



NATIONAL OPEN UNIVERSITY OF NIGERIA
FACULTY OF AGRICULTURAL SCIENCES

DEPARTMENT OF
CROP AND SOIL SCIENCES

FPY/SIWES PRACTICAL GUIDE MANUAL

CRP 311
LAND SURVEY AND FARMSTEAD PLANNING

Course Developer/Writer
DR PETU IBIKUNLE



National Open University of Nigeria

Plot 91, Cadastral Zone, University Village

Nnamdi Azikiwe Expressway

Jabi, Abuja

Lagos Liaison Office

14/16 Ahmadu Bello Way

Victoria Island, Lagos

e-mail: centralinfo@nou.edu.ng

Website: www.nou.edu.ng



This publication is made available in Open Access under the Attribution-ShareAlike4.0 (CC-BY-SA 4.0) license (<http://creativecommons.org/licenses/by-sa/4.0/>). By using the content of this publication, the users accept to be bound by the terms of use of the National Open University of Nigeria Open Educational Resources Repository: <http://www.nounonline.net/oer>

Published by National Open University of Nigeria

Printed by NOUN PRESS

np@noun.edu.ng

April 2018

CONTENT	PAGE
INTRODUCTION - - - - -	4
OBJECTIVES OF LAND SURVEY - - - - -	4
DISTANCE - - - - -	4
PRINCIPLES - - - - -	4
INSTRUCTIONAL TASK (PROCEDURES)	5
RULES FOR TAPING - - - - -	8
PRINCIPLES OF DIFFERENT LEVELING - - -	13
INSTRUCTIONAL TASK / PROCEDURE - - -	13
PROCEDURE FOR DIFFERENTIAL LEVELING - -	15
ESSENTIAL FACTORS IN FARMSTEAD PLANNING - -	20
PROCEDURE FOR ZONE PLANNING - -	21
ZONE PLANNING - - - - -	22
SUMMARY - - - - -	24

INTRODUCTION

This practical guide is designed for students of agriculture who are in 300 level and need to know about land survey and farmstead planning. As student of agriculture, land plays an important role in agriculture as there can be no agricultural production without the use of the land. By going through this practical guide students will have a hand-on some of the equipment used and know the concept of what land survey and farmstead planning is all about. Students will learn about the tools equipment use and learn about some of the procedures employ.

OBJECTIVES OF LAND SURVEY

1. it enables the farmer know the area of farm land
2. it enable the farmer know about the hydrology of the land
3. it enable the farmer have security over his farm land
4. it adds to the farmers security against intruders
5. it is good for collateral
6. it enables the farmer secures the boundaries of his land
7. it helps the farmer know how useful is his land
8. it is basis for farm design
9. it allows for decision making
10. it helps in farmstead planning.

according to the American congress and surveying and mapping (ACSM) land surveying is the sand and out of making all essential measurements to determine the relative points and or physical and cultural details above, on beneath the surface of the earth and to depict them in a usable farm, or to establish the position of points and or details. The techniques use land survey are:

- distance measurement
- angle measurement
- leveling
- determining
- reference network.

DISTANCE

Objectives:

1. Given a measure of length expressed in a particular unit, be able to express the given length in any unit (inches, feet, yard, rod, mile, meter, kilometer).
2. List and described the methods and equipment used in measuring distance and be able to work problems involving measuring by odometer, pacing or stadia.
3. Be able to write a distance measurement in terms of “full” or “plus” stations.
4. Describe the procedure for horizontal taping on sloping ground.

PRINCIPLES

Measuring distance is probably the most common procedure used in agricultural surveying. The instruments used are simple, but a high degree of accuracy can be achieved with practice and careful work. Greater errors are introduced in agricultural surveying by inaccurate

measurement of distance than by any other cause. In this section you will become acquainted with the basic methods and techniques of measuring distance.

INSTRUCTIONAL TASK (PROCEDURES)

Since several common units of length or distance are used in agricultural surveying, you will need to become familiar with the different sizes of length units and be able to change from or make connections from one unit to the other.

Common English units are

1 foot (ft)	=	12 inches (in)
1 yard (yd)	=	3 feet (ft)
1 rod = 16.5 (ft)	=	5.5 yd
1 mile (mi)	=	5280 ft = 1760 yds = 320 rods

Metric system of measure

1 centimetre (cm)	=	10 millimetre (mm)
1 Meter (m)	=	100 centimetre (cm)
1 Kilometre	=	1000 metres (m)

Conversion of one system of unit to the other

1 m	=	39.37 in	=	3.28ft
1 ft	=	0.3048m		
1 km	=	0.621 ml		
1 ml	=	1.609km		

Practice

Express 550 yds as rod

Express 10km as yd

Express 75 rods as meter

Express 12600 ft as kilometre

Instructional Task II

The principal methods of measuring distance are:

- (1) Odometer readings
- (2) Pacing
- (3) Stadia
- (4) Taping or Chairing.

Odometer

A device that counts the revolutions of a wheel rolled along the line to be measured. There are special types of wheels with counters but a bicycle or any round object may be use.

To be accurate the wheel must roll along the ground without slipping. The circumference of the wheel must be known and is equal to π (3.14) times the diameter. The measured distance is then the product of the wheel circumference and the number of wheel turns. This is expressed in the following equation.

MD	=	$(\pi D) \times (N)$
MD	=	Measured distance in ft or in
D	=	Wheel diameter in ft or cm/m
N	=	number of wheel revolutions.

Pacing

This is the oldest, simplest and easiest method of obtaining a measured distance. You must determine your pace distances (pd) and this can be found by multiplying the number of steps between two points by a predetermined pace factor (pf). The pace factor varies with individuals. Pace factor varies with the topography of the land and its shape. Pace factor can be determined by pacing a measured length severally, say, 3 to 4 times and taken the average. Pace factor varies with individual. Pace factor can be determined by using your normal stride or walk length. For example; to determine his pace factor, a man takes 62, 60 and 64 steps on 3 trials to travel a measured distance of 200ft what is his pf.

The average steps is $\frac{62 + 60 + 64}{3} = 62$ steps

His pace factor is $\frac{200\text{ft}}{62 \text{ steps}} = 3.23\text{ft per step}$

If he counts or measured 400 steps on a ground, what is the pace distance covered.

$$\begin{aligned}\text{pd} &= \text{steps} \times \text{pf} \\ &= 400 \times 3.23 \\ &= 1292 \text{ ft}\end{aligned}$$

Taping

This is the most common and most accurate method of measuring horizontal distance using a steel tape. Tapes come in various sizes and graduations some come in meters or feet or both. Before attempting to measure with a tape, it is important to note the marks or graduations, especially where the tape is sub-divided into tenths and hundredths of feet or metres. There are six basic steps involved in taping. These are:

(1) Lining in (2) applying tension (3) plumbing (4) marking tape length (5) reading the tape and (6) recording the distance

SURVEYOR'S STEEL TAPE

1. A Metallic tape: made of high grade linen re-in forced with fine copper wire.
2. Mostly found in soft long and comes in a leather case with a keel
3. Chaining pins: sometimes called "surveyors" arrows" are used to mark the end of each tape length. They are made of heavy gage wire and are 12 to 15 inches Long. Mostly painted red and white and have bright plastic cloth attached to help locate them in tall grass.
4. Range poles: usually 1 inch diameter tubular steel or wooden shafts 6 to 10ft long with one end pointed. They are painted red and white and are mostly used for "lining in" when taping or measuring angles.
5. Plum bobs: has 6 to 10ft of cord attached and are used when taping on sloping or irregular ground to transfer the distance from the horizontally held tape to a point on the ground.

Station in survey

Survey distances are referred to as "STATION" A distance of 100ft is called a "Full station" and is written as 1+00. Similarly a distance of 200 ft is written as 2+00. A fractional part of a distance between full stations is called a "plus station" .4216.8 ft is called station 2 +16.8

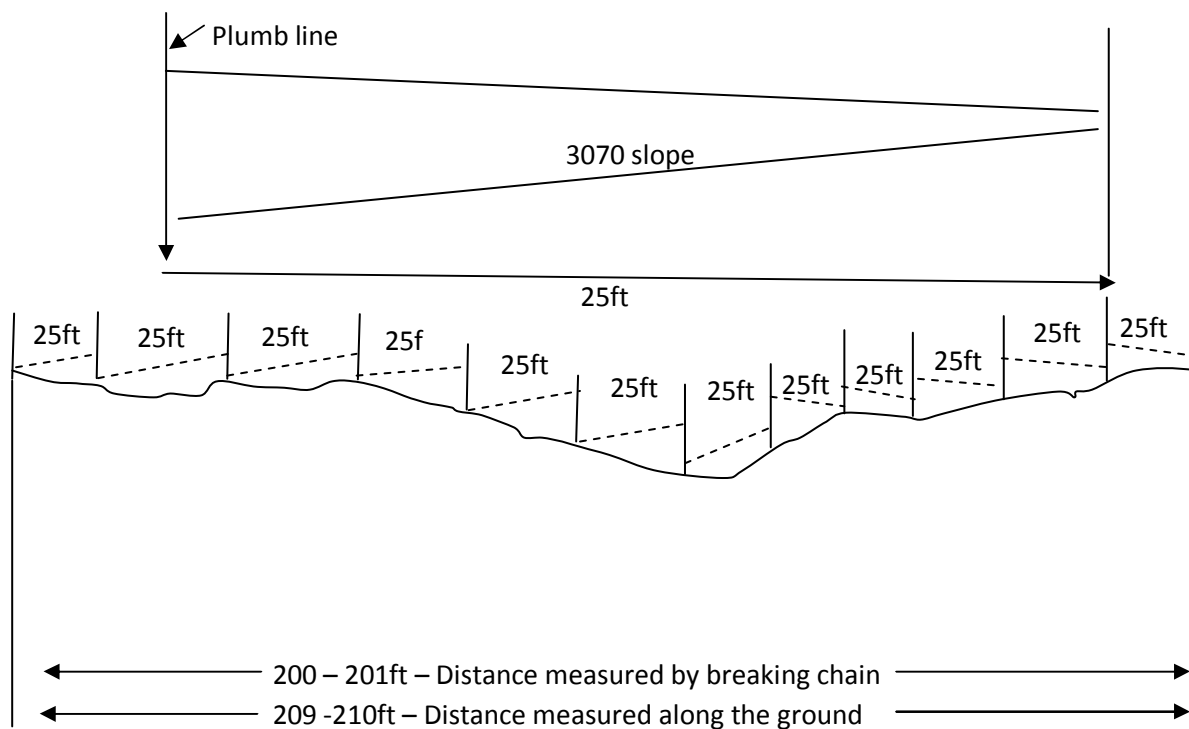
Express the following survey distance in terms of full and plus stations.

- 1) $1081.5\text{ft} = 10+ 81.5$
- 2) $65.7\text{ft} = 0+65.7$
- 3) $927.0\text{ft} = 27.0$
- 4) $230.0\text{ft} = 2+30.0$

Instructional Task

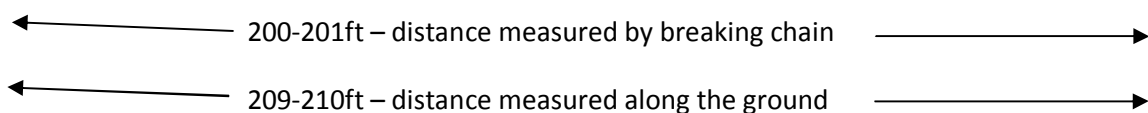
All distances in surveying are measured horizontally. There are two methods 1) tape held horizontally, and 2) tape on the sloping ground. If the latter method is used the percent slope must be measured and the horizontal distance calculated by trigonometry or obtain from tables.

With the horizontal tape method one end is held on the ground, while the other end may be a considerable elevation above the ground the true distance is transferred to the ground from the elevated end of the tape by a plumb bob. If the slope is more than 5 or 6% it is necessary to use a process called “breaking chain” in this method the head chain man lays out the full length of the tape. The 100ft length is then divided into convenient increments, always plumbing down to the ground from the horizontal tape. (See diagram below).



The 100ft length is then divided into convenient increments, always plumbing to the ground from the horizontal tape.

Taping equipment



Hand level: this consists of a small sighting tube 5 to 6 in long equipped with a spirit level. The image of the bubble is reflected by a prism and can be observed by the operator as he/she looks through the tube. The instrument is held to the operator's eye and is leveled by rising.

RULES FOR TAPING

- 1) Line in the tape carefully and keep the tape and the line being measured
- 2) Keep a uniform tension of about 15kb pull on the tape for each measurement.
- 3) Keep in mind the type/style of tape being used to avoid error of measurement.
- 4) "Break chain" on slopes as necessary to keep the tape level, or calculate the percent. Slope if measuring with the tape on the ground.
- 5) Carefully mark each station and keep an accurate count of the stations.

AREAS

Objectives

1. Be able to express the given area in any of the units earlier talked about
2. Given a list of area formulas for (triangles, rectangles, circle, trapezoids etc) and appropriate data (description or sketch of an unknown area be able to select the correct formula to calculate the area.
3. Given a dimensioned sketch of an rectangular field (with straight and curved sides) be able to subdivide the land into various sizes and use correct formula to calculate their areas.

Objective

One of the most common applications of surveying is to measure the area of a given land field or farm. If great accuracy is required, a professional engineer or land surveyor should be employed. He will measure the angles with a transit and the distance with a steel tape, and calculate the areas accurately.

1. Express 200 square rods as acres

$$1 \text{ sq rod} = \frac{1}{160} \text{ area}$$

$$200 \text{ sq rod} = 200 \times \frac{1}{160} \text{ ac} \\ = 1.25 \text{ qcre. (ac)}$$

2. Express 890 acres as sq mile

$$3. \quad 1 \text{ ac} = \frac{1}{160} \text{ sq ml.}$$

$$890 \text{ ac} = 890 \times \frac{1}{160} \text{ sq ml} \\ = 1.39 \text{ sq. ml}$$

Express 640 acres as hectares

$$1 \text{ ac} = 0.405 \text{ ha}$$

$$640 \text{ ac} = 640 \times 0.405 \text{ ha}$$

$$= 259 \text{ ha.}$$

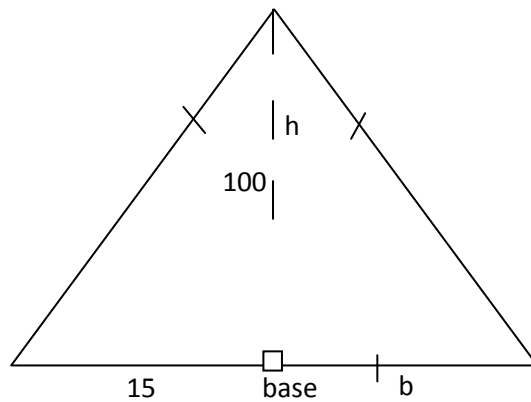
TRIANGLES:

Formula for calculating triangles with equal sizes. Find the areas in meters of a triangle with a base 15m and height 10m

$$A = \frac{1}{2} (b \times h)$$

B = base

H = height



$$\text{Area} = \frac{1}{2} (b \times h)$$

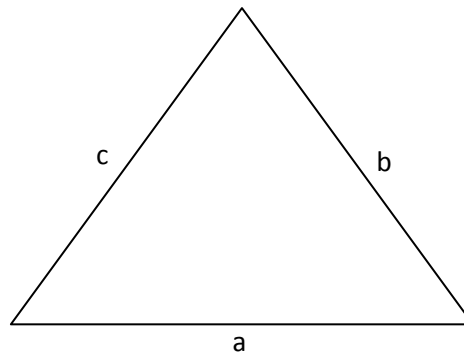
$$= \frac{1}{2} (15 \times 10)$$

$$= \frac{1}{2} \times 15 \times 10$$

$$= \frac{150}{2}$$

$$= 75m^2$$

With the length of the three sides known but not equal.



$$A = \sqrt{s(s-a)(s-b)(s-c)}$$

A = Area

$$S = \text{Total sum of } \frac{a+b+c}{2}$$

For example; find the area of triangle in areas and hectares whose size are given as 650, 428, 282

$$S = \frac{650+428+282}{2} = 680$$

$$A = \sqrt{680(680-650)(680-428)(680-282)}$$

$$= \sqrt{(680)(30)(252)(398)}$$

$$= \sqrt{20.4 \times 10^8}$$

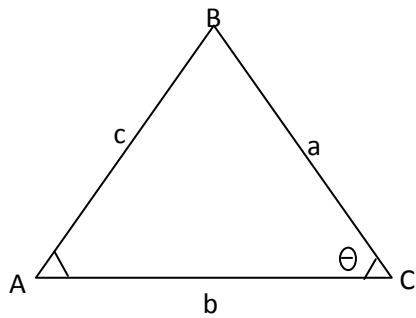
$$= 4.52 \times 10^4 \text{ sq ft}$$

$$\text{Since } 1 \text{ sq ft} = \frac{1}{43560} \text{ ac.}$$

$$4.52 \times 10^4 \text{ sqft} = 4.52 \times \frac{1}{43,560} \text{ ac}$$

$$= 1.04 \text{ ac.}$$

Triangle: with two sides plus an angle known



A = area

A and B = know side

Θ Angle between sides

Find the area of a triangle, in hectares, having sides measurement 555m 350m and 450 angle.

$$A = \frac{1}{2} (ab \sin \theta)$$

$$= \frac{1}{2} (350 \times 555 \times 0.707).$$

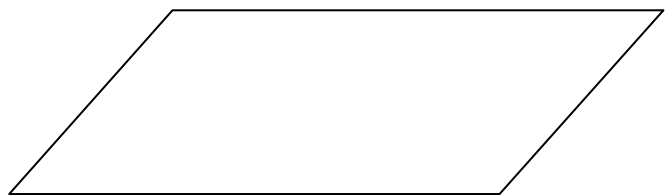
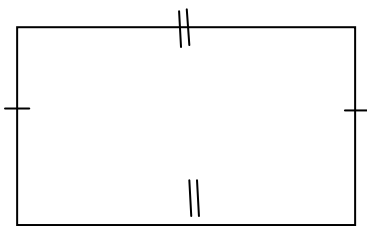
$$= 6.87 \times 10^4 \text{ sqm}$$

$$\text{Since } 1 \text{sqm} = \frac{1}{10,000} \text{ ha}$$

$$6.87 \times 10^4 \text{ sqm} = 6.87 \times 10^4 \times \frac{1}{10,000} \text{ ha}$$

$$= 6.87 \text{ ha}$$

Rectangle: either square or parallelogram



A square rectangle has 7 sides equal.

$$\text{Area} = a \times b$$

Find the area in acres of a rectangular area measuring 1320ft by 660ft.

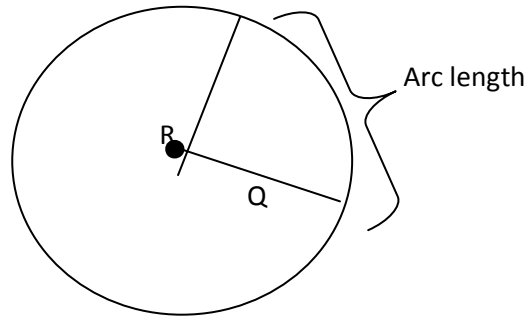
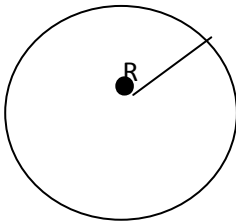
$$A = 1320 \times 660$$

$$= 8.71 \times 10^5 \text{ sqft}$$

$$1 \text{sq.ft} = \frac{1}{43,560} \text{ a}$$

$$= 20 \text{ ac.}$$

Circle or part of a circle



Area of a whole circle

$$A = \pi R^2$$

Circular sector

$$A = \frac{\text{Arc length}}{2} A = \frac{\pi R^2 (\text{angle})}{360}$$

Find the area of a circle in sq ft having a radius of 75 ft.

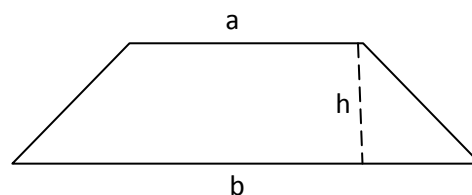
$$\begin{aligned} A &= \pi R^2 \\ &= 3.14 (75 \times 75) \\ &= 17,663 \text{ sq ft} \end{aligned}$$

Find the area of a circular sector, in sq meters. Having a radius of 135 meters and an angle of 60°

$$\begin{aligned} A &= \frac{\pi R^2 (\text{angle})}{360} = \frac{\pi (135)(135)(60)}{360} \\ A &= 9538 \text{ sq m} \end{aligned}$$

Trapezoid:

$$A = h \frac{a+b}{2}$$



A = area

H = perpendicular distance

A x b = length of parallel side

What is the area in acres of a trapezoid whose sides are 300 ft and 450 ft and a perpendicular distance of 120 ft.

$$H = 120$$

$$A = 300$$

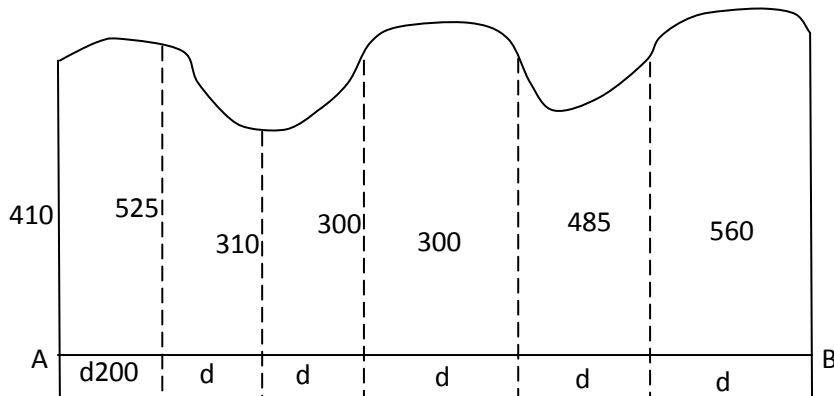
$$B = 450$$

$$\text{Area} = \frac{300+450}{2} = A.5 \times 10^4 \text{ sq ft}$$

$$= 4.5 \times 10^4 \text{ sq ft} = 4.5 \times 10^4 \times \frac{1}{43,560} \text{ ac}$$

$$= 1.03 \text{ ac.}$$

The trapezoid formula is used to find the area of a triangular shape area having three straight sides and curved side .



$$\text{Area} = d \frac{ho}{2} + \epsilon h + \frac{hn}{2}$$

A = Area

D = equal distance between offset

ho and hn = and of offsets

£h = sum of all interior offsets minus and offsets

$$\text{Area} = d \frac{ho}{2} + \epsilon h + \frac{hn}{2}$$

$$\text{Ana} = 200 \frac{410}{2} + 510 + 310 + 300 + 500 + 485 + \frac{560}{2}$$

$$= 200 (205 + 2105 + 280)$$

$$= 200 (2590)$$

$$= 518,000 \text{ sq ft}$$

$$\text{Since } 1 \text{ sq ft} = \frac{1}{43560} \text{ ac}$$

$$A = 11.89 \text{ ac.}$$

Differential leveling

Objectives:

1. Be able to describe what is meant by
 - a. Differential leveling
 - b. Bench mark (Bm)
 - c. Back sight (Bs)
 - d. Height of instruments (Hi)
 - e. Foresight (Fs)
 - f. Twining point (Tp)
 - g. Be able to describe the procedure used in differential leveling.

PRINCIPLES OF DIFFERENT LEVELING

Leveling is the process of determining the differences in the elevation of points on below or the above the surface of the earth e.g. such as the ground tops of stakes of various part of a building. Leveling ranks next to the measurement of distance in importance as a surveying technique. Practically no planning or construction can be due without prior leveling. Differential and profile leveling are two surveying methods very useful for agricultural and horticultural project

The two main purposes of leveling are:

1. For planning: to establish the necessary elevations to develop plans for such structures as buildings, roads and terraces etc.
2. For layout: prior to construction of structures such as building to the elevations shown on the plans. The equipment used in leveling consists of leveling instrument and leveling rod. The leveling instrument is a telescope to indicate when the instrument is in a level position. The level may be tripod – mounted or hand – held. The leveling rod is a wooden scale about 13ft long graduated into feet, tenths and hundredths of feet/meters or 4.5 6m long adro graduated in meter tenths hundredths of meter.

Differential leveling is the process of finding the difference in elevation between two points. Two rod reading, must be made for each of the leveling instrument. The differences in rod readings represent the difference in elevation between the two points

Profile leveling is the process of determining the elevation of points at measured distance along a selected line. This line may be the center of a proposed ditch, street, tile line, terrace channel etc. using the information gained by this type of surveying we can plot the elevation and distance of each point on a graph called a profile. With the aid of the plotted profile we can make studies relating to grades, depths, high or low spots, and make estimation of cuts and fills.

Topographic leveling: is the process which the elevations of spaced grid points in a field are determined. This information is needed to plot a topographic map of the field by contour lines. We can show the natural and artificial features in the field such as hills, valleys, ridge, slopes, dams, etc

INSTRUCTIONAL TASK / PROCEDURE

In All leveling survey, there are certain terms used which students must be formula with to make the survey work easier, quicker and faster.

Bench mark (BM): A permanent point of known elevation above sea level in which all elevation of other survey work are done.

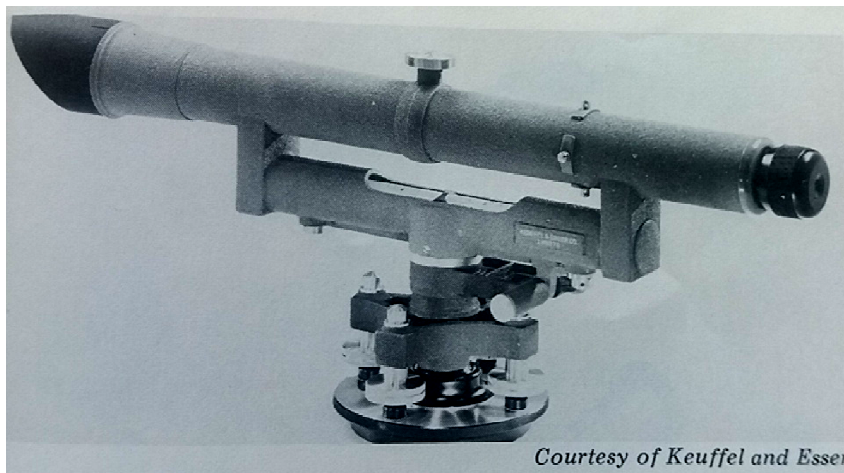
Back sight (BS): A rod reading taken on a point of known elevation it is the vertical distance between the line of sight and the point of known elevation on which the rod is held.

Twining point (TP): is a temporary bench mark upon which tore sight and book sight rod reading are taken for the purpose of continuing the line of levels

Fore sight (FS): is a rod reading taken on any point. The elevation of which is to be determined.

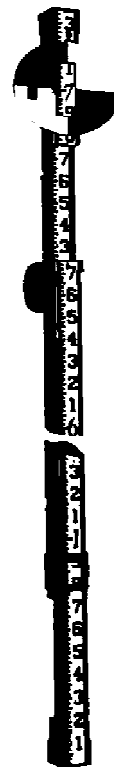
Height of instrument (HI): is the elevation of the line of sight when the instrument is leveled. It is found by doing the BS rod reading to a known elevation.

INSTRUMENTS FOR DIFFERENTIAL LEVELING



A Dumpy-Type Engineers Level





Courtesy of Keuffel and Esser

A PHILADELPHIA-TYPE LEVELING ROD

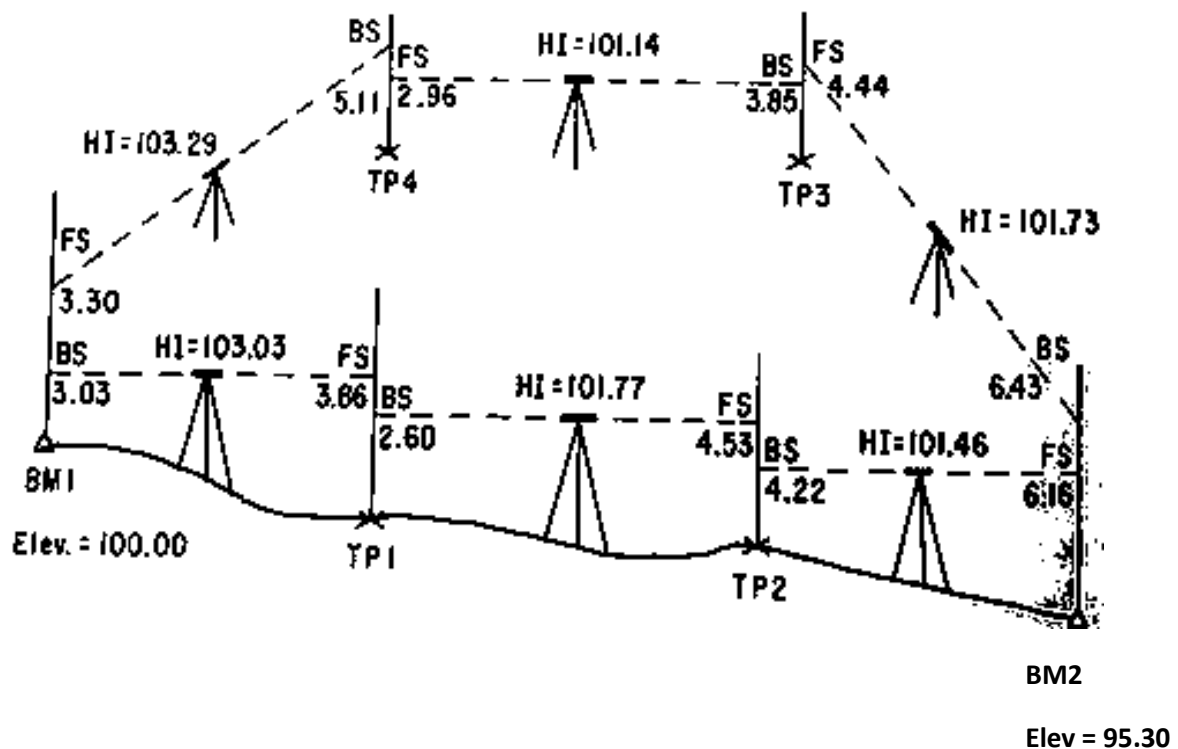
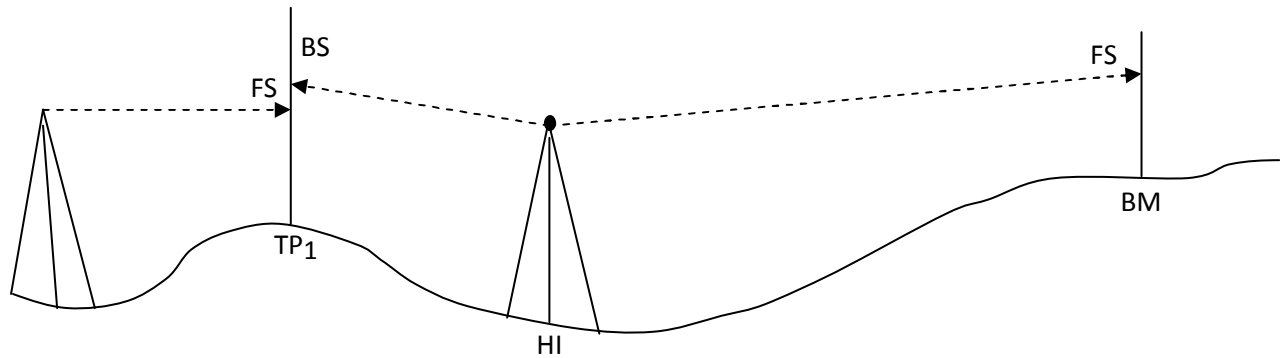
PROCEDURE FOR DIFFERENTIAL LEVELING

The survey begins with the instrument man setting the level a distance say 300 – 400ft away from the Bm. The rod man sets the rod on Bm, and the level is set to look towards the direction of the rod where is takes a reading on the rod as shown by the cross hairs in the level. Assuming this reading is 3.03 this is called BS reading so the BS reading is added to the BM known elevation (100.00) to give a HI 103.03, the rodman goes forward in the direction of line of the survey and sets the rod some distance from the instrument man the instrument man turns his level and sight the rod and takes a reading, where the crosshairs of the level meets the rod. This is the FS reading say 3.86. it is subtracted from the previous HI to give 99.1 where the rodman sets the rod after the BM, is called the TP, the instrument man can now move forward and sets up the level; takes a reading on TP I. this reading becomes BS (2.60) reading and is added to reading at TP₁. Say $99.17 + 2.00 = 101.77$ this is the HI reading at TP₁. Again a new TP₂ is selected and a rod reading is taken to be 4.53 is recorded

as FS reading. This reading is subtracted from HI 101.77 to give a new elevation ($101.77 - 4.53 = 97.24$) for TP₂. This process is repeated until the elevation for BM₂ is established to be 95.30

Note keeping procedure for leveling sway.

Five columns are needed from left to right and the column headings are station (STA), back sight (BS), higher of instrument (HI), foresight (FS), and elevation (elev).



Differential leveling

STA	BS	HI	FS	ELEV
BM ₁	303			
π		103.03		
TP ₁	2.60		3.86	99.17
π		101.77		
TP ₂	4.22		453	97.24
π		101.46		
π	6.43		6.16	95.74
π		101.73		
TP ₃	3.85		4.44	97.25
π		101.14		
TP ₄	5.11		2.96	98.18
BM ₁			3.30	99.99

£BS =25.4 £FS 25.5

£BS - £FS 25.24 – 25.25 = 0.01

BM₁

100.00 BM₂ (end)

99.99

Check 100.00 – 99.99 = 0.01

= 0.01

Summary of leveling procedure

- 1) Set up instrument
- 2) Establish BM, and take BS reading
- 3) Establish TP and take FS reading
- 4) Move instrument and set up again
- 5) Take BF on TP
- 6) Establish next TP and take FS reading
- 7) Move instrument and set up again

8) Repeat step 5.1

$BM \text{ elevation} + BS = HI$

$HI - FS = TP \text{ elevation}$

$TP \text{ elevation} + BS = HI$

$HI - FS = TP \text{ elevation}$

And so forth

In profile leveling there are several foresight (FS) reading and few back sights (BS) several FS reading can be taken on any given BM. Or TP, before profile can be made, survey crew set stakes where the rod readings are to be obtained. The stakes are set at equidistance apart e.g. 25,50 or 100ft apart. In profile leveling a station marking a full 100ft is called a full station and the other points along the line are called plus station e.g. $225 = 2 + 25.0$

Instructional task/procedure for profile leveling.

The procedure for profile leveling and note keeping are practically the same as in differential leveling. With the level set up near the line to be profiled, the rod is held on the BM and the BS reading (3.66) is taken the HI was observed ($HI = 100.00 + 3.66$) next the rod was held on the hub stake for station $0 + 00$, $1 + 00$, $2 + 00$ and so on and rod reading of 5.23, 3.76 and 3.42 were taken. The elevation of each point was calculated by subtracting the rod reading from the HI.(note the same HI was used for all the stations up to $6+00$):

When it becomes necessary to select a turning point the rod was held on the top of stake and a FS(4.12) is taken, the elevation of tp, was determined by subtracting the FS from the HI($TP, \text{ elevation}=103.66-4.12=99.54$).The level was moved forward and set up at a new location and a BS (1.38) taken on the tp. The new HI (100.92) was observed. This procedure is repeated in the same way until the elevation of BM was calculated.

Example of profile leveling and note keeping.

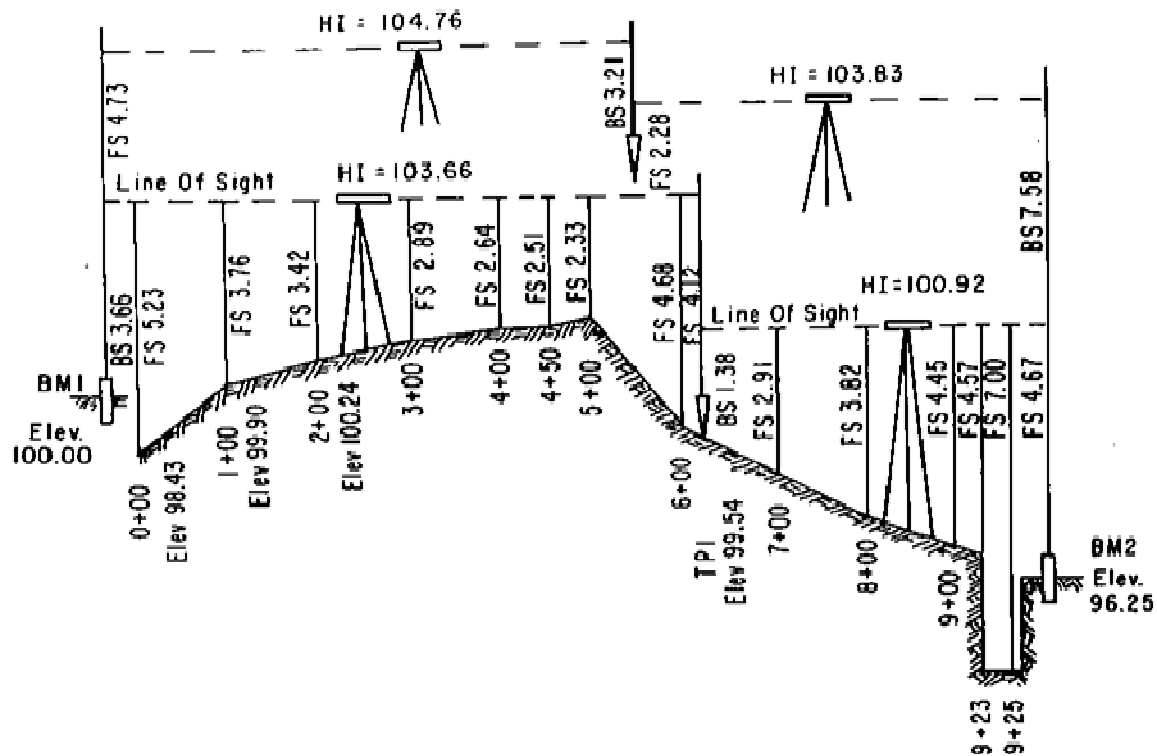


FIG. 20.1. PROFILE LEVELING

PROFILE LEVELING North Side Of Farm Road					Oct. 7, 1974 Fair, Clear, Calm	Brown Jones Smith
Sta.	B.S.	H.I.	F.S.	Elev.		
BM1	3.66	103.66		100.00	BM1 Nail in post	
0+00			5.23	98.43	SE corner of lot	
1+00			3.76	99.90		
2+00			3.42	100.24		
3+00			2.89	100.77		
4+00			2.64	101.02		
4+50			2.51	101.15		
5+00			2.33	101.33		
6+00			4.68	98.98		
TPI	1.38	100.92	(4.12)	99.54	Top of stake	
7+00			2.91	98.01		
8+00			3.82	97.10		
9+00			4.45	96.47		
9+23			4.57	96.35	Natural ground	
9+25			7.00	93.92	Bottom, conc. culvert	
BM2	7.58	103.83	(4.67)	96.25	"X" in SW corner of	
TP2	3.21	104.76	(2.28)	101.55	concrete headwall	
BM1			(4.73)	100.03		
$\Sigma BS =$	15.83	$\Sigma FS =$	15.80			
Error of closure: 15.83 - 15.80 =					0.03	

Field notes for profile leveling

FARM STEAD PLANNING

What is farmstead: this is a farm house and the binding near it.

Planning is the part of or process of arranging or putting things together. Planning includes all the elements of research e.g. how, what, when, where and who. Farmstead planning is a process or a systematic process of arranging things and putting those things together in order to achieve a purpose or goal.

Farms stead planning like in any planning activity usually starts with a problem: e.g can this be done; how do you achieve your goals or objectives. Where do you get what you want. The objectives of planning include expansion, improved performance higher capacity and better use of labor.

Careful planning includes reviewing the present assessing the near future and providing for the more distant future. For agricultural activities, farm stead planning means looking at the whole problem, the whole farm business as objectively as possible and as far into the future as possible it is better to plan on paper where a mistake can easily be changed.

In farmstead planning it is good for you to look ahead as far as you confidently can. Think big about space, mechanization, processes and operational changes that might occur so there can be adjustment when the need arises.

Farms stead planning includes mapping where things are and evaluating how useful they are. As you plan use all the factors, look closely at all farm activities, for example, a building in the wrong place is 20 years mistake and this can be very expensive.

FARM STEAD PLANNING

What is farmstead: this is a farm house and the binding near it.

Planning is the part of or process of arranging or putting things together. Planning includes all the elements of research e.g. how, what, when, where and who. Farmstead planning is a process or a systematic process of arranging things and putting those things together in order to achieve a purpose or goal.

Farms stead planning like in any planning activity usually starts with a problem: e.g can this be done; how do you achieve your goals or objectives. Where do you get what you want. The objectives of planning include expansion, improved performance higher capacity and better use of labor.

Careful planning includes reviewing the present assessing the near future and providing for the more distant future. For agricultural activities, farm stead planning means looking at the whole problem, the whole farm business as objectively as possible and as far into the future as possible it is better to plan on paper where a mistake can easily be changed.

In farmstead planning it is good for you to look ahead as far as you confidently can. Think big about space, mechanization, processes and operational changes that might occur so there can be adjustment when the need arises.

Farms stead planning includes mapping where things are and evaluating how useful they are. As you plan use all the factors, look closely at all farm activities, for example, a building in the wrong place is 20 years mistake and this can be very expensive.

ESSENTIAL FACTORS IN FARMSTEAD PLANNING

- I. WATER; very important for domestic animals and farm use. Quantity and quality very important. Keep source flowing, water is essential for use.
- II. DRAINAGE: surface and subsurface drainage is a top priority to avoid pounding hence sickness and diseases. Proper drainage is good keep town stead dry.

- III. **DON'T BUILT IN HOLES** =can cause problem of drainage, collapse of facilities of building. Difficult to maintain plus (+) and or a minus (-) effect on all activities in the farm.

OFF FARMSTEAD FACTORS

Farmstead development at a particular site may be limited by off-farm factor. Consider rural housing; urban subdivision; local state and federal building and zoning codes ;air and water pollution control requirements. A legal restrain can close your operation and may prevent recovering your investment, always clear your plans with the appropriate authority.

MAKING A PLAN

Preparing a good farmstead plan takes time and effort. It can be a rewarding and interesting experience : some tools to accumulate are:

1. **GOALS**-identify your instead goals and set priorities
2. **MECHANICAL ITEMS**-all the requirements for paperwork, survey, etc.
3. **INVENTORY**; prepare a scale map of the farmstead area, showing slope' underground utilities lines, building location, electric power lines, drives, service and other important physical features review present building-usefulness, condition, location and adaptability.
4. **INFORMATION**; identify facilities needed, additional services registered, traffic routes, feed handling methods family living desire and tax and insurance considerations. Establish realistic space requirement for activities and enterprises within the farmstead area.

DEVELOPING A FARMSTEAD

Farmstead planning once started, is a continuing part of farm management adjustment and additions to your plan buildings equipment, land, and management will reflect farming changes. First develop an accurate plan of what the farmstead looks like now. Then decides what is good and what's bad, analyze current needs, and anticipate future needs.

PROCEDURE FOR ZONE PLANNING

Before starting detail planning, get or prepare at least one map of any site to be considered. Aerial photographs are helpful and this will show major surface features, etc.

Contour maps are useful in planning drainage, building location, and adequate slope for drives, lots and drainage lines.

Use several different overlays and return to your plan from time to time to think of new arrangements that may be better. Take proposal to the field for a visual check. Look for ideas or other farmstead plans with situations similar to your own. Stake out proposals. Lay out proposal road, binding or distance zone to help visualize your revised farmstead. The best method is to use zone planning.

ZONE PLANNING

Zoning is a useful tool in planning new or remodeled farmstead after the general site has been selected. For a farmstead with a family living area, place the house at the centre of the planning zones, for a farmstead without a house, the farm court is usually the center, because vehicles, materials and labor tend to work from the court.

ZONE 1: family living lawns, recreation space and vegetable gardens, and guest parking are close to the house. Protect zone 1 farm noise, order, and dust as much as possible.

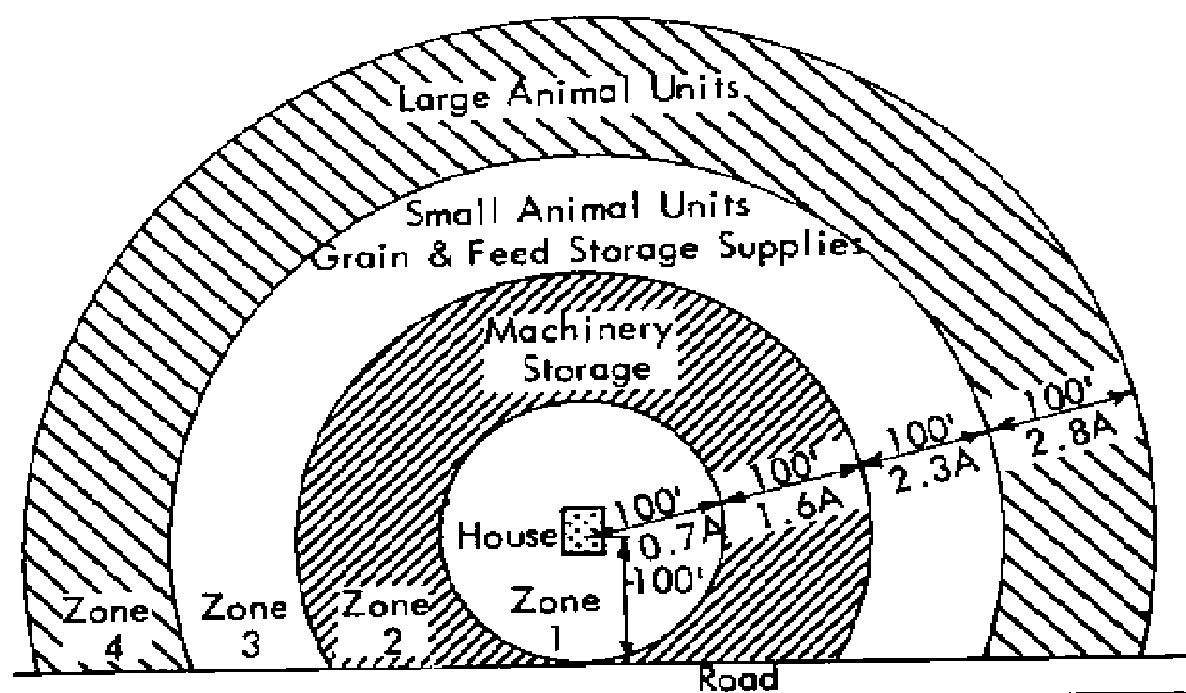
ZONE 2: machinery centre, shop, storage and related services that are relatively quiet dry and odor free are in zone 2. Consider screening the center from family view.

Much of the driveway and farm court may be in zone 2 put fuel and clerical storage toward the outer edge near the machinery, but removing odors, fire danger, and some hazards to children 40 – 60m from the home.

ZONE 3: grain, feed and some livestock. These areas come dust, noise, traffic and odor there tons they are moved another zone further form the house.

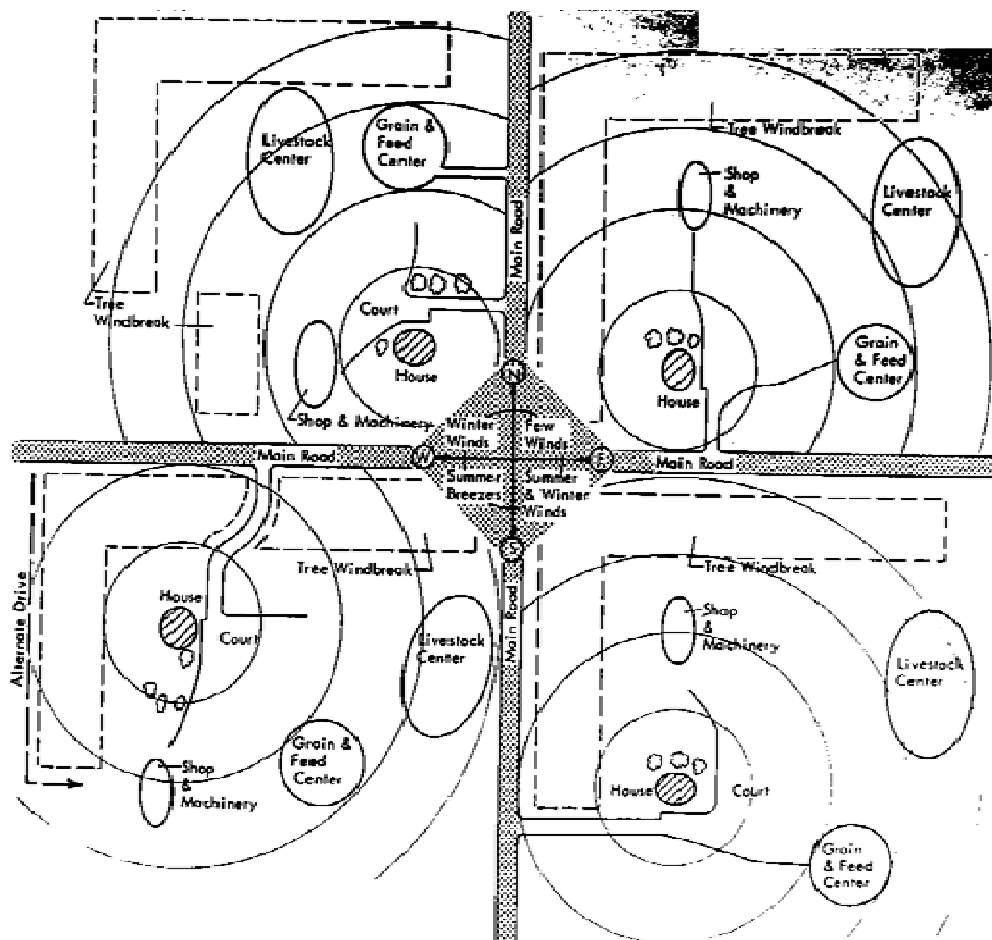
Small animals or small animal unit may be in zone 3 a livestock unit close to the house is convenient for active management of maternity and nursery units or for care of pets or hobby animals

ZONE 4: Major livestock facilities. A large unit, whether confined to building or an dry lot, aerates demand for adequate space drainage waste management, access, loading facilities, feed distribution and other service. It also creates noise, dust, traffic and odors. Space for expansion is usually important.



Curtsey Mid West Plan Service (USA)

Four planning zones



Management factors of farmstead planning

The type and volume of enterprise or combination of enterprises will determine type of farmstead and its management. Factors to manage are:

1. Size of enterprise: if small size locate in zone 20r 3 but large size locate further away because of noise, use of heavy trucks and or equipment, heavy traffic etc
2. Pollution: air and water can be polluted easily with waste management chemicals storage including fertilizers / pesticides and fuels. Keep them far away residential area
3. Nuisances: this include noise dust chaff insects and heavy traffic locate annoying activities so they do not detract comfort of living
4. Appearance: location, paints, lawn and type of building affects appearance

Topographic Factors: these are concerned with the lay of the land. Site selection is finding the best location for an enterprise with enough space, good drainage, access to water and other utilities and their proximity. Also consider view, access to neighbors of using same topography.

Drainage: surface and subsurface drainage very important features of an effective farmstead. Natural drainage is preferable but artificial or man made may sometimes not be available. Drainage keeps the farmstead clean an ideal slope for drainage should be between 2%. It should not cause erosion.

Slope: enough space is important for all major farmstead activities and for expansion. Avoid location near river, rough topography, sandy sub-soils, rocky or mountainous areas.

Climatic factors: these include wind, sun and rainfall they affect temperature and humidity which can have either a negative or positive effect on farmstead.

Service factors: the connecting links between farmstead buildings and activities; they help the farmstead operate effectively. They include drives, utilities, water, electricity, gas, telephone fire prevention and security.

Planning activity center.

- A) family living center essentials to be considered include
 - Water
 - Drainage
 - Site location
- B) Fuel chemical and fertilizer storage essential consideration include
 - Distance
 - Topography
 - Service factors

Livestock production: essential considerations include

- Water
- Drainage
- Production volume
- Waste disposal

NOTE: the general consideration in farmstead planning is safety, this affects every aspect of the enterprises. Safety from the view point of theft, fire, flooding, wind, heat from the sun, cold, intruders, poor drainage, wind, animals etc. safety is important to safe guard the investment.

SUMMARY

Land survey and farmstead planning is an important agricultural tool necessary for the success of any agricultural enterprise. While land survey deals with knowing the details of the land such as soil type, topography, slopes, land and its measurements and sizes etc. Farmstead planning deals with how the farm business is suppose to be organized or arranged for effective management and for profit maximization. Farmstead enables the farmer mitigate risks taking that may eventually become very expensive in the future.

ASSIGNMENT

- Differentiate between differential leveling and profile leveling.
- List five reasons why land survey is important in agriculture.
- What are the factors to be considered necessary for any farmstead planning?
- Why is zone planning an effective method for a farmstead planning?

REFERENCES

Brain, J.H (2009) *Farmstead Planning*. Wisconsin: University of Wisconsin – Madison Press.

Introductory Mathematics for Agriculture. Calabar: El – Summer Publisher

Colliers Encyclopedia, Vol 21: 663 – Surveying

Marlow, V. and Henry, B (1994). Land use Planning in Agriculture. *Encyclopedia of Agricultural Science Vol. 2*. Academic Press Inc.