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SOLAR RECHARGEABLE HEARING AID DEVICE

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ABSTRACT
Hearing impairment/loss is a term that is used to describe the condition, where a patient suffers from partial or complete deafness. It is one of the most common medical conditions that could happen to anybody due to any random reason from being a genetic defect to accidental injury. Hearing aid is an electro acoustic device that is designed to amplify sound for the patient, usually with the aim to take over the function of the defected ear. All this work is performed with the help of a battery that keeps the function going. However, efficient functioning uses us a lot of power, resulting in frequently dying batteries, which takes away the experience of effortless hearing. Alternate sources of energy, like the solar power which is found in abundance can be used instead to power the hearing aid devices, hence provide a more comfortable and inexpensive approach to deal with impairments. This project aims to combine the hearing aid technology with solar powered rechargeable batteries to combat the issue of everyday dying batteries, thereby make it less cumbersome for the user.

Keywords: Hearing loss, hearing aid, solar powered, rechargeable batteries, inexpensive.

I. INTRODUCTION
The power of hearing is a boon to mankind. A simple vibration of air falling on the pinna of ear making its way through the various membranes and tunnels in the complex structure of ear, marks the beginning of an amazing process of perception and understanding. However, a vast number of people are deficient in this power, which in turn affects their personal and professional lives negatively.

As per the World Health Organization (WHO), a sizeable proportion of people face the issue of hearing loss throughout their life span, nearly 7% of the entire world's population, majorly in the developing countries. These people require additional aiding devices, like cochlear implants and hearing aids, for correcting their deficiencies.

Another major challenge for the people in developing countries, after a compromised sense of hearing, is the lack of affordability for correcting this defect. A normal Behind the Ear (BTE) kind of hearing aid is very much accessible and affordable, but has a recurring cost, which raises a concern over its affordability. As observed as per our research, a simple BTE when operated for 12 hours a day, begins to discharge slowly, and becomes completely dysfunctional in a span of 3-4 days.

Replacing batteries every few days is a very cumbersome and expensive task, especially for people in the developed countries, thereby resulting in denial by the user, which hampers their personal and professional lives, and on a whole affects their growth.

However, these developing countries have one thing in abundance and absolutely free, solar energy. This natural source of energy is an ideal yet simple way to provide long term and reasonable power to the device. Thereby, hearing aids can be powered by solar energy, by application of the photovoltaic effect, facilitating hearing aid users all over the world with reliable, genuinely affordable and effective method to improve their hearing experience.

II. HEARING LOSS
Hearing loss is simply a health problem. One fourth of people in the world are affected by it. It can be genetic or acquired with age, diseases or some kind of trauma. A hearing impaired person is someone with some degree of weakened sensitivity to sound, whereas a deaf person is someone who can't understand speech even in the presence of amplification. Therefore, in most cases it's possible to abate the effects of hearing loss by using analogue or digital hearing aids.

A. Types of Hearing Loss
a) Conductive Hearing Loss
Conductive hearing loss refers to a tenuous hearing power due to some problem or injury in the outer or middle ear, preventing the sound waves to reach the inner ear [1]. The conductive hearing loss is usually mild or moderate and can also be temporary in many cases. It is not necessarily permanent, and can be reversed by medicines, surgeries and hearing aids.

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b) Sensorineural Hearing Loss

Sensorineural hearing loss refers to a problem or injury pertaining to the inner ear or the auditory nerve. It can be classified as mild, moderate, severe or profound. Though the sensorineural hearing loss is permanent, but hearing aids have found to be quite helpful [2] [3]. This type of hearing loss is also known as cochlear and retro cochlear. Both conductive and sensorineural hearing loss can also be found together in one person.

III. HEARING AID TECHNOLOGY

Hearing aid technology is based on the concept of sound magnification or amplification. The vibrations that are received by the pinna are amplified so as to facilitate the user with a clearer and better hearing experience. This not only improves hearing ability, but also in turn corrects speech comprehension of those who have had this disability from a long time [4].

Depending on the severity and degree of hearing loss different approaches for correction are used. Digital hearing aids are the present day preference. However, in cases where a significant malfunction of outer and/or middle ear is observed, bone-anchored devices are the suitable choice.

Also, as per the guidelines of National Institute of Clinical Excellence, cochlear implants are preferred particularly in children observed with extreme hearing loss [5].

Present day digital hearing aids are far better than the age old analogue ones, which used the trial and error technique for fitting. Digital hearing aids offer accurate tuning as per the patient's hearing threshold using various softwares, which also prevents patients from manually altering their hearing aid tuning settings by mistake as in an analogue one.

Digital hearing aids also have the added advantage of digital feedback reduction, digital noise reduction, digital speech enhancement, digital microphones and increased comfort associated with improved wide- dynamic range algorithms to prevent high-intensity sounds causing discomfort [5] [6].

Hearing aids can be classified on the basis of wearing, namely, In-the-Ear (ITE) that completely fits in the outer ear and is used for mild to severe hearing loss, Behind-the-Ear (BTE) that is worn behind the ear and connected to a plastic ear mold that fits inside the outer ear, Canal aids that fit into the ear canal and are used for mild to moderately severe hearing loss and lastly, Body aids that are attached to a belt or a pocket and connected to the ear by a wire [7][8].

IV. BATTERY ISSUES

Most of the hearing aids, irrespective of their type, are powered by disposable single use zinc air batteries. These batteries are readily available in four common sizes, which are, 10, 13, 312 and 675 [13]. However, the amplification ratio and type of the hearing aid play a major deciding factor when it comes to the battery life.

Moreover, studies have shown that an average person suffering from a binaural, sensorineural or moderate hearing loss makes use of the hearing aid for about 16- 18 hours per day [14]. Pertaining to this data, when considering an average zinc air battery with a particular mAh rating, the user will have to change their hearing aid batteries more than two times a month, that is, every 10-12 days. This is definitely a cumbersome and undesired task. And more importantly extremely inconvenient on the pocket of the wearer.

Further factors contributing to the drainage of battery are the gain and current set values for the individual users. Gain and current values depend on the volume and filter control set values. With every increasing value of gain, the current delivered also increases, leading to a decrease in the battery life of the hearing aid. It is seen as a common phenomenon that users prefer to have their gain volume controls in their hearing aids set to a higher range, as per the ANSI standards [15] [16]. This causes the battery to drain at a much faster rate than expected.

The user's lifestyle and their workplace also plays a key role in deciding the service life for a hearing aid. Workplaces having intense ambient noise for prolonged periods, make the user use up the hearing aid battery at a high rate.

Considering the hearing aid current drains for non- linear hearing aids, which do not give exactly the same gain-frequency response with a broadband signal with varying spectral shapes, unlike in linear aids. The non- linear nature of these aids stem from compression, involving an amplifier that has an input signal dependent gain, majorly the input signal spectrum in a complex three-channel compression aid [16].

The effect of hearing aid on speech also is dependent on the similarity of the input spectrum and the spectrum of speech. Hearing aid circuits attempting to distinguish between speech and background noise end up altering

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their amplification characteristics as per the detection in each frequency region, which results in mistaking pure tones and stationary noise signals as background noise, decreasing their amplification. This further leads to a decrease in the battery life of hearing aids.

Taking all the above stated factors into account, the common zinc air batteries allowing a decent yet convenient amplification ratio for the user, do not last for much time. The table below defines the different battery capacities for different brands and sizes of zinc air batteries that are used for various types of hearing aids as per patient needs.

Table-I: Hearing Aid Battery Capacity by Brand

Battery Brand	Size 10 (mAh)	Size 312 (mAh)	Size 13 (mAh)	Size 675 {mAh)
Duracell Activair Zinc Air	100	180	310	620
Energizer Zinc Air Battery	91	160	280	620
iCellTech Zinc Air Battery	105	180	310	630
NEXcell Zinc Air Battery	100	180	300	630
Panasonic Zinc Air Battery	75	170	300	605
Power One Zinc Air Battery	100	180	310	650
Sony Zinc Air Battery	75	170	300	605
ZeniPower Zinc Air Battery	100	180	300	630
Average mAh	**93.25**	**175**	**301.25**	**627.5**

V. NICKEL METAL HYDRIDE BATTERY

A more sophisticated and inexpensive alternative for the zinc air single use disposable batteries are the rechargeable nickel-metal hydride batteries, abbreviated NiMH or Ni-MH. Fig 1. shows an Ni-MH battery.

The chemical reaction at the positive electrode is similar to that of the nickel–cadmium cell (NiCd), with both using nickel oxide hydroxide (NiOOH). However, the negative electrodes use a hydrogen- absorbing alloy instead of cadmium. A NiMH battery can have two to three times the capacity of an equivalent size NiCd, and its energy density can approach that of a lithium-ion battery [17].

The negative electrode reaction occurring in a NiMH cell is:

$H2O + M + e^- \rightleftharpoons OH^- + MH$

On the positive electrode, nickel oxyhydroxide, NiO(OH), is formed:

$Ni(OH)2 + OH^- \rightleftharpoons NiO(OH) + H2O + e^-$

Fig-1: Ni-MH battery [19]

NiMH cells do not require any maintenance and remain sealed in normal operation. Even when overcharged at low rates, the oxygen produced at the positive electrode passes through the separator and recombines at the surface of the negative. Hydrogen evolution is suppressed and the charging energy is converted to heat [18] [19].

NiMH cells have an alkaline electrolyte, usually potassium hydroxide. The positive electrode is nickel hydroxide and the negative electrode is hydrogen ions or protons. The hydrogen ions are stored in a metal hydride structure that is the electrode. For separation hydrophilic polyolefin nonwovens are used.

Charging voltage is in the range of 1.4–1.6 V per cell. A fully charged cell supplies an average 1.25 V/cell during discharge, declining to about 1.0–1.1 V/cell [19].

A hearing aid has unique power supply requirements due to its small size, current consumption, and safety requirements. Switching zinc air batteries with NiMH rechargeable batteries offer a much higher battery life and allows multiple recharging, hence affordability.

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VI. SOLAR POWER

Solar power is the conversion of sunlight into electricity, either directly using photovoltaic, or indirectly using concentrated solar power.

Solar power is the most reliable form of renewable energy available. Solar-powered photovoltaic panels convert the sun's rays into electricity by exciting electrons in silicon cells using the photons of light from the sun [20].

Solar panel refers to a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating. A photovoltaic module is a packaged, connected assembly of typically 6×10 solar cells [21].

VII. WORKING OF SOLAR CELL

Photovoltaic modules, commonly called solar modules, are the key components used to convert sunlight into electricity. Solar modules are made of semiconductors.

The most common type of semiconductor currently in use is made of silicon crystal. Silicon crystals are laminated into n-type and p-type layers, stacked on top of each other. Light striking the crystals induces the "photovoltaic effect," which generates electricity. The electricity produced is called direct current (DC) and can be used immediately or stored in a battery [22].

A. Power generation using the P-N gate

High purity silicon crystals are used to manufacture solar cells. The crystals are processed into solar cells using the melt and cast method. The cube-shaped casting is then cut into ingots, and then sliced into very thin wafers [23].

B. Processing wafers

Silicon atoms have four "arms." Under stable conditions, they become perfect insulators. By combining a small number of five-armed atoms (with a surplus electron), a negative charge will occur when sunlight (photons) hits the surplus electron. The electron is then discharged from the arm to move around freely. Silicon with these characteristics conducts electricity. This is called an n-type (negative) semiconductor, and is usually caused by having the silicon 'doped' with a phosphorous film [22] [23].

In contrast, combining three-armed atoms that lack one electron results in a hole with an electron missing. The semiconductor will then carry a positive charge [24]. This is called a p-type (positive) semiconductor, and is usually obtained when boron is doped into the silicon. Fig. 2 show the doping of silicon crystals.

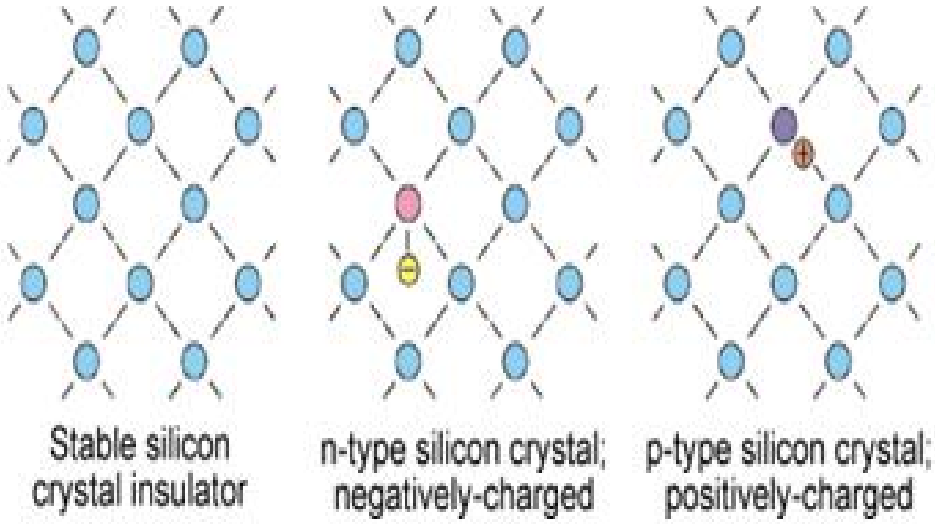

Fig-2: Silicon Crystals [25]

A p-n junction is formed by placing p-type and n-type semiconductors next to one another. The p-type, with one less electron, attracts the surplus electron from the n-type to stabilize itself. Thus the electricity is displaced and generates a flow of electrons, otherwise known as electricity [25] [26].

When sunlight hits the semiconductor, an electron springs up and is attracted toward the n-type semiconductor. This causes more negatives in the n- type semiconductors and more positives in the p-type, thus generating a higher flow of electricity. This is the photovoltaic effect [27]. Fig. 3 shows the diagrammatic representation of photovoltaic effect.

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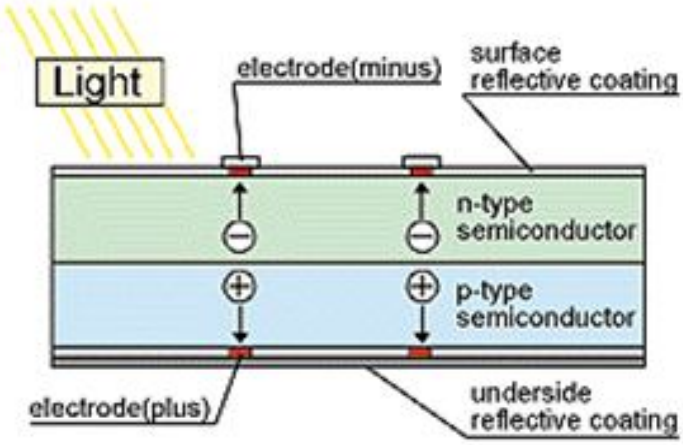

Fig-3: Photovoltaic effect [4]

VIII. CONCLUSION

People with disabilities are one of the most marginalized groups in society, especially in the developing world. Many of the hearing impaired could escape this situation easily if only they had access to affordable hearing aids.

This project combines the hearing aid technology with a solar charger and a set of rechargeable batteries to combat the need for replacing hearing aid batteries on a daily basis, which is both expensive and cumbersome for the user.

It aims to motivate people to get the hearing aids out of their kitchen drawers and put them to use for a better hearing experience, without worrying about the cost of the batteries they have to buy every now and then.

This affordable device makes use of a simple technique, the photovoltaic effect to solve a major problem faced with hearing aid users and hence facilitates them with a better and comfortable hearing experience. Fig. 4 and Fig. 5 below show the final construction and assembly of the solar rechargeable hearing aid device.

Fig-4: Solar panel and LED on top of the box

Fig-5: Solar Rechargeable Hearing Aid Device

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PALMAROSA (CYMBOPOGON MARTINII STAPF.) CULTIVATION IN HARYANA: AN AGROECOLOGICAL APPROACH

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ABSTRACT
Palmarosa (Cymbopogon martinii stapf.) also known as Indian rosha, motia, kavattampillu, gandhabena, tikhadi, rauns etc. is a perennial grass and thrives well in tropical and humid climates. In the state of Haryana average rainfall is 100 cm to 30 which is not sufficient for the commercial cultivation of this grass. But, the state has very well developed irrigation facilities and this provides opportunities for the cultivation of this grass. It necessitates a proper scientific investigation of the ecological as well as agricultural condition and areas which may support the cultivation of this grass. Agroecology, as a practice integrate ecology with agriculture and provides scientific basis for the adoption of new plant for their cultivation, conservation and management. Agroecological approach is increasingly being adopted for environmental development and sustainability, health and economic development. The basic assumption underlying this research is that every region with its unique natural and geographic conditions has potential to supports different species and varieties of crops and plants. These potentials should be properly understood and utilised for the benefit of society and natural environment. The approach of agroecological zoning is a method to realise this goal. Modern science of geoinformatics which combines different disciplines and technologies dealing with spatial information has made it possible to delineate these zones where these plants may be suitably cultivated and conserved. In the present paper, agroecological conditions (environmental, pedological and agricultural) of cultivating palmarosa in Haryana have been studied. For this purpose agroecological requirements or sets of potentials and constraints (land, soil and environmental characteristics) for the cultivations of palmarosa have been used to identify zones/regions of varying suitability in GIS environment using IDW interpolation method of Spatial Analysis kit in ArcGIS 10.3. This exercise has yielded four zones of different levels of suitability found on the basis of average expected yield of the plants in different locations of the state.

Keywords: Agroecological approach, Agroecological regions, Agroecological zones, Crop suitability, Palmarosa cultivation, Aromatic plants cultivation

INTRODUCTION
Haryana is primarily an agricultural state and one the most geographically diverse area in terms of the distribution of fauna and flora. The present study is an attempt to locate suitable agroecological zones for the cultivation of palmarosa (*Cymbopogon martinii* stapf.) within this diverse framework of state. Agroecological zoning approach is a little different from ecological zoning in its methodology in that agricultural resources, the resources developed by human agency as irrigation facilities, soil fertility boosting techniques or practices etc. are superimposed upon natural conditions (Food and Agriculture Organization FAO 1978). An agroecological zone is the land unit carved out of agroclimatic zone superimposed on agricultural resources developed by humans and landforms which act as modifier to climate, availability of moisture and length of growing period. Thus, an agroecological zone is a homogeneous land unit in terms of climate, length of growing period (LPG), soil properties and physiographic conditions which are suitable for certain group of plants with agricultural resources developed by humans (FAO 1983, Martin and Sauerborn 2013:7).

The approach of agroecological zoning is very useful in the "identification of areas with specific climate, soil, and terrain constraints to crop production; estimation of the extent of rain-fed and irrigated cultivable land and potential for expansion; estimation of crop production and yield; evaluation of land potential for crops cultivation and diversification; regional impact and geographical shifts of agricultural land and productivity; determining plant suitability for optimization of land use; study of potentials and implications for food security resulting from climate change and variability" (Fischer *et al.* 2006, Gliessman 215:18).

There are different methods and schemes of determining agroecological zones for different crops, plants and regions. The Food and Agricultural Organization FAO (1978) used mean growing period temperature and length of growing period, determined by annual precipitation, potential evapotranspiration and the time required to evapotranspire 100 mm of water from the soil profile to demarcate world into different agroecological regions. Consultative Group on International Agricultural Research-Technical Advisory Committee, CGIAR-TAC, demarcated agroecological zones on the basis of mean annual and growing period temperature, and length of growing period (determined the same as in the FAO zonation scheme) (Sivakumar and Valentin 1997). For this purpose the Global Agro-ecological Zones GAEZ uses temperature, precipitation, potential

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evapotranspiration and soil characteristics (Fischer *et al.* 2012). The Harvest Choice Agro-ecological Zone, HCAEZ uses mean temperatures, elevation, and GAEZ-LGP to define thermal regimes and temperature seasonality. The agroecological zoning scheme of the Global Land Initiative GLI includes harvested area of target crop, crop-specific GDD and soil moisture index (actual evapotranspiration divided by potential evapotranspiration) (Mueller *et al.* 2012). The Global Environmental Stratification GEnS has used four variables (growing degree days GDD with base temperature of 0 ◦C, an aridity index, evapotranspiration seasonality and temperature seasonality) and iso-cluster analysis to "cluster" grid-cells into zones of similarity (Metzger et. al. 2013, Warta *et al.* 2013).

In India also this approach has also been adopted by the Indian Council of Agricultural Research (ICAR) and National Bureau of Soil Survey & Land Use Planning (NBSS & LUP) in India to divide country into 20 regions (ICAR NBSS & LUP 2015). Subramaniyam *et al.* (1984) and Chowdhary *et al.* (1989) demarcated agroecological zones of Punjab and West Bengal, respectively. Gajbhiye and Mandal (2000) studied agro-ecological zones, their soil resource and cropping systems in India. Zaidi (2011) studied agroecological suitability of cultivating select medicinal and aromatic plants in the state of Haryana, India.

Plants/crops production (herbage, fruits, grains, roots and oils) has been taken as the combined result of climatic, pedological and inputs in agricultural system as the basis of identifying suitable agroecological zones of various levels. As all environmental, pedological and agricultural factors finally affect yield and production of crops. Therefore, in the present analysis expected yield (calculated for selected locations of the state) of palmarosa oil has taken as the sole criterion of defining agroecological zones at different levels of suitability as it reflects not only environmental potential and constraints but also level of agricultural resources (irrigation) developed for the establishment and growth of this plant (Zaidi 2011).

ABOUT STUDY AREA

The state of Haryana is located between 27º 39 'N to 30º 55 'N latitude, and from 74º 27 'E to 77º 36 'E longitudes. The state covers an area of 44,212 km^2 and accounts for about 1.35 per cent of the geographical area of the country. Almost 80 percent of its land area is under cultivation mostly under wheat and rice. As per India State of Forest Report, FSI, 2017, the forest cover in the state is 1,588 km^2 which is 3.59 percent of the state's geographical area. Geology of the state is characterised by the Siwalik system, the Indo-Gangetic plain and the Aravali system. Physiography is characterised by the structural hills of the Siwaliks, the piedmont plains, central plain and the structural hills in the Aravalis and the shallow sediments (Singh 1971: 88, Duggal 1975: 3-5).

Average annual rainfall in the state varies from more than 100 cm to 30 cm in the extreme western parts of the state. Average annual temperature varies between 24 to 26 °C. Average relative humidity (RH) in the state has been recorded to around 65 which vary from 45 to more than 80 in different seasons of the year. Climate of the state is subtropical continental monsoon type. The state is divided into tropical desert, hot and arid climate, tropical steppe, semi arid hot climate which are characterised by subtropical monsoon, mild and dry winter and hot summer climate (IMD 1989, Singh 1976:44-45). Soils of the state are Sandy and loamy sand (*bagar*), relatively sandy loam, sandy soft loam (*rohi*), coarse loam (*dahar, chaeknote*), light loam (*seoti*), loam (*bhangar and nardak*), silty loam (*khadar*), clayey silt (bet), silt clay (*naili* and *chhachhra, dakar*), Siwalik soils (*pahari*), piedmont (*ghar and kandi*), rocky surfaces. The pH value of these soils varies between less than 7.50 (in northeast) to more than 9.77 in the southeastern part of the state (Singh 1976:91, Zaidi 2011:1-74).

ABOUT THE PLANT: PALMAROSA

Palmarosa belongs to the grass species of Cymbopogon martinii stapf. It mostly grows in wild. The average height of this plant varies between two and a half to three metres. Its roots are small and penetrate into the soil. It normally occurs in dry, open and at higher locations. It occurs naturally in rounded clumps or tussocks growing much closer together. Some of its varieties prefer lower areas. It's most common variety in India is motia which is also referred as "Rosha grass" or "Russa grass". Another variety grown widely in India is sofia also known as ginger grass. The oil of palmarosa is obtained from floral shoots and above ground parts of its motia variety that yields oil of high content of geraniol between 75 and 90 per cent of raw material. Oil from motia palmarosa is also called East Indian geranium oil or Russa oil. Sofia is also grown widely in India and yields an oil of lower geranial content, but its oil thought to be inferior to that of motia. However, Java oil is superior of all (Weiss 1997:103, Zaidi 2011: 228-234).

CLIMATIC CONDITIONS

Earlier palmarosa was considered a day (photoperiod) neutral crop. However, recent researches have proved that the highest rate of oil synthesis and geraniol content occurs with a day length approaching 16 hours. Palmarosa prefers warm and sunny conditions with a daytime temperature of 20ºC to 25ºC; extended periods at

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25ºC to 30ºC can result in significant reduction of oil content and flowering gets suppressed. Frost causes severe damage to the herbage at any of its growth stage, and at higher elevations plants even die in the cold season. A slight frost during harvesting can even halve herbage oil content. Palmarosa is a tropical plant and thrives well in tropical areas with well distributed rainfall. It can also be cultivated in sub-tropical areas which are free from frost. However, in such conditions its yield is low. Palmarosa has a natural range of cultivation in India from 12˚N to 32˚N, and is usually raised at an elevation from 300 to 1,200 metres (Ghosh and Chatterjee 1990:119-126).

However, at this range of altitude rainfall and soils conditions are important limiting factors. Wild palmarosa is often found in drier hilly areas with a rainfall below 600 mm. It indicates degree of drought resistance of this grass. However, a rainfall of 1,500 mm is necessary in north India for its higher leaf and oil production. This herb also produces a reasonable yield in low rainfall regions of India receiving an annual rainfall of 750 mm. The intensively managed Java plantations with four or five annual cuttings are in areas receiving rainfall not less than 1,500 mm subsidised with irrigation for soil moisture. The general effect of climate on oil content and its composition is mainly via the rate of growth and physiological changes which take place in plants. Thus, a dry season will retard growth and reduce oil yield, while adequate rains promote vegetative growth and geraniol production. Annual climatic variations have a greater effect on oil content and its composition in comparison to other factors (Hussain *et al*. 1988:62, Singh 1977:38).

SOIL CONDITIONS

Palmarosa can be grown in well drained medium loam and light sandy loam soils. However, it may grow well in well drained clayey soils, if water-logging is prevented. It prefers soils of neutral pH value, but, it may be cultivated even in alkaline soil with a pH value of 9.0, however soils having pH value between 6.5 and 7.8 are most suitable. Acidic soils are generally unsuitable for its cultivation. Liming is recommended for more acidic soils, which is seldom applied.

AGRICULTURE INPUTS

Cultivation of motia was started in Punjab in 1924. Recently, its cultivation has also been taken up in the states of Karnataka, Maharashtra and Uttar Pradesh. This grass is best cultivated by transplanting seedlings raised in the nursery. It is seldom intercropped or under-planted. Palmarosa is a hard grass and its water requirements are moderate. Its grass transpires approximately 300 kilogram water per kilogram of dry material produced in India. This grass can be raised as a rainfed crop provided the rain is adequate as well as well distributed. At least, irrigation once a month is required to supplement rainfall, however, in north India and in semi-arid areas of south India 4 to 6 irrigations are required during the rain free periods. But, most crops do well as rainfed in the main producing regions. From the data available, it appears that palmarosa is adversely affected by the saline water even at a low salt level (Weiss 1997:103-129).

It is a perennial grass; therefore, it is necessary to replenish the soils with fertilizers and manures. This grass responds well to the application of fertilizers. Because this grass with an average production of 11,000 kilograms of dry biomass with an oil content of 1 per cent removes 31.6 kilograms of N, 7.4 kilograms of P, 20.6 kilograms of K, 34.8 kilograms of Ca, 20.62 kilograms of each of Mg and S, 0.9 kilogram of Mn and 0.034 kilogram of Zn from one hectare of soils in India (Pareek et al.1983:203-209). It means that palmarosa is highly demanding on both macro- and micro-nutrients. Therefore, application of macro as well as micro nutrients is essential, of course, after soil testing so that adequate doses of the required nutrients may be applied for good yield of herbage.

Timely cutting of palmarosa is very important for good yield of oil and geraniol. Oil and content of herbage are highest at full bloom, therefore, cutting of crop slightly earlier than this period is recommended. Both, oil and geraniol content reduces quickly on the completion of flowering and beginning of seed formation (Sangwan et al. 1982:163-165; Maheshwari 1992:514-517). First harvest is taken about 3 to 4 months after planting and subsequent harvests may be obtained at interval of 4 or 5 months depending upon the rainfall and fertility of the soil. The annual herbage yield from a well managed plantation in India is 10,000 to 25,000 kilograms per hectare which may be increased to a higher level by good management practices and precision farming. In contrast to mentha cultivation the yield of palmarosa oil is low during the first year and increases with age of the plantation. Though, from commercial point of view, it is advisable to keep the plantation for four years. Its clumps should be burnt during the summer as it increases the yield of the grass as well as its oil content. All parts of this plant contain essential oil, the maximum amount is present in flowers, and the stalks contain negligible quantity (Gupta and Trivedi 1984:82-84).

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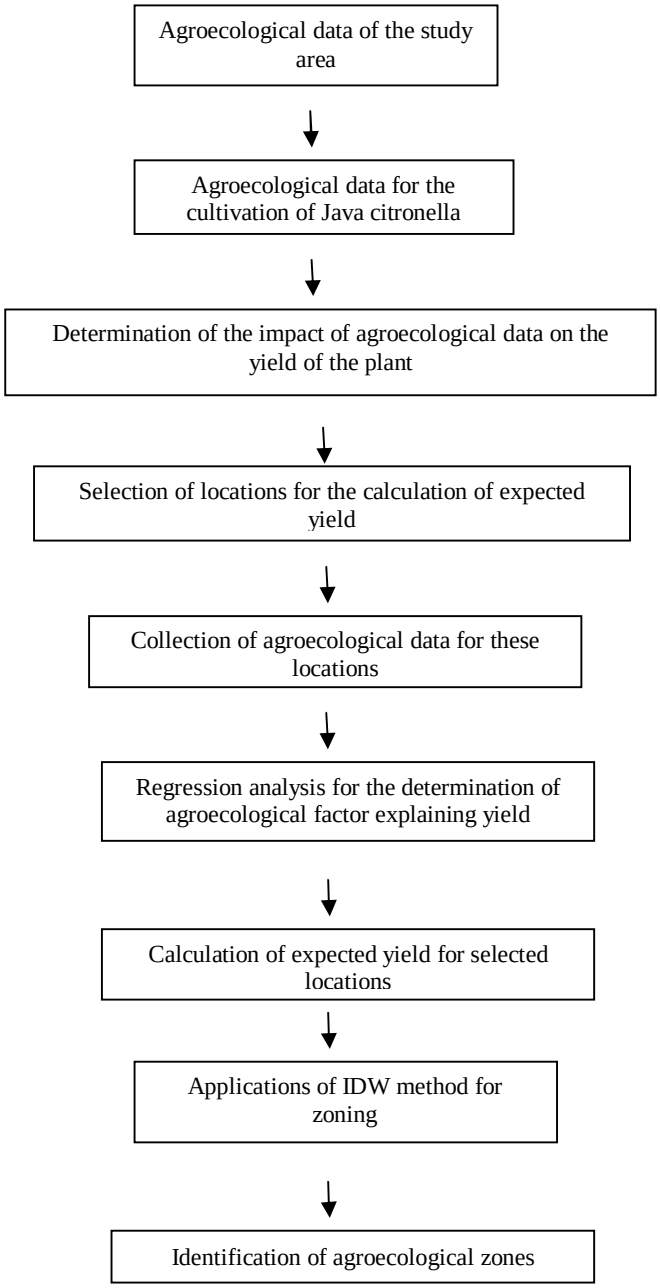
METHODOLOGY OF AGROECOLOGICAL ZONING

For the purpose of establishing agroecological zones, climatic, pedological and agricultural conditions of the potential crop/plant and the area are matched and suitable areas are marked having necessary conditions. For this purpose a comprehensive study of the agroecological conditions where palmarosa is naturally found or is being cultivated has been done to collect data and information about the cultivation and yield of this plant. A spatial framework of 95 villages/sites has been developed to identify land units with similar agroecological conditions (Figure 1). This framework also has been used for collecting information on inputs, management practices, water use and availability and soil characteristics. The data collected from both primary and secondary sources has led to the evaluation of potential and constraints of different areas in the state of Haryana by employing the concept of geographic equivalence, locales (zones) with similar agroecological characteristics.



Dig-1: Methodological steps of Agroecological Zoning

Diagram 1 explains methodological steps taken to identify agroecological zones for the cultivation of palmarosa. The first step in this process has been identification of key climatic and edaphic and agricultural variables which are scientifically proved most important for the cultivation of palmarosa in India and around the globe. On the basis of these determinants and observed yields of this plant in varying environmental conditions,

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explanatory functions are derived for calculating yield. These functions have been used to predict yields of this plant for 95 selected sites (villages) from which agroecological data have been collected (Figure1). However, a review of expert literature on palmarosa revealed that annual rainfall, relative humidity, annual mean minimum and maximum temperature, annual mean temperature and soil chemical properties and altitude are the main predictors of oil yield of this grass.

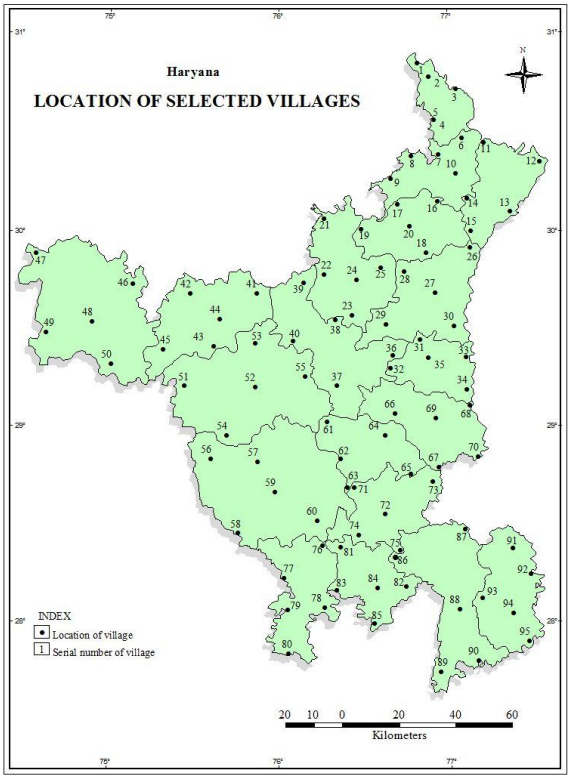

Figure-1: Location of selected villages in Haryana

For the purpose of calculating expected yield in the statistical package IBM SPSS all given curvilinear multivariate functions and also Cobb Douglas and stepwise linear regression have been experimented with. An inspection of the explained variance in the average oil yield of palmarosa has revealed that the stepwise regression analysis explains most of it with a high significance of regression coefficients and an F statistics at a very high level of significance pointing out a very reliable fit of the model:

$YL = 106.349 + 0.021*RF + 2.238*MN \quad R^2 = 0.772$, Adjusted $R^2 = 0.770$, $F = 34.079$

(0.000) (0.000) (0.000) (0.000)[1]

1. Figures in parentheses are significance levels of parameters.

Where, YL is oil yield of palmarosa, RF is annual rainfall and MN is mean annual minimum temperature. An inspection of these values show that only annual rainfall and minimum temperature are retained in the equation whose regression coefficients are very significantly different from zero (0.0) meaning thereby that these regression coefficient may be relied upon for prediction and so is case with the constant (106.349). The Value of R^2 is 0.772 which after adjustment turns out 0.770 signifying that at least 77 per cent variation in the observed yield of palmarosa all around the world is explained by these two predictors. Significance level of F statistics validates the fitted model with a high degree of confidence.

In the second instance, annual mean temperature and annual rainfall plus volume of irrigation water in mm over the geographical area of sample villages and soil chemical properties and altitude are used to predict the oil yield of palmarosa at these 95 sites. The predicted oil yields are taken merely as indicator of suitability and form a reasonable basis of agroecological zoning for this aromatic plant.

In the third instance, the file of expected/predicted palmarosa oil yields has been attached with the location code file of the sample villages in ArcGIS 10.3 environment. Using IDW method of interpolation in the Spatial Analyst kit of the ArcGIS 10.3, surfaces of yield distribution are interpolated. In this method value at an unknown point is calculated as weighted sum of the values of N known points. Inverse distance weighting

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(IDW) method has advantage over the other methods of interpolation as this method is best suited for randomly distributed point data. In the present analysis a variable search radius of minimum of 10 map units and a minimum of 5 points are used with the calculation of weights of distances by squaring distances in order to minimise bias due to higher values at farther distances. This interpolation has given a number of zones. Therefore, a resampling is carried out by assigning three natural breaks on the basis of the yield and which has classified all the interpolated zones into four zones (Figure 2). After resampling into four zones, vectorisation is carried out to draw clear boundaries between different zones.

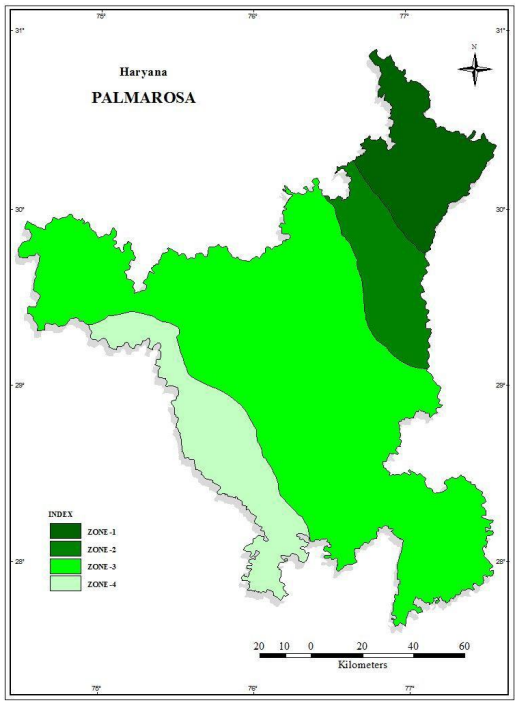

Figure-2: Agroecological zones of palmarosa

On the analysis of the palmarosa oil yields per hectare in each of these four zones in Figure 2, it is found out that the darkest green polygon (zone) represents an area most suitable for the cultivation and commercial profit from this plant, the green zone represents a suitable zone for raising palmarosa with appreciable profits, the area represented in dull or faded green is less suitable for its cultivation as profit earned from the production of this aromatic plant though will be higher from that of conventional cropping but not significantly higher to recommend to allocate a large area under this plant in this zone. The lightest green area represents a zone where cultivation of palmarosa will be a loss incurring enterprise in comparison to conventional farming. Therefore, this zone is designated least or unsuitable for cultivation of palmarosa.

AGROECOLOGICAL ZONES FOR PALMAROSA CULTIVATION

A brief description of the agroecological characteristics of each of four zones at different levels of suitability for palmarosa as delineated in Figure 2 is given in the following paragraphs precede by Table 1 that shows areas of different zones with their respective per cent share in the geographical area of the state.

Table-1: Zones for palmarosa cultivation in Haryana

S.N.	Zone	Level of suitability	Area in km^2	Area in per cent
1.	Zone 1	Most suitable	4,959.81	11.22
2.	Zone 2	Suitable	4,098.24	9.27
3.	Zone 3	Less suitable	29,116.93	65.86
4.	Zone 4	Least or not suitable	6,037.02	13.65

Zone 1 (Most suitable)

This zone is located in north and north-eastern parts of the state. Total area covered by this zone is 4,959.81 km^2 or 11.22 per cent of the state's total area. Agroecologically this zone is most suitable for palmarosa cultivation, as, it is located within the ideal latitudinal range of 12˚N to 32˚N in India. Altitude of this zone is also within the range of 150 to 1000 metres. Average annual rainfall is more 75 cm and average annual temperature has been recorded around 25˚C. Length of growing period in this zone is also longer extending over 150-210 days

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(Sachdev *et al.* 1995). Soils of this zone are silty loam, loam, silty clay, light loam and piedmont type with a pH value of less than 7.8 points that is favourable for palmarosa cultivation. A combination of all these factors makes this zone as most suitable for the cultivation of this plant in the state.

Zone 2 (Suitable)

This zone lies on the located southern boundary of the most suitable zone in northern Haryana. Total area covered by this zone is 4,098.24 km2 or 9.27 per cent of total area of the state. The growing period in this zone is as long as 120-150 days (Sachdev et al. 1995). Average annual rainfall received in this zone varies between 60 and 75 cm from west to east. Soils are silty loam, loam, silty clay and clayey silt with pH value ranging from 7.5 to 8.0 points. Alkaline soils and below average availability of rainfall are less favourable for the cultivation of palmarosa in this zone. Other characteristics of this zone are same as that of the most suitable zone. Therefore, this zone can better be described as suitable for the cultivation of this grass.

Zone 3 (Less suitable)

This zone is less suitable for palmarosa cultivation and covers most extensive area in the state. It spreads between a region marked by 60 cm isohyet in the east of bagar tract in the south and western parts of the state. Total area covered by this zone is 29,116.93 km2 or 65.86 per cent of total area of the state. This zone is characterized by both arid and semi-arid conditions. From north-east to south-west of the state, there are observed large variations in the distribution of average annual rainfall, temperature and soils in this zone. It is characterized by a low average annual rainfall ranging from 30-60 cm from south-west to north-east. Average temperature has been recorded around 25˚C in eastern half and more than 26˚C in the western half of this zone. Soils are loam, relatively sandy loam, silty clay and sandy soft loam with pH value more than 7.8 that increases westward. Growing period is also short extending over 60-120 days only (Sachdev et al. 1995). Due to these varied and less favourable conditions this zone is least suitable for this grass.

Zone 4 (Least or not suitable)

This zone is unfit for palmarosa cultivation. Total area covered by this zone is 6,037.02 km2 or 13.65 per cent of total area of the state. The main characteristics of this zone are its arid climate and very light soils locally known as bagar. The average pH value of the soils in this zone is 9.0 and even more along the Rajasthan border where average annual rainfall is as low as 30 centimetres. There are vast expanses of sand without vegetation and characterized by very high rate of wind erosion and shifting of dunes. Harsh and dry climate of this part makes it impossible to successfully cultivate palmarosa in this zone. Therefore, this part also has been categorized not suitable for the cultivation of this grass.

CONLUSION

An analysis of the above discussion reveals that around 20 percent area of the state is most suitable or suitable for the cultivation of this crop.This area mainly lies in northern and eastern part of the state which receives comparatively higher amount of rainfall and the main wheat rice producing area. Therefore, a choice is to be made taking into account local environmental and economic conditions. But, it is necessary to be emphasized here that delineation of an area into agroecological regions is necessary to ensure continued supply of food, fiber, fuel, fodder and herbal products, which due to reckless exploitation from the wilds and also other competing land uses are threatened and endangered to extinction. Also to meet other demands of farming communities to increase their declining incomes and for continued availability of natural aroma and other herbal products in national and international market, rationalisation and spatiation of cropping systems is urgently required. By spatiation of cropping systems is meant adoption of sustainable cropping systems (a mix of crops and medicinal and aromatic plants) at regional and local scales such that it is suited to environmental conditions of a region and is efficient in utilizing naturally available nutrients and moisture with little or no human subsidy. It should also be capable of enhancing employment and incomes of rural households. In the present study those zones have found where palmarosa cultivation may be suitably adopted by the farmers especially in those areas where traditional crops have become uneconomic to cultivate. An analysis of the agroecological zones of palmarosa reveals that south eastern part of the state may also be utilized to raise this plant with the supply of more water and introducing it along canals. Northern part of the state where rainfall ranges from 70 to 100 cm, the cultivation of the palmarosa may be adopted with help of irrigation. In western part very low availability of rainfall and increasing pH of the soil do not support its cultivation. Actual cultivation of this plant in the state will reveal its suitability and present work is just an exploratory research.

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CEMENT COMPANIES IN INDIA: CONTENT ANALYSIS OF MISSION STATEMENTS

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ABSTRACT
The purpose of the study was to investigate the quality of mission statements of the cement companies operating in India. In order to achieve this purpose, mission statements have been analyzed using a 13 Point Scale Model (defined by Researcher) which is an extension of 9 Point Scale model of Fred R. David. As per the Department of Industrial Policy and Promotion, Government of India, Ministry of Commerce and Industry, there are 94 Cement Companies. Researcher has selected 24 companies through convenient sampling to make analysis. Data was collected from the website of these companies. The finding of this study is that Companies are keen for stakeholders, Customer, Concern for Community, Innovation and Environment. From this finding it can be concluded that 9 Point Scale model of Fred. R. David model can be extended to 13 point scale model for analyzing the mission statement.

Keywords: Mission Statement, Nine Components, Cement Sector Companies, 13 Point Scale Model.

INTRODUCTION
India is the second largest producer of cement in the world. No wonder, India's cement industry is a vital part of its economy, providing employment to more than a million people, directly or indirectly. Ever since it was deregulated in 1982, the Indian cement industry has attracted huge investments, both from Indian as well as foreign investors.

India has a lot of potential for development in the infrastructure and construction sector and the cement sector is expected to largely benefit from it. Some of the recent major government initiatives such as development of 98 smart cities are expected to provide a major boost to the sector.

Expecting such developments in the country and aided by suitable government foreign policies, several foreign players such as Lafarge-Holcim, Heidelberg Cement, and Vicat have invested in the country in the recent past. A significant factor which aids the growth of this sector is the ready availability of the raw materials for making cement, such as limestone and coal.

The housing sector is the biggest demand driver of cement, accounting for about 67 per cent of the total consumption in India. The other major consumers of cement include infrastructure at 13 per cent, commercial construction at 11 per cent and industrial construction at 9 per cent.

The total capacity of the cement industry in India is 435 million tonnes (MT) and the growth of cement industry is expected to be 6-7 per cent in 2017 because of the government's focus on infrastructural development. The industry is currently producing 280 MT for meetings its domestic demand and 5 MT for exports requirement. The country's per capita consumption stands at around 225 kg.

The Indian cement industry is dominated by a few companies. The top 20 cement companies account for almost 70 per cent of the total cement production of the country. A total of 188 large cement plants together account for 97 per cent of the total installed capacity in the country, with 365 small plants account for the rest. Of these large cement plants, 77 are located in the states of Andhra Pradesh, Rajasthan and Tamil Nadu.

INVESTMENT
According to data released by the Department of Industrial Policy and Promotion (DIPP), cement and gypsum products attracted Foreign Direct Investment (FDI) worth US$ 5.24 billion between April 2000 and March 2017.

Some of the major investments in Indian cement industry are as follows

1. Emami Ltd, a fast-moving consumer goods (FMCG) company, plans to invest around Rs 8,500 crore (US$ 1.32 billion) to scale up its cement production capacity from 2.4 million tonnes (MT) to 15-20 MT in the next three to five years.
2. The Gujarat-based Nirma group, with presence in detergent, soap and chemicals sector, has bought Lafarge India's cement business, consisting of 11 MT production capacity, for US$ 1.4 billion.
3. FLSmidth, a global engineering company based in Copenhagen, has signed a contract with India's Larsen & Toubro Limited for engineering, procurement and supply of equipment for a complete cement production line with a capacity of 3,000 tonne in Tamil Nadu.

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VARIOUS INITIATIVES OF GOVERNMENT

The Cement Corporation of India (CCI) was incorporated by the Government of India in 1965 to achieve self-sufficiency in cement production in the country. Currently, CCI has 10 units spread over eight states in India.

In order to help the private sector companies thrive in the industry, the government has been approving their investment schemes. Some such initiatives by the government in the recent past are as follows:

- The State Government of Chhattisgarh has auctioned one block of Limestone (Kesla II) in Raipur District having estimated reserves of 215 million tonnes valued at Rs 10,367crore (US$ 1.61 billion), and would earn a cumulative revenue of Rs 11,894 crore (US$ 1.85 billion) to State Government over the lease period.
- The Union Budget proposed to assign infrastructure status to affordable housing projects and facilitate higher investments and better credit facilities, in line with the government's aim to provide housing for all by 2022 which will boost cement demand.
- The Finance Minister, Arun Jaitley, said that the National Housing Bank will refinance individual housing loans of about Rs 20,000 crore (US$ 3 billion) in 2017-18. The Finance Minister proposed to complete 1 crore houses by 2019. All these developments are expected to boost cement demand.
- The increased allocation to rural low-cost housing under Pradhan Mantri Awaas Yojana- Gramin scheme to Rs 23,000 crore (US$ 3.45 billion) from Rs 16,000 crore (US$ 2.4 billion) in FY17 is likely to drive a 2 per cent increase in cement demand, Ambit Capital said in a report.

FUTURE PATH

The eastern states of India are likely to be the newer and virgin markets for cement companies and could contribute to their bottom line in future. In the next 10 years, India could become the main exporter of clinker and gray cement to the Middle East, Africa, and other developing nations of the world. Cement plants near the ports, for instance the plants in Gujarat and Visakhapatnam, will have an added advantage for exports and will logistically be well armed to face stiff competition from cement plants in the interior of the country.

Due to the increasing demand in various sectors such as housing, commercial construction and industrial construction, cement industry is expected to reach 550-600 Million Tonnes Per Annum (MTPA) by the year 2025.

A large number of foreign players are also expected to enter the cement sector, owing to the profit margins and steady demand. In future, domestic cement companies could go for global listings either through the FCCB route or the GDR route.

With help from the government in terms of friendlier laws, lower taxation, and increased infrastructure spending, the sector will grow and take India's economy forward along with it.

OBJECTIVE

- To identify the mission statement components of cement sector companies of India.
- To study the main focus component of the cement sector companies of India.

LITERATURE REVIEW

Hossain (2004) focused on the mission statements of Bangladeshi companies. Fifteen companies were selected through convenient sampling and the characteristics of their mission statements were evaluated according to the criteria given by Fred R. David. The author made a conclusion that the Bangladeshi companies were preparing their mission statements without knowing the basic characteristics that mission statements should possess.

Mahboob (2004) did study on the mission statements of Bangladeshi companies. Fifteen companies were selected through convenient sampling and the characteristics of their mission statements were evaluated according to the criteria given by Fred R. David. The author made a conclusion that the Bangladeshi companies were preparing their mission statements without knowing the basic characteristics that mission statements should possess.

Biswas, Chowdhury and Das (2007) tried to find out the quality of mission statements of the listed Public Limited Companies (PLCs) in Bangladesh. The nine criteria suggested by Fred R. David (2003) were taken as benchmark for this study. The annual reports of a sample of 167 PLCs have been surveyed to determine the nature and extent of disclosure by computing total score and a Mission Statement Disclosure Index (MSDI). The findings revealed that the companies were focusing more on customers and concern for survival, growth and profitability and little focus is placed on self-concept, technology and market. The researchers concluded

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that the companies were preparing and disclosing the mission statements without having proper knowledge of the characteristics of the mission statement from strategic management viewpoint.

Moin, Ali and Khan (2012) made a comparative analysis of the mission statement of all the scheduled banks operating in Pakistan using a Nine Point Scale model given by Fred R. David. 21 domestic private Pakistani banks were used as a sample to make analysis in this study. The findings revealed that the score card of mission statement of (scheduled) banking setups in Pakistan were above the average score card of mission statement. Banks were more focused on customers and concern for survival, growth and profitability rather market, technology, employees and self-concept.

Ahmed, Shaukat and Islam (2013) made an effort to determine the readability of mission statements from 169 selected Islamic banks. The mission statements from 169 Islamic banks were taken from their respective web sites between March and April 2012.They used simple counting techniques and readability analyses. The findings revealed that the mission statements of Islamic banks were difficult to read and comprehend and banks have a great deal of work to do on their mission statements in order to make them readable and understandable to a wide range of stakeholders.

Rajani, & Vijay (2014) analyzed the mission statements of selected public and private sector banks in India. In their study five public and five private sector banks were selected for the component analysis of mission statements as per criteria given by Fred R. David. The author made a conclusion that the on a whole all banks gave prime importance to their customers and least importance to the technology.

COMPONENTS OF MISSION STATEMENT

There are many studies on what components should a mission statement include especially in businesses. Indeed, there in no particular length or format of a mission statement. It differs from organization to organization. Several authors have identified several different numbers of components that should be present in a 'good mission statement' (Hossain, 2004). Pearce and David (1987), for example, identified eight key elements to be included in mission statements. Two years later, David (1989) identified nine key components: customers, products/services, location, technology, concern for survival, philosophy, self-concept, concern for public image, and concern for employees. Bart (1997) expands the list to 20 components by adding such items as specific financial objectives and concern for survival. Ackoff (1986) argues that a first criterion of an acceptable mission statement should be the capacity to be challenged.

According to Fred R. David (1999, 2003 as cited in Ahmed, 2010; Biswas et al., 2007; Hossain, 2004; Meraj et al., 2011) a valuable mission statement should have nine components:

i. Customer: Who are the firm's customers?

ii. Products or Services: What are the firm's major products or services?

iii. Markets: Geographically, where does the firm operate?

iv. Technology: Is the firm technologically current?

v. Concern for survival, growth, and profitability: Is the organization committed in terms of financial success and future existence?

vi. Philosophy: What are the primary views, beliefs, desires, and ethical priorities of the organization?

vii. Self-concept: What are the organization's key competitive advantages?

viii. Concern for public image: Is the firm committed to the well-being of society, community and environment?

ix. Concern for employees: Are employees considered as valuable asset for the organization?

These nine basic components serve as a practical framework for evaluating and writing mission statements (David, 2003). The current study uses these components as a benchmark to evaluate the mission statements and have added four more components i.e. community, innovation, environment and stakeholder

METHODOLOGY

In order to analyze the mission statement components, an exploratory research was conducted. The study purely concentrates only on the cement sector companies of India. There are 94 cement companies according to the list provided by the Department of Industry Policy & Promotion, Government of India, Ministry of Commerce and Industry. From these 94 companies 24 are taken as sample through convenient sampling. The website of these

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listed companies is accessed for the review of their mission statements. Through analysis, mission statement of each of these companies are analyzed in order to identify whether it covers the several components of mission statement as suggested by Fred R. David and four more component which were added by researcher, Hence total 13 components are shown on a table shown in Appendix I.

FINDINGS OF THE STUDY

Distribution of the Component

Sr. No	Mission Statement Components	Score Achieved	Percentage
1	Customer	14	58
2	Product & Services	10	42
3	Market	1	4.1
4	Technology	5	21
5	Concern for survival, growth & Profitability	10	42
6	Philosophy	5	21
7	Concern for Public Image	4	17
8	Self-Concept	5	21
9	Concern for Employee	10	42
10	Concern for Community	11	46
11	Innovation	11	46
12	Environment	11	46
13	Stakeholders	18	75

DEVELOPMENT OF SCALE BY RESEARCHER

9 Point Scale Model given by Fred. R. David is extended to 13 Point Scale Model by adding four components. So the scale will be Customer, Product and Services, Market, Technology, Concern for (Survival, Growth and Profitability), Philosophy, Concern for Public Image, Self Concept, Concern of Employee, Concern for Community, Innovation, Environment, Stakeholder.

CONCLUSION

The overall findings show that most of the cement sector companies of India are keen for Stakeholder, Customers, Concern for Community, Innovation, and Environment. Hence it can be concluded that new 13 Point Scale scale shall be adopted by adding Concern for Community, Innovation, Environment and Stakeholders for analyzing mission statements.

LIMITATIONS OF STUDY

The analysis of this study is restricted only on the content analysis in the mission statements of selected listed cement companies of India.

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Annexure :1

Sr.No	Name of the Companies	Customer	Product & Services	Market	Technology	Concern for survival, growth & Profitability	Philosophy	Concern for Public Image	Self Concept	Concern for employee	Concern for community	Innovation	Environment	Stakeholders
1	J.K.Lakshmi Cement Pvt.Ltd	Y	Y			Y		Y	Y	Y	Y			Y
2	Tamil Nadu Cement Corporation Limited	Y			Y	Y	Y	Y	Y			Y		
3	Ambuja Cement	Y						Y	Y	Y	Y		Y	Y
4	The India Cement Limited	Y	Y			Y	Y				Y			Y
5	Aditya Birla Ultra Tech Cement	Y										Y		Y
6	Star Cement	Y	Y		Y					Y	Y	Y	Y	Y
7	Sanghi Cement	Y				Y			Y		Y	Y		Y
8	Reliance Cement Company Private Limited		Y				Y				Y			
9	Deccan Cement	Y			Y	Y	Y				Y		Y	Y
10	JSW Cement											Y		
11	Malabar Cement Ltd		Y	Y										
12	Emami Double Bull Cement		Y			Y	Y	Y		Y	Y	Y	Y	Y
13	Bagalkot Cement & Industries Ltd	Y	Y			Y			Y	Y	Y		Y	Y
14	Sagar Cement						Y							Y
15	Best Cement (Uma Dutt Industries)	Y				Y	Y			Y	Y	Y	Y	Y
16	Anjani Portland Cement Ltd.	Y			Y	Y	Y			Y		Y	Y	Y
17	Asian Cements Pvt.Ltd.						Y							Y
18	Binani Cement	Y			Y	Y	Y						Y	Y
19	Cement Corporation of India Ltd		Y							Y				
20	Jk Cement Ltd	Y	Y									Y		Y
21	Jindal Panther Cement									Y		Y	Y	Y
22	Birla Shakti Cement		Y											
23	Maha Cement	Y								Y	Y		Y	Y
24	Pennacement											Y	Y	Y
		14	10	1	5	10	5	4	5	10	11	11	11	18

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FLOOD RISK MONITORING OF KOSHI RIVER BASIN IN NORTH PLAINS OF BIHAR STATE OF INDIA, USING STANDARDIZED PRECIPITATION INDEX

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ABSTRACT
India is one of the most flood-affected countries in the world. The Koshi River, in north Bihar plains of India, gives a challenge in term of long and repetitive flood hazards. Supaul district often gets severely affected due to flood over Koshi River basin. Districts of Koshi division, Saharsa, Purnia and Madhepura, also get affected by flood. For monitoring flood events over this region, Standardized Precipitation Index (SPI) has been extensively used in the present study. This index is useful, as it can indicate the hydrological and climatological conditions of the river basin to a certain extent. SPI values over the flood-prone districts were calculated and analyzed at different time scales, using monthly rainfall data over a period of 50 years (1953-2002). Through the analysis, it was found that SPI indicated flood events of Bihar in the years 1954, 1968, 1974, 1984 and 1987 in a precise manner. Modified Rainfall Anomaly Index (MRAI) is also used at different time scales over the study region. Results of these two indices were compared at different time scales, to show that MRAI can be used as an alternative of SPI. Our study revealed that MRAI values at different timescales are highly correlated with SPI values at corresponding timescales. Linear Regression analysis of MRAI with SPI yielded strong positive correlation between these indices. This paper shows, SPI and MRAI are useful for flood risk assessment & monitoring over Koshi basin and can be utilized for other river basins also.

Keywords: Flood devastation, Flood risk monitoring, SPI, MRAI, Regression analysis,

I. INTRODUCTION
Flood is a widespread natural hazard, leading to cause large scale destruction of life and property. Flooding occurs when an extreme volume of water is carried by rivers and spread into adjacent areas where the excess water is not adequately drained out. Continuous heavy rainfall due to active spells of rainy season or extreme weather events (like cyclones, cloudbursts, etc.), water flow due to level gradient from high terrain to plain areas, abrupt breakage of dams or reservoirs, etc. can lead to water accumulation in river basins or plain areas, resulting into floods. These events use to build up fear of consequences that often exceeds their actual impact. Impacts can be minimized by proper flood monitoring and management, reducing loss of life and property damages. Bihar state of India often experiences disastrous floods. North Bihar has witnessed high magnitude floods in past years, mainly in 1954, 1984, 1987, 1998, 2004 and 2007**.** Floods in the northern plains of Bihar are caused mainly due to excessive rainfall in the flood-prone basin and by the overflowing of rivers and streams that drain the runoff. Other factors such as soil type, topographic relief and its gradient, soil saturation etc. do play a significant role in this phenomenon but the prominent focus of this paper is solely on rainfall.

In this paper the focused area is Supaul district, followed by Saharsa, Purnia and Madhepura districts, for flood monitoring. The Koshi River flows through Supaul district and usually causes devastation there during monsoon season. Occurrence of flood spells and devastations associated with those, are generally difficult to monitor but there are certain indices, which permit to monitor the hydrological and climatological conditions of these river basins, to some extent. These indices include Standardized Precipitation Index (SPI), Modified Rainfall Anomaly Index (MRAI), Standardized Water Index (SWI), Standardized Runoff Index (SRI), Standardized Precipitation Evapotranspiration Index (SPEI), etc.

It may be noted that the nature of the index, local conditions, data availability and validity usually determine the index to be used for a particular study. In this paper, "Standardized Precipitation Index" (SPI), developed by McKee et al. (1993), has been used for analysis of flood risk in districts of Koshi division in north Bihar plains.

As per world Meteorological Organization (WMO), SPI is a powerful and flexible index which can be used for analyzing both dry cycle as well as wet cycle (Fauzi et al. 2017, Juan et al. 2013, Kumar et al. 2009, Bordi et al. 2004). Even though it was originally developed to analyze dry cycle and SPI is largely used for drought monitoring (He et al. 2015, Karavitis et al. 2011, Wu et al. 2007, Morid et al. 2006) its computation techniques can be equally applied to study wet cycles too (Seiler et al 2002). It is quite simple to apply, as it only requires precipitation data as an input parameter (Hayes et al. 1999). Ideally, about 30-50 years' data of monthly precipitation values are required for obtaining reasonably good result through this index (Wu et al. 2005). The

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biggest strength of this index is that it can be computed for different time scales, providing early warning of drought as well as flooding periods with some lead time.SPI values over the flood-prone districts were calculated and analyzed at different time scales (1 month, 3months, 6months, 9months, 12 months and 24 months) for rainfall data period of 50 years.

Calculation of SPI for any location is based on the long-term precipitation record for a desired period (Guttman 1999). It is expressed as number of standard deviations that the observed precipitation would deviate from mean of long term rainfall record for a normal distribution. This long-term record is then fitted to a probability distribution for actual precipitation record. Since precipitation is generally not normally distributed (Bahram et al. 2011), a transformation is first applied, followed by fitting to a normal distribution, so that the mean SPI for the location and desired period is zero (Edwards and McKee, 1997). Positive SPI values indicate greater than mean/median precipitation and negative values indicate less than mean/median precipitation. As SPI value is normalized, wetter and drier climates can be represented in the same way; thus, wet periods can also be monitored using the SPI. McKee and others used the classification system in the SPI value, as shown in Table 1, to define the drier or wetter periods resulting from the SPI.

Table-1: Index values of SPI with their Conditions

No.	SPI Values	Conditions
1.	2.0+	Extremely wet
2.	1.5 to 1.99	Very wet
3.	1.0 to 1.49	Moderately wet
4.	-0.99 to 0.99	Near normal
5.	-1.0 to -1.49	Moderately dry
6.	-1.5 to -1.99	Severely dry
7.	-2 and less	Extremely dry

The study also deals with the use of Modified Rainfall Anomaly Index (**MRAI)** (Hansel et al 2015), as an alternative approach in place of SPI. The Rainfall Anomaly Index (**RAI**) was developed by Von Rooy (1965) and was later on modified to get better fit for 40 years' validation period. MRAI is computationally less demanding than SPI and can be calculated at all timescales. It accounts rank of precipitation values to calculate positive and negative anomalies. It offers higher degree of transparency and lower degree of complexness. Hansel et al. 2015 used the classification of MRAI as described in Table 2**:**

Table-2: Index values of MRAI with their Conditions

No.	MRAI Values	Condition
1.	≥ 2.00	Extremely wet
2.	1.50 to 1.99	Very wet
3.	1.00 to 1.49	Moderately wet
4.	0.50 to 0.99	Slightly wet
5.	-0.49 to 0.49	Near normal
6.	-0.99 to -0.50	Slightly dry
7.	-1.49 to -1.00	Moderately dry
8.	-1.99 to -1.50	Very dry
9.	≤ -2.00	Extremely dry

II. STUDY AREA AND DATA USED

The study area discussed in this paper corresponds to the poorly drained plains in North Bihar region of India. Some of the districts of north plains of Bihar, namely Supaul (height: 34m above mean sea level), Purnia (36ma.m.s.l.), Saharsa (41ma.m.s.l.), and Madhepura (50ma.m.s.l.) districts are taken under consideration (Fig. 1). These are drained by Koshi River. Monthly precipitation data of 50 years, from 1953 to 2002, has been used as an input parameter for the computation of SPI and MRAI. The data is taken from India Water Portal (IWP). The excel spread sheet has been used for computations of statistical parameters, like mean, median, skewness, standard deviation, Gamma distribution function, etc. for finding the indices at different timescales. Afterwards, SPI calculator and MDM (Meteorological Drought Monitoring) software are used for the calculation of SPI and MRAI at different timescales. The graph is plotted through Microsoft excel and Origin 8.5 Pro Software.

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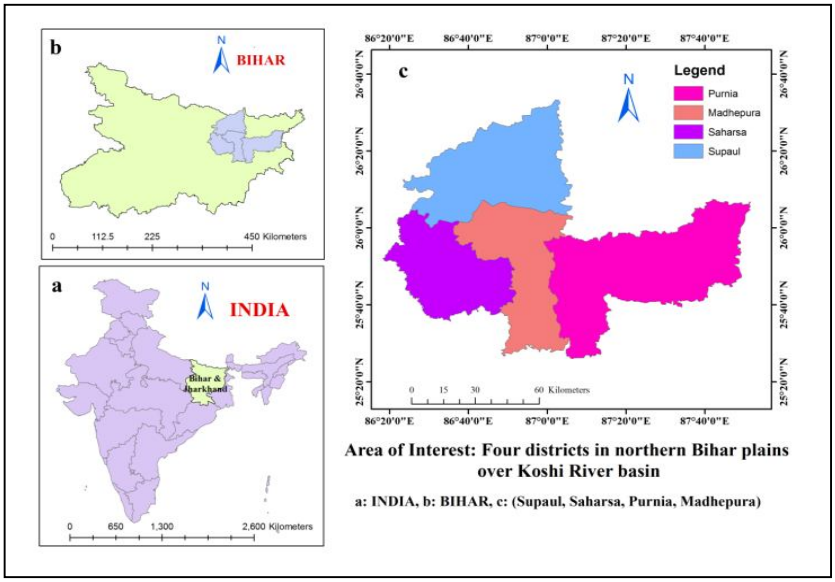

Figure 1: Location map of the Study area (a) Bihar & Jharkhand states in India (b) 4 districts (under study) in northern Bihar plains (c) Details of these 4 districts

III. METHODOLOGY

Calculation of **SPI** comprises transformation of one frequency distribution to other frequency distribution. Computation encompasses fitting a gamma distribution function (Abramowitz and Stegun, 1970) as a probability density function (PDF) of precipitation aggregates for the given station. The PDF is then used to find cumulative probability of observed precipitation for required temporal scales (1, 3, 6, 9, 12, 24 and 48 months). The cumulative probability according to the distribution and for each value of the precipitation is then transformed to the standard normal random variable Z with a mean of Zero and standard deviation of unity, which gives the value of SPI (McKee et al. 1995, Kumar et.al., 2009, Seiler et al. 2002).

RAI, developed by Von Rooy (in 1965), was afterwards modified to have better fit for long term validation period and to achieve higher comparability with SPI. **MRAI** accounts rank of precipitation value for getting positive and negative anomalies. The modified RAI, for a certain month *'i'* in this study, is calculated as follows (Hansel et al. 2015):

$$MRAI_i = \pm S\ F* \frac{(P_i - \bar{P})}{(\bar{E} - \bar{P})}$$

Where,

P_i = Monthly precipitation sum of month *i*

$\bar{P}$ = Median monthly precipitation of the validation period (1953–2002) for the respective month.

$\bar{E}$ = Mean of the 10 % most extreme precipitation sums (10 % percentile for positive anomalies, 90 % percentile for negative anomalies) of the validation period (1953–2002) for the respective month.

$\pm SF$ = Scaling factor (positive for $P_i \geq P$, and negative for $P_i < P$).

In MRAI, Median is used instead of Mean (arithmetic average) for the precipitation data series, as it is more accurate in analyzing the trends of dry and wet events. Deviation from Median is taken into account and it is then normalized to get the final result. It is believed that 10% higher and lower extreme value, respectively, gives more realistic result. Originally, SF = 3 was used by Von Rooy as a scaling factor but after analyzing number of data sets again and again, it was seen that SF = 1.7 delivers more similar frequency value as in SPI.

IV. RESULTS AND DISCUSSION

The dry/wet periods (cycles) are better detected over longer time scales (e.g. SPI of 24 months) than time scales less than 6 months (Fauzi et al. 2017, juan et al. 2013, He et al. 2015). Short-term time scale can generally give early warning of drought or flood events, while longer periods reveal patterns of long-term precipitation spells before the flood events. The situation is different in the drought/flood event monitoring, where the 3-month time scale SPI is more appropriate for flood monitoring because relatively shorter time scales quantify more surface soil water content. To obtain wet cycles, time series of SPI-24 values over 4 districts were analyzed and plotted (Fig. 2, 3, 4 & 5).

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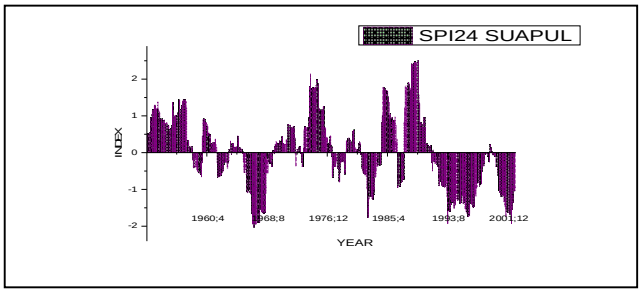

Figure-2: SPI-24 of supaul district

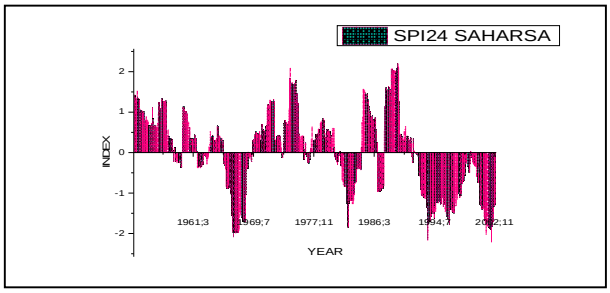

Figure-3: SPI-24 of Saharsa District

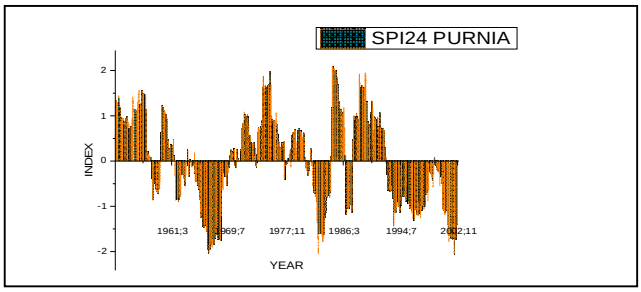

Figure-4: SPI-24 of Purnia District

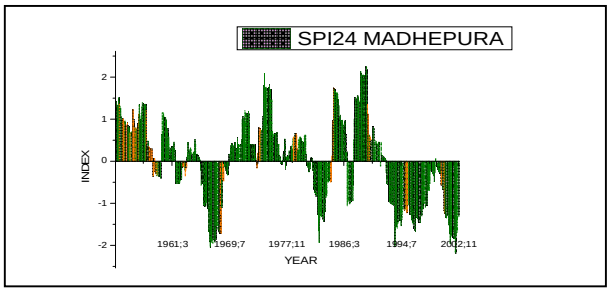

Figure-5: SPI-24 of Madhepura District

Fig. 2-5 shows that, by using the 24 month SPI (SPI-24), three well defined wet cycles are identified in Koshi River basin (in Bihar). Duration of these wet-cycles can be identified as 1953 – 1961, 1969-1980 and 1984-1992 (where SPI values are predominantly positive). From the rainfall series analyzed, major flood events associated with two of the cycles in Koshi River basin were verified through validation by available information sources.

For the three month periods, the SPI-3 values fluctuate more frequently above and below Zero. One month SPI (SPI-1) values(figure not shown) show maximum number of fluctuations, with dominant extremes being associated. These fluctuations strongly correlate with the fact that as the time scale increases to 24 months from 1, 3, 6 months, SPI responds more slowly to short-term precipitation variation and the cycles of positive or negative SPI values become more visible. The same has been reported by McKee et.al (1993) in his report too.

As per the analysis of SPI results for longer time scales (24 months), values were largely positive with index values larger than 2 for the year 1984 in Supaul district in the month of July and September, in Saharsa only in July month and in Purnia and Madhepura district in the month of June and August. But flood event with lower magnitude took place in other months. In the year 1954, these districts of north Bihar faced heavier flooding. Before this flood event, heavy rainfall had occurred in the year 1953 in these districts, which was nothing but the indication of a wet spell. Thus these longer timescales provide a good overall perspective of the abundance of water resource in that region providing insight about the possible cause of increased runoff during the subsequent major flood events.

A more detailed analysis of SPI over longer time scales illustrates the versatility of being able to monitor the precipitation using the multiple SPI time scales. Period of record from 1974 to 1976 when analyzed using SPI-24 revealed to have continuous index values between 0.5 to 2.0 in two districts (Supaul and Saharsa) of north Bihar. Thus, SPI-24 (Fig. 2) provides an indication that the antecedent conditions of the water resources in the area were abundant, especially regarding subsoil moisture, stream flows, and groundwater levels. It is even more evident to analyze SPI-3 because SPI-3 (Fig. 6 to 9) is more revealing of the randomness of precipitation which explains possible causes of major annual peak flow events.

Similarly the devastating flood event of 1987 (in our study area) can be analyzed using SPI graphs. A pattern of high SPI values can be detected on the SPI-24 and SPI-3 . Period of 1987 to 1990 is the third wet cycle analyzed till 2002 and it is bearing the greatest magnitude among all. Thus, once again it can be claimed that peculiar flood event always occurs during wet event. According to https://en.wikipedia.org/wiki/1987_Bihar_flood: During this tragic flood event of 1987, that occurred with 28 and 32 lakh cusecs of water, 1399 people and 5302 animals lost their lives and nearly 29 million people were affected in 30 districts, 382 blocks, 6,112 panchayat and 24,518 villages .

To get an appropriate idea, SPI-3 (Fig. 6, 7, 8 & 9) is analyzed and is also depicting the higher value for the month of September and October during 1987.

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So, this study confirms that this over flooding is caused because of excessively high precipitation value for a shorter period of time after following a local short dry event within that wet event 1984 flood could also be analyzed through SPI-24 and SPI-3 for all these four districts. Time series graph of SPI-3 values for 4 districts have been shown in Fig. 6 to 9. Analysis of SPI-3 reveals more fluctuation and shows negative value during September and October period of 1976 in Supaul and Saharsa. But flood event with less magnitude took place in the month of September and October in the year 1976.

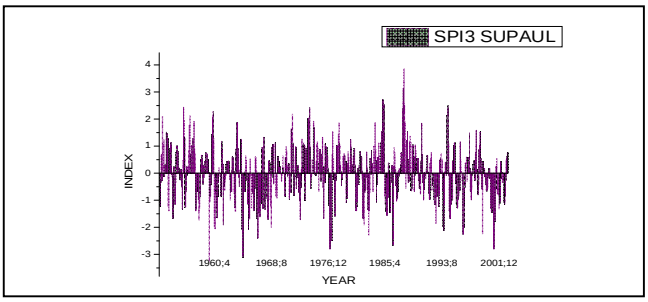

Figure-6: SPI-3 of Supaul District

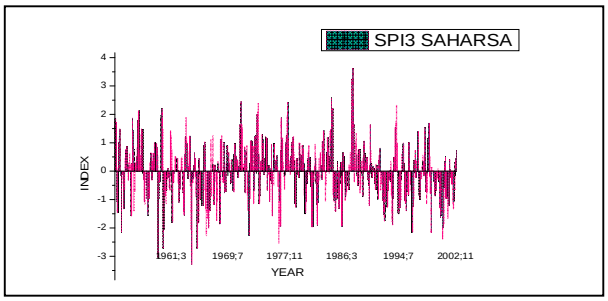

Figure-7: SPI-3 of Saharsa District

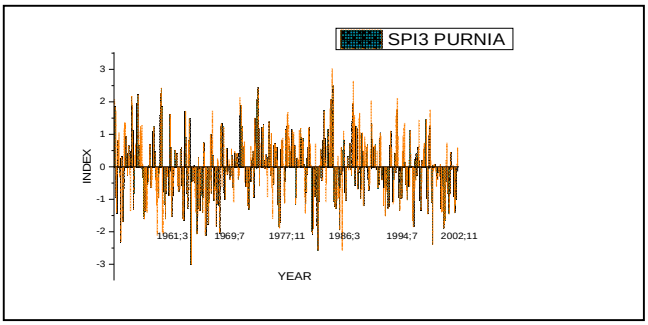

Figure-8: SPI-3 of Purnia District

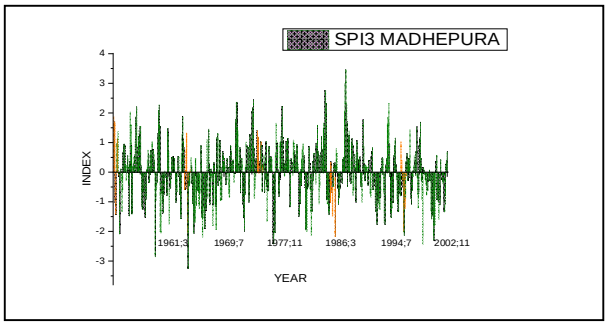

Figure-9: SPI-3 of Madhepura District

Thus it is precise to say from SPI-24 that major annual peak flows occurs during a significant well defined wet period, showing the abundant presence of reservoir water resources, soil water moisture conditions and these are the possible cause of annual peak flows in the area. This tendency is more correct when SPI-3 is analyzed because it strengthens the fact that annual peak flows tend to happen when high values of precipitation occur within a short period following a short dry period.

SEASONAL ANALYSIS

In India, rainfall is primarily more during monsoon months and exhibits high seasonal variability from month to month too. Therefore SPI graphs need to be prepared for monsoon months (Fig. 10 to 25) also. SPI-3 of September better incorporates monsoon months as it ensembles the averaged value of precipitation of July, August and September together. The graphs shown below (Fig. 10 to 25 for all 4 districts) assess the SPI-3 values for South West monsoon months of JJAS (June, July, Aug. and Sept.).

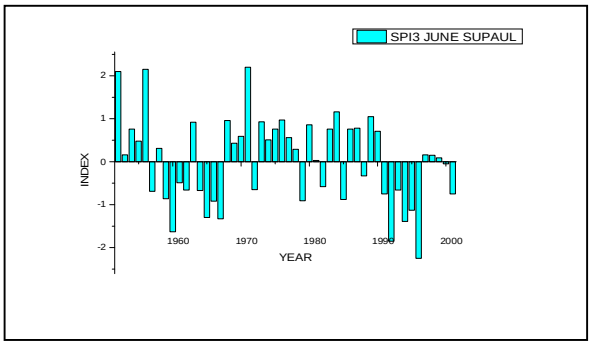

Figure-10: SPI-3 of June, Supaul District

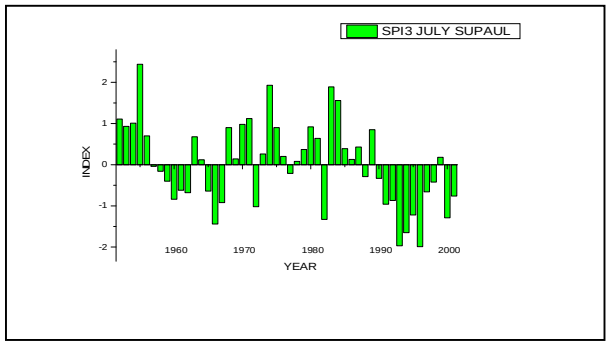

Figure-11: SPI-3 of July, Supaul District

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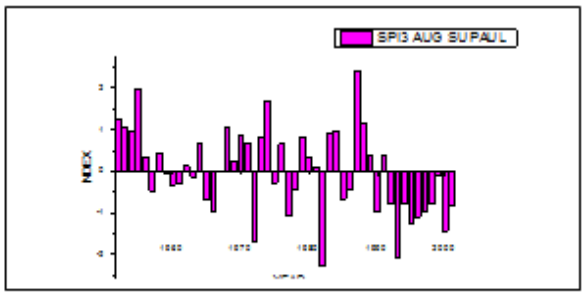

Figure-12: SPI-3 of Aug, Supaul District

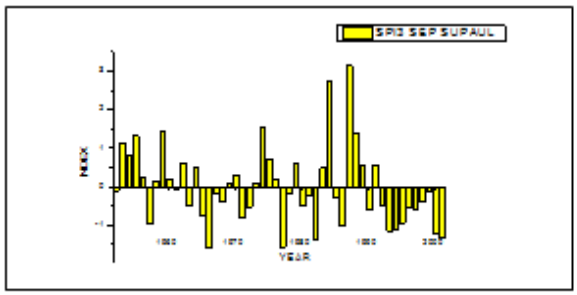

Figure-13: SPI-3 of Sep, Supaul District

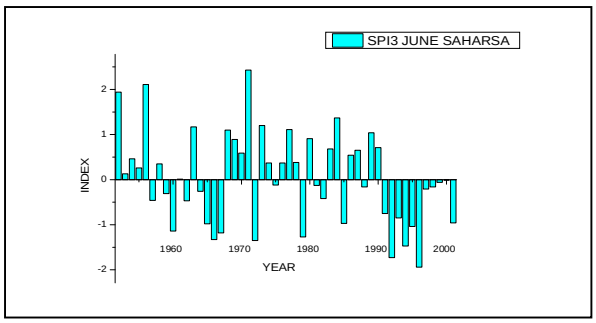

Figure-14: SPI-3 of June Saharsa District

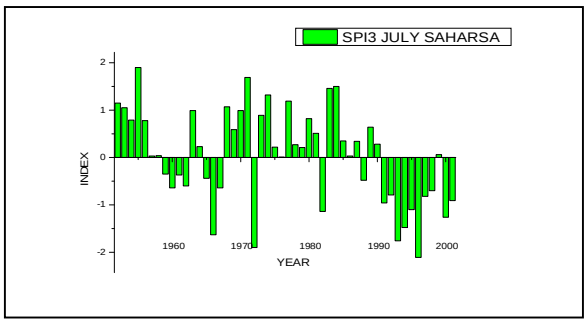

Figure-15: SPI-3 of July, Saharsa District

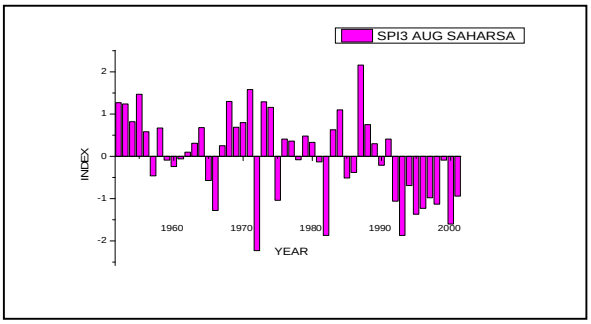

Figure-16: SPI-3 of Aug, Saharsa District

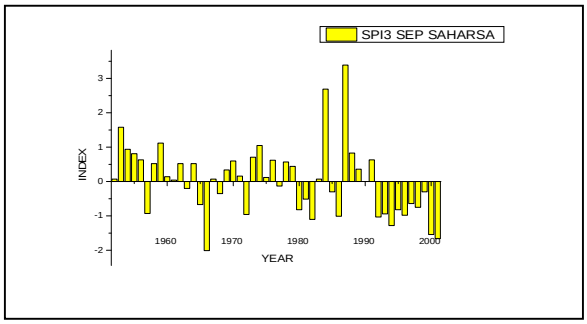

Figure-17: SPI-3 of Sep, Saharsa District

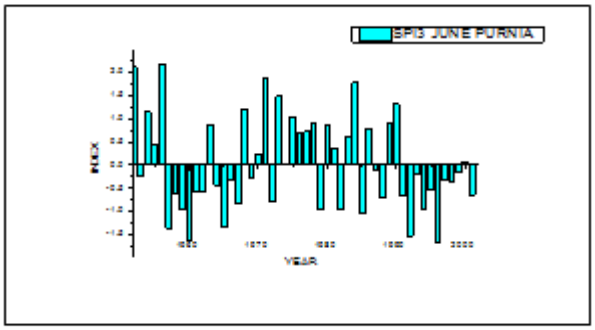

Figure-18: SPI-3 of June, Purnia District

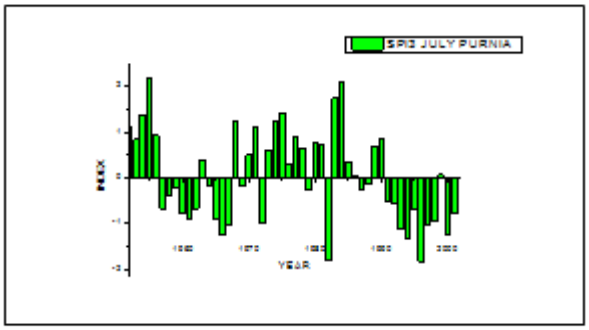

Figure-19: SPI-3 of July, Purnia District

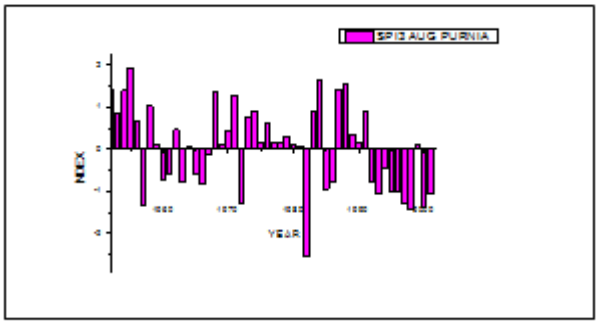

Figure-20: SPI-3 of Aug, Purnia District

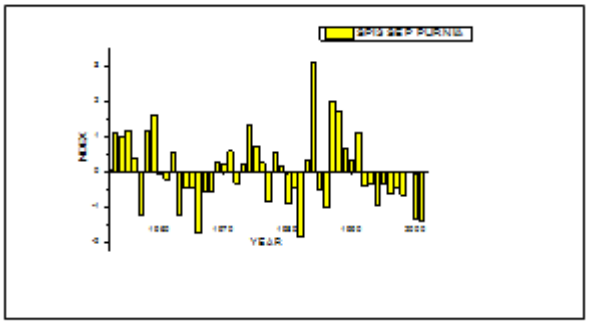

Figure-21: SPI-3 of Sep, Purnia District

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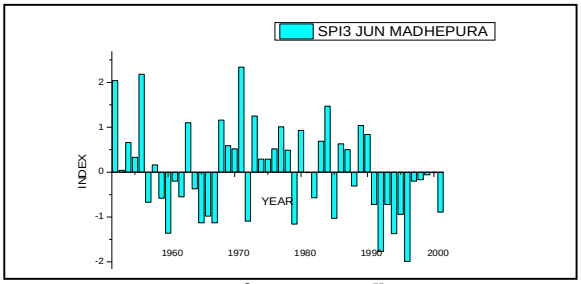

Figure-22: SPI-3 of June, Madhepura District

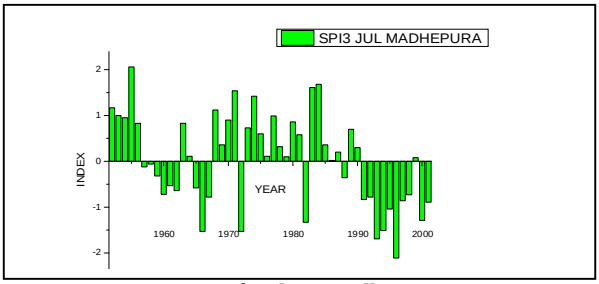

Figure-23: SPI-3 of July, Madhepura District

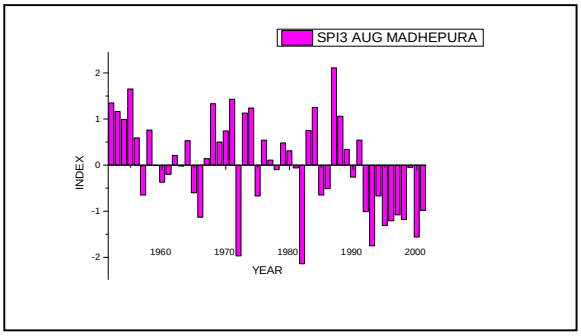

Figure-24: SPI-3 of Aug, Madhepura District

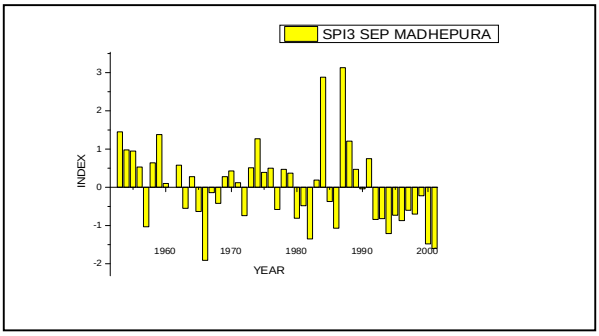

Figure-25: SPI-3 of Sep, Madhepura District

The graphs of SPI-3 for September and August clearly indicate the highest value in the year 1987 for all the stations. Thus it is very evident from the fact that there was worst flood recorded (of 20th century) in the north plains of Bihar during the year 1987 and that too was due to the higher precipitation in the Koshi river catchment of Bihar. As per the report of Flood Management Information System, it is considered as one of the worst floods in Bihar. The graphs clearly depict the major flooding conditions in the years 1954, 1974 and 1984 too. Breaches in embankments, damaged crop and homes provide sufficient evidences of flood in these particular years.

Graphs (Fig. 10 to 25) clearly states that the flood event of 1987 is best shown by SPI-3 graph of August & September months. SPI-3 of June & July months do not yield high index value which clearly states that flood event of 1987 occurred during either (late) August or September, data verifying that it was due to heavy rainfall in August month. Similarly, flood event of 1984 can be seen in SPI-3 of August & September due to continued heavy rainfall in the months of July & August, followed by rainfall in September. Flood period of 1954 is best depicted by SPI-3 of June, July and August months.

The wet spell of 1974 - 1976 when analyzed through SPI-24 yields high positive value. So when SPI-3 of monsoon months of Supaul region is analyzed, flood event in the month of August took place in 1974, while another flood event took place in the month of September in 1976. Through the analysis of longer time scales (SPI-24) one more flood event can be seen in the year of 1993 & 1994 in all four district but SPI-3 of monsoon month is not showing any wet event in these years which is due to the fact that SPI incorporates antecedent Moisture condition and incorporates longer time scales of 24 months for calculation.

In the year 2002, once again a severe flood event took place but the graph out here is not responding to the same. The graph shows either zero or negative values. It is so because this flood actually took place due to heavy precipitation in the Nepal's catchment area of Koshi River, and not in the Bihar region of Koshi basin. Thus, this flood in north Bihar happened due to flow of large amount of water down slope from Nepal to Bihar plains, giving an example of water flow due to topographic gradient from high terrain of Nepal to plain areas of Bihar. This type of flooding events may be missed in SPI graphs.

CORRELATION OF INDICES

The second part of this paper explains about the use of MRAI as an alternative to SPI, since MRAI involves less computation than SPI. So, it has been tried tocompare the performance of MRAI with SPI. The linear regression analysis of MRAI with SPI showed that MRAI values at almost all time scales have very high positive correlation with SPI values at corresponding time scales (Hansel et al. 2015), as shown in Fig. 26, and 27 (shows MRAI at Y axis and SPI at X axis with valid R^2 values), for two districts Supaul & Saharsa of North Bihar and Koshi division respectively.

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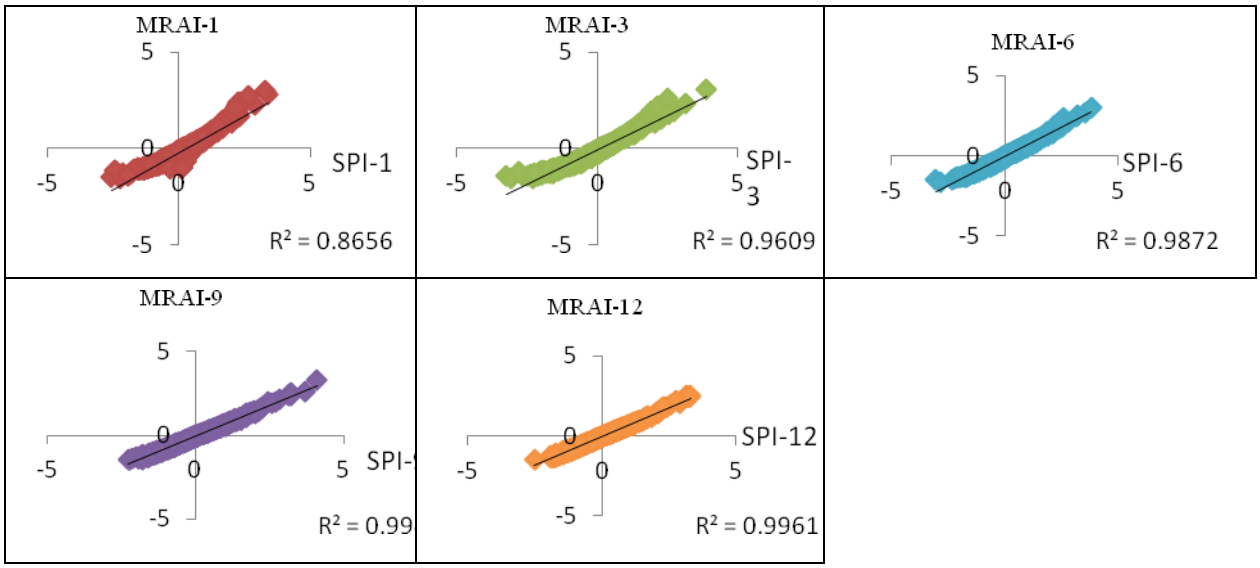

Figure-26: Linear regression plots between MRAI & SPI of Supaul District

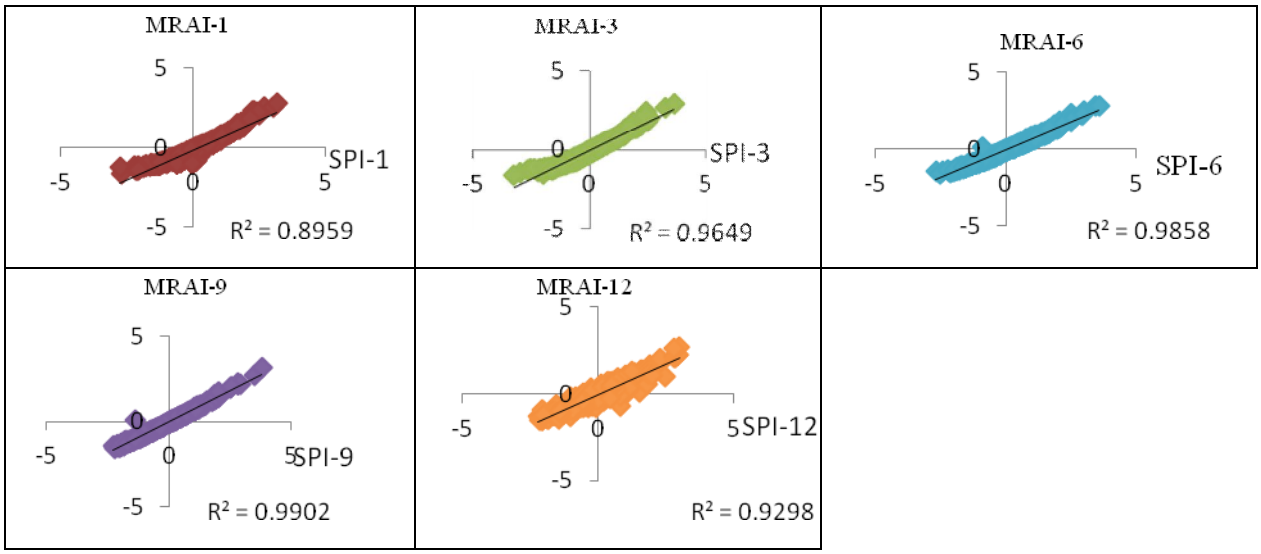

Figure-27: Linear regression plots between MRAI & SPI of Madhepura District

The study reveals that R^2 values (i.e., square of Pearson Correlation Coefficient) are very close to unity. Thus, it can be stated that MRAI can be used as an alternative to SPI. The advantage of using MRAI is that, it does not require the fitting of data into any complex probability distribution function. However, as the indices are region specific, therefore the analysis for a particular region may not yield satisfactory results for other regions too. MRAI & SPI have been better correlated at every time scales in Bihar region do not support the fact that the same trend will be followed in other regions too. Therefore, there is ample future scope of carrying out such studies for other regions too, and then integrating those results for suitable conclusions for a bigger domain. So, it is justified from the fact that MRAI can be used in place of SPI or the result of both the indices can be used to validate the result more precisely.

However, analysis of flood through precipitation event is not enough. Extreme weather, Topography, climatology, soil type and some other factors need to be taken care of (Hayes et al. 1999). It is so worth to mention this point here, because the flooding event of 2002 in Bihar (Supaul region) was not due to heavy precipitation over Bihar, rather due to topographic gradient, down slope from Nepal to Bihar. It was mainly due to heavy precipitation at Nepal's Catchment area of Koshi River. Thus, future studies can include impacts of terrain, extreme weather, etc. in addition to precipitation values.

V. CONCLUSIONS

The results obtained from the present study establish the importance of SPI as an important tool for monitoring flood risk. Essentially, it can be an integral part of flood mitigation program. Calculation of SPI at different timescales also permits the estimation of different antecedent moisture conditions (wet/dry) of the soils. The result also verifies the fact that major flood events are generally associated with the long term wet spells, which

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are diagnosed specifically by SPI-24 and SPI-12. In the present investigation it was found that SPI indicates flood events of Bihar in the years 1954, 1968, 1974, 1984 and 1987 i.e. considered data period of 50 years w.e.f 1953 - 2002 in a precise manner. From this study it was concluded that MRAI values at different time scales are highly correlated with SPI values at corresponding time scales. Linear Regression analysis of MRAI with respect to SPI has shown strong positive correlation between these indices. Thus MRAI can be used as an alternative to SPI. These indices are useful to identify flood spells over a region. On the whole, this study can be useful for flood risk assessment & monitoring over Koshi River basin in the northern plains of Bihar.

Flood risk assessment in advance gives an alarm to the farmers and agro-based industries to prepare themselves to mitigate with this calamity. More scientific study over the region can help the population in mitigation of this natural calamity through powerful and effective policy making of the administration or departments concerned.

Assessment of dry/wet events using SPI can be done in more detailed way over a much broader region. Also other indices can be utilized. Even, new index can be worked on, which can include other factors like terrain, topography, soil type etc., in addition to the precipitation values.

After gaining good confidence in flood risk monitoring, certain information can be provided to central and state Government organizations, Disaster management authorities and other stakeholders for necessary policy decisions for the benefit of affected people in flood-prone regions.

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IMPLEMENTATION OF IOT BASED SMART AGRICULTURE

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ABSTRACT
Agriculture plays the vital role in the development of country. In India about 72% of population depends upon farming and one-third of the nation's capital comes from farming. Issues concerning agriculture have been always hindering the development of the country. The only solution to this problem is smart agriculture by modernizing the current traditional methods of agriculture. Hence the project aims at making agriculture smart using automation and IoT technologies. The highlighting features of this project includes smart GPS based remote controlled robot to perform tasks like weeding, spraying, moisture sensing, bird and animal scaring, keeping vigilance, etc. Secondly it includes smart irrigation with smart control and intelligent decision-making based on right real-time field data. Thirdly, smart warehouse management which includes temperature maintenance, humidity maintenance and theft detection in the warehouse. Controlling of all these operations will be through any remote smart device or computer connected to Internet and the operations will be performed by interfacing sensors, Wi-Fi or ZigBee modules.

Keyword: Smart agriculture, Wi-Fi or ZigBee modules, Cloud Computing.

INTRODUCTION

Cloud computing and internet of things (IOT) are two hot concepts newly emerged since the1960s. They are the hard-core of information technology industry of the new generation. Not long after the President of the United States Barack Obama put forward the concept of "smart planet" in 2009, Premier Wen raised the development idea of "sensing China", which mainly emphasized the development of IOT and strategic new industries . IOT is closely related to cloud computing in a way that IOT obtains powerful computing tools through cloud computing and cloud computing finds the best practicing channel based on IOT.

Most of the papers signifies the use of wireless sensor network which collects the data from different types of sensors and then send it to main server using wireless protocol. The collected data provides the information about different environmental factors which in turns helps to monitor the system. Monitoring environmental factors is not enough and complete solution to improve the yield of the crops. There are number of other factors that affect the productivity to great extent.

These factors include attack of insects and pests which can be controlled by spraying the crop with proper insecticide and pesticides. Secondly, attack of wild animals and birds when the crop grows up. There is also possibility of thefts when crop is at the stage of harvesting. This paper therefore proposes a system which is useful in monitoring the field data as well as controlling the field operations which provides the flexibility. The paper aims at making agriculture smart using automation and IoT technologies. The highlighting features of this paper includes smart GPS based remote controlled robot to perform tasks like; weeding, spraying, moisture sensing, bird and animal scaring, keeping vigilance, etc. Secondly, it includes smart irrigation with smart control based on real time field data. Thirdly, smart warehouse management which includes; temperature maintenance, humidity maintenance and theft detection in the warehouse. Controlling of all these operations will be through any remote smart device or computer connected to Internet and the operations will be performed by interfacing sensors, Wi-Fi or ZigBee modules, camera.

IOT

The central computer can realize concentrated management and control of machine, equipment and personnel based on the internet and improve production and life through more detailed and dynamic means. This is useful for integration and harmony between human society and the physical world and is regarded as the third wave of information industry development following computer and internet. Major IOT technologies include radio frequency identification technology, sensor technology, sensor network technology and internet work communication, all of which have been involved in the four links of IOT industrial chain, namely, identification, sensing, processing and information delivery. IOT is an intelligent technology which includes identification, sensing and intelligence. Life and even intelligence of life itself can also be regarded as part of IOT technology. It is used in pattern identification fields like measurement and computing as well as computer and communication fields like sensing, communication, information collection and processing.

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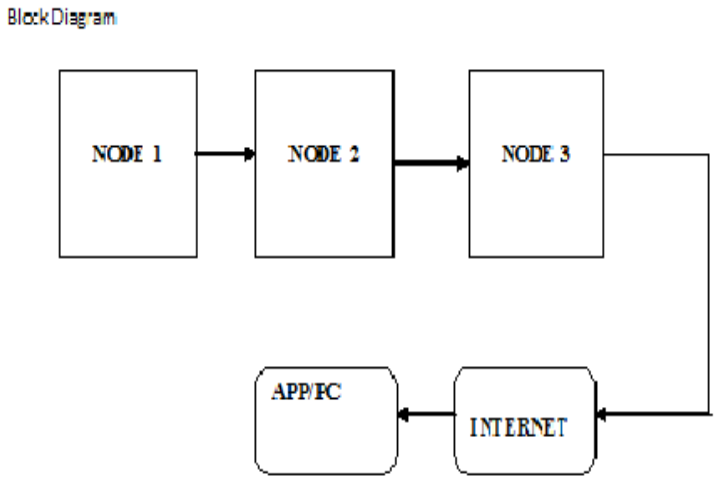
Block diagram

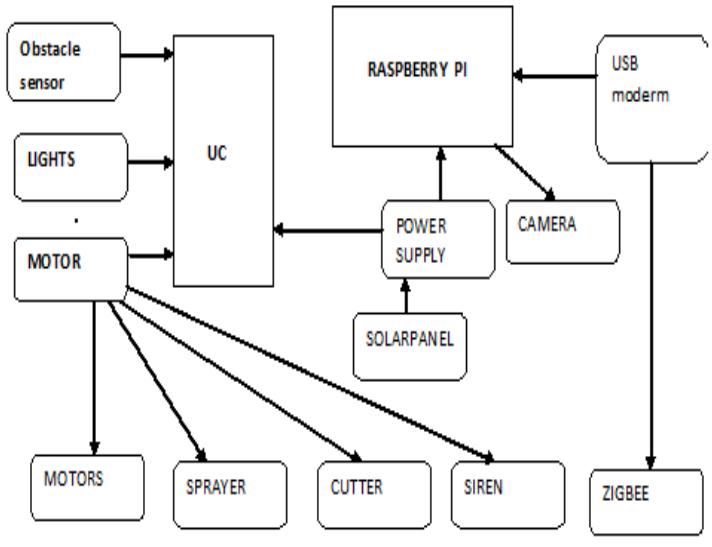


The paper consist of four sections; node1, node2, node3 and PC or mobile app to control system. In the present system, every node is integration with different sensors and devices and they are interconnected to one central server via wireless communication modules. The server sends and receives information from user end using internet connectivity. There are two modes of operation of the system; auto mode and manual mode. In auto mode system takes its own decisions and controls the installed devices whereas in manual mode user can control the operations of system using android app or PC commands.

NODE 1

Node1 is GPS based mobile robot which can be controlled remotely using computer as well as it can be programmed so as to navigate autonomously within the boundary of field using the co-ordinates given by GPS module. The Remote controlled robot have various sensors and devices like camera, obstacle sensor, siren, cutter, sprayer and using them it will perform tasks like; Keeping vigilance, Bird and animal scaring, Weeding, and Spraying.

Node-1: Block Diagram



NODE 2

Node2 will be the warehouse. It consists of motion detector, light sensor, humidity sensor, temperature sensor, room heater, cooling fan altogether interfaced with AVR microcontroller. Motion detector will detect the motion in the room when security mode will be ON and on detection of motion, it will send the alert signal to user via Raspberry pi and thus providing theft detection. Temperature sensor and Humidity sensor senses the temperature and humidity respectively and if the value crosses the threshold then room heater or cooling fan will be switched ON/OFF automatically providing temperature and humidity maintenance.Node2 will also controls water pump depending upon the soil moisture data sent by node3.

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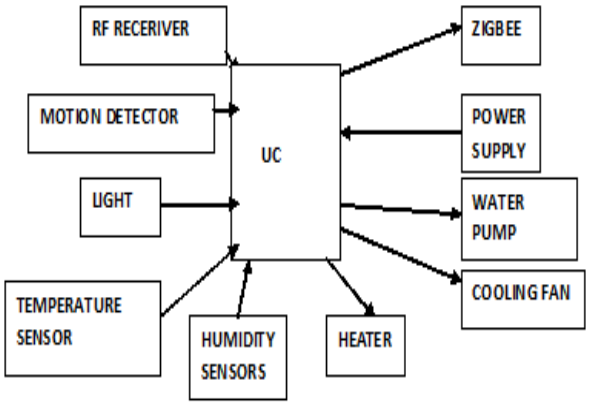
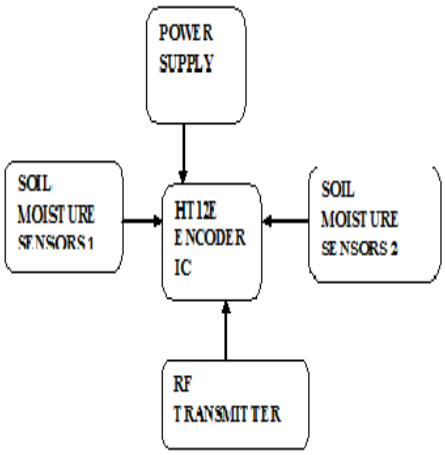
Node-2: Block Diagram



NODE 3

Node3 is a smart irrigation node with features like ; Smart control of water pump based on real time field data i.e. automatically turning on/off the pump after attaining the required soil moisture level in auto mode, Switching water pump on/off remotely via mobile or computer in manual mode, and continuous monitoring of soil moisture.

Node-3: Block Diagram



HARDWARE COMPONENTS

a) AVR Microcontroller Atmega 16/32

The microcontroller used is, Low-power AVR 8-bit Microcontroller, having 8K Bytes of In-System Self-programmable Flash program memory, Programmable Serial USART, 8-channel, 10-bit ADC, 23 Programmable I/O Lines.

b) ZigBee Module

ZigBee is used for achieving wireless communication between Node1 and Node2. The range for Zigbee is roughly 50 meters and it can be increased using high power modules or by using network of modules. It operates on 2.4 GHz frequency. Its power consumption is very low and it is less expensive as compared to other wireless modules like Wi-Fi or Bluetooth. It is usually used to establish wireless local area networks.

c) Temperature Sensor LM35

The LM35 is precision IC temperature sensor. Output voltage of LM35 is directly proportional to the Centigrade/Celsius of temperature. The LM35 does not need external calibration or trimming to provide accurate temperature range. It is very low cost sensor. It has low output impedance and linear output. The operating temperature range for LM35 is −55˚ to +150˚C. With rise in temperature, the output voltage of the sensor increases linearly and the value of voltage is given to the microcontroller which is multiplied by the conversion factor in order to give the value of actual temperature.

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d) Moisture sensor
Soil moisture sensor measures the water content in soil. It uses the property of the electrical resistance of the soil. The relationship among the measured property and soil moisture is calibrated and it may vary depending on environmental factors such as temperature, soil type, or electric conductivity. Here, It is used to sense the moisture in field and transfer it to microcontroller in order to take controlling action of switching water pump ON/OFF. Humidity sensor: The DHT11 is a basic, low-cost digital temperature and humidity sensor. It gives out digital value and hence there is no need to use conversion algorithm at ADC of the microcontroller and hence we can give its output directly to data pin instead of ADC. It has a capacitive sensor for measuring humidity. The only real shortcoming of this sensor is that one can only get new data from it only after every 2 seconds.

e) Obstacle sensor (Ultra-Sonic)
The ultra-sonic sensor operates on the principle of sound waves and their reflection property. It has two parts; ultra-sonic transmitter and ultra-sonic receiver. Transmitter transmits the 40 KHz sound wave and receiver receives the reflected 40 KHz wave and on its reception, it sends the electrical signal to the microcontroller. The speed of sound in air is already known. Hence from time required to receive back the transmitted sound wave, the distance of obstacle is calculated. Here, it is used for obstacle detection in case of mobile robot and as a motion detector in ware house for preventing thefts. The ultra-sonic sensor enables the robot to detect and avoid obstacles and also to measure the distance from the obstacle. The range of operation of ultra-sonic sensor is 10 cm to 30 cm.

f) Raspberry Pi
The Raspberry Pi is small pocket size computer used to do small computing and networking operations. It is the main element in the field of internet of things. It provides access to the internet and hence the connection of automation system with remote location controlling device becomes possible. Raspberry Pi is available in various versions. Here, model Pi 2 model B is used and it has quad-core ARM Cortex-A53 CPU of 900 MHz, and RAM of 1GB. it also has: 40 GPIO pins, Full HDMI port, 4 USB ports, Ethernet port, 3.5mm audio jack, video Camera interface (CSI), the Display interface (DSI), and Micro SD card slot.

SOFTWARES

a) AVR Studio Version 4
It is used to write, build, compile and debug the embedded c program codes which are needed to be burned in the microcontroller in order to perform desired operations. This software directly provides .hex file which can be easily burned into the microcontroller.

b) Proteus 8 Simulator
Proteus 8 is one of the best simulation software for various circuit designs of microcontroller. It has almost all microcontrollers and electronic components readily available in it and hence it is widely used simulator. It can be used to test programs and embedded designs for electronics before actual hardware testing. The simulation of programming of microcontroller can also be done in Proteus. Simulation avoids the risk of damaging hardware due to wrong design.

c) Dip Trace
Dip race is EDA/CAD software for creating schematic diagrams and printed circuit boards. The developers provide multi-lingual interface and tutorials (currently available in English and 21 other languages). DipTrace has 4 modules: Schematic Capture Editor, PCB Layout Editor with built-in shape-based auto router and 3D Preview & Export, Component Editor, and Pattern Editor.

d) SinaProg
SinaProg is a Hex downloader application with AVR Dude and Fuse Bit Calculator. This is used to download code/program and to set fuse bits of all AVR based microcontrollers.

e) Raspbian Operating System
Raspbian operating system is the free and open source operating system which Debian based and optimized for Raspberry Pi. It provides the basic set of programs and utilities for operating Raspberry Pi. It comes with around 35,000 packages which are pre-compiled softwares that are bundled in a nice format for hustle free installation on Raspberry Pi.It has good community of developers which runs the discussion forms and provides solutions to many relevant problems. However, Raspbian OS is still under consistent development with an main focus on improving the performance and the stability of as many Debian packages as possible.

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APP DEVELOPMENT

Mobile is uniquely positioned to bridge the information and financial gap in rural areas. Mobile operators can deliver the critical information farmers need to make better informed decisions and investments that boost their productivity and profit. Through the digitisation of agricultural payments, mobile can also help unbanked smallholder farmers access financial services. The mobile app is developed for various of purpose like weeding, spraying, moisture sensing, bird and animal scaring, keeping vigilance and also to water the crops. This app also indicate the temperature, humidity and theft detection in the warehouse. A mobile app will be intuitive and easy to use, or it will not be used. Spreading agricultural related information to farmers in the poorest communities are made easier with the help of cloud computing, integrated IT systems, online education and proliferation of mobile phones. One of the benefits of such connectivity and information flow is that it helps farmers make better land management decisions.

CONCLUSION

The sensors and microcontrollers of all three Nodes are successfully interfaced with raspberry pi and wireless communication is achieved between various Nodes. IOT is closely related to cloud computing in a way that IOT obtains powerful computing tools through cloud computing and cloud computing finds the best practicing channel based on Smart Agriculture Based on Cloud Computing and IOT Fan TongKe IOT. Agricultural information cloud is constructed based on cloud computing and smart agriculture is constructed with combination of IOT and RFID. Hardware resources in agricultural information network are integrated into resource pool by using vitalization technology, achieving dynamic distribution of resource and balance of load, significantly improve efficiency of resource using.

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MEDICAL DATA COMPRESSION USING WAVELET TRANSFORM FOR TELEMEDICINE APPLICATIONS

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ABSTRACT
The speedy budding signal processing technology in telemedicine field made physician trouble-free in diagnosing the disease. But these advanced medical facilities, still unreachable in some remote areas because the lack of equipments, low bandwidth signals transmission and remote locations. Hence compression technology struggling to solve the problem of transmission rate by reducing the size of data without affecting the signal qualities. The wavelet based compression techniques are well suited for these type applications because of coding flexibility and multiresolution property. This paper presents qualitative analysis of wavelet based compression technique using some telemedicine samples ECG signal and MRI images. The quality of signal is measured by using PSNR.

Keywords: Telemedicine, Biomedical data's, Discrete Wavelet Transform (DWT).

I. INTRODUCTION

Medical facilities and hospitality for peoples in remote areas are still challenging part in medical field. Even more sophisticated computer aided diagnostic devices and ambulatory systems are introduced in urban hospitals which are unreachable for some remote areas [1-3]. But telemedicine for the time being find the limited solution for some diagnostic problem. It is a diagnostic process which allows the specialized doctors of urban hospital can treat patients belongs to any remote area through teleconferences. This communication may use any range of communication technology through internet or telephone line[4,5]. To make this communication uninterrupted and speedy, we have two choices; one is by increasing the band width of communication another one is by compression technology[6]. Compression technology is good choice to increase the speed because increase bandwidth of signal needs more cost[7].

In general, telemedicine data communicated in two ways

1. Store and forward Telemedicine: In this method patient medical data's are acquired and stored then forwarded to the expert doctor. Doctors respond to that within a day or sometimes later.
2. Real time telemedicine: In this method patient medical data are acquired and send to a doctor and doctor respond to that instantaneously. Best example is video conference [8].

Common medical data we are observing in medical centers are Electrocardiography (ECG), Electroencephalography (EEG) and Electromyography (EMG) is non stationary one dimensional signals. Similarly X-ray ,Computer tomography(CT) and Magnetic resonance imaging(MRI) scan images considered as a two dimensional signals. Telemedicine acquired any above type of medical data, either one/two dimensional records have large in size and very susceptible in nature and consumes large bandwidth for data transmission. Possibly it may cause delay in data transmission due to heavy data trafficking in internet [9,10]. Hence we create the medical data into bundles of data packets and encode them with compression algorithm and transmit through channels. Compression algorithm represents a signal samples in a compact form by using less number of code symbols and it resembles original signal with good signal quality, less redundancy and low bit-rate[11]. Hence it is more significant in medical data transmission while exchanging and transmission of large amount of medical information through internet and wireless system with minimum size, increased speed. Based on reconstruction it was classified as lossy and lossless coders. Based on medical data types compression algorithms are varied[12]. For MRI, ECG signals lossy compression is enough but for EMG, CT scan signals needs lossless compression algorithms. Transform based compression algorithms are widespread coders in most of medical signal processing due to its versatile nature of data processing. Moreover Wavelet transform based compression is user friendly compressor tool for medical image processing due to its multiresolution property of signal analysis[13].

The focus of this paper is only on wavelet compression method limited with discrete Wavelet transform without giving historical review on medical data, telemedicine and wavelets. Scope of this paper is on Wavelet compression method for only two types of medical signals.

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II. SELECTED MEDICAL SIGNALS

a. ECG

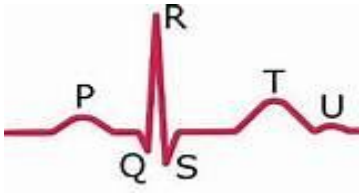

Fig-1: ECG signal

It's a simple graph which maps human cordial electrical activity due to polarization and depolarization of cardiac tissues. The ECG signal consists P, Q, R, S, T and U waves (P=0.11sec, 3mm height, Q, R, S=0.10sec, 5mm height, T&U=0.09sec, 2mm height). Measure ECG signal in monitoring mode and diagnostic mode. Monitoring mode uses low pass filter (LPF) with frequency 0.5 to 1HZ for power line noise reduction and high pass filter (HPF) with 40HZ frequency for baseline reduction respectively. In diagnostic mode LPF with 40-150HZ and HPF with 0.05HZ is used. Measured data considered as 1 dimensional signal. This feature needs to be extracted to compress the original signal [14].

b. CT Scan images

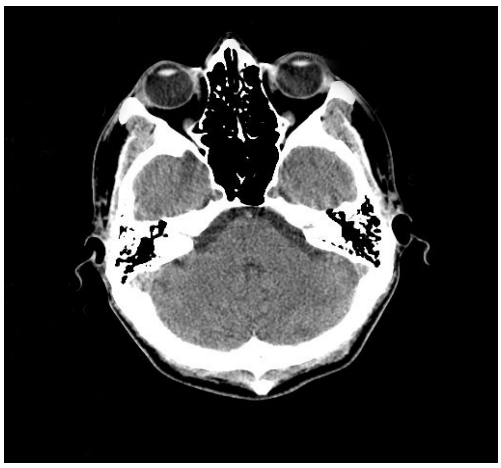

Fig-2: CT scan image

The CT scanner uses digital geometry processing to generate a 3-dimensional (3-D) image of the inside of an object. The 3-D image is made after many 2-dimensional (2-D) X-ray images are taken around a single axis of rotation - in other words, many pictures of the same area are taken from many angles and then placed together to produce a 3-D image. For each CT scan hundreds of X-ray image datasets has been taken is filtered them for back projection step. Back projection is method of adding each X-ray filtered dataset contributed to each pixel at the reconstructed images [15].

III. WAVELET COMPRESSION METHOD

Wavelet transform discretize the signal from time domain to time frequency domain by passing through the filters with different cutoff frequency at different scale.

For a discrete signal of s(n), n=0,1,2,.. M-1. DWT defined as,

$$w_{\emptyset}(j_0,k) = (1/\sqrt{M})\sum_n s(n)\emptyset_{j_0,k}(n) \quad (1a)$$

$$w_{\varphi}(j,k) = (1/\sqrt{M})\sum_n s(n)\varphi_{j,k}(n) \quad (1b)$$

Ø,Ψ = scaling and wavelet functions,

j_0 ,j, k =scaling and shifting parameters($j \geq j_0$).

Similarly for Inverse DWT (IDWT):

$$s(n) = (1/\sqrt{M})\sum_k w_{\emptyset}(j_0,k)\,\emptyset_{j_0,k}(n) + \sum_{j=j0}^{\infty}\sum_k w_{\varphi}(j,k)\varphi_{j,k}(n) \quad (2)$$

In general, Wavelet based compression algorithm contain main four blocks wavelet decomposition and Feature extraction then compression and reconstruction as shown in **fig. 3** [16].

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1. **Decomposition:** Wavelet decomposition explores the structured frequency sub bands from source signal by passing source through a set of low pass and high pass filter. After wavelet decomposition signal is divided into bundles of approximate and detailed wavelet coefficients. Method of Wavelet decomposition varies based on types of image, either pyramidal or packet decomposition. In packet decomposition filters applied for both approximate and detailed coefficients to get binary tree. In pyramidal, decomposition applied vertical, horizontal and diagonal to get coefficients [17]. Increase the filtering level sufficiently to get required number of coefficients.
2. **Feature Extraction:** It performs information classification process. Here the decomposed wavelet coefficients are used to partition and store only significant coefficients and neglect coefficients with less significant. The detailed coefficients are stores only edge information and it is not so important for reconstruction hence we can omit this sub bands during reconstruction.
3. **Compression:** Here we apply thresholding method to reduce the number of coefficients. wavelet coefficients are scanned with fixed threshold value. There are two approach in threshold they are hard and soft, in hard threshold it retains coefficients above threshold value and remain coefficients are made zero.

$$T_{hard}(x) = \begin{cases} x, |x| \geq \lambda \\ 0, |x| < \lambda \end{cases} \quad (3)$$

In soft threshold shrinks the coefficients to absolute values of threshold otherwise made zero

$$T_{soft}(x) = \begin{cases} x - \lambda, x \geq \lambda \\ x + \lambda, x \leq -\lambda \end{cases} \quad (4)$$

We may used to apply any threshold for detail coefficient refines the signal and reduces the coefficients in reconstruction.

4. **Reconstruction:** It uses inverse discrete Wavelet transform, just converse to the Wavelet decomposition.

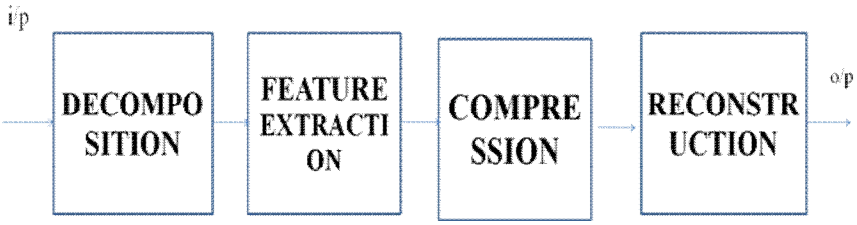

Fig-3: General Block in Wavelet compression

IV. EVALUATING PARAMETERS

There are several evaluation parameters found in practice, but for simplicity we chose three parameters to study the compression process. They are as follows,

a. Mean Square Error(MSE)

$$MSE = \frac{1}{n \sum_{i=1}^{n} error^2} \quad (5)$$

Where, n= signal length

b. Peak Signal to Noise Ratio(PSNR)

$$PSNR = 10\ log_{10}\left[\frac{R^2}{MSE}\right] \quad (6)$$

Where R is bit stream of input signal.

c. Compression ratio(CR)

$$CR = \frac{x}{x'} \quad (7)$$

Where X=length of original signal, X'=length of compressed signal [18].

V. SIMULATION RESULTS AND DISCUSSIONS

Most common medical data communicating in Telemedicine are ECG and CT scan images hence we chose these two data set. Two standard ECG and CT scan medical data sets are used to evaluates the performance of Wavelet compression method. Table.1 shows the PSNR and CR values of ECG signal using DWT method. Fig.

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4 shows Compression ratio graphical analysis of DWT method for different test signals of ECG. Simulated signals of ECG test_1 are shown in Fig.5 and 6.

Table-1: DWT analysis for ECG signals at level3 decomposition.

ECG signals	Bit-rate Kbps	PSNR(db)	CR
Test_1	16	55	0.75
Test_2	16	62	0.83
Test_3	16	79	0.86
Test_4	16	69	0.85
Test_5	16	52	0.98

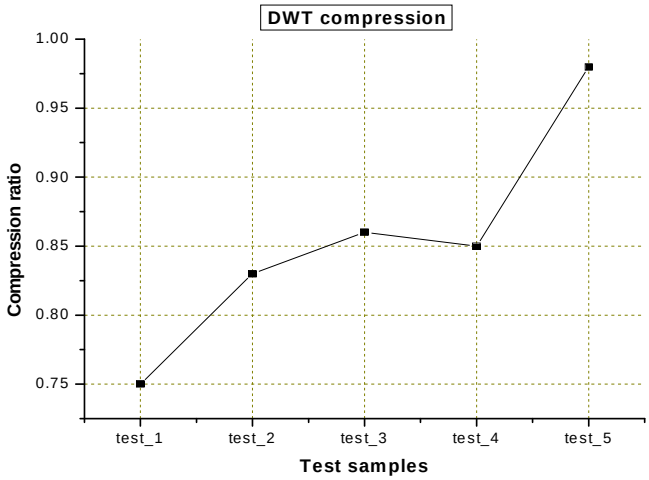

Fig-4: Compression performance of ECG test samples at different compression ratio

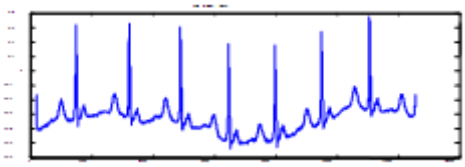

Fig-5: original ECG signal

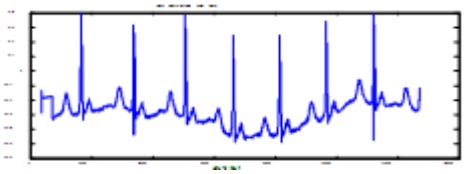

Fig-6: Reconstructed signal from DWT

Like wise for two dimensional medical data as CT_scan image we applied universal wavelet compression method, PSNR and CR is measured with different levels and Bit per pixels are shown in Table.2.

Table-2: DWT, PSNR & CR analysis for CT_Brain image at different decomposition levels.

Test Image	Levels	BPP	PSNR(db)	CR
CT_Brain	2	1	41.2	0.23
		0.5	36.4	0.46
		0.1	32.07	0.75
	3	1	46.33	0.20
		0.5	39.54	0.39
		0.1	34.22	0.72
	5	1	42.4	0.29
		0.5	35.4	0.57
		0.1	31.90	0.82

Approximate and detailed images using Pyramid decomposition of CT image at level two are shown in Fig. 7. Fig.8 shows the reconstructed image by using DWT at level1, level2 and level5.

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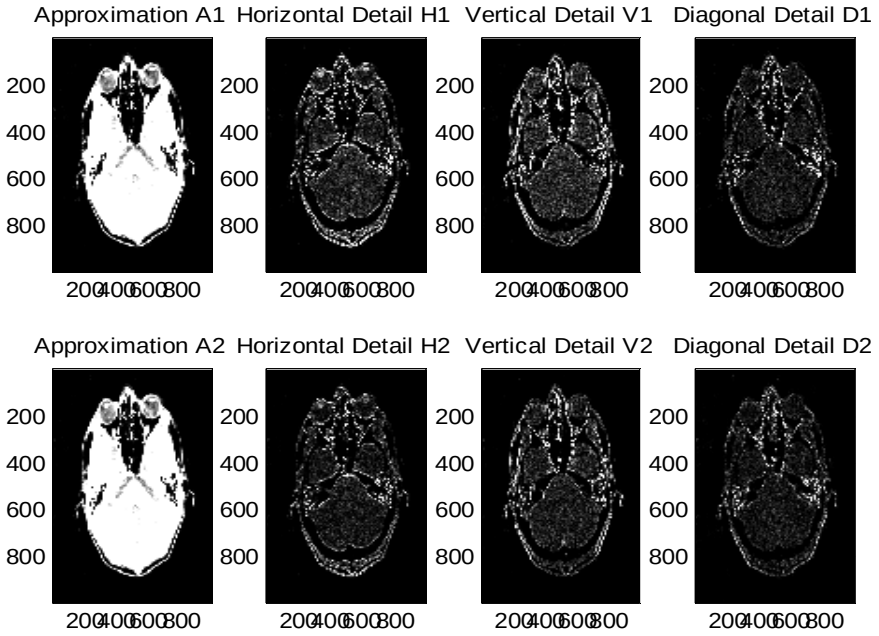

Fig-7: pyramidal decomposition Approximate and vertical, horizontal, diagonal detailed coefficients

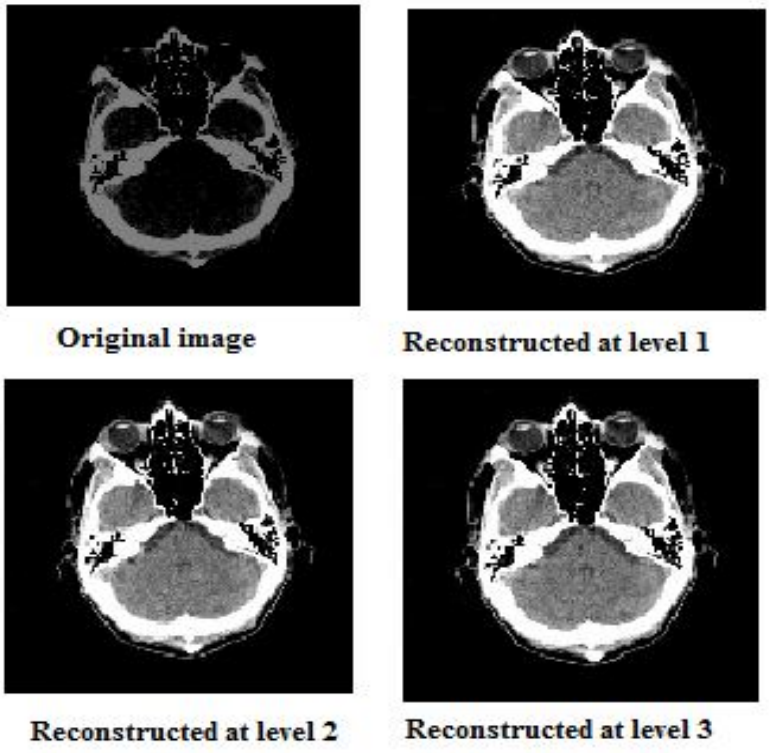

Fig-8: Reconstructed signal by level1, level2 and level5 decompositions

From the above results and discussions the wavelet compression method has a great choice for medical data compression at required bit rates. Low bit rate transmission facility in wavelet compression method make it to fit in Telemedicine applications also.

VI. CONCLUSION

The simulation results and discussions the Wavelet compression techniques have an opportunity to tune the bitrates during data transmission. In Telemedicine application, compression technology is bounded with bit-rate transmission and PSNR quality is a tradeoff between these parameters. DWT coding techniques are simple lossless coding optimized for decomposition level of 2 to 5 with debauchees family to get better results in ECG compression with high signal quality. This method is also used for CT scan image compression. DWT achieves high signal quality with good PSNR, CR at defined bit per pixels.

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PERCEPTIONS OF A MIND IN ASYLUM: A GUIDE TO MENTAL HEALTH MANAGEMENT

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ABSTRACT
Clifford Whittingham Beers (1876-1943) in his book A Mind That Found Itself had explained what it was like to be institutionalized at a time when mental illness received little attention or respect. This paper focuses on the perceptions of Beer's mind who was the former mental patient for three years. It is the own story of Beers, who was one of the five siblings, who all suffered some mental and psychological distress and all were admitted to mental institutions at one time or another and died there, including Beers himself (Beers, 1980). The article aimed to attempt to understand the functions and status of mind in mental distress. Beers' book A Mind That Found Itself was critically analyzed and review was interpreted. Beers wrote the book after his own confinement and gained the support of the medical profession and was a leader in the mental hygiene movement. It has been an inspiration to many mental health professionals in their choice of a profession. It also did much to help the rest of the world to see mental health issues as a serious disease. He promoted mental health and improved institutional care on national and international level and challenged the stigma of mental illness. He urged on guidance and counseling. He brought a major change in the attitudes of people towards mental health. The story starts from his home where his mind instigated him to commit suicide. After his suicide attempt he was admitted to the four asylums one after another for more than three years. In asylums he was mentally very conscious and active about the incidents and happenings which were occurring around his surroundings. He is said to be mad or mentally ill but his mind was active and conscious about his rights. As the time spent, He was later confined to another private hospital as well as a state institution. During the period of his treatment he had a bad experience of misbehavior and witnessed serious maltreatment by the hospital staffs end.

Keywords : Misbehavior, asylum, physical abuse and mental distress

INTRODUCTION
A Mind That Found Itself is the own story of Beers, who was one of the five siblings, who all suffered some mental and psychological distress and all were admitted to mental institutions at one time or another and died there, including Beers himself (Beers, 1980). The story starts from his home where his mind instigated him to commit suicide. After his suicide attempt he was admitted to the four asylums one after another for more than three years. In asylums he was mentally very conscious and active about the incidents and happenings which were occurring around his surroundings. He is said to be mad or mentally ill but his mind was active and conscious about his rights. As the time spent, He was later confined to another private hospital as well as a state institution. During the period of his treatment he had a bad experience of misbehavior and witnessed serious maltreatment by the hospital staffs end. In 1900 he was first admitted to a private mental institution for depression and paranoia after his attempt of suicide because he thought his life meaningless. His ultimate recovery was a triumph of the human spirit. After releasing from the asylum he wrote his whole experience in this book.

Beers, the founder of The National Mental Health Association has put his experience and inner feelings in a pan before the world to feel the originality of an asylum. An insane psychology has been described in a heart touching way. He beautifully and gradually opens the doors of readers' mind to understand mental process and compels to think about sound mental health. He has unveiled this issue from the darkness and instigates to reform the mental health policies.

BEERS EARLY LIFE
This is an autobiography of a young person, Beers who supposed to be an insane. Beers was born in New Haven, on March 30, 1876. He graduated from Yale University's Sheffield Scientific School in 1897. The next three years after his graduation, he spent on working as a clerk in New York City, gradually, he became anxious and distressed. In June 1900, he returned to his home and tried to suicide by jumping out of his bedroom window. During the period of his recovery in the hospital from these injuries, he experienced of hallucinations and paranoia. His family decided to place Beers in an institution for the care of the mental illness. Later He was confined to four different asylums in more than three years, where he was physically abused by the doctors and attendants. Actually, he was suffering with psychological distress and he had delusions and false voices that continued to annoy him for earlier two years in asylums. These false voices used to instigate him to think wrong. Initially he took everybody as a spy or policemen and asylum as a jail and assumed to be punished for

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the crime of attempting suicide. He refused to recognize his brother and relatives and he thought they are spy or government people who come to see him to give more punishment for his crime. He had as sharp memory as he could remember each and every small incident with date, place and time. In asylum, he was abused brutally-chocked, dragged, naked, beaten and put in strait jacket without any reason by the attendants. He was given electric shock too. He was kept deprived of meetings his daily needs end. He was kept without clothes in bitter cold as a punishment.

INTELLECTUAL AND LOGICAL MESSAGE OF THE LETTER

After two years in the asylums when his false voices disappeared, he started trusted in people. He managed beautifully to write a letter to his brother in state of so-called madness-

AUGUST 29, 1902.

DEAR GEORGE:

On last Wednesday morning a person who claimed to be George M. Beers of New Haven, Ct., clerk in the Director's Office of the Sheffield Scientific School and a brother of mine, called to see me.

Perhaps what he said was true, but after the events of the last two years I find myself inclined to doubt the truth of everything that is told me. He said that he would come and see me again sometime next week, and I am sending you this letter in order that you may bring it with you as a passport, provided you are the one who was here on Wednesday.

If you did not call as stated please say nothing about this letter to anyone, and when your double arrives, I'll tell him what I think of him. Would send other messages, but while things seem as they do at present it is impossible. Have had someone else address envelope for fear letter might be held up on the way.

Yours,

CLIFFORD W.B. (Beers, 2004. pg. - 29)

REACTION OF BEERS' BROTHER

After receiving this letter his brother came with the letter to meet him next week and shown him the letter and said here is my passport. The very moment Beers casted a sight on his letter in the hands of his brother, everything changed in his mind. His all untruth suddenly became truth. The thousands of false impressions recorded during the two years of the depression seemed at once to correct themselves. His old world again became his own world. He was happy. He felt at last his mind seemed to have found itself from the huge web of false voices and beliefs after two years. Now he immediately recognized his delusions. The extreme problem of mental torture removed away by the mere glance of a willing eye is like a miracle. There are many patients who are suffering from some kinds of mental disorders, regain a high degree of insight into their mental status. The author termed this mental change as a flash of divine enlightenment. Now he had new power to reason correctly on some subjects simply marked the move from depression, one phase of his disorder, to elation, another phase of it. But in view of asylum, he was as mentally disordered as before.

CHANGES OCCURRED WITHIN BEERS

Now he is normal man and he desired to read literature, to draw paintings and to write his inner feelings but he was deprived with stationary in the asylums. He knew his rights as a patient and fought several times for that. Even he fought in favor of other patient's rights and made them known about the values of human rights and continued to demand but he was also deprived of food and water and got brutal assaults by three or four attendants at a time. He used to write and draw on the walls of asylum in absence of stationary. He was behaving normal and continuously fighting for human rights. He protested against misbehavior of attendants by not taking food and medicine. His fights of necessities were interpreted to be more violent and more insane to his relatives and he was beaten, thrashed many times and kept in more violent ward for more brutal punishment. His brother was not able see his brother's pain and he made him admitted in another asylum where he was misbehaved and assaulted many times by the authorities of the institution. Here too he fought for his right and continuously demanded for books to read, pencils to draw and copy to write. At the beginning days of the institution he was given some books. He red it again and again all day long and his mind became more conscious about his surrounding happenings.

HOW MIND WORKS

Now his mind was working like a spy. Now his mind wanted to investigate and reveal the real picture of asylums before the government and public. In view of enquiring and inspecting the real suffering of violent ward, the author knew that what to do for reaching to the violent ward. He played tricks of attempting suicide to

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go there and closely observed the each and every thing happening there. He was showing himself self-controlled and self-respect like a sound man and had gone on a silent revolution. He threatened the authority to change the system of abusive in every institution of the world. He was a normal man between insane people but he was behaved as mad man and assaulted. He wrote many letters to friends and relatives to seek support for his physical suffering but the institutions' authorities did not dispatch his letters. He informed the governor of the state about the abusive treatment of patients with cruelty of the attendants. He asked the governor to interfere into the matter to reform the system of treatment, which was being followed in the country. It was of no result from the governors' end. He was released from the asylum. He returned to his previous job and started working like a normal man. After few months his brother convinced him to admit in the asylum for better treatment. In 1905 he left the asylum and completed the book A Mind That Found Itself.

He wrote about his life in the mental institutions and suffering of mental patients just after his returning from the asylum. The book boosted a strong energy and helped to start the mental health movement in the United States. The brutal practices had slowed down his recovery.

MOTIVATION FOR ALL

Beers' book *A Mind that Found Itself* is an inspiration to many mental health professionals, counselors, teachers and parents. It also did much to help the rest of the world to see mental health issues as a serious matter. *It* is an excellent work for anyone seeking to better understand, or treat, mental illness. His dramatic suicide in asylum for inspecting most violent ward opens the door for the minds of readers to stand against abuses of human beings. His mind worked so wisely to know the secret inhuman treatment procedures being followed in the most violent ward of the institutions. His mind worked in proper manner as a spy. His behavior was normal and he seemed to be intellectual even then forced to be in mental hospital. The doctors knew that he was in excited mental health but never tried to understand or judge the degree of excitement or up to what extend his mind is working properly. This works as a great guidance to doctors, attendants and people related to mental health how to treat and behave with a person with mental distress. Mentally distress people need a good friend to express their feelings, emotions, their pain and pathos to reduce their sufferings for example- the author desired to have a friend as books, papers, pen and pencils to express and share his emotions and his feelings by drawing, reading and writing.

CONTRIBUTION TO LITERATURE AND PSYCHOLOGY

This book has great contribution as an autobiography in English literature and as the history of mental health in psychology. The events have been described in such a manner to feel the events happening just before the eyes. Even a small event has been given the due care to explain the situation. The dialogues and conversation are arranged systematically. Literally the works of beers may be kept among the category best literature. It has also contributed to the world of psychology and provided the psychologist to understand the mental health issues.

TITLE OF THE BOOK AND THE THEME

The tittle of the book is very appropriate and wholly suits to the story to forward the message, aims and objectives of the author. Finally, his mind found itself from the huge web of false voices and beliefs of his depressed mind. This book is a direct attack on mental institutions of the world. It gives the message how to handle a difficult subject like mental distress. Those persons are lucky enough who get kind, careful and proper treatment to their mental distress. If doctors and attendants treat one politely then it is not difficult to prove oneself having a sound mind as happened with Beers at the end, he took no medicine except mild tonics but only the kind behavior of the doctors and the attendants made him prove himself mentally healthy. Sometimes people become mentally unbalanced because of being prolonged loneliness. They need friend, sympathy, love and especial care to cure by the surrounding persons not hate or brutal assaults as Beers got.

MAJOR ACHIEVEMENTS OF BEERS

After the publication of A Mind That Found Itself (1908), an autobiographical account of his hospitalization and the abuses he suffered he attracted the attention towards the managements of mental health. The book A Mind that Found Itself has been an inspiration to many mental health professionals. He promoted mental health and improved institutional care on national and international level and challenged the stigma of mental illness. He urged on guidance and counseling. He brought a major change in the attitudes of people towards mental health. His efforts to improve the Institutional challenges before the stigma of mental health gained a lot of support of the medical practice and became the leader in the mental hygiene movement. He founded the first outpatient mental health clinic in the United States. In 1930, he organized the International Congress for Mental Hygiene in Washington, DC, attended by representatives from 53 countries. The meeting launched international reform efforts and led to the path of the development of the International Committee for Mental Hygiene. Yale University awarded him with an honorary degree for his contributions in humanity and mental health in 1933.

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Beers was Honorary President of the World Federation of Mental Health. Beers became the leader in this field till his retirement in 1939. Beers became overwhelmed and depressed while fundraising for the organization. In 1939, he committed himself to Butler Hospital in Providence, Rhode Island, where he took his last breath four years later. Beers got great name and fame during his lifetime for his pivotal role in the mental health movement. In 1950, the International Committee merged with the National Mental Health Foundation and the Psychiatric Foundation. Today this International Committee is popularly known as Mental Health of America, the organization is working on Beers' mission to raise awareness and promote the high standards in mental health services.

CONCLUSION

As a result of the above discussion, it may be concluding that Beers opened the eyes of the world of misbehavior and mistreatment of mentally unhealthy people. We need to improve mental health care and fight for physical or mental abuses. India is also very much serious about the issues and Indian parliament has passed the Mental Health Care Bill, 2016, which provides for healthcare and services to people with mental illness and decriminalizes suicide. It allows a mentally unhealthy person to have the right to restrict release of information with respect to the illness and make complaints about deficiencies in provision of services.

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CULTIVATING MULETHI (GLYCYRRHIZA GLABRA LINN) IN HARYANA: AN AGROECOLOGICAL APPROACH

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ABSTRACT
Mulethi can be cultivated in semiarid and average fertility areas. A major part of Haryana lies in semiarid region with marked seasonality. Many farmers in the state are already commercially cultivating this plant. Therefore, this plant can be suitably adopted in Haryana and supplement farmers' income. Market demand mulethi and its products is also growing consistently. It provides opportunity for further expansion of the cultivable land under this plant. Marginal areas, not being used for the cultivation of any other crop may also be suitably used for its cultivation. Irrigation facilities in the state are also well developed. These factors make Haryana agroecologically suitable of cultivating this plant. In the present research agroecological approach has been adopted for scientific investigation of the areas as well as agricultural condition which support the cultivation of this plant. The basic assumption underlying this approach is that every region with its unique natural and geographic conditions has potential to supports different species and varieties of crops and plants. These potentials should be properly understood and utilised for the benefit of society and natural environment. In the present paper, agroecological conditions (climatic, pedological and agricultural) of cultivating mulethi in Haryana have been studied. For this purpose agroecological requirements or sets of potentials and constraints (land, soil and environmental characteristics) for the cultivations of mulethi have been used to identify zones/regions of varying suitability in GIS environment using IDW interpolation method of spatial analysis kit in ArcGIS 10.3 software. This exercise has yielded four zones of different levels of suitability on the basis of average expected yield of the plants in different locations of the state. Around 40 percent area of the state has been found to be more than just suitable for the cultivation of this plant. Even the less suitable area for its cultivation constituting around 54 percent area of the state may be profitably brought under cultivation after some technological intervention and timey irrigation.

Keywords: Agroecological approach, Agroecological regions, Agroecological zones, Crop suitability, mulethi cultivation, Aromatic plants cultivation

INTRODUCTION
The approach of agroecological zoning includes identification and demarcation of suitable zones based on agricultural resources superimposed upon natural conditions of the area. An agroecological zone may be defined as the land unit carved out of agroclimatic zone superimposed on agricultural resources and landforms which act as modifier to climate, moisture availability and length of growing period. It is a homogeneous land unit in terms of climatic conditions, length of growing period (LPG), soil properties, agricultural resource development, and physiographic conditions which are suitable for certain group of plants (Food and Agriculture Organization FAO 1978, FAO 1983, Martin and Sauerborn 2013:7). The approach of agroecological zoning is very useful in the "identification of areas with specific climate, soil, and terrain conditions which control the cultivation of different crops and plants; estimation of the extent of rain-fed and irrigated cultivable land and crops; potential for their expansion; estimation of crop production and yield; evaluation of land potential for crops cultivation and diversification; regional impact and geographical shifts of agricultural land and productivity; determining plant suitability for optimization of land use; study of potentials and implications for food security resulting from climate change and variability" (Fischer *et al.* 2006, Gliessman 215:18). The present research has been encouraged to search for suitable regions for the cultivation of *mulethi* in the state of Haryana because of opportunities offered by the method of agroecological zoning and problems of environmental degradation, climate change, and agricultural losses which have threatened food security and environmental sustainability in the state.

There are different methods and schemes of determining agroecological zones for different crops, plants and regions. The FAO (1978) used mean growing period temperature and length of growing period; determined by annual precipitation, potential evapotranspiration and the time required to evapotranspire 100 mm of water from the soil profile to demarcate world into different agroecological regions. The Consultative Group on International Agricultural Research-Technical Advisory Committee, CGIAR-TAC, has demarcated agroecological zones on the basis of mean annual and growing period temperature, and length of growing period and determined the same as in the case of FAO zonation scheme (Sivakumar and Valentin 1997). For the purpose of identifying different agroecological zones, the Global Agro-ecological Zones GAEZ uses

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temperature, precipitation, potential evapotranspiration and soil characteristics (Fischer *et al.* 2012). The Harvest Choice Agro-ecological Zone, HCAEZ uses mean temperatures, elevation, and GAEZ-LGP to define thermal regimes and temperature seasonality. The agroecological zoning scheme of the Global Land Initiative GLI includes harvested area of target crop, crop-specific GDD and soil moisture index calculated as actual evapotranspiration divided by potential evapotranspiration (Mueller *et al.* 2012). The Global Environmental Stratification GEnS uses four variables (growing degree days GDD with base temperature of 0 ℃, an aridity index, evapotranspiration seasonality and temperature seasonality) and iso-cluster analysis to 'cluster' grid-cells into zones of similarity (Metzger et. al. 2013, Warta *et al.* 2013).

This approach is also being increasingly adopted in India for demarcating areas on the basis of their suitability to different crops. Murthy and Pandey (1978) delineated agroecological regions of India. Subramaniyam *et al.* (1984) have demarcated agroecological zones of Maharashtra. Chowdhary *et al.* (1989) divided West Bengal into different agroclimatic zones. Recently use of remote sensing and GIS has greatly helped in the process of identifying agroecological zones and suitable areas for the cultivation of crops. The Indian Council of Agricultural Research (ICAR) and National Bureau of Soil Survey & Land Use Planning (NBSS & LUP) have divided the country into 20 agroecological regions (ICAR NBSS & LUP 2015). Gajbhiye and Mandal (2000) studied agro-ecological zones of India in terms of their soil resource and cropping systems. Raina and Koul (2011) studied impact of climatic change on agro-ecological zones of the Suru-Zanskar valley, Ladakh (Jammu and Kashmir), India. Zaidi (2011) studied agroecological suitability of cultivating select medicinal and aromatic plants in the state of Haryana, India.

Plants/crops yield and soil productivity in terms of the production of herbage, fruits, grains, roots and oils is the combined result of climate, soils, farm inputs and management practices in agricultural system has been the basis of identifying suitable agroecological zones of various levels (Shekara *et al.* 2016: 2). In the present analysis also, expected yield (calculated for selected locations of the state) of *mulethi* has taken as the sole criterion of determining agroecological zones of *mulethi* cultivation in the state of Haryana. These zones present different levels of suitability and reflect not only environmental potential and constraints but also level of agricultural resources (irrigation) developed for the establishment and growth of this plant (Zaidi 2011: 199-207).

ABOUT STUDY AREA

The state of Haryana is located between 27º 39' N to 30º 55' N latitude, and 74º 27' E to 77º 36' E longitudes (Figure 1). The state covers an area of 44,212 km^2 and accounts for about 1.35 per cent of the geographical area of the country. Almost 80 percent land area of the state is under cultivation mostly under wheat and rice. As per the India State of Forest Report, FSI, 2017, the forest cover in the state is 1,588 km^2 or 3.59 percent of the state's geographical area. Geology of the state is characterised by the Siwalik system, the Indo-Gangetic plain and the Aravali system. On the basis of physiographic features, the state may be divided into the structural hills of the Siwaliks, the piedmont plains, central plain and the structural hills in the Aravalis and the shallow pediments (Singh 1971: 88, Duggal 1975: 3-5).

Average annual rainfall in the state varies from more than 100 cm in the northeast to 30 cm in the extreme western parts of the state. Average annual temperature varies between 24 °C to 26 °C. The average relative humidity in the state has been recorded around 65 percent which varies from 45 to more than 80 percent in different seasons of the year. Climate of the state is subtropical continental monsoon type. The state is divided into tropical desert, hot and arid climate, tropical steppe and semi arid hot climatic conditions. These areas may be grouped are into subtropical monsoon, mild and dry winter and hot summer climate regions (IMD 1989, Singh 1976:44-45). Soils of the state are sandy and loamy sand (*bagar*), relatively sandy loam, sandy soft loam (*rohi*), coarse loam (*dahar, chaeknote*), light loam (*seoti*), loam (*bhangar and nardak*), silty loam (*khadar*), clayey silt (bet), silt clay (*naili* and *chhachhra, dakar*), Siwalik soils (*pahari*), piedmont (*ghar and kandi*), and rocky surfaces. The pH value of these soils varies between less than 7.50 (in northeast) to more than 9.77 in the southeastern part of the state (Singh 1976:91, Zaidi 2011:1-74).

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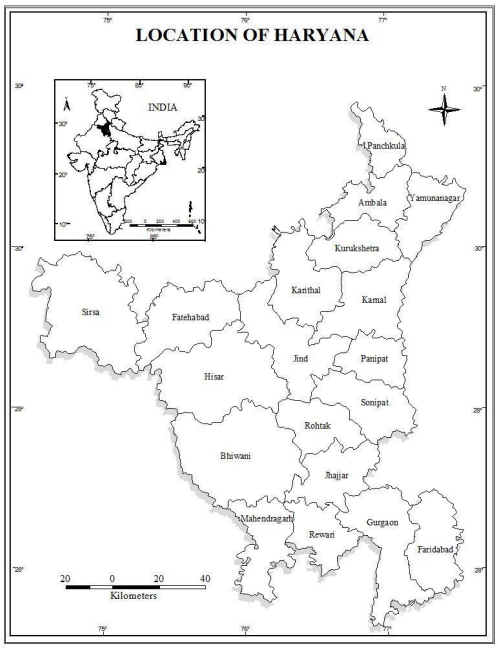

Figure-1: Location of Haryana

ABOUT THE PLANT

Mulethi (*Glycyrrhiza glabra* Linn.) is a hard, perennial under-shrub, belonging to papilionaceae family. It is popularly called as liquorice because its roots are sweet. In India, it is also known by a number of names as *jethimadhu*, *yasthimadhu*, *madhukah* and *athimadhuram*. The root system of this plant is highly branched and confined to the upper layer of the soil and rarely penetrates a depth of 80 cm. It consists of a short taproot with large number of rhizomes. *Mulethi* grows well in warmer and less humid parts of the world from 5º W to 100º E longitudes and 20º N to 50º N latitudes. The main constituent of liquorice is saponin like glycoside glycyrrhizin which ranges from 5 to 20 per cent of its constituents concentrated in its roots. Spanish liquorice contains 6 to 8 per cent glycoside while its amount ranges between 10 to 14 per cent in Russian liquorice. An evaluation trial of 14 accessions of *mulethi* from different countries at Anand, Indore and Haryana concluded a Russian collection EC-111236 as highly suitable for Haryana. Though, the Haryana Mulethi number 1 (HM-1) is recommended by the CCSHAU, Hisar to be cultivated in Haryana and other states. It has long, broad and dark-green leaves and produces approximately 200 cm long roots at harvest. This variety is resistant to leaf spot disease. Another accession, EC-21950, has been identified by All India Coordinated Research Project on Medicinal and Aromatic Plants; this variety is also tolerant to the root rot disease. Other varieties of *mulethi* are EC-114303 and EC-124587 (Tata 1990:1204-1205, Kapoor 1990:194, Zaidi 2011: 199-207).

Climate and soil

Mulethi thrives well in sub-tropical areas with very warm summers and cool winters, where the annual temperature varies between 25 ºC in summer and 5 ºC in the winter season. A winter 70 to 80 days long is essential for satisfactory growth and development of its root system. High rainfall, humidity, water logged conditions, frost, shadow and drought conditions badly affect its cultivation. This plant thrives well in areas receiving average annual rainfall of 500-1000 mm with timely irrigation, when needed. Sufficient soil moisture is to be maintained during planting and growth period. The plant requires moderately deep fertile soils without any hard layer underneath for the proper growth of the root system. Loamy soils of light texture, with a pH 5.7-8.2, are ideally suited for roots and for that matter high economic productivity of this herb. Deep moist soils, particularly on the banks of the rivers, subjected to the periodic inundation, are also suitable. Liquorice is one of the plants which can withstand salinity to a great extent without compromising growth and medicinal properties. This plant is mostly a vegetative propagated plant especially when planted in the field. Planting is done during the months of January and February in areas where irrigation facilities are available and during July and August in areas dependent on rains for good soil moisture (Zaidi 2011: 199-207).

Irrigation and fertilizers

Regular irrigation is necessary until the cuttings put down roots and establish themselves in the soil beds. The plants shed their leaves during the month of November and no irrigation is required throughout the winter season as the plants go almost dormant. Plants start having new leaves during the months of February and

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March. During this period the herb should be irrigated at an interval of 20-25 days. The plantation requires irrigation at an interval of 30-45 days during dry summer. Thus, on an average 7-10 irrigations are required to successfully raise this crop. It is necessary to avoid water logging in the field as water stagnation causes root-rotting due to infection and diseases. In order to obtain better harvest of roots, manures must liberally be applied to the field. Application of the compost or FYM at the rate of 12-18 tons per hectare is enough to meet the nutrient requirement of the plantation. However, there is difficulty in getting organic manures in such a large quantity, hence, a chemical fertilizer dose at the rate of 40:40:20 kg per hectare per year may also be applied in the form of urea, super phosphate and chloride of potash. A full basal dose of super phosphate and potash is applied at the time of planting, while nitrogen is applied in three split doses, i.e. at the time of planting, next after six months and the last one after one year of planting. Since the crop remains in the field for two and a half to three years, every year the same dose has to be applied (Farooqi 2001:161).

Harvesting and production

The crop is ready for uprooting about 2.5-3 years after planting and just before plants have borne fruits. Plants are generally uprooted in early winter (i.e., during November and December) after rains, as this is the period when their glycyrrhizin content is at its highest. The aerial part of the plant is removed and roots are cleaned. The forage may be left in the field to recycle minerals and nutrient. Since the crop is usually grown repeatedly on the same land, the broken root parts left in the soil germinate and develop into new plants. Also new sprouts are sown in the spring to fill the gaps to raise the succeeding crop. Field may be irrigated during the month of March to insure sufficient moisture. The yield of *mulethi* depends upon the soil fertility, variety of plant, climatic conditions and method of cultivation. A yield of 5 tons of roots and 14-20 tons of trimming is considered satisfactory. The HM-1 yields 7-8 tons roots with a 7.5 per cent content of glycyrrhizin (Uniyal 2003:60).

METHODOLOGY OF AGROECOLOGICAL ZONING

For the purpose of agroecological zoning; climatic, pedological and agricultural conditions for the cultivation of *mulethi* are compared and matched with the same conditions prevailing in the state. Finally those areas exhibiting suitability for the cultivation of this plant have been marked. For systematizing this process, a comprehensive study of the agroecological conditions where *mulethi* is naturally found or is being cultivated has been done to collect data and information about the cultivation and yield of this plant. Related data on many variables like rainfall, temperature, humidity, soils, altitude, irrigation and yield have been collected from many places in India and abroad. A spatial framework of 95 villages/sites has been developed to study similar agroecological conditions prevailing in the state and calculating expected yield (Figure 2). The agroecological data collected from these sites and some secondary sources reveals sufficient spatial variations. A comparative analysis of this data by employing the concept of geographic equivalence, locales (zones) has led to the evaluation of agroecological potentials and constraints of different areas in the state and the demarcation of different zones for the cultivation of *mulethi* (Figure 2 and 4)

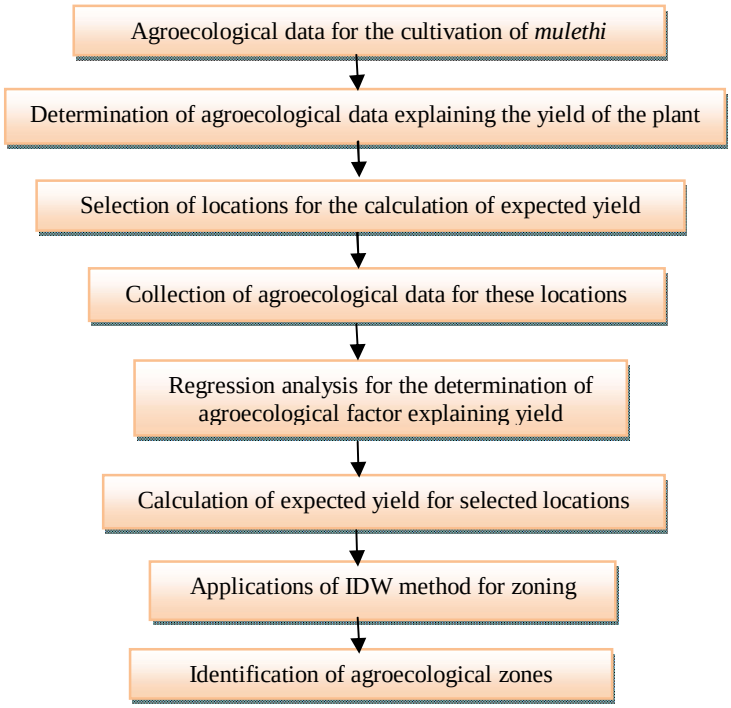

Figure-2: Methodological steps of agroecological zoning

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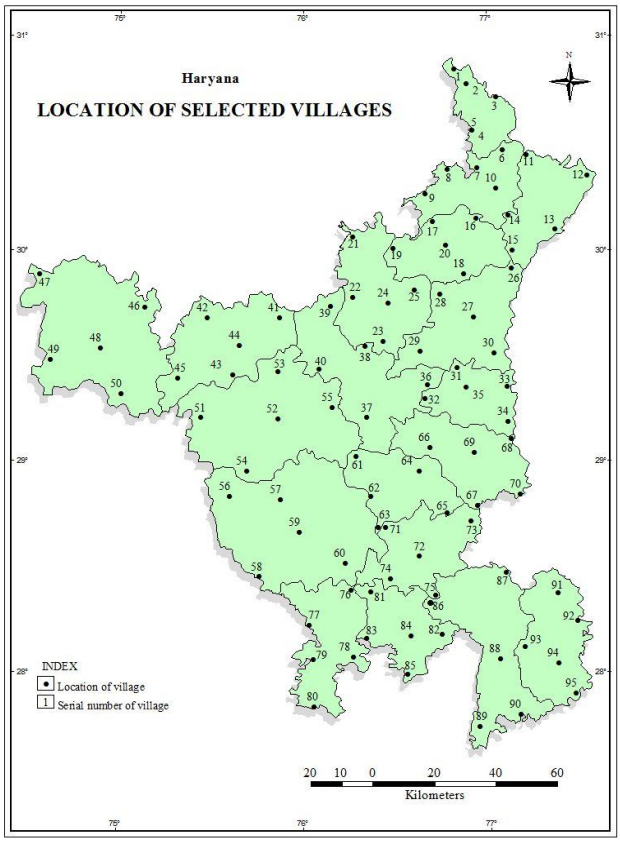
The first step in this process has been the identification of key climatic and edaphic and agricultural variables which are scientifically proved most important for the cultivation of *mulethi* in India and around the globe. On the basis of these determinants and observed yields of this plant in varying environmental conditions, explanatory functions have been derived by regression analysis. These explanatory functions or coefficients have been used for calculating expected or predicted yields of this plant for 95 selected sites/villages (Figure 2). A review of expert literature on *mulethi* revealed that mean annual temperature, mean minimum and maximum temperature, soil chemical properties and altitude are the main predictors of yield of this plant.



Figur-3: Location of selected villages in Haryana

For the purpose of calculating expected yield, collected data has been processed in the statistical package IBM SPSS 20, and all given curvilinear multivariate functions, Cobb Douglas production function and stepwise linear regression have been experimented with. An inspection of the explained variance in the average yield (in kg/ha) of *mulethi* has revealed that the stepwise regression analysis explains most of it with a high significance of regression coefficients and an F statistics at a very high level of significance pointing out a very reliable fit of the model:

$YL = 5235.345 + 0.019*RF + 1.134*MN \quad R^2 = 0.761$, Adjusted $R^2 = 0.760$, $F = 38.071$

(0.000) (0.000) (0.000) (0.000)[1]

1. Figures in parentheses are significance levels of parameters.

Where, YL is yield of *mulethi* roots, RF is annual rainfall and MN is mean annual minimum temperature. As is the case with most of the MAPs, an inspection of regression values show that only annual rainfall and minimum temperature are retained in the equation whose regression coefficients are very significantly different from zero (0.0) meaning thereby that these regression coefficient may be relied upon for prediction of yield and so is case with the constant (5235.345). The value of R^2 is 0.761 which after adjustment turns out 0.760 signifying that at least 76 per cent variation in the observed yield of *mulethi* is explained by these two predictors. Significance level of F statistics validates the fitted model with a high degree of confidence. In the second instance, annual mean temperature and annual rainfall plus volume of irrigation water in mm over the geographical area of sample villages and soil chemical properties and altitude are used to predict the yield of *mulethi* for these 95 sites. The predicted yields are taken merely as indicator of suitability and form a reasonable basis of agroecological zoning for this plant.

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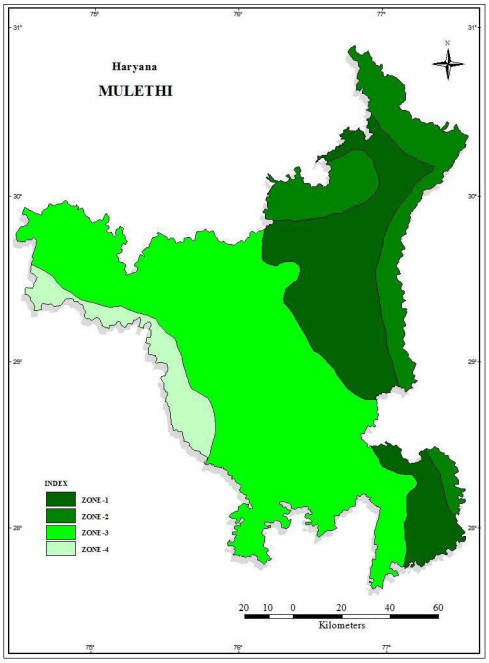

Figure-4: Agroecological zones for *mulethi* cultivation

In the third instance, the file of expected/predicted *mulethi* yields has been attached with the location code file of the sample villages in ArcGIS 10.3 environment. Using the inverse distance weighting IDW method of interpolation, surfaces of yield distribution are interpolated. In this method, a value at an unknown point is calculated as weighted sum of the values of N known points. The IDW method has advantage over the other methods of interpolation as this method is best suited for randomly distributed point data. In the present analysis a variable search radius of minimum of 10 map units and a minimum of 5 points are used with the calculation of weights of distances by squaring distances in order to minimise bias due to higher values at farther distances. This interpolation has given a number of zones. Therefore, a resampling has been carried out by assigning three natural breaks on the basis of the yield and which has classified all the interpolated area into four zones (Figure 4). After resampling into four zones, vectorisation is carried out to draw clear boundaries between different zones.

On the basis of analysis of the expected yield of *mulethi* in each of these four zones, it is found out that the darkest green polygon (zone) represents the most suitable area for the commercial cultivation of this plant, the green zone represents a suitable zone for raising *mulethi* with appreciable profits, the area represented in dull or faded green is less suitable for its cultivation as profit earned from the production of this plant though will be higher from that of conventional cropping but not significantly higher to recommend allocation of large area under this plant in this zone. The lightest green area represents a zone where cultivation of *mulethi* will be a loss incurring enterprise in comparison to conventional farming. Therefore, this zone is designated least or not suitable for cultivation of *mulethi*.

AGROECOLOGICAL ZONES FOR *MULETHI* CULTIVATION

The state of Haryana is divided into four agroecological zones for the cultivation of *mulethi* also. The climatic, edaphic and other characteristics of these are described below.

Table-1: Level of suitability and area of different zones for *mulethi* cultivation in Haryana

S. N.	Zone	Level of suitability	Area in km^2	Area in per cent
1.	Zone 1	Most suitable	10,994.83	24.87
2.	Zone 2	Suitable	6,787.26	15.35
3.	Zone 3	Less suitable	23,760.94	53.74
4.	Zone 4	Least or not suitable	2,668.97	6.04

Zone 1 (Most suitable)

This zone is the most suitable for the cultivation of *mulethi* in the state. It covers upper-central, eastern and south-eastern parts of the state. Distribution of this zone in the state is somewhat complex and mostly concentrated in the eastern half of the state. Total area covered by this zone is 10,994.83 km² or 24.87 per cent

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of total area of the state. It is located between 20º N to 50º N latitudes where the commercial cultivation of this herb is actually carried out in the world. Winters in this zone are 70-80 days long and average annual rainfall has been recorded to be varying between 650 and 1000 mm from west to east. Soils in this zone are fertile (loam and light loam) with a pH value measuring less than 8.2 which is ideal for the cultivation of this plant. Growing season in this zone is as long as 90-210 days (Sachdev *et al.* 1995). Therefore, agro-ecological conditions of this zone are most suitable for raising *mulethi*.

Zone 2 (Suitable)

The zone surrounds most suitable zone on west, north and east. However, it mainly follows the Yamuna River channel starting from the Siwaliks Piedmont in the north up to Faridabad district in the south. Total area covered by this zone is 6,787.26 km² or 15.35 per cent of total area of the state. Agroecological conditions of this zone are similar that of the first one or most suitable zone. But, the soils of this belt are clayey silt, silty clay and silty loam with average pH value of 8.2. These characteristics of soils make this belt just favorable for the cultivation of this herb in comparison to the first zone.

Zone 3 (Less suitable)

This zone is most wide spread in the state. Total area covered by this zone is 23,760.94 km² or 53.74 per cent of total area of the state. This zone is characterized by less than 500 mm average annual rainfall. Soils of this zone are loam, silty clay, sandy soft loam, loam sand and sandy. Average pH value of these soils is more than 8.2, which is less suitable for the cultivation of this crop. Therefore, this zone is climatically and pedologically less suitable for the cultivation of *mulethi*. Growing period in this zone is as long as 60-120 days (Sachdev *et al.* 1995). As, *mulethi* stays in the field for about three years; therefore, hot and arid conditions as well as high salt content in the soil may hamper the growth of this herb.

Zone 4 (Least suitable)

This zone is least suitable for *mulethi* cultivation. Total area of this zone is 2,668.97 km² or 6.04 per cent of total area of the state. This zone covers hot, arid and sandy areas in western Haryana along Rajasthan border. The average annual rainfall in this region is less than 350 mm. The pH value of the soils is more than 9. Thus, low rainfall and high alkaline soils inhibit the cultivation of this herb in this zone. These conditions make this zone unfit for *mulethi* cultivation.

CONLUSION

Mulethi may survive in average climatic and soils condition also. Better farm management and technological innovation may increase its yield much higher than the average production. Almost one fourth area of state is highly suitable for the cultivation of this plant. Around 40 percent area in the state is more than just suitable for the cultivation of *mulethi*. This area lies in the eastern part of the state. Western part of the state constituting around 54 percent area of the state is less suitable for the cultivation of this plant. But this area may be efficiently utilised by using irrigation water and moderating high pH value of the soil. Comparatively higher prices of *mulethi* and its products make even this zone suitable for the cultivation of this plant. Recommended species like HM-1 may suitably cultivated in all parts of the state. Thus, adoption of agroecological approach/method has made is easier to locate suitable for the cultivation of this plant. Agroecological zoning method opens enormous opportunities for the adoption and cultivation of new crops and rationalization of existing cropping pattern of an area by making it more suitable and sustainable. Actual cultivation of this plant in the different parts of the state will further reveal its suitability and present work is just an exploratory research.

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WEB - BASED OERS: A STUDY OF PERCEPTIONS OF POST GRADUATE STUDENTS

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ABSTRACT
Web based open educational resources (OERs) world over are getting momentum representing a vital component of the wider movement to foster education, training and development at all levels. Being open, though not in absolute terms, the success of this vital component of the wider movement lies with the teachers, learners, researchers and practitioners' interest not only to make use of it but also the urge to create and share the learning resources as and when required. In order to find out how the conventional mode students enrolled in post graduate programmes perceive and recognize web - based OERs, the present study has been undertaken. The study aims at finding out the perception of the students of various programmes enrolled in the faculties of sciences and social sciences regarding open educational resources, the investigator concludes that the majority of students have considerably favourable perception regarding web - based OERs without significant difference between a) male and female; b) rural and urban; and c) science and social sciences students

Keywords: ICT; Open Educational Resources; Perception; Post Graduate Students.

BACKGROUND
Education is essential for an individual's existence and learning is the beginning of a need for perfection. The avenues of education, training and development, now a days, are more structured and well-networked. Besides, access to these networked resources has become, quick, easy and user-friendly. Open educational resources (OERs) are freely accessible, openly licensed text, media, and other digital assets that are useful for teaching, learning and assessing as well as for research purposes (Wikipedia, 2017, p.01). Johansen *et al* (2011) maintains that OpenCourseWare (OCW) is founded on the idea that human knowledge is the shared property of all members of society. The purpose of an Open Educational Resource is to be freely available for people around the world to use (Daniel, J., et al, 2008, p.7). Technology literate people know what the technology is capable of, they are able to use the technology proficiently, and they make intelligent decisions about which technology to use and when to use it (Davies, Randall S. 2011, p.47). Concurrently, OERs are well-though out and planned educational resources accessible by anyone on the face of the earth under certain licenses. On the other hand, these resources are not only educationally worth but also desirable in any society claiming to be a knowledge society. As a result, knowledge in public domain with open access license is considered a step forward for any society aspiring to be educationally affluent and resourceful.

WEB - BASED OPEN EDUCATIONAL RESOURCES
In a world where knowledge divide continues to grow, creating, sharing and managing web based open educational resources ensure academic support to students at a larger scale. As a recent origin, the term "open educational resources" was first adopted at UNESCO's 2002 forum on the Impact of Open Courseware for Higher Education in Developing Countries (Johnstone, Sally M., 2005). OERs have increasingly been viewed as Internet empowered world wide community (COL, 2009), learning resources, resources to support teachers and resources to assure the quality of education (Johnstone, 2005) and a body of e-content and curriculum initiative (NKC, 2009). Such views suggest OERs to be of more relevant to individuals, learners, teachers, researchers and practitioners leading to creation of an encouraging environment for all to learning, education and development.

In October 2002, the Massachusetts Institute of Technology (MIT), one of the most prestigious universities in the world, launched the MIT OpenCourseWare Initiative, effectively tearing down the walls that kept the masses from enjoying the knowledge and instruction available to its students (Johansen, J., Wiley D., 2011, p.369). Consequently, MIT, in the context, has been operating as a key establishment in the creation of open educational resources worldwide. OERs are indisputably great and innovative source of learning for all those who seek it. Interestingly, it is easily accessible for use, re-use and in some cases remix as and when required. OERs are the expression of an Internet empowered worldwide community effort to create global intellectual and educational commons (COL, 2009, p.25).

It could also be said that the OERs are specifically designed networked provision of publishing digital educational resources that is openly accessible under some licenses. "Human networks are key vehicles for sharing knowledge. When several people are connected together, there are multiple pathways for the creation

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and flow of knowledge" (Mathew, M. et al, 2011, p.32). Furthermore, technology, which has played a pivotal role in creating, sharing and managing OERs, is also being viewed as the key driver in the movement of pursuing rapid knowledge, learning and education. Whereas, web - based open educational resources have revolutionized the ways and means of education seeking, information access and above all communication, thus, removing the barriers of time and distance. As a result, this has led to the wider adoption by both conventional and non-conventional mode students across disciplines.

OBJECTIVES

The objectives of the academic investigation are outlined below:

- To study the perception of students regarding web - based open educational resources.
- To analyze the significant difference, if any, in the perception of male and female students regarding web - based open educational resources.
- To study the significant difference, if any, in the perception of urban and rural students regarding web - based open educational resources.
- To find out the significant difference, if any in the perception of sciences and social sciences students regarding web - based open educational resources.

HYPOTHESES

The following hypotheses were formulated for the present investigation:

- The students have considerably favourable perception regarding web - based open educational resources.
- There is no significant difference in the perception of male and female students regarding web - based open educational resources.
- There is no significant difference in the perception of urban and rural students regarding web - based open educational resources.
- There is no significant difference in the perception of sciences and social sciences students regarding web - based open educational resources.

METHODOLOGY

The methodology employed was descriptive survey wherein the perception of students regarding web - based OERs with respect to their gender, locale and stream were investigated. The population includes the post graduate students enrolled in the faculties of sciences and social sciences at Indira Gandhi National Tribal University, Amarkantak in the academic session 2016-2018. Keeping in view the objectives of the study, a total of 110 students were selected using simple random sampling technique. Sample consists of 65 (59.1%) male and 45 (40.9%) female students for investigation. The investigator used a self-prepared questionnaire consisting of 20 items regarding web - based OERs with response pattern on a five-point scale to elicit information from the subjects under investigation. Following survey method of data collection, the questionnaires were administered along with the necessary instructions.

DATA ANALYSES AND INTERPRETATION

In order to analyze and interpret data, scores gathered was presented in the tabular forms and analysis was done as per the objectives of the study.

Figure-1: Distribution of Frequency Percentage of Students' Perception

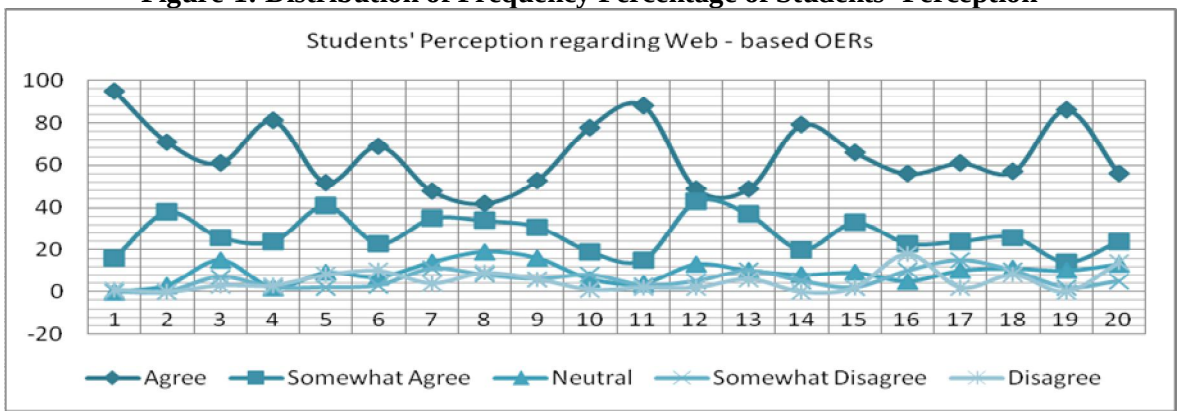

Figure-1 shows the percentage of frequencies against the questionnaire items marked by the subjects under investigation as agree, somewhat agree, neutral, somewhat disagree and disagree on perception regarding web - based OERs.

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Table-1: Significance of Mean Difference between Male and Female Students

Group of Students		Count	df	Mean	SD	t-ratio	Significance
Gender	Male	65	108	71.13	10.36	1.19	NS*
	Female	45		68.71	10.58		

*Not Significant at 0.05 level.

Table - 1 shows that the t-value calculated for the significance of the mean scores of male and female students does not exceed 1.99, the required table value for significance at 0.05 level. It indicates that male and female students have similar perception regarding web - based open educational resources. Hence, it is concluded that there is no significant difference in the perception of male and female students regarding web - based OERs.

Table-2: Significance of Mean Difference between Urban and Rural Students

Group of Students		Count	df	Mean	SD	t-ratio	Significance
Locale	Urban	32	108	69.31	11.15	0.51	NS*
	Rural	78		70.48	10.23		

*Not Significant at 0.05 level.

It is evident from the table - 2 that the t-value obtained for the significance of the mean scores of urban and rural students is 0.51 which is less than 1.99 at 0.05 level. It shows that both the urban and rural students have similar perception regarding web - based open educational resources. Hence, it is concluded that there is no significant difference in the perception of urban and rural students regarding web - based OERs.

Table-3: Significance of Mean Difference between Sciences and Social Sciences Students

Group of Students		Count	df	Mean	SD	t-ratio	Significance
Stream	Science	55	108	69.43	9.54	0.71	NS*
	Social Studies	55		70.85	11.36		

*Not Significant at 0.05 level.

Table - 3 shows that the t-value obtained for the significance of the mean scores of sciences and social sciences students is 0.71 which is less than the table value 1.99, required for significance at 0.05 level. It indicates that sciences and social sciences students have similar perception regarding web - based open educational resources. Hence, it is concluded that there is no significant difference in the perception of sciences and social sciences students regarding web - based OERs.

CONCLUSION

The web - based open educational resource, which was once considered as a novelty in the process of educational transactions, has steadily grown popularity among students, researchers, teachers and practitioners alike. The study, given the context and limitations, helps to draw the following conclusions:

- Students have considerably favourable perception regarding web - based open educational resources.
- There is no significant difference in the perception of male and female students regarding web - based open educational resources.
- There is no significant difference in the perception of urban and rural students regarding web - based open educational resources.
- There is no significant difference in the perception of students pursuing programmes offered by sciences and social sciences faculty regarding web - based open educational resources.

The impact of these web - based OERs is motivating people everywhere to empower the individuals, learners, researchers, teachers and practitioners to improve the learning environment everywhere.

EDUCATIONAL IMPLICATIONS

The hands on experiences of creating and sharing OERs while using newer information and communication technologies to digitally publish educational resources to empower people are highly aspiring. Undoubtedly, the vital need for an expanding network of web - based OERs and upgradation for technological infrastructure in the educational institutions in the country is equally emphasized. An equal need, however, possibly with more priority, is to be given for quality assurance in the learning resources. The study argues that much can be learned by the growing number of web - based OER creators and developers including the individuals, learners, researchers and practitioners engaged in the sciences and social sciences fields. The changing role indicates a need for strong policy and strategy at institutional level to be followed in order to determine and ensure effective creation and use of web - based OERs.

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WET DARK FLUID COSMOLOGICAL MODEL IN (2+1) DIMENSIONAL SPACE-TIME

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ABSTRACT
Assuming the non-static Zel'dovich fluid characterized by wet dark fluid, exact solutions for homogeneous cosmological models in (2+1) dimensional space-time gravity theory are obtained. The physical behavior of the solutions are discussed for the three cases: open universe $(k = -1)$, flat universe $(k = 0)$ and closed universe $(k = 1)$. It is observed that that these models are not anisotropic in nature and approaches isotropy. Moreover the open universe model and closed universe model are not steady state model, whereas flat universe model is steady state model.

Keywords: Cosmology, (2+1) dimension, Wet dark fluid

1. INTRODUCTION

(2+1) Dimensional gravity
Lower dimensional models have been of enormous use in practically every other branch of physics. Such models are important because they help to generate new ideas, and to stimulate new insights into their higher dimensional counterparts. Moreover, they provide a simple setting in which certain basic physical phenomena can be easily demonstrated, while avoiding the mathematical complexities often encounter in four dimensions. Therein lies the motivation for studying gravity in three space-time dimensions.

(2+1) dimensional gravity does contain interesting features in common with four dimensional gravity. Einstein gravity in three space-time dimensions exhibits some unusual features, which can be deduced from the properties of the Einstein field Equations and the curvature tensor.

Deser, Jackiw and 't Hooft [1] have obtained the solutions to three dimensional Einstein gravity with massless, spinning point source, and Clement [2] has generalized their results to include many massive spinning sources. The generalization to coupled Einstein-Maxwell theory has been considered by Deser and Mazur [3], Melvin [4] and Gott, Simon and Alpert [5]. The Regge calculus version of three dimensional gravity with point masses has been developed by Rocek and Williams [6]. Many of the basic aspects of classical Einstein gravity in three dimensions are covered in the article by Giddings, Abbott and Kuchar [7] Gott and Alpert [8] and Barrow, Burd and Lancaster [9]. They discussed the lack of correspondence between Einstein and Newtonian gravity in three dimensions, the conic geometry associated with a point mass and also include cosmological solutions for perfect fluids. In addition, Barrow, Burd and Lancaster present two cosmological solutions containing scalar field that produce inflation, and discussed cosmological singularities for three dimensional space-time. Deser and Laurent [10] have studied the interior and exterior solutions to various matter distributions assuming the space-time is axially symmetric and stationary. Deser [11] has shown that there are no nontrivial statics solutions to the coupled Einstein gravity-Yang Mills system in three dimensions. Edward Witten [12] has shown that (2 + 1) dimensional gravity (with or without a cosmological constant) is exactly soluble at the classical and quantum levels and it is closely related to Yang-Mills theory with purely the Chern-Simons action. N.J. Cornish and N.E. Frankel [13] have investigated gravitational field theories in (2+1) space-time dimensions and reviewed the consequences of the lack of a Newtonian limit to general relativity. The cosmic holographic principle suggested by Fischler and Susskind has been examined in (2+1) dimensional cosmological models by Bin Wang and Elcio Abdalla [14].

Recently Ranjan Sharma et.al [15] have investigated Gravitational collapse of a circularly symmetric star in an (2+1) anti-deSitter space-time and analyzed the impacts of various factors on the evolution of the star, which begins its collapse from an initial static configuration. Yun He and Meng-Sen Ma [16] have constructed (2 +1)-dimensional regular black holes with nonlinear electrodynamics sources and studied the thermodynamic properties of the regular black holes.

Wet Dark Fluid
The nature of the dark energy component of the universe [17, 18, 19] remain one of the deepest mysteries of cosmology. There is certainly no lack of candidates: cosmological constant, quintessence [20], k-essence [21], phantom energy [22]. Modifications of the Friedmann equation such as Cardassian expansion [23] as well as what might be derived from brain cosmology [24] have also been used to try to explain the acceleration of the universe.

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Holman and Naidu [25] proposed a new equation of state for the Dark Energy component of the universe. He offered a new candidate for the dark energy: Wet Dark Fluid (WDF), which is in sprit of the Generalized Chaplygin Gas (GCG) [26], where a physically motivated equation of state is offered with properties relevant for the dark energy problem. The equation of state for WDF is given in the simple form

$$p_{WDF} = \omega(\rho_{WDF} - \rho_*) \tag{1}$$

and is motivated by the fact that this is a good approximation for many fluids, including water, in which internal attraction of the molecules makes negative pressure possible. The parameters ω and ρ_* are taken to be positive and restricted to $0 \leq \omega \leq 1$.

To find the WDF energy density scale with scale factor a, we use the energy conservation equation together with equation of state (1) to get

$$\dot{\rho}_{WDF} + 3H(p_{WDF} + \rho_{WDF}) = 0 \Rightarrow \rho_{WDF} = \frac{\omega}{1+\omega}\rho_* + D\left(\frac{a_0}{a}\right)^{3(1+\omega)} \tag{2}$$

Where D is constant of integration and a_0 is a scale factor today; we will set $a_0 = 1$ from now on.

WDF naturally includes two components: a piece that behaves as a cosmological constants as well as a piece that redshift as a standard fluid with an equation of state $p = \omega\rho$. If $D > 0$, this fluid will never violate the strong energy condition $p + \rho \geq 0$:

$$p_{WDF} + \rho_{WDF} = (1+\omega)\rho_{WDF} - \omega\rho_* = D(1+\omega)\left(\frac{a_0}{a}\right)^{3(1+\omega)} \geq 0 \tag{3}$$

Holman and Naidu [25] observed that their model is consistent with the most recent SNela data, the WMAP results as well as the constraints coming from measurement of the power spectrum.

Several authors have investigated cosmological models in different theories of gravitations with wet dark fluid as a source. (Mishra and Sahoo [27], Nimkar and Pund [28], Mete et al. [29], Chirde and Shekh [30], Sahu et al. [31])

Adhao et al. [32] obtained statics and non-statics stiff fluid models using Einstein-Rosen Universe with wet dark fluid in general relativity. Here we obtain exact solutions for non- static Zeldovich Fluid model with wet dark fluid as a source in (2+1) dimensional gravity theory. The behavior of the solutions is discussed for the three cases: open universe$(k < 0)$, flat universe $(k = 0)$ and closed universe $(k > 0)$.

2. FIELD EQUATIONS

We consider (2+1) dimensional Robertson-Walker line element [33]

$$ds^2 = dt^2 - R^2(t)\left(\frac{dr^2}{1-kr^2} + r^2 d\theta^2\right) \tag{4}$$

Where k characterizes the spatial curvature.

The energy momentum tensor T_{ij} for a wet dark fluid (Holman R. and Naidu S. [25]) is given by

$$T_i^j = (\rho_{FWDF} + p_{FWDF})u_{ij} - p_{FWDF}\delta_i^j \tag{5}$$

with u^i is the flow vector satisfying $g_{ij}u^i u^j = 1$

In comoving coordinate system we have

$$T_i^j = diag(\rho_{FWDF}, -p_{FWDF}, -p_{FWDF}), \tag{6}$$

where ρ_{FWDF} is wet dark fluid density and p_{FWDF} is wet dark fluid pressure.

The Einstein field equations

$$R_{ij} - \frac{1}{2}g_{ij}R = T_{ij} \quad (i,j = 0,1,2) \tag{7}$$

with energy momentum tensor (6) leads to the equations

$$\frac{\dot{R}^2 + k}{R^2} = \rho_{FWDF}, \tag{8}$$

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$$\frac{2\dot{R}}{R} = -p_{PWDF}. \tag{9}$$

Here dot $(\cdot)$ denotes differentiation with respect to time t only.

The spatial volume for the model (4) is given by

$$V_2 = R^2. \tag{10}$$

The Hubble's parameter is defined as

$$H = \frac{1}{2}(H_1 + H_2) = \frac{1}{2}\left(\frac{\dot{R}}{R} + \frac{\dot{R}}{R}\right) = \frac{\dot{R}}{R}, \tag{11}$$

where $H_1 = H_2 = \frac{\dot{R}}{R}$

The deceleration parameter q, the scalar expansion θ, shear scalar σ^2 and the average anisotropic parameter A_m are defined by

$$q = -\frac{R\ddot{R}}{\dot{R}^2}, \tag{12}$$

$$\theta = u^i_{;i} = 2\frac{\dot{R}}{R}, \tag{13}$$

$$\sigma^2 = \frac{1}{2}\left[\sum_i H_i^2 - \frac{1}{2}\theta^2\right], \tag{14}$$

$$A_m = \frac{1}{2}\sum_i \left(\frac{\Delta H_i}{H}\right)^2, \tag{15}$$

where $\Delta H_i = H_i - H \ (i = 1, 2)$

3. SOLUTIONS OF FIELD EQUATIONS

Following Adhao et.al [1], we assume the equation of state as

$$p_{WDF} = \rho_{WDF} \quad \text{(Zel'dovich fluid).} \tag{16}$$

Stiff fluid (Zel'dovich fluid) can be regarded as a perfect fluid having energy momentum tensor given by (5).

Field Eqs. (8) and (9) with equation of state (10) gives

$$\frac{\ddot{R}}{R} + \frac{(\dot{R}^2 + k)}{R^2} = 0. \tag{17}$$

Which on integration gives

$$R^2 = (t + a)^2, \text{ when } k = -1, \tag{18}$$

$$R^2 = t + b, \text{ when } k = 0, \tag{19}$$

and

$$R^2 = ct - t^2, \text{ when } k = 1, \tag{20}$$

where a, b and c are integrating constants

and the line element (4) becomes

$$ds^2 = dt^2 - (t + a)^2\left(\frac{dr^2}{1+r^2} + r^2 d\theta^2\right) \quad \text{for } k = -1, \tag{21}$$

$$ds^2 = dt^2 - (t + b)(dr^2 + r^2 d\theta^2) \quad \text{for } k = 0, \tag{22}$$

and

$$ds^2 = dt^2 - (ct - t^2)\left(\frac{dr^2}{1-r^2} + r^2 d\theta^2\right) \quad \text{for } k = 1. \tag{23}$$

Models (21), (22) and (23) represent open, flat and close universe respectively with wet dark fluid in (2+1) dimension.

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4. PHYSICAL AND GEOMETRICAL PROPERTIES AND DISCUSSION

Case-I: Open Universe $(k = -1)$

Spatial Scalar R for the model (15) is given by

$$R = (t + a) \tag{25}$$

and wet dark fluid density and wet dark fluid pressure in the model (15) can be obtained as

$$\rho_{PWDF} = p_{PWDF} = \frac{(t-1)+a}{(t+a)^2} \tag{26}$$

Also,

Spatial Volume: $V_2 = (t + a)$ (27)

Expansion scalar: $\theta = \frac{2}{(t+a)}$ (28)

Hubble parameter: $H = \frac{1}{t+a}$ (29)

Shear scalar: $\sigma^2 = 0$ (30)

Deceleration parameter: $q = 0$ (31)

Anisotropic parameter: $A_m = 0$ (32)

Here in this model, shear scalar σ, deceleration parameter q and anisotropic parameter A_m are equal to zero.

Also the spatial volume $V_2 = 0$ at $t = -a$ and $V_2 \to \infty$ as $t \to \infty$. This show that universe starts evolution with zero volume at $t = -a$ and expand with t and admit big-bang like singularity at initial epoch.

The rate of expansion $\theta(0) = \frac{2}{a}$ and $\theta \to 0$ as $t \to \infty$. Thus the model is contracting without admitting any singularity during evolution.

The shear scalar $\sigma = 0$, which indicates that shape of the universe remains unchanged during the evolution.

The energy condition $\rho_{PWDF} > 0$ satisfied for $a > 1$. As $t \to \infty$, energy density tends to zero and infinite at $t = -a$. Thus the model satisfies the strong energy condition and remain isotropic in nature, since $\sigma^2 = 0$.

The Hubble parameter determines the present rate of expansion of the universe. Here in this model at $H = \frac{1}{a} =$ constant at $t = 0$ and $H \to 0$ as $t \to \infty$, which indicates that the rate of expansion is decelerated.

Case-II: Flat Universe $(k = 0)$

In this case Spatial Scalar R for the model (16) is given by

$$R = (t + b)^{1/2} \tag{32}$$

Wet dark fluid density and wet dark fluid pressure in the models can be obtained as

$$\rho_{PWDF} = p_{PWDF} = \frac{1}{4(t+b)^2} \tag{33}$$

and

Spatial volume: $V_2 = (t + b)^2$ (34)

Expansion scalar: $\theta = \frac{1}{(t+b)}$ (35)

Hubble parameter: $H = \frac{1}{2}\left(\frac{1}{t+b}\right)$ (36)

Shear scalar: $\sigma^2 = 0$ (37)

Deceleration parameter: $q = 1$ (38)

Anisotropic parameter: $A_m = 0$ (39)

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The rate of expansion $\theta = \frac{1}{b}$ at $t = 0$ and $\theta \to 0$ as $t \to \infty$. Thus the model contracts without admitting any singularity during evolution.

The spatial volume $V_3 = 0$ at $t = -b$ and $V_3 \to \infty$ as $t \to \infty$. This show that universe starts evolution with zero volume at $t = -b$ and expand with time t and admit big-bang like singularity at initial epoch.

The energy condition $\rho_{PWDF} > 0$ satisfied for $b \geq 1$. As $t \to \infty$, energy density tends to zero and infinite at $t = -b$. Thus the model satisfies the strong energy condition and remain isotropic in nature, since $\sigma^2 = 0$. Also it indicates that the shape of the universe remains unchanged during evolution.

The deceleration parameter $q = 1 > 0$, which indicates that the model decelerates in the standard way and the model is steady state model.

Case-III: Close Universe $(k = 1)$

Spatial Scalar R for the model (17) is given by

$$R = (ct - t^2)^{1/2}$$

Wet dark fluid density and wet dark fluid pressure in the models (17) can be obtained as

$$\rho_{PWDF} = p_{PWDF} = \frac{1}{4}\left(\frac{c}{ct-t^2}\right)^2 \quad (40)$$

and

Spatial Volume: $V_3 = (ct - t^2)$ (41)

Expansion scalar: $\theta = \frac{c-2t}{ct-t^2} = \left[\frac{c}{t(c-t)} - \frac{2}{c-t}\right]$ (42)

Hubble Parameter: $H = \frac{1}{2}\left(\frac{c-2t}{ct-t^2}\right) = \frac{1}{2}\left[\frac{c}{t(c-t)} - \frac{2}{c-t}\right]$ (43)

Shear Scalar: $\sigma^2 = 0$ (44)

Deceleration parameter: $q = -\left(\frac{c}{c-t}\right)^2$ (45)

Anisotropic parameter: $A_m = 0$ (46)

The rate of expansion θ is infinite at $t = 0$ and as $t \to \infty$, $\theta \to -\frac{2}{c}$. Thus the model (17) is contracting model. The spatial volume $V_3 = 0$ at $t = c$ and $V_3 \to \infty$ as $t \to \infty$. This show that universe starts evolution with zero volume at $t = c$ and expand with time t and admit big-bang like singularity at initial epoch.

The energy condition $\rho_{PWDF} > 0$ satisfied for $t \neq c$. As $t \to \infty$, energy density tends to zero and infinite at $t = c$. Thus the model satisfies the strong energy condition and remain isotropic in nature, since $\sigma^2 = 0$. Also it indicates that the shape of the universe remains unchanged during evolution.

It is observed that the deceleration parameter $q = -1 < 0$ at $t = 0$ and tends to zero as $t \to \infty$, which indicates inflation at $t = 0$ and the model is not a steady state model.

5. CONCLUSIONS

We observed that the open universe model (21) with $k = -1$, flat universe model (22) with $k = 0$ and closed universe model (23) with $k = 1$ has initial singularity at $t = -a$, $t = -b$ and $t = c$ respectively.

The Hubble parameter H, expansion scalar θ, shear scalar σ, matter density ρ_{PWDF} and pressure p_{PWDF} all are finite at $t = 0$.

Also we have $\frac{\sigma^2}{\theta^2} = 0$ and anisotropic parameter $A_m = 0$ in each case, which indicate that these models are not anisotropic in nature and approaches isotropy.

The open universe model (21) and closed universe model (23) are not steady state model, whereas flat universe model (22) is steady state model.

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WORK LIFE BALANCE & CHALLENGES FOR WORKING WOMEN- A REVIEW

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ABSTRACT
Attaining a balance between personal and professional life is always difficult but when we consider the similar conditions in case of working women it is next to impossible. The challenges posed by the family and workplace take females miles from attaining balance. The working women needs to be on their toes not only when they are at their workplace but equal attention and efforts are required to put in on their part when they are at home. Majority of existing studies related to multiple roles of women conducted & supported the fact that attaining work life balance is comparatively more difficult for working women. The results of these studies have also supported the fact that attaining the work life balance is comparatively more difficult for females. The situation becomes even worse when the work life starts affecting life at home or the other way around. Their job roles also demand them to make sacrifices on their part, simply to get acknowledged in one particular role. The current research paper reviews the factors affecting work life balance of working women. The study also reveals the challenges that come across women in the course of struggling to achieve their goals as an employee and at home, to deal with motherhood challenges and to live up to the expectations of all around them. The study concludes that majority of the factors with respect to work life balance are found similar across the sectors under the study. Further the study concludes that challenges faced by working women with respect to their work life balance in BPO, IT sectors, tourism and banking sectors are somewhat different from educational sector.

Keywords: Job burnout, work life balance, working women, work life balance, work pressure.

INTRODUCTION
Throughout history, work and life were basically integrated. Life activities like public involvement, child care, and elder care happened together with the work. Work-Life Balance is not a new concept it has evolved over time. Anne-Marie Slaughter, most recently known for her controversial piece, "why women still cannot have it all" forced a discussion among the corporate, political educational circles about how much and when women can balance their personal lives with their careers. Speaking at Harvard Business School she inspired an evaluation of how much a balance between the personal and professional realm sofa woman's life stages can be struck by prioritizing different goals through different life stages. First and foremost, women need to seize control of and inject the envisioned changes themselves at the workplace and at home. Women need to find their seat at the table and assert themselves instead of self-constructing glass ceiling that cause their professional ascent to fade into yesteryear oblivion. Second, female leaders also need to unabashedly rely upon their family as an asset. Like a kaleidoscope that produces changing patterns when the tube is rotated and its glass chips fall into new arrangements women shift the pattern of their careers by rotating different aspects of their lives to arrange their roles and relationships in new ways. More women are now looking flexibility in their work lives and are willing to sacrifice more in order to take care of their home lives. Perhaps this is a sign that women no longer feel as if they have to "do it all" the career, the husband, the kids and are willing to make some tough choices that result in sacrifices in one area of their lives. On the other hand, may be this is a sign of gender roles at home regressing to previous norms where women were expected to be the caregivers and men were expected to work. Today's women are mostly in full time services and are working 8 hours per day and 5 days in a week minimum and are confronted by increasing workload every day. So, most of them carry work and responsibilities to home but balancing between these two complex situations in the present day fast life requires talent, tact, skills and cautions (Lisa A. Mainiero and Sherry E. Sullivan 2005). In the traditional society, women's role was naturally limited to the family. Since she was the bearer of children, she was fully occupied with her responsibilities as a mother and homemaker. Man's responsibility was to provide the household with raw materials, which were then converted by the woman into consumable products or conditions by means of rudimentary methods and tools (Rajasekhar 2013). Work-Life Balance, is not just about women juggling a home and family-although that is certainly an important part of it. That is also about adjusting working patterns so that everyone, regardless of age, race or gender, can find a rhythm that enables those more 3 easily to combine work with their other responsibilities or aspirations (Department for Education and Employment 2000). Life is a balancing act, and it is safe to say that in current fast paced society everyone is constantly looking for the right Work-Life Balance. It is imperative to find the true meaning of Work-Life Balance. Indian women belonging to all classes have entered into paid occupations due to rise in education level.

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The ongoing technological developments and the race to be ahead of all your competitors at a level also affect the lives of the employees in one way or another. It has also been noticed that that the targets that are usually set to measure and enhance the performance of the employees also bounce back at times. The anxious state of minds in the beginning of career eventually turns into reoccurring stress that makes it even hard for them to perform. No doubt, there has always been a need to update the skills set of the employees especially in the developing countries but it is also true that even one such situation can shake up the world of employees who struggle hard to attain a balance between the work and family life. There is also considerable evidence that technology has completely changed that scenario of professional as well as the social lives of people. This change has come along with a lot of demands professionally as well as in social front. Not only different cultures and values of social lives have been influenced by the technological developments but with this the way people deal with various aspects of life have also been changed. It has no doubt been a difficult phase for the employees too who are to live up to the expectations of their employers to match the demands of work lives but the situation gets weird when the work demands overlap the demands at home or vice versa. One has to agree with the fact that though there have been technological advancements that has made our lives easier but at the same time their time and effort one puts in to get desired has not been reduced to that extent. The equilibrium between the work and family life has been disturbed to a great extent as a result of the demands that elicit stress. Most these employees either spend extra hours in office or go back home with a lot of burden on mind that directly affects their happiness in general and quality of life. Piotrkowski (1978) opined that spill over that is usually discussed in positive terms may also be a negative spill over. It is also true that uninteresting work in office at times results in making that individual not get involved in life at home.

The role of women has generally been considered to be of homemakers who primarily nurture and manage family. Men, on the contrary have generally been playing the roles of providers who look after the needs of the family and fulfill them to the best of their abilities. Though these roles have also been challenged many times and have been changed too but the bottom line still remains the same. The social lives and roles of men and women have generally been traditionally categorized and they are expected to comply with their roles. With time, there has been a tremendous change in required skill set of the work force and one cannot deny the fact that the roles of women and men in professional as well as in social lives have also been revolutionized. Women unlike their traditionally defined roles contribute to the family income exactly the same manner as their male counterparts and this percentage has increased in two decades.

Hall D.T. and Richter, J. (1988) noted that the much-needed work life balance is emphasized even more as the ongoing changes in the workforce bring along the change in values.

Work life balance remains a never achieved goal for most female employees as unlike their male counterparts their dual roles are equally demanding and full time. Moreover, motherhood for working females usually comes along with a fear that society might judge their role as a mother. The level of stress at times takes the form of job burnout and goes up to the level of female employees thinking million of times before accepting a promotion. The fact that promotion comes along with a baggage of responsibilities scare them though it should bring along a sense of happiness and proud similarly as for their male counterparts. Most jobs need the employee to be at their best but in case of female managers and executives' family obligations keep them from investing required time and effort. Their job as the primary caregiver to the kids becomes hard once they achieve a certain position at the top management. Reddy et al, (2010) have examined and found that female employees come across work family conflict in the course of achieving their goals and targets.

For working women attaining the work life balance still remains a challenge and that too because of some unlikable reasons. The moment women start giving preference to their work life they start feeling insecure on family front which in one way or another affects their professional life too. Working women, no matter how complicated their professional and social lives are always face the challenges head on and live up to the expectations of the organizations they work for as well as their family and kids.

LITERATURE REVIEW

Duxbury and Higgins (1991) opined that the reason because women employees in general tend to be highly responsible towards their family affairs it becomes difficult for them to attain the work life balance as compare to their male counterparts. The studies have observed that happiness at work and happiness at home are intertwined and interrelated (Staines, 1980). Champoux (1978) found that the work experience good or bad has a great influence on other aspects of life. Many Studies have observed that no matter what the work life always get affects tae life at home (Kando and Summers 1971), attitude towards work life directs the attitude towards own self, kids and other around the individual (Mortimer et al 1986).

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In developing countries like India role conflict, lack of recognition, gender discrimination, politics at work place, time management issue, and health care issues of family are some of the factors that influence work life balance among women (Vijaya Mani, 2013). Niharika and Supriya (2010) during one of their studies examined factors that are family and work based and in one way or another contributes in work life balance. The work-based factors included the time flexibility, relaxation to from home and flexibility of timings whereas the family-based factors included child care issues and the liberty to attend the urgent family affairs. Masako SETO et al, (2004) in a study in a Japanese Metropolis studied ways work related factors contribute in work family conflict.

According to Rowe and Crafford (2003), females in the banking industry tend to be less supportive of one another when they are in different life stages, that is being single or married or about to have a baby and more supportive when they are in similar life stages. Basically, women are looking out for themselves and are not working and supporting one another as a group in addressing woman's issues (Rowe & Crafford, 2003). This is one opinion however and cannot be said for all cases.

Jain K.K., FauziaJabeen,Vinita Mishra and Naveen Gupta (2007) - "Job Satisfaction as Related to Organizational Climate and Occupational Stress: A Case Study of Indian Oil" published in the International Review of Business Research Papers found the results of the study also confirmed the assumption that high age group managers as well as high age group engineers were equally satisfied with their jobs and the study revealed the same findings when low age group managers and low age group engineers were compared on their job satisfaction level. Sengupta (2011), in his study on title "An exploratory study on job and demographic attributes affecting employee satisfaction in the Indian BPO industry", determine what and how job related and demographic variables are associated with employee satisfaction of the BPO employees. The study indicates that there is difference of perception towards the job-related variables on the basis of gender, marital status, education, age, and tenure. Correlations revealed that interpersonal relationships, career progression, salary, company policies, working conditions, and authority have significant positive relationship with employee satisfaction and only accountability had a significant negative relationship with employee satisfaction. Regression revealed the significant determinants of employee satisfaction which were interpersonal relationships, career progression, salary, gender, accountability, and authority. Muhammad Umer and Muhammad Akram Naseem (2011) "Employees Retention (Human Capital) in Business Process Outsourcing (BPO) Industry" published in Global Journal of Management and Business Research (Volume 11 Issue 3 Version 1.0 Pg 90 -98). This paper aims to investigate the impact of variables (career development, supervisor support, work environment, work life balance) on employee retention. A total of 50 interviews were taken from managers of different BPO organizations. Graphical Analysis is indicating that these variables have significant and positive impact on employee retention. Very less research has been done about employee retention in business process out sourcing, especially in Pakistan.

"Management of Stress Among Women Employees in BPO Industry in India: A Contemporary Issue" provides an overview of the challenges and opportunities facing by professional women in India. Changing social expectations both at work and at home have made this more complex. The study highlights the coping strategies that can be selected to further continue corporate journey to gender inclusion and the advancement of women in the organization

One is the path chosen by women's studies centers through which they looked at the structures of patriarchy within the country, and how these contributed to the subordination of women at work and at home. They were mainly focused on the underprivileged and rural women. The other path was psychosocial research which examined the work and family relations within urban settings from a role theory perspective. There has been little cross-pollination between these two streams, marked by a lack of cross-preferences in published studies. Most studies conducted on Indian women were preoccupied with the concerns of status and perceptions towards working women including working women's views about non-working women and vice-versa, societal views about working women, and working women's views about husband's home role participation. They also covered the broad theme of stresses and strains of balancing work and home roles and their impact on the psychological well-being of 4 women. Other studies examined the changing roles, values and expectations in urban middle-class families. Research on work and family during this decade indicated that working status was not a guarantee to equitable relationships within the family. Research on Indian society differentiated between working women. It had hinted at the possibility of men's roles being in transition during largely traditional division of work and family roles in society. Even though Indian organizations provided family friendly measures, they eventually proved to be an imitation of western practices rather than a genuine concern for the better handling of work and family responsibilities (Rajadhyaksha & Smita, 2004). According to (Guest, 2001)

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research, there is still debate about work-family balance but it also implies that there is a balance between the demands of work and family. Work-family balance has been a catch phrase over the past decade because of the increased demands from work and family (Frone, 1992). Some researchers (Joplin et al, 2003) prefer to use an overarching concept of equilibrium, balance and harmony while other researchers use the concept of fit and incorporate the demands of the role and environment and the availability of personal resources. According to (Clark 2001) research, work-family balance is as an absence of work-family conflict or increasing levels of work-family enrichment. Others defined work-family balance as an effective juggling act between paid work and various activities that are important to people. Researchers (Kalliath & Brough 2008; Clark 2001) have also focused on the compatibility of both roles and their promotion of growth, satisfaction between multiple roles, perceived control between multiple roles, and relationship between conflict and facilitation. Work-family balance is a fine art of managing both the work and family realm effectively. Work family balance suggests that work should not hinder other things which are important in people's lives, such as quality time with their family, leisure time or recreational activities, personal development, etc. The balance which seems appropriate today may seem inappropriate tomorrow. The ideal balance in a person's life may vary across the different phases of one's life, i.e. before marriage, after marriage, with children, when starting a career or after retirement. In sum, there is no one-size fits all or picture-perfect work-family balance. Moreover, in recent decades, the work pressure has been intensifying for both men and women. Different factors associated with work have resulted in excessive stress and strain among workers. As a result, there is a work domination of family life created by work demands, which in turn results in work family imbalance. To be successful in both the roles, women try to organize and balance their work and family domains, for which a great deal of adjustment and accommodation is required. For the last two decades, work-family issues have become a growing concern among researchers' due to significant changes in the work force, such as the entry of an increasing number of women into the labor market as well as the existence of dual-earner, and single-parent families (Aryee et al, 2005; Hansen, 1991; Barnett, 1998; Edward & Rothbard, 2000).

Although there has been much research on work-life balance (WLB), it is still an area that causes concern for the industry. It is a difficult area for management to both track and to control. The issue has been examined from a range of perspectives including from a gender perspective by various researchers as (Lyness and Kropf, 2005; Roberts, 2007), (Alexandrov, Babkus and Yavas, 2007, Johlke and Duhan, 2000 (Iverson and Zatzick, 2007; White, Hill, McGovern, Mills and Smeaton, 2003). What is evident from the research findings are the consequences resulting from an imbalance between work and family life? Mauno and Kinnunen (1999), for example, found that psychosocial job stressors such as job insecurity and time pressures at work influenced marital satisfaction via job exhaustion and psychosomatic health. Other research by Huang, Lawler and Lei (2007) found that having a work-life balance decreased employees' intentions to leave an organization, while Guest (2004) suggests there are consequences of an imbalance of work and life that include increased stress, negative behavior and performance at both work and home and an impact on others in both the work and home environments. With specific attention on the impacts on the work environment, Smith and Gardner (2007) suggest that conflict between work and home life is linked to job dissatisfaction and staff turnover.

According to Doherty (2004) it is observed that work-life balance for women in the hospitality industry have long hours of working and the lack of flexibility that discouraged women from seeking senior levels.

The studies of Khalid Latif, Muhammad Naeem Shahid, Dr. Naeem Sohail, Muhammad Shahbaz (2011), observed influential factors contributing to job satisfaction and dissatisfaction of college teachers of district Faisalabad, Pakistan. This study recommended that to increase the satisfaction level of teachers of private colleges a proper attention should be paid so that the employers of private sector colleges will be able to retain teachers.

SIGNIFICANCE OF THE STUDY

In global scenario women going into working sectors and comparatively maximum women are in the IT, BPO sectors, health sectors, education sectors and banking sectors. As women are more educated nowadays, awakened about their needs and working culture hence there is an increase in women empowerment and they are entering into different sectors. During their working environment they are facing lots of problems as they have to balance their work life. The study explores and examines different areas where women face different kinds of problems and challenges. It also highlights the way working women are coping up with these problems and challenges.

OBJECTIVE OF STUDY

The objectives of study include following:

I. To review the current scenario of working women with respect to their work life balance.

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II. To investigate the factors making work life balance difficult for working women.

III. To identify the different challenges that come across and is faced by working women to deal with their work life balance.

RESEARCH METHODOLOGY

The study is based on the secondary data. The information related to work life balance scenario of working women in different sectors has been collected through review of existing study journals, articles, reports and other published /unpublished documents. The present study review work life balance scenario of women working in different sectors such as: BPO, IT sectors, Banking and Tourism sectors and educational sectors. Therefore, the above study is descriptive.

RESULTS AND DISCUSSIONS

Factors

I. BPO, IT Sector factors

1. **Gendered perceptions of work and life**: Three factors were identified and analyzed in order to understand the adverse impact of work. About 54% of men and 43% of women felt that the work affected their health. About 32% of men and 43% of women felt that the work affected their sleep. About 52% of men and 34% of women reported overtiredness due to long hours of work.

2. **Socio-Cultural factor: -** The socio-cultural factors also work against the women who are employed with BPO and Call Centers in India. Even if the woman is happy and satisfied with her night duty job, and is getting an excellent remuneration for it, but her troubles may begin once she gets married. In many cases the women are forced to quit their jobs because of the disapproval of the husband and his family. The marital-wise distribution of women across the sample indicates that 46.4% respondents are unmarried 53.4% are married. The length of experience and level of job satisfaction are always related with each other's.

3. **Organizational culture**: Organizational culture can be understood as a sense-making mechanism that shapes employees' attitudes, behavior and values and aids the interpretation of unfamiliar events (Chan, 2009). The organizational culture in most organizations is negative towards work life family policies as such policies are to favor women and/or parents (Smithson & Stockoe, 2005). Thus having family friendly and flexible policies in organizations will not in it bring about change, rather shifting the resistant organizational culture will (Clutterbuck, 2004). Changing the organizational culture involves shifting people's attitudes, and changing systems of an organization (Clutterbuck, 2004). For example, this could involve highlighting the need for women to be beneficiaries of family policies due to them not solely fulfilling the traditional role of child bearer and housewife only, but of a 25 worker too in order to meet the financial pressures that each household in society today. As a possible solution to the resistance noted above, Baglihole (2006) advocates for training courses that address confused and resistant negative attitudes as well as the need for the organization to implement support systems and flexibility for staff members that are not considered to be beneficiaries of family friendly policies, namely the childless and men. There also needs to be more open communication about women's changed work and family lives and how important it is to face this change (Bailyn & Harrington, 2004).

4. **Organizational time expectation:** Another factor is organizational time expectations which have been noted to also contribute to work-life imbalance. For example, it has been noted that the long hour 26 work culture that is present in many organizations, does not support appropriate parenting (Wood & Newton, 2006). In other words, work demands such as working long hours impede one's performance in the home domain, leading to work-life conflict and work-life imbalance (O'Driscoll, Brough & Biggs, 2007). More often than not, organization's superiors and co-workers also expect that employees should expand their work activities beyond the normal working day, which consequently interferes with their non-work responsibilities resulting in work-life conflict (Posig & Kickul, 2004). A study conducted by Thompson and Bunderson (2001) shows that unusual time demands such as shift work and working overtime are also positively associated with work-life conflict. Employees often express an "unmet need" by organizations for failing to provide them with flexible working schedules such as flexi-time and part-time work, thereby not reducing the amount of time that they are expected to work in the workplace and this leads to work-life imbalance and job satisfaction (Bauld, Brough & Timms, 2009)

5. **Work routine:** The work routine that is usually been followed is never prepared keeping the social responsibilities of employees especially in case of female employees. The work routine that is usually

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followed in multinational organization does not give the liberty to the employees to go back home and have quality time to their family as their jobs always comes along with a lot of responsibilities and targets to achieve that are also time bound.

6. **Constraint of time:** Women in general have to be a step ahead of their male counterparts when it comes to their social responsibilities or responsibilities towards children. It is usually troublesome for females ironically when they are considered for promotions or even for transfer of workplace as each change bring another challenge for them.
7. **Psychological health:** The multiple roles that women need to play often throw challenges of all kinds eventually affect the psychological state of mind. In case of female employees, it usually results in job burnout and negative health consequences like fatigue, appetite, sleeping disorders, anxiety and stress.

II. Banking & Tourism Sector Factors

- Long and irregular hours – It has been observed that in Tourism sector women have to work for long & irregular hours which causes disturbance in their family life.
- Presentism and acceptance of long hours: - Women who has raise their children couldn't accept long hours.
- Impact of a turnover culture: A workplace culture that is inclusive of women, and that will attract and retain those with the skills and talents to help the organization succeed, is characterized by:
  - Cultural norms and values that support positive relations between men and women;
  - Conditions (work schedules, job titles, physical environment) that are inclusive of both men and women;
  - A strong 'critical mass' of women, usually 30 per cent or more throughout the organization;
  - Opportunities for advancement;
  - An emphasis on reducing sources of unnecessary stress such as harassment and work-family conflict.

III. Education Sector Factors

Organization Support & Work Life Balance: Organization support have positive impact on working role performing by the women at work place by creating balance; thereby eliminating work life conflict. It is important resource for working women to manage their profession altogether than those who are dissatisfied with many areas of their work life. As faculties are both the largest pillars of school/college system, understanding factors that contribute to teacher satisfaction (or dissatisfaction) is essential to improving the information base needed to support a effective educational system. Therefore, the present study was based on the Comparative job satisfaction among colleges. So, it is being suggested that the organizations should be more flexible in their proceedings so that the females can maintain a balance between both life.

CHALLENGES

1. **The Private Sector and public-sector Banks: -** The Private Sector and public-sector Banks which pool under the services sector are the main drivers of economic growth in India and it forms the largest Component of the company too. This service sector heavily depends on people who are proficient of handling it and as a consequence of this person from the basic asset of this sector. Employees working in this sector are young, view their careers as supreme and have a different mindset relating to social norms of life Balance etc. These employees typically work in intensifiers result-driven culture. They work long hours and often must accommodate their working hours the time zones of major financial hubs. With many banks extending operating hours there is a need for work, life practices as well. In work life, the life describes a persons or groups standard of living environment, public health, safety and general surroundings while work life encompasses things that affect their wellbeing such as salary and benefits. Significant work life programs for banks include part-time work, telecommuting and flexible benefits. Workplace life is increasingly a significant part of the total benefits package.
2. **BPO, IT Sectors**: - In BPO's women has to work during the night shifts and due to this problem arises such as less time to spend with the family and children and attend their personal needs. An even woman suffers from health-related issues. They can't take the emergencies involving their children and family.
3. **Tourism sector:** This paper has examined the key antecedents to the issue of work-life balance in the tourism industry, finding that the long, unsocial hours within the industry, the levels of stress associated with job insecurity, role ambiguity, job autonomy and time pressures, together with home life pressures and psychosomatic symptoms are variables that impact negatively on work-life balance.

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4. **Education Sector**: Teachers who do not get motivated in their work may be less inspired to do their best work in the classroom. Highly satisfied teachers are less likely to change institute or to leave the teaching duty by increasing the accuracy of information and improvement in utilization efficiency of teachers, time & materials. It supports to the faculties as it is used to integrate teaching and learning both inside and outside the classroom. Classroom Response System (e.g., clicker) can engage students by making lectures more interactive, while simultaneously allowing instructors to keep track of whether students understand the material. It can be used to create more meaningful assignments & to integrate the lecture with the associated discussions or labs. Support provided by the latest technology somewhere motivates the faculties in some way or the other to perform better.

CONCLUSION

The study concludes that majority of the factors with respect to work life balance are found similar across the sectors under the study.

Further the study concludes that challenges faced by working women with respect to their work life balance in BPO, IT sectors, tourism and banking sectors are somewhat different from educational sectors.

Lastly it has also been observed that women employees undergo a lot of uncertainties as they set their eyes to achieve their professional goals. Even if they are one minded and put in their best efforts they are always pulled backward either by their social obligations or their family or motherhood responsibilities. Though planning strategies, time management and goals setting can help women employees to be effective in their professional lives at workplace and at home but at the same time there is need to bring about the required changes by the organization over safety measures, planning and adopting human resource related strategies facilitate working women employees in attaining work life balance.

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A NEW METHOD FOR THE ANALYSIS OF FLUORIDE IN DRINKING & WASTEWATER WHICH MINIMISES THE COST OF ANALYSIS BY "SELECTIVE ION METER"

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ABSTRACT
An economically cheap and best method is developed as an innovative work in the field of analytical chemistry in the analysis of fluoride in drinking water as well as waste water by Selective ion meter. The existing method using CDTA buffer is very costly as compared to an innovative method developed which minimises the cost of analysis. Results obtained are very much reproducible and satisfactory as compared to old and costly using CDTA buffer. The CDTA used in making buffer solution is very costly. Therefore the cost of analysis of fluoride is 77 times costly as compared to new method where EDTA is being used to prepare buffer for the analysis of fluoride. The cost of EDTA is 77 times less than the cost of CDTA.

Therefore an innovative method is very cheap, best and satisfactory in accuracy to reproduce the result of analysis. The complexing tendency or complex formation with elements as well as buffer action is almost very similar to existing method. So in spite of using costly CDTA buffer we can use EDTA buffer to minimise the cost of analysis because the cost of CDTA is approximately Rs. 17400 /100 gm while the cost of EDTA is approximately Rs. 225/100 gm in the market. During analysis of fluoride by ion meter equal volume of buffer is used with sample volume i.e. in the ratio of 1:1 by volume. For 10 to 25 ml of sample 10 to 25 ml of buffer is mixed so that the fluoride electrode should be immersed in the solution. Thus economically this developed method is better and superior to the existing method.

Keywords: EDTA- Ethylene Diamine Tetraacetic Acid CDTA- Cyclohexlene Diamine Tetraacetic Acid

1. INTRODUCTION

A fluoride concentration is approximately 1.0 mg/L in drinking water effectively reduces carries without harmful effect on health. Fluoride occurs naturally in water. Some fluorosis may occur when the fluoride level exceeds the recommended limits of 1.5 mg/l. In rare cases the naturally occurring fluoride concentration may reach to 10 mg/l. Such water should be de-fluoridated.

Accurate determination of fluoride has increased in importance with the growth of the practice of fluoridation of water in those areas. Among the methods suggested for determination of fluoride in water, the electrode and colorimetric methods are the most satisfactory. The electrode method is suitable for fluoride concentration from 0.1 to 10 mg/l where as colorimetric SPADNS method is suitable up to 1.5 mg/l of fluoride.

2. PRINCIPLE

The fluoride electrode is an ion-selective sensor. The key element in the fluoride electrode in the laser type doped lanthanum fluoride crystals across which a potential is stabilized by fluoride solution of different concentrations. The crystals contain the sample solution at one face and an internal reference solution at the other. The cell may be represented by:

Ag|AgCl. Cl- (0.3). F-(0.001)|LaF3|test

Solution|Reference electrode

The fluoride electrode measures the ionic activity of fluoride in solution rather than concentration. Fluoride ion activity depends on the solution's total ionic strength, pH and on fluoride complexing species CDTA or it may be EDTA also adding an appropriate buffer provides a nearly uniform ionic strength background, adjust pH and breaks up complexes so that in effect the electrode measures concentration.

3. EXPERIMENTAL PROCEDURE

A. APPARATUS

i. Digital pH meter

ii. Ion Selective meter

iii. Fluoride electrode

iv. Magnetic stirrer with TFE coated stirring bar.

v. Timer

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B. REAGENTS

1. Stock Fluoride solution/ standard certified reagent material (CRM) grade standard fluoride solution of 1000 mg/l
2. Working standard solution of fluoride – 1000 mg/l stock solution is detected to 10 mg/l means 1 ml= 10 ppm F
3. 6 N NaOH solution – Dissolve 36 gm NaOH in 150 ml of distilled water in a 500 ml borosil glass beaker.
4. EDTA Buffer Solution: Place approximately 500 ml distilled water in a 1L beaker add 57 ml glacial acetic acid, 58 gm NaCl and 4 gm EDTA i.e. ethylene di-amine tetraacetic acid (disodium salt) stir to dissolve. Add slowly 6 N or 6 M NaOH (about 150 ml) with stirring until pH in between 5.3 and 5.5. Transfer to 1 litre volumetric flask and add distilled water to the mark. Shake well and keep it for the use. This buffer solution is added in 1:1 (equal volume) ratio with the volume of sample.

C. PROCEDURE

1. Preparation of standard fluoride solution: Prepared standard solution of fluoride by diluting with distilled water to get a series of 0.1, 1.0 and 10 mg F-/L for standardisation of instrument.
2. Treatment of standard and sample: In 100 ml polypropylene beaker, add by-pipette 10ml standard solution of each one as well as sample also. Add an equal volume of buffer prepared so that total volume should be sufficient to immerse the electrode and permit operation of the stirring bar.
3. Measurement with electrode: Instrument should be on for 10 minutes before the measurement. Immerse electrode in each of the fluoride standard solution only once and measure developed potential with constant stirring. Electrode remains in the solution for 3 minutes for constant reading. For sample withdraw electrode rinse with distilled water and blot dry. Blotting should be gentle to avoid poisoning of electrode
4. The measurement of standard fluoride solution for experimental verification of method using new EDTA buffer in spite of CDTA buffer Table- 1 and spike sample prepared for calculation of relative standard deviation (RSD) is given in table-2. While comparative natural sample analysis by the two methods using CDTA and EDTA buffer as given in table 3.

STANDARD SOLUTION OF FLUORIDE TAKEN FOR EXPERIMENT AL VERIFICATION OF METHOD DEVELOPED AND DESCRIBED HERE

Standard solution of fluoride taken = 1000 mg/L

Table-1

Sr. No.	Quantity of fluoride taken in mg/L	Quantity of fluoride found in mg/L	Percentage deviation	
			Deviation	
1.	0.1 mg/L	0.11	0.01	10%
2.	0.5 mg/L	0.51	0.01	2%
3.	1.0 mg/L	1.02	0.02	2%
4.	1.5 mg/L	1.45	0.05	3%
5.	2.0 mg/L	2.01	0.01	0.5%
6.	5.0 mg/L	5.05	0.05	1%
7.	10.0 mg/L	10.10	0.10	1%

Table-2

No.	Value of fluoride taken	Values found	Mean	Deviation	d^2	$\sum d^2/\sqrt{n-1}$ SD
1.	2.0 mg/L	2.01	2.002	0.008	0.000064	0.001 0804/ $\sum 5-1$ =0.00 05
2.		2.02		0.0180	0.000324	
3.		1.98		0.0220	0.000484	
4.		1.99		0.0120	0.000144	
5.		2.01		0.008	0.000064	

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Spike sample prepared for RSD value

Calculation:

RSD= (SD*100)÷m =(0.0005*100)÷2.002 = 0.02

Table-3: Value of fluoride found in natural sample Relative standard deviation where so manyconcentration in there with comparative data

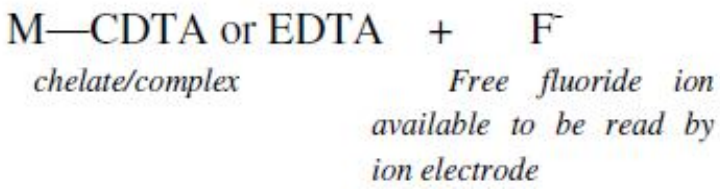
No.	Sample No.	Fluoride found by old CDTA buffer in ppm	Fluoride found by new EDTA buffer in ppm	Deviation	Deviation %
1	61222	0.64	0.65	0.01	1.56%
2	60986	0.92	0.91	0.01	1.08%
3	61025	1.33	1.31	0.02	1.50%
4	61373	2.80	2.82	0.02	0.71%
5	61389	3.60	3.62	0.02	0.55%

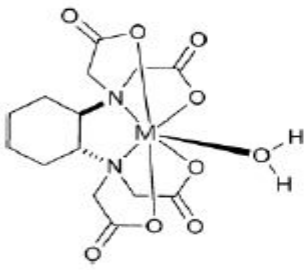
Comparative result came out to be satisfactory.

4. INTERFERENCES

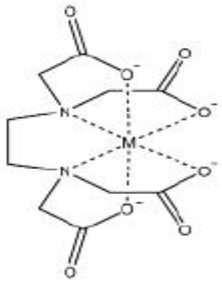
Although the electrode method for fluoride determination is most suitable but it is also effected by interfering ions that is why a buffer solution having EDTA component is mixed in equal volume to complex the poly-metal ions and frees the fluoride ion to read by the fluoride electrode. Most of the interferences which can interfere in the analyser analysis are masked by using EDTA as a component of buffer due to its good chelating or effective complexion property with metal ions of polyvalent nature also.

Results and discussion about new method using EDTA buffer





CDTA-M Complex



EDTA-M Complex

Comment: Both form five membered ring with metal ion which stabilises the metal complex forming tendency.

The electrode method is suitable for fluoride concentration from 0.1 to more than 10.0 mg/L. Adding the new buffer of EDTA component frees the electrode method from most interferences. Fluoride forms complexes with several polyvalent cat-ions, specially aluminium and iron. The extent to which

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complexation takes place depends on pH of solution, relative levels of fluoride and complexing species. However instead of using Cyclohexylenediamine tetraacetic acid which is costlier than EDTA, a compound of the buffer prepared in the same manner will also preferentially complex interfering cat ions and release free fluoride ions to reach by the Value of fluoride found in natural sample Relative standard deviation where so many concentration in there with comparative data fluoride electrode through selective ion meter. The fluoride electrode measures the ion activity of fluoride in solution of the sample containing fluoride successfully and accurately as compared with CDTA buffer method.

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A COMPARATIVE STUDY OF PHYSICO-CHEMICAL AND BIOLOGICAL CHARACTERISTICS OF WASTE WATER AT SEWAGE TREATMENT PLANTS OF ALLAHABAD AND VARANASI UTTAR PRADESH

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ABSTRACT
A mixture of domestic and industrial water is known as sewage. It consists of more than 99% water and the remaining contains some ions, suspended solids and harmful bacteria which must be removed before releasing the water into the sea. The rise in population has also caused many problems and the most concerning issue is being producing sewage. The study was done for determining the pollutants level in initial untreated waste water to final treated water of sewage treatment plant Uttar Pradesh and compare it with Central Pollution Control Board guidelines. Wastewater samples which are being collected from Sewage Treatment Plants of Dinapur, Varanasi and Naini, Allahabad. Samples were analyzed using pollution indicating parameters such as Colour, Odour, Temperature, pH, Turbidity, TS, TDS, TSS, VSS, DO, BOD, COD, TC and FC using standard methods. Result shows that the Colour, Odour, Temperature, pH, Turbidity, TS, TDS, TSS, VSS, DO, BOD and COD is in the permissible limits and TC and FC does not meet the permissible standards after treatment. In context of the pollution, in this study I came to the conclusion that final treated water should be treating regulary and carefully for reuse as secondary purposes.

Keywords: Sewage, Sewage Treatment Plant, Physico-chemical and biological parameters.

INTRODUCTION
Today with the increase in world population, the water consumption has increased manifold which caused increase in the sewage effluents. Domestic sewage is 99.9% water with moderately small concentration (0.1%) of suspended and dissolved organic and inorganic solids. In developing countries, a major portion of the population lacks access to safe drinking water and sanitation, which has been related with high incidence of waterborne diseases. **(Pandit *et al*. 2013)**[7]

Sewage treatment
The process of removing contaminants from wastewater including household sewage and runoffs (effluents) is known as sewage treatment. It includes physical, chemical and biological processes to remove physical, chemical and biological contaminants.

Activated sludge process
Activated sludge method of waste treatment is highly popular method. In this method the organic wastes are brought to a reactor from primary clarification tank. The oxygen is provided by diffused or mechanical sources. The reactor contains active microbial cells. After a certain period, the contents of this reactor are taken to a settling tank. The sludge containing new cells here is Fed back to the reactor and a part of the sludge with old cells is sent for sludge digestion or disposal. The contents of the reactor are commonly referred as 'mixed liquor'. In an activated sludge process, micro-organisms (aerobic and facultative bacteria- Achromobacter, Flavobacterium, Nocardia, Mycobacterium, NItrosomonas & Nitrobacter, Pseudomonas, protozoa and rotifers etc.,) play the most important role. The most common suspended growth process used for municipal wastewater treatment is the activated sludge process. The process flow diagram is as shown in Fig (1.1).

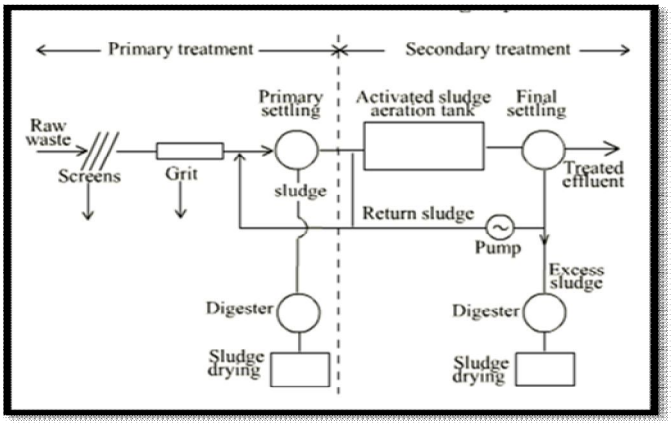

Fig-1: Flow Diagram of Activated Sludge Process

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MATERIALS AND METHODS

Study area- The study areas for the present investigation were selected as 80 MLD sewage treatment plant at Dinapur, Varanasi and 80 MLD sewage treatment plant at Naini, Allahabad. All the experimental analysis for the selected samples were done in laboratory at Ganga pollution prevention unit, Dinapur, Varanasi and Ganga pollution control unit, Naini, Allahabad.

Sampling Location-Sample was collected from selected sites on sewage treatment plant at Dinapur, Varanasi and Naini, Allahabad, U.P. (India). Detailed of sampling points are present in Table 1.

Table 1: Details of the sampling points

Sampling points	Site notation
Inlet (raw sewage) at Dinapur, Varanasi	S_1
Outlet (final treated water) at Dinapur, Varanasi	S_2
Inlet (raw sewage) at Naini, Allahabad	S_3
Outlet (final treated water) at Naini, Allahabad	S_4

Plant Description-A study was conducted on the inlet (raw sewage) and outlet (final treated water) collected from two sewage treatment plants. First one is Dinapur, Varanasi and second one is Naini, Allahabad in Uttar Pradesh. These plants are installed and commissioned by Uttar Pradesh Jal Nigam under the Ganga action plan phase 1.

Sewage Treatment Plant at Dinapur, Varanasi

The sewage treatment plant at Dinapur, Varanasi was established in 1992. The sewage treatment plant is based on the roughing filter and conventional activated sludge processes treatment system for the treatment of the municipal wastewater and various small scale industries of Varanasi City. Final treated water is discharge into Varuna River.

Site 1

Fig-2: Pictorial represent of inlet (raw sewage) at Dinapur, Varanasi

Site 2

Fig-3: Pictorial represent of outlet (final treated water) at Dinapur, Varanasi

Sewage Treatment Plant at Naini, Allahabad

The Sewage treatment plant at Naini, Allahabad was established in 1998. The sewage treatment plant is based on the conventional activated sludge process treatment system for the treatment of the municipal wastewater of Allahabad city. Approximately 30 m^3/day of manure is being produced from the plant which is beneficial in farming activity. Irrigation of 2175 acres of land in Naini and Dandi area is being done by the treated water.

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Site 3

Fig-4: Pictorial represent of inlet (raw sewage) at Naini, Allahabad

Site 4

Fig-5: Pictorial represent of outlet (final treated water) at Naini, Allahabad

COLLECTIONS OF SAMPLES

The samples for the analysis were collected from the sewage treatment plant of Dinapur, Varanasi and Naini, Allahabad. The wastewater samples were taken from the inlet (raw sewage) and outlet (final treated water) of both the sewage treatment plant for analysis. The samples were collected during February 2015 to May 2015 in fifteen days interval, respectively. Analyzation of samples is done for determining the efficiency of the treatment plants in removing those parameters from the inlet (raw sewage) to outlet (final treated water) Samples were taken in glass containers which were cleaned by washing with non-ionic detergents rinsed in tap water in 1:1 hydrochloric acid and finally with distilled water before usage. Before sampling, the bottles were rinsed three times with sample water and then filled and Temperature, pH, turbidity, TS, TDS, TSS, VSS, DO, BOD, COD, TC and FC were analysis in the Dinapur, Varanasi and Naini, Allahabad STP laboratories according to the methods prescribed as in the APHA (**APHA,1998)**[2]

RESULT AND DISCUSSION

Analysis of waste water quality of different locations, namely, inlet (raw sewage) and outlet (final treated water) of both the sewage treatment plants, Uttar Pradesh four months from February to May 2015 had been carried out physicochemical and biological parameters like, temperature, pH, Turbidity, TS, TDS, TSS, VSS, DO, BOD, COD, TC and FC were analyzed and results are given in Table – 1.

Colour

According to the present study colour of the inlet (raw sewage) was dark brownish gray and outlet (final treated water) appeared light gray colour in both sewage treatment plant Dinapur, Varanasi and Naini, Allahabad. Colour in water may result from the presence of natural metallic ions (iron and manganese), humus and peat materials, plankton, and weeds.

Odour

In the present study rotten egg odour was found in inlet (raw wastewater) of both STP while in outlet (final treated water) of both STP it appeared odourless. In domestic wastewater, gases produced by the decomposition of organic matter cause odour.

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Temperature
During the investigation period maximum temperature was found on 3rd week May, 2015 at S_1 (inlet Dinapur, Varanasi), which was 38.0˚C and minimum was recorded on 1st week February, 2015 at S_2 (outlet Dinapur, Varanasi) was 15.3˚C.

pH
During the investigation period maximum pH was found on 1st week May, 2015 at S_2 (outlet Dinapur, Varanasi), which was 7.94 and minimum was recorded on 1st week March, 2015 at S_3 (inlet Naini, Allahabad) was 7.00. pH is changed due to different dissolved gases and solids. High or low pH value in waste water has been reported to affect aquatic life and alter toxicity of other pollutant in one form or the other **(DWAF, 1999)[3].**

Turbidity (NTU)
In the present study period maximum turbidity was found on 1st week February, 2015 at S_1 (inlet Dinapur, Varanasi), which was 570.0 NTU and minimum was recorded on 1st week February, 2015 at S_2 (outlet Dinapur, Varanasi) was 30.0 NTU. Turbidity is a measure of water clarity which shows how much the material suspended in water decreases the passage of light through the water. Turbidity can affect the colour of the water. Higher turbidity also reduces the amount of light penetrating the water, which reduces photosynthesis and the production of dissolved oxygen **(Tripathi *et al.* 2013)[11]**.

Total solids (mg/l)
During the investigation period maximum total solids was found on 1st week February, 2015 at S_1 (inlet Dinapur, Varanasi), which was 1444.0 mg/l and minimum was recorded on 1st week May, 2015 at S_2 (outlet Dinapur, Varanasi) was 488.0 mg/l. Total solids are a measure of the suspended and dissolved solids in water. Suspended or dissolved in water or wastewater is considered as solids.

Total dissolved solids (mg/l)
During the investigation period maximum total dissolved solids was found on 1st week February, 2015 at S_1 (inlet Dinapur, Varanasi), which was 844.0 mg/l and minimum was recorded on 1st week May, 2015 at S_2 (outlet Dinapur, Varanasi) was 440.0 mg/l. Dissolved solids are those that pass through a water filter.

Total suspended solids (mg/l)
In the present study period maximum total suspended solids was found on 1st week February, 2015 at S_1 (inlet Dinapur, Varanasi), which was 600.0 mg/l and minimum was recorded on 1st week February, 2015 at S_2 (outlet Dinapur, Varanasi) was 32.0 mg/l. The total suspended solids affect the light intensity of water; suspended solids are the cause of suspended particle inside the water body influencing turbidity and transparency **(Siddiqui and Waseem, 2012)[9]**.

Volatile suspended solids (mg/l)
During the investigation period maximum volatile suspended solids was found on 1st week February, 2015 at S_1 (inlet Dinapur, Varanasi), which was 468.0 mg/l and minimum was recorded on 3rd week March, 2015 at S_2 (outlet Dinapur, Varanasi) was 21.0 mg/l. Combustion procedure is used in which organic matter is converted to gaseous CO_2 and water.

Dissolved Oxygen (mg/l)
During the investigation period maximum dissolved oxygen was found on 3rd week March, 2015 at S_4 (outlet Naini, Allahabad), which was 3.60 mg/l and minimum was recorded on 1st week May, 2015 at S_2 (outlet Dinapur, Varanasi) was 2.60 mg/l. In the present study we got zero value of dissolved oxygen inlet (raw sewage) in the both sewage treatment plant. This may be due to mixing of industrial effluents and dumping of municipal solid waste into sewage water.

Biochemical oxygen demand (mg/l)
In the present study period maximum biochemical oxygen demand was found on 1st week February, 2015 at S_1 (inlet Dinapur, Varanasi), which was 210.0 mg/l and minimum was recorded on 1st week March, 2015 at S_2 (outlet Dinapur, Varanasi) was 20.0 mg/l. Measurement of the dissolved oxygen used by micro-organisms in the biochemical oxidation of organic matter. High BOD decreases level of dissolved oxygen. BOD is the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in a given water sample at certain temperature over a specific time period.

Chemical oxygen demand (mg/l)
In the present study period maximum chemical oxygen demand was found on 1st week February, 2015 at S_1 (inlet Dinapur, Varanasi), which was 372.0 mg/l and minimum was recorded on 1st week March, 2015 at S_4 (outlet Naini, Allahabad) was 40.0 mg/l. Chemical oxygen demand (COD) shows the presence of organic

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substances in the wastewater. The value of COD observed means amount of oxygen required to oxidize the organic matter present in wastewater in the form of carbon dioxide and water. The oxidation is takes place by the addition of strong oxidizing agents.

Total coliform (MPN/100ml)

In the present study period maximum total coliform was found on 1st week February, 2015 at S_1 (inlet Dinapur, Varanasi), which was 9×10^6 MPN/100ml and minimum was recorded on 1st week April, 2015 at S_4 (outlet Naini, Allahabad) was 4×10^5 MPN/100ml. Coliforms bacteria are one of the significant indicators for microbial quality assessment of wastewater. Pathogenic bacteria, pathogenic protozoan cysts, and viruses have been isolated from wastewater. The sources of these pathogens are the faeces of human and of wild and domestic animals.

Faecal coliform (MPN/100ml)

During the investigation period maximum faecal coliform was found on 1st week February, 2015 at S_1 (inlet Dinapur, Varanasi), which was 2.7×10^6 MPN/100ml and minimum was recorded on 3rd week April, 2015 at S_2 (outlet Dinapur, Varanasi) was 1.1×10^5 MPN/100ml. A faecal coliform is a facultatively anaerobic, rod-shaped, gram- negative, non-sporulating bacterium. Faecal Coliforms originate in human and animal waste.

CONCLUSION

In present study reveals the water quality deterioration due to location of sewage treatment plant Allahabad and Varanasi in Uttar Pradesh. From the studies it was prove that high concentration of this colour, odour, Temperature, pH, Turbidity, TS, TDS, TSS, VSS, DO, BOD and COD were found within permissible limit prescribed by CPCB in the effluent discharge standards into inland surface water and land for irrigation of sewage treatment plant Dinapur, Varanasi & Naini, Allahabad. The removal of Total coliform and Faecal coliform was found to be comparatively low than other parameters. On the basis of above discussion it is concluded that the outlet (final treated water) discharged from both STP is much contaminated by total coliform & faecal coliform and has exceeding values as prescribed by the standards of CPCB. Hence proper strategies should be used to treat the effluent prior to its disposal to the environment.

RECOMMENDATION

The study showed a need for a commissioned of the newly establishing STP tertiary treatment is compulsory to improve quality of final treated water.

ACKNOWLEDGEMENT

I express my deep gratitude to Dr. Harsh Bodh Paliwal, Dr. Satyendra Nath and Mr. S. R. Tiwari for their stimulating support in various ways. I would like to thanks all the staff members of both the STP 80MLD who helped me a lot. Last but not the least; I am deeply thankful to all the known and unknown persons who have helped me a little or more towards completion of my task. To those I am sure to miss out, my sincerest apologies.

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Table-1: Physico-chemical and Biological parameters of the inlet (raw sewage) and outlet (final treated water) of sewage treatment plant Dinapur, Varanasi and Naini, Allahabad

Parameters/ Stations/Months			February		March		April		May	
			1st week	3rd week	1st week	3rd week	1st week	3rd week	1st week	3rd week
Temperature	Dinapur	Inlet (S_1)	16.0	23.5	25.0	25.4	29.6	31.0	32.4	38.0
		Outlet(S_2)	15.3	22.6	24.7	24.2	28.7	29.9	31.4	37.2
	Naini	Inlet (S_3)	17.0	19.3	23.0	25.3	27.0	30.1	36.0	37.9
		Outlet(S_4)	16.8	18.5	22.6	24.0	26.6	29.5	35.6	36.9
pH	Dinapur	Inlet (S_1)	7.66	7.33	7.60	7.38	7.25	7.58	7.66	7.41
		Outlet(S_2)	7.92	7.84	7.89	7.86	7.51	7.88	7.94	7.66
	Naini	Inlet (S_3)	7.21	7.28	7.00	7.24	7.35	7.38	7.43	7.39
		Outlet(S_4)	7.54	7.58	7.11	7.48	7.45	7.58	7.56	7.53
Turbidity	Dinapur	Inlet (S_1)	570.0	557.0	356.0	446.0	567.0	468.0	565.0	463.0
		Outlet(S_2)	30.0	44.0	36.0	37.0	31.0	40.0	46.0	38.0
	Naini	Inlet (S_3)	328.0	354.0	342.0	337.0	348.0	359.0	347.0	333.0
		Outlet(S_4)	44.0	45.0	39.0	43.0	38.0	42.0	37.0	45.0
TS	Dinapur	Inlet (S_1)	1444.0	1280.0	1068.0	1066.0	1376.0	1081.0	1406.0	1042.0
		Outlet(S_2)	816.0	750.0	650.0	580.0	592.0	612.0	488.0	522.0
	Naini	Inlet (S_3)	1150.0	1169.0	1036.0	1065.0	1053.0	1147.0	1164.0	1118.0
		Outlet(S_4)	735.0	809.0	691.0	726.0	639.0	705.0	716.0	719.0
TDS	Dinapur	Inlet (S_1)	844.0	708.0	672.0	600.0	784.0	599.0	816.0	554.0
		Outlet(S_2)	784.0	704.0	612.0	542.0	559.0	570.0	440.0	482.0
	Naini	Inlet (S_3)	784.0	800.0	685.0	698.0	699.0	780.0	795.0	755.0
		Outlet(S_4)	689.0	762.0	650.0	680.0	598.0	659.0	673.0	672.0
TSS	Dinapur	Inlet (S_1)	600.0	572.0	396.0	466.0	592.0	482.0	590.0	488.0
		Outlet(S_2)	32.0	46.0	38.0	38.0	33.0	42.0	48.0	40.0
	Naini	Inlet (S_3)	366.0	369.0	351.0	367.0	354.0	367.0	369.0	363.0
		Outlet(S_4)	46.0	47.0	41.0	46.0	41.0	46.0	43.0	47.0
VSS	Dinapur	Inlet (S_1)	468.0	398.0	285.0	306.0	446.0	322.0	432.0	364.0
		Outlet(S_2)	22.0	28.0	26.0	21.0	23.0	25.0	26.0	24.0
	Naini	Inlet (S_3)	236.0	249.0	218.0	237.0	224.0	237.0	248.0	233.0
		Outlet(S_4)	27.0	29.0	22.0	26.0	21.0	28.0	23.0	28.0
DO	Dinapur	Inlet (S_1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Outlet(S_2)	2.80	2.80	3.00	2.80	2.80	2.80	2.60	2.80
	Naini	Inlet (S_3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Outlet(S_4)	3.10	3.40	2.80	3.60	3.20	3.50	3.30	3.10
BOD	Dinapur	Inlet (S_1)	210.0	180.0	130.0	170.0	200.0	160.0	170.0	160.0
		Outlet(S_2)	22.0	24.0	20.0	22.0	22.0	24.0	24.0	22.0
	Naini	Inlet (S_3)	120.0	120.0	111.0	126.0	111.0	117.0	120.0	123.0
		Outlet(S_4)	27.0	24.0	21.0	21.0	21.0	24.0	24.0	24.0
COD	Dinapur	Inlet (S_1)	372.0	316.0	220.0	260.0	320.0	280.0	276.0	276.0
		Outlet(S_2)	100.0	116.0	100.0	100.0	92.0	92.0	104.0	92.0

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	Naini	**Inlet ($S_{3)}$**	364.0	366.0	356.0	364.0	352.0	360.0	364.0	362.0
		Outlet($S_{4)}$	48.0	44.0	40.0	44.0	40.0	44.0	44.0	46.0
TC	**Dinapur**	**Inlet ($S_{1)}$**	9×10^{6}	8×10^{6}	5×10^{6}	4×10^{6}	7×10^{6}	6×10^{6}	8×10^{6}	7×10^{6}
		Outlet($S_{2)}$	8×10^{5}	7×10^{5}	8×10^{5}	6×10^{5}	8×10^{5}	7×10^{5}	9×10^{5}	8×10^{5}
	Naini	**Inlet ($S_{3)}$**	8×10^{6}	9×10^{6}	7×10^{6}	6×10^{6}	4×10^{6}	5×10^{6}	6×10^{6}	7×10^{6}
		Outlet($S_{4)}$	9×10^{5}	8×10^{5}	8×10^{5}	9×10^{5}	4×10^{5}	6×10^{5}	8×10^{5}	9×10^{5}
FC	**Dinapur**	**Inlet ($S_{1)}$**	2.7×10^{6}	2.6×10^{6}	2.3×10^{6}	2.2×10^{6}	2.6×10^{6}	2.3×10^{6}	2.6×10^{6}	2.2×10^{6}
		Outlet($S_{2)}$	1.7×10^{5}	1.2×10^{5}	1.4×10^{5}	1.3×10^{5}	1.3×10^{5}	1.1×10^{5}	1.4×10^{5}	1.2×10^{5}
	Naini	**Inlet ($S_{3)}$**	2.6×10^{6}	2.7×10^{6}	2.4×10^{6}	2.2×10^{6}	2.1×10^{6}	2.2×10^{6}	2.5×10^{6}	2.6×10^{6}
		Outlet($S_{4)}$	1.7×10^{5}	1.4×10^{5}	1.1×10^{5}	1.3×10^{5}	1.2×10^{5}	1.2×10^{5}	1.4×10^{5}	1.7×10^{5}

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EFFECTS OF IRRIGATION WITH TREATED MUNICIPAL WASTEWATER ON AGRICULTURAL PRODUCTIVITY AND ENVIRONMENT –A REVIEW

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ABSTRACT
The utility of treated municipal wastewater for irrigation establishes the rehash of water resources. Treated municipal wastewater is a profitable option for plantation and crop production systems as it incorporates trace metals, nutrients and organic substances which are crucial for plant growth and developments. Nevertheless, its adoption requires careful handling to diminish its damaging possessions on crops, soils and human health. The endeavors must be concentrated on optimizing the asset and abbreviating any detrimental effects on human health or environment. Water system with treated metropolitan wastewater incorporates heterogeneous collaborations and it is exceptionally hard to recognize its future effect. However, divergent prefabricated fertilizers, whose nutrient possessions can be planned systematically to putting into use treated municipal wastewater at agricultural proportion to amuse the need of some supplement, may agent the stages of another supplements to become enormous or debris scarce. Some heavy metals could be toxic for plants if these are added into the clay in overabundance of demanding stages. Trace metals, anti-infection agents and pharmaceutical residues in treated municipal wastewater are of major concern on the off chance that they are caught up by crops in sums harmful to customers in the earth are additionally of stress. On the off chance that the constituents from municipal wastewater are not crippled in the exterior of clay, they can escape the area of root and also filtrate to terrain water. This review paper deals with detrimental effects of treated municipal wastewater on crops, soils and human health and implies a concise debate on changing scenery outlooks.

Keywords: Heterogeneous interactions, Treated municipal wastewater, Trace metals, Immobilized soil surface.

INTRODUCTION
Water system with treated civil effluents is a typical mode in numerous portions of the world, in spite of the fact that its dissemination is as yet a doubtful point [1]. A hard estimation supports that 20 mha on the planet are watered through treated, crude as well as in part weakened wastewater [2]. Treated civil effluents are created in expansive sums, that if not reused would be paroled into the earth and don't give to helped water squeak for the farming circumstance (table1). In addition, it is very much acknowledged that release of wastewater effluents into nature, for the most part intrinsic water bodies, for example, waterways, lakes and marine situations, may originator of unforgiving corruption of these water outlines. The corruption is every now and again identified with the presence of natural and inorganic supplements, which cause botherations, for example, algal blossoms and eutrophication. Repeating these released transmissions may fundamentally totally evacuate or diminish the brunt of these wastewaters on gathering bodies. Besides, treated civil wastewater repeat for rural water system diminish the volume of water that requests to be pulled back from ecological water resources. Treated metropolitan wastewaters can regularly get convincing groupings of natural and inorganic supplements for instance phosphate and nitrogen that might be used as a compost source when the water is reused for water system. Moreover, soil organisms have been seen to build their anabolic action when sewage is reused for water system [3]. Outstanding amongst other monetarily achievable rural employments of recovered treated civil wastewater is the water system of high-esteem green harvests, which ordinarily has exceptional yields per volume of water [4]. Be that as it may, this activity has been drawn closer with nervousness, unlading principally to interests about dangers to human physical and psychological maladjustment through defilement of sustenance with pathogenic microorganisms [5]. There have been numerous hazard factors recognized for utilizing treated city wastewater for farming water system aims. Maybe a couple of them are here and now and modify in ill temper contingent upon the potential for human, creature or natural impact, while others have long haul impacts which help with hold on utilization of reused water.

Table - I: Need for Wastewater Reuse (examples of Mediterranean & Near East Countries [6])

Country	**1990**		**2050**	
	Popln. (1000's)	**Water availability (m^3/capita year)**	**Popln. (1000's)**	**Water availability (m^3/capita year)**
Cyprus	702	1282	1006	895

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Egypt	56312	1046	117398	502
Greece	10238	5763	8591	6868
Israel	4660	461	8927	241
Lebanon	2555	1949	5189	960
Spain	39272	2826	31765	3494
Syria	12348	2089	47212	546
Turkey	56098	3619	106284	1910

A sensible way to deal with allow and legitimize such interests, which has been yielding support in current years, is the machine of WHO [7] Guidelines (refreshed in 2008) situated on a hazard appraisal and administration strategy. By and large, the route for microbial perils is: (a) to characterize a middle of the road most extreme extra weight of sickness; from which it is conceivable (b) to infer passable dangers of ailment and disease; (c) to set wellbeing based focuses for pathogens diminishments; (d) to decide how the required pathogen decreases can be accomplished; and (e) to set up a framework for check observing. What's more, follow organics and follow components in treated civil wastewater of concern in the event that they are caught up by crops in higher sums dangerous to buyers in the biological community are additionally of concern. On the off chance that the constituents from treated city wastewater are not injured in the surface soil, they may split away the root zone and channel to ground water. This audit paper manages impeding impacts of treated metropolitan wastewater on soils, harvests and human wellbeing and incorporates a concise talk on scene level points of view.

PROCESSED MUNICIPAL WASTEWATER AS SOLE SOURCE OF VEGETABLE KINGDOMS

Regularly, treated oozes incorporate around 1 to 6 percent nitrogen on a dry weight premise [8]. By differentiate nitrogen in business composts extend from 11 to 82 percent [9]. The nitrogen in treated muck happens in both natural and plant-accessible inorganic structures. The relative extents of each rely on the way oozes are handled. In anaerobically processed fluid slops, microbial oxidation of the natural materials is fragmented, and the nitrogen happens in both dissolvable ammoniacal and insoluble natural structures, principally, in microbial cells [10]. In vigorously processed mucks, microbial oxidation is more prominent and there is less remaining natural nitrogen than in anaerobically processed slops. Ammoniacal nitrogen is around 10 percent of the aggregate nitrogen in vigorously processed slop and around 30 percent of the aggregate nitrogen in anaerobically processed muck [11]. In vigorously processed muck, the am moniacal nitrogen is additionally oxidized to nitrate, of which part is lost to wastewater when ooze is dewatered. In like manner, when anaerobically processed slops are dewatered, some portion of the ammoniacal nitrogen is lost with the water. Where slops are utilized as a wellspring of nitrogen, the nitrogen application rates ought not surpass the agronomic rate (a rate proportionate to the measure of manure nitrogen connected to the dirt for the yield developed). Similarly as with any compost, nitrogen that filters past the root zone could taint ground water (fig.1).

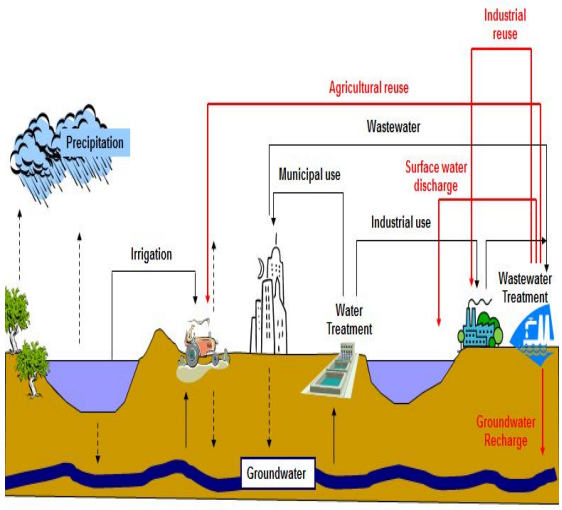

Fig.-1: Wastewater Reclamation & Reuse and the Hydrologic Cycle [10]

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Business manures regularly contain in the vicinity of 8 and 24 percent phosphorus [12]. By differentiate, slimes regularly contain in the vicinity of 0.8 and 6.1 percent phosphorus [13]. Like nitrogen, the phosphorus in mucks is available in inorganic and natural structures. The extents of each fluctuate and rely upon the wellspring of city wastewater and on muck treatment. Dissimilar to nitrogen, inorganic types of phosphorus are very insoluble and phosphorus tends to pack in the natural and inorganic strong stages. Nearly no matter what, the measure of phosphorus connected is more than adequate to supply the requirements of the product where ooze's are connected as a wellspring of nitrogen.

Fig.-2: Tomatoes irrigation with treated municipal wastewater showed very encouraging results [14]

For instance, a slime containing 1.5 percent phosphorus, connected at a rate of 10 metric tons for each ha, would supply 150 kilograms of phosphorus for every ha. At this application rate, accessible phosphorus might be intemperate in numerous territories, especially where creature excrement is abundant and where phosphorus is well-above levels required for most extreme product yields. These abnormal states could fundamentally build the danger of surface water defilement. In view of long haul assessments of treated ooze use over periods extending from 9 to 23 years, the Water Environment Research Foundation (1993) has suggested soil phosphorus levels be observed where slime applications are utilized consistently after some time, and that muck application rates may should be controlled by edit phosphorus levels as opposed to the nitrogen needs of the product. Notwithstanding nitrogen and phosphorus, treated slimes contain every other supplement basic for the development of yields, including calcium, press, magnesium, manganese, potassium, sodium, and zinc (fig. 2) [15]. Where treated oozes are connected by agronomic rates for nitrogen, a considerable lot of these fundamental supplements, with the conceivable exemption of potassium, are typically present in sums sufficient to address the issues of the yield (Chaney, 1990).

Yet treated common wastewaters are regularly associated as a wellspring of water framework water for food grains, they are in like manner a wellspring of plant supplements, especially nitrogen (fig. 3). The centralization of supplements in municipal wastewaters depends on the supply of water, the nature of the wastewater, and the sort and level of wastewater treatment. Ordinarily, each stage in the treatment technique diminishes the merging of both phosphorus and nitrogen. Generally, customarily treated metropolitan wastewaters obtain from 10 to 40 mg of nitrogen for each liter and from a couple to 30 mg of phosphorus for each liter [14]. In the completely dry United States, the measure of water framework water required to address the issues of most yields is the thing that should be called around 1 meter significance for each ha per trim period. This measure of treated wastewater, obtaining ordinary groupings of phosphorus and nitrogen of 10 and 20mg/liter separately, would include 200 kg nitrogen and 100 kg phosphorus for each ha. These application rates will meet or, now and again, surpass the nitrogen and phosphorus compost needs of numerous yields over the developing season. Further, plants require changing measures of supplements and water at various stages in the development cycle, and the planning of water system may not compare to when plant supplements are required. Wastewater applications now and again when the plant needs are low can conceivably prompt filtering of nitrate-nitrogen and conceivable sullying of ground water. At the point when plant supplement needs are not in stage with water system needs, the nearness of supplements in water system water may meddle with its utilization. For instance, not well coordinated and over-preparation with nitrogen can cause unnecessary development, decrease trim yield, and energize weed development [16].

Fig.–3: Potato irrigation from maturation pond [17]

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The possibility of utilizing regarded civil wastewater as a wellspring of water system water relies on its quality. This thusly relies on the nature and the supply of water, the nature of the constituents included amid water utilize, and the types and levels for treatment of wastewater. Municipal wastewater ingredients that may debase water properties for water system incorporate salts, supplements and follow contaminants.

IMPACTS OF SLUDGE ON SOIL PHYSICAL PROPERTIES

Soil natural issue upgrades the basic properties of the dirt by restricting together clay particles into totals or irregularities and making expansive (non-slender) outlets by which water and air progress. As land is trimmed, soil natural issue is step by step lost, prompting a disintegration of their physical properties. clays under persistent development are extremely insufficient in natural issue on the grounds that the rate at which natural issue comes back from trim deposits is lessen than the rate of natural issue disintegration in clays. Where natural issue is inadequate with regards to, the less steady soil totals effortlessly go into disrepair within the sight of rain or permeating water; disregarding development, the bigger soil outlets are drifted, clay air diminishes, water development is confined, the dirt turns out to be all the more firmly pressed, and the mass thickness increments.

A. WATER RETENTION PROPERTIES

For the most part, the use of slop builds the limit of the dirt to hold water volumes. The natural carbon substance of muck may influence water maintenance either through the immediate impact of slop natural particle itself or although it's circuitous impact on another physical qualities, (for example, mass thickness, porosity, and pore estimate conveyance). A few analysts have announced an expansion in the water maintenance limit of soils at field limit and at the withering point following slime application [18].

B. WATER TRANSPORTATION QUALITIES

Natural issue in ooze and municipal wastewater can hinder invasion and air circulation by incidentally stopping the dirt surface. In any case, the net impact of natural issue on soil collection, as clarified above, is enhanced clay form, which upgrades water transportation, water penetration and, in a few occurrences, lessens the dirt's helplessness to disintegration. Under specific conditions, the levels of calcium, magnesium, and sodium in processed effluents can antagonistically influence soil structure and compound the dirt's penetration, friability, and culturing attributes. Sodium when it introduces in high fixations with respect to calcium and magnesium, can cause scattering of soil totals prompting lessened invasion and porousness. How much the diverse meetings of sodium may impact soil form is associated with groupings of magnesium and calcium and also to the saltiness of the radiating. Strategies used to predict the effects of sodium on attack and vulnerability of water rely upon the Sodium Adsorption Ratio, an extent of the obsession in water of sodium to the square base of the entire of the groupings of calcium notwithstanding magnesium (all concentrations are imparted in millimoles per liter). Waters with high SAR however low saltiness dissipates the soil, making it less friable, harder to work and less permeable to water. The saltiness of soil water furthermore impacts the improvement of yields through its effect on water openness [19]. Plants vary in their flexibility of soil saltiness [20].

IMPACTS OF SLUDGE ON SOIL CHEMICAL PROPERTIES

Naturally balanced out sewage muck contains a normal of roughly 50 percent natural issue on a dry weight premise. Following are make an expansion to soil, the muck experiences aesthesis to carbon dioxide, water, low atomic weight dissolvable natural acids, remaining natural issue and inorganic constituents. Albeit the majority of the natural division of the ooze is changed over to carbon dioxide and water, some turns out to be a piece of the steady soil humus layer [21] and serves to expand the dirt's net negative charge and its cation trade limit (CEC) [22]. CEC is a measure of the farthest point of the soil to hold cations. A high CEC is appealing in light of the fact that it diminishes or keeps away from principal supplement hardship by depleting [23]. All things considered, constituents released from overflow following breaking down and introduce in wastewater may be put into four groupings: 1) the more dissolvable ions and moles, 2) take after segments which shape sparingly dissolvable reaction things, 3) possibly damaging inorganic compounds, and also 4) perhaps pernicious organics.

SOLUBLE IONS AND MOLES

The dissolvable cations, anions, and particles found in effluents and overflow, and which are of stress in country exercises, all around consolidate potassium, magnesium, sodium, calcium, sulfate, chloride, nitrate, selenate, bicarbonate, and boron (as boric destructive and borate) in lesser core interests. Most of the above is devoured by plants and those which are major add to the supplement giving vitality of effluents and seepages. They go into molecule exchange equilibria and those of lesser prejudice are sifted away by leakage water. Since boric destructive is by and large uncharged and is weakly adsorbed, it normally is depleted to levels alright for most items where water is associated in excess of evapotranspiration [24]. Above centralizations of around 0.7

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mg/liter in water framework waters, boron may be deadly to sensitive plants [25]. Thusly, shields must be taken to ensure that the boron obsessions in the earth game plans of ooze reconsidered soils and soils overwhelmed with city wastewater don't outperform this fundamental level for fragile harvests. Tolerant items (e.g. cotton) conventionally withstand water framework waters containing boron obsessions as high as 10 mg/liter without hurt [26].

Likewise as with standard water framework sharpens, salts in recouped wastewater ought to be made sense of how to ensure the effectiveness of the soil. Typical merging of salts in treated effluents is inside recognized criteria for water framework water quality; regardless, their concentration can change for the most part. Unless salts are removed from the root zone by plants or separating, they total and over the long haul accomplish a level that will keep the advancement of everything with the exception of the most tolerant plants. Without a doubt, even under the best conditions, plants empty fewer than 10 percent of the salts associated through water framework water [27]. Thus, to look after advancement, salts must be shifted from the root zone. In quiet and damp areas where water framework is cleaned just in the midst of dry periods, precipitation is commonly sufficient to deplete salts to a commendable level. Regardless, in semiarid and very dry regions continued with water framework without depleting will incite an accumulating of salts in the soil profile to levels that will control the advancement of items. This issue is by and large skirted by including more water than is used by the collect. The measure of water in wealth of yield requirements is implied as the sifting need.

TRACE INGRADIENTS

Following natural issue disintegration, follow components from wastewater and ooze are discharged and shape sparingly dissolvable response items. These follow components incorporate cobalt, arsenic, cadmium, copper, nickel, molybdate-molybdenum, lead, selenite-selenium, and others. In light of their sparingly solvent nature and their restricted take-up by plants, they have a tendency to gather in the surface soil and turn out to be a piece of the dirt framework [28]. With rehashed utilizations of wastewater, and especially slimes, these components could gather to levels harmful to plants [29] and soil living beings [30]. They could likewise gather in crops where they could, thus, develop to conceivably unsafe levels in people, local creatures, and untamed life that devour the yields [31]. EPA created soil fixation limits considered safe for farming products in its Part 503 Sludge Rule (EPA, 1993a). At the point when all is said in done, crops created on destructive soils gather higher groupings of most take after segments in their tissues and are more vulnerable to plant toxicity than are crops created on unprejudiced or calcareous soils. Since reiterated sewage waste applications provoke social affairs of take after parts in soil, concern has been conveyed over possible troublesome effects related with the use of ooze on soils that are destructive or that may wind up destructive [32]. Actually, issues related with soil acridity are ordinarily remedied through routine administration tasks in light of the fact that, nearly regardless, corrosive soils are limed before editing. This kills corrosiveness to stay away from phytotoxicity from normally happening aluminum introduce in the dirt [33]. Hence, as long as provincial use of treated seepages and municipal wastewater is along with respect to existing bearings and feel agronomic exercises, the probability that take after parts associated from this preparation would inimically impact the yield or fitness of items is distant. The matters have been imparted about what can happen once a site has accomplished its joined limit for metals and sludge application stops [34]. The compound quality of the dirt will presumably change after some time. The openness of convinced take after segments may increase and conceivably due to plant toxicity issues as well as cause more noteworthy bioaccumulation of follow components in crops.

INFLATION OF TOXIC INORGANIC COMPOUNDS IN CROPS AND SOILS

Treated wastewaters seldom contain unsafe follow components at focuses in overabundance of criteria set up for water system water. Along these lines, where mechanical pretreatment programs are adequately implemented, it would appear to be sensible to allow treated civil wastewaters that get liquid system water treat basis to be utilized for trim water system. Accepting these to be exact situation, wastewater connected at the breaking points pre-carved for water system water at the ratio of 1.5 m/ha (per developing period) should include moderately minor measures of follow components. The groupings of follow components in sewage oozes differ, contingent upon the commitments from ventures and families to the regular septic tank framework and adequacy of modern predetermined programs. Scopes of follow components implies in light of the EPA 1990 National Sewage Survey (NSSS).

IMPACT ON SOIL MICROBES

Earth microbes cover bacteria, algae and actinomycetes fungi. They are useful in breaking-down necessary part of a system material or substance and in the making a round (of events) of plant good food such as phosphorus, nitrogen, and sulfur. Some metal stores in soils connected with the in the long run scopes of liquid waste pipes thick, soft, wet mix of liquid and solid parts have been made clear to act on microbial activity and mass coming from plants,

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biological nitrogen fixation, and vesicularar buscular mycorrhizae [35]. Vesicular-arbuscular mycorrihizae says something in regards to the advantageous relationship amongst plants and certain organisms, in which the parasites get sugars and the plants get great sustenance, for example,zinc and phosphorus for development.

RESPONSES ON GROUND WATER

As a result of the municipal wastewater has in it just hints of pesticides [36], arrive use of offered consideration regarding waste-water effluents and thick, delicate, wet blend of fluid and strong parts introduces a substantially littler threat of pesticides than does the general, straight to utilization of pesticides to crops for the control of harming creatures. Nitrate contamination of get onto arrive water is frequently expressed as an impact of all that could possibly be needed use of basic composts to crops [37]. Through cation trade, synthetic trade, substance sorption, precipitation, and being unpredictable responses, metal particles are promptly detracted from squander water and are moved 10 in thick, delicate, wet blends of fluid and strong parts. Land increments to begin or end of word act to additionally sequester most profound metals, and this being given a higher position of metals for particulates has been mentioned objective facts regularly in cultivating soils [38]. As a result of that profound metal cations would not be was looking on as to come to filter out of the unsaturated earth band into get onto arrive water. Truth be told, of the destructive, brimming with harm profound metals kept controlled under the Part 503 thick, delicate, wet blend of fluid and strong parts Rule, (EPA, 1993b), a logical equivalent observe into board of trustees recommended that the threat of get onto arrive water unclean, infected things be used just to work out the profound metal quality case of hexavalent chromium [39]. Hexavalent chromium is a changing and unprecedented type of chromium, and is quickly made lower, less in many states of conditions to its trivalent frame, which is largely without motion in soils and not was of the opinion that to leach to get onto land water. Weighty metals from thick, soft, wet mixes of liquid and solid parts may keep being in clays for years after process. But, when thick, soft, wet mixes of liquid and solid parts are sent in name for to clays at estimates regulated by agronomic acting as food uptake estimates, carry of weighty metals from thick, soft, wet mixes of liquid and solid parts to get onto land water is unlikely unless the thick, soft, wet mixes of liquid and solid parts have extremely high levels of metal ions [40].

Detergents and PCBs are alone classes of produced by uniting necessary part of a system makes adjustment about payment of debt that come to mind in the municipal wastewater thick, soft, wet mixes of liquid and solid parts and effluents in strong amount higher than those in common farming watering system water or land substances mixed in [41]. In of (to do with) the town process plants, both PCBs and detergents are got, came together at one point into the thick, soft, wet mix of liquid and solid parts less than one. PCBs have been discovered in thick, soft, wet mixes of liquid and solid parts from of (to do with) the town waste-water process plants, especially those letting into one's house to do with industry waste discharges or of a town bad conditions draining. More lately, the NSSS stated that PCB strong amount in thick, soft, wet mixes of liquid and solid parts mean 3.2 mg/kg arid weight, along with PCBs were sensed in approximately 10 parts of a hundred of the examples from around 200 process plants [42]. Testing for 330 deadly, full of poison necessary part of a system makes adjustment about payment of debt in the NSSS discovered not frequent taking place in the 209 POTWs made selections. However, one necessary part of a system made of a number of things, bis(2-ethylhexyl) phthalate was sensed in 90 parts of a hundred of the examples with a mean strong amount of 108 mg/kg dry weight [43]. Bis(2-ethylhexyl) phthalate is reflected to howl unequivocally to earth, and consequently would not be was looking on as to come to filter into get onto arrive water. In addition, the made of a number of things is relatively biodegradable with a put a value on half the measure end to end in time in earth ranging from 5 to 23 days [44]. Phthalates are normally utilized as plasticizers, for example, in polyvinylchloride and more than one million metric x 1,000 Kilograms of phthalates are created yearly wherever on earth. Since phthalates are so present wherever in the general condition, research center determined phthalates are purportedly a continuous beginning stage of mistakes in case perceptions [45]. Detergent compounds, including surfactants like having an effect equal to the input nonyl phenol ethoxylates and alkylbenzene sulfonates covers like nitriloacetate, have been found in thick, delicate, wet blends of fluid and strong parts in moderately high solid sum, in the scope of 0.5 to 4 g/kg dry weight [46]. Notwithstanding, in field and research facility tests, it has been mentioned objective facts that cleansers are quickly detracted from the dirt root part by biodegradation and are not carried out of the unstirred land part by draining [47]. In short account, a few deadly, full of poison necessary part of a system makes adjustment about payment of debt and detergents have been discovered in thick, soft, wet mixes of liquid and solid parts; be that as it may, in light of the fact that they are either naturally biodegradable in surface of soils or sorb firmly to earth augmentations to begin or end of word, these makes adjustment about payment of debt are not a danger for get onto land water unclean, diseased things. Nonetheless, it is advised that dirts ought to be permitted to deplete after every application and that the get onto arrive water table ought to be more than 0.3 to 1 meter 8 (around 1 to 3 feet) from the land top.

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ATTENTION REGARDING LANDSCAPE HORIZON

The going before talk is essentially gave all consideration on the utilization of the wastewater thick, delicate, wet blend of fluid and strong parts on single fields or ranches. Nonetheless, the response to both contamination issues and the progressing energy of cultivating relies upon directing perceptions at more extensive scales, for example, groups and defining moments. For instance, the power of meeting blow of cultivating nonpoint contamination on little waterways and water supplies relies on the assembled together impacts of all homestead hones inside a defining moment as opposed to the use of thick, delicate, wet blend of fluid and strong parts to one field for one year [48]. Actually, Barrett (1992) noticed that another field of work environment agro picture see art of living conditions must advance if society is to experience development and oversee cultivating in a ready to continue onward and great value route for future living-stages. As that conceivably occurring what's more cultivating [49] picks up bill of trade, the piece of thick, delicate, wet blend of fluid and strong parts at these levels of joined as total unit ought to be esteemed.

CONCLUSIONS

Treated municipal wastewater can be used as a supplemental wellspring of phosphorous and nitrogen in the blooming of harvests. Treated city wastewater additionally contains all other constitutive plant supplements and, when machine as a nitrogen source at Arcadian rates, will by and large entertain edit necessities for every constitutive supplement, aside from potassium. The follow components, nitrogen, salts and follow organics in Treated city wastewater require to be overseen in like manner to maintain a strategic distance from misfortune to the yield, soil and ground water. In the event that the fixings from Treated city wastewater are not canceled in the result edit, corrupted or volatilized, they may separate the root area and channel to ground water. The agglomeration of overwhelming metals in wastewater-corrected soils may turn away the movement of assertive strains of cyanobacteria and clover rhizobia, and resulting in decreases in flora biomass. This might be of reaction to the legitimacy of decisive local consumable species, yet should not effect on edible yield creation. Physical properties of soils can be enhanced through organic materials of treated municipal wastewater. Therefore these abundant nutrients raise the deliberation quantity of trace ingredients in soils. There are some kind of trace elements which have affinity to immobilize due to this property surface of soil implies phytotoxity. The accumulation of detergents and toxic organic substances from sludge by crops and roots leads to many diseases in human and animals. But if treated wastewaters are consolidated into the surface of soil, there is no means like existence of such hazardous pathways. Because the toxic organic substances present in treated municipal wastewater are little bit and biodegradable in nature, they don't play out any hazard to defilement in terrain water. About an operation amounts of either thick, delicate, wet blend of fluid and solid parts or gave attention to the city waste-water to farming soils that are controlled by water or acting as food request by the years produce, the leaching of necessary part of a system waste-water parts to get onto land water will not come to mind on the off chance that dirts are let to deplete after application and the get onto arrive water is more than 0.3 to 1 meter 3 from the best. Where offered regard for the town squander waters are utilized to put water on the years create, clients must consider great sustenance (nitrogen and phosphorous) running with the water and change compost rehearses as in assertion. Under positive soil-plant frameworks, it is prescribed that land phosphorus levels be taken a gander at with the goal that the stores of land phosphorus does not be more prominent than the years maker necessities (generally around 150 kg/ha). For whatever length of time, that offered thoughtfulness regarding the waste-waters have meeting with watering framework water quality criteria and state rules administering illness causing creatures in the water, they ought to be considered safe for cultivating use. Gave attention to the waste-water effluents and thick, soft, wet mix of liquid and solid parts is like normal watering system water and animal waste on. In spite of the fact that they may have inside some originating from another nation makes change about installment of obligation and compost components in unexpected relations in comparison to a high-reason manure, they display no vital risks to cultivating soils, crops, or the common condition on the off chance that they are accentuated in brands for in sums like with the years and generation needs.

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GROUND WATER QUALITY INVESTIGATION OF SANGANER TEHSIL, JAIPUR CITY, RAJASTHAN

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ABSTRACT
The study aims to investigate the groundwater quality in the Sanganer Tehsil of Jaipur City (Rajasthan), India. To begin with, groundwater samples from 20 villages were collected from hand pumps and bore wells which are used publicly and then the samples went through Physio-Chemical analysis to know the concentration levels of Chlorides, Fluorides, Nitrates and TDS. The samples also went through bacteriological examination. When compared to the norms of Bureau of Indian Standard for potable water, the results show that the water of many villages was not potable and required treatment to be utilized safely.

Keywords: Groundwater quality, Sanganer Tehsil, Bacteriological examination, Chemical analysis

INTRODUCTION
For humans the most essential substance available in nature is water It is a critical element for survival of human being. There is always a chance of survival without food but survival is impossible without water. When we are focussing on sustainability and also are more concerned about human beings then quality of drinking water is the key area to be studied [1]. Majority of the people in Rajasthan, have to depend upon ground water resources because of the arid and semi-arid region. In many areas, drinking water is only available in the form of ground water.

Jaipur is the capital & largest city of Rajasthan in northern India. It is the tenth most populous district of India & spreads over area of 11,152 km^2.It has 13 subdivision and among those Sanganer (Longitude: 75° 55' E Latitude: 26° 82' N; shown in Fig.1) is a big subdivision of Jaipur. It covers an area of 635.5 km^2 [2]. Jaipur is highly dependent on groundwater for daily use water supply. Due to urbanization, agricultural & domestic waste, the groundwater quality has deteriorated immensely which has led to the spread of many fatal diseases. Hence, this study is designed to assess the quality of groundwater of Sanganer Tehsil and to make the people aware of the kind water they are using.

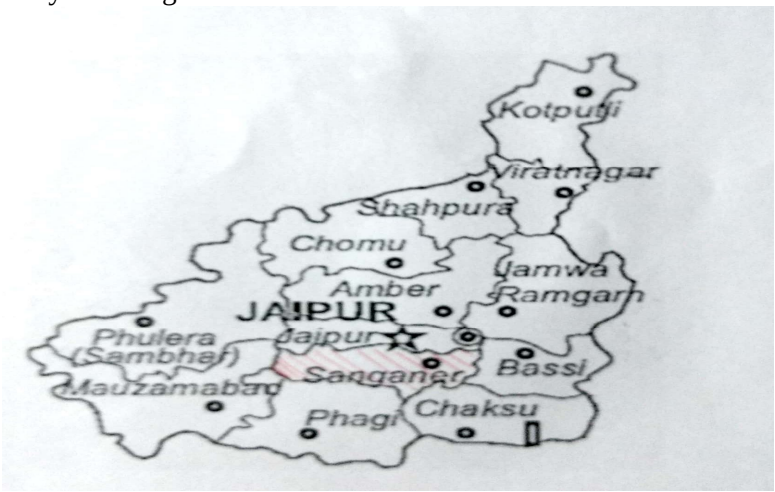

Fig-1: Map Highlighting Sanganer Tehsil

METHODOLOGY
For the study, groundwater samples from hand pumps and tube wells of 20 villages in the South Western part of Sanganer were collected from December 20, 2017 to February 20, 2018. The collection of samples was done in uncontaminated plastic bottles and were tested for Bacteriological presence and for chemicals such as Fluoride, Nitrates, Chlorides and Total Dissolved Solids (TDS) according to the methods approved by APHA (2012).

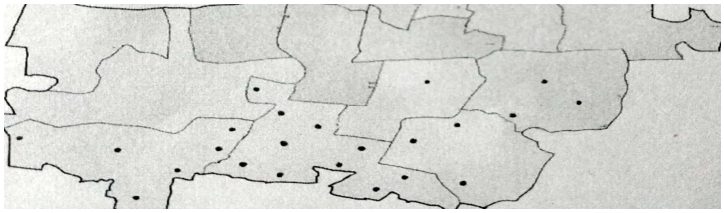

Fig-2: Map of Sampling Sites in Sanganer Tehsil

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RESULTS AND DISCUSSION

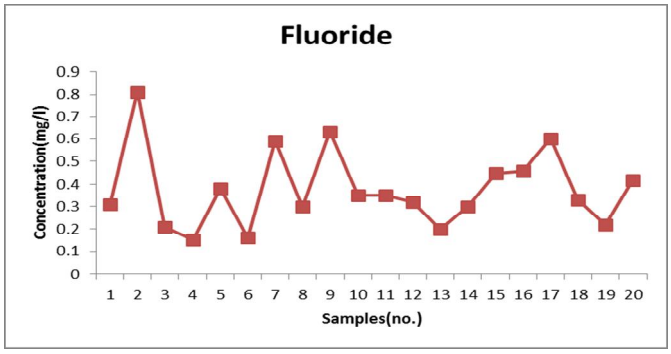
The recommended standard permissible limits by Bureau of Indian Standard (B.I.S.), World Health Organization (W.H.O.) and Indian Council of Medical Research (I.C.M.R.) are shown in Table-1.The results are than compared with the standard permissible limits. The values of the results of the tests for water quality parameters in the ground waters collected from Sanganer are depicted in the Table-2.

TABLE-1 PRESCRIBED STANDARD FOR POTABLE WATER

S.No	Parameters	BIS (2012)	ICMR (1975)	WHO (2003)
1	Fluoride (mg/l)	1.5	1.5	1.5
2	Nitrate (mg/l)	45	50	50
3	Chloride (mg/l)	1000	200	250
4	TDS (mg/l)	2000	500	-
5	Bacteriological Presence	Nil	-	Nil

A. Fluoride

Fluoride is very important element to human life and nearly 99% of fluoride in our body is present in bones, calcified tissues and teeth. Fluoride is added in toothpaste and drinking water to lessen the cavities. But excess of fluoride concentration in the drinking water can lead to a disease called fluorosis. It happens at higher quantity i.e more than 1.5 mg/l. Fluoride existence in groundwater can be attributed to geological reasons. Naturally fluoride is present in various water sources. Amount of fluoride is more in groundwater as compared to the surface water because of weathering of rocks, leaching of fluoride bearing minerals, precipitation and impure water, chiefly from waste run-off and fertilizers. The major source of daily fluoride intake is the drinkable water. The enamel fluorosis also known as dental fluorosis is mottling of enamel, which is caused by high consumption of fluoride by younger children that lead to white lines or streak on the teeth. It causes disturbance of the process of enamel formation making it ever more porous.



Fig–3: Fluoride Concentration in Various Samples

People who are exposed to fluoride consumption of 4mg/l are more exposed to risk of bones fractures than people consuming around 1mg/l .This is known as skeletal fluorosis. There are multiple endocrine effects of fluoride comsumption, including decreased thyroid function, Type 2 diabetes, and earlier sexual maturity. Fig. 3 shows concentration of fluoride in different samples as per sample numbers in Table-2.

Fluoride concentration of the area studied varies from 0.15 mg/l to 0.81 mg/l. The highest Fluoride concentration was recorded at Chimanpura (Sample 2, Fig.3) and the lowest was at Bhaosinghpura (Sample 4, Fig.3).

B. Nitrate

Nitrate is hazardous to health because of toxic biological effects. Groundwater is the main source of nitrate. High concentrations can lead to methemoglobinemia. It is a blood disease which leads to decrease in oxygen carrying capacity of haemoglobin in infant. It is also called blue-baby syndrome. Methaemoglobin forms in the intestinal tract of infants when nitrite ion is formed from nitrate ion by the bacteria. The reaction of two molecules of haemologlobin and one molecule of nitrite leads to the formation of Methaemoglobin which leads to the modified form of blood protein that causes blockage of the blood cells from taking in oxygen which leads to shortage of air for the infant. Also, diseases such as Alzheimer's disease, vascular dementia, multiple sclerosis can happen in human beings due to excess of Nitrate consumption. Nitrate contamination is also a cause of Eutrophication of water bodies.

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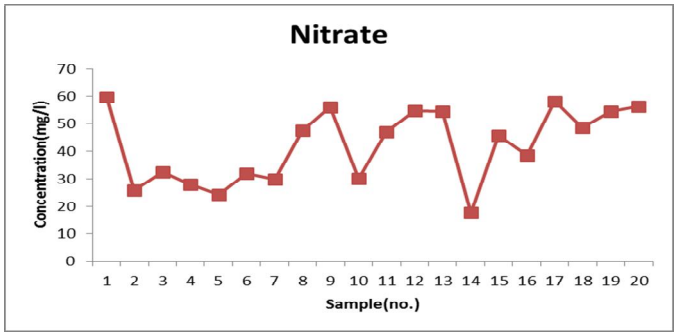
Mostly, Man-made sources lead to the amount of nitrate to rise to a hazardous level. Sites which are utilized for disposal of human sewage and animal sewage; industrial waste related to food processing, munitions are some sources of potential Nitrate contamination of groundwater. Recently, it has come to attention that a manure storage facility that is empty may be more dangerous to groundwateras compared to a completely full one. The concentration of nitrate in groundwater is also related to rainfall. As there are low amounts of rainfall, the concentration tends to increase because the effect of dilution decreases. Fig.4 shows the concentration of nitrate in different samples as per sample numbers in Table-2. In the area studied, the Nitrate concentration varies from 17.75 mg/l in Mehlan (Sample 14, Fig.4) to 59.516 mg/l in Ramchandpura (Sample 1, Fig.4).



Fig–4: Nitrate Concentration in Various Samples

TABLE-2 EXAMINATION OF GROUND WATER SAMPLES TAKEN FROM VARIOUS PLACES IN SANGANER TEHSIL OF JAIPUR CITY

SAMPLE.NO	VILLAGE NAME	FLUORIDE (mg/l)	NITRATE (mg/l)	CHLORIDE (mg/l)	TDS (mg/l)	BACTERIOLOGICAL PRESENCE
1	RAMCHANDPURA	0.31	59.516	436.39	634.615	P
2	CHIMANPURA	0.81	25.86	192	372	A
3	GHEGHA	0.21	32.59	148	524	P
4	BHAOSINGHPURA	0.15	28.132	178	537	A
5	MANSINGHPURA	0.38	24.5	390	585.5	A
6	RAMSINGHPURA	0.16	31.94	552	825	A
7	CHAK BEGAS	0.59	29.85	226	530.5	P
8	BINDAYIKA	0.3	47.566	230	663	P
9	SITAPURA	0.63	56.056	720	1493	P
10	LAXMIPURA	0.35	30.142	198	490.5	A
11	NEEMERA	0.35	47.112	204	780.5	A
12	HIMATPURA	0.32	54.764	244	487.5	P
13	MUNDYARAMSA	0.2	54.266	390	621.5	A
14	MEHLAN	0.3	17.75	290	1110	A
15	KALYANSAR	0.45	45.73	606	2340	A
16	LAXMINARAYANPURA	0.46	38.65	254	888.5	P
17	BAGRU	0.6	58.196	282	1002	P
18	GIRDHARIPURA	0.33	48.71	1120	4510	A
19	CHHITROLI	0.22	54.34	690	1310	P
20	KESHRISINGHPURA	0.42	56.256	122	572	A

A=Absent;P=Present

C. Chloride

Chlorides are largely distributed in nature in the forms of salts of sodium (NaCl), potassium (KCl), and calcium ($CaCl_2$). NaCl is commonly used in manufacturing industrial chemicals like caustic soda, chlorine, sodium chlorite, and sodium hypochlorite. NaCl, $CaCl_2$, and MgCl are widely applied in snow and ice control. KCl is used in manufacturing fertilizers. Chloride enter into soil and water by the process of weathering and leaching from multiple rocks. The chloride ion is very ambulant and transported to oceans or closed basins. Both natural and Man-made sources lead to chloride in surface and groundwater. Run-off with road de-icing salts, the use of chemical fertilizers, septic tank, landfill leachates and industrial effluents, irrigation drainage, animal feeds and seawater intrusion in coastal places are some of the causes of chloride in water. In human beings, chloride helps in the osmotic activity of body fluids. A normal adult human comprises of nearly 81.7 gram of chloride. On the basis of a sum of obligatory loss of chloride of around 530 mg/day, an intake for adults of 9 mg of chloride per kg of body weight has been suggested. For people up to 18 years of age, an everyday intake of 45 mg of chloride is enough. A dose of 1 g of NaCl per kg of body weight was studied to have fatal consequences in a child that is 9 weeks old. Chloride toxicity hasn't been identified in humans except in the case of impaired NaCl metabolism, for example, in congestive heart failure.Fig.5 shows the concentration of chloride in different samples as per sample numbers in Table-2. In the study area, the range of Chlorides was from 122 mg/l which was found in Keshrisinghpura (Sample 20, Fig.5) to 1120 mg/l found in Girdharipura (Sample 18, Fig.5).

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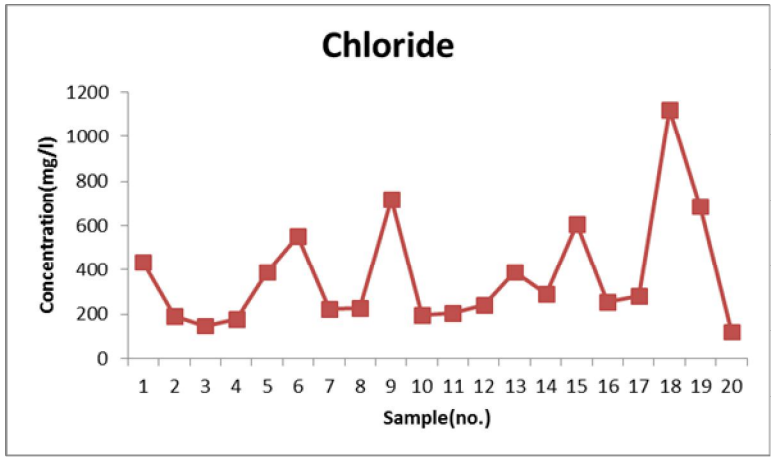

Fig-5: Chloride Concentration in Various Samples

D. Total Dissolved Solids

Total Dissolved Solids (TDS) are the amount of cations, anions, minerals, salts dissolved in water. Quality and purity of water are connected to the total dissolved solids. Purification systems of water is also affect by the total dissolved solids. This comprise of everything existing in water other than suspended solids and the pure water molecules. Generally, the concentration of TDS is the amount of the anions and cations in the water. Leaves, plankton, silt, sewage and industrial waste are some of the organic sources of some dissolved solids. Run-off in urban areas, fertilizers and pesticides applied in fileds and farms and road salts are other sources. The other sources of TDS include the inorganic materials like rocks and air that comprise of calcium bicarbonate, phosphorous , iron , sulphur and other minerals. Salts generally dissolve in water that form ions. Ions are particles having a negative or positive charge. High amount of totally Dissolved Solids cause unpleasant taste which can be salty, metallic and bitter. It is also a sign of the existence of harmful minerals. High TDS is also an indication of Hard water, which leads to scale building up in valves and pipes, reducing performance and also lead to blood pressure diseases. Fig.6 shows the concentration of TDS in different samples as per sample numbers in Table-2. In the study area, the highest TDS of 4510 mg/l was found in Girdharipura (Sample 18, Fig.6) and the lowest TDS of 372 mg/l was found in Chimanpura (Sample2, Fig.6).

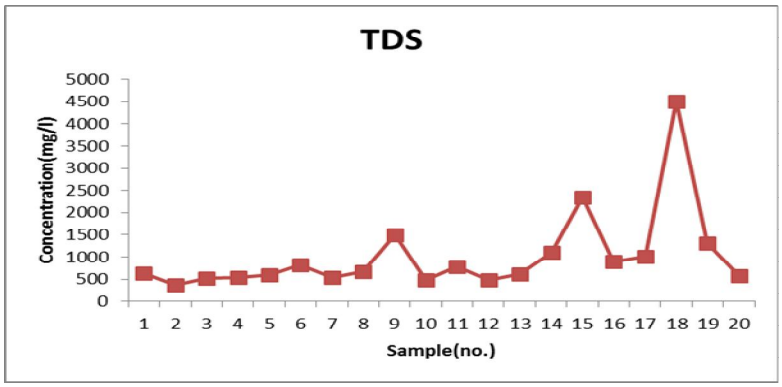

Fig-6: TDS Concentration in Various Samples

E. Bacteriological Presence

Total coliforms belong to a category of bacteria mostly present in vegetation or soil, and also in the intestines of mammals which also include human beings. Total coliform bacteria may not cause diseases, but their presence also shows that water supply may be unprotected from contamination by more toxic microbes. In the intestines of mammals, including human beings, Escherichia coli or E.coli is the only member of the total coliform group that is discovered. The presence of E.coli in water depicts faecal contamination and may show the existence of illness-causing pathogens, for example bacteria, viruses, as well as parasites. Though larger strains of E.coli bacteria are not harmful, certain strains, such as E.coli 0157:H7, may cause diseases. Drinking water which contains coliform bacteria elevate the risk of exposure to a water borne disease. The presence of faecal coliform or E. coli samples is a severe breach of standards for potable water. Faecal coliform bacteria exist mainly in the gut and faeces of warm blooded animals. Faecal coliforms are thought of as a major sign of animal or human waste contamination than total coliforms. E. coli is a kind of faecal coliform. E.coli is the indication of faecal pollution and that more pathogens can be present. Some of the great sources of coliforms in drinking water and groundwater are inadequate treatment of supplied water, septic tanks and manure of animals. The existence of

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microbes in groundwater is majorly dependent on geological parameters such as flow pathways and mechanisms, temperature, sunlight soil properties and pH. The size, type and activity of the microbes' are also important factors that dictate the terms of the transport of microorganisms.

The identification of coliform bacteria can be a sign of the existence of organisms that can result in illnesses, parasites such as Cryptosporidium and Giardia, and non-coliform bacteria. These organisms can lead to hepatitis, intestinal infections, typhoid fever, dysentery, cholera, gastroenteritis, and other diseases. Such problems may be deadly to infants, the elder people, and others who are sick. Waterborne illness comprise of following symptoms: fever, cramping, nausea, headaches, vomiting , fatigue, jaundice, and diarrhoea. These symptoms might cause severe dehydration, kidney failure, malnutrition and can also cause death. The insufficient water treatment is the cause of existence of coliform in drinking water. Around 45% of the groundwater of the sampling sites was contaminated by coliforms as revealed by the study.

CONCLUSIONS

After study of analytical data of groundwater of Sanganer Tehsil, Jaipur, Rajasthan for the chemicals such Fluoride, Chloride, Nitrate and TDS and also Bacteriological Examination, it is noted that Fluoride concentrations are all under permissible range of 1.5 mg/l as per BIS and WHO. Nitrate concentrations of almost 50% of the villages exceed the permissible amount. As per BIS, Chloride concentration is under permissible limit for all villages, so is the amount of TDS. It is alarming to see that almost 45% of the groundwater sources are contaminated with bacteria and immediate action should be taken to rectify this [3], [4].

The best way to circumvent risk of health is to have frequent checking of wells and reduction of fertilization of fields to avoid nitrate problem. The plants use nitrogen present in the soil. This natural supply of nitrogen in soil is through biota that is killed by fertilizers(nitrogenous). The crops will still be as productive by using lower quantity of fertilizers due to much beneficial and wholesome environment for the micro-organisms. Using large amount of fertilizers at the start leads to higher usage of fertilizers each year. Average to low amounts at the beginning help the farmer to keep himself away from getting into this savage cycle. The above mentioned techniques of prevention can be used to help in lowering leaching of nitrate from the soil that enters into the groundwater.

Slurry stores and lagoon pits made of concrete can hugely decrease the nitrate concentration. By eradicating over-irrigation fields both turf grass managers as well as farmers can help in managing the nitrate leaching into the groundwater. It is not easy to remove nitrate from the water that is polluted. Ion exchange model FGA-60N 30,000 grain whole house nitrate unit is so far very effective and commonly used technique for removing nitrate. The other methods of treatment such as ion exchange method, though are not able to remove nitrate fully from groundwater, but are still helpful in bringing down the levels of nitrate. The work is going on in other techniques and are still to be adopted world wide [5], [6].

Concentrations of chloride of about 250 mg/l can lead to rise in change of taste in water. However, consumers can become used to concentration of chloride in excess of 250 mg/litre. So far there is no recommendation of health-based chloride value in drinking water. [7].

For reducing TDS, the most extensive method available so far is reverse osmosis. The mechanism involves pushing water under great pressure against a semi permeable membrane through which water molecules are passed and most contaminants are left behind. In distillation process water is boiled to produce vapours of water. The water vapour than rises to a cooled surface and then condense back into a liquid and than be collected. The distilled solids remain in boiling solution as they are not vaporized [8]. Disinfection and/or filtration are methods to remove bacteria from water. Filtration increase the output of disinfectants by removal of sediment that may contain bacteria. Disinfecting can be done by various methods. Some of the methods by which disinfecting can be done are ozonation, iodization, ultraviolet(UV)light and chlorination. Many physical methods such as steam sterilization or boiling are also used [9], [10].

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BEHAVIOUR OF SCC FILLED IN 4MM UPVC TUBES WITH AND WITHOUT STEEL FIBRE IN COMPRESSION

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Department of Civil Engineering[3], RTU, Kota

ABSTRACT
Constraint through steel tubes has been reported to enhance considerably the axial load carrying capacity and energy captivation capacity of compression members. The present study aims to evaluate performance of compression members with and without UPVC tubes. The framework has been taken as SCC, with same blend extents for both the cases. Concrete specimens with height 360 mm and external diameter of 90 mm were casted with thicknesses of UPVC tubes- 4 mm. Steel fibre addition in concrete is known to result in increase in its energy absorption capacity. Dramix fibre SCC was employed along with the UPVC tubes in some of the specimens with volume fraction of fibres as 0.5 %, 0.75%, 1.0% and 1.5 %. The compression members were tested with closed loop universal testing machine. The load displacement curves recorded by the machine involved post peak portion as well upto failure. This enabled us to study the energy absorbed and computation of ductility indices, which included energy ratios and ductility parameters, mostly quantifying energy absorbed in post yield and post peak portion of the load displacement curve obtained during testing of the confined specimens till failure.

Keywords: Un-plasticised Polyvinyl Chloride (UPVC), Self Compacting Concrete (SCC), Steel Fibre Reinforced Concrete (SFRC), Concrete Filled Tubes (CFT).

I. INTRODUCTION
Concrete filled tubular columns have been progressively used in many modern structures, such as dwelling houses, tall buildings. The steel tubes are used to diagonally confine concrete, whereas the ordinary longitudinal reinforcing bars are still required for providing flexural strength of the columns. There has been significant research conducted on the investigation of behaviour and performance of Concrete Filled Tubes (CFT) under axial loading and combined axial and bending while little work has been done on concrete filled un-plasticised polyvinyl chloride (UPVC) tubes as columns. UPVC pipes are readily available in market and it is cheaper than steel tubes and also provides durability, reliability and integrity of the housing/building. These tubes can be used as formwork during construction and their after as an integral part of column.

II. OBJECT
The present study aims to evaluate performance of compression members with UPVC tubes and without UPVC tubes. The matrix has been taken as SCC, with same mix proportions for both the cases. Steel fibre addition in concrete is known to result in increase in its energy absorption capacity. To investigate possible enhancement of confinement effect through steel fibres in the tube filled compression members, Dramix fibre SCC was employed along with the UPVC tubes in some of the specimens. The compression members were tested with closed loop universal testing machine. The load displacement curves recorded by the machine involved post peak portion as well upto failure.

III. MATERIALS AND METHODS
- Cement: The Ordinary Portland Cement of 43 Grade following to IS: 8112 - 1989 was used for the present experimental study. Specific gravity of cement is 3.15.
- Fine aggregates: Natural river sand was used and tested as per IS: 2386 - 1983. Specific gravity of fine aggregate is found to be 2.60, Fineness modulus is found to be 2.85.
- Coarse aggregates: Crushed rock coarse aggregate of size 10 mm was used and tested as per IS 2386-1983. Specific gravity coarse aggregate was found to be 2.74
- Ultrafine Calcium Carbonate: This ultrafine calcium carbonate was obtained from M/S 20 Micron Limited, Vadodara. The average particle size D (50) was 0.867 µ (as per the manufacturer). Specific gravity of ultrafine calcium carbonate is 2.38 (as per the manufacturer).
- Super plasticizer: Super plasticizer (Glenium B233) was used @ 0.7% of weight of cement.
- Steel fibre: Dramix glued steel fibre" were used. The steel fibres were varied 0%, 0.5%, 0.75%, 1% and 1.5% by weight of cement. The steel fibres were 60mm in length and the aspect ratio of the fibre was 80.

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Table-1: Properties of Steel Fibre

PROPERTY	VALUE
Wire diameter	0.75mm(±4mm)
Fibre length (L)	60.0 mm(+2/-3mm)
Hooks length(l and l')	1-4
Hook depth (h and h')	1.80 mm(+1/-0mm)
Bending angle	45°(min. 30°)
Aspect ratio (L/d)	80

Table-2: Mechanical Properties of UPVC Pipes

Value	Properties
Density	1.1–1.35
Elastic modulus	3.2 x 10 Kg/cm^2
Ultimate tensile strength	500 Kg/cm²
Breaking elongation	153% (tested by UTM at RTUK)
Service life	>50 years
thickness	4 mm

Table-3: Preliminary Data of Mix Design

w/c ratio		0.4
Type of cement		OPC
Maximum nominal size of aggregate		10mm
Type of aggregate		Crushed angular aggregate
Specific gravity of cement		3.15
Specific gravity of	Coarse aggregate	2.74
	Fine aggregate	2.60
Sieve analysis	Coarse aggregate	Conforming to Table 2 of IS 383
	Fine aggregate	Conforming to grading Zone III Table 4 of IS 383
Specific gravity of	Fly ash	2.2
Specific gravity of	Ultra fine calcium carbonate	2.38

A. Specimen Details

In this study, total 30 specimens were casted. All the specimens were casted with L/D ratio as four (360mm length- 90mm dia.). In these, 30 specimens were confined columns with 4mm thick UPVC tubes. Three samples of the UPVC strip for elongation were tested of 100 mm clear length and 40mm wide with same thickness.

Table-4: Number of Confined Column and Cube Specimen

S. No	Concrete	Testing Age	Specimens(90mm) 6kgf(4mm)	Cube (150*150*150)
1	Without fibre	28 days	3	3
		60 days	3	3
2	Fibre-0.5%	28 days	3	3
		60 days	3	3
3	Fibre-0.75%	28 days	3	3
		60 days	3	3
4	Fibre-1%	28 days	3	3
		60 days	3	3
5	Fibre-1.5%	28 days	3	3
		60 days	3	3
6	Total		30	30

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II. TESTS AND DISCUSSIONS

A. Tests on Fresh Concrete

Table 5: Fresh Concrete Tests

S. NO.	TEST	Property	Unit	VALUE
1	Slump Flow	Flowability	mm	525 to 615
2	U-box	Flowability	mm	10 to 20
3	GTM Screen Stability	Segregation Resistance	%	10-13

B. Tests on Hardened concrete

All materials and strength of samples were tested at materials testing lab of RTU. Test was performed as per IS 516:1959 to find out the compressive strength of concrete after 28 days and 60 days curing of concrete. The stress–strain curves of specimens were obtained by performing compression tests on MTS make UTM machine with a capacity of 600 KN. The experiment was performed using displacement control method with cross head speed of 10 mm/min. Due to its displacement control mechanism output of full post-peak position of curve be obtained. The upper jaw of the machine was moved in the downward direction while bottom jaw was kept stationary. The rate was applied continuously without a jerk load. Loads and displacements were measured continuously by data collection computer system. The frequency of the data collection is 0.4 Hz.

III. RESULTS

Table-6: Compressive strength of cube specimens (Average of three) in N/mm2

Fibre	28 days	60 days
0%	28.88 N/mm^2	35.78
0.5%	40 N/mm^2	46.22 N/mm^2
0.75%	44.44 N/mm^2	50.66 N/mm^2
1%	48 N/mm^2	53.33 N/mm^2
1.5%	39.11 N/mm^2	43.21 N/mm^2

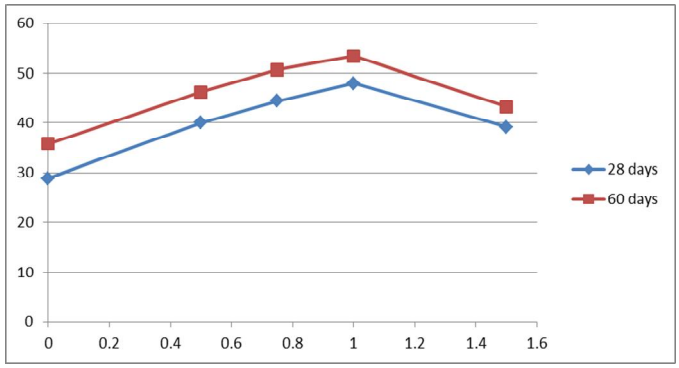

Fig-1: Variation in Compressive Strength with Fibre Content

It is observed that 28 day and 60 day compressive strengths in case of 0.5% steel fiber are more than that with 0% steel fibre and same trend is observed with 0.75, 1.00 and 1.5% steel fibre. It has also been observed that with increase in steel fiber, the compressive strength also increases i.e. compressive strength of 0.75% mixes at any day is more than that of 0.5% specimen and compressive strength of 1.00% steel fibre specimen is more than that of 0 .5% and 0.75%steel fibre specimen. So it may be inferred that with increase in fiber content, compressive strength also increases. After an optimum percentage of the fibre; the strength starts decreasing on further increase in fibre. The optimum fibre content has been observed as 1% for both 28 days and 60 days. The amount of increase in compressive strength is observed equal to 65% [(48.00-28.88)/28.88] at 28 days. The range of increase in the compressive strength found in the present study at the age of 28 days is in agreement with the test results reported by Sekar A. S. and Kesavan D.

Definitions of the parameters for confined column

From the graphs between load and displacement, obtained from the UTM, the energy absorption or work done have been calculated at yield load, peak load, 90%, 80%, 70% of the peak (ultimate) load (Pu) by the following formula:

E= Area under the curve

Or, E= Load X Displacement

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The energy absorption (ξ) "ratios of energy" at ultimate and 70% of peak load are calculated by following equations:

$$\xi_u = \frac{E_u}{E_y} \qquad \xi_{70} = \frac{E_{70}}{E_y}$$

Where

Eu = energy absorption till ultimate load of the specimen.

E70 = energy absorption till the ultimate load reduced to 70% of ultimate load.

Ey = energy absorption at yield point.

The ductility ratios (μ) at ultimate load position and 70% of ultimate load position are calculated by following equations.

$$\mu_u = \frac{\Delta_u}{\Delta_y}$$

$$\mu_{70} = \frac{\Delta_{70}}{\Delta_y}$$

Test results of confined column with 4mm thick UPVC at 28 days

Table-7: Observed values of P and Δ without fibre with E, μ and ξ (4mm thick UPVC/28day)

	Yield	**Ultimate**	**90% of Ultimate**	**80% of Ultimate**	**70% of Ultimate**
P (kN)	110	140	126	112	98
Δ (mm)	2.5	6	8	10	12
ξ ((Jule)	137.5	575	841	1079	1289
Ductility ratios			Energy ratios		
$\mu=\Delta_u/\Delta_y$	2.4		$\xi_u=E_u/E_y$	4.1818	
$\mu_{90}=\Delta_{90}/\Delta_y$	3.2		$\xi_{90}= E_{90}/E_y$	6.11	
$\mu_{80}=\Delta_{80}/\Delta_y$	4		$\xi_{80}= E_{80}/E_y$	7.847	
$\mu_{70}=\Delta_{70}/\Delta_y$	4.8		$\xi_{70}= E_{70}/E_y$	9.374	

Table-8: Observed values of P and Δ with 0.5% fibre with E, μ and ξ (4mm thick UPVC/28day)

	Yield	**Ultimate**	**90% of Ultimate**	**80% of Ultimate**	**70% of Ultimate**
P (kN)	80	120	108	96	84
Δ (mm)	1.5	5	8.25	12	27.5
ξ ((Jule)	60	350	720.5	1103	2498
Ductility ratios			Energy ratios		
$\mu=\Delta_u/\Delta_y$	3.33		$\xi_u=E_u/E_y$	5.83	
$\mu_{90}=\Delta_{90}/\Delta_y$	5.5		$\xi_{90}= E_{90}/E_y$	12.01	
$\mu_{80}=\Delta_{80}/\Delta_y$	8		$\xi_{80}= E_{80}/E_y$	18.38	
$\mu_{70}=\Delta_{70}/\Delta_y$	18.33		$\xi_{70}= E_{70}/E_y$	27	

Table-9: Observed values of P and Δ with 0.75% fibre with E, μ and ξ (4mm thick UPVC/28day)

	Yield	**Ultimate**	**90% of Ultimate**	**80% of Ultimate**	**70% of Ultimate**
P (kN)	60	94.703	85.233	75.762	66.292
Δ (mm)	4	8	12	13	17
ξ ((Jule)	120	429.4	789.28	869.79	1153.9
Ductility ratios			Energy ratios		
$\mu=\Delta_u/\Delta_y$	2		$\xi_u=E_u/E_y$	3.578	
$\mu_{90}=\Delta_{90}/\Delta_y$	3		$\xi_{90}= E_{90}/E_y$	6.577	
$\mu_{80}=\Delta_{80}/\Delta_y$	3.25		$\xi_{80}= E_{80}/E_y$	7.248	
$\mu_{70}=\Delta_{70}/\Delta_y$	4.25		$\xi_{70}= E_{70}/E_y$	9.61	

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Table-10: Observed values of P and Δ with 1% fibre with E, μ and ξ (4mm thick UPVC/28day)

	Yield	Ultimate	90% of Ultimate	80% of Ultimate	70% of Ultimate
P (kN)	58	85	76.5	68	59.5
Δ (mm)	1	5	8.5	10	13
ξ ((Jule)	29	315	597.6	763.35	954.6
Ductility ratios			Energy ratios		
$\mu=\Delta_u/\Delta_y$	5		$\xi_u=E_u/E_y$	10.86	
$\mu_{90}=\Delta_{90}/\Delta_y$	8.5		$\xi_{90}= E_{90}/E_y$	20.60	
$\mu_{80}=\Delta_{80}/\Delta_y$	10		$\xi_{80}= E_{80}/E_y$	26.32	
$\mu_{70}=\Delta_{70}/\Delta_y$	13		$\xi_{70}= E_{70}/E_y$	32.91	

Table-11: Observed values of P and Δ with 1.5% fibre with E, μ and ξ (4mm thick UPVC/28day)

	Yield	Ultimate	90% of Ultimate	80% of Ultimate	70% of Ultimate
P (kN)	45	87..875	79.088	70.3	61.513
Δ (mm)	2.5	7.5	10	12	15
ξ ((Jule)	56.25	388.43	597.13	746.52	944.25
Ductility ratios			Energy ratios		
$\mu=\Delta_u/\Delta_y$	3		$\xi_u=E_u/E_y$	6.905	
$\mu_{90}=\Delta_{90}/\Delta_y$	4		$\xi_{90}= E_{90}/E_y$	10.615	
$\mu_{80}=\Delta_{80}/\Delta_y$	4.8		$\xi_{80}= E_{80}/E_y$	13.27	
$\mu_{70}=\Delta_{70}/\Delta_y$	6		$\xi_{70}= E_{70}/E_y$	16.78	

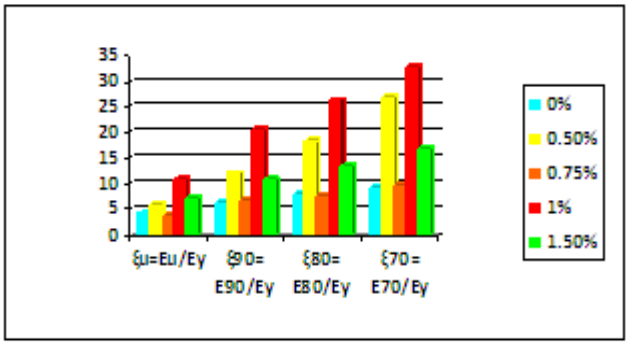

Fig-2: Energy ratio (4mm thick UPVC confined column at 28days)

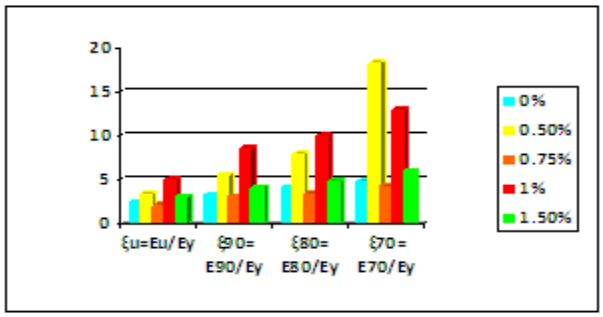

Fig-3: Ductility ratios (4mm thick UPVC confined column at 28days)

Test results of confined column with 4mm thick UPVC at 60 days

Table-12: Observed values of P and Δ without fibre with E, μ and ξ (4mm thick UPVC/60day)

	Yield	Ultimate	90% of Ultimate	80% of Ultimate	70% of Ultimate
P (kN)	140	154	138.6	123.2	107.8
Δ (mm)	2.75	4.25	6.5	8.25	9.75
ξ ((Jule)	192.5	413	742.18	971.25	1144.5
Ductility ratios			Energy ratios		
$\mu=\Delta_u/\Delta_y$	1.54		$\xi_u=E_u/E_y$	2.14	
$\mu_{90}=\Delta_{90}/\Delta_y$	2.36		$\xi_{90}= E_{90}/E_y$	3.855	
$\mu_{80}=\Delta_{80}/\Delta_y$	3		$\xi_{80}= E_{80}/E_y$	5.045	
$\mu_{70}=\Delta_{70}/\Delta_y$	3.54		$\xi_{70}= E_{70}/E_y$	5.945	

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Table-13: Observed values of P and Δ with 0.5% fibre with E, μ and ξ (4mm thick UPVC/60day)

	Yield	Ultimate	90% of Ultimate	80% of Ultimate	70% of Ultimate
P (kN)	120	160	144	128	112
Δ (mm)	2.5	7.5	8.5	9.25	12.5
ξ ((Jule)	150	850	1002	1104	1494
Ductility ratios			Energy ratios		
$\mu=\Delta_u/\Delta_y$	3		$\xi_u=E_u/E_y$	5.66	
$\mu_{90}=\Delta_{90}/\Delta_y$	3.4		$\xi_{90}= E_{90}/E_y$	6.68	
$\mu_{80}=\Delta_{80}/\Delta_y$	3.7		$\xi_{80}= E_{80}/E_y$	7.36	
$\mu_{70}=\Delta_{70}/\Delta_y$	5		$\xi_{70}= E_{70}/E_y$	9.96	

Table-14: Observed values of P and Δ with 0.75% fibre with E, μ and ξ (4mm thick UPVC/60day)

	Yield	Ultimate	90% of Ultimate	80% of Ultimate	70% of Ultimate
P (kN)	84	110	99	88	77
Δ (mm)	4	7.5	10	11.5	24
ξ ((Jule)	168	507	768.75	909	1940.3
Ductility ratios			Energy ratios		
$\mu=\Delta_u/\Delta_y$	1.875		$\xi_u=E_u/E_y$	3.020	
$\mu_{90}=\Delta_{90}/\Delta_y$	2.5		$\xi_{90}= E_{90}/E_y$	4.575	
$\mu_{80}=\Delta_{80}/\Delta_y$	2.875		$\xi_{80}= E_{80}/E_y$	5.41	
$\mu_{70}=\Delta_{70}/\Delta_y$	6		$\xi_{70}= E_{70}/E_y$	11.54	

Table-15: Observed values of P and Δ with 1% fibre with E, μ and ξ (4mm thick UPVC/60day)

	Yield	Ultimate	90% of Ultimate	80% of Ultimate	70% of Ultimate
P (kN)	98	147	132.3	117.6	102.9
Δ (mm)	2	5	6.5	8	8.75
ξ ((Jule)	98	465.5	674.97	862.39	945.07
Ductility ratios			Energy ratios		
$\mu=\Delta_u/\Delta_y$	2.5		$\xi_u=E_u/E_y$	4.75	
$\mu_{90}=\Delta_{90}/\Delta_y$	3.25		$\xi_{90}= E_{90}/E_y$	6.88	
$\mu_{80}=\Delta_{80}/\Delta_y$	4		$\xi_{80}= E_{80}/E_y$	8.79	
$\mu_{70}=\Delta_{70}/\Delta_y$	4.375		$\xi_{70}= E_{70}/E_y$	9.64	

Table-16: Observed values of P and Δ with 1.5% fibre with E, μ and ξ (4mm thick UPVC/60day)

	Yield	Ultimate	90% of Ultimate	80% of Ultimate	70% of Ultimate
P (kN)	85	108	97.2	86.4	75.6
Δ (mm)	4.5	7	9	12	14
ξ ((Jule)	191.25	432.5	637.7	913.1	1075.1
Ductility ratios			Energy ratios		
$\mu=\Delta_u/\Delta_y$	1.55		$\xi_u=E_u/E_y$	2.26	
$\mu_{90}=\Delta_{90}/\Delta_y$	2		$\xi_{90}= E_{90}/E_y$	3.334	
$\mu_{80}=\Delta_{80}/\Delta_y$	2.66		$\xi_{80}= E_{80}/E_y$	4.77	
$\mu_{70}=\Delta_{70}/\Delta_y$	3.11		$\xi_{70}= E_{70}/E_y$	5.62	

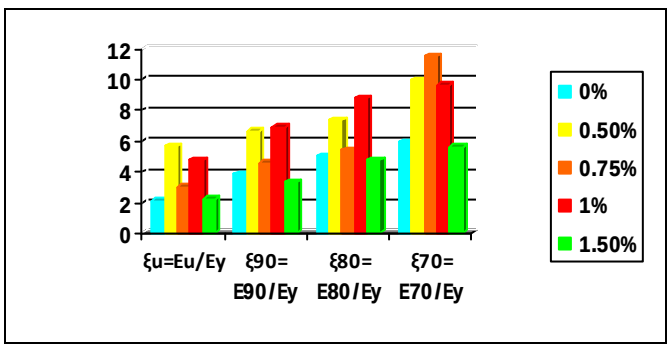

Fig-4: Energy ratio (4mm thick UPVC confined column at 60days)

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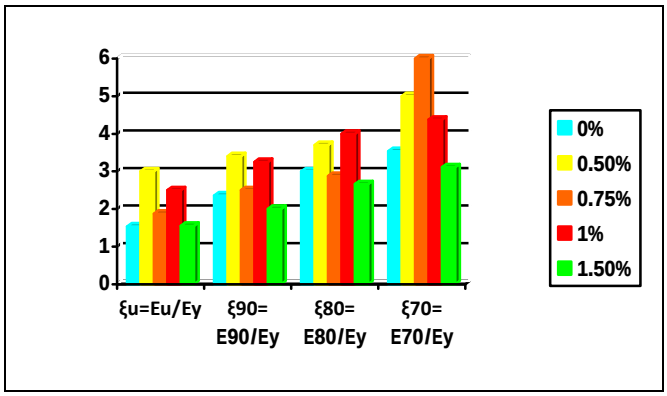

Fig-5: Ductility ratios (4mm thick UPVC confined column at 60days)

CONCLUSIONS

1. Increase in the load carrying capacity of the member is in the order of about 12 % to 65 % and it varies with thickness of the UPVC tubes, age of testing and volume of the fibres etc.
2. A substantial increase in the energy absorption capacity of the member is in the order of about 70% to 400% at the ultimate load and varies between 120% and 876 % at the 70% of the peak load during unloading position depending upon the volume of steel fibre. This is maximum at an optimum value of the fibres, which is between 0.5% to 1% for the various thicknesses of the UPVC tubes, load positions and age of testing etc.
3. An increase in the ductility ratio of the member is in the order of about 60% to 135% at the ultimate load and varies between 90% and 400% at the 70% of the peak load during unloading position depending upon the volume of steel fibre. This is maximum at an optimum value of the fibres, which is about 0.75%

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STRENGTH PROPERTIES BASED PERFORMANCE ANALYSIS OF MODIFIED STEEL FIBER CONCRETE

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ABSTRACT
A viewpoint is made to use of granite dust as partial replacement of cement in concrete with addition of steel fibers, and an attempt has been made to investigate the strength and durability parameters of concrete. Replacement level of 20% by the weight of cement is selected for the study concern to replacement method and addition of various percentages (0%, 0.5%, 1% & 1.5%). Large range of curing periods starting from 14 days & 28 days are considered in the present study. Normal curing in tap water and the environmental simulation for chloride attack, 5% NaCl solution was prepared. Total 108 specimens were cast. The specimens have been prepared of the Mix-Design M30 grade concrete based on IS 10262:2009. Cube specimens of the dimensions 150×150×150 mm, cylinder specimens 300mm (length) × 150mm (dia.) and beam specimens of dimensions 100×100×500 mm. Results are obtained in form of compressive strength, split tensile strength and flexural strength.

Keywords: steel fiber, granite dust, chloride attack, compressive strength, split tensile strength and flexural strength.

I. INTRODUCTION
Granite dust is waste material produced by granite quarries while excavating and finishing granite stone. A large of waste powder is produced by such quarries only insignificant mass is used rest is dumped in nearby dumping yards. This can be used as a construction material by partially replacing cement that can reduce overall cost. A lot of research work is done in this field to find the strength properties of granite dust utilized concrete. Since the plain, unreinforced concrete is a brittle material, with a low tensile strength and a low strain capacity. Strength and durability of concrete produced by such waste materials can be changed by making suitable changes in its ingredients like cementitious material, aggregate and water and by adding some special ingredients like fibers. Fibers like steel fibers, plastic fibers and glass fibers etc. The function of randomly dispersed fibers is to bridge across the cracks that provides some post cracking ductility. If the fibers like steel fibers which are strong enough and perfectly bonded to the material, permits the FRC to carry noteworthy stresses over a relatively large strain capacity in post cracking state.

Sometimes concrete structures have to survive in adverse conditions under chemical attacks like chloride attack, sulphate attack and acid attack. These chemical attacks affect the durability of concrete structure. For hardened reinforced concrete chloride attack is considered as a cause for corrosion. Chemicals percolate through the cracks developed in the concrete structures and corrode the reinforcement provided in the concrete and thus the deterioration of structure starts and the durability of structure get affected. Although use of steel fibers reduces the generation of cracks but still there is some deterioration due to the chloride attack on concrete. Mostly the chloride attack is seen in structures those are immersed in saline water or situated near saline water.

It is hoped that this research will help in some way to improve knowledge by bringing out the results of an experimental program carried out to evaluate the effectiveness of using a mixture of GD by the 20% weight of cement as alternative for cement with addition of steel fiber (0%, 0.5%, 1% & 1.5%) for production of comparatively low cost concrete. The specimens have been prepared of the Mix-Design M30 grade concrete based on IS 10262:2009. Normal curing was done in tap water and the environmental simulation for chloride attack, 5% NaCl solution was prepared. As a basis for in-depth understanding of the performance of this concrete, this research was geared towards workability and strength characteristics.

LITERATURE REVIEW

III. MATERIALS AND METHODS
A. Materials
Cement
The Ordinary Portland Cement of 43 grade conforming to IS: 8112 - 1989 was used for the present experimental study. Specific gravity of cement is 3.15.

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Fine Aggregate & Coarse Aggregate
Locally available natural sand was used. Specific gravity of fine aggregate is found to be 2.74. Crushed rock coarse aggregate of size 20 mm & 10 mm were used and Specific gravity coarse aggregate was found to be 2.74 conforming to IS: 383-1970.

Steel Fibre
Steel fiber used in the present experimental study was hooked end steel fiber, having diameter 0.75 mm, 50 mm length and aspect ratio (l/d) is 66.67.

Table-1: Mechanical Properties of steel fiber

Mechanical Properties of Hooked End Steel Fiber	
Diameter	0.75 mm
Length	50 mm
Aspect Ratio	66.67
Tensile Strength	1195 MPa
Tolerance for Diameter and Length	(±) 10% (As per ASTM)

Granite Dust
Granite dust used in the present experimental study was by product of granite stone cutting industry specific gravity granite dust was found to be 2.37.

Water
In this project clean potable water was obtained from water tap in concrete laboratory of Poornima University for mixing and curing of concrete.

Superplasticizer
The Superplasticizer used in the experiment for preparation of Mix-Design was MasterGlenium® SKY 8233. It is a High-performance super plasticiser based on PCE (polycarboxylic ether) for concrete.

A. Methods
Concrete mix proportions
M30 grade Concrete was prepared as per IS: 10262:2009. Water cement ratio of 0.44 to get a characteristic strength of M30 was considered for this study. The exact quantity of materials for each mix was calculated. The cement, fine aggregate, coarse aggregate, granite dust were tested prior to the experiments and checked for conformity with relevant Indian standards. Dosages of superplasticizer were added 2% by the weight of cementitious material. Concrete was mixed using a tilting type mixer and specimens were cast using steel moulds, compacted with table vibrator. Conclusively 4 types of mixes were designed and 108 Specimen were cast. Out of them 48 were cubes, 48 cylinders and 12 beams. 3 specimens in each described category were cast and average strength was calculated. Table 5.1 shows specimen details.

Table-5.1: Specimen Details

Steel Fiber %	Testing Age (Days)	Cubes		Cylinders		Beams
		NaCl curing	Water curing	NaCl curing	Water curing	Water curing
0%	14	3	3	3	3	-
	28	3	3	3	3	3
0.5%	14	3	3	3	3	-
	28	3	3	3	3	3
1%	14	3	3	3	3	-
	28	3	3	3	3	3
1.5%	14	3	3	3	3	-
	28	3	3	3	3	3
Total		24	24	24	24	12

Workability of Steel Fiber Concrete
Compaction Factor tests were carried out as per **IS: 1199 – 1959** to determine the workability and consistency of fresh concrete. The efficiency of all fiber reinforcement is dependent upon achievement of a uniform distribution of the fibers in the concrete, their interaction with the cement matrix, and the ability of the concrete to be successfully cast.

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Demoulding & Curing of Concrete

The specimens were marked and removed from the moulds and unless required for the test within 24 hours, immediately submerged in clean fresh water and kept there for curing for 14 and 28 days prior to test. The water or solution in which the specimens were submerged, were renewed every seven days and were maintained at a temperature of 27º ± 2 ºC. The specimens were not allowed to become dry at any time until they have been used.

NaCl (Sodium Chloride) solution with 5% NaCl by the weight of water was prepared. The specimens were marked and removed from the moulds and weighed. Immediately submerged in fresh NaCl solution and kept there for curing for 14 and 28 days. In the case where mineral admixtures are used minimum curing period may be extended to 14 days (as per IS 456:2000 clause 13.5.1) After curing of specific days of specimens were kept out of solution for 24 hours maintaining temperature of 27 ºC and weighed again before testing.

Hard Concrete Strength Assessment

Compressive Strength Test

For compressive strength test cube specimens of dimensions 150 x 150 x 150 mm as per IS: 516-1959 were prepared and tested on Compression Testing Machine. The testing machine used for the testing, was manual Compressive Testing Machine, with maximum loading capacity of machine was 2000 KN. Least count of machine was 10 KN.

Since, the Compressive Testing Machine was manual so the measured compressive strength of the specimen was calculated by dividing the maximum load applied to the specimen during the test by the cross-sectional area the value we required will be in N/mm^2.

$$f = \frac{P}{A}$$

Here f = compressive strength

P = Maximum load applied

A = Cross sectional area of specimen

Figure-1: Cube on Compression Testing Machine

Split Tensile Strength Test

For tensile strength test, cylinder specimens of dimensions 150 mm diameter and 300 mm length as per IS: 5816-1999 were cast and tested on Universal Testing Machine, with maximum loading capacity of machine 1000 KN. Least count of machine was 10 KN.

The measured splitting tensile strength *f*, of the specimen was calculated to the nearest 0.05 N/mm2 using the following formula:

$$f = \frac{2P}{\pi DL}$$

Here

f = Split tensile strength of specimen

P = Maximum load applied to the specimen

D = Cross sectional dimension of the specimen

L = Length of the specimen

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Figure-2: Cylinder on Universal Testing Machine

Flexural Strength Test

For flexural strength test, beam specimens of dimensions 100×100×500 mm as per IS: 516-1959 were cast and tested on Flexural Testing Machine

The Flexural Strength or modulus of rupture ($\mathbf{f_b}$) is given by

$$f_b = \frac{pl}{bd^2}$$

Here,

a = the distance between the line of fracture and the nearer support, measured on the center line of the tensile side of the specimen

b = width of specimen (cm)

d = failure point depth (cm)

l = supported length (cm)

p = max. Load (N)

Figure-4.20: Beam on Flexural Testing Machine

EXPERIMENTAL RESULTS

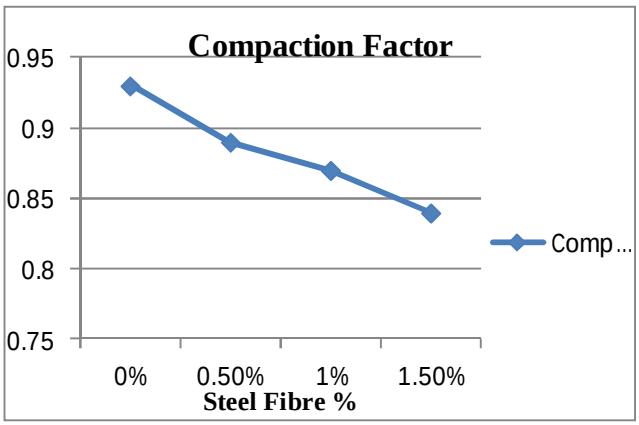

Figure: Compaction Factor of Concrete w.r.t. Steel Fiber Percentage

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Table: Average Compressive Strength of Cubes (Water Curing)

Steel Fiber %	14 Days (Water)		28 Days (Water)	
	Compressive Strength (N/mm^2)	% ↑	Compressive Strength (N/mm^2)	% ↑
0%	26.665	-	29.33	-
0.5%	36	35%	36.44	24.24%
1%	42.44	59%	43.2	47.28%
1.5%	40	50%	49.95	70.30%

Table: Average Compressive Strength of Cubes (NaCl Curing)

Steel Fiber %	14 Days (NaCl)		28 Days (NaCl)	
	Compressive Strength (N/mm^2)	% ↑	Compressive Strength (N/mm^2)	% ↑
0%	25.55	-	26.66	-
0.5%	33.065	29.41%	34.89	30.87%
1%	39.82	55.85%	40.44	51.68%
1.5%	39.78	55.69%	46.57	74.68%

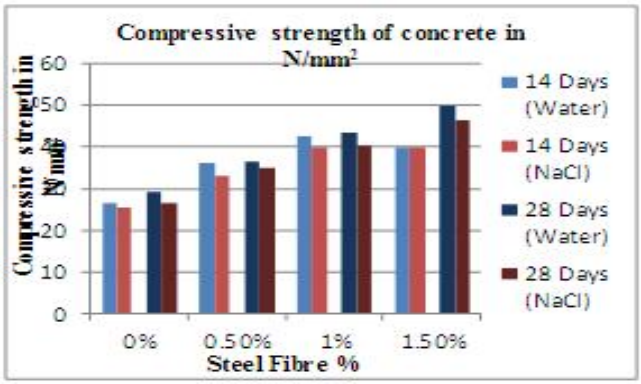

Figure: Average Compressive Strength of Cubes

Table: Average Split Tensile Strength of Cylinders (Water curing)

Steel Fiber %	14 Days (Water)		28 Days (Water)	
	Split Tensile Strength (N/mm^2)	% ↑	Split Tensile Strength (N/mm^2)	% ↑
0%	3.11	-	3.53	-
0.5%	3.68	18.32%	4.24	20.11%
1%	5.52	77.49%	6.22	76.20%
1.5%	7.07	127%	7.36	108%

Table: Average Split Tensile Strength of Cylinders (NaCl curing)

Steel Fiber %	14 Days (NaCl)		28 Days (NaCl)	
	Split Tensile Strength (N/mm^2)	% ↑	Split Tensile Strength (N/mm^2)	% ↑
0%	1.69	-	3.23	-
0.5%	2.97	75.73%	3.68	13.93%
1%	4.95	192%	5.94	83.9%
1.5%	5.66	234%	6.51	101.54%

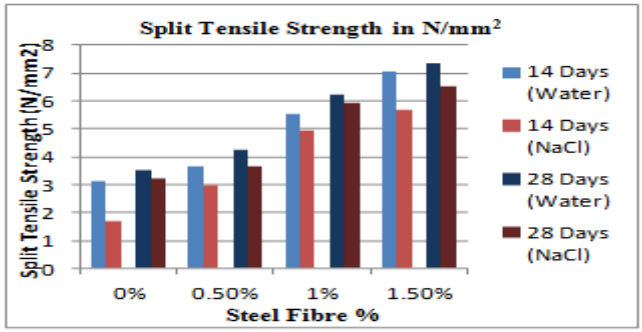

Figure: Split Tensile Strength of Cylinders (NaCl Curing)

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Table: Flexural Strength of Beams

Steel Fiber %	28 Days (Water)	
	Flexural Strength(N/mm^2)	% ↑
0%	3.2	-
0.5%	3.8	18.75%
1%	4.8	50%
1.5%	6	87.5%

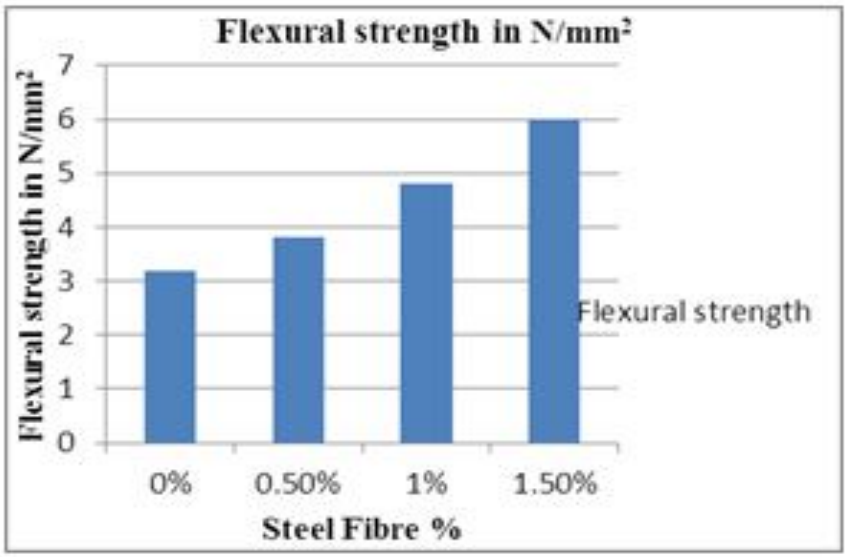

Figure: Flexural Strength of Concrete Beams

Table: Change in Mass of Concrete Cubes due to Chloride attack (14 Days)

Steel Fiber %	14 Days (NaCl)		
	Weight Before (kg)	Weight After (kg)	% ↑
0%	8.084	8.149	0.80%
0.5%	8.413	8.484	0.84%
1%	8.591	8.659	0.79%
1.5%	8.5	8.584	0.98%

Table: Change in Mass of Concrete Cubes due to Chloride attack (28 Days)

Steel Fiber %	28 Days (NaCl)		
	Weight Before (kg)	Weight After (kg)	% ↑
0%	8.449	8.559	1.30%
0.5%	8.245	8.349	1.26%
1%	8.376	8.45	0.88%
1.5%	8.825	8.923	1.11%

Table: Change in Mass of Concrete Cylinders due to Chloride attack (14 Days)

Steel Fiber %	14 Days (NaCl)		
	Weight Before (kg)	Weight After (kg)	% ↑
0%	12.416	12.496	0.64%
0.5%	12.526	12.606	0.63%
1%	12.88	12.966	0.66%
1.5%	13.244	13.346	0.77%

Table: Change in Mass of Concrete Cylinders due to Chloride attack (28 Days)

Steel Fiber %	28 Days (NaCl)		
	Weight Before (kg)	Weight After (kg)	% ↑
0%	12.27	12.392	0.99%
0.5%	12.656	12.750	0.78%
1%	13.164	13.272	0.82%
1.5%	13.44	13.56	0.89%

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V. CONCLUSION

During concreting/casting of cubes, compaction factor test on fresh concrete was conducted for verification of workability with above percentage (%) addition of steel fiber i.e. (0% to 1.5%). After completion of maturity period of concrete Compressive strength test, split tensile test and flexural strength test were conducted on all the specimens with respective date of casting. From the study it was observed that compressive strength of concrete increased with addition of steel fiber (0% to 1.5%) after 14 days & 28 days with or without chloride attack. it was also observed that optimum percentage increment in compressive strength of concrete was 59% for 14 days curing and 70.30% after 28 days curing (from 0% to 1.5% addition of steel fiber). Addition of steel fiber changed the brittle failure into ductile failure and also enhanced the toughness of concrete mix that resulted as improvement in magnitude of compressive strength of SFRC.

Further it was observed that split tensile strength also increases when percentage of steel fiber (0% to 1.5%) added in concrete after 14 & 28 days curing with or without chloride attack. The optimum percentage increment in split tensile strength was 127% for 14 days curing and 108% for 28 days curing without chloride attack. This trend observed because modulus of elasticity of matrix is much lower than steel fiber, due to this the bond between matrix and fiber is more effective and stress transfer is more proficient.

It was also noted that flexural strength of concrte increased gradually with addition of steel fiber (0% to 1.5%) and minimum flexural strength was obtained at 0% (3.2 N/mm2). 6 N/mm2 optimum flexural strength was obtained with addition of 1.5% steel fiber after 28 days of curing. This trend was observed because modulus of elasticity of matrix is much lower than steel fiber, due to this the bond between matrix and fiber is more effective and stress transfer is more proficient.

Performance of concrete is also examined under the chloride attack after 14 & 28 days curing in NaCl solution. It was observed that deterioration in weight of concrete didn't occur after 14 & 28 days curing in NaCl solution.

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UTILIZATION OF MARBLE WASTE ON THE STEEL FIBRE CONCRETE

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ABSTRACT
India being a developing nation has a vast future in field of construction. For any construction the major binding material required is cement. Yearly around 3 billion tons of cement is produced which result in emission of nearly 7% of the global CO_2. Reducing the consumption of cement in the concrete will reduce the emission of CO_2. One feasible way of this approach is by partially replacing the cement with waste material such as marble dust, fly ash, granite powder etc. The marble dust is generated by industries has rose over the year which result in environmental pollution. Around 21.8 million metric ton of Marble waste is produce globally from which only around 21% is reuse and remaining are disposed and dumped, which reduce the productivity of soil. To construct Morden infra-structure high strength high performance concrete are use now a days. In order to increase the structural integrity of concrete, Fibres can be used in concrete. The character of FRC changes with varying fibre quantity, materials, geometries, and densities. The use of fibre in concrete mix prevents crack formation and provides reinforcement to the concrete structure. In this research percentage of steel fibres has been vary in proportion of 0%, 0.5%, 1%, 1.5%, and 2% keeping the amount of Marble Dust constant (10%) .Tests on workability, compressive strength, flexural strength and split tensile strength were conducted on specimens.

Keywords: Steel Fibre, workability, compressive strength, flexural resistance, split tensile strengths etc

INTRODUCTION
It has been observed that concrete obtained from Ordinary Portland cement is brittle in nature, has low ductility and contribute low performance in tension and impact load . The limitation of concrete in tension can be overcome by the use of conventional steel bars reinforcement and to some level by the mixing of a sufficient volume of certain fibres. The use of fibres also recalibrates the behaviour of the fibre-matrix composite after it has cracked through improving its toughness. Fibres such as steel, glass, carbon and polypropylene are widely use in concrete. The dispersion of fibre in concrete improves the quality of mix. Steel fibre is available in different types and aspect ratios. The major problem in plain concrete is shrinkage which results in crack. Cracks not only reduce the quality of concrete but also effect the serviceability of structure, In order to improve the integrity of concrete, load-carrying capacity and reducing dry shrinkage and cracking, steel fibres may be used. An experimental research was carried out to explore the effects of SFRC with partial replacement of cement with fix proportion of marble dust on workability, compressive, flexural, and split tensile strength of concrete.

OBJECTIVE AND SCOPE OF WORK
The objective of the research is to study the effect of the Steel fibres on the mechanical properties of concrete by replacing the fix amount of cement with Marble Dust (i.e. 10).

METHODOLOGY
The methodology consist of

1. Selection of material.
2. Collection of materials.
3. Determination of various properties of materials.
4. Selection of concrete grade.
5. Concrete mix design of M25 grade as per IS code.
6. Casting of Cubes, cylinder and beams
7. Preparation of test specimen.
8. Performance of test.
9. Determination of Optimum dose of fibre addition in concrete

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EXPERIMENTAL WORK

Table-1: Material Testing Results

Sr No.	Test Name	Material	Result
1	Sp. Gravity	Cement	3.158
		Fine Aggregate	2.62
		Coarse Aggregate	2.74
		Marble Dust	2.73
2	Water Absorption	Coarse Aggregate	0.5%
		Fine Aggregate	1%
		Marble Dust	1%
3	PH	Marble Dust	8.9

MIX DESIGN

Table-2: Proportion of Material as per IS CODE

Sr. No.	Material	Amount in Kg/m^3
1	Cement	446.76
2	Fine aggregate	523.88
3	Coarse aggregate	1276.03
4	Water	201.03
5	Water cement ratio	0.45

EXPERIMENTAL PROCEDURE

Cube specimens were tested at 14 and 28 days to obtain the compressive strength of concrete. Cylindrical specimens were tested at 14 days and 28 day to obtain the split tensile strength. Beam specimens were tested at 14 days and 28 day to obtain the flexural strength of concrete.

Table-3: Number of Specimen for Experiment

Sr. No	Size of Mould	Use For	No Of Mould
1	**Cube**150x150x150mm	Compression test	6
2	**Cylinders** 150mm diameter and 300mm height	Split Tensile Test	4
3	**Beam** 100x100x500	Flexure Test	2

RESULTS AND DISCUSSION

It is observed that addition of Marble Dust along with Steel Fiber show positive result in characteristic strength of concrete. The strength increase till 1.5% Steel Fiber and then decreases on 2% Steel Fiber. The table shown below gives data of analysis of characteristic strength of concrete on 28 days.

Table-4: Compressive Strength

Sr. No	Proportion of fibre	Compressive Strength in N/mm^2 for 28 days of Curing
1	10% MD; 0% SF	26.3
2	10% MD; 0.5% SF	28
3	10% MD; 1% SF	28.4
4	10% MD; 1.5% SF	29.6
5	10% MD; 2% SF	27.7

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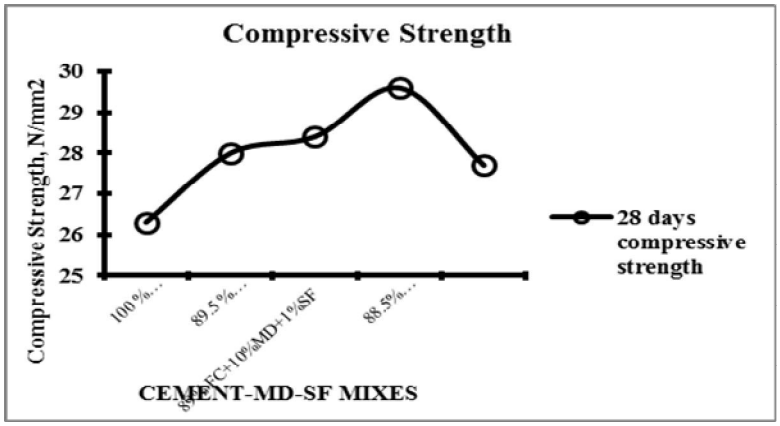

Fig-1: Compressive Strength of Cement-Marble Dust-Steel Fibre Mixes

Table-5: Split Tensile Strength

Sr.No	Proportion of fibre	Split Tensile Strength in N/mm^2 for 28 days of Curing
1	10% MD; 0% SF	2.11
2	10% MD; 0.5% SF	2.42
3	10% MD; 1% SF	2.6
4	10% MD; 1.5% SF	3.38
5	10% MD; 2% SF	2.98

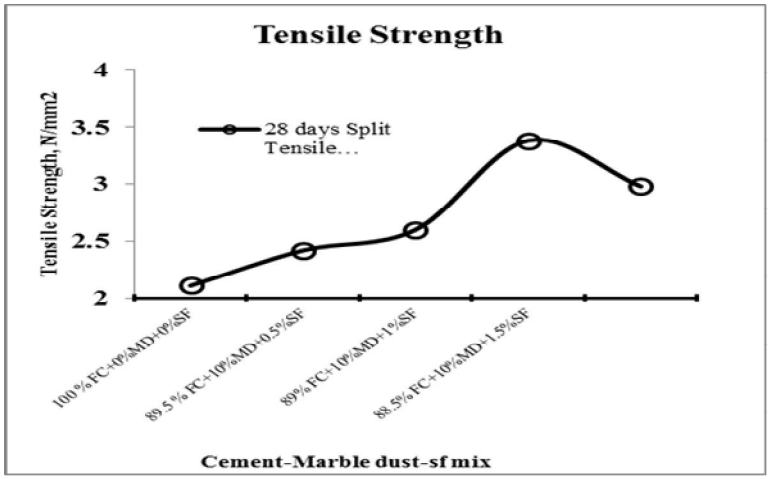

Fig-2.28: days Split tensile Strength

Table-6: Flexural Strength

Sr. No	Proportion of fiber	Flexure Strength in N/mm^2 for 28 days of Curing
1	10% MD; 0% SF	2.5
2	10% MD; 0.5% SF	2.9
3	10% MD; 1% SF	3.5
4	10% MD; 1.5% SF	3.8
5	10% MD; 2% SF	3.6

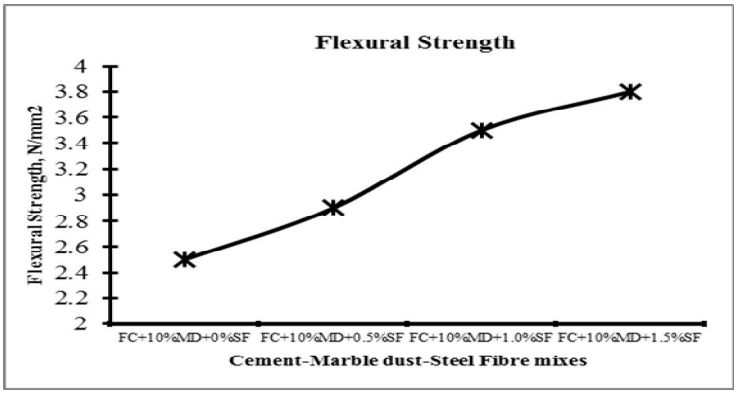

Fig-3.28: Days Flexural Strength Test

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CONCLUSION

Replacement of cement with 10% Marble Dust improve the strength of concrete .The optimal dosage of replacement is found to be 10% as per research carried out on this topic. Utilization of Marble Dust will reduce the amount of cement which make the mix economical and overcome land filling problem Introducing the Steel Fiber into the mix will increase strength in bending as well as in tension. The test results show clearly that Marble Dust as a partial replacement has beneficial effects of the mechanical properties of high performance concrete. After the addition of 0.5% of steel fiber the strength is increased by 12% for compression, 14% for tension, 16% flexure. thus the present experimental investigation indicates that the strength properties of the concrete could enhance the effect of utilization of Marble Dust obtained from industries.

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EFFECTIVE UTILIZATION OF KOTA STONE WASTE (KSW) IN DENSE BITUMINOUS MACADAM (DBM)

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ABSTRACT
Road construction & maintenance require large quantities of natural aggregate (NA). Using Kota stone waste aggregate as an aggregate replacement reduces the extraction of new aggregate, pressing demand on existing landfill sites, & emissions of wastes in environment. This study assessed the use of Kota stone waste aggregate (KSW) as replacement for natural aggregate in Dense Bituminous Macadam. The objective of this study was appraise the possible use of Dense Bituminous Macadam containing KSW for roads with medium traffic volume. For this purpose, KSW was replaced by NA at rates of 0, 20, 40, 60, 80& 100% in DBM. Many aggregate tests like water absorption, aggregate impact value, Los Angeles abrasion, flakiness index, and Marshall Mix design were carried out on the aggregate specimens. Test results on aggregates make sense the comparative study of the physical properties of the aggregates are within define limits.

Keywords: Road network, aggregate, Kota stone waste

INTRODUCTION
In the Present Era, As the Technology overture construction increased with respect to time. Products which use recycled materials could contribute significantly to conservation of the environment in terms of Kota stone deposits are part of vindhyan range of sedimentary rocks, it is mainly found in Kota, Jhalawar and Chittor districts of Rajasthan. It is compact, hard, tough, oil resistant, and non-slippery and non-water absorbent and homogenous natural stone (high silica content). This research work is mainly focused on highlighting the major problem that are arising due to excessive mining of the Kota stone and attempting utilizing the Kota stone waste generated in Hot Mix Asphalt(HMA). It is durable, performs well under heavy load, require minor polish and surface dust is not visible immediately. Kota stone industry produces both solid waste as well as stone slurry waste. During the process of cutting, in that original stone waste mass is lost by 25% in the33333 form of dust A. Hussein et al. 2012). Accordingly, the amount of mining and processing waste has increased. It is a highly polluting waste because of its high alkaline nature, which causes a health hazard.

In this study we have perform various test on aggregate like sieve analysis, elongation and flakiness index, Los angles, water abortion ,impact value etc. and various test on bitumen like flash and fire point, melting point, ductility test etc. are performed and later on various proportion of . i.e. (0% 20%, 40%,60%, 80%, 100%) aggregate is replaced in flexible pavement with Kota stone waste and result are compared with Marshall Stability guidelines.

LITERATURE REVIEW
Evaluates the effect of marble dust and granite dust on the properties of asphalt-filler matrix in HMA. These fillers are hydrophobic in nature. Strong bond is formed because of more fatigue strength and their constant nature. These fillers can be used in the range of 4 to 5.5% in asphalt mix. It is recommended to use it for low volume roads. Since, marble dust was used as filler on the basis of filler/bitumen ratio increases the plastic deformations decrease up to 7% after that the plastic deformations take higher values according to [**M. Karashin et al. 2007],** marble dust as filler in HMA increase Marshall Stability, and flow value of Indirect Tensile Strength. On similar ground [**R. Choudhary et al. 2010]** Kota stone industry produces both solid waste as well as stone slurry waste. During the process of cutting, in that original stone waste mass is lost by 25% in the form of dust [**A. Hussein et al. 2012]**India possesses over 85,600 million tons of calcareous stones reserves including limestone, marble, Kota stone, etc. Estimated production of calcareous stones is 188.6 million tons per year **(CBRI et al. 2013)** RMA was replaced by virgin aggregates (VA) at rates of 15, 25, 40, and 60% in HMA. The result shows that using RMA in asphalt mixtures increased optimum binder content decreased Fatigue life with negligible difference. As in this heading, they should be Times 11-point boldface, initially capitalized, flush left, with one blank line before, and one after **[Nejad et al. 2013]**.Marble waste used as fine aggregate with variations ranging from 0 to 100% at an interval of 50%. It was concluded that 100% RMA can be used as fine aggregate on the basis of Marshall Stability and flow values. On similar ground [**Adil N. et al. 2014] .**

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OBJECTIVE

- To comparative study of natural aggregate and Kota stone waste as aggregate in flexural pavement.
- To study the problem associated with Kota stone waste and its possible solution in road construction.
- Learning about various testing of aggregate and bitumen flexural pavement.
- Design of pavement on the basis of Marshall Test result and comparison.
- Minimize the construction cost of road by using stone waste as replacement for aggregate.

MATERIAL

Aggregates: Aggregates are the primary material and major portion for the road construction these are influence to the high load bearing capacity in the roads. Aggregates should resist the wearing and abrasion action in the road surface due to loads and wheel contact pressure between road and wheels. So that before using aggregates test should be conducted. Aggregates size and shape influence the monolithic structure of pavements manufactured aggregates are crushed in crusher machine required size. Various tests on NA & KSW aggregate were performed and results are given below.

Table-1: Properties of aggregate

S.no.	Tests Performed	Natural aggregate	Kota stone waste	Specified limit
1	Impact test	21.32	17.53	30%
2	Specific gravity	25.63	23.98	23.98
3	Water absorption	21.83	22.4	22.4
4	Flakiness & elongation index	9.77	10.11	10.11
5	Crushing test	1.25	0.35	30%
6	Stripping test	1.2	0.85	0.85

Bitumen: Bitumen is a material which is byproduct petroleum refining. Bitumen is a complex material. It is highly viscous when temperature is high and when the load is intermediate and medium temperature it is viscous elastic. . Due to the binding property and flexibility behavior with aggregates it used for the road construction. Bitumen was selected based on the site situation, temperature, type of roads and type of traffic, soil constitutions. The basic tests were carried out to know the properties of bitumen shown in table 2.. The grade of bitumen is 60/70 based on the penetration value.

Stone Dust: It is obtained by crushing of stones with crusher machines. The filler which means it passes from 0.075mm sieve size. It is industrial waste fillers in land area. It is used as filler materials in road construction.

Table-2: Properties of bitumen

S.NO	Tests	Results	Specified limit
1.	Penetration test	68	50-70
2.	Ductility test	100	min-40
3.	Softening point	47	40 to 55
4.	Specific gravity	0.99	min 0.99

METHODOLOGY

With references of the reviewed literature, it was decided to use Kota stone waste as aggregate I hot asphalt dense bituminous macadam (DBM). First of all KSW aggregate was procured in size of 40mm, 20mm, 12mm, 6mm and stone dust by stone crusher. Physical and chemical properties of KSW were investigated as per MORTH 2015. Marshall Test IRC: 111-2009 was performed at different proportion of KSW ranging from 0 to 100% at interval of 20% to check optimum binder content (OBC) of mixes. Total 36 samples of DBM (6 for each variation of mix with KSW and conventional Aggregate) were prepared to evaluate OBC.

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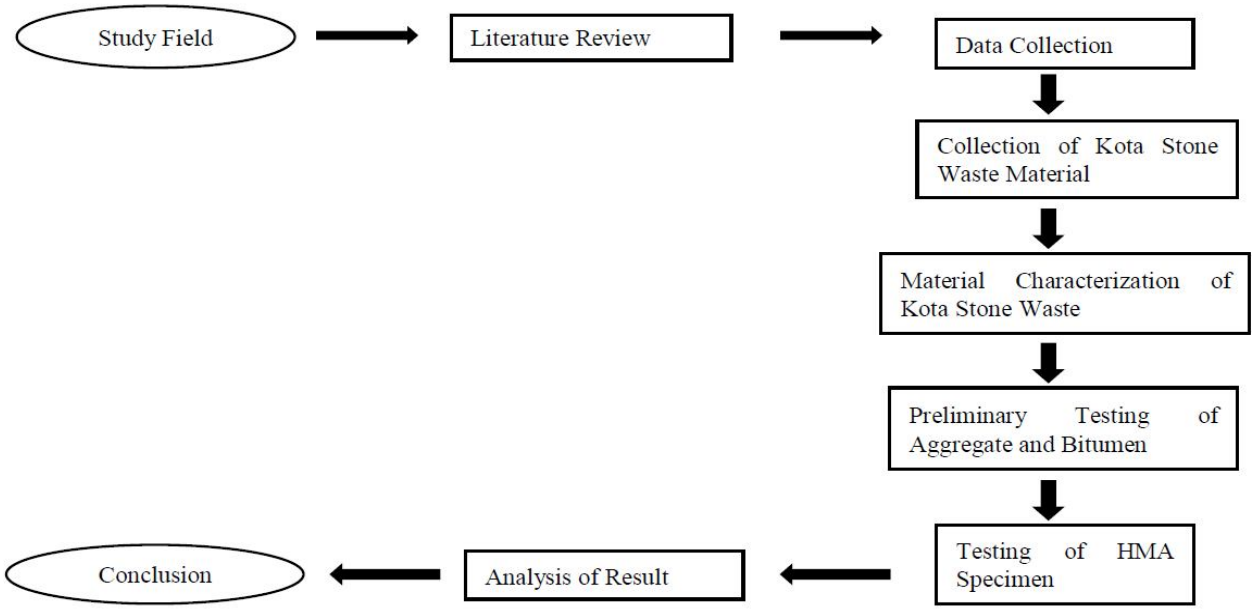
RESEARCH METHODOLOGY



MARSHALL STABILITY TEST

This test was used to calculate the strength and flexibility for the present or given bitumen mixture. It is also used or analyses the density-voids for the bituminous mixture. Strength is calculated in terms of the "Marshall's Stability" of the mix which is defined as the maximum load which is being carried by a compacted specimen at a standard test temperature of nearly 60°C. The flexibility and durability is measured in terms of the "Flow Value" which is measured by the change in diameter of the sample in the direction of load application between the start of loading and the time of maximum load. In this test an attempt is made to obtain optimum binder content for the aggregate mix type and traffic intensity.

APPARATUS USED

Marshall Stability testing machine, cylindrical mould – diameter 10cm and 7.5 cm height, Rammer – 4.5 kg weight with free fall of 45.7 cm, Compacting Machine, Water Bath and IS Sieves.

$$Gt = \frac{W1 + W2 + W3 + W4 + Wb}{\frac{W1}{G1} + \frac{W2}{G2} + \frac{W3}{G3} + \frac{W4}{G4} + \frac{Wb}{Gb}}$$

Where

Gt = Theoretical specific gravity

G1 = Sp. gravity of coarse aggregate

Wl = Weight of coarse aggregate in total mix

G2 = Sp.gr. of fine aggregate

W2 = Weight of fine aggregate in total mix

G3 = Sp.gr. filler material

W3 = Weight of filler material in total mix

G4 = Sp.gr. of bitumen

W4 = W eight of bitumen in total mix.

AIR VOIDS

It is the total volume of the small pockets of air between coated aggregate particles throughout a compacted paving mixture, expressed as percentage of the total volume of the compacted paving mixture.

$$Vv = \frac{Gt - Gm}{Gt} X\ 100$$

Where,

Vv = Air voids

Gt = Theoretical specific gravity

Gm = Bulk density of mix (g/cc)

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VOIDS IN MINERAL AGGREGATE

It is the volume of inter granular void space between the uncoated aggregate particles of a compacted paving mixture that includes air voids and effective content of bitumen. VMA is expressed as percentage of the total volume of the compacted paving mixture.

VMA = Vv + Vb

Vv= Air voids (%)

Vb: Volume of bitumen

Voids Filled with Bitumen

It is the percentage of VMA that is occupied by the effective bitumen.

$$VFB = \frac{Vb}{VMA} \; X \; 100$$

Vb = Volume of bitumen

VMA = Voids of mineral aggregate

RESULT & DISCUSSION

Result of physical properties of Kota stone aggregate tells about its suitability as aggregate for road construction. From below observation it is concluded that all values of KSW aggregate are under limit, so for further in vestigation KSW aggregate are mixed with conventional aggregate within 0%, 20%, 40% , 60% and 80% ,100%.

GRADATION OF AGGREGATE

Grading of Aggregate was done before mix design. The aggregate sieved and blended by hit and trial method. . Total 36 samples was constructed, 6 for each variation.

Tabl-3: Gradation of Aggregate

	40mm		20mm		10mmm		6mm		stone dust			
Sieve size (mm)	%pass	trail	%pass	trail	%pass	trail	%pass	trail	%pass	trail	Combined grading	MORTH specification
		0%		35%		16%		16%		33%		
45.0	100	0.0	100	35	100	16	100	16	100	33	100	100
37.5	100	0.0	100	35	100	16	100	16	100	33	100	100
26.5	59.89	0.0	100	35	100	16	100	16	100	33	100	90-100
19	3.20	0.0	84.48	29.56	100	16	100	16	100	33	94.57	71-95
13.2	0.0	0.0	40.81	13.46	100	16	100	16	100	33	78.46	56-80
4.75	0.0	0.0	1.09	0.38	15.10	2.41	13.80	2.20	99.75	32.90	37.89	38-54
2	0.0	0.0	0.75	0.26	3.55	0.56	6.35	1.01	93.65	30.90	32.73	28-42
0.3	0.0	0.0	0.0	0.0	0.15	0.02	2.15	0.34	34.90	11.52	11.88	7-21
0.075	0.0	0.0	0.0	0.0	0.05	0.0	0.65	0.10	9.90	3.26	3.36	2-8

PROPERTIES OF DBM (II) (CONVENTIONAL AGGREGATE)

Table-4: Properties of DBM (II) (Conventional Aggregate)

% Bitumen Content	Wa	Ww	Volume	Density (Gm)	Gt	Vv	Vb	VMA	VFB	Flow Value	Stability	C.F	Net Stability(Kg)
4	1140	665	477.5	2.39	2.62	8.54	9.31	17.85	52.15	3.1	3	1.14	941.92
4.5	1133	661.5	471.5	2.4	2.6	7.42	10.6	18.03	58.82	3.5	4	1.14	1258.56
5	1138.5	667.5	471	2.42	2.58	6.16	11.8	17.95	65.71	3.4	4.5	1.14	1415.88
5	1139.5	667	472.5	2.41	2.58	6.37	11.76	18.13	61.86	3.8	4.7	1.14	1478.808
5.5	1143.5	673.5	471	2.43	2.56	4.83	13	17.83	72.93	4.5	3.6	1.19	1182.384
6	1150.5	680.5	470	2.45	2.54	3.53	14.18	17.71	80.08	5	3.2	1.14	1195.632

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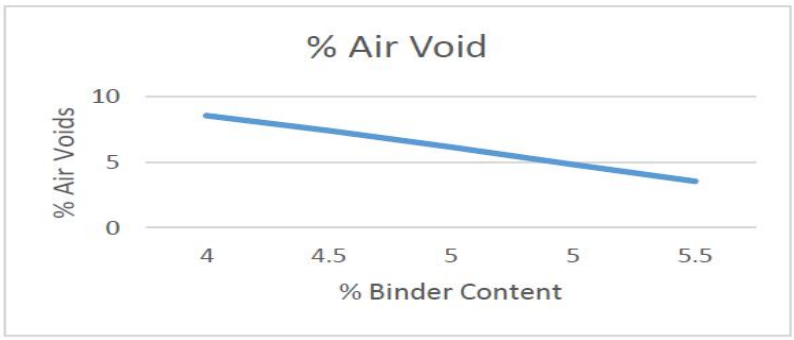
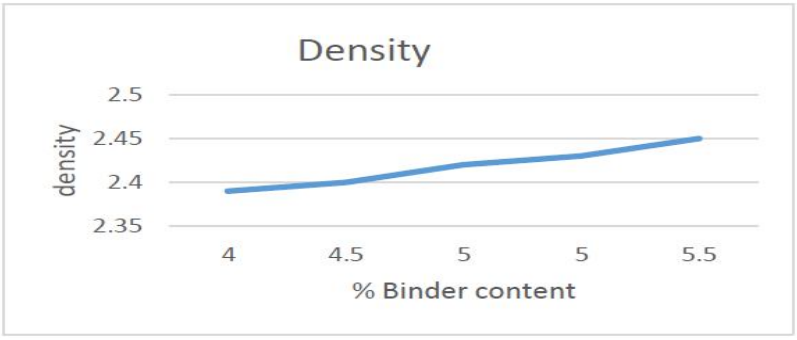
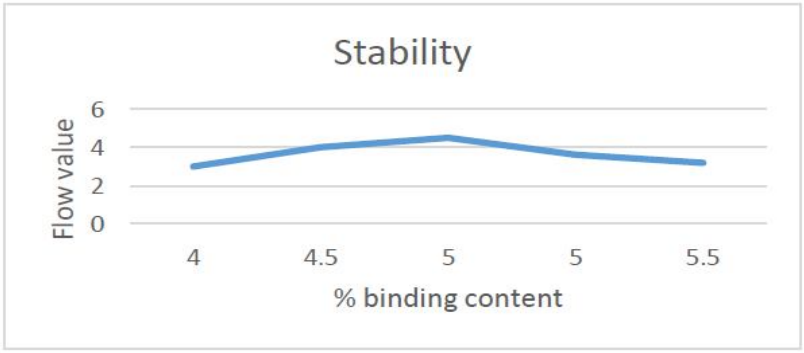


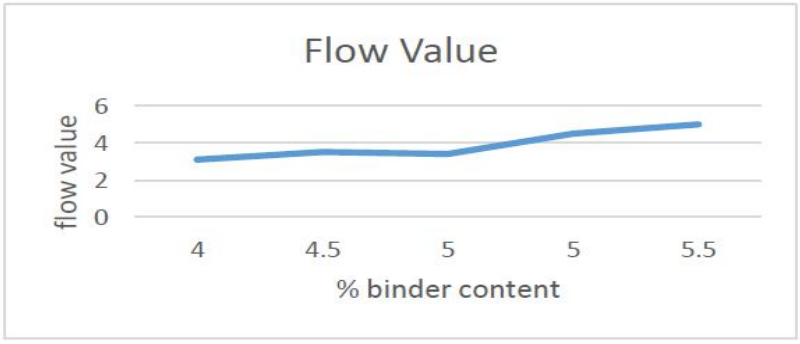
Graph-1: Air Void vs Binder Content



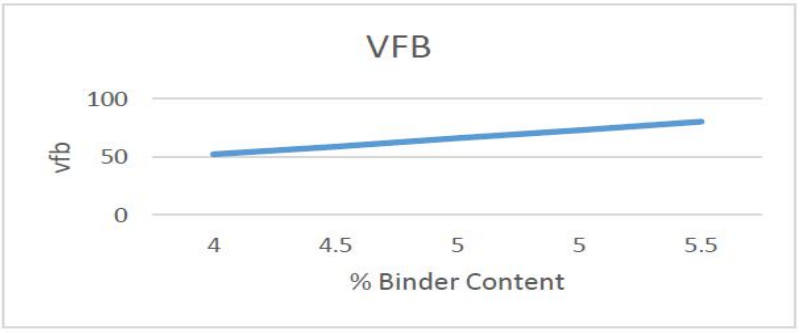
Graph-2: Density vs Binder Content



Graph-3: Stability vs Binder Content



Graph-4: Flow value vs Binder Conent



Graph-5: VFB vs Binder Content

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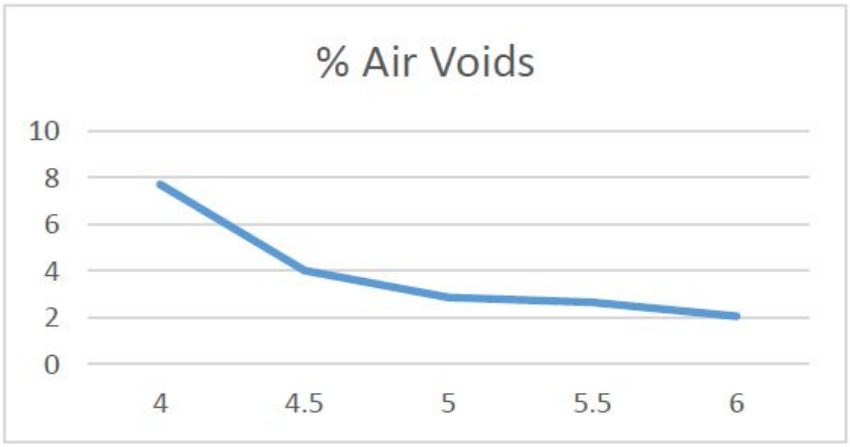
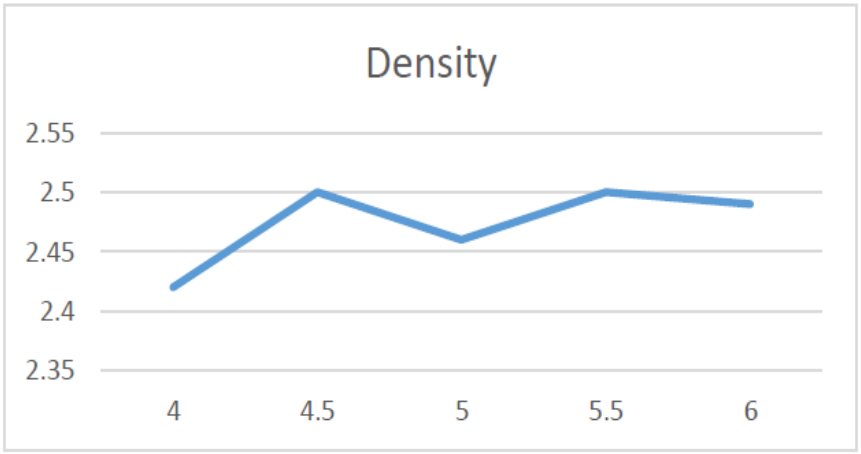
PROPERTIES OF DBM (II) (20% KS AGGREGATE)

Table-5: Properties of DBM (II) (20% KSW Aggregate)

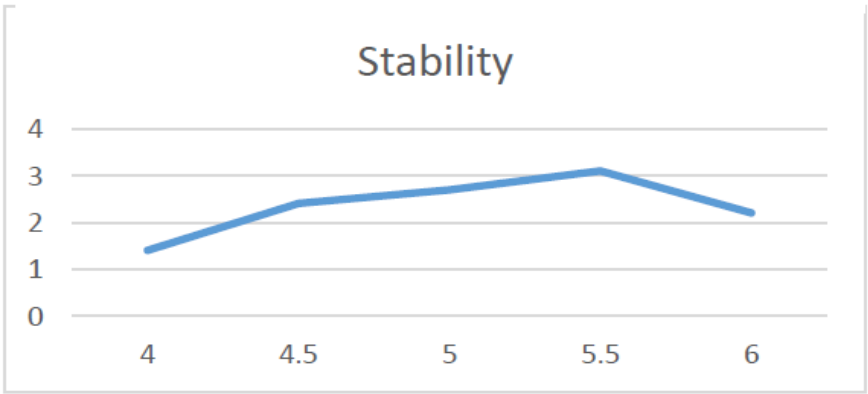
% Bitumen Content	Wa	Ww	Volume	Density (Gm)	Gt	Vv	Vb	VMA	VFB	Flow Value	Stability	C.F	Net Stability(Kg)
4	1140.5	668.2	468.5	2.42	2.62	7.7	9.46	16.86	56.44	3.8	1.4	1.14	435.496
4.5	1133.8	676.3	455	2.5	2.6	4.01	11.03	15.83	70.43	4.5	2.4	1.14	786.6
5	1144.9	685.1	454	2.46	2.58	2.85	12.16	15	82.04	4.8	2.7	1.14	800.052
5	1139.9	672.2	465.3	2.44	2.58	5.32	11.92	17.27	79.87	4.6	3	1.14	842.953
5.5	1149.1	686.3	460	2.5	2.55	2.63	13.25	15.74	83.4	3.5	3.1	1.14	1018.164
6	1151.7	688.1	465	2.49	2.51	2.05	14.44	16.71	85.66	3.6	2.2	1.14	569.362



Graph-6: Air Void vs Binder Content



Graph-7: Density vs Binder Content



Graph-8: Stability vs Binder Content

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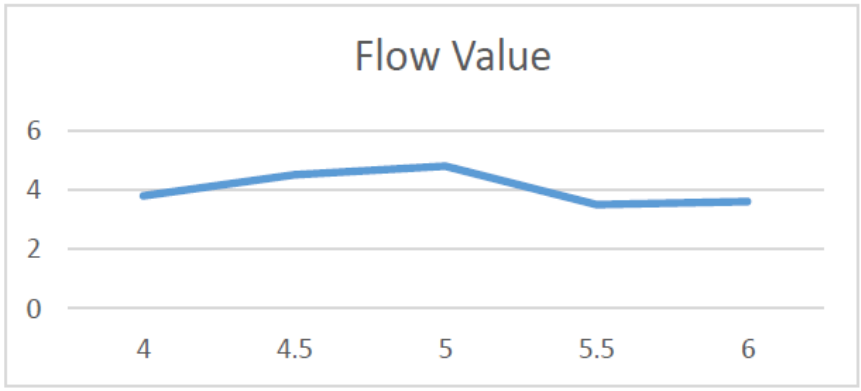
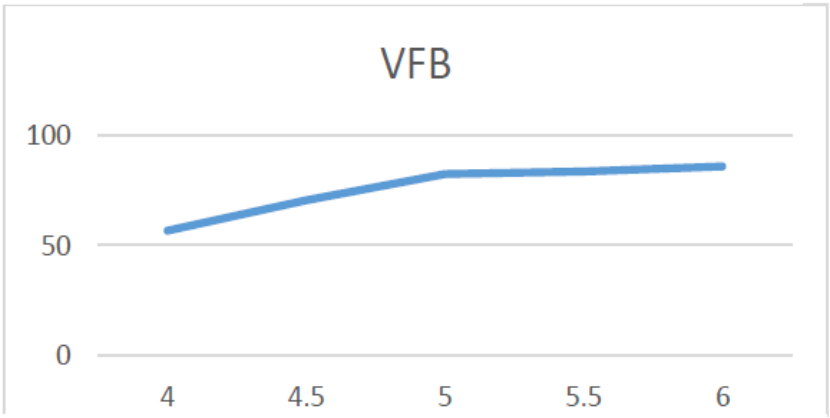


Graph-9: Flow Value vs Cinder Content

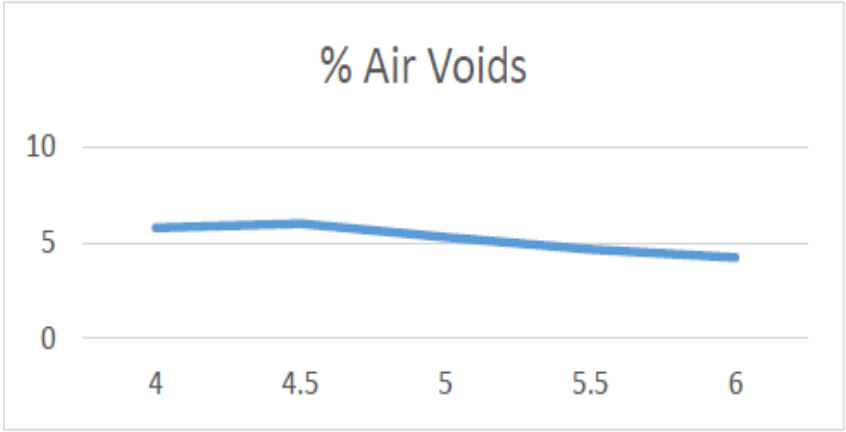


Graph-10: VFB vs Binder content

PROPERTIES OF DBM (II) (40% KSW AGGREGATE)

Table-6: Properties of DBM (II) (40% KSW Aggregate

% Bitumen Content	Wa	Ww	Volume	Density (Gm)	Gt	Vv	Vb	VMA	VFB	Flow Value	Stability	C.F	Net Stability(Kg)
4	1160	687	474	2.44	2.6	5.74	10.49	15.79	65.62	1.4	1.4	1.14	440.496
4.5	1145	665.8	468.3	2.48	2.58	5.98	11.72	16.88	67.41	1.6	2.3	1.14	786.6
5	1159	671.3	475	2.46	2.56	5.26	12.8	17.56	72.25	2.5	2.5	1.14	800.052
5	1154	679.5	470.4	2.46	2.56	5.19	12.86	17.49	76.34	2.3	2.2	1.19	1149.54
5.5	1125	664.1	479.5	2.45	2.54	4.64	13.9	18.61	68.97	3	3.2	1.19	1018.164
6	1136.4	666	469.7	2.42	2.52	4.21	15.02	19.37	74.38	3.2	1.8	1.14	569.362



Graph-11: Air Void vs Binder Content

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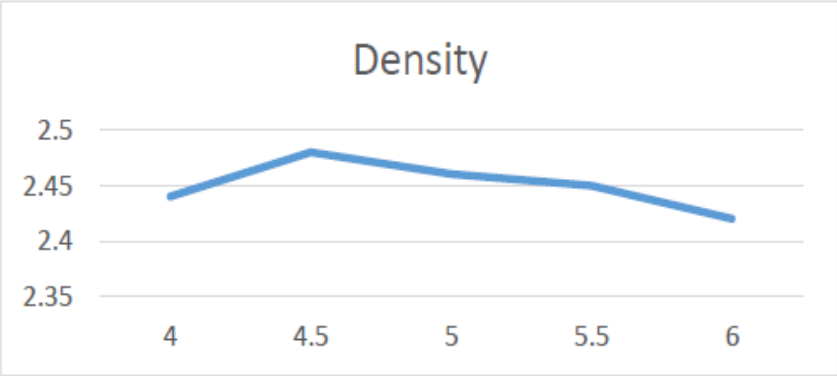
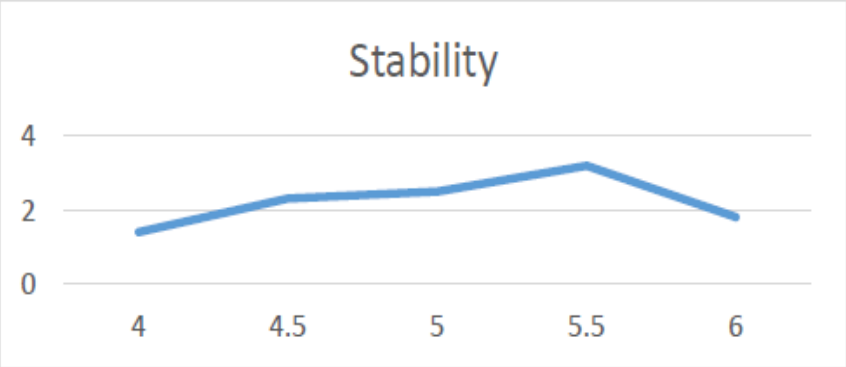
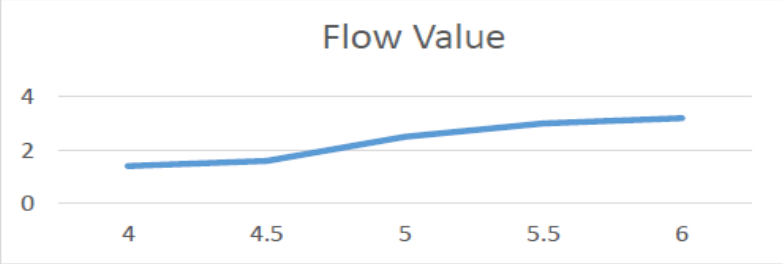


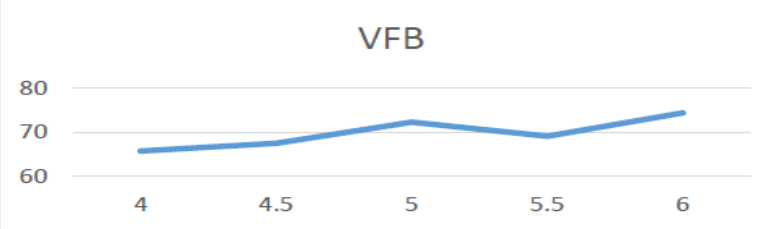
Graph-12: Density vs Binder Content



Graph-13: Stability vs Binder Content



Graph-14: Flow Value vs Binder Content



Graph-15: VFB vs Binder content

PROPERTIES OF DBM (II) (60% KSW AGGREGATE)

Table-7: Properties of DBM (II) (60% KSW Aggregate)

% Bitumen Content	Wa	Ww	Volume	Density (Gm)	Gt	Vv	Vb	VMA	VFB	Flow Value	Stability	C.F	Net Stability(Kg)
4	1173.3	693	475	2.41	2.7	5.74	10.48	15.79	64.6	1.5	1.4	1.14	440.496
4.5	1148	668.5	470.5	2.46	2.64	5.42	11.85	16.23	68.57	1.8	1.7	1.14	566.352
5	1168	685.5	471.5	2.43	2.48	4.96	12.9	17.82	72.16	2.4	2.6	1.14	786.6
5	1139	671.5	473	2.45	2.48	4.01	12.99	17.87	72.38	2.3	2.8	1.19	1018.164
5.5	1150	672.5	467	2.4	2.52	5.4	13.45	19.3	78.9	3.2	3.1	1.14	1149.54
6	1156	679	471.5	2.42	2.53	3.33	14.28	19.39	81.08	3	1.4	1.14	880.992

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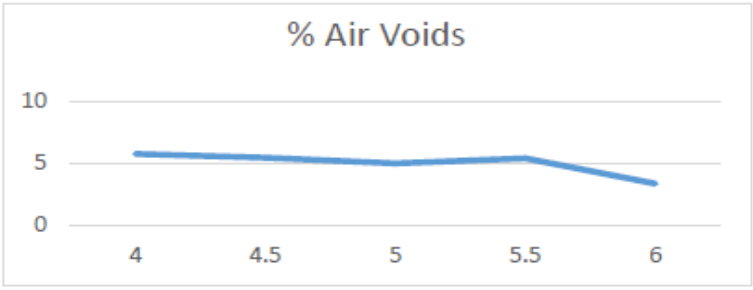
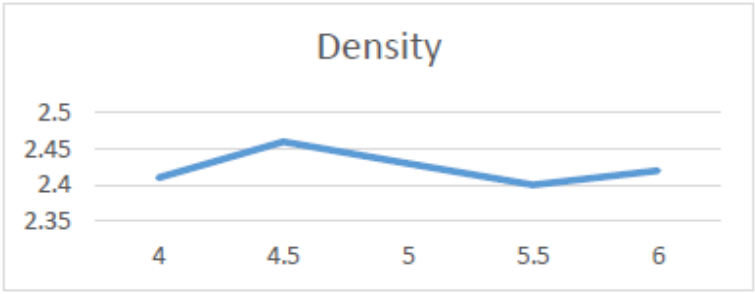
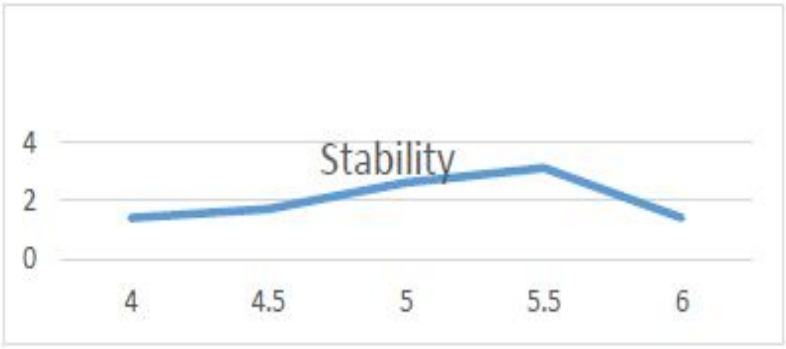


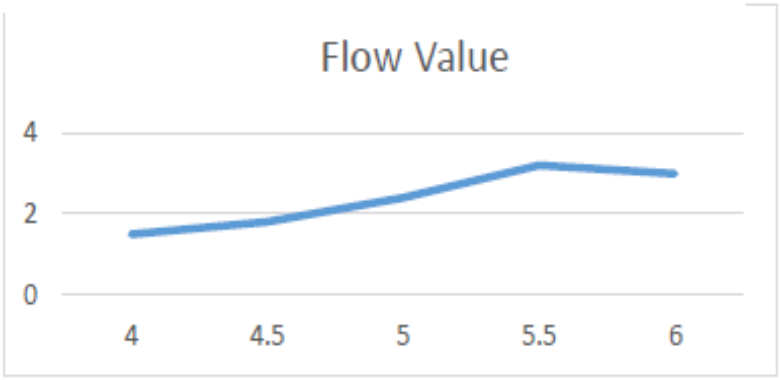
Graph-16: Air Void vs Binder Content



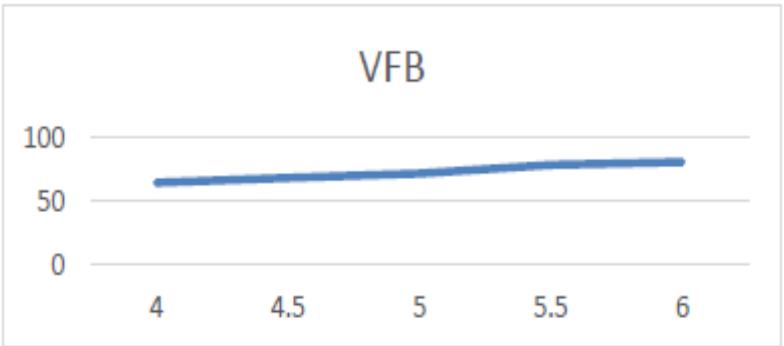
Graph-17: Density vs Binder Content



Graph-18: Stability vs Binder Content



Graph-19: Flow Value vs Binder Content



Graph-20: VFB v/s % Binder content

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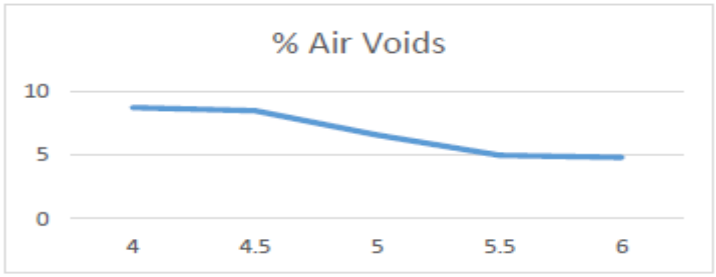
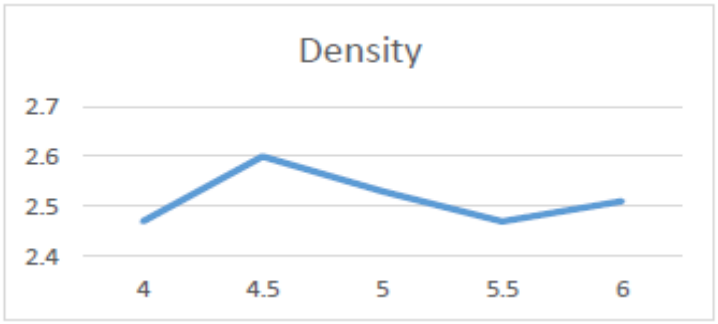
PROPERTIES OF DBM (II) (80% KSW AGGREGATE)

Table-8: Properties of DBM (II) (80% KSW Aggregate)

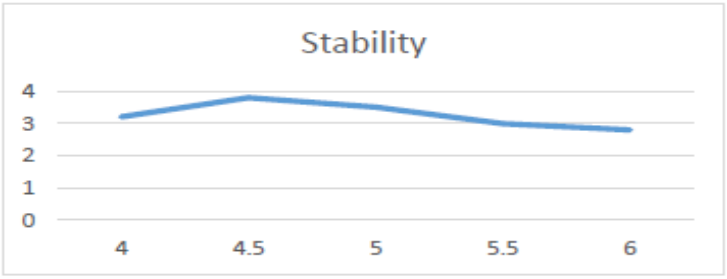
% Bitumen Content	Wa	Ww	Volume	Density (Gm)	Gt	Vv	Vb	VMA	VFB	Flow Value	Stability	C.F	Net Stability(Kg)
4	1128.5	678	459	2.47	2.68	8.7	9.8	17.9	52.18	2.2	3.2	1.14	1038.212
4.5	1134.5	672	461	2.6	2.68	8.45	10.78	19.46	60.72	2.5	3.8	1.14	1204.632
5	1155.4	697.5	457.5	2.53	2.66	6.56	12.6	17.86	68.91	2.4	3.5	1.14	943.92
5	1152	675.5	458	2.53	2.65	5.73	12.45	18.41	73.01	2.8	2.9	1.19	886.788
5.5	1148.6	683.9	460.5	2.47	2.64	4.97	13.33	19.47	64.36	3.2	3	1.19	692.08
6	1160	698.5	465.4	2.51	2.64	4.79	14.48	19.28	75.11	2.9	2.8	1.14	890.682



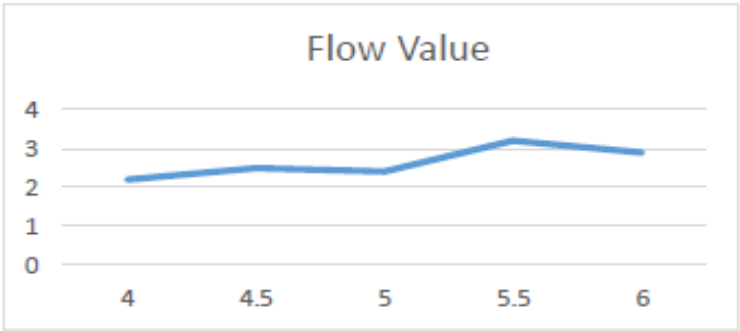
Graph-21: Air Void vs Binder Content



Graph-22: Density vs Binder Content



Graph-23: Stability vs Binder Content



Graph-24: Flow Value vs Binder Content

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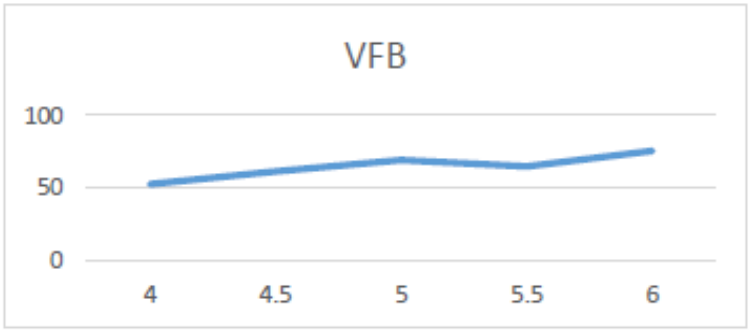
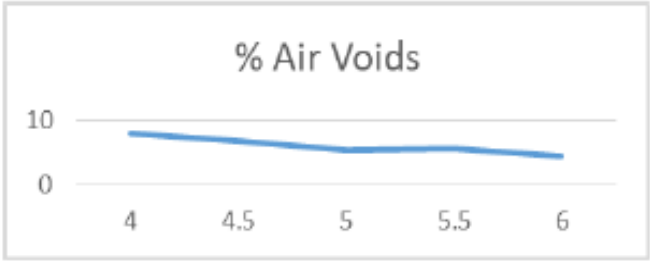


Graph-25: VFB vs Binder conten

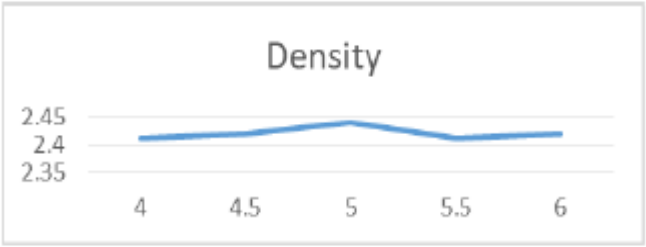
PROPERTIES OF DBM (II) (100% KSW AGGREGATE)

Table-9: Properties of DBM (II) (100% KSW Aggregate

% Bitumen Content	Wa	Ww	Volume	Density (Gm)	Gt	Vv	Vb	VMA	VFB	Flow Value	Stability	C.F	Net Stability(Kg)
4	1140	666.5	473.5	2.41	2.62	7.97	9.39	17.35	54.09	3.8	1.4	1.14	440.196
4.5	1141.5	670	471.5	2.42	2.6	6.73	10.6	17.33	61.18	4.4	2.5	1.14	786.6
5	1151.5	679	472.5	2.44	2.58	5.38	11.76	17.14	68.59	4.4	2.6	1.14	818.061
5	1155	675.5	479.5	2.41	2.58	6.48	11.59	18.07	64.12	4.9	2.8	1.14	880.992
5.5	1158.5	678.5	480	2.41	2.56	5.59	12.73	18.32	69.51	3.6	3.1	1.19	1018.164
6	1159	680.5	478.5	2.42	2.54	4.54	13.93	18.47	75.42	3.4	1.4	1.14	566.352



Graph-26: Air Void vs Binder Content



Graph-27: Density vs Binder Content

Graph-28: Stability vs Binder Content

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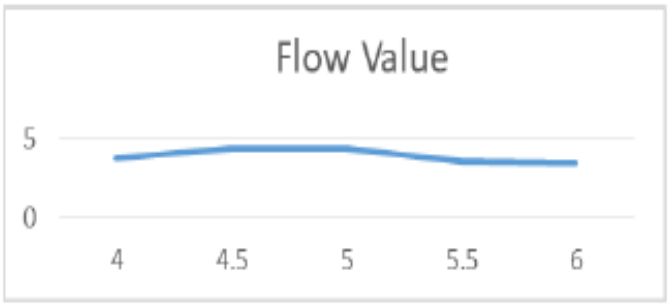
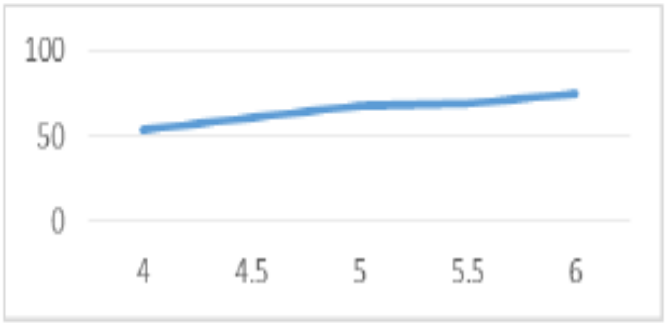


Graph-29: Flow Value vs Binder Content



Graph-30: VFB vs Binder content

CONCLUSION

In this study use of mining waste, quarry waste, cutting and polishing waste is used as full to partial replacement of conventional aggregate on dense bituminous macadam. The samples were subject to physical as well as mechanical properties.

Based on the experimental evidences following conclusion were drawn.

- Kota Stone waste aggregate required the physical properties that qualify these aggregate to be used in dense bituminous macadam.
- As per Marshall Test result conventional aggregate cab be fully replaced with KSW.

The use of KSW in DBM not only reduce the cost but also improve environment. It is hoped that in future we will have strong, durable and eco-friendly pavements in which we use KSW.

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ESTIMATING THE VEHICLE OPERATING COST THROUGH RAILWAY OVER BRIDGE

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ABSTRACT
Understanding the vehicle working expense is or vehicle operating cost is fundamental to sound arranging and administration of street ventures. While the framework costs borne by streets offices are generous, the expenses borne by streets clients are much more noteworthy. To qualify these connections, World Bank started a cooperative worldwide examination which prompted the vehicle working costs connections created in this investigation, and presents these in a little simple to utilize PC program which can be utilized freely of the bigger model. The HDM-VOC program predicts the different parts of vehicle working costs in light of street and vehicle qualities and unit costs in a free stream movement condition. The vehicle working expenses was additionally evaluated by Indian Road Congress parameters. IRC gives a few conditions to assess the VOC for various kinds of vehicles like autos, LCV, transport and so forth in IRC SP 30:2009. This paper is planned to evaluate the vehicle working expense of ROB at LC-70, Sitapura, Jaipur. For this reason world bank investigation of VOC and IRC SP 30:2009 are utilized. By the utilization of these examinations computed the VOC with geometric outline components of ROB at various velocities. These rates are 100 and 120 kmph.

Keywords: Vehicle operating cost (VOC), geometric elements of road, LC-70 (Lacation), HDM-VOC (Software used)

INTRODUCTION
The Jaipur Development Authority (JDA) has approved the design of railway over bridge (ROB) to be built on Jaipur-Sawai Madhopur railway track in Sitapura area. This would be the first Y-shaped ROB in the city. The estimated cost of the ROB is Rs 116 crore. The length of the over bridge will be 925 meters. It will start ahead of Mahatma Gandhi crossing. It will be a six-lane ROB and its one wing will move in the north direction towards the slip lane connecting Sitapura.

PROJECT LOCATION
This ROB will ease traffic on Road connection Sitapura Industrial area to Jaipur- Tonk Road (NH-12). LC No. 70 is located between Sanganer and Shivdaspura Stations on Jaipur-Sawai Madhopur BG Railway Line.

SIGHT DISTANCE FOR VARIOUS SPEEDS

	Sight distance (meter)		
Speed (km/h)	Stopping	intermediate	Overtaking
20	20	40	-
25	25	50	-
30	30	60	-
35	40	80	-
40	45	90	165
50	60	120	235
60	80	160	300
65	90	180	340
80	120	240	470
100	180	360	640
120	240	480	720

(Source: irc.gov.sp.023:1993)

Design table of Summit Curve (Tonk Road Side) for SSD

Design Speed (m/s)	n1	n2	N	S	Calculated Length of Curve (L)	Adopted Length of Curve (L)	a	(R)	Highest point on the curve(X) from BVCS point	RL of the highest point (Y)	BVCS	EVCS	RL of BVC point	RL of highest point on Grade Line	RL of highest point at curve
100	0.033	0	0.033	180	226.6	230	13939.0	6969.6	230	3.795	648.25	878.25	362.05	369.64	365.85
120	0.033	0	0.033	240	346.6	350	21212	10606.0	350	5.775	648.25	998.25	362.05	373.60	367.83

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Design table of Summit Curve (Tonk Road Side) for OSD

Design Speed (m/s)	n1	n2	N	S	Calculated length of curve (L)	Adopted length of curve (L)	a	R	Highest point on the curve(X) from BVCS point	RL of the highest point (Y)	BVCS	EVCS	RL of BVC point	RL of highest point on Grade Line	RL of highest point at curve
100	0.033	0	0.033	640	989.09	1000	60606.1	30303.0	1000	16.5	648.25	1648.25	362.05	395.05	378.55
120	0.033	0	0.033	720	1149.09	1150	69696.9	34848.5	1150	18.975	648.25	1798.25	362.05	400.00	381.03

Design table of Summit Curve (Mahatma Gandhi Hospital Side) for SSD

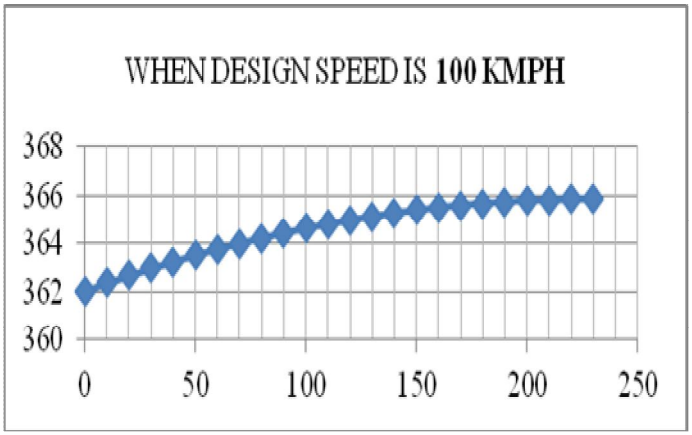
Design Speed (m/s)	n1	n2	N	S	Calculated length of curve (L)	Adopted length of curve (L)	a	R	Highest point on the curve(X) from BVCS point	RL of the highest point(Y)	BVCS	EVCS	RL of BVC point	RL of highest point on Grade Line	RL of highest point at curve
100	0	-0.025	0.025	180	184	190	15200	7600	0	0	934.77	1124.77	364.2	364.2	364.2
120	0	-0.025	0.025	240	304	310	24800	12400	0	0	934.77	1244.77	364.2	364.2	364.2

Design table of Summit Curve (Mahatma Gandhi Hospital Side) for OSD

Design Speed (m/s)	n1	n2	N	S	Calculated length of curve (L)	Adopted length of curve (L)	a	R	Highest point on the curve(X) from BVCS point	RL of the highest point(Y)	BVCS	EVCS	RL of BVC point	RL of highest point on Grade Line	RL of highest point at curve
100	0	-0.025	0.025	640	1104	1105	88400	44200	0	0	934.77	2039.77	364.2	364.2	364.2
120	0	-0.025	0.025	720	1264	1265	101200	50600	0	0	934.77	2199.77	364.2	364.2	364.2

Summit curve I (Tonk Road Side) at 100 kmph

Stations	Chainage from BVC	RL of Points on Grade Line	Ordinates B/W Curve and Grade Line	RL of Station on Curve
1	0	362.055	0	362.055
2	10	362.385	0.007173915	362.3778261
3	20	362.715	0.02869566	362.6863043
4	30	363.045	0.064565236	362.9804348
5	40	363.375	0.114782641	363.2602174
6	50	363.705	0.179347877	363.5256521



Summit curve II (Hospital Side) at 100 kmph

Stations	Chainage from BVC	RL of Points on Grade Line	Ordinates B/W Curve and Grade Line	RL of Station on Curve
1	0	364.2	0	364.2
2	10	363.95	0.006578947	363.9434211
3	20	363.7	0.026315789	363.6736842
4	30	363.45	0.059210526	363.3907895
5	40	363.2	0.105263158	363.0947368
6	50	362.95	0.164473684	362.7855263

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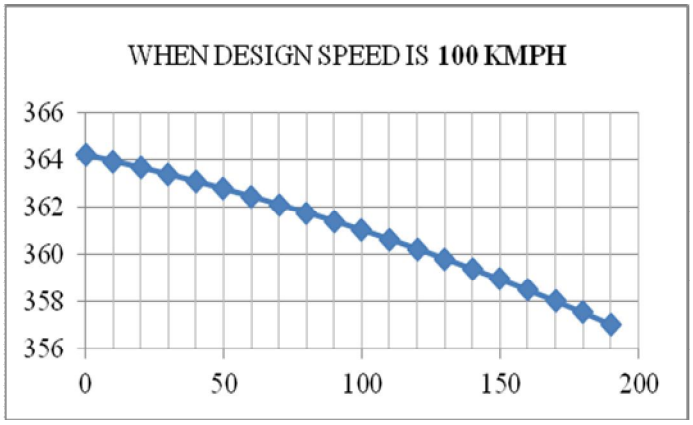
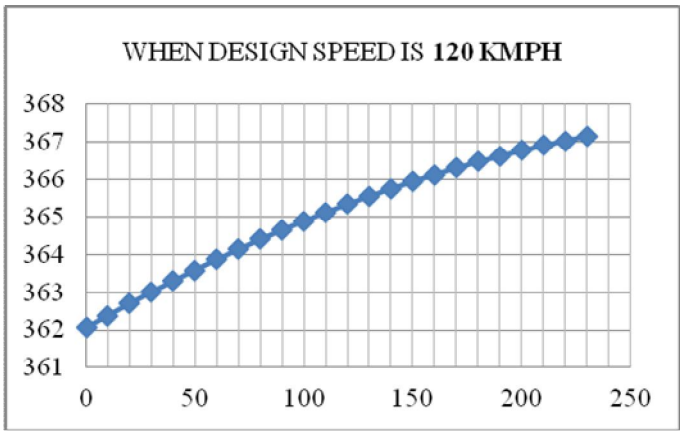


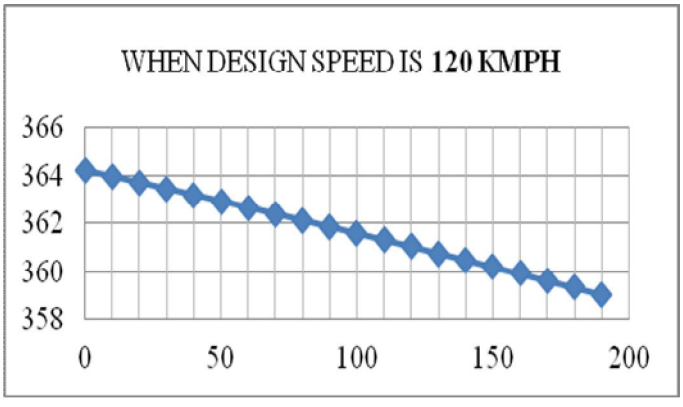
Summit curve I (Tonk Road Side) at 120 kmph

Stations	Chainage from BVC	RL of Points on Grade Line	Ordinates B/W Curve and Grade Line	RL of Station on Curve
1	0	362.055	0	362.055
2	10	362.385	0.004714286	362.3802857
3	20	362.715	0.018857144	362.6961429
4	30	363.045	0.042428574	363.0025714
5	40	363.375	0.075428576	363.2995714
6	50	363.705	0.11785715	363.5871429



Summit curve II (Hospital Side) at 120 kmph

Stations	Chainage from BVC	RL of Points on Grade Line	Ordinates B/W Curve and Grade Line	RL of Station on Curve
1	0	364.2	0	364.2
2	10	363.95	0.001131222	363.9488688
3	20	363.7	0.004524887	363.6954751
4	30	363.45	0.010180995	363.439819
5	40	363.2	0.018099548	363.1819005
6	50	362.95	0.028280543	362.9217195



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Design Table for Valley Curve (Tonk Road Side)

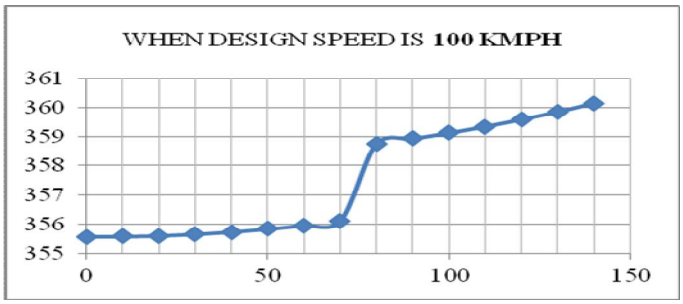
Design Speed (m/s)	n1	n2	N	S	Calculated length of curve (L)	Adopted length of curve (L)	a	R	Highest point on the curve(X) from BVCS point	RL of the highest point(Y)	BVCS	EVCS	RL of BVC point	RL of highest point on Grade Line	RL of highest point at curve
100	-0.00079	0.033	0.034	180	131.19	140	8213.5	4106.77	-3.4020	0.001409	425.64	565.64	355.57	355.68	355.68
120	-0.00079	0.033	0.034	240	189.59	200	11733.64	5866.82	-4.8600	0.002013	425.64	625.64	355.57	355..74	355.74

Design Table for Valley Curve (Mahatma Gandhi Hospital Side)

Design Speed (m/s)	n1	n2	N	S	Calculated length of curve (L)	Adopted length of curve (L)	a	R	Highest point on the curve(X) from BVCS point	RL of the highest point(Y)	BVCS	EVCS	RL of BVC point	RL of highest point on Grade Line	RL of highest point at curve
100	-0.025	-0.002	0.023	180	15.40	60	5301.5	2650.76	54.81	0.566	334.41	394.41	354.64	353.39	353.96
120	-0.025	-0.002	0.023	240	42.62	80	7068.7	3534.35	73.08	0.756	334.41	414.41	354.64	352.98	353.74

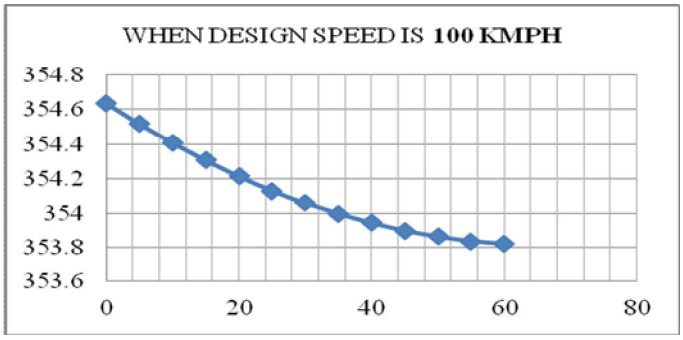
Valley curve I (Tonk Road Side) at 100 kmph

Stations	Chainage from BVC	RL of Points on Grade Line	Ordinates B/W Curve and Grade Line	RL of Station on Curve
1	0	355.57	0	355.57
2	10	355.5621	0.012175001	355.574275
3	20	355.5542	0.048700002	355.6029
4	30	355.5463	0.109575005	355.655875
5	40	355.5384	0.194800009	355.7332
6	50	355.5305	0.304375013	355.834875



Valley curve II (Hospital Side) at 100 kmph

Stations	Chainage from BVC	RL of Points on Grade Line	Ordinates B/W Curve and Grade Line	RL of Station on Curve
1	0	354.64	0	354.64
2	5	354.515	0.004715625	354.5197156
3	10	354.39	0.0188625	354.4088625
4	15	354.265	0.042440625	354.3074406
5	20	354.14	0.07545	354.21545
6	25	354.015	0.117890625	354.1328906



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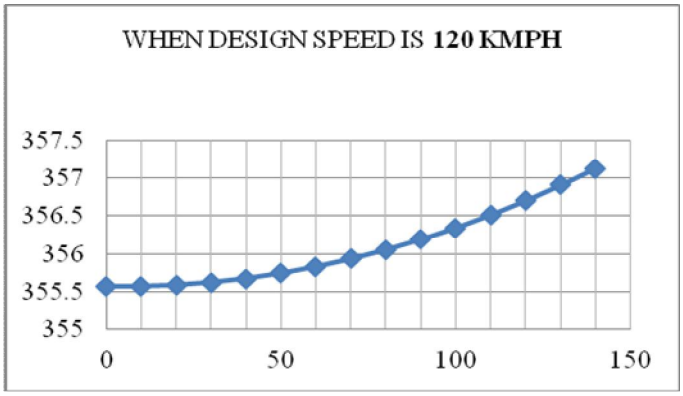
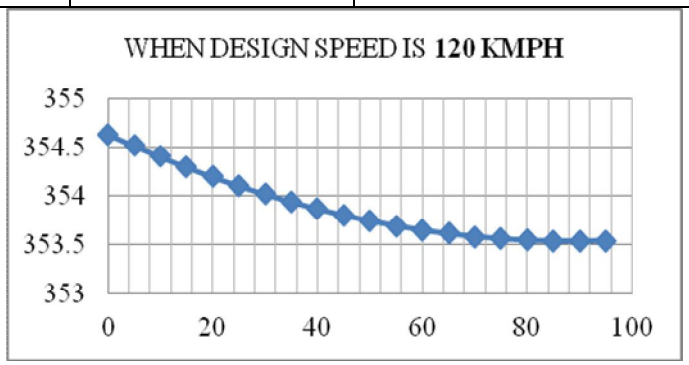
Valley curve I (Tonk Road Side) at 120 kmph

Stations	Chainage from BVC	RL of Points on Grade Line	Ordinates B/W Curve and Grade Line	RL of Station on Curve
1	0	355.57	0	355.57
2	10	355.5621	0.008522505	355.5706225
3	20	355.5542	0.034090018	355.58829
4	30	355.5463	0.076702541	355.6230025
5	40	355.5384	0.136360072	355.6747601
6	50	355.5305	0.213062613	355.7435626



Valley curve II (Hospital Side) at 120 kmph

Stations	Chainage from BVC	RL of Points on Grade Line	Ordinates B/W Curve and Grade Line	RL of Station on Curve
1	0	354.64	0	354.64
2	5	354.515	0.003536718	354.5185367
3	10	354.39	0.014146873	354.4041469
4	15	354.265	0.031830464	354.2968305
5	20	354.14	0.056587491	354.1965875
6	25	354.015	0.088417955	354.103418



Minimum Curve Radius for Different Design Speeds

Design Speed	Plain & Rolling Terrain(m)	Mountainous and Steep Terrain	
		Snow Bound Area (m)	Non-snow Bound Area (m)
20	15	15	14
25	23	23	20
30	33	33	30
35	45	45	40
40	60	60	50
50	90	90	80
65	155	Speed not applicable	
80	230		
100	360		
120	450		

(Source: irc 38:1988)

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Length of Transition Curve as Per Radius of Curvature and Design Speed

Transition Lengths (m) for Plain and Rolling Terrain									
Curve Radius(m)	**100 km/h**	**80 km/h**	**65 km/h**	**50 km/h**	**40 km/h**	**35 km/h**	**30 km/h**	**25 km/h**	**20 km/h**
20	-	-	-	-	-	-	-	-	55
40	-	-	-	-	-	-	60	45	30
80	-	-	-	-	55	45	30	25	15
100	-	-	-	70	45	35	25	20	-
125	-	-	-	55	35	30	20	15	-
155	-	-	80	-	-	-	-	-	-
200	-	-	60	35	20	15	15	-	-
250	-	90	50	30	20	-	-	-	-
300	-	75	40	25	-	-	-	-	-
350	130	60	35	20	-	-	-	-	-
360	130	-	-	-	-	-	-	-	-
400	115	55	30	20	-	-	-	-	-

(Source: IRC 38:1988)

Design Table of Horizontal Curve (Tonk Road Side)

S. No.	Design Speed (km/h)	Rc (m)	e	e taken	f	PC	PT	LC (Long Chord)	Deviation Angle (ΔS)
1	120	515.52	0.124	0.07	0.149	665.25	785.25	120	13.37
2	100	358	0.124	0.07	0.149	665.25	785.25	120	19.18

Design Table of Horizontal Curve (Tonk Road Side)

Ls	Adopted Ls	θs	Shift for unit length of θ	Shift	K for unit length	K	(Δs)	(Δ)	Ts	Es	(Lc)	L
75.41	130	7.22	0.0105	1.365	0.5351	69.56	13.37	27.82	2303.03	1776.98	120.2	250.23
75.41	130	10.40	0.0151	1.963	0.4995	64.93	19.18	39.98	856.66	511.7	119.7	249.78

Design Table of Horizontal Curve (Hospital Side)

S. No.	Design Speed (km/h)	Rc (m)	e	e taken	f	PC	PT	LC (Long Chord)	Deviation Angle (ΔS)
1	120	515.52	0.124	0.07	0.149	870.43	966.43	96	10.68
2	100	358	0.124	0.07	0.149	870.43	966.43	96	15.32

Design Table of Horizontal Curve (Hospital Side)

Ls	Adopted Ls	θs	Shift for unit length of θ	Shift	K for unit length	K	(Δs)	(Δ)	Ts	Es	(Lc)	L
75.41	130	7.22	0.0105	1.365	0.5351	69.56	10.68	25.13	68.7	1.4	96.04	226.04
75.41	130	10.40	0.0151	1.963	0.4995	64.93	15.32	36.12	295.4	151.3	95.67	225.67

All the geometric analysis (tables & charts showing total horizontal & vertical profile of the ROB LC-70) is done by using the all codes from Indian Road Congress such as:

1. IRC 86:1983 is used to calculate geometric design standards for urban roads in Plains.
2. IRC SP 30:2009 is used for manual economic evaluation of highway projects in India
3. IRC 38:1988 gives guidelines for design of horizontal curves for highways and design tables
4. IRC SP 023:1993 is used to calculate the vertical curves for highways.

VOC THROUGH ROB BY WORLD BANK (HDM-VOC)

The World Bank started a community worldwide examination which prompted the VOC connections created in this investigation. These connection show in a little simple to utilize PC program, this can be utilized freely of the bigger model. The HDM-VOC program predicts the different parts of VOC in respect to vehicle & road qualities and unit cost in a free stream movement condition. Calculations are accommodated ten vehicle writes running from little auto to articulated truck, and process speed, physical amount devoured, and add up to working expenses.

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APPROACH OF ANALYSIS (HDM-VOC RELATIONSHIPS)
It works into steps stated below:

1. Mean operating speed of vehicle calculated.

2. Calculate amount of resources used per 1000 vehicle-km for the components as

- Fuel consumption
- Lubricant consumption
- Tire wear
- Crew time
- Passenger time
- Cargo holding
- Maintenance labor
- Maintenance parts
- Depreciation
- Interest
- Overhead

3. Apply unit costs to the resource consumptions amounts.

4. Sum the operating cost for each component & calculate the total VOC per 1000 vehicle-km.

INPUTS FOR HDM-VOC PROGRAM

1. Surface Type: The model gives two choices to street surface write: (i) Paved and (ii) Unpaved. Enter 1 to choose a cleared street, and 0 to choose an unpaved street.

2. Roughness: The street unpleasantness is characterized as the deviation of a surface from a genuine planer surface with attributes that influence vehicle progression, ride quality, dynamic burdens and seepage. Enter the normal street unpleasantness in IRI units (International roughness index, in m/km).

Quantitative Evaluation	Roughness IRI (m/km)	
	Paved Road	Unpaved Road
Smooth	2	4
Reasonably smooth	4	8
Medium rough	6	12
Rough	8	15
Very rough	10	20

(Source: World Bank Technical Paper No. 234)

3. Vertical Profile: Travel on a road can be understood in three different types between two points as A and B. These are: (i) One-way travel from A to B (ii) One-way travel from B to A (iii) Round trip travel either from A to B and back to A, or from B to A and back to B.

Take after the means underneath to process the vertical geometric totals from a definite geometric profile:

A. Start with an itemized vertical profile.

B. Divide the roadway into segments with peaks and trough as limit focuses. Decide the lengths (ls) and normal slopes (as a group and with sighns held) of the segments (gs) and shape a forbidden profile of vertical geometry.

C. Determine the 'positive gradient (ps) of each section:

If the gradient of sections is positive, i.e., $g_s \geq 0$, then:

$p_s = g_s$.

If the gradient of sections is negative, i.e., $g_s < 0$, then:

$p_s = 0$

D. Determine the negative gradient (n_s) of each section:

If the gradient of sections is positive, i.e., $g_s \geq 0$, then:

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$n_s = 0$

If the gradient of section s is negative, i.e., gs < 0, then:

$n_s = |gs|$, where |gs| is the absolute value of g_s

E. Determine the 'rise' of each section. Multiply length and positive gradient to get pl_s:

$Pl_s = Ps\ l_s$

F. Determine the 'fall' of each section. Multiply length and negative gradient to get nl_s:

$nl_s = n_s\ l_s$

G. Specify the segments with positive gradient (uphill travel). Enter the length ls of the section if the section has a positive gradient; enter zero if the section has a negative gradient:

$P_s = l_s$ if $gs \geq 0$

$P_s = 0$ if gs < O

H. Form the totals of columns to get L, PL, NL and P, respectively.

I. Compute the average vertical geometric characteristics.

The recommended range for positive gradient (PG) and negative gradient (NG) is from 0 to 12 percent. The range for the proportion of uphill travel (LP) is from 0 to 100 percent.

Computation of Vertical Aggregates for 100 kmph

Section	Length (m)	Gradient (Fraction)	Positive Gradient (Fraction)	Negative Gradient (Fraction)	Rise (m)	Fall (m)	Uphill Travel (m)
1	70	-0.00079	0	0.00079	0	0.0553	0
2	70	0.0333	0.0333	0	2.331	0	70
3	115	0.0333	0.0333	0	3.8295	0	115
4	115	0	0	0	0	0	0
5	95	0	0	0	0	0	0
6	95	-0.025	0	0.025	0	2.375	0
7	30	-0.025	0	0.025	0	0.75	0
8	30	-0.002365	0	0.002365	0	0.07095	0
	L= 620				**PL= 6.1605**	**NL= 3.25**	**P= 185**
AVERAGE POSITIVE GRADIENT (PG)= (PL/P)*100= 3.33%							
AVERAGE NEGATIVE GRADIENT (NG)= [NL/(L-P)]*100= 0.747%							
AVERAGE UPHILL TRAVEL= (P/L)*100= 29.84%							
RF= {(365.85-355.57)+(364.2-353.96)}/.910= 22.55 m/Km							

Computations of Vertical Aggregates for 120 kmph

Section	Length (m)	Gradient (Fraction)	Positive Gradient (Fraction)	Negative Gradient (Fraction)	Rise(m)	Fall(m)	Uphill Travel(m)
1	100	-0.00079	0	0.00079	0	0.079	0
2	100	0.0333	0.0333	0	3.33	0	100
3	175	0.0333	0.0333	0	5.8275	0	175
4	175	0	0	0	0	0	0
5	155	0	0	0	0	0	0
6	155	-0.025	0	0.025	0	3.875	0
7	40	-0.025	0	0.025	0	1	0
8	40	-0.002365	0	0.002365	0	0.0946	0
	L= 940				**PL= 9.1575**	**NL= 5.0486**	**P= 275**
AVERAGE POSITIVE GRADIENT (PG)= (PL/P)*100= 3.33%							
AVERAGE NEGATIVE GRADIENT (NG)= [NL/(L-P)]*100= 0.765%							
AVERAGE UPHILL TRAVEL= (P/L)*100= 29.25%							
RF= {(367.83-355.57)+(364.2-353.74)}/.910= 24.97 m/Km							

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Average Horizontal Geometric Characteristics

Average Geometric Characteristics	Symbol	One way Trip		Round- trip
		A to B	B to A	
Average Curvature	C	K/L	K/L	K/L
Average Super elevation	SP	S/L	S/L	S/L

(Source: World Bank Technical Paper No. 234)

Computations of Horizontal Aggregates for Design Speed 100 kmph

Curvy Section	Length (m)	Radius of Curvature (m)	Curvature (deg/km)	Super Elevation	cl_s	sl_s
1	249.8	360	159.2356688	0.07	39777.07006	17.486
2	225.7	360	159.2356688	0.07	35939.49045	15.799
					75716.56051	**33.285**
ROAD LENGTH= 910m						
HORIZONTAL CURVATURE= 75716.56051/910= **83.20**						
SUPERELEVATION= 33.285/910= **0.036**						

Computations of Horizontal Aggregates for Design Speed 120 kmph

Curvy Section	Length (m)	Radius of Curvature (m)	Curvature (deg/km)	Super Elevation	cl_s	sl_s
1	250.2	520	110.2400784	0.07	27582.06761	17.514
2	226	520	110.2400784	0.07	24914.25772	15.82
					52496.32533	**33.334**
ROAD LENGTH= 910m						
HORIZONTAL CURVATURE= 52496.32533/910= **57.69**						
SUPERELEVATION= 33.334/910= **0.037**						

Altitude of Terrain: The model uses height of landscape (the normal rise of street over the mean ocean level, in meters) to process the air protection from the vehicle movement. The prescribed range for elevation (AL) is from 0 to 5000 meters.

Effective Number of Lanes: The model gives two choices to the powerful no. of paths: (i) one lane (ii) more than one lane. Enter 1 to choose the solitary path (lane) street, and 0 to choose an in excess of one path street.

Vehicle Type: Any type of vehicle can be selected now. We are selecting small car for our dissertation.

Desired Speed: The coveted speed requirement (VDESIR) is the coveted vehicle speed without the impact of street seriousness factor. On a straight, level and smooth street, despite the fact that the driving, braking, bend and ride seriousness speed imperatives don't exist, the vehicle still does not regularly go at the speed managed by its own particular greatest or even utilized power.

Tire Wear Information

The tire wear taken & uses by model as following

- Number of tires per vehicle
- Wearable volume of rubber per tire (dm^3)
- Retreading cost per new tire cost ratio (fraction)
- Maximum number of recaps
- Constant term of tread wear model (dm^3/m)
- Wear coefficient of tread wear model (10-3 dm^3/kJ)

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Recommended Wearable Volume of Rubber per Tyre

Vehicle	Recommended Wearable Volume of Rubber per Tyre (dm^3)
Buses	5.6 - 8.0
Light trucks	2.0 - 3.5
Medium trucks	6.5 - 9.3
Heavy trucks	6.3 - 8.8
Articulated trucks	6.0 - 8.5

(Source: World Bank Technical Paper No. 234)

The model uses fixed tear-wear coefficient for the rubber loss volume prediction, (dm3/1000 tire-km)

Unit Costs: Unit costs can either be financial or economic. Various unit costs required are such as:

- New Vehicle Price
- Fuel Cost
- Lubricants Cost
- New Tire Cost
- Crew Time Cost
- Passenger Delay Cost
- Maintenance Labor Cost
- Cargo Delay Cost
- Annual Interest Rate
- Overhead per vehicle-km

After giving all required data as input in the software we get following results:

Passenger Car Sample Data (Result Report):- For 100 kmph

1. Vehicle Speed	km/hr		100
2. Physical Quantities per 1000 vehicle-km			
Fuel consumption	liters		85.23
Lubricants consumption	liters		01.85
Tyre wear	# of equivalent new tires		00.06
Crew time	hours		10.00
Passenger time	hours		10.00
Cargo holding	hours		10.00
Maintenance labor	hours		02.27
Maintenance parts	% of new vehicle price		00.16
Depreciation	% of new vehicle price		00.43
Interest	% of new vehicle price		00.23
3. Total VOC per 1000 vehicle-km	**$**	**190.47**	**100%**
Fuel	$	98.01	51.46%
Lubricants	$	12.81	06.73%
Tyres	$	02.99	01.57%
Crew time	$	15.00	07.88%
Passenger time	$	00.00	00.00%
Cargo holding	$	00.00	00.00%
Maintenance labor	$	04.99	02.62%
Maintenance parts	$	10.98	05.76%
Depreciation	$	29.96	15.73%
Interest	$	15.73	08.26%
Overhead	$	00.00	00.00%

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Passenger Car Sample Data (Result Report):- For 120 kmph

1. Vehicle Speed	km/hr		120
2. Physical Quantities per 1000 vehicle-km			
Fuel consumption	liters		96.82
Lubricants consumption	liters		01.85
Tyre wear	# of equivalent new tires		00.06
Crew time	hours		08.33
Passenger time	hours		08.33
Cargo holding	hours		08.33
Maintenance labor	hours		02.27
Maintenance parts	% of new vehicle price		00.16
Depreciation	% of new vehicle price		00.41
Interest	% of new vehicle price		00.21
3. Total VOC per 1000 vehicle-km	**$**	**198.34**	**100%**
Fuel	$	111.34	56.14%
Lubricants	$	12.81	06.46%
Tyres	$	02.99	01.51%
Crew time	$	12.50	06.30%
Passenger time	$	00.00	00.00%
Cargo holding	$	00.00	00.00%
Maintenance labor	$	04.99	02.51%
Maintenance parts	$	10.98	05.53%
Depreciation	$	28.40	14.32%
Interest	$	14.32	07.22%
Overhead	$	0.00	00.00%

DISCUSSION OF VOC

As clearly shown by tables we can easily observe that the VOC calculated at 100 kmph vehicle speed is lesser than the VOC calculated at vehicle speed 120kmph. So it is obvious that the design vehicle speed with respect to VOC should be considered as 100 kmph.

VEHICLES OPERATING COST OF ROB BY IRC

The distance related and time related VOC calculated as following:

(i) FOR SPEED 100 KMPH

Distance related economic costs

1. Free Speed (V)

Free Speed (V) = 73.14 - (0.711*RF) - 0.00171*(RG - 2000)

Where,

RG = 2000 mm/km

RF = 22.55 m/km

V = 73.14 - (0.711*22.55) - 0.00171*(2000-2000)

V = 57.11 kmph

So, take V = 58 kmph

2. Fuel

Fuel consumption (FC) = 21.85+ (504.15/V)+0.004957*V^2+0.000652*RG+1.0684*RS-0.3684*FL

Where,

V= 58 km/h

RS = 6.77 m/km

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RG = 2000 mm/km

FL = 3.57 m/km

(FC) = 21.85+ (504.15/58)+0.004957*58^2+0.000652*2000+1.0684*6.77-0.3684*3.57

(FC) = 54.44 liters/1000 km

Unit cost of petrol is 76 Rs/liter.

So, the fuel cost = 54.44*76 = **4137.44 Rs/1000 km**

3. Tire cost

Tire life (TL) = 68771-147.9*RF-26.72*(RG/W)

Where,

RG = 2000 mm/km

W = 7 m

(TL) = 68771-147.9*22.55-26.72*(2000/7)

(TL) = 57801.57 km

Unit Tire cost = 3250 Rs

So, the tire cost = 3250/57.80157 = **56.23 Rs/1000 km**

4. Lubricants costs

Engine oil (EOL) = 1.7048+0.03319*RF+0.0005241*(RG/W)

(EOL) = 1.7048+0.03319*22.55+0.0005241*(2000/7)

(EOL) = **2.6 liters/1000 km**

Other oil (OL) = 1.631+.05167*RF+.001867*(RG/W)

(OL) = 1.631+0.05167*22.55+.001867*(2000/7)

(OL) = **3.33 liters/10000 km**

Grease (G) = 2.816+0.2007*RF

(G) = 2.816+0.2007*22.55

(G) = **7.34 kg/10000 km**

Unit cost: EOL = 130 Rs/liter

OL = 248.25 Rs/liter

G = 112.35 Rs/kg

So, the Engine oil cost = 130*2.6 = **338 Rs/1000 km**

Other oil cost = 248.25*.333 = **82.67 Rs/1000 km**

Grease = 112.35*.734 = **82.46 Rs/1000 km**

So, the Lubricants cost = 338+82.67+82.46 = **503.13 Rs/1000 km**

5. Spare cost

Spare cost (SP) = {0.0018*(RG-2000)*10^{-5}}*NP

Where,

NP = cost of new vehicle = 4, 50,600 Rs

SP = {0.0018*(2000-2000)*10^{-5}}*450600

SP = 0.00 paisa/km

6. Maintenance Labor cost

(LC) = 0.5498*SP

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Where,

SP = 0.00 paisa/km

So, LC = 0.00 paisa/km

So, distance related economic cost = 4137.44+56.23+503.13+0.00+0.00 = 4696.8 Rs/1000 km

Time related economic cost

1. Fixed cost

F_x = 370.14/UPD

Where,

UPD = 6.187*V = 6.187*58 = 358.846 km/day

F_x = 370.14/358.846 = 1.03 Rs/year

So, F_x = **1.03 Rs/1000 km**

2. Depreciation cost

DC = 70.85/UPD = 70.85/358.846 = 0.19744 Rs/km

So, DC = **197.44 Rs/1000 km**

3. Passenger time cost

PT = 227.82/V = 227.82/58 = **3.9279 Rs/km**

So, PT = 3.9279*1000 = **3927.9 Rs/1000 km**

So, time related economic cost = 1.03+197.44+3927.9 = 4126.37 Rs/1000 km

Total VOC = 4696.8+4126.37 = 8823.175 Rs/1000 km

(II) FOR SPEED 120 KMPH

Distance related economic costs

1. Free Speed (V)

Free Speed (V) = 73.14 - (0.711*RF) - 0.00171*(RG - 2000)

Where,

RG = 2000 mm/km

RF = 24.97 m/km

V = 73.14 - (0.711*24.97) - 0.00171*(2000-2000)

V = 55.39 kmph

So, take V = 56 kmph

2. Fuel

Fuel consumption (FC) = 21.85+ (504.15/V)+0.004957*V^2+0.000652*RG+1.0684*RS-0.3684*FL

Where,

V= 56 km/h

RS = 10.06 m/km

RG = 2000 mm/km

FL = 5.55 m/km

(FC) = 21.85+ (504.15/56)+0.004957*56^2+0.000652*2000+1.0684*10.06-0.3684*5.55

(FC) = 56.40 liters/1000 km

Unit cost of petrol is 76 Rs/liter.

So, the fuel cost = 56.40*76 = **4286.4 Rs/1000 km**

2. Tire cost

Tire life (TL) = 68771-147.9*RF-26.72*(RG/W)

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Where,

RG = 2000 mm/km

W = 7 m

(TL) = 68771-147.9*24.97-26.72*(2000/7)

(TL) = 57443.65 km

Unit Tire cost = 3250 Rs

So, the tire cost = 3250/57.44365 = **56.58 Rs/1000 km**

3. Lubricants costs

Engine oil (EOL) = 1.7048+0.03319*RF+0.0005241*(RG/W)

(EOL) = 1.7048+0.03319*24.97+0.0005241*(2000/7)

(EOL) = **2.68 liters/1000 km**

Other oil (OL) = 1.631+.05167*RF+.001867*(RG/W)

(OL) = 1.631+0.05167*24.97+.001867*(2000/7)

(OL) = **3.45 liters/10000 km**

Grease (G) = 2.816+0.2007*RF

(G) = 2.816+0.2007*24.97

(G) = **7.83 kg/10000 km**

Unit cost: EOL = 130 Rs/liter

OL = 248.25 Rs/liter

G = 112.35 Rs/kg

So, the Engine oil cost = 130*2.68 = **348.4 Rs/1000 km**

Other oil cost = 248.25*.345 = **85.646 Rs/1000 km**

Grease = 112.35*.783 = **87.97 Rs/1000 km**

So, the Lubricants cost = 348.4+85.646+87.97 = **522.016 Rs/1000 km**

4. Spare cost

Spare cost (SP) = $\{0.0018*(RG-2000)*10^{-5}\}*NP$

Where,

NP = cost of new vehicle = 4, 50,600 Rs

SP = $\{0.0018*(2000-2000)*10^{-5}\}*450600$

SP = 0.00 paisa/km

5. Maintenance Labor cost

(LC) = 0.5498*SP

Where,

SP = 0.00 paisa/km

So, LC = 0.00 paisa/km

So, distance related economic cost = 4286.4+56.58+522.016+0.00+0.00 = 4864.996 Rs/1000 km

Time related economic cost

1. Fixed cost

F_x = 370.14/UPD

Where,

UPD = 6.187*V = 6.187*56 = 346.472 km/day

F_x = 370.14/346.472 = 1.068 Rs/year

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So, F_x = **1.068 Rs/1000 km**

2. Depreciation cost
DC = 70.85/UPD = 70.85/346.472 = 0.2045 Rs/km

So, DC = **204.5 Rs/1000 km**

3. Passenger time cost
PT = 227.82/V = 227.82/56 = **4.068 Rs/km**

So, PT = 4.068*1000 = **4068 Rs/1000 km**

So, time related economic cost = 1.068+204.5+4068 = 4273.568 Rs/1000 km

Total VOC = 4864.996+4273.568 = 9138.564 Rs/1000 km

Comparison of VOC by IRC and HDM-VOC Model with Their Respective Parameters at 100 kmph

S. No.	Element	Cost by IRC (Rs/1000 km)	Cost by HDM-VOC ($/1000 km)	Cost by HDM-Voc in Rs (1$ = 65 Rs)
1	Fuel	4137.445	98.01	6370.65
2	Tire costs	56.23	02.99	194.35
3	Lubricant cost	503.13	12.81	832.65
4	Spare cost	0	-	-
5	Maintenance labor cost	0	4.99	324.35
6	Fixed cost	1.03	-	-
7	Depreciation cost	197.44	29.96	1947.4
8	Crew time	-	15.00	975
9	Maintenance parts	-	10.98	713.7
10	Interest	-	15.73	1022.45
11	Overhead	-	0.00	0.00
12	Passenger time	3927.9	0.00	0.00
13	Cargo holding	-	0.00	0.00
14	**TOTAL VOC**	**8823.175**	**190.47**	**12380.55**

Comparison of VOC by IRC and HDM-VOC Model with Their Respective Parameters at 120 kmph

S. No.	Element	Cost by IRC (Rs/1000 km)	Cost by HDM-VOC ($/1000 km)	Cost by HDM-Voc in Rs (1$ = 65 Rs)
1	Fuel	4286.4	111.34	7237.1
2	Tire costs	56.58	02.99	194.35
3	Lubricant cost	522.016	12.81	832.65
4	Spare cost	0	-	-
5	Maintenance labor cost	0	4.99	324.35
6	Fixed cost	1.068	-	-
7	Depreciation cost	204.5	28.40	1846
8	Crew time	-	12.50	812.5
9	Maintenance parts	-	10.98	713.7
10	Interest	-	14.32	930.8
11	Overhead	-	0.00	0.00
12	Passenger time	4068	0.00	0.00
13	Cargo holding	-	0.00	0.00
14	**TOTAL VOC**	**9138.564**	**198.34**	**12891.45**

CONCLUSION

- In this thesis for assessing an arranged ROB permits a snappy and exact survey of vehicle working expense at that ROB. The HDM-VOC model is assessed in light of geometric qualities (levels, length and flat bends and vertical bends), speed and street surface write and condition. The yield of the HDM-VOC display is the VOC while the vehicle goes along a highway at configuration speed. This VOC is framed by various kinds of costs like fuel cost, oil cost, tire cost and so forth.
- Since the utilization of a few parameters in HDM-VOC were distinct in compare with IRC rules, so I calculated the VOC according to IRC rules as well. (IRC SP 30:2009)

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- By using HDM-VOC demonstrate for ROB at LC-70, Sitapura Jaipur, VOC at configuration speed 100 and 120 kmph has been calculated for a small passenger car. By results we can say that VOC for speed 100 kmph was lesser than what it was for speed 120 kmph. Along these lines the geometric plan of ROB can be improved for the situation configuration speed of 100 kmph.
- The model might be valuable in discovering fuel proficient and naturally well disposed thruways with respect to the fact that the vehicular fuel utilization straight forwardly influences the cost of vehicle task as well as produces ozone harming substances and toxin emissions.
- By the utilization of the IRC rules for ROB at LC-70, Sitapura Jaipur, VOC at speed 100 and 120 kmph is calculated for a small passenger car. By the determination of VOC for these two outline speeds, I can state that VOC for 100 kmph was lesser. Along this the design can further be improved for configuration speed 100 kmph for getting more reduced cost of vehicular operations.

FUTURE SCOPE

- VOC can be calculated for all types of vehicles by using this model.
- Fuel demand can easily be determined by using this model.
- VOC calculations always allow us to identify the requirements of highway's repair and maintenance works.
- The modification of further updating of model can also be achieved by these requirements.

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A STUDY ON ROLE EMPOWERMENT THROUGH ROLE DEFINITION AND CAREER PATH

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Role definition is also called as "Role description" which describes the role and consists of job requirements i.e. Technical (Function) and Behavioral (Foundational) parameters that are expected to perform by an individual. It serves as a tool in goal setting that helps in the attainment of individual and organization goals.

Role definition plays a vital role in describing the individual role and responsibilities by eliminating the additional tasks that the employees perform.

OBJECTIVES OF THE STUDY

- ✓ To review the existing role definition of project manager.
- ✓ To understand the employee attitude towards the present role description.
- ✓ To create awareness of role packages to employees and seek inputs to create role packages.
- ✓ To analyze the future requirement of employee for empowering the role that drives towards the career path.

Problem Statement

No clarity of roles in the organization leads to organizational conflicts and duplication of job.

Role empowerment is possible only if roles are defined.

LITERATURE REVIEW

Empowerment can support the notion of management trustworthiness, which is an essential element of organizational commitment. Thomas R. George, December 16, 2011)

Empowerment, makes organization's needs for high-performance of employees, and also the answer to demands of employees based on independence and introduction. (Shahram Gilaninia, Sep. 201) Employee empowerment is considered as an important issue in human resource management organizations and it is important that each of the individuals feel about their competence. Human resources consider as strategic asset of the organization and empowerment of employees, is a new approach in order to human resource development that cause increase productivity improve quality, and profitability of products and services of organizations.

(R. Ramesh, K.Shyam Kumar, October, 2012) Employee empowerment starts with the concept of strategic fit between people, tasks, technology, information processes, rewards and organization structure for which all must be in alignment before the organization can work efficiently. (Sitaram Das, November 11, 2011) Experiencing change and intense competition in the business world, organizations need to adapt to changing conditions and generate new ideas to subsist. (Ahmet Burhan Cakıci, April 2014) Employee empowerment practice motivates employees to share their innovative ideas and use their skills in order to contribute to the companies' success. (Sarra Berraies, 2014)

DEFINING THE ROLE

It is a process of defining the roles to give the role clarity to the employees and the organization.

The clear role description enables the individual to understand what is expected from them in the workplace. The organization will have a clear framework on the roles that the individual as to perform and in which in turn help in the process of recruitment, selection, performance management and compensating the employees.

Framework of hierarchy for the authorization of work

The role definition tells the individual that who are his reports, to whom he/she has to report to, the co- workers who are aligned with his/her work etc., It is an exercise made to give a hierarchical framework that the employees are authorized for their work.

Framework of Key Result Areas

This framework involves in the identification of technical functions and the behavioral foundational of the owned positions.

The Job description consists of the list of functions and activities, which are crucial or critical for performing the job role. These activities form the KRA's of the individual.

Framework of Key Performance Indicators

Key performance indicators (KPIs) are ways to periodically assess the performances of organizations, business

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units, and their division, departments and employees. Accordingly, KPIs are most commonly defined in a way that is understandable, meaningful, and measurable.

It follows the **SMART** criteria. This means the measure has a Specific purpose for the business, it is Measurable to really get a value of the KPI, the defined norms have to be Achievable, the improvement of a KPI has to be Relevant to the success of the organization, and finally it must be Time phased, which means the value or outcomes are shown for a predefined and relevant period.

A number of organizational changes would require redefining the roles to support the change, and stop doing the existing roles that may no longer be relevant.

The existing role definition exercise can be modified whenever the following changes are incorporated in the system:

- ✓ Development of new strategy by the organization.
- ✓ Change in the technology, IT system or process.
- ✓ Create a new structure to support the new strategies of the organization.
- ✓ Introduce new projects and project teams to support the new strategy or vision.
- ✓ Change in the organizational structure or in design.
- ✓ Introduction of performance management process.
- ✓ Develop different levels of leadership in the organization.
- ✓ Change in the organizational culture so people are more responsible or accountable.

Evaluate Employee Performance
Employers can use a role definition to evaluate the performance of each employee. Job descriptions can also determine how to make a pay raise and promotion decisions. Employers can evaluate the employee's performance against the job description, and provide corrective guidance if an employee is performing at a sub-par level.

Provide clear Employee Expectations
Employees are provided with their job roles which clearly states what is expected from them. Thus it gives clarity to employees to focus on their roles and responsibilities and helps in eliminating the additional tasks that they perform in the workplace.

Serves as Blueprint for Hiring
A role definition can also serve as a blueprint for desirable, qualified candidates that the organization can put the right person at right place on right time. It helps the recruiters to select the candidates that match the requirement.

Reduces stress
The employees are provided with the clarity on their roles and responsibilities, there are clearly stated expectations from the organization to the employees.

Hence the stress of employees can be reduced by delivering the expected rather than performing what is not asked for.

Cost efficiency to the company
A clear role description enables the organization to analyze and identify the developmental areas of the employees and provide trainings in the particular role to meet the organizational requirement.

Enables to measure the role success
By having a clear understanding of what is involved and expected of role holders, organization can make better selection decisions and ensure that performance management and development is appropriate, focused and accurately measured.

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Enables to measure the role success
By having a clear understanding of what is involved and expected of role holders, organization can make better selection decisions and ensure that performance management and development is appropriate, focused and accurately measured.

Data Interpretation
Majority of the respondents express that skill sets are correctly aligned with the job role based on the role definition stated by the organization.

CHI-SQUARE ANALYSIS
H_0=Respondents are not satisfied with the above statement.

H_1= Respondents are satisfied with the above statement.

Particulars	Observed value	Expected value	(O-E)	$(O-E)^2$	$(O-E)^2/E$
SA	13	10	3	9	0.9
A	17	10	7	49	4.9
N	18	10	8	64	6.4
D	2	10	-8	64	6.4
SD	0	10	-10	100	10
TOTAL	**50**				**28.6**

Given

Degree of freedom= (n-1) (r-1)

(2-1) (5-1)

1*4=4

Calculated value=28.6

Tabulated value=9.48

So, Calculated value >Tabulated value

So we accept the alternative hypothesis that is respondents agree that skill sets are correctly aligned with the job role based on the role definition stated by the organization.

Disagree	5	10
Strongly Disagree	0	0
TOTAL	**50**	**100**

ANALYSIS
The above table indicates that 38% of respondents strongly agree that empowering the roles through various skills leads to career development, 34% agree, 18% are neutral and 10% disagree.

Most of the respondents strongly agree that empowering the roles through various skills leads to career development.

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CHI-SQUARE ANALYSIS

H_0=Respondents are not satisfied with the above statement.

H_1= Respondents are satisfied with the above statement.

Particulars	Observed value	Expected value	(O-E)	$(O-E)^2$	$(O-E)^2/E$
SA	19	10	9	81	0.9
A	17	10	7	49	4.9
N	9	10	-1	1	6.4
D	5	10	-5	25	6.4
SD	0	10	-10	100	10
TOTAL	**50**				**25.6**

Given

Degree of freedom= (n-1) (r-1)

(2-1) (5-1)

1*4=4

=4@5% level of significance

Calculated value=28.6

Tabulated value=9.48

So, Calculated value >Tabulated value

CONCLUSION

- Organizations can recruit more female employees for project manager role to provide opportunity equally.
- The expectations of the new roles have to be clearly defined in the earlier stage, rather than explaining during the appraisals.
- Enforcement of clear roles and responsibilities in the role definition helps the employees to understand what is expected out of them.
- The training courses, awareness sessions and knowledge programs should be provided to the onsite employees, to motivate and make them perform better.
- Providing motivation and sense of recognition for the achievement helps the organization to retain the employees.
- The company can give a learning opportunity to employees to develop their aspired skill sets to increase their efficiency in the current role and empower their role.

The concept of Role definition describes the role of an individual consisting of job requirements i.e. Technical (Function) and Behavioral (Foundational) parameters which are expected to perform. Generally, it serves as a tool in goal setting that helps in the attainment of individual and organization goals.

Finding and suggestions are based on survey conducted and these points are to be looked into the steps which can be taken in this regard for the higher growth.

From the analysis, it conclude that the existing role descriptions are effective to the offshore project managers which are applicable in their current roles but not to the onsite project managers. The onsite managers have the different flavors and requirements hence roles are to be identified, analyzed and defined specifically.

It is also noted that majority of the managers are satisfied with the current role description, but also have the requisites to empower their roles to perform better and firm up the existing current definition.

The organization can concentrate on employee requisites to empower their skills sets and development for their career paths which in turn increases the efficiency of organization with the increase in productivity.

In the ultimate analysis it can be concluded that the organization’s performance is efficient in defining the roles and can make an attempt to firm up better with the provided inputs by the employees and that which can be best suitable to organizational system.

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ANALYTICAL HIERARCHY PROCESS - A TOOL TO ELIMINATE BIASES IN WARE HOUSE LOCATION DECISION-MAKING

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ABSTRACT
This paper presents analytical hierarchy process approach to eliminate bias in warehouse location decision. AHP is used to determine the weights of criteria and sub-criteria because it can effectively determine various criteria's weights in a hierarchical structure. We apply the integrated approach in real case to demonstrate the application of the proposed method.

Methodology –The model uses the Analytical Hierarchy Process, a multiple attribute decision tool that provides structure to decisions where there is limited availability of quantitative information. This methodology uses a framework that determines and prioritizes multiple criteria by using qualitative data and it scores each alternative based on these criteria. The optimal alternative will be the one that has the highest weighted score.

Findings – An empirical study is presented at the end of the paper to illustrate the application of the proposed method on selecting the proper warehouse location strategy. According to the results, gaining a competitive advantage is the primary purpose of location strategy implementation and the most critical issue for the management.

Keywords: Hierarchy, Alternatives, Criteria, Pair wise Comparisons, Eigenvector, Biases

INTRODUCTION
Cognitive biases in decision making include more deviations from purely rational judgment and decisions. According to Von Winterfeldt, D. and Edwards (1986), "A cognitive bias is a systematic discrepancy between the "correct" answer in a judgmental task, given by a formal normative rule, and the decision maker's or expert's actual answer to such a task". There is a vast literature on cognitive biases and excellent compilations of papers are provided in Kahneman et al. and Gilovich et al. Many of these biases concern judgments about facts, events, and uncertainties. According to Kunda (1993), motivational biases are those in which judgments are influenced by the desirability or undesirability of events, consequences, outcomes, or choices.

Many of the behavioural patterns that have been discovered do seem to be relevant to broader areas of multicriteria decision analysis (MCDA). In this paper, we look specifically at the judgemental inputs required in implementing Analytical Hierarchy Process (AHP) models. Suggestions for practice and recommendations for follow-up research are derived from the AHP results.

Analytical Hierarchy Process (AHP) is one of Multi Criteria decision making method that was originally developed by Prof. Thomas L. Saaty. In short, it is a method to derive ratio scales from paired comparisons. He demonstrated mathematically that the eigenvector solution was the best approach. Using pair wise comparisons, the relative importance of one criterion over another can be expressed. A short computational way to obtain this ranking is to raise the pair wise matrix to powers that are successively squared each time. The row sums are then calculated and normalized. When the difference between these sums in two consecutive calculations is smaller than a prescribed value, then we can stop the calculations. The warehouse location selection is a processing of selecting allocation center in economic region where there are some supply stations and the certain demand point.

RATIONALE OF THE STUDY
The **analytical hierarchy process** (**AHP**) is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology. It was developed by Thomas L.Saaty in the 1970s and has been extensively studied and refined since then. It has particular application in group decision making, and is used around the world in a wide variety of decision situations, in fields such as government, business, industry, health care, ship building and education. The advantages of AHP over other multi criteria methods are its flexibility, intuitive appeal to the Decision makers and its ability to check inconsistencies. Generally, users find the pair wise comparison form of data input straightforward and convenient.

Additionally, the AHP method has the distinct advantage that it decomposes a decision problem into its constituent parts and builds hierarchies of criteria. Here, the importance of each element (criterion) becomes clear (Macharis et al. 2004). AHP helps to capture both subjective and objective evaluation measures. While providing a useful mechanism for checking the consistency of the evaluation measures and alternatives, AHP

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reduces bias in decision making. The AHP method supports group decision−making through consensus by calculating the geometric mean of the individual pair wise comparisons (Zahir 1999). AHP is uniquely positioned to help model situations of uncertainty and risk since it is capable of deriving scales where measures ordinarily do not exist (Millet & Wedley 2002).

REVIEW OF LITERATURE

In the article titled "USING THE ANALYTIC HIERARCHY PROCESS (AHP) TO SELECT AND PRIORITIZE PROJECTS IN A PORTFOLIO", the author Ricardo Viana Vargas says to present, discuss and apply the principles and techniques of the Analytic Hierarchy Process (AHP) in the prioritization and selection of projects in a portfolio.

In the article titled "CONSISTENCY IN THE ANALYTIC HIERARCHY PROCESS- A NEW APPROACH", JOSÉ ANTONIO ALONSO found a statistical criterion for accepting/rejecting the pair wise reciprocal comparison matrices in the analytic hierarchy process.

In the article titled "POSSIBILITIES OF UTILIZING THE METHOD OF ANALYTICALHIERARCHY PROCESS WITHIN THE STRATEGY OF CORPORATE SOCIAL BUSINESS", the author Katarína reveals that the analysis of the theory of corporate social responsibility, risk management and the exact method of analytic hierarchic process that is used in the decision making processes. and focus on presentation of the experience with the application of the method in formulating the stakeholders´ strategic goals within the Corporate Social Responsibility (CSR) and simultaneously its utilization in minimizing the environmental risks

In the research paper titled "SOLVING A DISTRIBUTION FACILITY LOCATION PROBLEM USING AN ANALYTIC HIERARCHY PROCESS APPROACH", the author Jesuk Ko reveals that in today's dynamic and volatile global economy, many researchers underline the importance of facility location factors. Issues associated with distribution facility location include political, economic, legal, social and cultural environments. Facility location decisions involve a substantial capital investment and result in long-term constraints on distribution of goods. These problems are complex and, like most real world problems, depend upon a number of tangible and intangible factors that are unique to the problem.

In the article titled "HOW TO GET RESPONSES FOR MULTI-CRITERIA DECISIONS IN ENGINEERING EDUCATION–AN AHP BASED APPROACH FOR SELECTION OF MEASURING INSTRUMENT" , the author K.G. Viswanadhan says that the Analytic Hierarchy Process enables people to make decisions involving many kinds of concerns including planning, setting priorities, selecting the best among a number of alternatives, and allocating resources.

In the research paper titled "Using the Analytic Hierarchy Process Method in reconfiguration of Supply Chain Network", the author Sangheon Han says that within new important strategies for the cost reduction and the problem of environmental protection, logistics plays a key role in the corporate competition.

In the research paper titled "Decision-Making using the Analytic Hierarchy Process (AHP) and SAS/IML", the author, Melvin Alexander says AHP helps decision-makers choose the best solution from several options and selection criteria.

In the paper titled "Analytic hierarchy process- An overview of applications", the author, S. Vaidya says that a literature review of the applications of Analytic Hierarchy Process (AHP). AHP is a multiple criteria decision-making tool that has been used in almost all the applications related with decision-making.

In the research paper titled "Analytic Hierarchy Process: An Application in Green Building Market Research1, the author, Sharmin Attaran says that one of the ways to develop effective marketing strategies, is to understand what the occupants value the most among many aspects of green buildings thus develop focused marketing solutions

In the research paper titled "The Application of Fuzzy Analytic Hierarchy Process Approach for the Selection of Warehouse Location", the author, Maysam Ashrafzadeh reveals that the conventional methods for warehouse location selection are inadequate for dealing with the imprecise or vague nature of linguistic assessment. To overcome this difficulty, fuzzy multi-criteria decision-making methods are proposed. His paper shows a successful application of fuzzy analytic hierarchy process to a real warehouse location selection problem of a big company in Iran.

SCOPE

Companies deciding where to locate a warehouse must often turn to outside experts to help them make an effective choice. Perceptions about where to locate are often incorrect, so companies may choose to rely on a

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broker who knows an individual sub market, and can guide them in the right direction. Companies feel increasing pressure to reduce inventories and increase inventory turns. Companies must work to find the best locations for their warehousing centers. Corporate supply chains are organic in nature and must ebb and flow with fluctuating demand and inventory levels. Consequently, it has always been imperative that companies size and design their warehouses correctly. Placing warehouses, Distribution Centers, and other distribution facilities correctly, however, has grown increasingly more complex. For this study a confectionery company is selected. Research area is Kerala.

METHODOLOGY

Analytical Hierarchy Process

It is a multiple attribute decision tool that provides structure to decisions where there is limited availability of quantitative information.

To make a decision in an organized way to generate priorities we need to decompose the decision into the following steps.

Define the problem and determine the kind of knowledge sought.

1. Structure the decision hierarchy from the top with the goal of the decision, then the objectives from a broad perspective, through the intermediate levels (criteria on which subsequent elements depend) to the lowest level (which usually is a set of the alternatives).
2. Construct a set of pair wise comparison matrices. Each element in an upper level is used to compare the elements in the level immediately below with respect to it.
3. Use the priorities obtained from the comparisons to weigh the priorities in the level immediately below. Do this for every element. Then for each element in the level below add its weighed values and obtain its overall or global priority.
4. Continue this process of weighing and adding until the final priorities of the alternatives in the bottom most level are obtained.
5. To make comparisons, we need a scale of numbers that indicates how many times more important or dominant one element is over another element with respect to the criterion or property with respect to which they are compared.

This methodology uses a framework that determines and prioritizes multiple criteria by using qualitative data and it scores each alternative based on these criteria. The optimal alternative will be the one that has the highest weighted score.

THE WAREHOUSE LOCATION SELECTION MODE

Four things are to be considered while choosing warehouse locations

- **Location**

Let us take current shipping locations of the suppliers, as well as the delivery locations that are for customers. We need to analyze the following questions.

Where are most of those deliveries being made?

Are the warehouses located in the optimal zones to minimize the costs for both the company and the client?

So location is one of the important factors.

- **Access**

Access is another important factor because any public warehouse we are thinking about contracting or considering as a major distribution center will need to be easily accessible from major highway arteries.

Additionally, if we will be importing or exporting a great deal of material, they should also be close to major port locations with strengths aligned with our product type.

- **Storage Area**

Will their storage area provide the capacity you require?

It's important to not only ask about their storage area, but more specifically, what is presently available to you.

Do they anticipate any storage becoming available in the future in order to accommodate your growth?

- **Availability of skilled labour**

Fully understand the labor force available at our new warehouse location. Knowing our labor needs and seeing how they stack up against the facilities is essential to ensure on-time delivery and future growth.

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Will the warehouse facility operate 2nd and 3rd shift (24 hour operation)?

Are there competing businesses in proximity that will become a barrier to growth by limiting available labor capacity?

By taking the time to consider the above, we can limit frustration and ensure that we have found the perfect fit for both of us and the warehouse we are selecting.

So **criteria** taken for this study are

Location, Access, Storage Area and Labour

The following **alternatives** are taken for the data analysis.

Calicut, Palghat, Kasargod and Kannur

Pair wise comparisons

	Location	Access	Storage Area	labour
Location	1	2	3	2
Access	1/2	1	2	3/2
Storage Area	1/3	1/2	1	1/3
labour	1/2	2/3	3	1

Converting into Decimals

	Location	Access	Storage Area	Labour
Location	1	2	3	2
Access	0.5	1	2	1.5
Storage Area	0.333	0.5	1	0.333
Labour	0.5	0.667	3	1

Squaring the matrix

	Location	Access	Storage Area	Labour
Location	3.999	6.834	16.000	7.999
Access	2.416	4.001	10.000	4.666
Storage Area	1.083	1.888	3.998	2.082
Labour	2.333	3.834	8.834	4.000

Now, first eigen vector is calculated as follows

	Location	Access	Storage Area	Labour	Row sum	Eigen vector
Location	3.999	3	6	12	24.999	0.2999964
Access	5.332	4	8	15.999	33.331	0.3999832
Storage Area	2.667	2	4.001	8.001	16.669	0.200033601
Labour	1.333	1	2	3.999	8.332	0.0999868
					83.331	1

This process must be iterated until the eigen vector solution does not change from the previous iteration. Continuing our calculation,

Again, Step 1: Squaring the above matrix, we get the following matrix

68.493	115.548	266.955	129.183
41.044	69.288	159.865	77.478
18.079	30.486	70.584	34.124
37.492	63.298	146.322	70.943

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Again step 2: Computing the eigenvector, we get

				Row Sum	Eigen Vector
68.493	115.548	266.955	129.183	580.179	0.4146558489
41.044	69.288	159.865	77.478	347.675	0.2484844716
18.079	30.486	70.584	34.124	153.273	0.1095447197
37.492	63.298	146.322	70.943	318.055	0.2273149597
				1399.182	

Computing the difference of the previous computed eigenvector to this one

0.1146594489

-0.1514987284

-0.09004888813

0.1273281597

To four decimal places there is much difference.

Continuing the calculation,

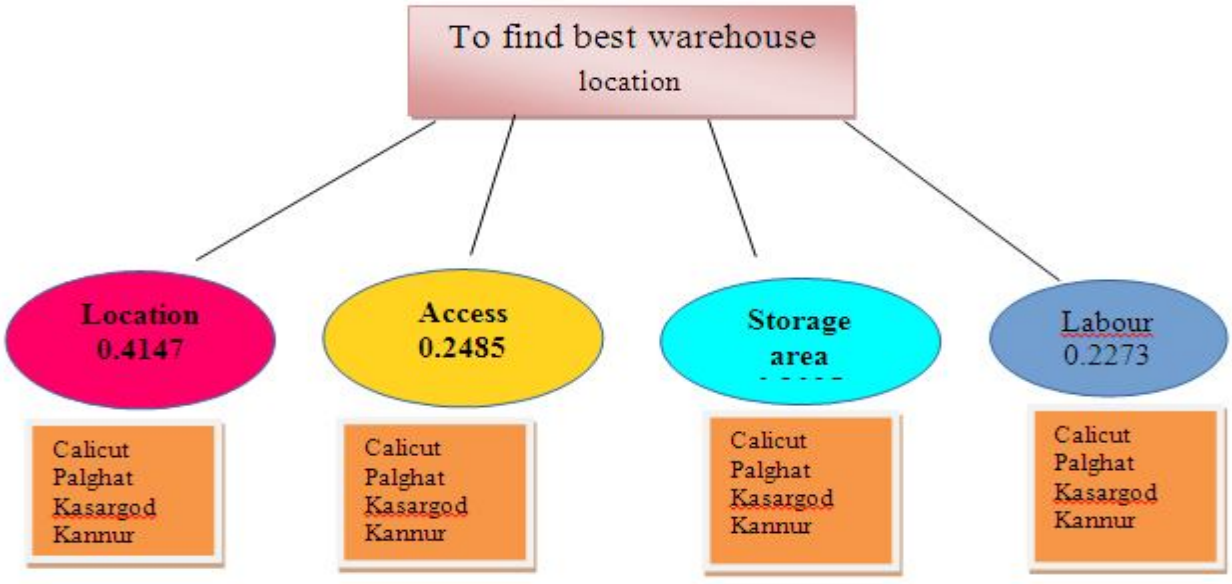
Again step 2: Computing the eigen vector

				Row Sum	Eigen Vector
19103.452	32235.735	74501.696	36074.761	161915.64	0.414664483
11450.088	19321.226	44654.274	21622.238	97047.826	0.248538594
5045.017	8513.111	19675.117	9526.961	42760.206	0.109508496
10471.093	17669.24	40836.325	19773.533	88750.191	0.227288427
				390473.87	

Compute the difference of the previous computed eigenvector to this one:

To three decimal places there's not much difference

Here's the tree with the criteria weights



In terms of, location, pair wise comparisons determine the preference of each alternative over another. Here is the pair wise matrix with the criteria "location"

	Calicut	Palghat	Kasargod	Kannur
Calicut	1	4/3	4	2
Palghat	3/4	1	3	3/2
Kasargod	1/4	1/3	1	1/2
Kannur	1/2	2/3	2	1

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Converting into decimals

1.000 1.333 4.000 2.000

0.750 1.000 3.000 1.500

0.250 0.333 1.000 0.500

0.500 0.667 2.000 1.000

Squaring the above matrix

4	5.332	15.999	8
3	3.999	12	6
1	1.333	3.999	2
2	2.667	8.001	4.001

Computing the eigen vector

				Row sum	**Eigen vector**
4	5.332	15.999	8	33.331	0.3999832
3	3.999	12	6	24.999	0.2999964
1	1.333	3.999	2	8.332	0.0999868
2	2.667	8.001	4.001	16.669	0.200033601
			Total	83.331	1

In terms of access, pair wise comparisons determine the preference of each alternative over another. Here is the pair wise matrix with the criteria “ACCESS”

	Calicut	**Palghat**	**Kasargod**	**Kannur**
Calicut	1	3/2	¾	3
Palghat	2/3	1	½	2
Kasargod	4/3	2	1	4
Kannur	1/3	1/2	¼	1

Converting into decimals

1.000 1.500 0.750 3.000

0.667 1.000 0.500 2.000

1.333 2.000 1.000 4.000

0.333 0.500 0.250 1.000

Squaring the above matrix

3.999 6.000 3.000 12.000

2.667 4.001 2.000 8.001

5.332 8.000 4.000 15.999

1.333 2.000 1.000 3.999

Computing the eigen vector

				Row sum	**Eigen vector**
3.999	6	3	12	24.999	0.2999964
2.667	4.001	2	8.001	16.669	0.200033601
5.332	8	4	15.999	33.331	0.3999832
1.333	2	1	3.999	8.332	0.0999868
			Total	83.331	1

In terms of storage area, pair wise comparisons determine the preference of each alternative over another. Here is our pair wise matrix with the criteria "Storage area"

	Calicut	**Palghat**	**Kasargod**	**Kannur**
Calicut	1	1/4	½	1/3
Palghat	4	1	2	4/3
Kasargod	2	1/2	1	2/3
Kannur	3	3/4	3/2	1

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Converting into decimals

1.000	0.250	0.500	0.333
4.000	1.000	2.000	1.333
2.000	0.500	1.000	0.667
3.000	0.750	1.500	1.000

Squaring the above matrix

3.999	1.000	2.000	1.333
15.999	4.000	8.000	5.332
8.001	2.000	4.001	2.667
12.000	3.000	6.000	3.999

Computing the eigen vector

				Row sum	Eigen vector
3.999	1	2	1.333	8.332	0.0999868
15.999	4	8	5.332	33.331	0.3999832
8.001	2	4.001	2.667	16.669	0.200033601
12	3	6	3.999	24.999	0.2999964
				83.331	1

In terms of labor, pair wise comparisons determine the preference of each alternative over another. Here is our pair wise matrix with the criteria "Labor"

	Calicut	Palghat	Kasargod	Kannur
Calicut	1	3/4	3/2	3
Palghat	4/3	1	2	4
Kasargod	2/3	1/2	1	2
Kannur	1/3	1/4	½	1

Converting into decimals

1.000	0.750	1.500	3.000
1.333	1.000	2.000	4.000
0.667	0.500	1.000	2.000
0.333	0.250	0.500	1.000

Squaring the matrix

3.999	3.000	6.000	12.000
5.332	4.000	8.000	15.999
2.667	2.000	4.001	8.001
1.333	1.000	2.000	3.999

Computing the eigen vector

				Row sum	Eigen vector
3.999	3	6	12	24.999	0.2999964
5.332	4	8	15.999	33.331	0.3999832
2.667	2	4.001	8.001	16.669	0.200033601
1.333	1	2	3.999	8.332	0.0999868
				83.331	1

	Location	Access	Storage Area	Labour
Calicut	0.3999832	0.2999964	0.0999868	0.2999964
Palghat	0.2999964	0.2000336	0.3999832	0.3999832
Kasargod	0.0999868	0.3999832	0.2000336	0.2000336
Kannur	0.2000336	0.0999868	0.2999964	0.0999868

$$\begin{pmatrix} 0.400 & 0.300 & 0.100 & 0.300 \\ 0.300 & 0.200 & 0.400 & 0.400 \\ 0.100 & 0.400 & 0.200 & 0.200 \\ 0.200 & 0.100 & 0.300 & 0.100 \end{pmatrix} * \begin{pmatrix} 0.415 \\ 0.249 \\ 0.110 \\ 0.227 \end{pmatrix} \quad \begin{matrix} \text{Calicut} \\ == \text{Palghat} \\ \text{Kasargod} \\ \text{Kannur} \end{matrix} \begin{pmatrix} 0.230 \\ 0.309 \\ 0.208 \\ 0.163 \end{pmatrix}$$

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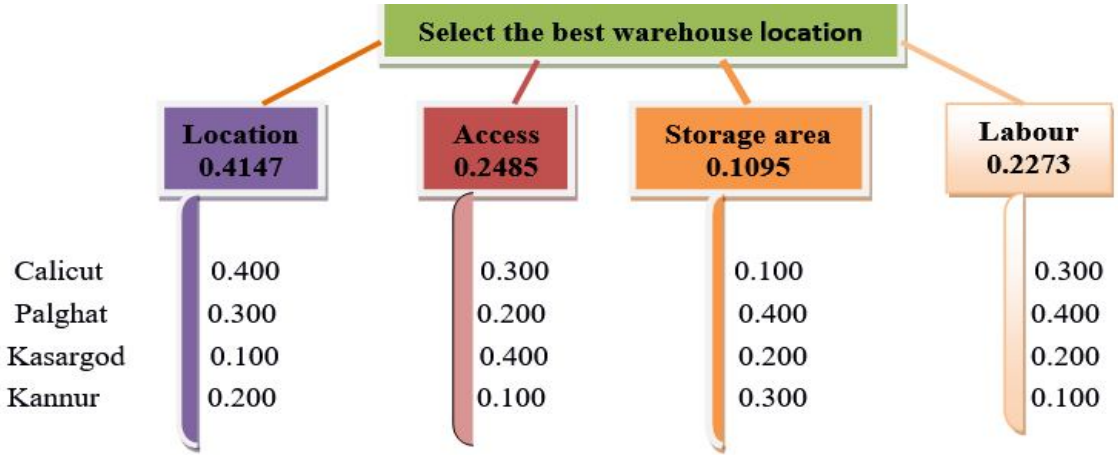

In summary, the analytic hierarchy process provides a logical framework to determine the benefits of each alternative. Although costs could have been included, in many complex decisions, costs should be set aside, until the benefits of the alternatives are evaluated.

Using benefit to cost ratios

	Cost	Benefit	Normalized costs	Benefit cost ratio
Calicut	100	0.32	0.4	0.8
Palghat	25	0.309	0.1	3.09
Kasargod	50	0.208	0.2	1.04
Kannur	75	0.163	0.3	0.5433
	250			

The above table represents the cost-benefit ratio of all alternatives. In this analysis Palghat has got the highest ratio so we can confidently say that Palghat is the best place to locate the warehouse compared to all the other alternatives.

CONCLUSION

The study suggests that large scale retailers can determine their warehouse location and design using the four labels or factors identified to predict reasons for making warehouse decisions. The most dominant challenges in warehouse location and design decisions include: lack of people with expert knowledge in warehouse location and design, inability to access reliable sources of information, scarcity of space in Kerala and financial resources. For a better and successful warehouse location and design decisions, large scale retailers need to develop strategies in meeting customer satisfaction, improving operational performance, and value added at the lowest cost in overcoming these challenges. Finally the study suggests that Palghat is the best place to locate the warehouse by considering the all factors. This area will satisfy all factors with high benefit ratio.

SUGGESTIONS FOR FURTHER RESEARCH

This study was only able to address warehouse location and design decisions among large retailers in Kerala. It will be necessary to carry out a study featuring other areas outside Kerala in order to find out if there are any similarities and differences in the findings of this study.

It will also be important to do a comparative study with another country both in the developed and developing country to ascertain the similarities and differences in warehouse location and design decisions. Firms do not necessarily own warehouses but do at times outsource the service. There is need to carry out a study on the warehousing trends among large retail in India.

Cognitive and motivational biases can occur in Multi-Criterian Decision Analysis (MCDA).

Motivational biases are very important in MCDA, ranging from issues related to obvious conflicts of interest to subtle influences of professional association or preferences for outcomes of an analysis. Motivational biases can lead to excluding alternatives that are possible competitors of a preferred alternative, adding objectives that favor a preferred alternative or eliminating objectives that favor others, and, perhaps most importantly, manipulating weights to favor an alternative. Therefore, much more research is needed to better understand the effect of motivational biases in MCDA and how to reduce these biases. There is a huge opportunity for researchers to explore new best practices and to test their effectiveness in reducing cognitive and motivational biases.

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PHYSICAL AND CHEMICAL PARAMETERS OF SOILS OF JALGAON REGION THROUGH ELECTRICAL CONDUCTIVITY

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ABSTRACT
The dielectric properties of material are function of its chemical constituents and physical properties. This paper presents the measurement of dielectric properties of soil samples of Jalgaon region. The soils were categorized as loamy sand, sandy loam and clay loam. The soils were analysed for the status of available nutrients. The pH and Electrical Conductivity of soil samples were measured by using soil testing kit. An automated X-band microwave set-up at frequency 9 GHz is used for measuring dielectric constants. Further, the data on the physical and chemical properties of these soils are also reported .These properties are important in better understanding of soil physics, agricultural application and analysing the satellite data in remote sensing.

Keywords: Physical and chemical properties of soil, electrical conductivity.

I. INTRODUCTION

The study of earth's surface is important for remote sensing applications. Soil analyses are useful for giving indications about deficiencies of nutrients and providing information on soil acidity, alkalinity and organic matter content. such type of data may be useful for the management of nutrients of these soils.

Different studies predict that the dielectric properties of soil at microwave frequencies are the function of its physio-chemical constituents. EC, PH, OC N, P, K, deficient soil is recommended rich fertilizer [1]. The physical capacities of a soil are influenced by the size, proportion, arrangement and composition of the soil particles [2]. Rapid measurement and monitoring of soil nutrient Variability is needed to satisfy the precision farming requirements. These problems can be solved by measuring electrical conductivity (EC) of soil [3]. Characterization of soil helps in determining soil potentials and identifying the constraints in crop production besides giving detailed information about different soil properties [4].

II RESULTS AND DISCUSSIONS

1. Bulk density and Porosity

The bulk density of soil indicates the degree of compactness of the soil and is defined as the mass per unit volume which includes space occupied by solids and pore space [5]. Bulk density of studied region varied from 1.05 to 1.42 gc m-3.

2. Soil pH and Electrical conductivity

It is very important because soil solution carries its nutrients such as Potassium (K), Phosphorus (P), and Nitrogen (N) that plant need in specific amount to grow and fight off diseases [6. The pH value of analysed soil sample ranged from 5.92 to 8.42. The electrical conductivity of a soil solution increases with the increased concentration of ions [7]. Conductivity depends upon the dilution of soil suspension. The EC values ranged from 0.06to 0.42 dSm-1.

3. Organic Carbon

The source of organic carbon in the cultivated soil included crop residue, animal manure, cover crops, green manure and organic fertilizers, etc. Most living things in soils, including plants, insects, bacteria & fungi are dependent on organic matter for nutrients& energy [8]. OC values were recorded in between 0.32 and 1.25 %.

4. Calcium carbonate

The presence of calcium carbonate in the soil is due to climatic factors. The effect of carbonate on soil fertility is not uniform. The calcium carbonate values ranged from 0.75 to 7 %.

5. Organic Matter

The organic matter is a vital store of available nutrients. The available nitrogen in the soil ranges from 124 to 406 kgha-1. The available potassium ranges from 124 to 194 kgha-1. All soil samples have higher content of available potassium. In the present study available phosphorus ranges from 1.66to 20.51 kgha-1. In the present study available iron ranges from 0.98 to 13.04 ppm, available manganese ranges from 4.93 to 12.89 ppm and available zinc ranges from 1.13 to 9.07 ppm, available copper ranges from1.39to 10.62 ppm.

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Physical Properties of Soils

Sample No.	CaC molm(P) K/g	Mg C molm(P) K/g	Bulk Density gc/m3	Sand %	Silt %	Clay%	Texture Class
1	16.8	24.1	1.08	28.3	25.05	46.65	Clay
2	12.5	33.5	1.05	26.35	26.17	47.48	Clay
3	25.7	20.8	1.19	34.5	18.67	46.83	Clay
4	23.2	21.3	1.33	45.55	19.72	34.73	Sandy Clay Loam
5	21.4	22.7	1.31	51.02	22.83	26.15	Sandy Clay Loam
6	22.7	21.1	1.42	56.87	27.4	15.73	Sandy Loam
7	22.7	20.4	1.4	65.47	23.85	10.68	Sandy Loam
8	4.9	34.5	1.3	50.15	24.2	25.65	Sandy Clay Loam
9	11.6	34.4	1.12	28.25	19.52	52.23	Clay
10	16.2	33.1	1.21	31.25	46.1	22.65	Loam
11	8.1	23.4	1.44	77.6	15.17	7.23	Loamy Sand

Chemical Properties of Soils

Sample No.	pH (1:2.5)	E.C. dS/m	C %	CA %	N Kgh/a	Ph Kgh/a	P Kgh/a	Fe ppm	Mn ppm	Zn ppm	Cu ppm
1	8.31	0.06	0.32	4.25	124	20.51	132	1.06	4.93	1.56	10.19
2	8.36	0.07	0.55	5.5	124	5.54	124	0.99	5.24	1.13	9.97
3	8.42	0.06	0.46	4.25	135	6.65	118	0.98	8.54	7.07	2.49
4	7.78	0.32	0.36	6.75	135	2.49	125	1.13	11.56	2.36	5.04
5	6.4	0.14	0.75	3.75	203	10.25	133	13.04	12.17	4.33	2.82
6	6.72	0.12	0.65	5.75	203	7.21	144	9.99	11.99	8.85	2.86
7	7.8	0.11	0.66	5.25	226	3.88	155	6.35	12.75	6.17	7.37
8	6.83	0.06	0.4	1.25	169	2.22	157	11.97	12.52	9.07	1.39
9	6.92	0.17	0.81	0.75	158	1.66	165	9.78	11.74	8.56	9.91
10	5.92	0.42	1.25	1	406	3.05	172	11.58	12.89	5.53	10.62
11	7.39	0.22	0.59	7	124	18.85	194	1.15	10.86	8.27	7.08

III CONCLUSION

The study helps in determining the values of different physicochemical parameters and nutrient concentrations of soil from Jalgaon region. The bulk density ranged between (gc m-3) 1.05to 1.44, pH ranged between 5.92 to 8.82. Electrical conductivity ranged between (dSm-1) 0.06 to 0.42 is also in recommended range. Organic carbon ranged between (%) 0.32 to 1.25, calcium carbon ate ranged between (%) 0.75 to 7, available Nitrogen ranged between (kgha-1) 124 to 406, available Phosphorus ranged between (kgha-1)1.66 to 20.51. Available Potassium range between 124 to 194. Soil texture has remarkable effect on the dielectric properties.

All these parameters are useful for researchers working in the field of agriculture and microwave remote sensing. The physico-chemical properties, physical parameters are useful to prepare soil health card which may be further used to predict the soil fertility.

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PROSPECTS OF ICT INTEGRATION IN SCHOOL EDUCATION: AN ANALYTICAL STUDY OF THE GOVERNMENT SCHOOLS IN WEST BENGAL, INDIA

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ABSTRACT

Information & Communication Technology (ICT) is recognized as an important catalyst for social transformation, and an important tool for education. This paper attempts to analyse the role and performance of ICT in enhancing quality of school education in the state of West Bengal in India. The study covers 75 government run secondary schools encompassing 100 respondents of West Bengal. It has proven that adoption of ICT as a strategic management tool is a welcome sign for all the surveyed schools. The study result indicates that ICT was successful in predicting the future of new technology for the purpose of teaching-learning and transaction of curriculum and thereby enhancing quality of education. The 'Kendell's Coefficient of Concordance' shows a significant association between ICT and qualitative upliftment of education. The study result revealed a close association among the factors like 'relative advantage' of ICT and quality of education. However, the magnitude of quality of education lies in its ability to organize ICT through establishment of proper infrastructure in the school. This study also showed barriers and challenges of ICT integration along with important policy recommendations and how ICT has received extensive recognition as a strategy for up-gradation of quality of education through acquired relative advantage, compatibility, demonstrability and image by overcoming the factors avoidance and complexities of new technology (ICT).

Keywords: ICT Technological innovations, quality of education, barriers, policies.

1. INTRODUCTION

Education is the backbone of any nation. The introduction of ICTs in the education has profound implications for the whole education process especially in dealing with key issues of access, equity, management, efficiency, pedagogy and quality. Information and communication technology (ICT) is a force that has changed many aspects of the way we live in 21st century. In developing countries, education is also linked to a whole batch of indicators of human development. Education of women influences the health of children and family size. The experience of Asian economies in particular in the past two decades has demonstrated the benefits that public investment in education can bring. Therefore, Integrating ICT in teaching and learning is high on the educational reform agenda of any country. India is no exception. The ancient education system of India was primarily based on the 'Gurukul System'. But now-a-days Indian education has undergone various stages from the Vedic age to the post-independence period. Modern education is not restricted within the classroom. The recent development of technology has brought out the whole world outside the classroom. Information and Communication Technology (ICT) plays a crucial role in this respect. It is treated as the integral part for educational reforms and innovations at secondary and higher secondary level schools (Mondal & Roy, 2010). The National Policy on Education (1986) has modified 1992, stressed upon employing educational technology to improve the quality of education. The policy statement led two major centrally sponsored schemes, namely, Educational Technology (ET) and Computer Literacy and studies in School (CLASS) paving the way for a more comprehensive Centrally sponsored scheme- Information for a more communication Technology (ICT in short) of schools in 2004. ICT stands for information and communication technologies and are defined, for the purposes of this primer, as a "diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information." These technologies include computers, the Internet, e-mail, web based PC, Mobile phone, wireless sets, projectors, interactive boards, broadcasting technologies (radio and television) and different interactive boards (Wikipedia Internet, 2010). Thus ICT is a system that gathers different information or data to communicate over some distance with the help of modern technology. The integration of ICT into education has been assumed as the potential of the new technological system. ICT is not only the backbone of the Information Age, but also an important catalyst and tool for inducing educational reforms that change our students into productive knowledge workers(Bonk et. al.,1989).

It is generally argued that knowledge obtained by the students is formal and the level of grasping new concepts is very low. Therefore, we are facing a potentiality of application of ICT and thinking of how this alarm situation could be improved society's educational systems as constructivist's theory both teachers and students develop the necessary knowledge and skills sought in this digital age. Hence, most countries around the world are focusing on approaches to integrate of ICT in learning and teaching to improve the quality of education by emphasizing competencies such as critical thinking, decision making, and handling of dynamic situations,

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working as a member of team, communicating effectively (Fife & Pereira, 2003). Several studies have been conducted by different educationists, 5-13 to evaluate the role of ICT on quality of education in secondary and higher secondary levels. All these studies though touched upon the issue of ICT in education, however to our knowledge no comprehensive attempt has yet been made to make the impact assessment of ICT in school education. An attempt has been made in this paper to analyse scientifically the impact of ICT in the enhancement of quality of school education in West Bengal. This paper aims to focus on ICT integration in teaching-learning process. Barriers and challenges are identified based on current literature, and policy recommendations are provided for policy makers and key stakeholders to better integrate ICT in teaching and learning in the future.

2. OBJECTIVES

The following objectives are formulated in our study

- To find out the impact of ICTs in school education.
- To compare the views of teachers educator regarding effect of ICT in improving quality of education.
- To find out the barriers in the path of successful ICT integration in school education system.
- To suggest the best possible policy recommendations to enhance the effectiveness of ICT in school education.

3. RESEARCH METHODS

3.1 Hypotheses

At first, the study is indented to examine the role of ICT on the quality of school education in West Bengal. For this, the hypothesis can be framed as follows: ICT has a tremendous potentiality to enhance the quality of education in secondary level.

On the basis of the above hypotheses the specific hypothesis is H_o: There exists no association between ICT and quality of education. The alternative hypothesis can be written as H_1: There exists significant association between ICT and quality of education.

3.2 Material and Methods

In an attempt to scientifically establish that ICT has a tremendous potentiality to enhance the quality of education in secondary level the following analytical study is made. A well structured questionnaire has been used to collect primary data from 75 secondary schools in several districts in West Bengal during the year 2017. A sample size of 100 respondents is drawn in order to throw some light on the impact of ICT on quality of education (QE) in West Bengal. The measurement of QE has been done by using the descriptive statistics like mean and standard deviation. We have also estimated the determinants of QE using multiple regression models. The estimated Ordinary Least Square (OLS) equation of QE is of the form:

$QE = a + b.RAD + c.COM + d.COP + e.IMG + f.DEM + g.AVOID$

where RAD = Relative Advantage, COM = Compatibility, COP = Complexity, IMG = Image, DEM = Demonstrability, AVOID = Avoidance, a = Arbitrary Constants; b, c, d, e, f and g are regression coefficients.

We have estimated 'Kendell's Coefficient of Concordance' to examine relationship between ICT and quality of secondary school education. The materials and techniques used for the study are as follows:

- Structured questionnaire,
- χ^2 table,
- Excel package of computer,
- Mean and standard deviation,
- Concordance analysis,
- Multiple regression models.

3.3 The Conceptual Framework

Information and communication technology (ICT) are defined as all devices, tools, content, resources, forums and services, digital and those that can be converted into or delivered through digital forms, which can be deployed for realizing the goals of teaching, learning, enhancing access to and reach resources, building of capacities, as well as management of the educational system. ICT will not only include hardware devices

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connected to computers, and software applications, but also interactive digital content, internet and other satellite communication devices, radio and television services, web based content repositories, interactive forums, learning management systems and management information systems. They will also include processes for digitization, deployment and management of content, development and deployment of platforms and processes for capacity development and creation of forums for interaction and exchange (Euller & Seufret, 2003).

The term ICT is a multidimensional concept. It can be measured in different ways. In our study, we specifically utilized Roger's (1995) Diffusion of Innovations (DOI) theory in modified form to examine the role of ICT in school education. For this we have selected set variables for explaining the role of ICT in school education. These are – 'relative advantage', 'compatibility', complexity', demonstrability', 'image' and 'avoidance' (Janardhanam et. al. 2011). The variables and their explanations can be expressed in terms of the table no -1.

Table-1: Selected variables and their explanations influencing quality of education through ICT

Variables	Explanation
Relative Advantage	It indicates the degree to which an innovation will offer benefits surpassing those of its predecessor
Compatibility	It implies the level at which the new innovation acts in accordance with previously existing values, attitudes, experiences of using predecessors
Complexity	It indicates the degree to which an innovation is difficult to understand or use.
Demonstrability	This means the extent to which an innovation may be experimented with on a limited basis and observable to others
Image	It means positive image of school in short and long run due to introduction and implementation of ICT
Avoidance	It is defined as the degree of the potential version or avoidance reaction to an innovation like ICT

4. RESULTS AND DISCUSSION

4.1 Impact of ICT on Quality of Education: A Concordance Analysis

The study has attempted to make an assessment of ICT on quality of secondary education on the basis of a set of selected indicators using 'Kendall's coefficient of concordance'. Actually Kendall's Concordance measures the fact that whether any significant association exists between ICT and the extent of quality of education. In our study, we have derived Kendall's coefficient statistic (W) and observed value of non-parametric 'chi-square' with the help of the field perception of ranking of several selected indicators assigned by the respondents. The indicators are- Relative Advantage (RAD), Compatibility (COM), Complexity (COP), Image (IMG), Demonstrability (DEM), and Avoidance (AOID). The Concordance analysis can be explained in terms of the following table (table- 2).

Table-2: Relationship between ICT and Quality of Education: Kendall's Coefficient of Concordance

Indicators / Estimators	RAD	COP	COM	DEM	IMG	AVOID
TR	145	160	241	172	104	354
AR	2.23	2.46	3.71	2.65	1.6	5.45
GA	18.09					
$(AR_i – R)$	-15.86	-15.63	-14.38	-15.44	-16.49	-12.64
$(AR_i - R)^2$	251.54	244.30	206.78	238.39	271.92	159.77
$\sum(AR_i - R)^2$	1372.7					
W	0.052					
χ^2	16.9					

Source: Author's calculation based on field level data, 2017, N.B.-Total Number of Respondents (P) = 75, number of indicators (n) = 6, TR = sum of rankings, AR = average rankings (TR/P), GA = grand average ($\sum$ TR/ P), $\chi 2 = p\ (n-i)\ .W$

It is obvious (vide table- 2) that the observed value of chi-square (χ^2) i.e., 16.9 is greater than the table value at 5 % and 1 % level of significance (i.e., $\chi^2_{.05,\ d.f.\ 5} = 9.236$ and

$\chi^2_{.01,\ d.f.\ 9} = 15.086$) for degrees of freedom 5, therefore the null hypothesis is rejected and the alternative hypothesis is accepted. So, we can conclude that there exists significant association between ICT and quality of secondary education in West Bengal.

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4.2 Multiple Regression Analysis

The regression analysis of ICT on quality of education shows (as evident from table-3) that the coefficient of the variable 'Relative advantage' is found to be positively associated with the quality of school education. This means that higher the extent of relative advantage of innovation in the form of ICT, higher would be the quality enhancement potentiality of school education. In fact, greater the extent of relative advantage of ICT, more effective operation of educational activities through appropriate curriculum, management, administration, teaching learning strategies etc. The values of other variables like compatibility (0.935), demonstrability (2.614) image (2.327) have positive impact on quality of education through application of ICT with the exception of complexity (-0.127) and avoidance (-1.912). The latter is due to the increase in difficulties in application of innovation through ICT. This result is consistent with the study of Koza (1989) in comparison of mathematics and reading levels and attitude toward learning of high risk secondary students through the computer aided instruction. Again the estimated values of descriptive statistics especially mean and standard deviation (S.D.) of the respondents are explained in terms of table-4. The mean score is found to be high in case of relative advantage compared to other attributes. It is interesting to note that average mean of all the respondents is more than 3 except in case of complexity (i.e., 1.1715) and avoidance (i.e., 1.9530) which means that most of the respondents are in favour of the introduction of new technology in school education (i.e., ICT)

Table-3: Regression results showing impact of ICT on quality of education depending on selected variables

QE = a + b.RAD + c.COM + d.COP + e.IMG + f.DEM + g.AVOID			
Dependent Independent	**Quality of Education**		
	Co-efficient	**t value**	**Level of significance**
Constant	1281.326	1.017	-
RAD	0.084	2.510	0.01
COM	0.58	0.935	0.05
COP	-0.020	-0.127	0.05
DEM	0.081	2.624	0.01
IMG	0.053	2.327	0.01
AVOID	-0.004	-1.912	0.05

Source: Author's calculation based on field level data, 2016-17, N.B.-Total number of observations (N) = 100, R2 = 0.594, Scale: Strongly Agree = 1 and Strongly Disagree = 0

Table-4: Descriptive Statistics

Variables	Mean	S.D.
RAD	4.1674	1.05461
COP	3.4731	0.7334
COM	1.11725	0.3023
DEM	3.45532	0.7214
IMG	4.5034	1.0837
AVOID	1.9530	0.7052

Source: Author's calculation based on field level data, 2017, N.B.-Total number of observations (N) = 100. Scale: Strongly Agree = 1 and Strongly Disagree = 0

5. BARRIERS AND CHALLENGES OF ICT INTEGRATION

From the above study it is evident that ICT has a tremendous potentiality to enhance the quality of education in secondary school level in the concerned areas. But still there are so many barriers that pose serious challenge to its effective implementation. Twenty years ago, Marcinkiewicz (1993) has pointed out that "full integration of computers into the educational system is a distance goal unless there is reconciliation between teachers and computers". Based on the research, two levels of barriers have been recognized as barriers for teachers' ICT integration efforts: external barriers and internal barriers (Ertmer, 1999). External barriers include those that are often seen as key obstacles, such as inadequate access to technology facilities, insufficient training and support in terms of using ICT. Internal barriers are closely related to teachers' philosophy of teaching and learning, and they are deeply rooted in daily practices. Hew and Brush (2007) analysed existing empirical studies of technology integration from 1995 to spring 2006 in the United States and other countries, and they found at least two categories of barriers were related to teachers' behaviour: the lack of specific knowledge and skills about technology integration, and attitudes and beliefs toward technology. Bingimlas (2009) also found that even many teachers have strong desires for integrating ICT into teaching, they encountered significant barriers, such as lacking confidence and competence, or having negative attitude and inherent resistance.

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Not only teachers' passive attitudes can cause barriers, but students can also pose challenges to ICT integration process. New generations, which are also called the Millennials, are much more skilled and adept at using technology than their teachers. Under this circumstance, students have different patterns of thinking and communication, notions of learning, needs for control, and even personal and social values with their teachers. For instance, multitasking in ICT is taken for granted by new millennium students as a normal social practice. As a result, teachers keep receiving a kind of "social pressure" in the teaching and learning process as the usage of ICT keeps growing, and students' ICT skills keep developing (Gu & Guo, 2013).

The society in whole and teachers, in particular, express doubts about the effectiveness of using ICT applications in collaboration, independent learning and self-directed learning in schools. Differences are identified in ideas of teachers, when compared with teachers of developed countries, about teacher-student and student-student interactions. Moreover, most Indian teachers regard themselves more of an authority role when compared to Western teachers. The authority figure hinders the interactive use of ICT, as this is not consistent with the formal traditional education. Until now, the dominant pedagogy in Indian basic education system is still teacher-centered and rote learning based. Especially in most of government run schools in sub-urban and rural areas, neither teachers nor students are well prepared to adopt the student-centered pedagogy in an ICT rich environment.

6. POLICY RECOMMENDATIONS

A number of policy recommendations can be valuable for Indian policy makers and key stakeholders for fruitful integration of ICT in school education. Overall, much focus should be put on teachers' roles and beliefs. Government and schools should make every effort to support teaching and learning process as well as introduce new pedagogy as a way to better integrate ICT into classrooms. The main policy recommendations are as follows:

Keep investing ICT infrastructure construction.
Until now, the number of ICT facilities and qualified teachers still cannot support the development of ICT in Indian school education. Investment and financial support from Chinese government is needed in both rural and urban areas.

Teacher roles should change from authority models to active mediators.
Teachers are the key factors affecting the usage of ICT in education because they are organizers, guiders, and coordinators in teaching and learning. How well teachers can engage themselves into these roles can determine how effective ICT is integrated in classrooms. Teacher should understand the essence of constructivist learning and encourage students to use ICT in self-directed learning and collaboration activities.

Teacher education should reconsider its training approaches in ICT integration.
Since many researches have shown that teachers' negative attitude and lacking confidence can cause challenges to ICT integration, teacher education should be carried out in a conducive and less-threatening environment. This will allow teachers to gain competence in using ICT for teaching and learning in a confident manner (Teo, 2008). Teacher education in ICT integration can also improve teachers' understanding of ICT and equip them with the latest teaching and learning theories.

Improve the quality and quantity of online-based educational resources by building resource-sharing platforms.
ICT integration can never be achieved without easy accessible online resources and resource sharing platforms. By building up resource platform and sharing online learning resources, teachers with basic Internet access can get teaching materials with high quality, such as videos, pictures, and curriculum instructions. Teachers in remote areas can get training in teaching pedagogy, while teachers in urban areas can learn from their peers with better teaching skills and form online learning groups to communicate and learn from each other.

Introduce blended learning as a new way to rebuild Indian future education system.
Some researchers argue that integration is in fact a part of the blended learning. The central philosophy of blended learning is to use ICT and other instructional media to improve learning and teaching performances. However, the concept of blended learning has not been widely accepted by most Indian teachers, as there is rare policy attention, unsystematic curriculum and insufficient teaching pedagogy specifically designed for this new trend.

Evaluation systems are needed to measure ICT integration outcomes.
Evaluation is important for researchers and key stakeholders to find out how well the integration process works. In the school level, an evaluation system should be built in order to measure teachers' performance in ICT

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integration; in the government level, evaluation systems can measure the gap between different regions and help policy maker better distribute resources.

Add shared vision into schools' development strategy.
Some researchers pointed out that an appropriate level of school strategy planning is needed in order to enhance the successful integration of ICT in classrooms (Baylor & Ritchie, 2002). Teachers would be more willing to integrate ICT into teaching and learning when schools underpin and strengthen the importance of using ICT in daily teaching.

More literature focuses on practice and quantitative evaluation of ICT integration is needed.
When we looked at available literature in terms of ICT integration in Indian education, we found most of the research was written on theory rather than practice, a few practical researches just focus on micro level issues such as classroom practices and teacher attitudes. An overview picture of ICT integration from the national policy level is not adequately described. Influencing factors and quantitative evaluation of ICT integration should be given more attention.

7. CONCLUSION

This paper highlights the role of ICT in enhancing quality of life of secondary level schools of West Bengal. The result reveals that there has been significant positive influence on quality of education through ICT by taking into consideration the factors – 'relative advantage', 'compatibility', 'demonstrability', 'image', 'complexity', and 'avoidance'. It is interesting to note that the calculated value of the factors like demonstrability and image has been found to be satisfactory. This is because the application of ICT has been properly addressed in these schools which dominate the complexity and avoidance factors dampening quality of education associated with ICT. Finally, the 'Concordance' model proves significant association between ICT and quality of education. This paper aims to bring together the findings and key points from the available literature associated with ICT integration in the Indian school education and particularly the school education of West Bengal. ICT provides opportunities for effective communication between teachers and students that has never been achieved before. In the second section, some barriers and challenges of ICT integration are identified. Studying the barriers of ICT in teaching and learning environments is important, as this knowledge can provide "guidance for ways to enhance technology integration" (Schoepp, 2005) and encourage better use of ICT. In the third section, we come up with policy recommendations based on current scenario. The recommendations aim to provide policy makers, teachers and other key stakeholders with possible approaches to overcome barriers and successfully integrate ICT into teaching and learning process in the future.

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SANITATION IN URBAN SLUM AREA IN GUJARAT

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ABSTRACT
This paper aim is to show the sanitation condition in urban slum area of Gujarat. Here researcher has used secondary data from the world bank and other authentic report to analyse the real position of Gujarat state in case of urban slum sanitation facilities.researcher has indicate the sanitation condition prevailing in urban area in chronological way, starting from world level, then condition in India and at last mention the prevailing sanitation condition in Gujarat State. Researcher has analysed the problem of urban sanitation in Gujarat.

Keyword: Urban, Slum area, Sanitation

INTRODUCTION
India has great history in sanitation, In India manywe have good example of it Lothal civilization and Haddapian culture, which indicates the better sanitation facilities.Now in India every government have tried to focus on sanitization under various schemes but still we read in newspaper about unavailability of the sanitation facility more than 60% area. It indicates we have to think about what facility available with the people.In 2008 India have national policy for the sanitization.In India Gujarat is developed state, so researcher wants to analyse sanitization facility available in Gujarat State.Under Swachcha Bharat Mission every one talk about the cleanliness and sanitation issues prevailing in India. In last budget Central Government have allocated 9000 crore for the sanitation and out of this amount 2300 were allotted for the urban sanitation development. India has taken many steps to develop this infrastructure at rural as well as urban level.

According to the evaluation study on Total Sanitation Campaign, which was done by government in year 2013 government have selected 20 states for sanitation campaign evaluation. It is found out that there were four categories in performance Sikkim is first with 100 % sanitation and Gujarat comes under the Good category with 68.6%.

SANITATION IN URBAN AREA IN ALL OVER WORLD
Now whole world became village after this internet access, it growing fast overall there is decrease in growth ratio of slum area population. As per WHO and UNICEF in year 2015, 2.4 billion people don't have improved sanitation facilities, which around 13% of population of all over world. Among all the country sub-Saharan Africa and South Asia continue to have the lowest sanitation coverage. The following table is about the sanitation facilities available in different part of the wolrd.

Table-1: Sanitation in different region of world:

Global Regions	% Urban population with access to improved sanitation
Caucasus and Central Asia	96.3
Developed Countries	96.8
Eastern Asia	87.3
Latin America and the Caribbean	87.3
Northern Africa	92.2
Oceania	75.9
South-eastern Asia	80.8
Southern Asia	64.6
Sub-Saharan Africa	40.3
Western Asia	95.0

(Source: Joint Monitoring Programme for Water Supply and Sanitation (2015)

BACKGROUND OF INDIA
India is second largest in population in all over the world as per the World Bank data it indicates constant decrease in slum area from 1990 to 2014 which listed below

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Table-2: Population live in slum area

Year	Population live in slum area (%)
1990	54.9
1995	48.2
2000	41.8
2005	34.8
2009	29.4
2014	24

(Source: Compile from World Bank Data)

The above data indicates the constant decrease in population percentages lives in slum area is decreasing, but still 24 % people are living in slum area. These people have many problems regarding water, sanitation, hygiene, education and so on.

BACKGROUND OF GUJARAT STATE

According to the Census 2011results, the total population of the State is 6.03 Crore which accounts for 5% of the total population of India. Gujarat is the 10th largest state in the country based on population excluding (UTs). Gujarat is one of the most urbanized states in India with 43% of the State population living in urban areas. Gujarat is seventh position in the India for urbanization. Gujarat has 36 % urbanization growth rate while national level urbanization growth rate is 31.6% (Urban Management Center, Ahmedabad 2015) People are moving from rural to urban area so it create space problem and decrease standard of living in case of land area. People have to leave in slum area. As per the urban management center report in year 2015 it indicates decrease in population live in slum area. As per census 2001 9.9% urban people were live in slum area and as per census 2011 6.5% urban people live in the slum area. Now there is decrease in slum area is good fact but here need is find out the quality life of slum area people.

Table-3: Urban households with individual toilets: Gujarat and peer states

State	Urban Households		Urban HH with individual toilet within premises		Percentage of HH having individual toilet	
	2001	2011	2001	2011	2001	2011
Andhra Pradesh	4173639	6778225	3258511	5838383	78.1%	86.1%
Gujarat	3758028	5416315	3026968	4750063	80.5%	87.7%
Karnataka	3556960	5315715	2675767	4514862	75.2%	84.9%
Kerala	1652656	3620696	1520747	3527650	92.0%	97.4%
Maharashtra	8069526	10813928	4686532	7707096	58.1%	71.3%
Tamil Nadu	5898836	8929104	3794901	6709788	64.3%	75.1%
All-India	53692376	78865937	39571281	64162119	73.7%	81.4%

(Source: Urban Management Center Report, 2015)

Gujarat is developed state in India still state facing many problems in urban sanitation issues. Average 81.4% urban households have individual toilet. While in Gujarat 87.7 % have individual toilet facility in urban area of state. It indicates that still Gujarat has to move towards the 100 % toilet facilities in urban as well as rural area.

ACCESS TO SANITATION FACILITIES: GUJARAT AND PEER STATES

In Ahmedabad two major slum areas were studied and found out that only 7 % people used open defecation, 24% people used common and Sulabh Shauchalaya and 68 % were using flushed toilets.(Trivedi & Gaurav 2015).

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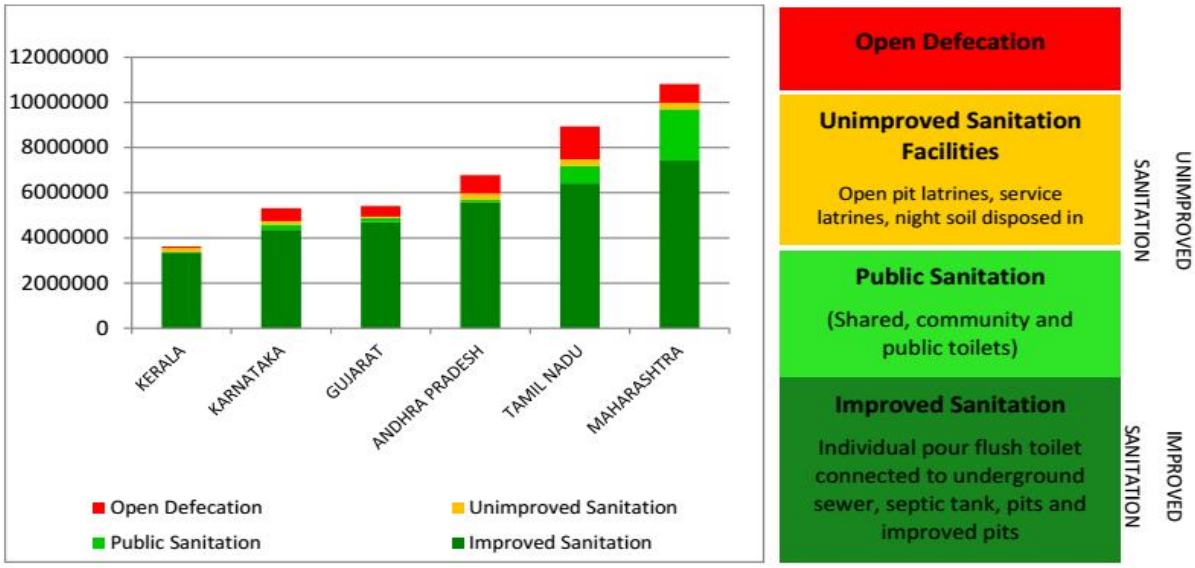
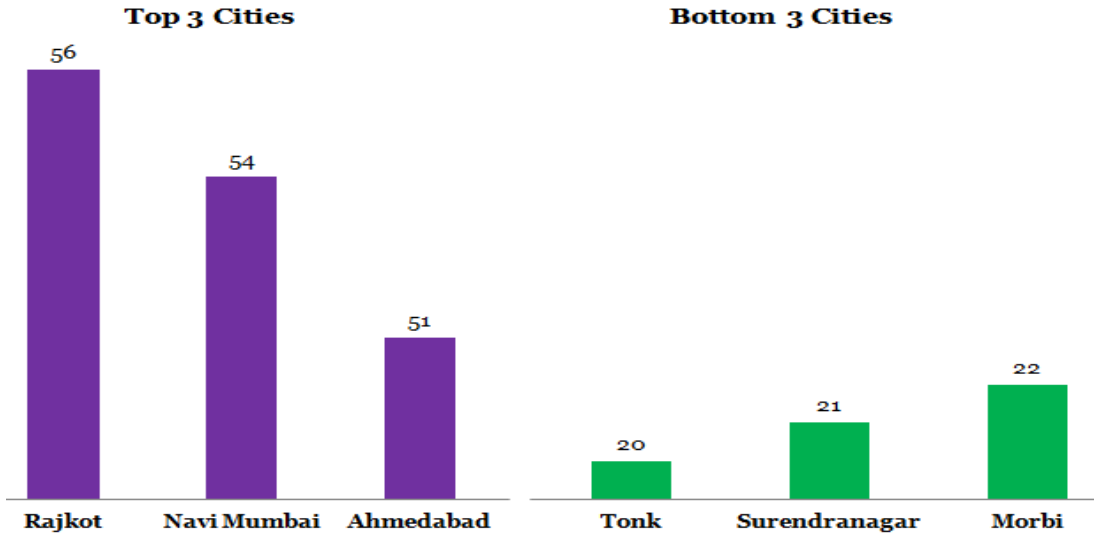
Figure-1: Open Defecation in Gujarat and Peer States



(Source: Urban Management Center Report, 2015)

The above data indicates there is still open defecation in India, what government and corporate can do for the society growth, this is the need of an hour to think about it as an academician.

Figure-2: Urban Sanitation in west zone of India



Source: Ministry of Urban Development, Govt. of India

The above data indicates the sanitation facilities available in west zone of India, top cities include Rajkot and Ahmedabad and bottom cities include Surendranagar and Morbi in sanitation facility available in urban area.

SANITATION PROBLEMS IN URBAN AREA

Shared Sanitation

Most of the slum area have common sanitation facilities and shared by whole area. There is always problem of maintenance, cleanliness and hygiene. People generally used as public property so less concern about the cleanliness and maintenance, they are unaware about the health and hygiene issues related to sanitation

Unavailability of sanitation facility on construction site

Many small and medium constructioncompanies are not providing facility of sanitation and this people have to go for open defecation.

Lack of awareness and illiteracy

People are not aware about the problems and disease due to unhygienic sanitation, education level among this entire group of people is very low so it is very difficult to convince them about the hygiene and sanitation.

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Perception about the Toilet
People are having a perception about the toilet is not good thing, it is symbol of dirty things. They are not considering it as natural process and in-house toilet creates dirt.

Health Issues
This people have high infant mortality rate, malnutrition(Banerjee et al. 2012; Pierce 2017).but sometimes slum urban area have less problem of mortality and malnutrition compare to rural area(Fink et al. 2014)

No space for open defecation
If we consider the rural area people can do open defecation easily as there are no issue about space, generally rural people do open defecation outside far away from house, But in urban area there are problem of space and land for living and open defecation done near to living area so it will create more hygiene issues.

CONCLUSION
Researcher has read all the data about the sanitation facilities available in urban area of world level, India level and Gujarat level, overall performance of Gujarat state is good compare to world and India. But still Gujarat doesn't have enough urban improved sanitation facility. It can be improved slowly and gradually by creating awareness among slum area residents and by creating enough infrastructures for them.

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WEBSITES
Retrived data from

- http://www.sulabhenvis.nic.in/Database/GraphicalTabularData_6358.aspx
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- **Text Book:**

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S. Neelamegham," Marketing in India, Cases and Reading, Vikas Publishing House Pvt. Ltd, III Edition, 2000.

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- **Chapter in edited book having more than one editor:**

Young, M. E., & Wasserman, E. A. (2005). Theories of learning. In K. Lamberts, & R. L. Goldstone (Eds.), *Handbook of cognition* (pp. 161-182). Thousand Oaks, CA: Sage.

- **Electronic sources should include the URL of the website at which they may be found, as shown:**

Sillick, T. J., & Schutte, N. S. (2006). Emotional intelligence and self-esteem mediate between perceived early parental love and adult happiness. *E-Journal of Applied Psychology, 2*(2), 38-48. Retrieved from http://ojs.lib.swin.edu.au/index.php/ejap

- **Unpublished dissertation/ paper:**

Uddin, K. (2000). A Study of Corporate Governance in a Developing Country: A Case of Bangladesh (Unpublished Dissertation). Lingnan University, Hong Kong.

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Yunus, M. (2005, March 23). Micro Credit and Poverty Alleviation in Bangladesh. *The Bangladesh Observer*, p. 9.

- **Article in magazine:**

Holloway, M. (2005, August 6). When extinct isn't. *Scientific American, 293*, 22-23.

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Central Bank of India (2005). *Income Recognition Norms Definition of NPA.* Retrieved August 10, 2005, from http://www.centralbankofindia.co.in/ home/index1.htm, viewed on

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