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EDITORIAL

The idea of the magazine being published by our department is gradually proving out to be the best thing since sliced bread. The faculties and technical assistants are getting engrossed and their partaking has amplified. Initially we thought it might happen that we are trying to bite off more than we can chew. Fortunately we are proved erroneous. One of the prime flair is that they are getting the basic idea to write paper. It is an attempt which will positively instill the art of observation in them.

Survey is one of the old engineering subjects. In the field of industry people cannot move without survey work. Hope this technical magazine of the department will enrich it through their valuable writings. This will also highlight the industry-institute-interaction program.

CONTENTS

SPECIAL MAPS, GRAPHS AND DIAGRAMS USED IN CARTOGRAPHY

Increasingly it is appreciated that out of the five sense organs for acquisition of knowledge the visual method contributes the maximum towards that end. The successful harnessing of visual language in symbology adopted for mapping to impart effortlessly gainful knowledge to engineers, geographers and geologists, foresters and revenue officials, has attracted attention of many disciplines (sciences and humanities) to make its use. The vital data for their basic use is focused in a frame for visual assimilation through design, drawing, survey and reproduction. Even newspapers and magazines are using the Technique.

In such cases angles, distances, directions and even areas have less and less relevance. Only relevant factor may be land boundary. In some cases even the latter may also be dispensed with and the globe or a part thereof may be the focus of attention. Because the emphasis of study may not be land but natural elements like wind, pressure, temperature etc. or items like population, crops, industrial production and growth etc. Naturally then, in such cases even a projection may not be necessary. Inspite of the aforesaid dispensations the work may remain a cartographic feat called thematic cartography. The writer envisions that erelong cartography will occupy revered place as the easiest and most effective way of comprehensions of statistical knowledge.

THE BASIS OF THEMATIC CARTOGRAPHY

The basis in most if not invariable cases is statistical data, It may be depiction of climate like seasonal wind velocities with direction, rainfall dispersion, temperature distribution; or it may be depiction of economic studies like agricultural statistics, industrial data, transport and communication net, income standards; Or social studies for population distribution, sex and age or ethnic or occupation figures, education contents etc. mortality and morbidity rates; settlements groupings, housing patterns; scientific depictions of soils; shales and crusts, meteorological data.

Various kinds of symbols for their communications are used like dots, lines, patterns and designs, bars and columns pictures and colours, wheels and divided circles etc. These may be shown in the concerned area on the map or otherwise.

SYMBOLOGY

For such wide and varied depiction the symbols can be limitless conditioned only by the flight of imagination of the cartographer. Some symbols in frequent use are given below. Main thing to be remembered is that choice of symbol may also include a psychological impact on mind. Symbol shall tell its tale fully and well. Legibility to be main caution, better show one type on one map without unwanted details or names.

1) **Dots:** Very useful and easy to draw to show numerically quantities unevenly spread in an area. The range of such quantities (i.e. highest—lowest) shall be known to assign such value to one dot that they shall neither be so dense that they could not be counted nor so rare that in a large area only one or two small dots appear. Suppose we depict growth of mechanised farming in UP district-

wise. In this Meerut has 500 units, Etawah 100 and Gazipur only 20, then giving one dot for 10 units we have 50 for Meerut, 10 for Etawah and 2 for Gazipur. The location could also be retained on map like the Tehsil in the district having more units should get denser dots.

Even variety in dot size, shape and colour can bring distinction, e.g. production of food grains say wheat, rice, different kinds of pulses are to be shown. If we show wheat by round dot, rice by a triangle and three kinds of pulses by squares in three different colours or different pattern like one solid filled, other inside blank third half-filled etc. thus colours, and/or shapes bring variety.

Sizes in drawing should be so selected as to avoid becoming too tiny on reduction or too clumsy on enlargement.

2) **Proportional Symbols:** Symbols like circles, spheres, squares rectangles, cubes, bars can be used to show quantities. It is good to represent data meaning area by symbols which show area like circle, square etc., and those representing volume could be shown by cubes, spheres etc. For example, say U.P.'s area is X sq. km of which a, b, c, d sq. km are respectively used as agriculture, forests, waterlogged, barren Then a circle with radius V x will show total area on some suitably chosen scale. Now if x sq km is placed in 360° around the centre of the circle then, a, b, c & d will take

(a/b) x 360° or [(b/x), (c/x), (d/x)]/360°

These segments can accordingly be drawn.

Similarly, suppose population of Calcutta x lakh, Bombay, y; Delhi, z; etc. then we can show by spheres by taking cube-roots of x, y and z. These can be drawn on the map in their proper location on suitable scale, which shall match well with scale of map.

Again volume of trade from different cities or countries is to be represented, then cubes may be better choice.

3) **Isopleths:** (Iso= same; plethos= multitude) lines joining points having same numerical value. The most important example is a contour line. Such lines joining same temperature is called isotherm: same pressure; isobar, same magnetic declination, isogons, rainfall, isohyets; sea-depths, isobaths.

The regions between consecutive isopleths can be tinted with colours going from light for lowest value to darkest for the highest value. Here geographers may show vegetation belts depending on height above MSL or Subsoil water content etc.

4) **Choropleths:** Quantitative areal distribution can best be shown by this method. If such distribution be contiguous the way is still more effective. Areas for each type of distribution can be shown by different colours using light for lower quantity and going darker for increasing values. Instead of colour patterns of lines (horizontal, verticals, slanting, grills etc. with denser and rarer patterns for high to low quantities, can be used.

For example physical features of a country could be shown by light colour for one height belt near M.S.L., and darkest for a belt of snow line etc. or areas of soil quality like sand, alluvial, forest covered, hilly etc. can be shown in different colour or pattern.

5) **Pictorial:** These can be classed in two viz.
   a) A picture of the item depicted e.g. production of cars, coal, milk, food

grains can be shown by a picture of car representing a number, or a coal or food-grain bag or a milk bottle similarly shown. Now if we make comparison of production in each five year block since independence say 500, 2000, 8000, etc. units of production, we make 1000 units as one picture (car or bag) and block of years shown on. Horizontal direction. This in first block half picture, second two, third eight. The unit should be so chosen that the final or last depiction may not become unwieldy or too large, shown as radii from origin.

b) Other pictorial methods include
   i) Star used for depiction of vector quantities like wind (direction, velocity etc.) or trade flow, population migration, etc. These are also called clock vector or rose diagrams. They are on proper place on map.
   ii) **Columns or Bars:** Consist of columns or bars drawn proportional in length to the represented quantities. They can be drawn horizontal or vertical depending on convenience and effective impact. They could be simple i.e. each bar showing a total value or compound when, constituents in total are shown. For example, a country's total food produce is 10 m. tonnes of which 40% wheat, 30% rice, 20% pulses and 10% others. Thus a 10 cm bar or column shown as 4 cm in one way, 3 cm in another and so on to represent wheat, rice etc. A bar of this kind can be made a little broader to accommodate pattern (lines, grill or dots) and also percentage numbers of produce inside. Such diagrams are called divided rectangles.
   iii) Bars become very handy in showing comparative production figures in blocks of years or expenditures in items, e.g. comparing production of coal, iron ore, steel in each five year plan of India. For four plans a compound bar three columns each proportional to quantities, say coal 500 tonnes (5 cm black). Iron ore 200 tonnes (line shaded 2 cm) Steel 100 tonnes (1 cm white or blank). Similarly for the other 3 plans. The patterns like black for coal well-chosen also add to understanding. Similar comparison of production level and expenditure can be drawn, say Iron produced 500 tonnes and consumed 800 will have a compound bar say 5 cm while joined to 8 cm black. It gives a good comparative view.
   iv) **Divided Circles (also called wheel or pie graphs):** Like divided rectangles circle gives greater perceptual impact. Here the division is in sectors proportional to quantities represented. As in the example of food grains the 360° will represent total produce then how many degrees sector will be for wheat, rice, maize etc. will be worked out and drawn. This sort of drawing helps in scale expanding in one direction. Say produce 5000 m tons having 2500 m ton wheat, 1250 m ton rice then in the circle we colour 2500/5000 X 360° =180° wheat, similarly 90° rice portions etc.

There may be a real representation and sometimes comparative too, e.g. say in 18 states, in India we total cultivable land and division of such land under different important crops. Take for example U.P. and Rajasthan total respective figures.

State	U.P.	Rajasthan
Wheat	4900 ha	100 ha
Maize	2500 ha	400 ha
Gram	1600 ha	100 ha
Other	1000 ha	300 ha
Total cultivation	10000 ha	900 ha

If the full area of circle shows area of cultivation, then in πr^2 the area of circle, π will in each case be common. It is r^3 which will vary. Therefore the quantity could go proportional to r^2. Hence for U.P. the radius of circle will be square-root i.e. 100 units and for Rajasthan 30 units. These again could be scaled to fit well the scale of base map, and such that circle comes in most cases within the area of the state. Here we could take a circle of 1 cm and 0.3 cm radius. These will further be divided in 4 parts proportional to produce, and each distinguished by pattern or colour, such symbols are good for statistics related to area.

v) **Cubes and spheres:** They are generally to show volume. The cube root of the quantity gives side of a cube or radius of sphere.

Such proportional symbols can be quantitative i.e. representing quantity and locational as well i.e. placed in the area the quantity represents. For example population distribution in towns is shown by spheres.

THEMATIC MAPPING

For thematic mapping we need quantities and outline map will have only such detail and boundaries that reader could understand what he sees, and where.

LIST OF THEMES AND THEIR MAPS AND DIAGRAMS

1) **Climatic Depletions:** It includes temperature, rainfall, wind, sunshine and cloud, humidity, visibility and weather reports. The data is obtained from concerned department or sample survey.

Ways of Depiction

a) **Isopleths:** Isopleths for similar temperature, pressure, rainfall i.e. lines joining places having same values: isobars (Pressure) isotherms (Temp.) isohyets (rain), isohels (sunshine) etc. These may be shown by isopleths i.e. lines (drawn like contours) joining points of same value (of temp, rainfall etc.) The examples only apprise reader of scope.

b) **Columnar diagrams:** These can be used to show rhythm of changes diurnal or seasonal. It can show monthly rain as a single column in proportional height for rain each month or number of clear days per month in the year. Compound columns can be drawn to show comparisons of different places in the year. These can be drawn in their geographical locations on maps too. These are called base maps. Imaginative reader can adopt many combinations.

c) **Linegraphs:** Temperature, humidity are plotted as quantities on one axis of a graph say ordinate and the time on other axis. The points plotted are joined by

line. Simple graphs are for time and quantity (like month & Temp.) plot.

d) **Histogram:** A graph showing frequency distribution. The frequency percentage of values taken on ordinate and actual values on abscissa, then the peak of such graph will show highest frequency.

e) Some interesting studies can be had as:

i) Take values of rainfall for each month of each year for number of years. Then plot maximum and minimum values for each month in 12 bars, their standard deviation, mean of the month for the whole range of years. Such a compound column is hyetograph. In a map at location of each town taking rainfall of each month yearly hyetographs can be drawn.

ii) Similarly plotting temperature in 12 bars—one for each month-showing in each tar minimum, maximum, mean of max, and min. and monthly mean etc.

iii) Precipitation and evaporation simultaneous on one graph in centimetres then drawing a line graph. Say plotting rainfall per month and the average loss per month of land water by evapotranspiration and joining each type by line, tells of climate.

iv) **Climatograph—**Mean monthly temperatures are plotted from the centre of circle divided in 12 segments of 30° each representing a month. The scale of plotting is so chosen that distance x to plot 0°F =1/10 of 100°F then to plot any distance for t° the distance, $y= x\ c_o \log t/100$

If then limiting temperatures for hot, warm, cool and cold seasons are decided a id with their distance as radius circles are drawn, then the areas enclosed within, these circles and temperature graph will give the extent of season of the place.

v) Various types of wind-rose diagrams can be drawn. Like diagram to show wind velocities with direction are shown as a star or octagon, e.g. of Northern wind in a month 1-3 km per hour for 5 days 4 km 2 days, 6 km. 1 day etc. can be plotted for all the directions on uniform scale for days or percentage of the period considered.

Such diagrams can be made for important towns on a map in their locations to give immediate comparison or information.

vi) **Climographs:** The temperature and relative humidity values are plotted for each month and joined by line graph. From this we can study weather of the place. During the period when temperature and humidity are both less the climate is good.

2) Economic Maps and Diagrams: These show spatial distribution and inter-relations of various economic activity of the region like production, distribution, consumption of commodities. Amounts, values, rates areas etc. may have to be suitably depicted. Agricultural statistics may involve areas, yields, sales livestock, farm labour, soil samples etc. Areas may be shown by line patterns and colours, yields differences in areas by different kinds in pattern, other things by letters, dots etc. as convenient, round square, triangles etc.

Industrial statistics may include fuel, power, raw materials as in-put and finished goods, employment ratios, per capita income, expenditure, etc. dots and circles differing in shape, size and colour as applicable generally show quantities, bar or wheels and

divided circles as comparison of values, like in-put and output.

Transport and communications by rail, road, steamer services, delimitations of their hinterland, analysis of port or rail head activity. Dots, choropleths, bars, line graphs, arrows are mostly used for their depiction. Choice of symbol depends on what appeals best.

a) By dots we can show location and roughly quantity of different items to be shown. The shape of dot will represent different item—say, a circle wheat, a triangle rice etc.
b) By choropleth showing say wheat production per 100 hectares in each region or distribution of milch cattle.
c) Proportional symbols like circles with varying radius can show coal mining or any quantitative produce in different location of the country. The size related to produce will give comparative look.
d) Locational bars for different years for different regions giving immediate comparison of different productions.
e) In these cases one aspect can be shown in several ways, e.g. total industrial (engineering goods) is worth 1600 cores that is exported 20% America, 30% Russia, 15% Africa, 20% Australia and rest to Japan.
    i) Show as divided rectangle 0.8 on width 16 cm length and then divide for various exports.
    ii) Show as divided circle 1600 cores representing 360° and percentage export by divided sectors and so on.
    iii) As star from a small circle. Putting 1600 inside the circle then percentage flow in different directions by big and small rays proportional to data can be drawn to the stars. To avoid long rays comparative Thickness can be used.

Flow-line maps.—Show movement in direction or route followed by road, rail or waterway. The quantity is projected by width of lines. For example to show movement of coal from Bengal mines to various states or say passenger movement in various ports by Indian Air Lines, the lines varying in thickness proportional to quantity can be drawn in direction of flow.

What is needed to make such a map is the flow data say from Delhi x air-passengers to Madras, y to Calcutta, z Bombay and t Amritsar. Then seeing max. and min. quantities, such suitable scale has to be chosen to show quantities by thickness of route that on the scale of outline of map the thick lines do not eclipse wholly the background for locational reading.

3) **Population Maps and Diagrams—**Many economic aspects if not all are dependent on population data, often; therefore, cartographer will be called upon to make such visual information available for those who need them, like planning departments.

There are various sources to obtain data for a region the census records are the best. Many countries including India conduct census and collect variety of data like total population, male and female composition, gainful employment for various age groups, education structure, etc.

For local studies house tax data, voters lists, toll tax records, etc. made useful data.

Types of Studies.—(i) Area-wise distribution to show density, (ii) Social structure like rural and urban, (iii) Sex and age depiction, (iv) Ethnic distribution, (v) Occupation, (vi) migration, (vi) growth, mortality & morbidity rates etc.

Symbols.—Dots, choropleths, proportional circles, spheres, rectangles, and some ingenious diagrams are used like bars, pyramids.

Most effective use of pyramids is to show male and female population in different age groups. They are made as under:

i) Of the total population male and female population is separated.
ii) Their separate percentages of different age groups with a range of 5 or 10 yrs. (i.e. 0, 5, 5 to 10 etc.) are determined.
iii) The age scale is taken vertically. Since range is same the distance apart will be the same. Percentage scale is made horizontally separately pointing to opposite direction for male and female. The age scale runs vertically up at a small gap. Thus there will be right and left sides of age scale made with a gap, say left for male, right female.
iv) Now the percentages of each age are plotted as horizontal bars giving a pyramid of which one side shows female and other male.

4) Science Maps — Geological Studies, oceanography etc. can be presented in charts and graphs. They are good for geographers to study land forms, for miners, engineers (tunnelling, water-bearing strata and artesian bores) for army (for dugouts) and soils, tides and tidal Currents etc. Geological Maps generally have relief depiction as an essential part and therewith land forms are shown. They can also be shown by cross sections with structural relationship in the profile of land. It includes study of (i) rocks and minerals, (ii) rock Structure, tectonics, (iii) landscape and erosion geomorphology, (iv) study of earth's gravity magnetism, etc. i.e. geophysics, (v) chemical composition of earth's crust, i.e. geochemistry, (vi) study of geological forms for bridges, dams and tunnels, i.e. engineering geology.

The other effective way is drawing of Block of earth's crust with one or two vanishing points. It can bring out land-use land types. W. M. Davis has made it an enchanting way of graphic expression of geomorphology.

Block diagrams as said above are Blocks of earth's crust such that sides to a depth and tops are visible with vanishing point technique. Vanishing points are points to which extended edge-lines converge and meet. In one vanishing point lying behind the block, only one face of Block comes in front; in two vanishing points (left and right) a corner and two edges could be viewed.

Oceanography gives profile of sea bottom, tides etc. Soil and vegetation maps give a rich tapestry of foliage and land use.

The ways of graphic communications of the story of geographer, meteorologist, economist, are almost infinite. They show statistical data either with precise numerical values like census figures, rainfall or other precipitation figures or may show quality like wheat producing, rice growing areas without numerical data of produce; or Hindu or Muslim predominant areas. Hence such mapping could be quantitative or qualitative. For quantitative mapping statistical data is essential.

- Mr. Kausik Patra (Lecturer in Survey Deptt.)

HYDROPONICS

Look, no soil! We're so used to plants growing in fields and gardens that we find anything else completely extraordinary. But it's true. Not only will plants grow without soil, they often grow a lot better with their roots in water or very moist air instead. Growing plants without soil is known as hydroponics. It might sound weird, but many of the foods we eat—including tomatoes on the vine—are already grown hydroponically. Let's take a closer look at hydroponics and find out how it works!

What is hydroponics?

Plants grow through a process called **photosynthesis**, in which they use sunlight and a chemical inside their leaves called chlorophyll to convert carbon dioxide (a gas in the air) and water into glucose (a type of sugar) and oxygen. Write that out chemically and you get this equation:

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

There's no mention of "soil" anywhere in there—and that's all the proof you need that plants can grow without it. What they *do* need is water and nutrients, both easily obtained from soil. But if they can get these things somewhere else—say, by standing with their roots in a nutrient-rich solution—they can do without soil altogether. That's the basic principle behind hydroponics. In theory, the word "hydroponics" means growing plants in water (from two Greek words meaning "water" and "toil"), but because you can grow plants without actually standing them in water, most people define the word to mean growing plants without using soil.

Why grow things hydroponically?

Photo: Onions, lettuces, and radishes all grow well with hydroponics. The white surface of hydroponic containers like these helps to reflect light evenly onto the plant leaves, improving growth. Photo by courtesy of NASA Kennedy Space Center (NASA-KSC).

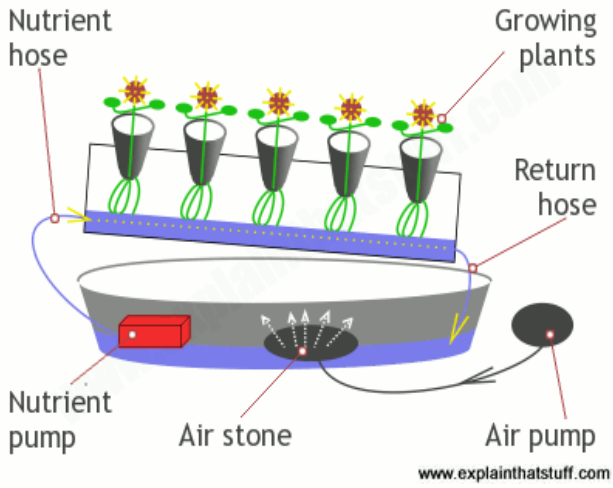
Although the benefits of hydroponics have sometimes been questioned, there seem to be many advantages in growing without soil. Some hydroponic growers have found they get yields many times greater when they switch from conventional methods. Because hydroponically grown plants dip their roots directly into nutrient-rich solutions, they get what they need much more easily than plants growing in soil, so they need much smaller root systems and can divert more energy into leaf and stem growth. With smaller roots, you can grow more plants in the same area and get more yield from the same amount of ground (which is particularly good news if you're growing in a limited area like a greenhouse or on a balcony or window-ledge inside). Hydroponic plants also grow faster. Many pests are carried in soil, so doing without it generally gives you a more hygienic growing system with fewer problems of disease. Since hydroponics is ideal for indoor growing, you can use it to grow plants all year round. Automated systems controlled by timers and computers make the whole thing a breeze.

It's not all good news; inevitably there are a few drawbacks. One is the cost of all the equipment you need—containers, pumps, lights, nutrients, and so on. Another drawback is the *ponic* part of hydroponics: there's a certain amount of toil involved. With conventional growing, you can

sometimes be quite cavalier about how you treat plants and, if weather and other conditions are on your side, your plants will still thrive. But hydroponics is more scientific and the plants are much more under your control. You need to check them constantly to make sure they're growing in exactly the conditions they need (though automated systems, such as lighting timers, make things quite a bit easier). Another difference (arguably less of a drawback) is that, because hydroponic plants have much smaller root systems, they can't always support themselves very well. Heavy fruiting plants may need quite elaborate forms of support.

Photo: Waste not, want not: A researcher at the US Department of Agriculture examines the roots of a hydroponic strawberry plant that's being nourished on wastewater from a trout farm! Photo by Scott Bauer courtesy of US Department of Agriculture (USDA) Agricultural Research Service (ARS).

How does hydroponics work?



Artwork: In the nutrient-film technique, nutrient constantly drips past the roots of the plants, which grow out from an inclined tray. The nutrient is pumped back up to the tray and a second pump adds oxygen through an air stone (a piece of porous rock that lets air bubble through it—just like in a fish tank).

There are various different ways of growing things hydroponically. In one popular method, you stand your plants in a plastic trough and let a nutrient solution trickle past their roots (with the help of gravity and a pump). That's called the **nutrient-film technique**: the nutrient is like a kind of liquid conveyor belt—it's constantly sliding past the roots delivering to them the goodness they need. Alternatively, you can grow plants with their roots supported by a nutrient-enriched medium such as rockwool, sand, or vermiculite, which acts as a sterile substitute for soil. Another method is called **aeroponics** and it's typified by a popular product called the AeroGarden (see box below). Although the name suggests you're growing plants in air, the roots are actually suspended inside a container full of extremely humid air. Effectively, the roots grow in a nutrient-rich aerosol a bit like a cloud packed full of minerals.

In theory, you can grow any plant hydroponically but—as is always the case with gardening—some things inevitably do better than others. Fruit crops such as tomatoes and strawberries, and lettuces and herbs, are among plants that do particularly well.

Advantages & Disadvantages of Hydroponics

Advantages:

1. No soils needed

In a sense, you can grow crops in places where the land is limited, doesn't exist, or is heavily contaminated. In the 1940s, Hydroponics was successfully used to supply fresh vegetables for troops in Wake Island, a refueling stop for Pan American airlines. This is a distant arable area

in the Pacific Ocean. Also, Hydroponics has been considered as the farming of the future to grow foods for astronauts in the space (where there is no soil) by NASA.

2. Make better use of space and location

Because all that plants need are provided and maintained in a system, you can grow in your small apartment, or the spare bedrooms as long as you have some spaces.
Plants' roots usually expand and spread out in search for foods, and oxygen in the soil. This is not the case in Hydroponics, where the roots are sunk in a tank full of oxygenated nutrient solution and directly contact with vital minerals. This means you can grow your plants much closer, and consequently huge space savings.

3. Climate control

Like in greenhouses, hydroponic growers can have total control over the climate - temperature, humidity, light intensification, the composition of the air. In this sense, you can grow foods all year round regardless of the season. Farmers can produce foods at the appropriate time to maximize their business profits.

4. Hydroponics is water-saving

Plants grown hydroponically can use only 10% of water compared to field-grown ones. In this method, water is recirculated. Plants will take up the necessary water, while run-off ones will be captured and return to the system. Water loss only occurs in two forms - evaporation and leaks from the system (but an efficient hydroponic setup will minimize or don't have any leaks).

It is estimated that agriculture uses up to 80% water of the ground and surface water in the US.
While water will become a critical issue in the future when the food production is predicted to increase by 70% according to the FAQ, Hydroponics is considered a viable solution to large-scale food production.

5. Effective use of nutrients

In Hydroponics, you have a 100% control of the nutrients (foods) that plants need. Before planting, growers can check what plants require and the specific amounts of nutrients needed at particular stages and mix them with water accordingly. Nutrients are conserved in the tank, so there are no losses or changes of nutrients like they are in the soil.

6. pH control of the solution

All of the minerals are contained in the water. That means you can measure and adjust the pH levels of your water mixture much more easily compared to the soils. That ensures the optimal nutrients uptake for plants.

7. Better growth rate

Is hydroponically plants grown faster than in soil? Yes, it is.

You are your own boss that commands the whole environment for your plants' growth - temperature, lights, moisture, and especially nutrients. Plants are placed in ideal conditions, while nutrients are provided at the sufficient amounts, and come into direct contacts with the root systems. Thereby, plants no longer waste valuable energy searching for diluted nutrients in the soil. Instead, they shift all of their focus on growing and producing fruits.

8. No weeds

If you have grown in the soil, you will understand how irritating weeds cause to your garden. It's one of the most time-consuming tasks for gardeners - till, plow, hoe, and so on. Weeds are mostly associated with the soil. So

eliminate soils, and all bothers of weeds are gone.

9. Fewer pests & diseases

And like weeds, getting rids of soils helps make your plants less vulnerable to soil-borne pests like birds, gophers, groundhogs; and diseases like Fusarium, Pythium, and Rhizoctonia species.Also when growing indoors in a closed system, the gardeners can easily take controls of most surrounding variables.

10. Less use of insecticide, and herbicides

Since you are using no soils and while the weeds, pests, and plant diseases are heavily reduced, there are fewer chemicals used. This helps you grow cleaner and healthier foods. The cut of insecticide and herbicides is a strong point of Hydroponics when the criteria for modern life and food safety are more and more placed on top.

11. Labor and time savers

Besides spending fewer works on tilling, watering, cultivating, and fumigating weeds and pests, you enjoy much time saved because plants' growth is proven to be higher in Hydroponics. When agriculture is planned to be more technology-based, Hydroponics has a room in it.

12. Hydroponics is a stress-relieving hobby

This interest will put you back in touch with nature. Tired after a long working day and commute, you return to your small apartment corner, it's time to lay back everything and play with your hydroponic garden. Reasons like lack of spaces are no longer right. You can start fresh, tasty vegetables, or vital herbs in your small closets, and enjoy the relaxing time with your little green spaces.

Seem like there are lots of benefits of Hydroponics and the image below seems to try to persuade you into Hydroponic growing. But keep reading to learn about its downsides.

Disadvantages and Challenges:

1. A Hydroponic garden requires your time and commitment

Just like any things worthwhile in life, hard-working and responsible attitude gives satisfactory yields. However, In soil-borne counterparts, plants can be left on its own for days and weeks, and they still survive in a short time. Mother nature and soils will help regulate if something is not balancing. That's not the case in Hydroponics. Plants will die out more quickly without proper care and adequate knowledge. Remember that your plants are depending on you for their survival. You must take good care of your plants, and the system upon initial installation. Then you can automate the whole thing later, but you still need to gauge and prevent the unexpected issues of the operations, and do frequent maintenance.

2. Experiences and technical knowledge

You are running a system of many types of equipment, which requires necessary specific expertise for the devices used, what plants you can grow and how they can survive and thrive in a soilless environment. Mistakes in setting up the systems and plants' growth ability in this soilless environment and you end up ruining your whole progress.

3. Organic debates

There have been some heated arguments about whether Hydroponics should be certified as organic or not. People are questioning whether plants grown hydroponically will get microbiomes as they are in the soil. But people around the world have grown hydroponic plants - lettuces, tomatoes, strawberries, etc. for tens of years, especially in Australia, Tokyo,

Netherland, and the United States. They have provided food for millions of people. You cannot expect perfection from anything in life. Even for soil growing, there are still more risks of pesticides, pests, etc. compared to Hydroponics. There are some organic growing methods suggested for Hydroponic growers. For example, some growers provide microbiomes for plants by using organic growing media such as coco coir and add worm casting into it. Natural-made nutrients are commonly used such as fishes, bones, alfalfas, cottonseeds, neems, etc.

For this debate for the organic product issue, there will still be researches done currently and in the near future. And we'll know the answer then.

4. Water and electricity risks

In a Hydroponic system, mostly you use water and electricity. Beware of electricity in a combination of water in close proximity. Always put safety first when working with the water systems and electric equipment, especially in commercial greenhouses.

5. System failure threats

You are using electricity to manage the whole system. So suppose you do not take preliminary actions for a power outage, the system will stop working immediately, and plants may dry out quickly and will die in several hours. Hence, a backup power source and plan should always be planned, especially for great scale systems.

6. Initial expenses

You are sure to spend under one hundred to a few hundreds of dollars (depending on your garden scale) to purchase equipment for your the first installation. Whatever systems you build, you will need containers, lights, a pump, a timer, growing media, nutrients). Once the system has been in place, the cost will be reduced to only nutrients and electricity (to keep the water system running, and lightning).

7. Long return per investment

If you follow news on agriculture start-up, you may have known that there have been some new indoor hydroponic business started recently. That's a good thing for the agriculture sector and the development of Hydroponics as well. However, commercial growers still face some big challenges when starting with Hydroponics on a large scale. This is largely because of the high initial expenses and the long, uncertain ROI (return on investment). It's not easy to detail a clear profitable plan to urge for investment while there are also many other attractive high-tech fields out there that seem fairly promising for funding.

8. Diseases & pests may spread quickly

You are growing plants in a closed system using water. In the case of plant infections or pests, they can escalate fast to plants on the same nutrient reservoir. In most cases, diseases and pests are not so much of problem in a small system of home growers.
So don't care much about these issues if you are beginners.
It's only complicated for big hydroponic greenhouses. So better to have a good disease management plan beforehand. For example, use just clean disease-free water sources and growing materials; checking the systems periodically, etc.
Should the diseases happen, you need to sterilize the infected water, nutrient, and the whole system fast.

So would I still recommend Hydroponics?

Absolutely!

There are downsides to Hydroponics, just like any other things in life. But you can overcome most of them with just some planning and

experiences. Meanwhile considering the pros it can offer, Hydroponics is worth doing. It is always a part of modern agriculture. Compared with the soil-counterparts, Hydroponics is a highly effective growing method.

And here are the summarized winning key points of Hydroponics over soils.

Hydroponics vs. Soil

- Space saver.
- Effective use of plant nutrients.
- Water-efficient.
- No weeds, fewer pests, and plant diseases.
- Stable and higher yields.
- Control of the whole system.
- Growing media can be chosen and sterilized fast.
- Fewer fertilizers and insecticides used.
- Easy to transplant.
- Able to grow crops all year round.

- Mr. Monoj Kumar Mondal (Technical Assistant in Survey Deptt.)

TOPOGRAPHIC SURVEYING

Topographic Surveying

- determining the relative locations of points (places) on the earth's surface by measuring horizontal distances, differences in elevation and directions
- topos (Gr.): place; topographic maps give the locations of places (observable features); they serve as base maps

Use of topographic surveying in geography:

- producing topographic maps
- constructing topographic (cross-sectional) profiles
- establishing vertical and horizontal control for accurately defining locations

General Principles

1. select a scale in advance; this determines the plotable error
2. work from the most accurate to the least accurate methods
3. orient each survey, preferably with respect to true north
4. the first stage of surveying is always establishing horizontal and vertical control: the distance, direction and difference in elevation between key fixed points
5. establish a survey plan that includes checks on accuracy, *e.g.* redundant points, pacing of measured distances, surveying between fixed positions, etc.

Methods

1. **horizontal distance**
   - tachymetry: a rapid optical means of measuring distance using a telescope with cross hairs and a stadia rod (one stadium = about 607 feet)
   - measuring slopes distance with a tape and reducing it to horizontal distance using the cosine of the slope gradient
2. **difference in elevation**
   - leveling with a level telescope and a stadia rod, or
   - measuring a vertical angles and a slope distance (height is the product of the distance and sine of the angle)

Leveling is more accurate since elevation differences are measured not calculated. Two readings are taken at each position of the automatic level: a **backsight** towards a station located before the level on the traverse and a **foresight** to the next station on the traverse. Thus the stadia rod occupies two stations, before and after the level on the survey. The difference in elevation between successive stations if the difference between the backsight and the foresight read from the stadia rod. For each position of the level, the lengths of the foresights and backsights should be approximately the same since accuracy is a function of the distance of a sighting. The level operator should anticipate the distance to the next station and set up the level midway along this distance (note: the distance that can be sighted decreases with increase in slope,

since the stadia rod will disappear above or below the level line of sight). The lengths of backsight and foresight can be paced by the rod person or measured by the interval between the upper and lower cross hairs (tachymetry).

3. direction

- horizontal angle measured with a compass
- precise measuring devices use vernier scales
- direction is expressed relative to a reference line or meridian
- true meridian: a north-south line
- magnetic meridian: a line parallel with the earth's magnetic lines of force
- assumed meridian: an arbitrary line

Types of horizontal angles

1. bearing: angles expressed relative to a meridian using the quadrant and an acute angle, *e.g.* N37°E, S62°E, N20°W
2. azimuth: the clockwise angle from the north branch of a meridian, *e.g.* 45° (northeast), 180° (south)
3. deflection angle: the angle between a line and the prolongation of a preceding line; it is a right or left angle depending on whether the new line is right (clockwise) or left (counterclockwise) of the preceding line
4. interior angle: an angle inside a closed polygon

Types of Traverses

1. azimuth: along a single direction (azimuth); common for slope profile surveys where the profile is always perpendicular to contours (*i.e.* maximum slope angle)
2. closed traverse: begins and ends at fixed control points of known location; permits calculation and adjustment for closure error
3. closed-loop traverse: begins and ends at the same station; permits calculation and adjustment for closure error and use of interior and deflection angles
4. open traverse: surveying from a known position to a point of unknown position; does not enable computational checks for error, rather all measurements must be repeated to check for error

Shape of The Earth And Error: The two basic problems in topographic surveying

The shape of the earth (the geoid) is a consideration only in geodetic surveying, where over long distances flat surfaces are not level, plumb lines are not parallel and the sum of the angles in a triangle is greater than 180°; thus precise surveys over large areas employ the principles of geodesy (the mathematical properties of an ellipsoid that emulates the earth); however with most surveys, including virtually all topographic surveying in geography, the departure of horizontal lines from level and plane angles from spherical angles are negligible and can be ignored

plane surveying: where the earth's surface is regarded as a plane; level lines are considered straight, angles are considered to be plane angles and plumb lines are considered to be parallel within the survey

with these assumptions, the relative locations of points can be calculated using the principles of plane trigonometry:

a. for right angles: sinA = a/c, sinB = b/c, and $c^2 = (a^2 + b^2)$, where A & B are the acute angles, C is the right angle and a, b & c are the sides opposite the angles designated with the same letter; thus the sides and angles can be calculated with a knowledge of 1 side and 1 angle or 2 sides

b. for oblique triangles: a/sinA = b/sinB = c/sinC; thus given 2 angles and one side or 2 sides and 1 angle are the other sides and angles can be calculated

Error

Distances and angles can never be determined exactly; measurements are subject to error. Error can be controlled through procedure and instrumentation. Surveys are conducted according to standard levels of accuracy (first order, second order, etc.). The desired level of accuracy depends on the intended us of the survey data (*e.g.* locating permanent stations or surveying bridges and dams versus surveying for terrain analysis or orienteering).

For topographic mapping, the desired level accuracy is the plottable error, the shortest distance that can be depicted on a map at a given scale. The drafting of lines generally is accurate to within 0.25 mm. At 1:1000, 0.25 = 250 mm or 0.25 m on the ground. Optical measuring devices will provide this level of accuracy. At 1:25,000, 0.25 mm = 6.25 m on the ground. Pacing of distance will provide this level of accuracy, although in practise accuracy is greater than the plottable error by as much as one-third (*e.g.* 80 mm rather than 250 mm at a scale of 1:250,000) so that plotting and surveying errors are not compounded.

Adjusting For <u>Closure Error</u>

Horizontal angles

- In a closed polygon, the sum of the interior angles = 180^o (n-2), where n is the number of sides in the polygon, thus the sum of the horizontal angles in a triangle (n = 3) is 180^o; an equal angle is subtracted or added to each measurement to satisfy the equation for interior angles; if the closure error is not equally divisible by n, make the largest adjustments to the largest angles.

- The sum of deflection angles for any closed polygon is always 360^o; this provides for another means of determining and adjusting for closure error.

Difference in elevation

Closure error can be determined for closed and closed-loop traverses. The closure error can be divided by the number of stations on the traverse or the correction at each station can be calculated according to the distance from the origin of the survey:

$C_i = d_i/L * E_c$, where

- C_i = the correction applied to station I

- d_i = the distance to station i from the origin of the traverse

- L = the total length of the traverse

- E_c = the closure error

This method accounts for the propagation of error with distance.

Horizontal distances

As with leveling, closure error can be determined for closed and closed-loop traverses, where the coordinates of the end points are identical or known. Location in the horizontal plane are given by x and y coordinates (*e.g.*

northing and easting). Using the measured horizontal distances and adjusted angles, calculate the coordinates of each station. The difference between the calculated and known coordinates of the end control point is dx and dy, the closure error in x and y. As with leveling, the adjustment is a function of the distance traversed (Li) relative to the total length of the traverse (L):

$Cdx_i = dx * L_i/L$ $Cdy_i = dy * Li_i/L$, where Cdx_i and Cdy_i are the adjustments in x and y coordinates at station i

The relative accuracy of distance measurements can be expressed as $((dx^2 + dy^2)^{1/2})/L$. An angular error of one minute is equivalent to a distance measurement error of 3 cm over a distance of 100 m, since the sine of $1/60^o$ is .00029.

- Mr. Suman Polley (Technical Assistant in Survey Deptt.)

E-WASTE

The production of electrical and electronic equipment (EEE) is one of the fastest growing global manufacturing activities. Rapid economic growth, coupled with urbanization and a growing demand for consumer goods, has increased both the consumption and the production of EEE. The Indian information technology (IT) industry has been one of the major drivers of change in the economy in the last decade and has contributed significantly to the digital revolution being experienced by the world. New electronic gadgets and appliances have infiltrated every aspect of our daily lives, providing our society with more comfort, health and security and with easy information acquisition and exchange. The knowledge society however is creating its own toxic footprints.

E-waste broadly covers waste from all electronic and electrical appliances and comprises of items such as computers, mobile phones, digital music recorders/players, refrigerators, washing machines, televisions (TVs) and many other household consumer items.

The increasing 'market penetration' in the developing countries, 'replacement market' in the developed countries and 'high obsolescence rate' make e-waste one of the fastest waste streams. This new kind of waste is posing a serious challenge in disposal and recycling to both developed and developing countries. While having some of the world's most advanced high-tech software and hardware developing facilities, India's recycling sector can be called medieval. All this has made e-waste management an issue of environment and health concern.

Magnitude of the problem

In India, about 1.2 million tonne of e-waste is generated every year, as per a study conducted by the Central Pollution Control Board (CPCB). Of the total e-waste generated in the country, western India accounts for the largest population at 35%, while the southern, northern and eastern regions account for 30, 21 and 14%, respectively. The top states in order of highest contribution to waste electrical and electronic equipment (WEEE) include Maharashtra, Andhra Pradesh, Tamil Nadu, Uttar Pradesh, West Bengal, Delhi, Karnataka, Gujarat, Madhya Pradesh and Punjab. The city-wise ranking of the largest WEEE generators is Mumbai, Delhi, Bengaluru, Chennai, Kolkatta, Ahmedabad, Hyderabad, Pune, Surat and Nagpur.

While northern India is not a leading generator, it happens to be the leading processing centres of e-waste in the country. Over 1 million poor people in India are involved in the manual recycling operations. Most of the people working in this recycling sector are the urban poor with very low literacy levels and hence very little awareness regarding the hazards of e-waste toxins. There are a sizeable number of women and children who are engaged in these activities and they are more vulnerable to the hazards of this waste.

The main sources of computer usage and thereby e-waste generations are the business sector (government departments, public or private sector, multinational corporation offices, etc.), accounting for 78% of the total installed PCs today. Other sources are individual households (22%), foreign embassies, PC manufacturing units, PC retailers, secondary markets of old PCs and imported electronic scrap of other countries.

The following three categories of WEEE account for almost 90% of the generation

- Large household appliances: 42%
- Information and communications technology equipment: 33.9 %
- Consumer electronics: 13.7%.

What is e-waste?

Electronic waste or e-waste is the term used to describe old, end-of-life electronic appliances such as computers, laptops, TVs, DVD players, mobile phones, mp3 players, etc., which have been disposed by their original users.

E-waste has been categorized into three main categories, i.e., Large Household Appliances, IT and Telecom and Consumer Equipment. Refrigerator and washing machine represent large household appliances; PC, monitor and laptop represent IT and Telecom, while TV represents Consumer Equipment.

Each of these e-waste items has been classified with respect to 26 common components found in them. These components form the 'building blocks' of each item and therefore they are readily 'identifiable' and 'removable.' These components are metal, motor/ compressor, cooling, plastic, insulation, glass, LCD, rubber, wiring/electrical, concrete, transformer, magnetron, textile, circuit board, fluorescent lamp, incandescent lamp, heating element, thermostat, brominated flamed retardant (BFR)-containing plastic, batteries, CFC/HCFC/HFC/HC, external electric cables, refractory ceramic fibers, radioactive substances and electrolyte capacitors (over L/D 25 mm).

The composition of WEEE/e-waste is very diverse and differs in products across different categories. It contains more than 1000 different substances, which fall under 'hazardous' and 'non-hazardous' categories. Broadly, it consists of ferrous and non-ferrous metals, plastics, glass, wood and plywood, printed circuit boards, concrete and ceramics, rubber and other items. Iron and steel constitutes about 50% of the WEEE followed by plastics (21%), non-ferrous metals (13%) and other constituents. Non-ferrous metals consist of metals like copper, aluminium and precious metals, e.g. silver, gold, platinum, palladium, etc. The presence of elements like lead, mercury, arsenic, cadmium, selenium and hexavalent chromium and flame retardants beyond threshold quantities in WEEE/e-waste classifies them as hazardous waste.

The electronic and electrical goods are largely classified under three major heads, as: 'white goods,' comprising of household appliances like air conditioners, dishwashers, refrigerators and washing machines; 'brown goods,' comprising of TVs, camcorders, cameras, etc.; 'grey goods,' like computers, printers, fax machines, scanners, etc. The grey goods are comparatively more complex to recycle due to their toxic composition.

Health and environmental impact of e-waste

EEEs are made of a multitude of components, some containing toxic substances that have an adverse impact on human health and the environment if not handled properly. Often, these hazards arise due to the improper recycling and disposal processes used. It can have serious repercussions for those in proximity to places where e-waste is recycled or burnt. Waste from the white and brown goods is less toxic as compared with grey goods. A computer contains highly toxic chemicals like lead, cadmium, mercury, beryllium, BFR, polyvinyl chloride and phosphor compounds.

Environment and health hazards.

Lead

exerts toxic effects on various systems in the body such as the central (organic affective syndrome) and peripheral nervous systems (motor neuropathy), the hemopoietic system

(anaemia), the genitourinary system (capable of causing damage to all parts of nephron) and the reproductive systems (male and female).

Mercury

causes damage to the genitourinary system (tubular dysfunction), the central and peripheral nervous systems as well as the foetus. When inorganic mercury spreads out in the water, it is transformed into methylated mercury, which bio-accumulates in living organisms and concentrates through the food chain, particularly by fish.

Cadmium

is a potentially long-term cumulative poison. Toxic cadmium compounds accumulate in the human body, especially in the kidneys. There is evidence of the role of cadmium and beryllium in carcinogenicity.

Polycyclic aromatic hydrocarbons (PAH)

Affects lung, skin and bladder. Epidemiological studies in the past on occupational exposure to PAH provide sufficient evidence of the role of PAH in the induction of skin and lung cancers.

Existing legislations and policy related to e-waste

The E-waste (Management & Handling) Rules, 2016 have been notified on March 23 2016. The new rules include Compact Fluorescent Lamp (CFL) and other mercury containing lamps, as well as other such equipment. The Rules also brings the producers under Extended Producer Responsibility (EPR), along with targets.

Organizations/networks working on e-waste issues in India

Knowledge bank for e-waste management in India

The Asia Pro Eco-programme supported by the European Commission is dedicated to the environmental performance in Asian Economic sectors through the exchange of environmental policies, technologies and practices and to promote sustainable investment and trade between the European Union Member States and South Asia, South-East Asia and China.

The E-waste Guide, India

An Initiative of the Indo–German–Swiss Partnership [Ministry of Environment and Forests, German Federal Ministry for Economic Cooperation and Development and Swiss State Secretariat for Economic Affairs] It is designed to serve as an information resource on e-waste as well as a common collaborative work platform for stakeholders.

National Solid Waste Association of India (NSWAI)

A leading professional non-profit organization in the field of solid-waste management, including toxic and hazardous waste and also biomedical waste in India. It was formed in 1996. Its objectives include development of solid-waste management as a profession, research and development, development of expertise, standards and goods practices with regards to solid-waste management. Some of the others include improvement in legislation and creating awareness and community involvement.

Toxics Link

A Delhi-based environment activist group with a mission of working for environmental justice and freedom from toxics. It is also actively involved in creating public awareness on environmental issues through publications,

reports, articles and environment news bulletins besides organizing various events.

Others are STEP Workweb, WEEE Forum, Clean India, Indian Environmental Society, INDIA HABITAT CENTRE and Microbial Biotechnology Area of Tata Energy Research Institute.

How can we control e waste?

- Don't trash them. First, we should never throw e-waste in the trash!
- Recycle them.
- Find a good e-waste recycler.
- Staples stores.
- Do a cell phone recycling drive and fundraiser in your school.
- Learn to fix broken gadgets yourself.
- Buy less. Buying things we simply do not need is probably the biggest cause of e-waste. ...
- Organize what you have. ...
- Give away or donate your e-waste. ...
- Take them back to the store. ...
- Sell. ...
- Learn about your local recycling options. ...
- Think ahead. ...
- Live in the cloud.

- Mr. Himanshu Bakshi (Lecturer in Survey Deptt.)

Floating Concrete

Floating concrete is a fluid mixture of density less than water, which is suitable to build floating structures, reducing the consumption of land for buildings. This project report addresses the procedure of preparation of mix proportion of floating concrete, materials used & various test results of compressive strength at the age of 7 days & flow, for acceptance of this concrete. Also, it presents an application of this concrete for canoe construction along with a light weight but, strong reinforcement. Despite the self weight of the canoe, it can bear a certain amount of external load.

What is concrete? (Conventional & Floating Concrete)

Concrete is the most widely-used composite material in the construction industry. It is durable, weather-resistant, environmentally neutral and economically affordable.

There are many types of concrete each designed for fulfilling specific technical, structural and aesthetic requirements. In the broadest definition, concrete is a mixture of Portland cement, aggregate (gravel and sand) and potable water.

Fresh concrete is a workable, form-able, non-toxic paste that can be easily poured and formed as per design requirements. During the hydration process, the water reacts with Portland cement to form a crystallized and permanent matrix holding aggregates together. In few days after casting the concrete, the concrete body reaches the pick of its strengths provided curing process is supervised by experienced and trained team in a conditioned environment.

Concrete compressive strength can easily surpass the compressive strength of many naturally occurring rocks; a compressive strength of 70 MPa can be easily achieved in a precast concrete factory and many cast-in-situ concrete elements achieve a compressive strength of 40 MPa and more.

What is floating concrete structure?

A floating concrete structure is usually a solid body made of reinforced concrete & an inner chain of chambers filled with a lightweight impermeable material, typically polystyrene but, here the concrete is made to float by addition of aluminium powder as an air entraining agent. In addition to this, the concrete includes polypropylene fibers for good binding, nano silica for increasing its strength, $CaCl_2$ as an accelerator & Dr. Fixit for water proofing. Aluminium mesh instead of steel mesh is used for reinforcement, for making it light weight & corrosion resistant.

MATERIALS USED:

The cement used is somewhat similar to Ferrocement but, instead of steel wire mesh, aluminium wire mesh is used possessing a light weight than regular chicken mesh making an innovative type of “Aluminicement”(Carbon fiber mesh can also replace the aluminium mesh as it is the best among the light weight but strong meshes available). Pozzolanic Portland Cement (PPC) reinforced with polypropylene fibers, for increasing the binding among particles was used, pursuing following physical & chemical properties:

Physical properties of Portland Pozzolanic Cement and OPC		
Property	Results	
	Ordinary Portland Cement	Blended Pozzolanic Cement

Compressive Strength (MPa)		
3 Day	**11.3**	**10.7**
7 Day	**13.2**	**14.3**
28 Day	**16.9**	**21.2**
Setting time (min)		
Initial	**120**	**164**
Final	**166**	**203**
Specific Gravity	**3.107**	**2.936**
Fineness %	**85.4**	**86.2**
Soundness (mm)	**0.5**	**1**

Chemical properties of Portland Pozzolanic Cement and OPC

Property	**Results**	
	Ordinary Portland Cement (%)	**Blended Pozzolanic Cement (%)**
Loss on Ignition	**2.05**	**1.05**
Insoluble Residue	**4.1**	**20**
Total alkalis	**0.59**	**0.71**
Chloride Content	**0.07**	**0.01**
SiO_2 Content	**28.7**	**23.5**
Al_2O_3 Content	**13.5**	**12.9**
CaO Content	**53.6**	**47**
MgO Content	**2.21**	**1.74**
Fe_2O_3 Content	**2.27**	**2.04**
SO_3 Content	**2.9**	**2.21**

Ordinary Portland cement is replaced by PPC because of its pozzolanic property as well as making it economical by the use of cheaper pozzolanic material such as fly ash for sustainable development.

Aggregate

Locally available natural sand with 300 microns maximum size was used as fine aggregate.

Admixtures

- Aluminium fine powder is used as gas forming admixture. It generates fluffiness in the concrete same as baking soda does in a cake. This admixture when added to mortar or concrete mixture react chemically with hydroxides present in the cement & form minute bubbles of hydrogen gas of size ranging from 0.1 to 1 mm throughout the cement-water

- To shorten the setting time of the mix, the accelerating admixture used is Calcium Chloride ($CaCl_2$).

Mineral additives

Since we have made a light weight concrete with density less than that of water, it possesses a little less strength as compared to the conventional concrete. So, to overcome this drawback, nanotechnology is taken as a support.

- Nano-SiO_2 having particle size less than 100 nm, has been found to improve concrete workability & strength, increase resistance to water

penetration & to help control the leaching of calcium, which is closely associated with various types of concrete

Water proofing agent

One of the major requirements of floating concrete is it should not have any leakage through it. The porosity of the concrete mortar should almost be equal to zero.

For this reason a water proofing substance is required.

- Fixit powder is added to the mortar for making it water resistant.

Images of materials used

3. PROPERTIES

Light Weight: Density range from 650 Kg/m3 to 1850 Kg/m3 as compared to 1800 Kg/m^3 to 2400 Kg/m3 for conventional brick and concrete respectively. Despite millions of tiny air filled cells, it is strong and durable. There is Lightweight advantage for the structure design, leading to savings in supporting structures and foundation.

Compressive Strength: 2.0 to 7.0N/mm^2.

Excellent Acoustic Performance: It can be used as effective sound barrier and for acoustic solutions. Hence, highly suitable for partition walls, floor screens/roofing and panel material in auditoriums.

Earthquake Resistant: Since lighter than concrete & brick, the lightness of the material increases resistance against earthquake.

Insulation: Superior thermal insulation properties compared to that of conventional brick and concrete, so reduces the heating and cooling expenses. In buildings, light-weight concrete will produce a higher fire rated structure.

Workability: Products made from lightweight concrete are lightweight, making them easy to place using less skilled labor. The bricks can be sawed, drilled and shaped like wood using standard hand tools, regular screws and nails. It is simpler than brick or concrete.

Lifespan: Weather proof, termite resistant and fire proof.

Savings in Material: Reduces dead weight of filler walls in framed structures by more than 50% as compared to brickwork resulting in substantial savings. Due to the bigger and uniform shape of blocks, there is a saving in bed mortar and plaster thickness. In most cases the higher cost of the light-weight concrete is offset by a reduction of structural elements, less reinforcing steel and reduced volume of concrete.

Water Absorption: Closed cellular structures and hence have lower water absorption.

Skim Coating: Do not require plaster and water repellent paint suffices. Wallpapers and plasters can also be applied directly to the surface.

Modulus of Elasticity: The modulus of elasticity of the concrete with lightweight aggregates is lower, 0.5 – 0.75 to that of the normal concrete.

Therefore more deflection is there in lightweight concrete

4. EXPERIMENTAL VALUES

Compressive Strength Test:

Concrete is primarily meant to withstand compressive stresses. Hence, behavior of concrete in compression is of foremost importance.

A cube of 10cm×10cm×10cm was prepared by taking cement:sand ratio as 1:3 & adding 0.08% of aluminium powder by volume of cement, polypropylene fibers in equal amount of cement, 2% $CaCl_2$ by weight of cement, 10% nano silica by weight of cement & a small quantity of Dr. Fixit powder.

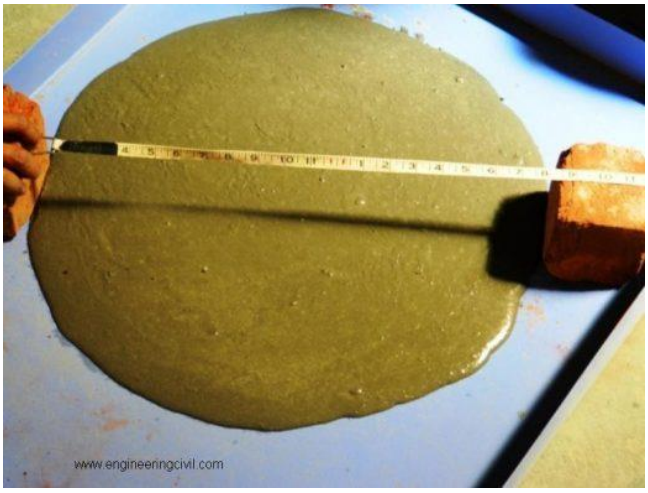
The sample was then tested in compressive strength testing machine as shown above and below.

Recommended limit for compressive strength of the concrete is 2-7 N/mm^2 & the calculated result came to be 3 N/mm^2.

Flow test:

This test gives an indication to the quality of concrete with respect to consistency, cohesiveness & the proneness to segregation.

The mix proportion of concrete is same as mentioned in compressive strength test



Concrete is filled in the mould in two layers, each layer is tamped 25 times & then after removal of the mould, the table on which mould is kept is raised & dropped for 15

The diameter of the spread concrete is measured in about 6 directions & average spread is

Flow is calculated as given below:

Flow, percent = (Spread diameter in cm-25) ×100) / 25

- The value could range anything from 0-150
- The calculated value of flow came to be 14%.

Conclusions on the basis of Compressive strength test:

- Test results obtained show that floating concrete is not as effective in compression as the conventional
- Its strength can be improved by addition of substances such as carbon nano fibers & silica nano particles which provide sufficient strength to the
- With this amount of strength, floating concrete can be used at harbors & docks for loading & unloading of materials to & from the ships, respectively.
- Also, a hollow cube can be built with floating concrete slabs & later it can be filled with Styrofoam for making it compact & can be used in floating structures & hence its load bearing capacity can be
- Pumice stone (aggregate size approximately equal to 20 mm) can be used as coarse aggregates in the concrete mix to increase its compressive

Conclusions on the basis of Flow test:

- The concrete can be used for marine structures as the flow is within the specified
- The durability of the structures is also high in comparison to that of the conventional concrete
- The problem of segregation is also reduced to a large extent so; it can be used for construction of piers of marine

- Mr. Braja Gopal Dey (Lecturer in Survey Deptt.)