CE200 SURVEYING

Lecture 6
August 27, 2007

AREAS

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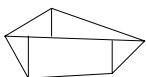**Surveying Techniques Division**

For many purposes, the areas of closed figures on plans and drawings are required.

Areas of closed figures are calculated either from original measurements or from readings on plans, or from coordinates.
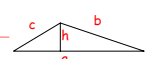
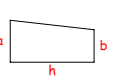**There are two cases for calculating areas:**
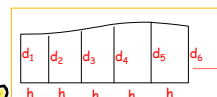
Case 1: Coordinates of corner points are not available.

Step 1:
Divide the whole area into series of triangles and/or trapezoids by drawing appropriate lines.

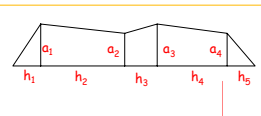Measure the lengths of these lines either in the field or on the plan.

Step 2:
Calculate the area of each part using one of the following formulas.

triangle

$S = (a+b+c)/2$

$Area = a*h/2$ $Area = \sqrt{S*(S-a)*(S-b)*(S-c)}$

trapezoid

$Area = (a+b)*h/2$
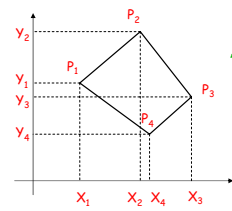
$Area = h*(((d_1+d_6)/2)+d_2+d_3+d_4+d_5)$

curved line boundary

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broken line boundary

(Simpson's Rule) $Area = (a_1*(h_1+h_2)/2)+(a_2*(h_2+h_3)/2)+(a_3*(h_3+h_4)/2) +(a_4*(h_4+h_5)/2)$

Step 3:
Summation of areas of parts will give the total area.

Case 2: If the coordinates of corner points are available

$Area = ((Y_2+Y_1)(X_2-X_1)/2) + ((Y_3+Y_2)(X_3-X_2)/2) + ((Y_4+Y_3)(X_4-X_3)/2) + ((Y_1+Y_4)(X_1-X_4)/2)$

$Area = ((X_2+X_1)(Y_2-Y_1)/2) + ((X_3+X_2)(Y_3-Y_2)/2) + ((X_4+X_3)(Y_4-Y_3)/2) + ((X_1+X_4)(Y_1-Y_4)/2)$

$2*Area = \sum_{i=1}^{n}(Y_{i+1} + Y_i)*(X_{i+1} - X_i) = \sum_{i=1}^{n}(X_{i+1} + X_i)*(Y_{i+1} - Y_i)$

for i=n take i+1=1

Officework 2:

❑ Form a closed figure with six contour points of your fieldwork 4.

❑ Calculate the area of the figure from readings on your plan of fieldwork 4.

❑ Calculate the same area using X,Y coordinates of 6 contour points found in fieldwork 4.

❑ Compare the areas calculated and make a comment on the result.

❑ Each member of subgroup will choose different areas.