TECHNICAL REPORT

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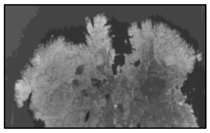
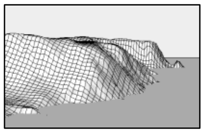
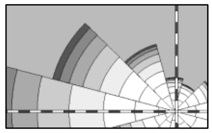
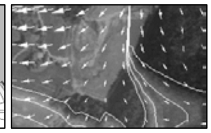
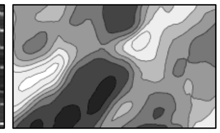


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REVISION HISTORY

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EXECUTIVE SUMMARY

The 3 second extreme wind in 50 return year at site XXX Solar Park Point 1 is assessed as 80.5mph at 10m, 67.6mph at 4.6m and 54.0mph at 2m.

From the north, the 3 second extreme wind in 50 return year is assessed as 63.1mph at 10m, 55.1mph at 4.6m and 46.5mph at 2m.

From the south, the 3 second extreme wind in 50 return year is assessed as 66.6mph at 10m, 55.1mph at 4.6m and 43.3mph at 2m.

The probability is 85% that the actual value will be less than those assessed value.

The directional extreme wind is shown as below.

Sector	From	To	Extreme Wind (mph) P85			Frequency
			2m	4.6m	10m	
1	**345**	**15**	**46.5**	**55.1**	**63.1**	
2	15	45	44.8	54.9	65.0	
3	45	75	47.8	61.7	73.8	
4	75	105	46.8	59.5	80.5	
5	105	135	41.6	53.5	41.6	
6	135	165	45.6	58.3	71.3	
7	**165**	**195**	**43.3**	**55.1**	**66.6**	
8	195	225	42.5	53.8	64.7	
9	225	255	40.8	51.7	62.1	
10	255	285	52.2	65.5	78.1	
11	285	315	53.3	66.7	79.5	
12	315	345	50.1	62.4	74.2	
Total			**54.0**	**67.6**	**80.5**	

Table Extreme wind by direction at XXX Solar Park Point 1 as 3-sec peak gust in mph for 50 return years. (For ASCE 7-05 Category II)

The 3 second extreme wind in 300 return year at site XXX Solar Park Point 1 is assessed as 96.6mph at 10m, 81.1mph at 4.6m and 64.8mph at 2m.

From the north, the 3 second extreme wind in 300 return year is assessed as 75.8mph at 10m, 66.1mph at 4.6m and 55.8mph at 2m.

From the south, the 3 second extreme wind in 300 return year is assessed as 79.9mph at 10m, 66.2mph at 4.6m and 51.9mph at 2m.

The probability is 85% that the actual value will be less than those assessed value.

The directional extreme wind is shown as below.

Sector	From	To	Extreme Wind (mph) P85			Frequency
			2m	4.6m	10m	
1	**345**	**15**	**55.8**	**66.1**	**75.8**	
2	15	45	53.8	65.9	78.0	
3	45	75	57.4	74.0	88.5	
4	75	105	56.2	71.3	96.6	
5	105	135	49.9	64.2	49.9	
6	135	165	54.8	70.0	85.6	
7	**165**	**195**	**51.9**	**66.2**	**79.9**	
8	195	225	51.0	64.6	77.7	
9	225	255	49.0	62.0	74.5	
10	255	285	62.7	78.6	93.7	
11	285	315	63.9	80.0	95.4	
12	315	345	60.1	74.9	89.1	
Total			**64.8**	**81.1**	**96.6**	

Table Extreme wind by direction at XXX Solar Park Point 1 as 3-sec peak gust in mph for 300 return years. (For ASCE 7-10/16 Category I)

CONTENTS

1 Introduction

The purpose of this project is to analyse the extreme wind conditions at a solar park.

The design of the solar panel rack in USA follows the national standard, named ASCE/SEI 7 Minimum Design Loads for Buildings and Other Structures, issued by American Society of Civil Engineers (ASCE) /1/.

In chapter26.5.3 of ASCE 7-16, Estimation of Basic Wind Speeds from Regional Climatic Data, it is defined that in areas outside hurricane-prone regions, regional climatic data shall only be used in lieu of the basic wind speeds given in Fig. 26.5-1 when

(1) approved extreme-value statistical-analysis procedures have been employed in reducing the data; and
(2) the length of record, sampling error, averaging time, anemometer height, data quality, and terrain exposure of the anemometer have been taken into account.

Reduction in basic wind speed shall be permitted.

Following the requests, WindSim AS applied the statistical and physical models in the analysis in the following steps:

- Nearby regional reference wind conditions
- On-site wind conditions
- On-site extreme wind conditions
- Uncertainty of the assessment

1.1 Site

XXX Solar Park is located near XXX, XXX, United States with coordinates XXXN, XXXW. The location of solar park is shown in Figure 1.1. The site is located in the non-hurricane region, methodology for non-hurricane applies.

Figure 1.1 The location of the solar park

1.2 Methodology

The extreme wind analysis has four major steps.

1.2.1 Step 1, analysis of nearby regional reference wind conditions

The regional reference wind near the solar park is the starting point for extreme wind analysis. The accuracy of the assessment may depend largely on the availability and the quality of the reference wind nearby.

In this step, the area of 100km x 100km, cantering solar park is examined to identify reference wind nearby. The reference wind comes mostly from two sources.

The first source is Standardized Extreme Wind Speed (SEWS) database /2/. The database is processed and managed by Statistical Engineering Division from National Institute of Standards and Technology (NIST). The raw data is from National Climatic Data Centre (NCDC). Integrated Surface Hourly (ISH) Data Set 3505 is used from the raw data. The raw data is recorded by the weather stations, which are Automated Weather Observing System (AWOS), operated mostly by Federal Aviation Administration (FAA), and Automated Surface Observing System (ASOS), which are operated and controlled cooperatively in the United States by the National Weather Service (NWS), Federal Aviation Administration (FAA), and Department of Defence (DOD).

The data is processed by NIST for standardization of elevation, averaging time, terrain roughness, with quality control. The final dataset includes 1865 sites in the United States, representing the time series of 3 second averaging extreme wind at 10m height at roughness of 0.03. The length of the record depends on the data, and it may range from several years to more than 30 years.

The selected data has been verified and quality controlled by WindSim AS. Typically, the extreme wind events over 70mph are compared with reports for storm paths, deaths, injuries, and property damage, from Storm Data Publication from National Centres for Environmental Information (NCEI), from National Oceanic and Atmospheric Administration (NOAA) /3/.

The second source is Modern Era Retrospective Analysis for Research and Applications (MERRA-2) /4/, MERRA-2 is a reanalysis for the satellite era using a major new version of the Goddard Earth Observing System Data Assimilation System Version 5 (GEOS-5), from Global Modelling and Assimilation Office (GMAO) from National Aeronautics and Space Administration (NASA).

The data is regularly distributed in USA, at resolutions of 0.5 degree latitude and 0.625 degree longitude (around 50-60km to each other). It gives average wind speed and direction at the time step of 1 hour at 50m for about 41 years.

Usually one or more SEWS and 4 MERRA-2 are located in the area of 100km x 100km.

The quality of SEWS is investigated, by comparing nearby SEWS points in case the data period is less than 10 years, and by comparing Storm Data Publication when the wind speed record is over 80mph.

1.2.2 Step 2, analysis of on-site wind conditions

Wind is correlated to each other within the micro scale wind pattern zone. The ratio between wind speed at two locations nearby from one direction is roughly a constant, independent to the wind speed.

The purpose of this step is to transfer the regional reference wind condition to the solar park by WindSim flow modelling. Thus, the basic assumption is that the extreme wind at solar park is correlated with the regional reference wind nearby.

Because the wind flow is affected by the local terrain, the digital terrain model including elevation and roughness is set for the simulation.

The elevation data comes from National Elevation Dataset (NED), which is the primary elevation data by United States Geological Survey (USGS). NED data are available in USA at resolutions of 1 arc-second (about 30 meters) and 1/3 arc-second (about 10 meters), and in limited areas at 1/9 arc-second (about 3 meters) /5/.

The roughness is converted mainly from National Land Cover Database 2011 (NLCD 2011) /6/, created by Multi-Resolution Land Characteristics (MRLC) Consortium. It has multiple-class land cover classification scheme that has been applied consistently across the United States at a spatial resolution of 30 meters.

Near the US border area, when the NLCD 2011 is not available, Global Land Cover 30 (GLC30) dataset, which is managed by National Geomatics Center of China (NGCC), is complemented /7/.

Based on the digital terrain model, the simulation domain is generated covering the air above it. The entire large simulation domain is then further divided into small boxes, and each small box is represented by a node. Boundary conditions are applied to the nodes on the surfaces of the simulation domain, and Reynolds Averaged Navier-Stokes (RANS) equations are applied to each node within the simulation domain, before the numerical simulation started by iteration to solve the wind flow from each wind direction /8/.

Once the flow model is completed, the wind speed and direction at any point within the simulation domain is known. Then the speed-up ratio and direction shift between reference wind place and solar park point can be calculated. As the reference wind is created in the first step, the on-site wind condition at solar park is generated.

1.2.3 Step 3, analysis of on-site extreme wind conditions

In this step, a time series of wind speed and direction at the solar park from step 2 is used for analysis, and Method of Independent Storm (MIS) /9/ is applied to estimate the extreme wind. MIS has two steps. First, the peak wind value from each storm event is picked from the time series. The storm event is usually defined by the period of 48 - 72 hours and the 3 second wind speed is over 20 - 40mph, or the hourly averaging wind speed is over 9 – 11mph, and it is around 20 storms per year.

The Gumbel distribution is used for modelling the probability of the extreme wind speeds. The Equation 1.1 gives the cumulative probability distribution function of the Gumbel distribution:

$$F(x) = \exp\left\{-\exp\left[\frac{-(x-\mu)}{\beta}\right]\right\}$$

Equation 1.1 Cumulative probability distribution function of the Gumbel distribution

Where, x is the extreme value, beta is a scale parameter, and mu is a mode parameter. Both parameters have the same units as x.

The equation can be further linearized as Equation 1.2.

$$-\ln[-\ln F(x)] = \left(\frac{1}{\beta}\right)x - \frac{\mu}{\beta}$$

Equation 1.2 Linearized cumulative probability distribution function of the Gumbel distribution

That is in the form y = mx + b, when plotting -ln(-ln(F(x))) versus x, a straight line can be found with a slope of 1/beta and an intercept of -mu/beta.

A highest few extreme values are used in the curve fit /10/ to calculate scale parameter beta and model parameter mu.

The return period is defined as the reciprocal of the probability of exceedance. A given Gumbel distribution represents the distribution of annual extreme wind speeds, and when x takes a value of 80 mph, for example, the cumulative distribution function F(x) gives a value of 0.98. That means that there is a 98% probability that in any one year, the annual extreme wind speed x will be equal to or less than 80 mph. The probability of exceedance of 80 m/s is therefore 100% - 98% = 2%. The resulting return period is 1 / 0.02 = 50 years. That means that, on average, we would expect a wind speed of 80mph once in 50 years.

The Equation 1.3 gives the annual extreme value for a specified Gumbel distribution and a return period of R years:

$$x = \mu - \beta \cdot \ln\left[-\ln\left(1-\frac{1}{R}\right)\right]$$

Equation 1.3 Annual extreme wind for a return period of R years

In the case that MERRA-2 is used in the first step, the time step, then, is 1 hour, the further unit and time step conversion are needed.

Based on the internal validation study /12/ on 21 sites across US, there are discrepancy in the result between method driven by MERRA-2 and method driven by SEWS. The reason is that extreme winds mostly happen during the thunderstorm, which tends to be very short and local, MERRA-2, however, tends to fail to record those events. The study recommended that when the MERRA-2 is the sole source, the correction factor should be applied.

1.2.4 Step 4, analysis of assessment uncertainty

Uncertainty in extreme wind assessment is a vital part of the result. It gives confidence analysis to the accuracy of the extreme wind estimate. The uncertainty is divided into four categories.

1. Wind record
2. Long term representativeness
3. Flow model
4. Extreme wind model

Wind record: This is the uncertainty in the wind speed as measured by anemometers after data validation and adjustments. It reflects not only the uncertainty in the sensitivity of the instruments when operating under ideal wind conditions, but also their performance in the field. When SWES is used, it is assumed that the equipment has high accuracy, well calibrated, the installation is according to the standard, and the maintenance is well conducted, the data collection and treatment is free of error. The total uncertainty for extreme wind is 3.0%. When MERRA-2 is applied, uncertainty of 10.0% is assumed.

Long term representativeness: The uncertainty is associated with the length of the recording period, historical data availability, representativeness of the long-term wind regime. Based on the study for 21 sites /12/, it is calculated that yearly variability of the annual extreme wind is 15%, then the uncertainty of the period of X years is calculated as 15%/sqrt(X).

Flow model: The uncertainty is associated with the WindSim flow modelling. It depends on suitability of the flow model to the flow pattern, model gridding, governing equations, boundary conditions, flow similarity, terrain similarity, and distance between reference wind and on-site wind locations. The uncertainty is estimated as 0.1% per km for simple terrains, and 0.15% per km for complex terrains.

Extreme wind model: It relies on the mathematical expression of the extreme wind. The uncertainty is estimated as 2.0% by applying current method.

Each uncertainty is assumed to be independent, and the total uncertainty is calculated by root-sum-square basis. The extreme wind estimation is assumed to follow a normal distribution, and the probability of non-exceedance is estimated as

Extreme Wind (P85) = Extreme Wind (P50) x (1 + 1.04 x Uncertainty);
Extreme Wind (P90) = Extreme Wind (P50) x (1 + 1.28 x Uncertainty);
Extreme Wind (P95) = Extreme Wind (P50) x (1 + 1.65 x Uncertainty).

The expected Extreme Wind PXX implies that there is a probability of XX% that the outcome will be less than PXX and a probability of (100-XX)% that the outcome will be more.

2 Wind Conditions

1 Merra2 is located within the area 100km x100km around the potential solar park. The coordinates and wind conditions are in Table 2.1 and Figure 2.1.

Name	Easting (m)	Northing (m)	Height (m)	Average wind speed (mph)	50 - year Extreme wind speed (mph)	300 - year Extreme wind speed (mph)
Merra2_D	XXX	XXX	XXX	XXX	67.6	74.6

Table 2.1 Location of reference wind conditions (UTM Zone 17, WGS 84)

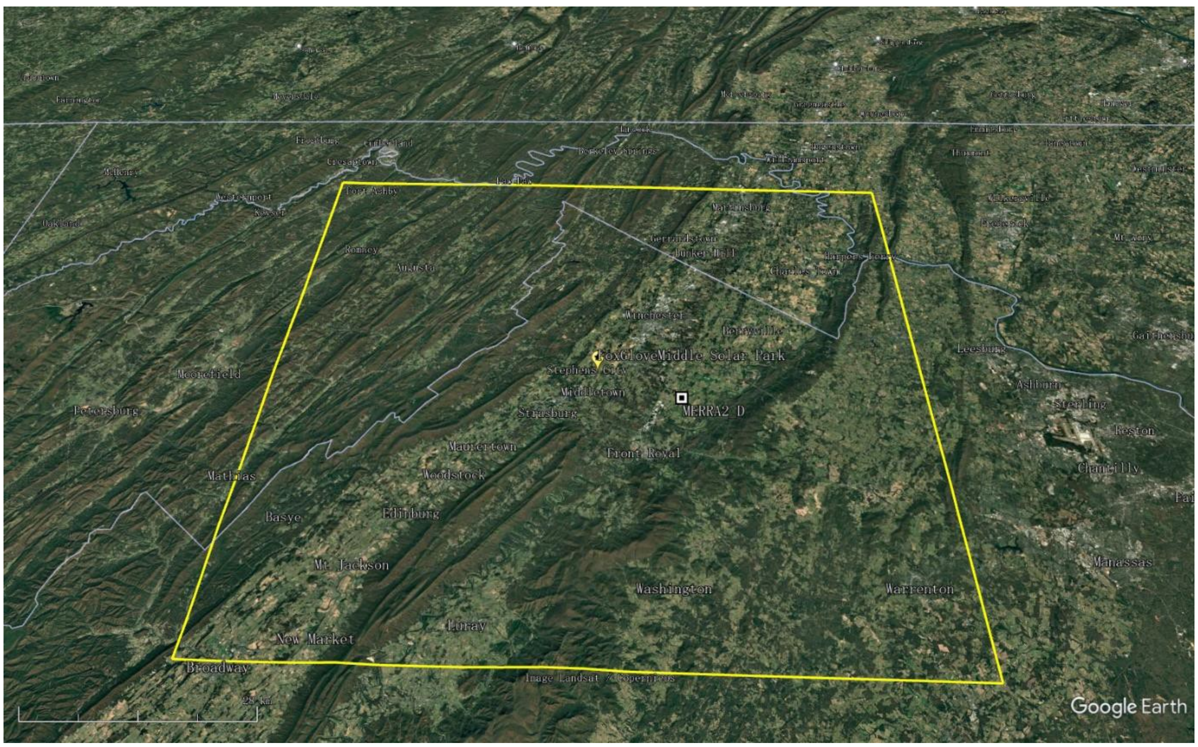

Figure 2.1 Location of reference wind condition, solar park and simulation domain

3 CFD Modelling

The detail of the digital terrain model is shown in Table 3.1, Table 3.2, Table 3.3 and Figure 3.1.

Parameter	**Information**
Extension	.gws
Type	Grid
Projection	UTM Zone 17
Horizontal Datum	WGS 84

Table 3.1 Geo information of the digital terrain model

Corner	**Easting (m)**	**Northing (m)**
Northeast	XXX	XXX
Southwest	XXX	XXX
	East-West (m)	**North-South (m)**
Distance	100000.0	100000.0
Resolution	100.0	100.0

Table 3.2 Coordinates and distance of digital terrain model (UTM Zone 17, WGS 84)

Land Cover	Roughness length (m)
Open Water	0.0003
Perennial Ice/Snow	0.0010
Developed, Open Space	0.0300
Developed, Low Intensity	0.0300
Developed, Medium Intensity	0.3000
Developed, High Intensity	0.5000
Barren Land (Rock/Sand/Clay)	0.0100
Unconsolidated Shore	0.0500
Deciduous Forest	0.4000
Evergreen Forest	0.4000
Mixed Forest	0.4000
Dwarf Scrub	0.0500
Shrub/Scrub	0.1000
Grassland/Herbaceous	0.0500
Grassland/Herbaceous	0.0500
Lichens	0.0020
Moss	0.0020
Pasture/Hay	0.0300
Cultivated Crops	0.0300
Woody Wetlands	0.2000
Palustrine Forested Wetland	0.3000
Palustrine Scrub/Shrub Wetland	0.1000
Estuarine Forested Wetland	0.3000
Estuarine Scrub/Shrub Wetland	0.1000
Emergent Herbaceous Wetlands	0.1000

Table 3.3 Roughness table for digital roughness model

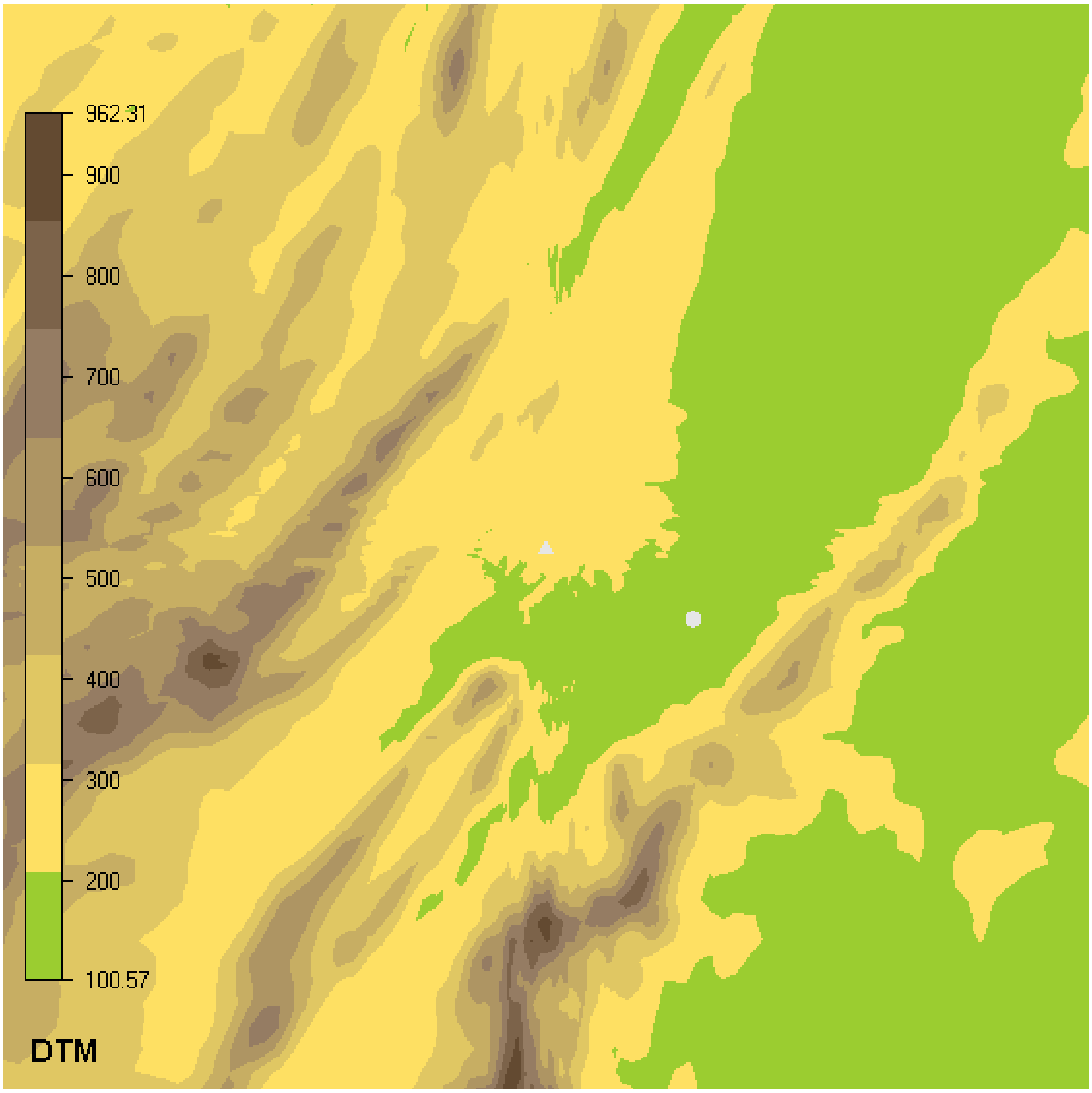

Figure 3.1 Digital elevation model (triangle is the solar park, dot is the reference wind)

4 Extreme wind analysis

The results are shown in Table 4.1 and Figure 4.1.

Sector	From	To	Extreme wind (mph) P85			Frequency
			2m	4.6m	10m	
1	345	15	46.5	55.1	63.1	
2	15	45	44.8	54.9	65.0	
3	45	75	47.8	61.7	73.8	
4	75	105	46.8	59.5	80.5	
5	105	135	41.6	53.5	41.6	
6	135	165	45.6	58.3	71.3	
7	165	195	43.3	55.1	66.6	
8	195	225	42.5	53.8	64.7	
9	225	255	40.8	51.7	62.1	
10	255	285	52.2	65.5	78.1	
11	285	315	53.3	66.7	79.5	
12	315	345	50.1	62.4	74.2	
Total			54.0	67.6	80.5	

Table 4.1 Extreme wind by direction at site Point 1.

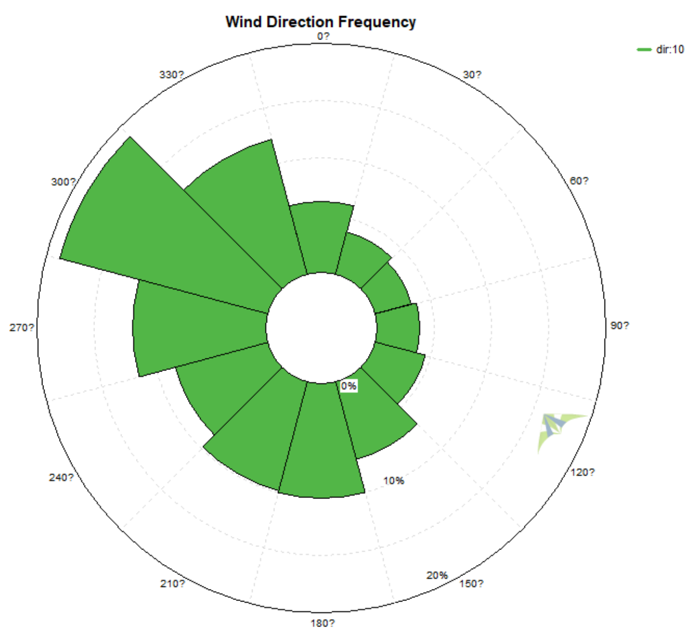

Figure 4.1 On-site wind direction distribution

The recording period is 45 years in total, the average distance between reference wind and solar park is 14.4km, and the site is simple. The uncertainty analysis result is shown in Table 4.2 and Table 4.3.

	Item	**Unit**	**Uncertainty**
	Total Uncertainties	%	10.7
1	Wind record	%	10.0
2	Long term representativeness	%	2.3
3	Flow model	%	2.2
4	Extreme wind model	%	2.0

Table 4.2 Uncertainty analysis

Extreme Wind (mph)	2m	4.6m	10m
P85	54.0	67.6	80.5
P90	55.3	69.2	82.4
P95	57.2	71.6	85.2

Table 4.3 Extreme wind with probability of non-exceedance analysis for Point 1

The extreme wind as 3-sec peak gust in mph for 300 return years by direction at site results for XXX Solar Park Point 1 are shown in Table 4.4.

Sector	From	To	Extreme Wind (mph) P85			Frequency
			2m	4.6m	10m	
1	**345**	**15**	**55.8**	**66.1**	**75.8**	
2	15	45	53.8	65.9	78.0	
3	45	75	57.4	74.0	88.5	
4	75	105	56.2	71.3	96.6	
5	105	135	49.9	64.2	49.9	
6	135	165	54.8	70.0	85.6	
7	**165**	**195**	**51.9**	**66.2**	**79.9**	
8	195	225	51.0	64.6	77.7	
9	225	255	49.0	62.0	74.5	
10	255	285	62.7	78.6	93.7	
11	285	315	63.9	80.0	95.4	
12	315	345	60.1	74.9	89.1	
Total			**64.8**	**81.1**	**96.6**	

Table 4.4 Extreme wind by direction at XXX Solar Park Point 1as 3-sec peak gust in mph for 300 return years. (For ASCE 7-10/16 Category I).

5 Conclusions and Recommendations

1. Weather station is used as the regional reference wind for the study. P85 value is used in the result.

2. The 3 second extreme wind in 50 return year at site XXX Solar Park Point 1 is assessed as 80.5mph at 10m, 67.6mph at 4.6m and 54.0mph at 2m. The 3 second extreme wind in 300 return year at site XXX Solar Park is assessed as 96.6mph at 10m, 81.1mph at 4.6m and 64.8mph at 2m.

3. From the north, the 3 second extreme wind in 50 return year is assessed as 63.1mph at 10m, 55.1mph at 4.6m and 46.5mph at 2m. the 3 second extreme wind in 300 return year is assessed as 75.8mph at 10m, 66.1mph at 4.6m and 55.8mph at 2m.

4. From the south, the 3 second extreme wind in 50 return year is assessed as 66.6mph at 10m, 55.1mph at 4.6m and 43.3mph at 2m. the 3 second extreme wind in 300 return year is assessed as 79.9mph at 10m, 66.2mph at 4.6m and 51.9mph at 2m.

5. The uncertainty of the extreme wind estimation is 10.7%. The probability is 85% that the actual value will be less than those assessed value. The closely correlates with the 15% probability of exceedance as mentioned in note 5 per Figure 26.5-1C & 26.5-1A per ASCE 7-10 and ASCE 7-16, respectively.

6. The extreme wind (mph) provided in Table 4.1 represents an Occupancy/Risk Category II wind velocity (50 year return period) at 2m & 10m height, at varying probabilities of non-exceedance (highlighted below). To convert the 50 year return extreme wind to a Risk Category I design wind to be used for ASCE 7-10 or ASCE 7-16, the extreme wind must first be multiplied by the square root of the ASCE 7-05 importance factor, sqrt(0.87) = 0.93 and then divided by the square root of 0.6 (IBC Equation 16-33). Therefore, 0.93* Extreme Wind (mph)/sqrt(0.6) = 1.2*Extreme Wind (mph).

ASCE Code Reference	Risk/Occupancy Category	Return Period (yrs)	Conversion Factor	Design Wind (mph): Extreme wind*Conversion Factor
ASCE 7-05	I	25	0.93	0.93*Extreme Wind
ASCE 7-05	II	50	1	1.00*Extreme Wind
ASCE 7-10/16	I	300	1.2	1.20*Extreme Wind
ASCE 7-10/16	II	700	1.29	1.29*Extreme Wind

7. From ASCE 7-16, the 3 second extreme wind in 50 return year is 89mph at 10m. ASCE 7 may over-estimate the extreme wind at site Point 1. The 3 second extreme wind in 300 return year is 103mph at 10m. ASCE 7 may over-estimate the extreme wind at site Point 1.

8. A thorough extreme-value statistical-analysis procedures have been employed in the study.

9. The length of record, sampling error, averaging time, anemometer height, data quality, and terrain exposure of the anemometer have been taken into account.

10. Reduction in basic wind speed shall be permitted.

6 Deliverables

The deliverables of this project are:

- 241209_TR_XXX_100_A: Project report

7 References

/1/ ASCE/SEI 7-16 Minimum Design Loads for Buildings and Other Structures (7-16), American Society of Civil Engineers, https://sp360.asce.org/PersonifyEbusiness/Merchandise/Product-Details/productId/233133882

/2/ Standardized Extreme Wind Speed, NIST, http://www.itl.nist.gov/div898/winds/NIST_TN/nist_tn.htm

/3/ Storm Data Publication, NCEI, NOAA, https://www.ncdc.noaa.gov/IPS/sd/sd.html

/4/ Modern Era Retrospective Analysis for Research and Applications (MERRA-2), NASA, https://gmao.gsfc.nasa.gov/reanalysis/MERRA-2/

/5/ National Elevation Dataset, USGS, https://lta.cr.usgs.gov/NED

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/13/ Vickery, Peter J., and Peter Irwin. "Ultimate Wind Load Design Gust Wind Speeds in the United States for Use in ASCE7." *Journal of Structural Engineering.* May 2010: p. 623.

8 Appendix

For the engineer applying ASCE 7-10: Minimum Design Loads for Buildings and Other Structures, or ASCE 7-16: Minimum Design Loads for Buildings and Other Structures, the following steps are applied.

The risk category of this study is classified as Occupancy Category I and II according to ASCE 7-10 or ASCE 7-16.

The extreme wind speed in this study is equivalent to Figure 8.1, Figure 8.2, Figure 8.3 and Figure 8.4 on the conditions that Kz=1, Kzt=1. It is because that in this study, the result has considered the basic wind speed, exposure and topographic effect. The extreme wind speed is defined as 3-second gust wind speeds in mph at 10m above ground.

When combinations of loads are used, wind directionality factor, Kd could be calculate based on directional results from this report. For example, if extreme wind speed from 90 degree is 90 mph, and extreme wind speed in total is 100 mph, the directionality is 90/100 = 0.9.

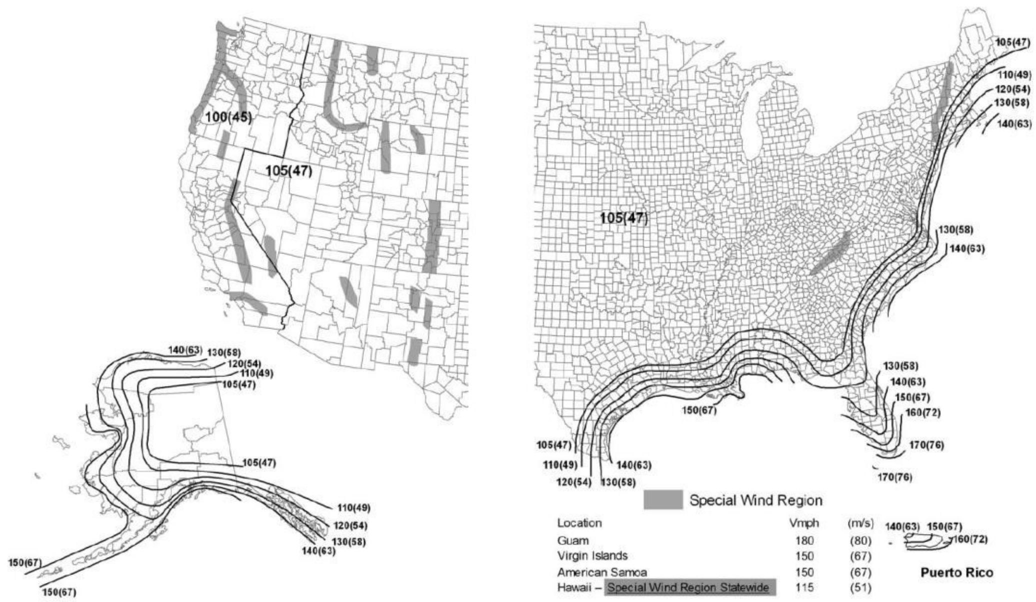

Figure 8.1 Basic Wind Speed for Occupancy Category I Building and Other Structures from ASCE7-10. Values are nominal design 3-second gust wind speeds in miles per hour (mph) at 33ft (10m) above ground for Exposure C category. Wind speeds correspond to approximately a 15% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00333, MRI = 300 Years).

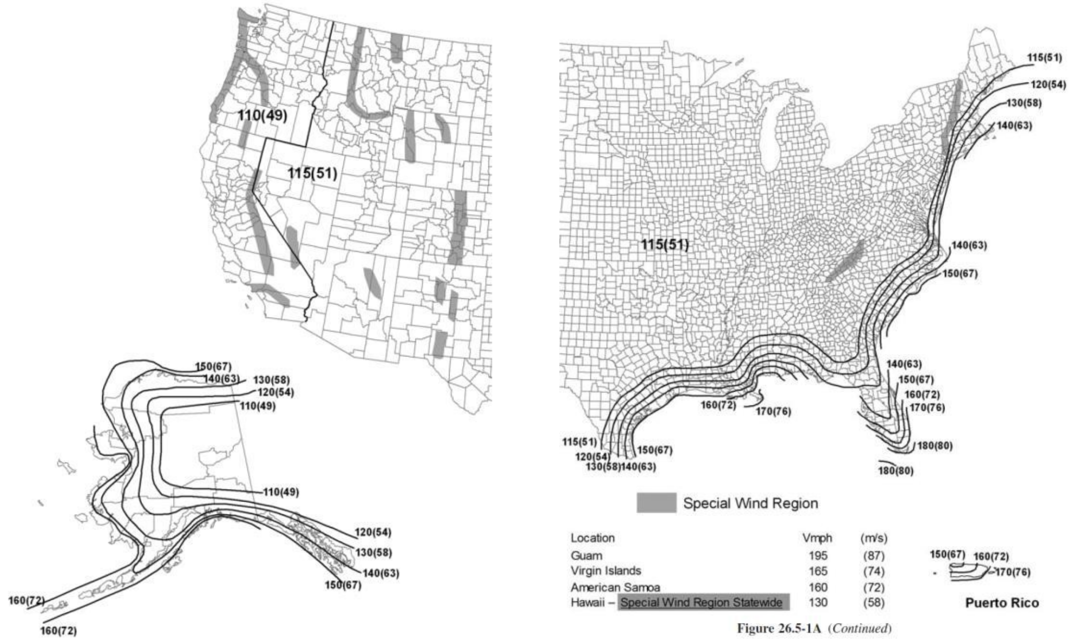

Figure 8.2 Basic Wind Speed for Occupancy Category II Building and Other Structures from ASCE7-10. Values are nominal design 3-second gust wind speeds in miles per hour (mph) at 33ft (10m) above ground for Exposure C category. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 Years).

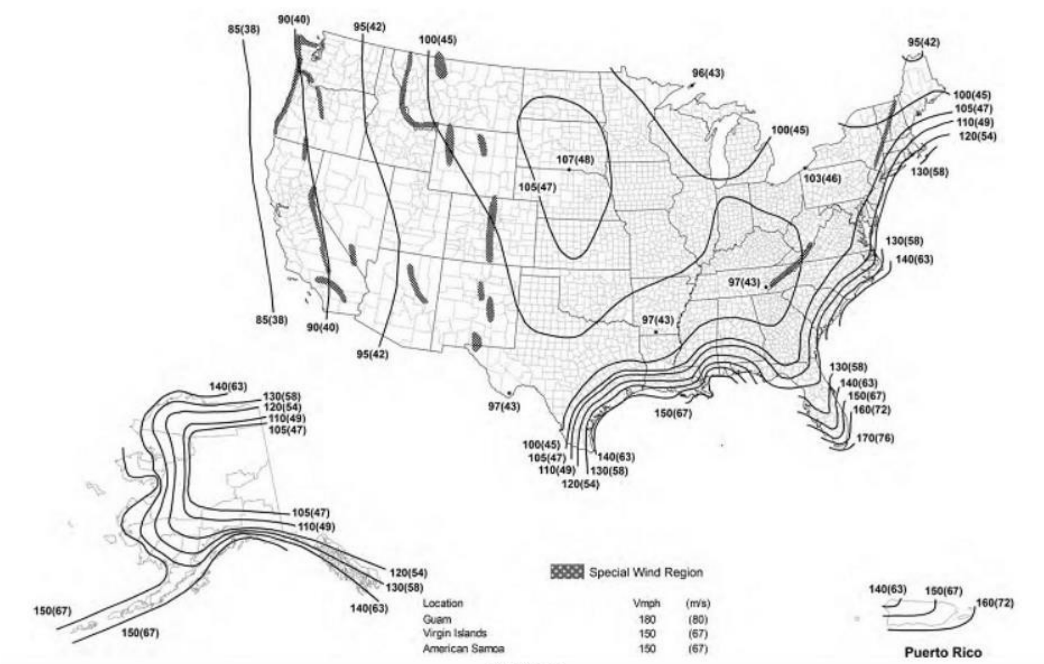

Figure 8.3 Basic Wind Speed for Occupancy Category I Building and Other Structures from ASCE7-16. Values are nominal design 3-second gust wind speeds in miles per hour (mph) at 33ft (10m) above ground for Exposure C category. Wind speeds correspond to approximately a 15% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00333, MRI = 300 Years).

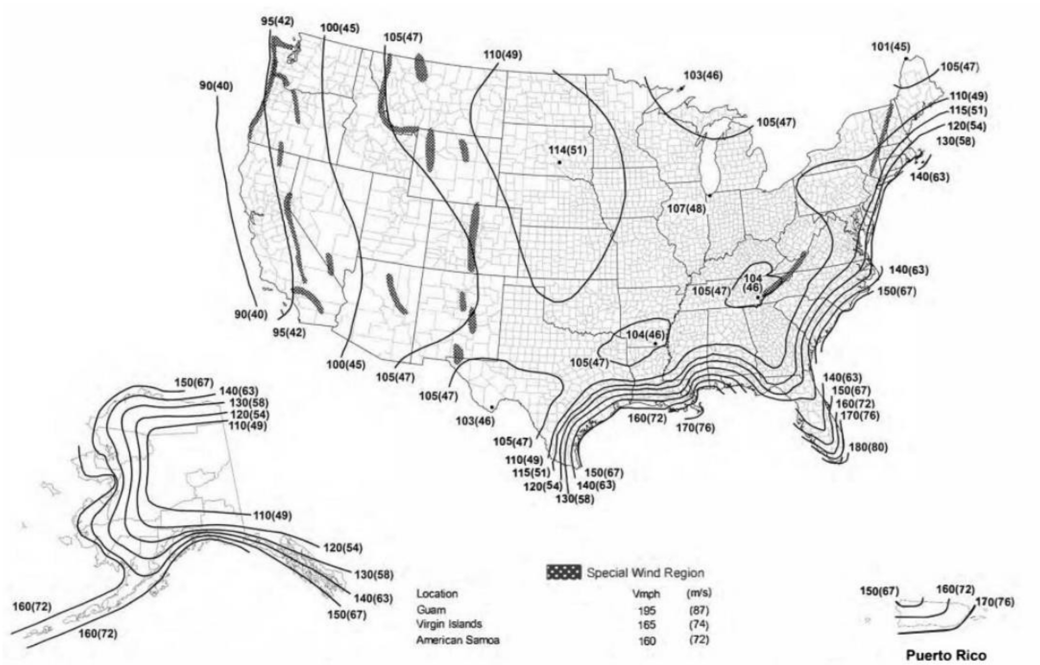

Figure 8.4 Basic Wind Speed for Occupancy Category II Building and Other Structures from ASCE7-16. Values are nominal design 3-second gust wind speeds in miles per hour (mph) at 33ft (10m) above ground for Exposure C category. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 Years).

Thus, the steps of wind load calculation based on this study are

1. Basic Wind Speed, from this report.
2. Exposure category, Kz =1.
3. Topographic factor, Kzt=1
4. wind directionality factor, Kd:
    a. Option a: Calculated from this report, for combined load only;
    b. Option b: From ASCE, Kd=0.85, for combined load only.
5. Gust-effect factor, from ASCE, for example, G=0.85 for rigid building or other structure
6. Enclosure classification, from ASCE