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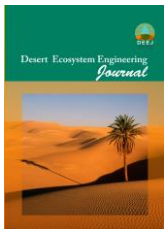

Performance of two measurement methods of pin meter and laser disto meter in the measurement of microtopography Created by desert pavement

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Extended Abstract

Introduction: Wind erosion is one of the main factors of soil degradation and air pollution. Roughness by creating an obstacle to wind flow, decreases wind speed and consequently reduces the amount of wind erosion, hence its measurement in wind erosion is important. Roughness is one of the most effective factors. In soil erosion by water and wind by accuracy measurement of soil surface roughness, can be used by them as indicators of ecosystem healthMethods for *measuring of soil* surface *roughness* using Roughness meter can be classified into two large classes. Contact methods which mechanical devices are *directly* in *contact* with the *soil*. Non-contact methods that the measuring instruments are *far away* from the soil surface and do not touch with surface of the soil. Pin meter includes a row of pins with equal distances which is placed in a frame that can be placed according to high and low levels of roughness.

Materials and Methods: Yazd - Ardakan Plain with a total area of 7,15950 square kilometers Is located in the northern part of Yazd province.and Is located in Longitude 748337 to 296893 East and in latitude 3559572 to 3566743 North. After determining the studied area, 10 randomly selected samples were selected in the Yazd-Ardakan Plain and the sampling was carried out in both methods. Roughness data of soil surface were taken randomly by using laser distance measuring and pin meter in 10 transects. In each transect, roughness height was measured of length 50 cm. The distance between the pins in pin meter method is 2 cm and measuring distance in Laser *Distance Meter* is 2 cm. Thus, the height of the points was recorded separately by both methods, in each transect.

Methods for measurement of roughness index Pin meter.

In this way, with the help of pins on the soil surface, Height of pebbles, is measured at several points to the base level. That way, Roughness altitude information was recorded. According to the definition, this index

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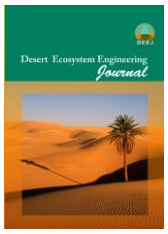

(roughness) is the standard deviation of the height of the points, which is obtained using the following equation:

$$SD = \sqrt{\frac{\sum_{i=1}^{n}(X_i - \bar{X})^2}{n-1}} \qquad (1)$$

That in, SD, X_i, $\bar{X}$, and n are respectively, standard deviation of points Height, the height of each of the points (mm), Average height and the number of sample points in the transect. Laser method:
This method, measures roughness using the laser meter model (X310) from the Leica Company. The laser meter is A small and handy device, that calculates the exact distance, by using laser technology and by calculating round-trip time of laser lightworking method is as follows: The laser beam is emitted to the target and the calculation is performed with an error of less than 3 mm. Thus, the height of the points is measured at 50 cm up to the base level.

Results: The maximum amount of the calculated average by the method of the pin meter and laser distance meter is 2 and 1, respectively. The minimum amount of calculated average for both methods is in the point 10. The highest and lowest amount of standard deviation derived from laser *distance meter* and pin meter methods are for points 2 and 10 respectively.
In Table 1, are presented the results of the comparison of the two methods of pin- meter and Laser rangefinder. As can be seen:

t	Degrees of freedom	Mean ± Invalid Criterion	Groups 2 cm		characteristics
1.438	24	21.83±1.70	pin meter	Point 1	The roughness index
		23.66±2.28	Laser		
-1.120	24	23.50±2.37	pin meter	Point 2	
		22.5±2.53	Laser		
-0.646	24	17.58±1.99	pin meter	Point 3	
		16.87±2.30	Laser		
-1.040	24	10.50±1	pin meter	Point4	
		11.08±1.08	Laser		
0.924	24	19.62±1.91	pin meter	Point5	
		18.50±1.69	Laser		
-0.793	24	9.66±1.30	pin meter	Point 6	
		10.37±1.54	Laser		
-1.221	24	14.29±1.10	pin meter	Point 7	
		15.12±0.95	Laser		
-0.175	24	11.79±1.11	pin meter	Point 8	
		12±1.16	Laser		
0.135	24	9±1.10	pin meter	Point 9	
		9.12±1.23	Laser		
0.809	24	7.04±0.59	pin meter	Point 10	
		7.83±1.09	Laser		

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Figure (1): shows the Matching charts, two methods of *laser disto meter* and pin meter.
These two methods are Good match to all points, but this match, have more matches at points 2, 3, 5, and 6 Compared to other points.

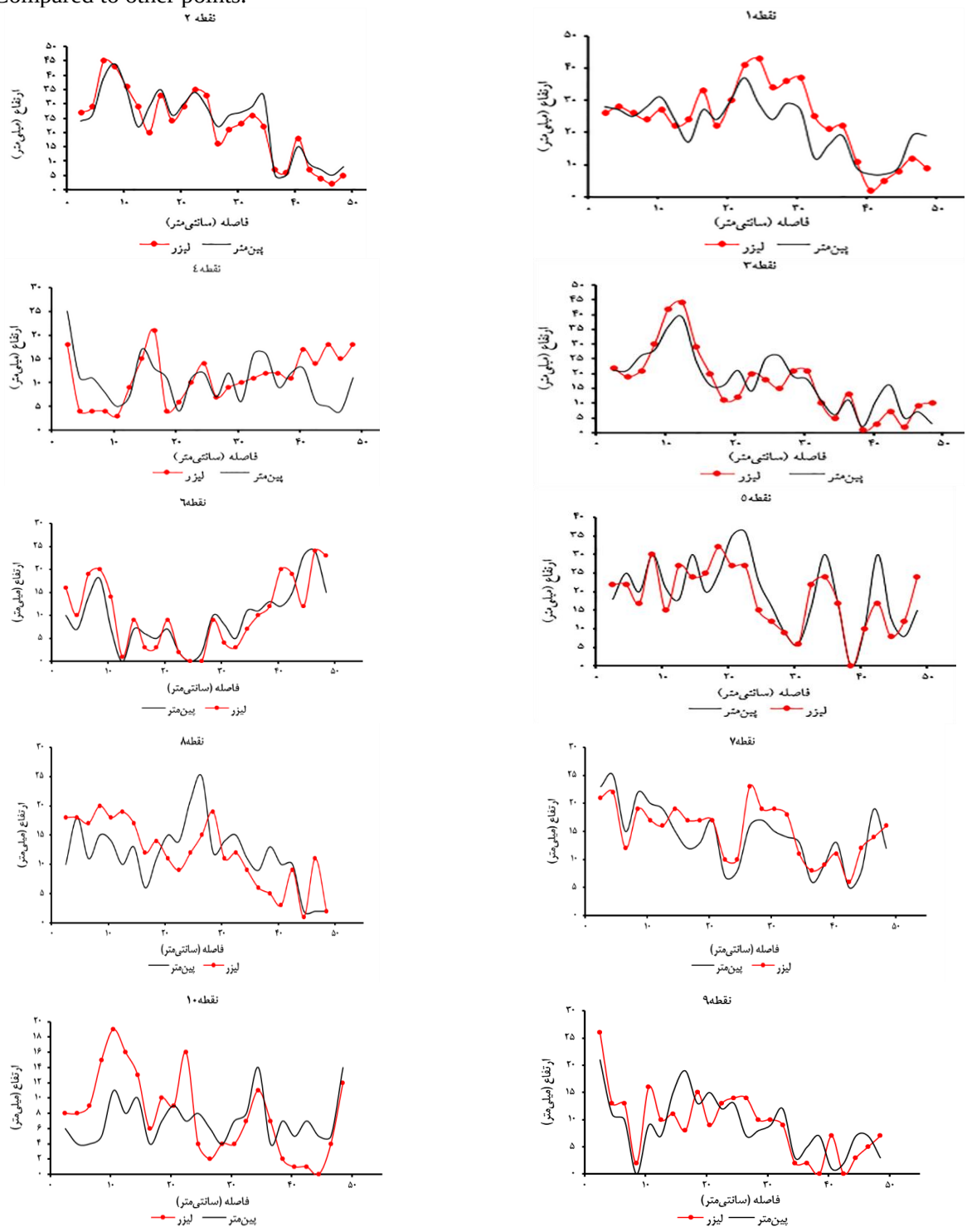

Figure (1): Charts for the matching of the two methods at the sampling points.

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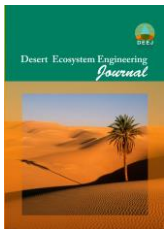

Discussion and Conclusion: The Calculated Statistical indicators by the two methods, are almost the same at all harvested points. The results of the t- student test also showed that, the mentioned two methods, in all sampled points, there is no significant difference at 95% level. Which indicates the ability of two devices For measuring roughness Which, depending on the conditions, can replace each other.the results of this study, with the results of the studies of Zhang et al. (2012), that investigated the methods of measuring the roughness of the soil to provide a Universal and comprehensive method, and concluded that the best method for determining the roughness is laser scanning method and followed by it is pin meter method. labideh (2015), measuring the aerodynamic roughness length of the harvested soil using ا a pin meter. It was concluded that a pin meter could be used to estimate aerodynamic roughness. Which is accommodation with the results of our studies.so it may be concluded that so it may be concluded that using the pin meter method as a traditional tool in pavement roughness measurement, similar results will be obtained using laser method. Therefore, according to the cost of laser distances, pin meter method can be used with similar results.

Keywords: Almaras roughness, T test, Desert Pavement, Laser Distance Meter, Pin Meter.