Total Station – Digital Level Height Accuracy

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Introduction

Leveling is an operation that is used for determining the elevations of points or the differences in elevation between points on the earth's surface.

Data from a finished level survey are used to

(1) design roads, highways, and airfields;

(2) develop maps, showing the general configuration of the ground (Topographic Maps);

(3) calculate volume of earthwork;

(4) lay out construction projects.

Differential Leveling

-Differential leveling with spirit or automatic levels and graduated rods is the traditional method used to establish vertical control.

-Accurate results are obtained when all systematic errors are controlled and corrected.

-Short sight lengths and balanced sights are the most limiting restrictions.

-The absence of benchmarks at higher elevations all over the world suggests that differential leveling is extremely costly and time consuming in mountainous regions

Total Station

-The total station is an electronic theodolite integrated with an electronic distance meter (EDM) to read slope distances from the instrument to a particular point and reduce it to horizontal by observing the vertical angle.

-It computes the difference in elevation using the sine function of the vertical angle multiplied by the slope distance.

Objective of Research

-The objective of this work is to carry out leveling using three sets of total stations and compare the results with those of a digital differential level being tested at the same site and used as reference for height accuracy comparison.

Tested Instruments

The test includes four instruments:

1- Leica Digital Level DNA03 to be used as reference for evaluation of the total station height accuracy,

2- Three Total Stations:

-Total Station(TCR1105- Leica),

-Total Station(TCR1101- Leica) and

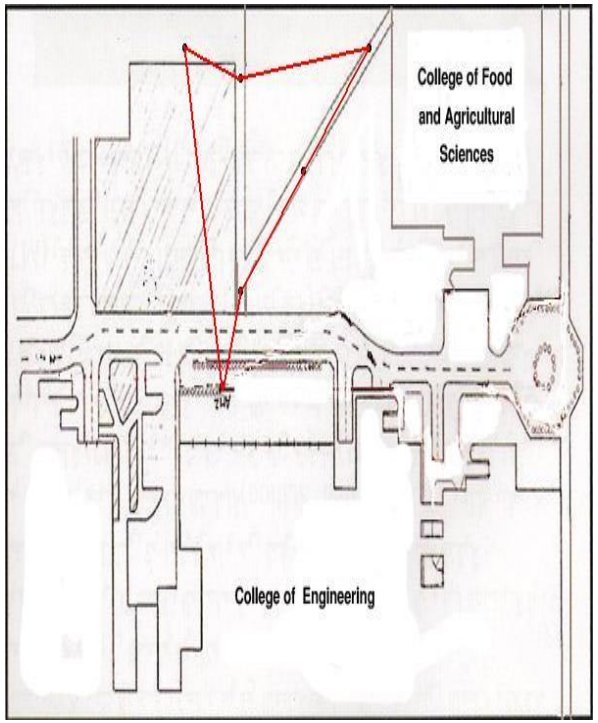
- Total Station(TCR1102- Leica).

Test Area

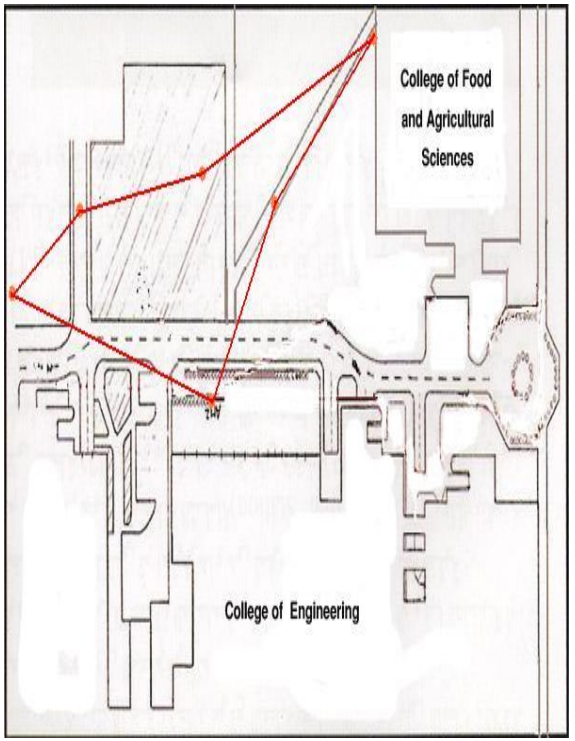
The test site is an area located between the college of Engineering and college of Food and Agricultural Sciences:

Test Methodology

Test 1 (250m)



Test 2 (450m)



Results

Test Results

Summary of height standard errors of total stations relative to digital level

Total Station	TCR 1101	TCR 1102	TCR 1103
Test 1 (250m)	0.178	0.144	0.170
Test 2 (450m)	0.034	0.015	0.018

Conclusions

-The height standard errors for total stations relative to the digital level whose accuracy was tested as 2mm for a level run of length 250m, and 3mm for level run of 450m range from 0.14m to 0.18m and from 0.02 to 0.03m respectively.

-It can be concluded that for a mountainous site where it is very difficult to use a differential level the total station can be a good substitute if the accuracy required is within 20mm.

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