Modeling of Retaining Wall for Surveillance under the Sensors

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Abstract – *Retaining wall is considered as one of important structure and by the growing technology it has been a necessity to upgrade in terms the monitoring and the surveillance of the retaining wall using sensors. In the falling paper a model or a prototype of a cantilever retaining wall is made and is acted by the soil load the soil is dry soil. According to the calculation made the model has been made and then practically checked with the sensors mounting on the retaining wall.*

*Key Words***:** Retaining wall, sensors, Model, Monitoring, Dry soil.

1. INTRODUCTION

Retaining walls are moderately inflexible walls utilized for supporting the dirt mass along the side with the goal that the dirt can be held at various dimensions on the two sides. Retaining walls are structures intended to control soil to a slant that it would not normally keep to commonly a lofty, close vertical or vertical incline. The use is to bound soils between two distinct heights frequently in regions of various territory having bothersome inclines or in zones where the scene should be formed extremely and intended for increasingly explicit purposes like slope cultivating or roadway bridges. Retaining wall is one of most essential retaining structure yet as of late there have been many gripes going ahead the failure of the wall. So it has been important to keep up and keep observation on the strength of the structure. The fundamental burden following up on this structure is the sidelong earth weight which is otherwise called the earth pressure. The most essential thought in legitimate plan and establishment of retaining walls is to perceive and check the inclination of the held material to move down slant because of gravity. This makes parallel earth pressure behind the wall which relies upon the point of inward grating and the strong quality of the held material, just as the bearing and greatness of development the retaining structure experiences. The research work presents the monitoring and the surveillance of the retaining wall with use of sensors. The complete surveillance of the retaining wall is done considering the soil. In the following paper the soil type which has been considered is dry soil. The soil is then applied which surcharge ranging from zero to hundred kilo Newton based on the Rankine theory the load acting on the retaining wall is calculated on the basis of the load acting on the retaining wall the retaining wall is considered as a cantilever beam and then the maximum

deflection is calculated. After calculating the deflection for failure the sensors are set according to the limits and if the limits are exceeds the alert is issued. Infrared sensors are used for the surveillance purpose

Development of Model

While making the model parameters were considered of a real retaining wall. The parameters were as follows, the height of the wall was considered as 4m. Then from the calculations the other dimensions were, the thickness of the stem was 200mm, the length of the base slab was 2.8m the length of the toe slab was 1.2m and heel slab is 1.4m the thickness of the base slab is 0.6m. This is the dimensions of the original retaining wall; from the above dimensions after carrying the dimensional analysis the prototype of the model was constructed. The model is constructed in mild steel. The dimension of the prototype is, 0.25m is the height of the wall, followed by the thickness is 1.62mm; the length of the base slab is 0.17m.

1.2 Sensors

Initally the sensor to be used was the infrared sensor but because of the precision issue a made sensor was used.

Fig 1- Sensors

The sensor included NODEMCU WIFI: it is micro controller with built in wifi, suitable for posting data to cloud. USB cable: provides power to NODEMCU. Linear displacement Sensor: this sensor has 5 touch points which are sensed by NodeMCU.

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2. Calculations

Here the calculation of the earth pressure acting on the retaining wall is given which carry zero surcharge load also the maximum deflection caused due to the load acting on the cantilever retaining wall is put forth in the calculation considering the retaining wall as a cantilever beam the calculations of the maximum deflection of the beam.

Pressure on the Retaining Wall			
Unit Weight of the backfill	Y	15	KN/m³
Height of the wall	H	0.25	m
Surcharge load of the wall	q	0	kN/m²
Shear resistance	θ	30	deg
		0.5236	rad
coefficent of active pressure	k_a	0.3333	
pressure intensity due to surchac	p_1	0	kN/m²
pressure intensity at backfill	p_2	1.25	kN/m²
total intensity at the base of wall	p	1.25	kN/m²
Total pressure P1 due to p1	P1	0	KN/m
acting at	x1	0.125	m
Total pressure P2 due to p2	P2	0.1563	KN/m
acting at	x2	0.0833	m
Total Pressure P	P	0.1563	KN/m
acting at	x	0.0833	m
Grade Of Concrete	M	25	N/mm²
	E	200000	N/mm²
		2E+08	kN/m²
Thickness of the retaining wall		0.0016	m
Moment of Interia	I	2E-06	m⁴
Deflection	Δ_{max}	0.0069	m
		6.9464	mm

Using the rankine formula the calculation were done after applying the load i.e. soil load on the prototype of the retaining wall.

Fig -2: Prototype of Retaining wall

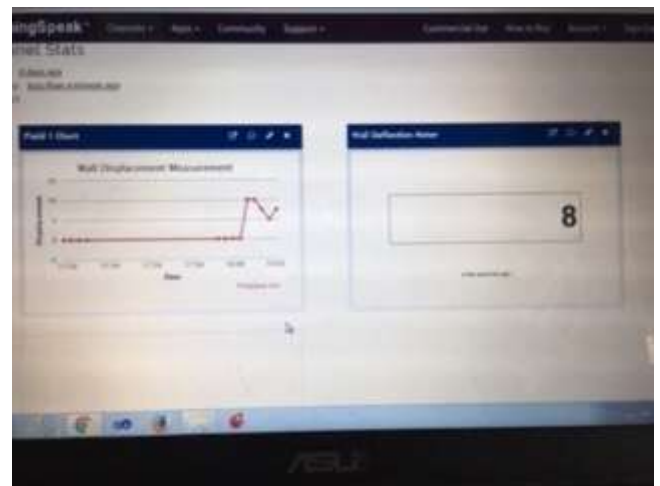After applying the load the practical result was that there was a deflection by 8mm which was recorded in the sensors.

Fig -3: Result of the sensor on monitor

3. CONCLUSION

The manual calculation matched the result obtained from the practical result it was varying by +1mm. For more precision there is a need of more accurate sensors and the placement and mode of calculation for monitoring the retaining wall was successfully portrayed in the model.

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