.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85	0.18	0.00
67.00	18.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.00	0.00
69.00	19.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.18	0.00
71.00	19.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.09	0.00
73.00	20.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00
75.00	20.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

October 1996 to September 1997

km/hour	m/s	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1.00	0.28	0.67	0.40	0.10	0.00	0.30	0.31	0.10	0.00	0.00	0.00	0.00	0.30
3.00	0.83	0.78	0.63	0.26	0.41	1.40	0.31	0.62	0.21	0.11	0.00	0.20	0.34
5.00	1.39	1.56	1.50	0.39	1.13	2.20	1.36	1.66	0.42	0.32	0.00	0.20	0.58
7.00	1.94	2.56	1.70	0.55	1.37	3.20	2.09	2.10	1.35	0.42	0.11	0.30	1.09
9.00	2.50	3.45	2.70	0.78	2.48	5.20	4.07	4.30	2.08	0.84	0.11	0.30	1.75
11.00	3.06	4.56	3.40	1.90	3.31	5.68	6.48	7.10	3.70	1.90	0.67	0.84	3.07
13.00	3.61	6.24	4.49	2.57	5.01	6.40	7.10	7.82	4.80	2.01	0.67	1.12	3.18
15.00	4.17	6.35	4.82	3.35	6.20	7.20	8.00	8.02	6.22	2.33	0.67	0.98	4.71
17.00	4.72	8.03	5.37	5.36	6.90	7.78	8.50	9.23	6.27	2.33	0.67	1.26	4.49
19.00	5.28	8.40	6.05	7.14	7.70	8.75	8.70	8.13	6.35	2.09	0.92	1.26	4.05
21.00	5.83	9.86	8.54	8.93	7.90	8.80	9.10	8.02	6.33	2.19	1.35	1.26	4.38
23.00	6.39	8.21	8.87	9.68	8.86	8.14	8.52	7.88	6.35	2.63	1.50	1.40	4.60
25.00	6.94	7.98	8.06	8.43	8.49	8.00	6.81	7.05	6.25	3.18	1.35	1.67	5.10
27.00	7.50	7.74	7.04	8.70	8.16	5.90	6.23	5.58	6.27	3.36	2.36	2.48	5.50
29.00	8.06	5.40	6.68	8.10	8.06	5.13	5.50	4.72	6.21	6.98	4.02	3.60	5.92
31.00	8.61	4.95	6.23	7.39	7.00	5.10	4.10	3.79	4.88	7.30	5.26	4.70	6.03
33.00	9.17	4.66	5.80	6.23	6.10	3.72	3.73	3.70	5.07	7.35	6.41	5.20	7.32
35.00	9.72	3.34	5.65	5.87	3.31	3.76	3.36	3.14	4.79	9.10	7.61	5.90	6.58
37.00	10.28	1.91	3.40	4.97	3.13	1.80	2.41	3.00	4.31	8.69	8.26	8.30	6.10
39.00	10.83	1.49	2.80	3.54	2.11	1.10	1.95	2.40	3.94	8.64	9.30	8.20	5.70
41.00	11.39	1.23	2.25	2.85	0.84	0.20	1.10	0.78	3.57	8.74	8.96	10.20	5.68
43.00	11.94	0.40	1.09	1.62	0.75	0.10	0.00	0.18	2.78	6.17	5.65	9.00	5.55

October 1996 to September 1997													
45.00	12.50	0.10	1.00	0.81	0.09	0.00	0.00	0.00	2.41	4.81	5.56	6.30	3.70
47.00	13.06	0.10	0.72	0.27	0.00	0.00	0.00	0.00	2.04	3.84	5.00	5.30	2.18
49.00	13.61	0.00	0.45	0.18	0.00	0.00	0.00	0.00	1.39	2.65	4.53	5.78	0.97
51.00	14.17	0.00	0.36	0.00	0.00	0.00	0.00	0.00	1.02	1.55	4.10	4.23	0.45
53.00	14.72	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.08	0.00	3.70	3.85	0.20
55.00	15.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.20	2.47	0.12
57.00	15.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.10	1.74	0.00
59.00	16.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.48	0.64	0.00
61.00	16.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30	0.40	0.00
63.00	17.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30	0.28	0.00
65.00	18.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.10	0.00
67.00	18.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.10	0.00
69.00	19.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.00
71.00	19.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00
73.00	20.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00
75.00	20.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

October 1997 to September 1998

km/hour	m/s	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1.00	0.28	0.66	0.20	0.11	0.00	0.00	0.30	0.10	0.00	0.00	0.00	0.11	0.10
3.00	0.83	0.77	0.60	0.21	0.00	0.33	0.30	0.64	0.22	0.11	0.00	0.11	0.15
5.00	1.39	1.53	0.90	0.31	0.43	1.31	1.42	1.75	0.43	0.33	0.00	0.00	0.50
7.00	1.94	2.40	1.29	0.52	1.19	2.30	2.19	3.94	1.41	0.43	0.00	0.11	1.09
9.00	2.50	3.20	2.10	0.73	1.43	4.16	4.07	4.82	2.17	0.87	0.11	0.11	1.62
11.00	3.06	4.48	3.24	1.78	2.71	6.02	6.48	6.90	4.45	1.96	0.66	0.66	2.78
13.00	3.61	5.93	4.45	2.52	3.57	7.15	7.52	7.90	5.43	2.07	0.66	0.88	2.90
15.00	4.17	6.50	4.77	3.29	5.40	7.99	8.25	8.47	6.49	2.40	0.66	0.77	3.30
17.00	4.72	7.30	5.10	5.17	6.76	8.25	8.58	9.20	6.54	2.40	0.66	0.99	4.00
19.00	5.28	8.10	5.70	6.82	8.30	8.47	8.80	8.58	6.62	2.07	0.88	0.99	4.21
21.00	5.83	9.20	8.21	8.35	8.69	8.14	9.96	8.00	6.61	2.18	0.99	0.99	4.38
23.00	6.39	8.70	8.79	8.90	8.72	7.70	7.17	7.26	6.62	2.61	1.10	1.10	4.71
25.00	6.94	8.22	9.10	9.30	8.30	7.10	6.45	6.50	5.44	3.16	0.99	1.32	5.37
27.00	7.50	8.10	8.12	8.60	7.70	5.90	6.18	5.56	5.46	3.33	1.73	1.95	5.92
29.00	8.06	5.90	7.50	8.10	7.60	5.40	5.21	4.81	5.73	6.93	3.16	3.37	6.10
31.00	8.61	5.23	6.23	7.96	6.30	5.07	3.89	3.86	4.73	7.25	4.13	4.60	6.15
33.00	9.17	4.67	6.10	6.50	6.12	4.61	3.53	3.39	4.91	8.80	5.88	5.74	6.80
35.00	9.72	3.52	5.32	6.13	5.74	3.78	3.18	3.20	4.64	9.40	7.63	6.60	7.30
37.00	10.28	2.01	3.42	5.08	3.38	2.30	2.29	2.06	4.17	8.20	8.80	8.86	7.92
39.00	10.83	1.58	3.06	3.62	3.19	1.60	1.85	1.69	3.81	8.33	9.30	9.70	7.00
41.00	11.39	1.30	2.25	2.91	2.16	1.10	1.14	0.94	3.46	8.42	8.87	9.60	6.15
43.00	11.94	0.47	1.09	1.65	0.84	0.28	0.53	0.19	2.69	5.83	7.80	6.70	4.90
45.00	12.50	0.09	0.54	0.82	0.75	0.28	0.00	0.00	2.33	4.54	6.40	6.50	3.00
47.00	13.06	0.00	0.72	0.28	0.09	0.00	0.00	0.00	1.97	3.63	5.50	6.60	1.60
49.00	13.61	0.00	0.45	0.19	0.00	0.00	0.00	0.00	1.34	2.53	4.49	6.07	1.18

October 1997 to September 1998														
51.00	14.17	0.00	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.98	1.52	4.30	4.93	0.46
53.00	14.72	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	3.66	3.98	0.27
55.00	15.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.19	2.55	0.05
57.00	15.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	1.80	0.00
59.00	16.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.46	0.66	0.00
61.00	16.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.10	0.09	0.00
63.00	17.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.29	0.38	0.00
65.00	18.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.19	0.00
67.00	18.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.00	0.00
69.00	19.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.19	0.00
71.00	19.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.10	0.00
73.00	20.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00
75.00	20.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00

October 1998 to September 1999

km/hour	m/s	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1.00	0.28	0.33	0.44	0.00	0.00	0.34	0.34	0.00	0.00	0.00	0.00	0.11	0.34
3.00	0.83	0.33	0.69	0.28	0.45	1.57	0.34	0.62	0.23	0.12	0.00	0.15	0.38
5.00	1.39	1.00	1.65	0.43	1.25	2.46	1.10	1.82	0.47	0.35	0.00	0.15	0.65
7.00	1.94	1.40	1.87	0.60	1.50	3.36	1.90	2.35	1.52	0.46	0.12	0.19	1.23
9.00	2.50	2.87	2.97	0.86	2.73	5.46	3.70	4.90	2.34	0.93	0.12	0.20	1.96
11.00	3.06	4.50	3.74	2.09	3.64	6.13	6.80	7.53	4.16	1.10	0.73	0.60	3.37
13.00	3.61	6.10	4.94	2.82	5.51	6.45	7.46	8.60	5.40	2.21	0.74	0.64	3.49
15.00	4.17	6.99	5.30	3.90	6.82	7.50	8.80	9.50	6.99	2.56	0.74	1.08	5.18
17.00	4.72	7.95	6.44	6.70	7.59	8.10	9.35	8.96	7.05	2.56	0.74	1.10	4.94
19.00	5.28	9.10	7.87	7.85	8.47	8.82	9.57	7.56	6.67	2.29	1.01	1.38	4.46
21.00	5.83	8.79	8.97	9.83	8.30	8.90	8.20	7.46	6.65	2.41	1.48	1.38	4.82
23.00	6.39	7.39	8.92	9.10	8.91	7.90	7.90	7.33	6.67	2.89	1.65	1.54	5.06
25.00	6.94	7.12	7.74	7.92	8.32	7.45	6.30	6.56	6.56	3.50	1.48	1.84	5.61
27.00	7.50	6.90	6.34	8.18	8.00	5.80	5.79	5.19	5.71	3.70	2.60	2.73	6.05
29.00	8.06	6.40	6.01	7.62	7.10	4.90	5.06	4.39	5.65	6.70	4.42	3.00	7.70
31.00	8.61	5.90	5.60	6.95	6.20	3.80	4.02	3.53	4.44	8.03	5.94	3.76	7.24
33.00	9.17	4.20	5.22	5.86	5.70	3.65	3.43	3.44	4.61	9.18	7.25	5.72	6.73
35.00	9.72	3.60	4.20	5.52	3.08	3.68	3.30	2.92	4.36	8.46	7.80	7.38	6.06
37.00	10.28	3.20	3.06	4.67	2.88	1.76	2.10	2.79	3.92	8.08	9.33	10.23	5.20
39.00	10.83	2.00	2.52	3.33	1.95	1.08	1.91	2.23	3.59	7.86	8.65	8.90	4.78
41.00	11.39	0.90	2.02	2.68	0.77	0.20	1.90	0.73	3.25	8.12	8.33	8.70	4.50
43.00	11.94	1.10	0.98	1.52	0.67	0.10	0.00	0.17	2.53	5.74	5.09	7.60	4.30
45.00	12.50	1.10	0.90	0.76	0.07	0.00	0.00	0.00	2.19	4.48	5.00	5.90	2.30
47.00	13.06	0.15	0.65	0.25	0.00	0.00	0.00	0.00	1.90	3.57	4.45	5.70	2.01
49.00	13.61	0.00	0.41	0.17	0.00	0.00	0.00	0.00	1.29	2.39	4.03	4.05	0.89

October 1998 to September 1999															
51.00	14.17	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.95	1.50	3.65	3.74	0.41	
53.00	14.72	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	3.30	3.60	0.18	
55.00	15.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.96	3.30	0.00	
57.00	15.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.87	1.62	0.00	
59.00	16.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.70	1.50	0.00	
61.00	16.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.42	0.78	0.00	
63.00	17.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.40	0.67	0.00	
65.00	18.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.23	0.00	
67.00	18.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00	
69.00	19.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	
71.00	19.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	
73.00	20.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00	
75.00	20.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

October-1999 to September-2000

km/hour	m/s	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1.00	0.28	1.00	1.00	0.80	1.00	0.30	0.70	3.00	0.30	0.50	0.30	0.12	0.70
3.00	0.83	1.10	1.20	0.90	1.50	0.36	0.90	3.80	0.40	0.60	0.30	0.12	0.90
5.00	1.39	2.20	1.60	1.20	1.80	1.50	2.00	6.20	0.50	0.80	0.40	0.20	1.10
7.00	1.94	3.30	2.00	1.80	3.00	2.16	2.40	6.50	2.00	0.80	0.50	0.20	1.70
9.00	2.50	3.50	3.30	2.00	3.50	4.56	4.68	6.90	3.40	1.40	0.50	0.30	2.80
11.00	3.06	4.50	4.20	2.60	4.90	6.00	7.00	7.60	4.00	1.60	0.50	0.40	3.30
13.00	3.61	5.00	4.68	3.00	5.50	6.60	8.04	9.00	5.00	1.70	0.60	0.60	3.50
15.00	4.17	5.90	5.07	3.30	5.80	7.50	9.20	9.30	5.28	1.70	0.70	0.60	3.70
17.00	4.72	6.00	5.72	4.20	6.00	7.90	9.30	8.50	5.28	1.80	0.70	0.70	3.96
19.00	5.28	8.00	7.93	6.00	6.90	8.20	9.50	6.60	5.40	2.00	0.80	0.70	4.10
21.00	5.83	8.80	9.62	8.00	6.30	9.00	8.00	6.20	5.50	2.10	0.80	0.80	4.20
23.00	6.39	9.00	9.00	8.50	6.10	8.50	7.00	5.00	5.40	2.20	1.00	1.00	4.29
25.00	6.94	9.00	7.50	8.40	6.00	8.20	5.44	4.70	5.40	3.00	1.30	1.20	4.90
27.00	7.50	7.02	5.18	8.00	5.90	7.30	5.28	4.10	5.50	3.10	1.60	1.50	5.00
29.00	8.06	6.57	4.90	7.50	5.40	6.00	4.40	3.10	5.61	3.40	2.00	2.50	6.20
31.00	8.61	5.50	4.62	6.40	5.30	5.00	3.28	2.70	5.72	3.90	3.00	4.00	6.20
33.00	9.17	5.40	4.69	5.20	5.20	3.76	2.96	2.50	5.94	4.00	4.00	6.50	6.00
35.00	9.72	3.00	3.92	4.70	4.50	2.50	2.64	2.00	5.50	6.00	6.00	7.00	5.60
37.00	10.28	1.70	2.87	3.70	3.00	2.00	2.32	1.10	4.20	7.00	7.08	8.00	5.50
39.00	10.83	1.60	2.59	2.70	2.96	0.90	1.92	0.60	3.30	7.50	8.00	9.20	5.40
41.00	11.39	1.40	1.96	2.00	2.08	0.60	1.10	0.40	2.20	8.00	9.00	9.00	5.30
43.00	11.94	0.81	1.12	0.00	1.04	0.40	0.70	0.30	1.10	7.00	7.12	8.40	5.30
45.00	12.50	0.45	0.70	0.00	0.96	0.20	0.10	0.20	1.00	6.50	7.04	7.48	3.30
47.00	13.06	0.27	0.00	0.00	0.00	0.10	0.00	0.10	0.70	5.50	6.50	7.20	2.30
49.00	13.61	0.09	0.00	0.00	0.00	0.24	0.00	0.00	0.60	4.20	6.00	6.40	1.45

October-1999 to September-2000														
51.00	14.17	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	3.20	6.16	5.20	0.77
53.00	14.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	2.00	4.00	4.00	0.00
55.00	15.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	1.30	3.52	2.30	0.00
57.00	15.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	2.96	1.20	0.00
59.00	16.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	1.02	0.00
61.00	16.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.50	0.00
63.00	17.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.12	0.20	0.00
65.00	18.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.10	0.00
67.00	18.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00
69.00	19.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.00
71.00	19.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
73.00	20.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
75.00	20.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00