

## 2022Q12

## DISTANCE VS. DISPLACEMENT

Have you ever looked at a wind turbine and wondered about the logistics behind getting the turbine parts to the project site? Because today is your lucky day! In this Wind Study, we're going to be talking about transporting wind turbine blades to a project site.

The blades on the wind turbines that One Energy installs are 142 feet long. We store the blades for our wind turbines, along with other wind turbine parts, in our laydown yard. In order to build a wind turbine, we need to transport the blades from our laydown yard to our project site using connected eighteen-wheel trailers. Since the trailers are so long, they can't easily cross raised road features, such as a railroad track. This means that we can't always take the most direct route from the laydown yard to the project site!

The concepts of distance and displacement come into play here. Distance is defined as the total space covered by an object during its motion; it is a scalar quantity that does not take into account direction of motion. Displacement is defined as the change in position of an object from the beginning to the end of its motion; it is a vector quantity that takes direction into account.

These concepts apply to the transportation of wind turbine blades because, as stated above, sometimes the most direct route cannot be taken. For example, a turbine blade might have to travel a distance of 50 miles from the laydown yard to the project site, while only having a displacement of 30 miles from the laydown yard to the project site.

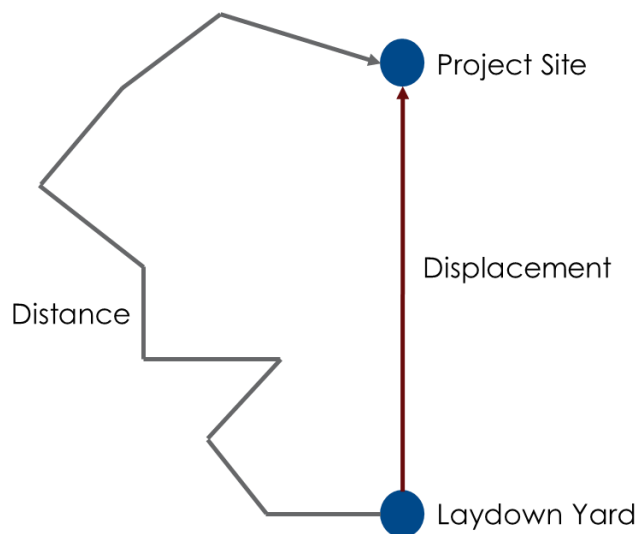


Figure 1: Distance vs Displacement

Now that we know the difference between distance and displacement, let's dive into this week's questions!

**Level 1:** We want to transport a turbine blade from our laydown yard to our project site. In order to get to the project site, while avoiding any potential road hazards, the trailers carrying the blade have to travel 2 miles East, 10 miles North, 4 miles East, 3 miles North, 2 miles West, 15 miles North, 5 miles West, 6 miles South, and 1 mile West. What is the distance the trailers traveled and the displacement of the wind turbine blade?

**Level 2:** We have another turbine blade that is being transported from our laydown yard to the project site. This time the trailers carrying the wind turbine blade travel 8 miles at 230° Southwest, 3 miles at 140° Southeast, 5 miles at 260° West-southwest, 2 miles at 170° South-southeast, 7 miles at 320° Northwest, and 10 miles at 250° West-southwest. Find the distance and displacement of the trailers carrying the wind turbine blade.

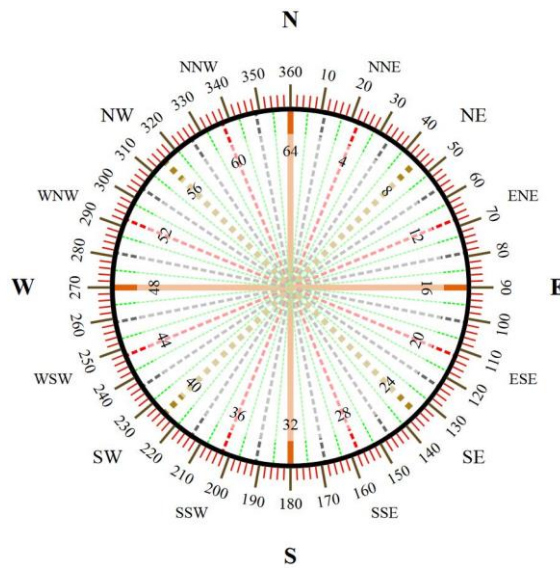


Figure 2: Degree compass <sup>[1]</sup>

<sup>[1]</sup> <https://ambientweather.com/faqs/question/view/id/1814/>