THE LIMELIGHT

5th edition 2011

AN ESGB PUBLICATION

Engineering Students' Group of Bhaktapur
Pulchowk Campus
2059

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IOE, PULCHOWK CAMPUS

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THE LIMELIGHT

an ESGB publication

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ENGINEERING STUDENTS' GROUP OF BHAKTAPUR
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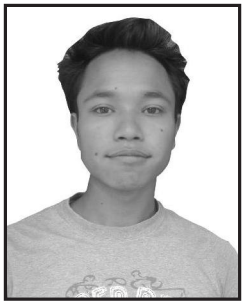

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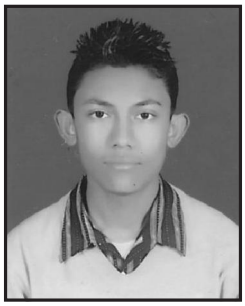

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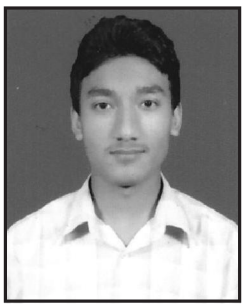

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THE LIMELIGHT

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Editorial…

Change is to one man the death of a friend,
To another the birth of a child.
Change is the shifting of soft winds of spring,
To a hurricane deadly and wild.

Change, the inevitable, is the theme of this issue of 'The Limelight'. Change is taking each step at a time therefore we need to grab each opportunity that comes forth us. There is a saying, when we write we are in a completely different world and an entirely different state of mind. One's true being is always portrayed in his/her writing. We are putting our efforts together to portray people's true being in this journal.

Despite obscured obstacles, we have come once again to the same point from where annual magazine "THE LIMELIGHT" outbursts. This is the fifth volume of "The Limelight", the technical journal of ESGB and it feels an immense amount of pride and pleasure at its release. At this blissful moment, we shall salute everyone who has directly and indirectly helped us accomplish this mission. Without their support and feedback, releasing this magazine would have been an endless abyss for us. We would like to shower out heartiest gratitude to all our sponsors and well wishers.

With full effort, we have made the issue perfect, flawless and to live up to the expectation of readers but it is bound to be erroneous. We present ourselves through 'The Limelight', that proves to be candle in the darkness. Finally, we'd like to mention that we are always expecting your precious comments, creative criticism and suggestions for the betterment of this journal and beautify its significance in the future.

But, change in the end, will not change
It's the one constant in everyone's lives
Change is the light at the end of the tunnel,
The healer who opens our eyes.

The Limelight Team 2011

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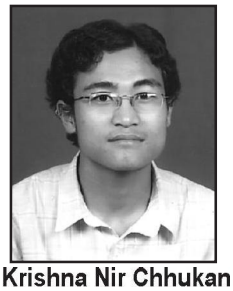

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Message from the Dean

This is my privilege to write few notes in the "The LIMELIGHT", an organ of Engineering students' group of Bhaktapur(ESGB), IOE, Pulchowk Campus.

As the world is moving towards creating knowledge based society, Engineering and Technology has become a promising discipline. Moreover, the existence and development of the human civilization, right from skill of hunting to nano-technology, has been possible only by engineering and technology. Understanding this reality, engineering is the potential career for bright, creative young people.

The LIMELIGHT- publication of ESGB, having ample articles, is one of the praiseworthy magazine.

Institute of Engineering
Office of the Dean

Dr. (Er.) Bharat Raj Pahari
[B.E.(civil), M.Sc. engg(Bldg.), Ph.D.(qlty of Engg Edu), Post Doc.(TQM)]

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Institute of Engineering
Pulchowk Campus
Pulchowk, Lalitpur

MESSAGE FROM CAMPUS CHIEF

It is a matter of a great pleasure to learn that the member of Engineering students' Group of Bhaktapur ESGB of this campus is publishing the fifth volume of technical journal "The Limelight".

As the world is surging towards knowledge, economy, present day professionals, especially the youngsters are thirsty for knowledge, innovative daring to dream & daring to excel. In this context, the continuous effort made by ESGB is really appreciable.

I wish ESGB to succeed in their quest for providing the opportunity to all that are interested and enlighten some hidden talent. I extend my heartfelt congratulation to all members of ESGB editorial board of the magazine for their success.

With Best Wishes!

Dr. Arbind kumar Mishra
Campus Chief
Pulchowk Campus

त्रिभुवन विश्वविद्यालय
इन्जिनियरिङ अध्ययन संस्थान
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पुल्चोक क्याम्पस
पुल्चोक, ललितपुर

च. नं.

मितिः-

Date:2067/12/15

MESSAGE FROM FSU PRESIDENT

It is a pleasure to express few words on the occasion of publication of the journal "The Limelight" volume-5 published by ESGB(Engineering student's group of Bhaktapur),IOE Pulchowk campus. The effort of students for the publication of this journal is highly appreciated and would like to congratulate the editorial board of the magazine for their success and also that, the journal is very helpful for the students and professionals.

Lastly, I would like to thanks ESGB .And Free student's Union always encourages the students to publish such types of journal in future also.

With Best Wishes!

Prakash Sapkota
President
Free Student's Union
Pulchowk Campus

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ENGINEERING STUDENTS' GROUP OF BHAKTAPUR

IOE, PULCHOWK CAMPUS

Pulchowk, Lalitpur

Ref. No: ..... *DATE:* .....

MESSAGE FROM ESGB PRESIDENT

I would like to heartily thank and congratulate **'The Limelight Team'** for their efforts in publishing the 5th edition of **"THE LIMELIGHT"** on the behalf of all the **ESGB** members.

Drop a pebble in the water, just a splash and it's gone;
But there is half a hundred ripples circling on and on and on,
Spreading, spreading from the center, flowing on out to the sea.
And there is no way of telling where the end is going to be. -James W. Foley

I hope **"The LIMELIGHT"** will be that pebble that will create ripples in the minds of its readers and extend beyond any department or this college.

I would like to thank all our teachers and colleagues for providing their articles for the publication of **"THE LIMELIGHT"** and their indispensable support and suggestions during various activities commenced through **ESGB** platform.

As a president of **ESGB**, it is my duty to lead this group and held this group together for initiating and continuing the works for the improvement of this group with the help of all the past and present members of this group.

I would also like to thank the alumni's' of this group for their valuable suggestions to guide me and this group. I would also use this opportunity to express my gratitude towards financial helping hands for the successful publication of **"THE LIMELIGHT"**.

Finally I expect the new executive committee, **"The Limelight Team"** and all **ESGB** members will take the responsibility of this group, bring new ideas and concepts and keep themselves driven towards the goal of this group.

.....
Saurav Pradhananga
President , ESGB

ACKNOWLEDGEMENT

The Limelight Team is very grateful to our seniors and well wishers for their constant encouragement, support, help and guidance. We would like to express our highest degree of gratitude to all the respected teachers who have provided us invaluable articles for the fifth volume of "The Limelight". We are indebted to our advisors for guiding us throughout the publication period.

We humbly express appreciation towards the Executive Committee of 'Engineering Students' Group of Bhaktapur' (ESGB), without whose untiring efforts and support, we would have never been able to achieve this success.

Thanks to all the business houses, financial institutions and our sponsors for their financial support and like to appreciate all well wishers especially to Mr. Tulsi Lal Basukala for his effective suggestions and help.

At last, our team would like to salute everyone who has helped us directly and indirectly to accomplish this publication.

Table of Content

Earthquake and the People

Dr. Hikmat Raj Joshi
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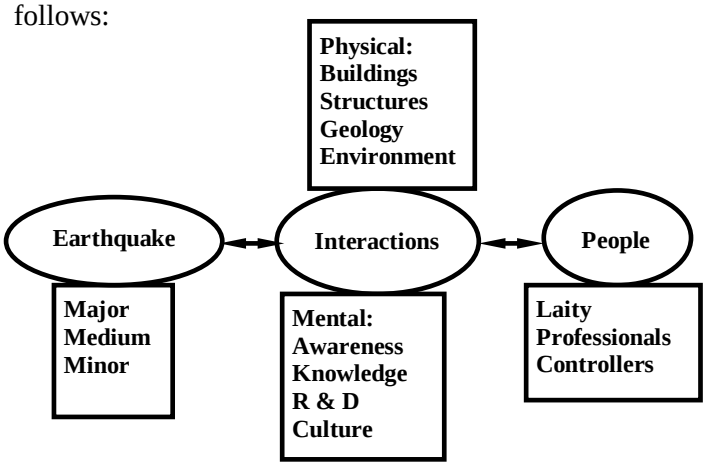
1. Limitations

- This write-up is an attempt to analyze the interaction between people of various backgrounds and earthquake from a civil engineer's view.
- The analysis is based upon the application of algorithm of working or thinking procedure of the people involved and the situation faced by them.
- This is more of sharing experiences and feelings rather than exploring or establishing new things.

2. Introduction

Earthquake is a natural phenomenon people have to face with and damages and losses due to which could possibly be controlled or minimized depending upon the preparedness of the people facing it. Preparedness for an event like earthquake is raised by increasing the level of understanding of the event and their ability to apply it among the people. However, this preparedness among people is like 'snooze alarm'. If not built in the system properly most of it is forgotten or lost between the events. In order to understand the two basic elements of discussion and the interactions between them they have been classified and categorized as follows:



3. Earthquake

Earthquake used to be entirely divine wrath upon mankind until they started to understand it as a geological phenomenon, which could be understood, measured and prepared for. However, it was not until the beginning of the 20th century people were not in a position to understand the tectonic causes of the earthquakes. Whereas, in the same century people were not only able to understand a lot of fact and figures about earthquake they have been even able to cause earthquakes due to their own doings. According to the magnitude, extension and severity earthquakes could be classified into *major*, *medium* and *minor*. Major earthquakes are those, which require national, regional or international level of works for studies, preparedness and tackling. Medium level earthquakes may have to be handled in local or national level efforts, whereas minor earthquakes are to be studied as preparation for the major ones. As Prof. R Jahns from Stanford University says 'The longer it has been since the last one, the closer it is to the next one'.

Major	Medium	Minor
1976, Tangshan, China	1988, Eastern Nepal	Earthquakes occurring in Katmandu for the last 10 years

Prediction: Attempts are being made to predict earthquakes from ancient times. However, it is too early and too little to say that there is a reliable way of predicting earthquakes.

Successful Predictions	Aborted Prediction
In 1975 in Haicheng, China; 1976, in Yunan and Sichuan by Chinese scientists In 1978 in Garm, Tadzhikistan by Russian Scientists.	In 1981 by two US scientists for off coasts, Peru and Chile

The Predictions were based upon tilting of land surface, fluctuations in the magnetic field, changes in the electrical resistance of the ground, increase in seismicity, change in wave velocity, change in water well etc.

In order to have established scientific basis the algorithm to be followed should be:

- Signal, indications (observed repeatability)
- Data (collected systematically)
- Information (processed and analyzed)
- Knowledge (established facts, laws, theorems, methods)
- Implementation (regulations, codes, commercialization)

The earthquake prediction science, it seems, has hardly reached the third steps in this order.

4. People

According to the involvement in and contribution to the interactions the people in Nepal have been grouped:

People	Groups
Laity	Upper, middle, lower class in income brackets Literate, Illiterate Earthquake conscious, not earthquake conscious
Professionals	Directly related to earthquake: Scientists, Engineers etc. Indirectly related to earthquake: Lawyers, Medical doctors, media people etc. Unrelated to earthquake
Controllers	Professionals directly related to earthquake Professionals indirectly related to earthquake Implementers: government officials, pressure groups

The purpose of grouping of people in this table is to find out which way and how the influence should flow to make each and everyone aware of, conscious and able to know the necessary facts about earthquake.

5. Interactions

The interaction between earthquake and people takes place in two media both physically and mentally. The instinctive reactions of people to try to be safer, inventiveness and creativity make people to produce improved way of interacting with earthquake.

Physical		Mental	
Buildings	Residential, Public	Awareness	Laity
Structures	Lifelines	Knowledge	Professionals
Geology	Substructures, Subsoil	R & D	Professionals and Scientists
Environment	Sustainability and planning	Culture	Controllers, Implementers

Awareness: The problem of making all the people aware of the necessary facts and figures of earthquake is to be addressed by all the concerned institutions and organizations. It is right and duty of everyone in the country to be aware of these necessary facts and figures. For this purpose the institutions like NSET, SEANep, NEA etc could be effectively mobilized. A course in earthquake should be taught in school level as a compulsory part. Every one should know where to go and who to ask if s/he has questions. For those who do not know what to ask, the institutions should reach to them and make them listen to and remember. It is the duty of the institutions and authorities to be responsible for informing and educating them in entertaining way, if necessary, to mobilize them and make them understand.

Knowledge: One of the challenging tasks is to disseminate the available knowledge to the professional through systematic channels. The professionals involved in design and planning should be imbued with classics and conventional knowledge of earthquake. For this purpose courses should be included in the professional disciplines and trainings organized for those who have missed or who need a refresher course. The knowledge of earthquake should be made compulsory or should carry weights in the career development of the professionals. The target group from professionals in this case is fresh graduates, practicing professionals or even experienced professionals. The institutions involved are the universities, professional associations, institutions and societies, governmental and non-governmental organizations.

R & D: The group of people involved and engaged in research and development in leading role are experienced, experienced and highly qualified or highly qualified professionals. They should be encouraged to their work in a systematic way giving priority to the problems the country is facing. They should try to do their R & D in framework form to encompass and include the necessary areas and professionals. For example it is also their task to be interested in saving lives of majority of the people living in non-engineered building by finding out simple building techniques and ways to retrofit the existing buildings to make them safer from earthquake. Saving and making the historical monuments safer could also be a fertile area for R & D.

Culture
Buildings
Structures
Geology
Environment

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Green House Gas Displacement through Installation of Photovoltaic Solar Home System in Nepal – A Glimpse

Prof. Dr. Jagan Nath Shrestha
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Abstract:
Although Nepal has been endowed with vast natural energy resources, such as solar, hydro, wind etc. it remains far behind in their fruitful utilization, with a per capita energy consumption of about 15 GJ only. At least 60% of her population is still deprived of access to electricity, which is a basic necessity in modern society, and has to depend upon the nonrenewable, imported fossil fuels for lighting and other purposes. This has been contributing to the indoor as well as the outdoor environment degradation. Due to the diverse terrain, remote geographical condition and dispersed rural population it is not feasible to provide grid electricity, in some part of the country at present. This hard fact compels Nepal to look for decentralized off-grid or mini –grid electricity sources. Solar photovoltaic (PV) technology is one of the viable options, and there have been more than 44,000 Solar Home System (SHS) with above 1.6 MWp installed till now in different parts of the country. This paper contains a brief account on the potential, present installation and future trend of installation of SHS in Nepal and the relevant impact upon the reduction of Green House Gases (GHGs). The paper also accounts for a qualitative and quantitative reduction of the GHG emission through the installation of SHS in private sectors. The paper concludes that more awareness programmes on the PV Technology, its contribution in the protection of the local and global environment as well as its relevant benefits are needed, especially in the remote areas with no access to national grid system. This will help not only in the poverty reduction but also in the protection of the local and eventually global environment as well as supporting the national economy.
Key Words: *Solar Photovoltaic, Rural Electrification, Solar Home System, Green House Gas, Global Warming*

1. Solar Insolation in Nepal

Nepal is a mountainous country with a fragile and steep topography (about 60m in the south to 8,848 m the north). It is located on the southern slopes of the Himalayas between 26°22' N to 30°27' N and 80°4'E to 88°12' E. Nepal has a total population of 23,151,423 living in 4,253,220 households [1].

The country is divided into five development regions, 14 zones and 75 districts. The solar energy resource in Nepal is abundant, evenly distributed over the country and over the seasons. The average insolation in Nepal is around 4.5 kWh/m^2/day at optimum tilt [16]. Nepal enjoys about 300 sunny days in a year. Solar photovoltaic (PV) system that generates electricity from the energy of solar radiation has emerged as a viable option to meet the demand for electric energy, especially in remote areas of Nepal.

2. History of Solar PV Technology Development in Nepal

Nepal could not remain isolated from global development in the field of solar PV technology. The exact date of the first use of solar PV in Nepal cannot be ascertained. Nepal Telecommunications Corporation (NTC) was the first organization to use solar PV power to operate a high frequency transceiver located in Damauli in 1974 [15]. NTC started massive use of solar PV power from the year 1980. At present NTC remains one of the largest corporate user of PV power with installed capacity exceeding 700 kWp[2].

Centralized electricity supply from solar PV started in Nepal in 1988. Nepal Electricity Authority (NEA), with the assistance from the French government, installed centralized solar PV power system in three locations: Simikot (50 kWp) in 1988, Kodari/Tatopani (30 kWp) and Gumgadhi (50 kWp) in 1989. Out of these three, the installation at Kodari/Tatopani was dismantled in 2000 and the modules were re-installed in Darchula district as individual solar home systems.

Recorded use of solar PV power for domestic electrification started in 1991/92 when the first solar PV company was established. Agriculture Development Bank of Nepal (ADB/N) had been using solar PV power to electrify its 100 branch offices starting from 1987. Use of PV power for rural electrification gained momentum only after the successful launching of Pulimarang Village Electrification Project in late 1993. This project was initiated by Solar Electric Light Fund (SELF), a USA based not-for-profit organization and managed by Center for Renewable Energy (CRE), a Nepalese non-governmental organization. The solar PV system components for this project were supplied by local solar PV industry-Solar Electricity Company (SEC). Except PV modules and batteries all other system components were locally manufactured. The success of the Pulimarang project played a pivotal role in drawing the government's attention to PV technology's huge potential in providing electricity to remote villages.

The first highly subsidized (95%) 68 SHS were installed at Chhaimale village in southern part of Kathmandu valley in September 1995 [3]. The subsidy was provided by Plan International, an INGO, and the SHS were installed by Wisdom Light Groups Pvt. Ltd. The government of Nepal started providing subsidy to the decentralized SHS from the fiscal year 1995/96. For the first time, ADB/N provided 50% subsidy to install 40 SHS at six village development committees (VDCs) in Kabhrepalanchowk district in June 1996 [3]. The SHS were promoted by Lotus Energy Pvt. Ltd. under its LEVEL-UP1 programme funded by the US Bureau of Oceans and International Environmental Scientific Affairs (OES) through the American Embassy in Kathmandu. As the Pulimarang project, the LEVEL-UP programme also motivated the government to recognize solar PV technology as a tool for rural electrification.

In 1996, the Alternative Energy Promotion Center (AEPC) was established under the Ministry of Science and Technology, which started providing subsidy to SHS from 1998/99. The government announced renewable energy subsidy policy in October 2000. The subsidy policy addresses, among other renewable energy technologies, the policy related to solar energy systems. The policy has made separate provisions for SHS and solar PV powered pumps.

Another major sector where solar PV is extensively used is water supply. Royal Nepal Academy of Science and Technology (RONAST), with financial assistance from Showa Shell, installed the first 1.48 kWp solar PV powered water pumping system in Ghorahi of Dang district in 1989. The largest solar PV powered water-pumping system (40 kWp) for drinking water was installed at Bode in Bhaktapur district in 1995 jointly by RONAST, Water Supply and Sewage Corporation and Tribhuvan University (TU) and funded by NEDO, Japan.

3. Solar PV Technologies in Nepal

PV based electrification has become immediate means of electrifying rural households of Nepal. The number of solar electrified households has exceeded 34,000 by mid 2003 [14]. This is an indication that the solar PV based rural electrification technology has become mature and that its popularity has increased substantially. This phenomenon is not unique to Nepal only; globally more than half a million households in developing countries are PV electrified [4]. Unlike other sources of electricity (e.g. hydro, wind, fuel) the PV has the shortest installation period, a household can be electrified within hours. The impact of solar PV technology on the environment is also minimal. The environmental threat is posed by the haphazard disposal of used storage batteries. However this threat can be mitigated by implementing systematic collection and recycling of the used batteries.

The basic solar PV technologies in use in Nepal are home systems, water pumping including drip irrigation, powering telecommunications equipment, powering navigational equipment, institutional systems like lighting community buildings, temples, dormitories etc., and powering computers in remote offices and schools.

A major contribution of the SHS is the reduction of indoor air pollution. A study conducted by Centre for Energy Studies (CES), Institute of engineering, Tribhuvan University, Nepal, shows that the particulate matter accumulated in a room of dimension 25 ft by 10 ft within 6 hours of burning a single kerosene lamp exceeded the WHO limit of 2.6 µg/m3 for 24 hours operation from kerosene lamp. After burning 101 ml (container capacity of a standard *tuki* lamp) for 7 hours and 47 minutes, the weight of the soot deposited was 0.085 gm. For one year this value could be as high as 11.63 gm at the rate of 3 hours burning time per day. [5] The detail results of the study are shown in Table 1.

Table 1: Measurement of Particulate matter due to Kerosene Lamp [5]

S. No.	Time	Particulate Level (µg/m3) at			Remarks
		3 ft.	6 ft.	9 ft.	
1	10:00	0.48	0.45	0.45	Background level
2	10:15	1.05	1.76	2.62	With lamp
3	11:00	7.88	8.50	7.50	With lamp
4	12:00	6.79	7.10	7.47	With lamp
5	13:00	6.71	5.64	5.93	With lamp
6	14:00	7.45	7.26	7.56	With lamp
7	15:00	7.52	7.31	7.46	With lamp
8	16:00	7.59	7.52	7.49	With lamp

4. The Solar Home System

The Solar Home Systems (SHS) generally comprise of a PV module, a storage battery, a charge regulator/controller and a few DC lights. The PV module capacity ranges from 10 Wp for smaller systems with two lights and a single socket for radio to 75 Wp for six-seven lamps, a single socket for radio/cassette and color television. The most popular system is with 35 to 45 Wp PV modules in which the users have facility to use 3-4 lights of 7-10 Watts for about three hours per day and to operate a medium sized black and white television. At the locations where terrestrial television broadcast signals are not available, some users also use solar PV power to operate satellite TV receivers. The capacities of the

batteries generally follow the installed capacity of PV module. For an average size of PV modules of 35-45 Wp the size of the battery is around 70 Ampere-hour (Ah) [6].

5. Trend of SHS Installations

The use of solar PV systems for lighting rural households began in early 90's in Nepal. Since then, the number of installations has been on an ever increasing trend. Various factors, like the growing involvement of civil society organizations and donor agencies, improvement in the environmental policy, provision of subsidy as well as the demonstration effect, have played important roles in maintaining the trend. The data on the annual installation numbers and peak capacity are shown in the Table 2.

Table 2: Installation of SHSs

Year of Installation	No. of Installations	Total Capacity, Wp
1992/93	8	272
1993/94	89	3,276
1994/95	36	1,247
1995/96	149	4,898
1996/97	562	20,394
1997/98	736	27,276
1998/99	1,899	68,290
1999/00	2,715	97,401
2000/01	6,082	236,951
2001/02	12,931	511,101
* 2002/03	19,451	690,222
Total	44,658	1,661,327

Source: [6, 9]

*Installed till mid July 2003 [6, 9]

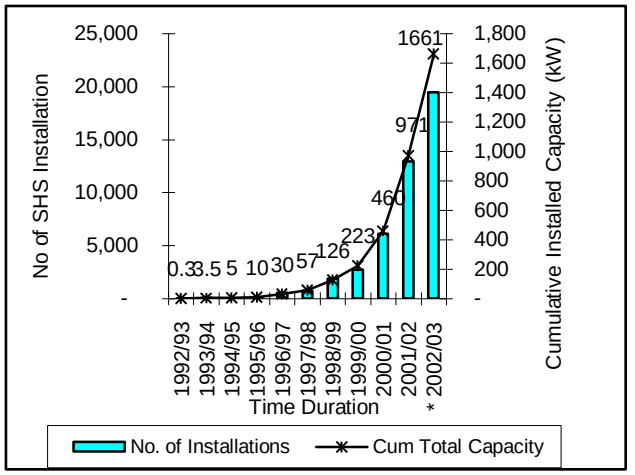


Figure 1: Cumulative Capacity wise Installation of SHSs

The estimated market potential is huge and stand-alone system constitute above 1,600 kW with more than 44,600 SHSs as of mid July, 2003; among them 34,561 SHSs have been installed under Alternative Energy Promotion Centre/ Energy Sector Assistance Programme (AEPC/ESAP) [6] subsidy program. The trend of installation of stand-alone SHS is shown in the Figure 1, from which, it is evident that the growth rate of SHS installations has increased markedly in 1995/96-1996/97. This was due to the introduction of subsidy on SHS for the first time in 1995 and the trend of SHS installation shows a steep rise after 1999/2000 due to introduction of a new subsidy policy in 2000 by AEPC/ESAP.

6. GHG emission reduction due to installation of SHS

By using the base case scenario model, the GHG reduction due to the installation of SHS is calculated by assumption based on what would have happened in the absence of the project activities. In this case the baseline scenario is the continued uncontrolled release of GHG emission to the atmosphere due to the increasing use of the imported fossil fuels like Kerosene for lighting purpose.

The installed SHS is mostly used to power lights, TV and radio in rural areas. The major contribution for the GHG emission reduction is through the change over of fuel source for lighting, i.e., from kerosene fuel to solar PV electricity. According to the latest survey report published in 2003, the lighting devices used before installation of SHS were *tuki*, petromax, lantern and fire wood flame (in Jumla). After the installation of SHS, it was estimated that the resulting reduction in kerosene use amounted to around 5 litres per household per month. [8].

Using the base case scenario model, the reduction in the GHG due to the replacement of kerosene for lighting is given by the equation:

The ith GHG reduction per year per SHS, $GRi = Q \times EFi \times T$ (1)

Where,

Q = Consumptioon Rate, ltr/month

EFi = Emission Factor for ith GHG

T = Time Duration, months

The emission factors of combustion for kerosene with different GHGs are given in the table 3

Table 3: Emission Factors of combustion for kerosene

Fuel Source	GHG	EF_i	CO_2e	Remarks
Kerosene*	CO_2	2.457 kg/ltr	2.457 kg/ltr	IPCC 1996, [10,11]
	CH_4	0.35 g/ltr	0.007 kg/ltr	(Smith et al, 1999), [11] GWP of CH_4 = 21 @CO_2, (Source:

				Houghton et al, 2001), [11]
	N_2O	0.063 g/ltr	0.020 kg/ltr	(Smith et al, 1999), [7, 11] GWP of N_2O = 310 @CO_2, (Source: Houghton et al, 2001), [11]

* NHV of Kerosene = 35 MJ/ litre, [13]

Total GHG reduction = Σ ($GR_i \times GWPi$)(2)

Where,

GWPi = Global Warming Potential for ith GHG

Then using equation (1) and (2),

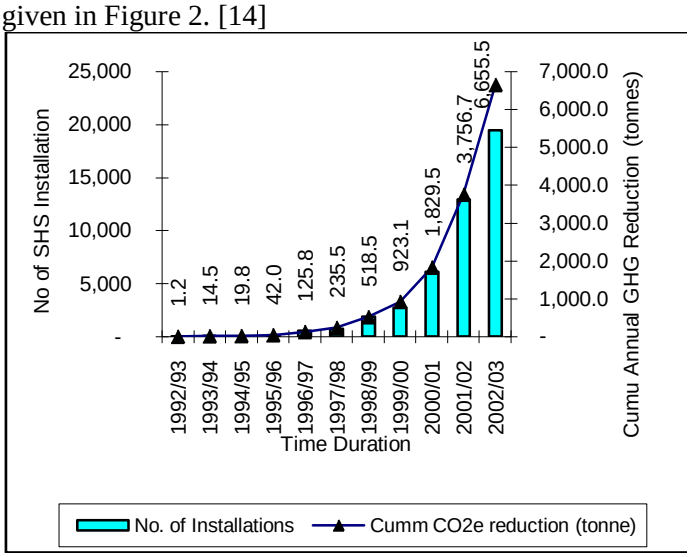
CO_2 reduction per year per SHS = (5) ltr/month × (2.457) kg CO_2/ltr × 12 months/yr
= 147.42 kg CO_2/year

CH_4 reduction per year per SHS = (5) ltr/month × (0.00035) kg CH_4/ ltr × 12 months/yr
= 0.021 kg CH_4/year
= (0.021 X 21)
= 0.441 kg CO_2e/year

N_2O reduction per year per SHS = (5) ltr/month × (0.000063) kg N_2O/ ltr × 12 months/yr
= 0.00378 kg N_2O/year
= (0.00378 X 310)
= 1.1718 kg CO_2e/year

Total Annual GHG reduction potential per unit installation of the SHS
= 147.42 + 0.441 + 1.1718
= 149.0328 kg CO_2e/year

The cumulative annual GHG reduction in CO2e is given in Figure 2. [14]



The total annual GHG reduction due to the installation till mid July 2003 is calculated as 6,655.5 tonnes of CO2e. If the life cycle period of the SHS is considered as 15 years, then, the cumulative reduction of GHG comes out to be 99,832.5 tonnes of CO2e. If it were to be included in the Clean Development Mechanism (CDM) with Certified Emission Reduction, then it can generate the Carbon Abatement Revenue of US $ 299, 497.5 @ US $ 3/tonne CO2e [12].

7. Conclusion

The PV based SHS has become one of the very important Renewable Energy Technology (RET) for Nepal to provide the electricity for lighting to the remote areas of the country, which depends entirely on the traditional technology like kerosene lamps for lighting. The annual GHG reduction potential of installed SHS considering lighting only in Nepal is calculated as 149 kg per SHS. It is very important for Nepal, being faced with the problems of excessive foreign currency reserve expenditure on commercial fuel import and increasing deforestation, to implement CDM, based on the RET, which focuses on imported petroleum fuel substitution.

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Surface Dressing

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Abstract: Surface Dressing works are extensively executed in the recent years on the different new roads and on the existing roads all over the country to prolong the road life and better serviceable condition. Therefore it is essential to know about this works by the persons involved in the construction industries for the proper and quality execution.

Definition

Surface dressing is one of the most common and cost effective techniques used as wearing course

Types of Surface dressing

- Single Bituminous Surface Dressing
- Double Bituminous Surface Dressing
- Triple Bituminous Surface Dressing

Main function of surface dressing

- To provide a dust free surface over a base course
- To provide a water proof layer to prevent infiltration of surface water
- To protect the base course

Construction Procedure of Surface Dressing

- ***Material Requirement***

- Bitumen :- Normally 80/100 grade Straight run
- Aggregate :- Clean, strong, durable with following properties
- Los Angeles Abrasion value (LAA)-35% (Max)
- Aggregate Crushing Value (ACV)-30% (Max)
- Flakiness Index (FI) - 25% (Max)
- Water Absorption - 1 % (Max)
- Stripping Value - 25% (Max)

Gradation Requirement of Aggregates (Chipping)

Sieve Size (mm)	Percentage passing by weight			
	Nominal sizes			
	14/20	10/14	6/10	4/6
25	-	-	-	-
20	85 - 100	100	-	-
14	0 – 20	80 - 100	100	-
10	0 – 3	0 - 15	80 - 100	100
6.3	-	0 - 3	0 - 15	85 - 100
4.75	-	-	0 - 10	-
2.80	-	-	0 - 2	0 - 10
1.18	0 - 2	0 - 2	-	-
0.60	-	-	-	0 - 2
0.075	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5

Equipment Requirement

- Storage Tank with Bitumen Heating Device
- Bitumen Distributor or Spreader
- Mechanical Broom or Hand Brushes
- Air Compressor
- Aggregate or Stone Chip Spreader
- Pneumatic Roller

Construction Steps

- Preparation and intensive cleaning of the existing surface by broom and air compressor
- Spreading of binder as per specified rate of application
- Spreading of stone chipping as per specified rate of application
- Rolling with the help of pneumatic roller of first or final coat at least four passes (SBSD)
- Opening to traffic with controlled lower speed (< 10 Kmph) for one or two weeks
- Broom and clean the loose chips
- Application of binder or and stone chipping for second coat
- Rolling with the help of pneumatic roller of second or final coat at least four passes (DBSD)
- Opening to traffic with controlled lower speed (< 10 Kmph) for one or two weeks
- Broom and clean the loose chips
- Opening to traffic with controlled lower speed (< 10 Kmph) for one or two weeks
- Broom and clean the loose chips
- Application of binder or and stone chipping for third coat
- Rolling with the help of pneumatic roller third or final coat at least four passes (TBSD)
- Opening to traffic with controlled lower speed (< 10 Kmph) for one or two weeks

Quality Control

- Checking of the conditions of the equipments
- Checking of temperature of binder
- Checking of dust content in stone chipping
- Conduction of tests on binder at least penetration, viscosity and ductility or availability of laboratory facility at site
- Conduction of tests on stone chipping at least Gradation, LAA, ACV, AIV, FI, WA,

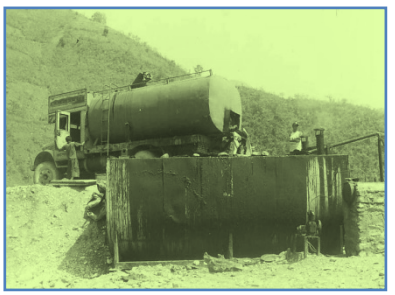
Stripping Value or availability of laboratory facilities

- Checking of rate of application of binder and stone chipping by placing rectangular tray during spreading of binder and stone chipping

Precaution

- Equipment condition should be in perfect running condition before starting
- Excellent coordination between the labors, equipment and supervisor should be maintained perfectly
- Never attempt to start the work when the ambient temperature is below 16 ^{0} C

Stock of aggregates for surface dressing works in crusher plant



Bulk bitumen brought by tanker delivering in the storage tank at construction site camp

Packed bitumen pouring into the storage tank at construction site camp

Washing of stone chipping before transporting to laying site to reduce the dust in chips

Intensive broom with hard and soft brushes and removal of the dust from the existing surface

Use of the compressor for cleaning the surface and make free from foreign materials after intensive broom

Heating of bitumen to the required temperature at site to be ready for spraying for the surface dressing work

Chip spreader and pneumatic rollers are in ready position to execute surface dressing work

Bitumen spreader and chip spreader in ready position to execute surface dressing work

Spraying of the bitumen by distributor. Aggregate spreader is following to cover the spread bitumen

Covering of the spread bitumen by the chips with the help of chip spreader

Immediate rolling after spraying of aggregates by pneumatic roller

Perfect arrangements of the different equipment in sequence for better performance SD works

Good spacing between bitumen spreader, chip spreader and pneumatic roller in SD work

Covering of the spread bitumen by the chips with the help of chip spreader following immediately

Back up rolling by pneumatic roller. It is better to roll when road surface attain high temperature

Manual spraying of aggregates on uncovered edge of the pavement by labors for better finish of Surface Dressing

Escorting by motorbike for controlling traffic and safe guarding the executed surface from stripping of aggregates

Historical Development of Engineering Higher Education in Nepal

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Introduction

The higher education in Nepal incepted during Vedic period as Gurukul and subsequently developed in the course of time. Modern higher education that began after the Tri-Chandra College in 1918 is at present being disseminated from different universities through their constituent and affiliated colleges. Many colleges have been established with the delivery of diversified discipline and having affiliation with one of those universities. The state of condition of the universities and the colleges is different. Tribhuvan University is the largest one and expanding in the span of the country. It has the highest numbers of students, faculties, programs and staffs. Sanskrit University is running traditionally the subject matters in Sanskrit medium. This university is hardly functioning with the government financing. Kathmandu University established from private sector and has established academic excellence. It seems to be satisfied with its' own endeavours and the outputs. Purwanchal and Pokhara Universities are largely running with the strength of affiliated colleges. They are sustaining from giving affiliation to private colleges and government assistance. Lumbini Bauddha University is still in the course of developing its infrastructure. BPKIHS in Dharan is running satisfactorily and National academy of medical sciences is running in Bir Hospital.

Right from the beginning of the civilization, technology has been instrumental for the change. In the early days, the skill of hunting and the development of fire were engineering and later on this was developed in to the production of weapons, survey of the geography and construction of roads. In the early period, engineering was the part of military activities in exploring new ventures and developing civilization. In the course of time, this process developed into the modern complex technology. The life is becoming more and more dependent on the technology. This has made inevitable to develop a technologically literate society (Jones, 2006).

It is obvious that transformation of society is possible with knowledge and skill, more specifically, with the engineering knowledge and skill. At present, engineering higher education has become concern to every country.

At present, there are 31 engineering colleges including constituents and affiliated colleges under four universities; Tribhuvan University, Kathmandu University, Pokhara University and Purwanchal University, disseminating engineering higher education in Nepal (NEC, 2007).

Historical Development of Engineering Education in Nepal

Stacks of information are found in different religious doctrines on engineering education. Among them, Vastushastra is well known. There are different literature illustrating engineering fundamentals, some of them are; Vastupuran, Vasturatnakar, Vastusar, Vastumandan, Mayamatam, Manashar, Matsyapuran, Mahabharat, Prashadmandan, Shukraniti, Brihatsamhita etc. (Pandey, 2001). The Takshashila, Nalanda and other universities of the early periods were some evidences of delivering formal engineering education. However, all these treaties of the past are not the content of present day conventional engineering education (Sharma, 2000).

In the historical period, there was more informal technical education, transferring technology from generation to generation through experiences. The great legend Balabahu (Araniko) was the architect of the 13th century, well-known for establishing new history of pagoda architecture in China. Vocational education was very much popular in Kathmandu valley during Malla period as a tool to increase revenue. There was a special degree for citizens to learn some kind of skills and involve in production and business. Malla period was famous for handicraft. It was the golden period for all types of architectures. The kings from parts other than valley were also found to be cautious on the importance of technical works. This is illustrated in the decree of King Prithwi Malla of Sinja state in the west Nepal (Sharma, 2000).

During Rana dynasty (1846-1950) Mr. Bir Shamsher was found to be aware of the technical service for the development of the country. As a result of this, his son, Gehendra Shamsher, along with other 5 students were sent to Japan for higher technical study (Sharma, 2000). They were the pioneer engineers taking formal engineering degree in modern technical

education in Nepal. However, the policy regarding technical education did not prevail.

Formal technical education started in 1930 (1987/11/19 B.S.) after the establishment of technical school in Kumari Chowk, Kathmandu. At the beginning, this school began the trade course on textile skill. In 1942 (1998/10/17 B.S.), engineering section was introduced in the school offering two years sub-overseer course for SLC graduates. This school was shifted to Tri-Chandra campus in 1945 and renamed as engineering school in 1950. It was in 1958 that this school was accepted as a formal institution to deliver engineering education and once again renamed as Nepal Engineering Institute and it was shifted to Nepal Administrative Training Council Complex, Jawalakhel at the beginning of 1958. By the end of same year 1958, it was taken to Ananda Niketan, Pulchowk. It offered overseer course in civil engineering and later on in 1971 offered electrical overseer course. In 1965, technical training institute was established in Thapathali under the assistance of German Government offering overseer course in mechanical and electrical engineering.

After the introduction of New Education System Plan in 1972 in the country, Institute of Engineering was formed under Tribhuvan University and both the Nepal Engineering Institute and Technical Training Institute were brought under Institute of Engineering. Nepal Engineering Institute was renamed as Pulchowk Campus and Technical Training Institute was renamed as Thapathali Campus. Later on, in 1984 and 1987 Purbanchal Campus in Dharan and Paschimanchal Campus in Pokhara were established respectively. Pulchowk Campus started Bachelor level (B.E.) in Civil Engineering in 1978. Similarly, B.E. in Electrical and Electronics Engineering began in 1994, Architectural and Mechanical Engineering began in 1995, and Computer Engineering began in 1998 in Pulchowk Campus. Paschimanchal Campus of IOE in Pokhara started B.E. Civil Engineering in 1999 and Electronics Engineering in 2005. Similarly, Purwanchal Campus of IOE started B.E. in Agricultural Engineering in 2000 and Civil Engineering in 2004. Thapathali Campus began B.E. in industrial engineering in 2005 and civil engineering in 2007 (IOE, 2007).

It was after the adoption of bill of multi-university from the parliament in 1994, there was a momentum to establish engineering colleges in private sectors. Nepal Engineering College was first of this kind to be established in 1994. Kathmandu University established in 1991 also began engineering program in 1994. Later on, Purwanchal University and Pokhara University have also launched engineering program. There are about 31 engineering colleges today running diploma, bachelor degree and master degree and Ph.D. courses in multi-dimensional Engineering discipline. Among them 24 colleges are affiliated with different Universities and seven colleges are the constituent colleges of universities. At present, engineering higher education is disseminated in 14 different engineering discipline, namely; civil, electrical, electronics and communication, mechanical, computer, environmental, agriculture, architecture, electrical and electronics, electronics, biomedical, software, information technology, industrial etc (NEC, 2007).

Inception and Growth of Higher Engineering Education

The planned development of Nepal was incepted after the democratic change of 1949. National plans were formulated for the overall development of the country. The first national plan began in Nepal in 1956. The planned attempt of engineering human resource development was initiated in fifth plan under Colombo plan; as a result of this substantial numbers of engineers were produced. As a part of Karnali hydro power project large contingent of engineers were produced from Roorkee University that begin from 1980. However, the issue of engineering education was considered in the seventh plan by the introduction of engineering education project and formulating the plan for overall development of the infrastructures and faculties. The issue of human resource development was stressed in the 8th Plan statement:

"Capacity will be increased and quality education will be promoted to produce medium and high level manpower production within the country in agriculture, medicine, engineering and forestry through Tribhuvan University" (NPC, 1992, p. 28).

The first engineering education project under the assistance of World Bank, Swiss & Canada, though incepted in seventh plan was in the implementation in the eighth plan after 1986. It was instrumental to develop curriculum, faculties and establish infrastructures necessary for engineering higher education.

The ninth plan was more specific human resource development. This was included in the strategy and policy statement (NPC, 1997). The ninth plan emphasized on the formation of Nepal Engineering Council with the idea of regulating the engineering profession. The tenth plan illustrated the human resource development among its four strategies. It has also stated to prepare the policy to match the engineers' production and engineers' absorptive

capacity for the development of the country. Tenth plan was more specific on maintaining and enforcing quality control measures of engineering colleges and of engineering education (NPC, 2002). It is envisaged that the human resource agenda is in the lime-light since seventh plan. The issues of engineering education has found included in the three years interim plan (2008-2010) as well. According to which the process of preparatory works are underway for the establishment of engineering university, technical university and dimmed university. The World Bank at present is launching second higher education project under national three years interim plan. A component of this project is obviously the engineering education.

Henceforth, higher education is drawing the attention of the policy makers. The focus is naturally on engineering human resources. The reason behind this is that the activities that drive the industrial state and the activities that implement scientific advance are generally rooted in engineering.

In the course of time, attempts were made to revitalize the higher education of Nepal through different education commissions. In this process, new policy decisions were made regarding engineering education.

The education policy drafted by the first education commission formed in 1955 illustrated that the pace of development of the country may take momentum if the vocational education could be managed in a proper way (HEC, 1955). The commission had also emphasised on the compulsory vocational education in school and established a notion that selection of a vocational subject has to be a part of basic education.

National education system plan adopted in 1961 put forward the recommendation to change engineering school to engineering college under the Tribhuvan University (National Education Committee [EC], 1961). With this recommendation, government had accepted engineering as a formal education. Besides, it did not talk much about engineering education.

After a decade, the government thought to overhaul the prevailing education system. New education system project was launched in 1972. This system said on education, 'the country needs such education that makes people competent in any profession having high moral and serve the country' (EC, 1972). It had also emphasized on the optional vocational subjects in the high school. As a result of this, vocational education was extensively applied in the school.

The discontentment of the student questioned on the prevailing education system and government formed the royal higher education commission in 1984 to look over the student's issues and entrusted the task of formulating new education policy. The recommendation of this commission can be taken as a landmark in the process of developing technical education. It had emphasised on the need of technical manpower for the development of the country. The four areas of technical education were identified, namely; Engineering, Agriculture and animal science, Forestry and Medicine (EC, 1984).

Regarding engineering education, the commission recommended; "Institute of Engineering should be established as a centre for producing quality engineering manpower and promoting and developing technology as required in the national development process"(EC,1984, p. 38).

The commission also talked about the planned system of engineering higher education. In addition to this, commission proposed the board of technical and vocational training and education to conduct trade course and training. This commission streamlined the technical education to the national policy as the basis of development.

After the restoration of democracy in the country in 1991, there was the notion of remoulding education policy in democratic setting and then government formed the national education commission in 1993 to work in this direction. This commission had put forward some of the crucial policies regarding engineering education. It emphasized on the promotion of informal and non-formal way of basic skill training in one way and in other way the medium and higher level trainings should be conducted in the vocational training schools (EC, 1993).

Once again, a high level national education commission was formed in 1998. This commission was entrusted to analyze the prevailing education system and suggest the rational and timely direction to education system. This commission had presented comprehensive vision regarding engineering education. The objectives were clearly spelled out and the infrastructure necessary for this were noticeably illustrated and also gave direction for establishing engineering University for the cause of national development. Special focus was given to enhance national technical capacity of the country through the production of the engineering human resource, development of appropriate technology and technical services (EC, 1998).

In the course of time, then government formed a 'high level executive committee for education' in 2001 with an intention of transparent and effective

management of school education. This committee was focused on the school education in general and did not talk anything about the engineering education.

So far stating higher education in engineering, it was started in 1978/79 as Bachelor in Civil Engineering in Institute of Engineering. The enrolment was only 22 students in the first batch. The graduates produced from Nepalese colleges were limited in numbers (72 nos.) up to 1997. This number was increased after the establishment of private engineering colleges including engineering program of Kathmandu University from 1994.

Total enrolment of students in the higher engineering education (B.E. Level) in the fiscal year 2003 was 2014 numbers (UGC, 2004). There has been tremendous increase in the numbers of students after the establishment of private colleges. The enrolment capacity of 31 numbers of engineering colleges accredited from Nepal engineering Council in 2007 was found to be 4417 (refer table 1). But, actual entry of the student was only about 70 percent of the enrolment capacity.

Table 1

Student Enrolment Capacity of Engineering Colleges

University	Engineering Colleges		Students enrolment capacity
	Constituents	Affiliated	
Tribhuvan University	4	7	1638
Purwanchal University	1	8	1078
Pokhara University	0	9	1522
Kathmandu University	2	0	179
Total	7	24	4417
Source: (NEC, 2007)			

The scenario of students' pass/ fail rate is varying in different universities. In Tribhuvan University, the average fail rate in all eight semesters is found to be 33 percent to 47 percent the data of past two batch of graduation from IOE- 2004 and 2005, from both constituents and affiliated colleges respectively. This rate is slightly high in the first and second year and slightly low in the third and fourth year (IOE-exam, 2006). The average fail rate in Kathmandu University is found to be 14 percent to 36 percent in the past five years-2003-2007 (KU-exam, 2008).

The drop-out rate in the 2004 and 2005 batch from first year to fourth year was found to be 8 percent and 6 percent respectively (IOE-exam, 2006). This rate is 12 percent to 5 percent in Kathmandu University (KU-exam, 2008). The drop-out rate in Purwanchal and Pokhara Universities are slightly higher. Students fail rate in constituent colleges of IOE is found to be slightly lower in compare to the affiliated colleges.

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Exploratory Data Analysis (EDA)

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Exploratory Data Analysis (EDA) is an approach/philosophy for data analysis that employs a variety of techniques (mostly graphical) to

1. Maximize insight into a data set;
2. Uncover underlying structure;
3. Extract important variables;
4. Detect outliers and anomalies;
5. Test underlying assumptions;
6. Develop parsimonious models; and
7. Determine optimal factor settings.

Most EDA techniques are graphical in nature with a few quantitative techniques. The reason for the heavy reliance on graphics is that by its very nature the main role of EDA is to open-mindedly explore, and graphics gives the analysts unparalleled power to do so, enticing the data to reveal its structural secrets, and being always ready to gain some new, often unsuspected, insight into the data. In combination with the natural pattern-recognition capabilities that we all possess, graphics provides, of course, unparalleled power to carry this out. The particular graphical techniques employed in EDA are often quite simple, consisting of various techniques of:

1) Plotting the raw data (such as data traces, histograms, bi-histograms, probability plots, lag plots, block plots, and Youden plots.
2) Plotting simple statistics such as mean plots, standard deviation plots, box plots, and main effects plots of the raw data.
3) Positioning such plots so as to maximize our natural pattern-recognition abilities, such as using multiple plots per page.

Generally we use following approach for data analysis
1. Classical 2. Exploratory (EDA) 3. Bayesian

These three approaches are similar in that they all start with a general science/engineering problem and all yield science/engineering conclusions. The difference is the sequence and focus of the intermediate steps.
For classical analysis, the sequence is
Problem => Data => Model => Analysis => Conclusions
For EDA, the sequence is
Problem => Data => Analysis => Model => Conclusions
For Bayesian, the sequence is
Problem => Data => Model => Prior Distribution => Analysis =>Conclusions

Thus for classical analysis, the data collection is followed by the imposition of a model (normality, linearity, etc.) and the analysis, estimation, and testing that follows are focused on the parameters of that model. For EDA, the data collection is not followed by a model imposition; rather it is followed immediately by analysis with a goal of inferring what model would be appropriate. Finally, for a Bayesian analysis, the analyst attempts to incorporate scientific/engineering knowledge/expertise into the analysis by imposing a data-independent distribution on the parameters of the selected model; the analysis thus consists of formally combining both the prior distribution on the parameters and the collected data to jointly make inferences and/or test assumptions about the model parameters.

In the real world, data analysts freely mix elements of all of the above three approaches (and other approaches). The above distinctions were made to emphasize the major differences among the three approaches.

Classical approach	EDA approach
The classical approach imposes models (both deterministic and probabilistic) on the data. Deterministic models include, for example, regression models and analysis of variance (ANOVA) models. The most common probabilistic model assumes that the errors about the deterministic model are normally distributed--this assumption affects the validity of the ANOVA F tests.	The Exploratory Data Analysis approach does not impose deterministic or probabilistic models on the data. On the contrary, the EDA approach allows the data to suggest admissible models that best fit the data.
Classical techniques are generally quantitative in nature. They include ANOVA, t tests, chi-squared tests, and F tests.	EDA techniques are generally graphical. They include scatter plots, character plots, box plots, histograms, bihistograms, probability plots, residual plots, and mean plots.

Classical techniques serve as the probabilistic foundation of science and engineering; the most important characteristic of classical techniques is that they are rigorous, formal, and "objective".	EDA techniques do not share in that rigor or formality. EDA techniques make up for that lack of rigor by being very suggestive, indicative, and insightful about what the appropriate model should be.
Classical estimation techniques have the characteristic of taking all of the data and mapping the data into a few numbers ("estimates"). This is both a merits and a demerits. The merit is that these few numbers focus on important characteristics (location, variation, etc.) of the population. The demerit is that concentrating on these few characteristics can filter out other characteristics (skewness, tail length, autocorrelation, etc.) of the same population. In this sense there is a loss of information due to this "filtering" process.	The EDA approach, on the other hand, often makes use of (and shows) all of the available data. In this sense there is no corresponding loss of information.
The classical approach is that tests based on classical techniques are usually very sensitive it depend on underlying assumptions *(e.g., normality)*, and hence the validity of the test conclusions becomes dependent on the validity of the underlying assumptions. The exact underlying assumptions may be unknown to the analyst, or if known, untested. Thus the validity of the scientific conclusions becomes intrinsically linked to the validity of the underlying assumptions. In practice, if such assumptions are unknown or untested, the validity of the scientific conclusions becomes suspect.	Many EDA techniques make little or no assumptions--they present and show the data--all of the data--as is, with fewer encumbering assumptions.

Example of EDA approach:

Let us consider the 4 sets of data

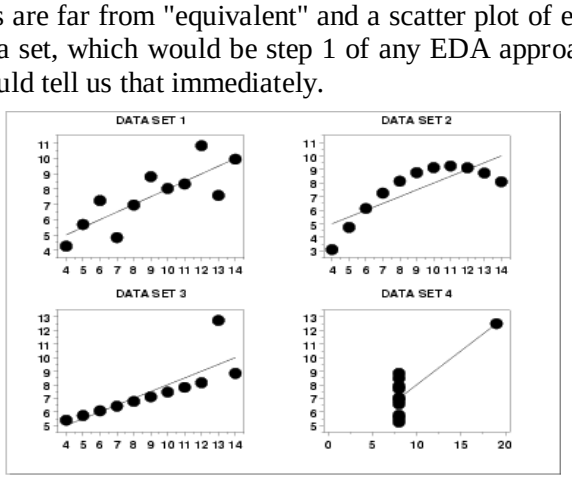
X1	Y1	X2	Y2	X3	Y3	X4	Y4
10	8.04	9	8.77	9	7.11	8	8.84
8	6.95	11	9.26	11	7,81	8	8.47
13	7.58	14	8.10	14	8.84	8	7.0
9	8.81	6	6.13	6	6.08	8	5.25
11	8.33	4	3.10	4	5.39	19	12.5
14	9.96	12	9.13	12	8.15	8	5.56
6	7.24	7	7.26	7	6.42	8	7.91
4	4.26	5	4.74	5	5.73	8	6.89
12	10.82						
7	4.82						
5	5.68						

Quantitative analysis on data set 1, 2, 3 and 4 are as follows

N=11, mean of X = 9, Mean of Y = 7.5, b_0 (Intercept) =3, b_1= 0.5

Residual standard deviation =1.237 and correlation = 0.816

which implies that in some quantitative sense, all four of the data sets are "equivalent". In fact, the four data sets are far from "equivalent" and a scatter plot of each data set, which would be step 1 of any EDA approach, would tell us that immediately.



Conclusions from the scatter plots are:

1st data set 1 is clearly linear with some scatter.

2nd data set 2 is clearly quadratic.

3rd data set 3 clearly has an outlier.

4th is obviously the victim of a poor experimental design with a single point far removed from the bulk of the data.

These points are exactly the substance that provide and define "insight" and "feel" for a data set. They are the goals and the fruits of an open exploratory data analysis (EDA) approach to the data. **Quantitative statistics are not wrong, but they are incomplete.** They are incomplete because they are numeric **summaries** which in the summarization operation do a good job of focusing on a particular aspect of the data (e.g., location, intercept, slope, degree of relatedness, etc.) by judiciously reducing the data to a few numbers. Doing so also **filters** the data, necessarily omitting and screening out other sometimes crucial information in the focusing operation. Quantitative statistics focus but also filter; and filtering is exactly what makes the quantitative approach incomplete at best and misleading at worst.

The estimated intercepts (= 3) and slopes (= 0.5) for data sets 2, 3, and 4 are misleading because the estimation is done in the context of an assumed linear model and that linearity assumption is the fatal flaw in this analysis.

The EDA approach of deliberately postponing the model selection until further along in the analysis has many rewards, not the least of which is the ultimate convergence to a much-improved model and the formulation of valid and supportable scientific and engineering conclusions.

HVDC Light Technology

(Evolution, operation & application)

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Introduction

The competition in the electricity industry forced the government world wide to achieve cost effective outcomes. However, while competition in the generation sector is now well established, to date the achievement of market outcomes in the provision of network services has been ignored. This situation is largely due to assumptions regarding economies of scale and scope and the inevitability of loop flow. These assumptions have delayed the exploitation of advanced transmission technologies, including HVDC Light. The concepts of HVDC arose when it is required to transmit bulk power to hundreds of KM.HVDC Light is a technology for power transmission using high voltage direct current. It employs the latest in power semiconductor technology, the **IGBT**, and is based on Voltage Source Converters which has characteristics well suited to meet the demands from the new markets. HVDC light technology was evolved due to essence of power transmission through sea. IGBT is used as switching the converters in HVDC Light technology. Since IGBT is light in nature, the term **"Light"** is used. The **HVDC classic** used thyristor or MOSFETs for switching the converters but they are bulky and costly. HVDC Light is also know as HVDC plus (Power Link Universal System).It has a standardized design, power ratings up to 200 MW; short delivery times and is friendly to the environment. The Light concept uses extruded DC cables to transmit the power which are easy to install.

Why IGBT?

BJTs have low power losses but have long switching time (especially at turn off). MOSFETs have very fast switching characteristics (low turn ON & turn OFF) but have high power losses. But IGBTs have low switching time as well as well as low power losses. So **IGBT** is popular now days.

History of HVDC Light Technology

HVDC transmissions have been built for more than half a century with a capacity of a single converter up to about 1500 MW at a transmission voltage up to ±600 kV. Applications have normally been bulk transmissions from distant power generation, long underground or sub-sea cable transmissions or asynchronous ties between different power systems. Applications to feed power to or from offshore installations, using HVDC, have been discussed for many years. However, due to the nature of conventional HVDC which requires certain strength of ac system, to operate, this has not been feasible in the past. Not until the HVDC Light technology was developed about ten years ago. The new technology is based on transistors as opposite to the conventional HVDC, which use thyristors. This difference makes the new converters self commutated i.e. they do not require an existing ac.

The first application of the HVDC Light technology was put into operation in 1997 and 2 years later the first commercial project was commissioned on the island of Gotland, Sweden. A total of 11 HVDC Light transmission systems are now in operation in different parts of the world. The first offshore application was commissioned early 2005 to feed the new compressors on the Troll a platform outside Bergen, Norway. This is a double circuit, 2 x 40 MW sub-sea HVDC cable installation from Kollsnes to the Troll A platform 67 km offshore feeding two large compressors.

Basic theory

HVDC Light technology uses the series-connected power transistors (IGBT) connecting voltage source converters to networks at high voltage level. This can be used for power transmission, for reactive power compensation and for harmonic/flicker compensation. With fast "vector control", this converter offers the ability to control active and reactive power independently while imposing low levels of harmonics, even in weak grids.

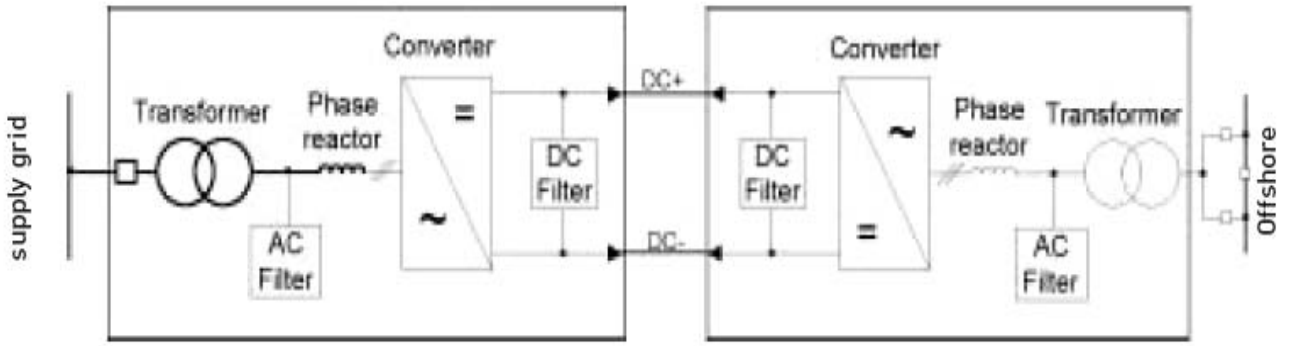

Fig. Principal components of HVDC light

In HVDC Light, Pulse Width Modulation, PWM is used for generation of the fundamental voltage. It also provides the steady state and dynamic MVAr capability reducing flicker, improving stability and regulation. It improves steady state and dynamic performance of the network. In HVDC Light, Pulse Width Modulation, PWM is used for generation of the fundamental voltage. Using PWM, the magnitude and phase of the voltage can be controlled freely and almost instantaneously within certain limits. This is also called phase angle control compensation. If, the power angle due to the line inherent parameters is not suitable to transmit desired amount of power through the line keeping $|V_s|$ and $|V_r|$ constant to previous value, then phase angle control can be used. For phase shifter can be used which is a voltage source whose phase angle is $\pm\pi/2$ out of phase with respect to V_s in such a way that,

$$Vseff = |Vs| = |Vr|$$

In phasor term;

$$Vseff = Vs + V\sigma$$

$$\text{Active Power transferred, } P = (V2/X)\,Sin(\delta + \sigma)$$

$$\text{Inductance of line is given by, } 1/Xl(\delta) = \left(\frac{1}{\omega L}\right)\left(1 - \frac{2\delta}{\pi} - \frac{Sin(2\delta)}{\pi}\right)$$

This allows independent and very fast control of active and reactive power flows. PWM VSC (Voltage Source Converter) is therefore a close to ideal component in the transmission network. From a system point of view, it acts as a zero-inertia motor or generator that can control active and reactive power almost instantaneously. Furthermore, it gives only a limited contribution to the short-circuit power, as the ac current can be controlled. Principle of pulse width modulation, PWM is no need for communication between the rectifier control on land and the inverter control on the platform in case of offshore is only quantity that needs to be detected in both ends of the transmission is the dc link voltage. The HVDC Light converter design is based on the two-level bridge but with the midpoint of the capacitor floating. The switching of the bridge between 0 kV and -150 kV makes optimal use of the coaxial HVDC cable design with the center conductor at high voltage and the return conductor close to the grounded screen. The design philosophy enables operation both steady state and dynamic, with extremely low levels of induced ground currents. This feature is one of the critical factors for implementing an HVDC system in an offshore environment. There is no need for any cathode protection in conjunction with the installation. Operation with fixed 60 Hz frequency in the offshore end and fixed 50 Hz grid frequency in the onshore end does not require main circuit equipment that differs from the normal design. The design principles adopted for normal transmission system applications can also be used to feed a local offshore ac network. Some of the more important benefits with an HVDC transmission feeding a platform are; Control of AC voltage and frequency Direct On Line (DOL) start of large asynchronous machines, ride through of mainland ac system disturbances. The performance of the HVDC transmission system together with the platform ac system has been verified in simulations using EMTDC, an Electro Magnetic Transient Stability Program for simulation of e.g. power transmission systems. The simulation set-up includes an equivalent of the mainland AC network, a detailed model of the HVDC main circuits including e.g. a switching converter bridge, filters and a dc cable model. The HVDC Light converter compensates almost momentarily for the active and reactive power needed by the accelerating motor. The bus voltage is therefore almost unaffected. It is only in the very first moments that a small dip can be seen. A HVDC Light converter is easy to control. The performance during steady state and transient operation makes it very attractive for the system planner as well as for the project developer.

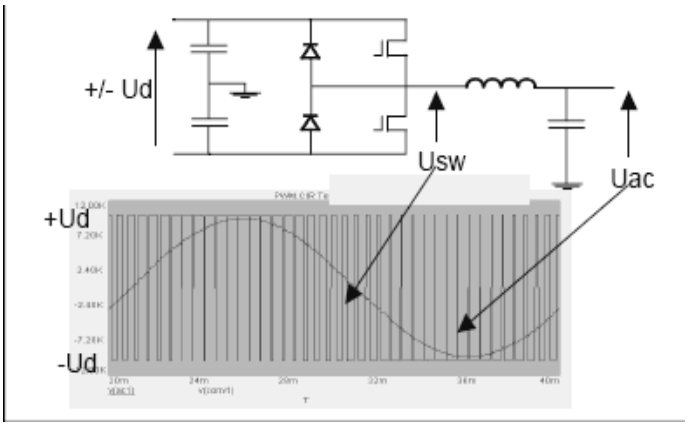

Fig. Principles of Pulse Width Modulation (PWM)

Control of active and reactive power

The control makes it possible to create any phase angle or amplitude, which can be done almost instantly. This offers the possibility to control both active and reactive power independently. As a consequence, no reactive power compensation equipment is needed at the station, only an AC-filter is installed. While the transmitted active power is kept constant the reactive power controller can automatically control the voltage in the AC-network. Reactive power generation and consumption of HVDC Light converter can be used for compensating the needs of the connected network within the rating of a converter. As the rating of the converters is based on maximum currents and voltages the reactive power capabilities of a converter can be traded against the active power capability. The combined active /reactive power capabilities can most easily be seen in a P-Q diagram (positive Q is fed to the AC network).

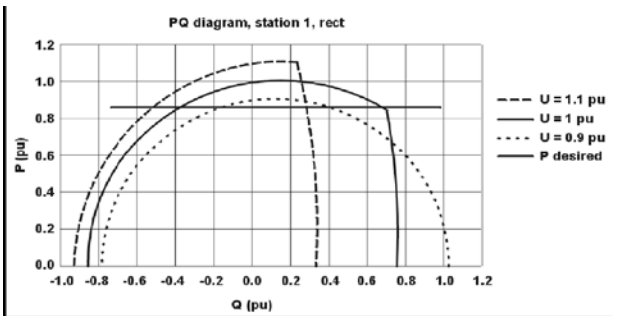

Fig. Capability chart, PQ Diagram

Power quality control

The Light converter has a switching frequency of 2 kHz that is 40 times faster compared to a phase commutated converter operated at 50 Hz. This offers new levels of performance regarding power quality control such as flicker and mitigation of voltage dips and sags, harmonics etc caused by disturbances in the power system. Power Quality problems are issues of priority for owners of industrial plants, grid operators as well as for the general public. In the presence of a fault which would normally lead to an AC voltage decrease the converter can be rapidly deblocked and assist with voltage support to avoid severe disturbances in local industries that are sensitive to voltage dips. The response time for a change in voltage is 50 ms i.e. for a step order change in the bus voltage the new setting is reached within up to around 3 Hz, thereby helping to keep the AC bus voltage constant.

Advantages of HVDC Light Technology

Space and weight are scarce resources on offshore installations. Particularly in the light of these constraints, the HVDC Light concept offers important advantages. Since the filters are small, HVDC Light can be made compact and light weight compared to other solutions. Apart from the obvious needs to make the converter station compact and lightweight, the offshore environment places a number of other demands on the converter station and equipment. Examples include: Safety for personnel as well as for equipment in a production and processing environment. Reliability and Availability is of utmost importance since a shutdown means shut down of the whole production. The offshore environment is very tough with salt and humid air which imposes severe requirements on the choice of materials and surface treatment. The high voltage equipment has been installed inside a module in offshore and indoor a building onshore. The ventilation system in the module/building will be designed to protect the high-voltage equipment and the electronics from salt and humid air. The main circuit equipment is therefore exposed to lower environmental requirements than a normal outdoor installation, which allows for a more compact design. The ventilation also has to take care of the airborne losses. An advantage of being offshore is that cold (5-11 °C) water for cooling is readily available. Another requirement on the ventilation system comes from possible presence of gas in the area. The installation offshore will be over pressurized to ensure that no gas can enter high voltage areas. In case gas is detected, the system is tripped and deenergized directly. A conclusion is that there are no additional requirements on main circuit equipment when installed in an offshore environment. Other advantages of HVDC light technologies are short delivery times, large rated power up to 200 MW environmentally friendly solutions.

The benefits are technical, economical, environmental as well as operational. The most advantageous are the following: Independent control of active and reactive power, feeding of power into passive networks (i.e.

network without any generation), power quality control, modular compact design, short delivery times, and unmanned operation, robust against grid alterations. Major electrical equipment is delivered in enclosures and tested at factory before shipment. This eliminates the need of any buildings and also makes the installation and commissioning faster than for a traditional converter. The heaviest piece of equipment weights about 20 tons and is transportable by truck direct to site. The modular design also facilities a relocation of the converters, should that be desired due to changed conditions.

Applications

The VSCs performance and characteristics invite to many new applications and concepts which previous has not been considered due to technical and economical limitations. The major driving force is the deregulation of the electricity market, where short delivery times, flexible systems and power ranges up to 200 MW are frequently used. Some applications of HVDC light technology are:

- Connecting Wind power farms to the grid
- Distributed generation
- Multiterminal DC-grid
- Interconnecting networks
- Utilizing existing Rights-Of-Way

Conclusions

It is widely recognized that the role of network services has changed as a result of the introduction of competitive power markets. HVDC Light is a DC transmission technology that has important advantages for application in competitive markets. These advantages include its modularity, standardized design leading to short delivery times, and compact stations and cables reducing environment impacts and controllability giving possibilities to match the power need and/or to control the voltage in the network. These features mean that HVDC Light facilities can be installed quickly in response to competitive market signals.

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Civil Engineering: An Introduction

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Civil Engineering is a discipline that deals mainly with the **DESIGN, CONSTRUCTION AND MAINTENANCE** of the physical and naturally built environment, including works such as Buildings, Bridges, Roads, Canals, Dams, Tunnels etc.

A design engineer creates the initial blueprints and schematics for various structures. Most design engineers use advanced computer technology and applications, such as computer-aided design (CAD) software, to help them create and test virtual models. Depending on the type of structure that is being built, a design engineer may be asked to construct a physical model or prototype to test in realistic situations.

Figure 1: Design

Construction Engineers implement the plans to build structures so that construction occurs safely while meeting legal code requirements. The construction engineer also does cost estimation, orders building materials, and selects equipment.

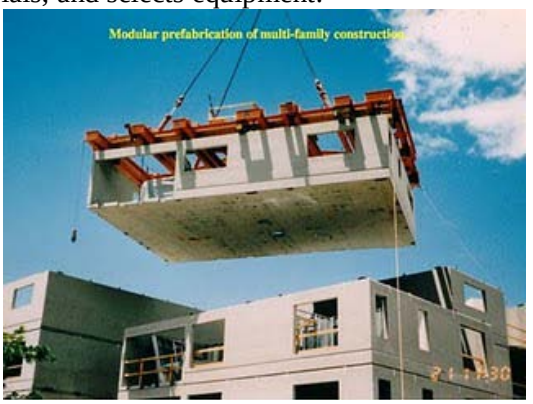

Figure 2: Construction

And **Maintenance Engineers** keep the physical structure in working condition.

Figure 3: Maintenance

History of the Civil Engineering Profession

Engineering has been an aspect of life since the beginning of human existence. The earliest practices of Civil engineering may have commenced between 4000 and 2000 BC in Ancient Egypt and Mesopotamia (Ancient Iraq) when humans started to abandon a nomadic existence, thus causing a need for the construction of shelter. During this time, transportation became increasingly important leading to the development of the wheel and sailing.

The Pyramids in Egypt, Great Wall of China, the stupas in ancient Sri Lanka and the extensive irrigation works in Anuradhapura are the major civil engineering structures constructed in the past. Similarly, The Romans developed aqueducts, insulae, harbours, bridges, dams and roads throughout their empire.

Figure 4: Egyptian Pyramid

History of Civil Engineering

In the 18th century, the term civil engineering was coined to incorporate all things civilian as opposed to military engineering. The first self-proclaimed civil

engineer was John Smeaton who constructed the Eddystone Lighthouse. In 1771, Smeaton and some of his colleagues formed the Smeatonian Society of Civil Engineers. In 1818 the Institution of Civil Engineers was founded in London, and in 1820 the eminent engineer Thomas Telford became its first president. The institution received a Royal Charter in 1828, formally recognizing civil engineering as a profession.

In most countries, a Bachelor's degree in engineering represents the first step towards professional certification and it is certified by a professional body. In Nepal Diploma in Civil Engineering is considered as a first step but it is recognized by Engineering Council only after attaining Bachelors degree.

Sub-disciplines

In general, civil engineering is concerned with the overall interface of human created fixed projects with the greater world. General civil engineers work closely with surveyors and specialized civil engineers to fit and serve fixed projects within their given site, community and terrain by designing grading, drainage, pavement, water supply, sewer service, electric and communications supply, and land divisions. General engineers spend much of their time visiting project sites, developing community consensus, and preparing construction plans. General civil engineering is also referred to as site engineering, a branch of civil engineering that primarily focuses on converting a tract of land from one usage to another. Civil engineers typically apply the principles of geotechnical engineering, structural engineering, environmental engineering, transportation engineering and construction engineering to residential, commercial, industrial and public works projects of all sizes and levels of construction. The following are the major sub discipline of Civil Engineering.

Structural Engineering

Structural engineering is concerned with the analysis and design of structures such as buildings, bridges, dams, towers, flyovers, tunnels, off shore structures like oil and gas fields in the sea, and other structures. This involves identifying the loads which act upon a structure and the forces and stresses which arise within that structure due to those loads, and then designing the structure to successfully support and resist those loads.

Figure 5: Burj Khalifa, worlds tallest building

Earthquake Engineering

Earthquake engineering covers ability of various structures to withstand hazardous earthquake exposures at the sites of their particular location. Earthquake engineering is a sub discipline of the broader category of Structural engineering. The main objectives of earthquake engineering are to understand interaction of structures with the shaky ground; foresee the consequences of possible earthquakes; and design, construct and maintain structures to perform at earthquake exposure up to the expectations and in compliance with building codes.

Figure 6: Earthquake Test

Geotechnical Engineering
Geotechnical engineering is concerned with the rock and soil that civil engineering systems are supported by. Knowledge from the fields of geology, material science and testing, mechanics, and hydraulics are applied by geotechnical engineers to safely and economically design foundations, retaining walls, and similar structures.

Figure 7: Slab-on-grade foundation

Water resources Engineering
Water resources engineering is concerned with the collection and management of water as a natural resource. This area of civil engineering is intimately related to the design of pipelines, water distribution systems, drainage facilities (including bridges, dams, channels, culverts, levees, storm sewers), and canals..

Figure 8: Itaipu dam, Brazil

Construction Engineering
Construction engineering involves planning and execution of the designs from transportation, site development, hydraulic, environmental, structural and geotechnical engineers. As construction firms tend to have higher business risk than other types of civil engineering firms, many construction engineers tend to take on a role that is more business-like in nature: drafting and reviewing contracts, evaluating logistical operations, and closely-monitoring prices of necessary supplies.

Figure 9: Construction going on

Transportation Engineering
Transportation engineering is concerned with moving people and goods efficiently, safely, and in a manner conducive to a vibrant community. This involves specifying, designing, constructing, and maintaining transportation infrastructure which includes streets, canals, highways, rail systems, airports, ports, and mass transit.

Figure 10: Highway in snowy area

Environmental Engineering
Environmental engineering deals with the treatment of chemical, biological, and/or thermal waste, the purification of water and air, and the remediation of contaminated sites, due to prior waste disposal or accidental contamination. Environmental engineers can be involved with pollution reduction, green engineering, and industrial ecology. Environmental engineering also deals with the gathering of information on the environmental consequences of proposed actions and the assessment of effects of proposed actions for the purpose of assisting society and policy makers in the decision making process.

Figure 11: A filter bed for sewage treatment

Surveying

Survey engineers measures certain dimensions that generally occur on the surface of the Earth by the help of surveying equipment, such as levels, theodolites, electronic distance measurement (EDM), total stations, GPS etc. This information is crucial to convert the data into a graphical representation of the Earth's surface, in the form of a map. This information is then used to design from, build on, and trade, respectively. Although surveying is a distinct profession with separate qualifications and licensing arrangements, civil engineers are trained in the basics of surveying and mapping, as well as geographic information systems.

Figure 12: Surveying

Municipal or Urban Engineering

Municipal engineering is concerned with municipal infrastructure. This involves specifying, designing, constructing, and maintaining streets, sidewalks, water supply networks, sewers, street lighting, municipal solid waste management and disposal, storage depots for various bulk materials used for maintenance and public works (salt, sand, etc.), public parks and bicycle paths.

Coastal Engineering

Coastal engineering is concerned with managing coastal areas. In some jurisdictions, the terms sea defense and coastal protection are used to mean, respectively, defense against flooding and erosion. The term coastal defense is the more traditional term, but coastal management has become more popular as the field has expanded to include techniques that allow erosion to claim land.

Materials Engineering

Material engineering deals with development and use of different material to be used in engineering works. Cement, Concrete, HDPE polyethylene pipe etc are the contribution of material engineer. It focuses on increased strength, durability, weight, cost etc.

Career Opportunity:

There is no one typical career path for civil engineers. However Civil Engineering graduates will have the good opportunity to take part in the development of the nation. Being a developing country, Nepal need to build the infrastructures like Hydropower, Roads, Bridges, Airports, Dams, Irrigation canals, Water supply schemes and residential and business complexes. From survey, design, estimate and construction, civil engineers have major role to play in such projects. In Nepal, Civil Engineer can build their career in:

Government Sectors: Different government ministries such as Ministry of Local Development which includes District Development Committee and Municipalities; Ministry of Housing and Physical planning includes Department of Roads, Civil Aviation Authority, Department of Building, Department of Water Supply and Sanitation; Ministry of Water Resource includes Department of Irrigation, Ministry of Energy etc. At present, approximately 2500 civil engineers are employed in Government Sector.

Consulting firms (Consultancy): More than hundred consulting firms are providing service and most of the employees are Civil Engineers. At present approximately 2000 Civil Engineers are employed.

Construction Companies: More than five hundred registered construction companies and more than thousand unregistered contractors are involved in construction of infrastructures all over the country. Some construction companies are employing more than 50 civil engineers alone. Thus we can guess that thousands of civil engineers are employed in this industry.

Similarly, hundreds of Civil engineers are working in National and International Non- Government organizations most of which are registered in Samaj Kalyan Parisad (Social Welfare Council).

More than 6000 Civil Engineers are registered in Nepal Engineering council and more than thousand civil engineers are being produced every year. Country need to utilize these valuable manpower for the development of the country.

Urban Mobility: The Role of Public Transportation

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Abstract:
This paper deals with the current problems of urban mobility in developing countries like Nepal, from the perspective of public transport services. Pollution and congestion have rapidly become a key problem in many cities of developing countries, leading to delays in transport and side-effects such as sickness and long travel times. However, solutions to these problems appear to be particularly complicated, especially because the policy of transport sector is often poorly formulated to reflect the needs to direct resources towards efficient provision of services, which most part of the population could utilize. This is made even more difficult by the fact that subsidized public transport will reduce private sector incentives to service provision, leading to crowding out effects. However, these issues are confronted by the fact that infrastructure and use of it are crucial components of a development process. This paper aims to sharpen the current policy focus on urban transport system development in the developing countries, taking into consideration the problems and advantages of a transport system where public transport is effectively prioritized against other forms of transport. Some aspects of the public transport service of Kathmandu were taken as case study. The results of a questionnaire survey conducted by the students for the academic project work are presented in the paper.

INTRODUCTION

Transportation infrastructure is vital to the economic growth and well-being of cities, particularly in developing parts of the world, where transport investments account for as much as 40 per cent of public-sector expenditures.

Competitiveness of cities is based on their infrastructure. Cities are no longer considered as fixed locations for production but logistical centers that manage flows between distant points. This type of an argument is gaining ground in the literature on urban transport, no doubt because it is derived from the backbone of current infrastructure development in urban settlements: number of passenger is increasing, demand on infrastructure is very high and land becomes scarce, especially in the urban areas. But what are the experiences so far? Do we have any guidelines to give based on the past developments? Do we have any information on how we should deal with issues such as cost recovery, subsidies, contracting, private provision of services vs. public provision etc?

This paper tries to identify the necessary framework for successful provision of public transport in the cities like Kathmandu. State of the problem at present, hopefully provoke discussion and help to avoid future flaws in Public Transport planning, design and operation.

This paper is an attempt to conceptualize the role of public transport in development. This conceptualization in based on the fact that almost every transport system in the world has a component of public transport, yet the role of this component is far from clear. This topic is of more importance than one would conclude from an initial assessment. Looking ahead for the challenges facing our countries, one of the key questions is what will be the outcome if our country reaches a higher level of development? Can we sustain this effort? Efficient and reliable transport system, with special emphasis on the needs of the poor people, is a necessary condition for developing countries to maintain their competitiveness. Early experiences of countries with a rapid speed of development and associated high GDP growth suggest that constraints to economic development may well be imposed by labour and transport markets. We should grasp the role of public transport for the reason that it is the part of transport provision, most likely to benefit the poor people and sustainable development. The arguments to support this are the following:

- In developing countries, a large share of the population lives below poverty line, meaning that they cannot afford private means of transport.
- For the very same reason, a relatively small part of the population can afford car ownership, which makes investments into infrastructure that supports car use peculiar.
- Finally, for the poor participation to labour force and the access to basic services is greatly dependent on availability of public transport.

Major issues in the sector

Urban transportation system could be divided into two parts private modes and public (mass movement) transport. In Kathmandu, we have only road based transport system. It is very early to think about Rail based urban transport. Main questions for us are: How do we evaluate our daily trips? Are we satisfied during travel? How do reflect our travel-stress to our daily activities? Some of the issues to address for better urban transport are listed below.

1. **Restructuring, private participation and regulatory arrangements**

- What restructuring models have been adopted in similar situations around the world?
- Which is the most appropriate model for Kathmandu?
- What institutional, administrative, and regulatory changes need to be brought about to facilitate restructuring?
- What legislative changes would be necessary?
- Who should allocate routes and schedules amongst bus operators? Should a government agency or an independent body outside the government do this?
- What institutional, administrative and legislative arrangements would be necessary to monitor the quality of service norms?
- Which agency should be responsible for data collection and management?

2. Coordination functions

- Is there a multiplicity of agencies?
- What coordination activities would need to be carried out?
- Which agencies would be involved?
- What are the merits and demerits of a statutory agency carrying out such coordination?
- Should the coordination mechanism be independent of the government or a part of it?

3. Dispute resolution

- What would the best mechanism for dispute resolution be?
- What systems exist elsewhere and which of them can be replicated in Nepal?
- What legislative changes, if any, would be required for dispute resolution mechanism outside of the normal judicial process?

4. Fixing fares and fees

- On what principles should tariffs for public transport be based?
- On what principles should tariff revisions be based?
- Who should determine these tariffs?
- What are the skills required for such activities?
- On what principles should the integration of fares between different modes be used?
- What models are used internationally?
- How should the tariff be linked to the cost of inputs?

5. Route and network design

- What parameters should be taken into account in designing route networks?
- What is the present practice for route design in Nepal?
- What is the international experience in route network design, the institutional arrangements, and parameters taken into account?
- How often should this be done?
- What skills would be required for such an exercise?
- How should this information be disseminated to the public and for research purposes?

6. Route allocation and issue of permits

- On what criteria should route allocation to bus operator be based?

7. Specification, monitoring and enforcement of the quality of service standards

- Which parameters should be monitored for determining quality of service and specifying standards for quality of service?
- What method should be used to define the quality of service norms?
- How should the quality of service norms be monitored and enforced? Who should monitor and enforce them?

8. Data collection and management

- What kind of data needs to be collected and maintained?
- How should the data be collected and managed?
- How should universal access to the database be ensured?

How should we approach transport?

"The principal objective of the National Transport Policy is to develop a reliable, cost effective, safe facility oriented and sustainable transport system that promotes and sustains the economic, social, cultural and tourism development of the Nepal as a whole". National Transport Policy-2058.

On the topic of public transport, NTP-2058 states: "Special attention shall be given to improving the comfort, reliability, safety, frequency, availability and affordability of public transport and to reducing harmful emissions arising from public transport operations."

From the above statement the desirable characteristics of the transportation system and public transport can easily be understood. We can compare our ground reality with our policy statements. Are we doing something to achieve objectives? There are a number

of different factors affecting the transport sector, not to mention the public transport in particular. Policies targeted to other parts of the economy can have significant impact on transport sector as well. It is fact that a lot of policies tend to have vicious, sometimes unforeseen, consequences on other sectors.

Outside the policy framework, there are a number of broader economic and society based issues that alter the need for transport policies, especially regarding the public transport. The following broad development agendas are closely related to public transport provision:

Poverty and transport: are closely linked. In fact, extreme poverty in rural areas is often associated with limited access to transport networks, but similar co-incidence takes places in the urban context as well. Lack of good transport system is harmful for the economic potential of any given region. Economic losses resulting from a poor transport system are substantial. In fact, poverty is also a major obstacle for the poor in participation to economic activities, as additional problems are created by long travel times and costs of the travel. Part of the strategic city planning should be the setting of user fees so that the poor are not excluded from using the services.

Urban transport can contribute to poverty reduction both indirectly, through its impact on the city economy and hence on economic growth, and directly, through its impact on the daily needs of poor people.

Equity: Public transport addresses important equity concerns. In developing countries, car ownership is limited and those with assets enough to buy a car are small elite of the population. Public fund allocated for the infrastructure development should always consider for the equity between car-owner and car-less people. This can be achieved by constructing wide sidewalks, public parks and developing the public transport system.

Environmental concerns: these are not the least influential issue. In fact, the problems associated with emissions and land-use in developing countries carry a considerable losses directly and indirectly. Impacts can become global through the greenhouse-effect and other means of transferring the pollution. More efficient and reliable public transport can reduce the need to use private vehicles and through less traffic also the level of emissions caused by, for instance, congestion.

Need for restructuring the public transport system

As mentioned above one of the major issues in the public transport sector is to choose a suitable model for our context. Our public transport system is based on nothing in terms of scientific or any economical principles. The productive efficiency of urban agglomerations will be maintained only if mobility requirements in the cities are fully met. However, this productive efficiency in Kathmandu is now threatened by the increasing number of vehicles causing congestion, and thus slower speeds on roads. Transportation infrastructure appears to be the primary bottleneck for the unimpeded growth of city. Thus, it is important that the existing transportation infrastructure be utilized optimally. This would imply meeting mobility needs efficiently through a greater modal share of public transport.

Another major consideration for restructuring public transport is our past experiences from the operation of "Trolley Bus" and "Sajha Yatayat" and other state owned corporation. With greater emphasis on fiscal discipline, it is becoming increasingly difficult for governments to continue funding loss making ventures. In this context this is the time to make policies strategies concentrating on the role of state and obligation of the private operators in providing efficient transport services to the public.

Public transport is less polluting and causes less congestion than personal vehicles, on a per passenger trip basis. The road space occupied by each of these vehicles and the pollution caused by them is given in table below.

Table 1 Comparison of various modes

Type of Vehicle	Pax/vehicle	Pollution Load in g/pax-km	Congestion effect in PCU/Pax
2-Stroke 2 wheeler	2	7.31	0.375
4-Stroke 2 wheeler	2	4.76	0.375
Car with Petrol engine	4	0.93	0.25
Bus with diesel engine	40	1	0.075

(Source: TERI Report No.2001UT41)

The given table shows that though cars (fitted with catalytic converters) and buses have about the same pollution effects on a per passenger basis, buses have the advantage of occupying less road space, thus causing less congestion and consequent pollution. On the other hand, two-wheelers not only have a far more damaging effect on the environment than cars and buses, but are also undesirable from a congestion point of view. Hence, among the above modes of transport, buses are clearly the most desirable.

Streets in Kathmandu are crowded by the motorcycles. This is the not suitable mode of transport in any aspect, but it is the single solution for the middle level income people to choose it. Poor service quality of public transport is caused to choose us this very uneconomic and unsafe mode of urban transport.

THE ROAD TRANSPORT SYSTEM MANAGEMENT

Even in highly congested cities, urban road transport efficiency can be improved through better system management. Although rapid development of technology has reduced the cost—as well as the maintenance and operational skill requirements—of modern traffic management techniques, many cities are still too poorly organized and inadequately staffed to make effective use of this development. Both technical assistance and investment are capable of yielding high returns in this field, as long as fundamental institutional and human resource problems are addressed. Urban road decay is a serious problem in Kathmandu. Road decay contributes to congestion and increasing operating costs. It often arises from jurisdictional conflicts—such as conflicts, over which authority is responsible for which roads, lack of clear ownership of neighborhood roads, or inadequate allocation for urban roads from the state road funds through which road funding is channeled.

NONMOTORIZED TRANSPORT

NMT is systematically under-recognized. In the cities like Kathmandu non-motorized trips have significant portion of total mode share. Walking still accounts for the largest proportion of trips taken. All income groups are involved. Despite this fact the welfare of pedestrians, and particularly the welfare of mobility-impaired pedestrians, is frequently sacrificed in planning to increase the speed of the flow of vehicles. Cycling is similarly disadvantaged. Without a continuous network of secure infrastructure, people will not risk bicycle travel. Without users, investment in infrastructure for cycling may appear wasteful. A comprehensive vision and action plan for NMT is required. In the planning and management of infrastructure, the excessive emphasis on motorized transport may be redressed.

Incorporation of responsibilities for provision for NMT should also be included in road fund statutes and procedures. Traffic management should be focused on improving the movement of people rather than on improving the movement of motorized vehicles. In order to achieve that goal, traffic police need to be trained to enforce the rights of NMT in traffic priorities as well as in recording and preventing accidents.

BUS BASED PUBLIC TRANSPORT

Public transport is for all. Concentrating on the transport modes of poor and middle income group of people essentially means the provision of affordable forms of public transport. But it should not be viewed as only for the poor, as the importance of public transport to all income groups in many rich European cities demonstrates. Improving efficiency in public transport must be concerned not only with keeping costs down but also with providing a flexible framework within which the less poor as well as the very poor can use public transport with confidence and comfort.

Most urban public transport is road based. Bus lanes and automatic priority at intersections can improve public transport performance significantly, but these solutions tend to suffer from inadequate enforcement by implementing agency as traffic police, who are untrained in traffic planning and management. In contrast, exclusive busways in developing countries have proved to be capable, except in very high traffic volume corridors, of performance nearly equivalent to rail-based systems but at much lower cost.

There is a rich agenda of urban public transport policies that is both pro-growth and pro-poor. The recent decline in both the quality and quantity of public transport has resulted partly from the absence or disappearance of a secure fiscal basis for support. Public transport, however, can be improved in many ways that are consistent with the fiscal capabilities of our context. Giving priority to public transport in the use of road space makes public transport faster and more financially viable.

Cities should strive to mobilize the potential of the informal sector. Informally supplied small vehicle paratransit (publicly available passenger transport service that is outside the traditional public transport regulatory system) is often dominant in providing for dispersed trip patterns and in flexibly addressing the demands of poor people, particularly in low income countries, but it is typically viewed as part of the problem of public transport and not part of the solution. Certainly, anticompetitive or antisocial behavior should be controlled through quality controls and enforcement, but its potential can be better mobilized through legalizing associations and through structuring franchising arrangements to give the small operator an opportunity to participate in competitive processes.

MASS TRANSIT

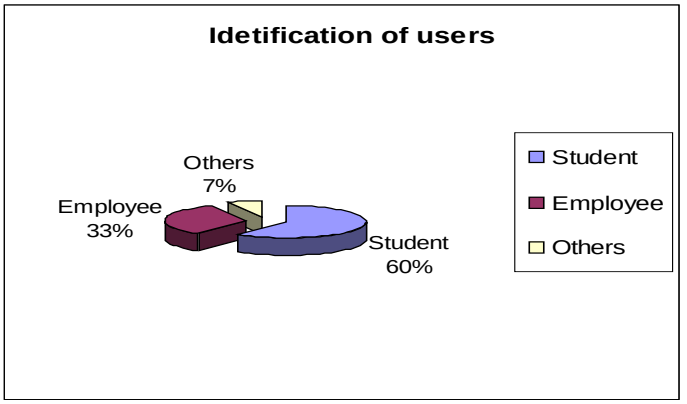
Rail-based mass transit systems have a role to play in very large cities. Rail-based mass transit systems are less congesting than are road-based systems and can be

very important for those who are peripherally located and have long journeys to access employment in the cities. However, it is very costly to build the rail based mass transit system in Kathmandu. Investors can be encouraged by the BOOT system.

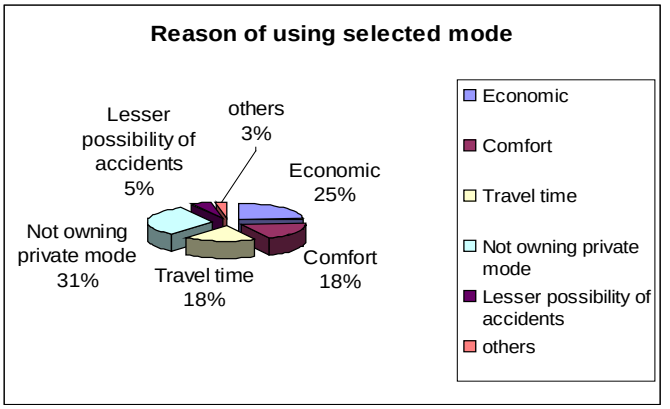
The next solution on the mass transit is to build Bus Rapid Transit (BRT) system. It is exclusive bus-way system. This system can be constructed with very low cost than rail system but the mass transit efficiency can be as much as higher of the rail system. Many developing countries have been started to operate BRT system as the optimum and effective solution to the mass transit.

CASE STUDY: Service Quality of Public Transport in Kathmandu

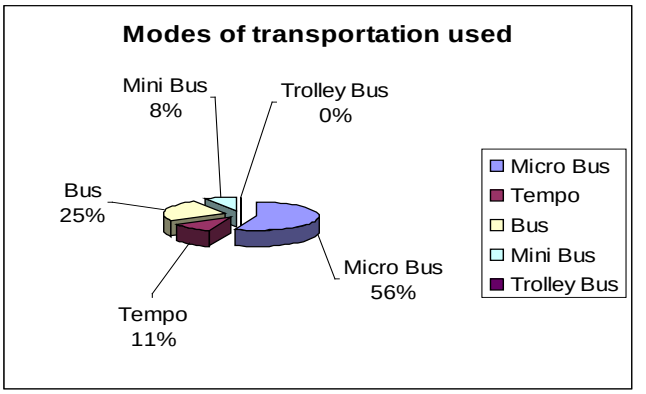
Survey sample: all the respondent were the user of public transport among them were 33 % of employee, 60% of students and 7% others.



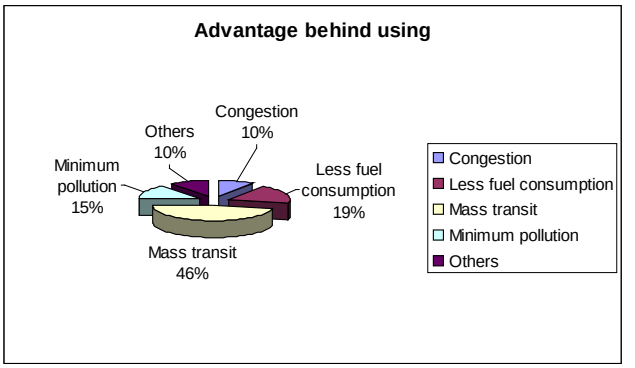
Reasons for using public transport: The major reason behind using the public transport was that, they do not own the private means of transport such as Motorcycle or car. Second reason was economic but it can be linked with the first reason for using the public transport.



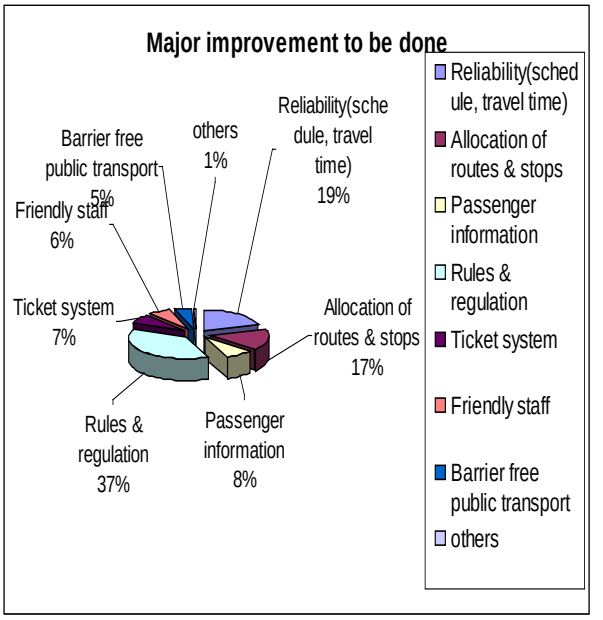
Modes of public transport used: Among the mode of public transport micro-bus was found most popular in Kathmandu valley.



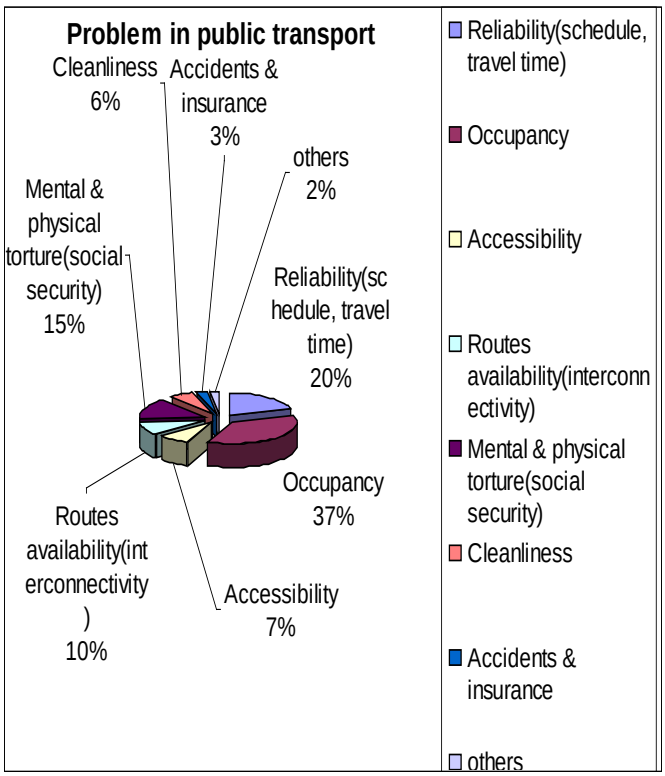
Advantage of using public transport: The respondent have disclosed the advantages of public transport such as: congestion reduction, minimum pollution, less fuel consumption and mass transit facility.



Major improvements to be done for Public Transport: Rules regulation, reliability of travel time and schedule, non-friendly bus staff, allocation of routes and stops and passenger information are main improvements to be done for the better public transport in Kathmandu.



Problems in Public Transport: Respondents disclosed major problems such as cleanliness, insurance, mental & physical security, reliability, route connectivity etc. in traveling by public transport in Kathmandu.



Conclusion

Urban areas are the engines of national economy, urban mobility the fuel for this engine. Three key points for successful management of urban transport system may be pointed out:

- Well-designed and well-constructed basic infrastructure network.
- Proper transport management must be in place. Transport management in developing countries in many cases lacks resources, mandate and political will. These three combined lead to inefficiencies and management problems.
- Public transport must be part of the transport system. Focusing on the public transport and buses, one of the key elements is the above discussed role division between private and public sectors.

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4. Restructuring options of public transport in India Final report. Prepared by the Department of Transport, land, and the Region s, UK, 2001.
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Script in AutoCAD

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Introduction

In Auto Desk's AutoCAD, script writing facility is a very useful tool but most of the AutoCAD users are unfamiliar with this facility. In this article, the brief introduction to scripting in AutoCAD is given which may be very useful to the most of the general AutoCAD users. The examples and step by step method of using script command in AutoCAD is given, which should be read and understand first, and then tried directly in the computer.

Using script files, different AutoCAD commands can be combined and execute them in a predetermined sequence. Script command in AutoCAD, reads the commands from a text file and then execute it sequentially. The commands can be written as a text file using any text editor like Notepad, MS Word or AutoCAD's EDIT command. Generally, Notepad is used to write the script files, as it is assigned as a default text editor file, when AutoCAD is installed in its default format. To start Notepad, either directly 'Notepad' is typed in the AutoCAD command button or it can be started through Start menu-Accessories-Notepad.

Script files can be used to generate a slide show, do the initial drawing setup or plot drawing to a predefined specification. It can also be used to draw the drawings, referring the database in a text file; the script file is also capable to create simple animations in AutoCAD. In civil engineering, the script files can be used to draw the co-ordinates of the tachometric data. Some specific curves can be drawn using script file such as a parabola (for e.g. tendon of a suspension bridge). It doesn't really mean that, the above tasks can be done only by script file, the same task can be done by different other approaches also.

Characteristics of Script File

a. To run the text file as a script in AutoCAD, the extension of a file name must be .scr, for e.g. the file should be saved giving the file name 'drawclock.scr', where drawclock is a file name and scr is its extension.
b. The script file should only contain Texts (ASCII Characters). No characters such as %,*, $, ^, # etc. are allowed.
c. Must use command line syntax only. The commands which display dialogue box are not allowed to use. These commands can be used after converting them to command line syntax.
d. The script file doesn't accept command aliases (Short form of the command). For e.g. to draw a line, only typing 'L' is not enough, the full command 'LINE' must be typed.
e. The script file ignores the line behind Semicolon; so semicolon is used to place comments in script files.
f. Blank space in script is equivalent to pressing Enter key in AutoCAD. So it has a prime importance, the blanks (pressing Space Bar) should be checked very carefully.

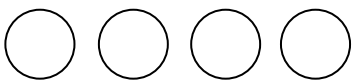
Examples of Script File

1. **To draw simple objects executing a sequence of commands**

Drawing Circles

This is the simple example of the use of script command. This example simply draws four circles with specified diameter and co-ordinates of the center point. Note that, for clarity in the texts, the underscore "_" is used to mark the space.

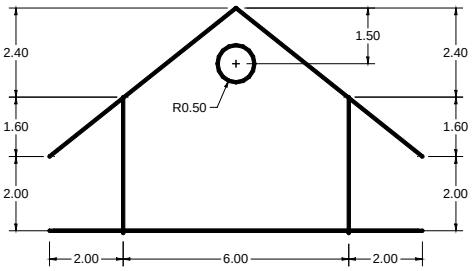
Circle_2,2_1.5
Circle_6,2_1.5
Circle_10,2_1.5
Circle_14,2_1.5
Zoom e



Drawing House

Drawing a simple elevation of a house shown in fig. using script file.

Line	*Line*	*@-2<90*
2,2	*2,4*	*N*
@10<0	*7,8*	*Id*
_	*_*	*7,8*
Line	*Mirror*	*Circle*
4,2	*All*	*@1.5<270*
4.5,6	*_*	*0.5*
_	*7,8*	



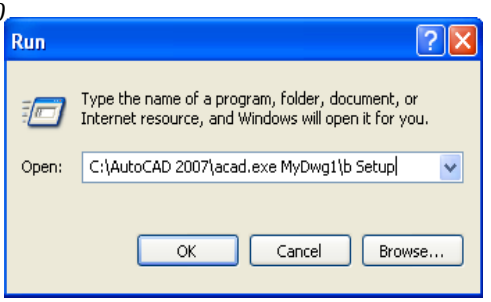
2. To perform the Initial Setup of a Drawing

The script file can also be run when loading AutoCAD, without getting into the drawing editor. The format of the command for running a script file when loading AutoCAD is :

Drive>AutoCAD2007[existing-drawing][/t template][/v view]/b script-file

First script file is written and save the file under the name Setup.scr. The following file is a sample listing of the script file that does the initial setup for a drawing.

Grid 2.0
Snap 0.5
Limits 0,0 36.0,24.0 Zoom all
Setvar Textsize 0.25
Ltscale 3
Setvar Dimscale 3.0
Layer New
Obj,Cen, Hid, Dim
L Center cen
L Hidden Hid
C Red obj
C Yellow Cen
C Blue Hid
C Green Dim



3. To Create a Slide Show

AutoCAD provides a facility using script files to combine the slides in a text file and display them in a predetermined sequence. In this way, a slide show can be generated for a slide presentation. A slide is the snapshot of a screen display; it is like taking a picture of a display with a camera. The slides do not contain any vector information's so it can not be edited like drawings.

Slides are first created using MSLIDE Command. Generally, shaded final 3D image were made slides and stored in certain folders to view later on as a slide show. AutoCAD will save the slide file with .SLD extensions. To view the saved slides VSLIDE command can be used. AutoCAD will then prompt to enter the name of the slide file.

After saving the slide files, now a script file can be written to generate a slide show with a time delay of 15 seconds after every slide.

Vslide Slide1
Delay 15000
Vslide Slide2
Delay 15000
Vslide Slide3
Delay 15000
Rscript

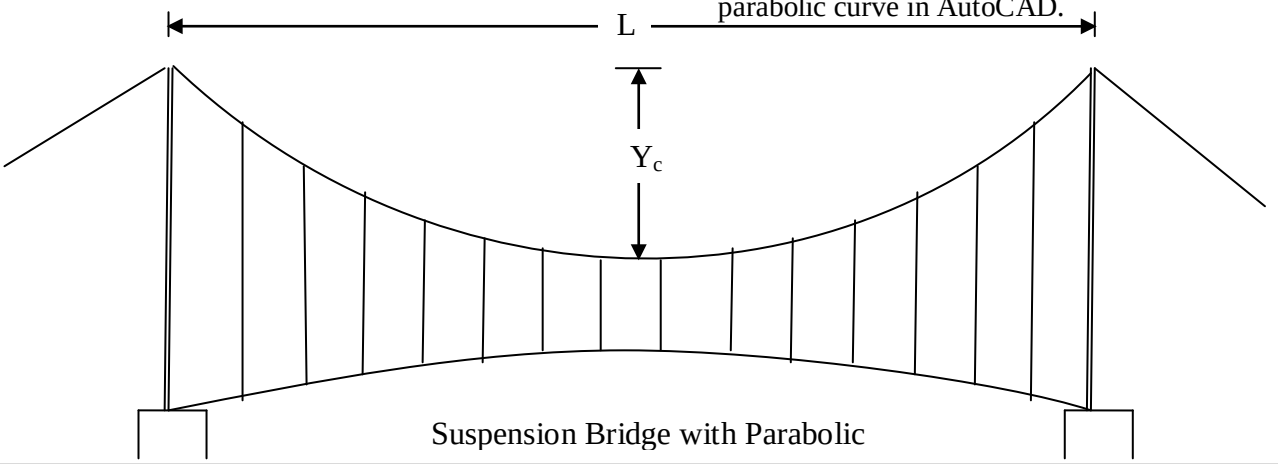
4. To plot the Parabolic Curve

The tendon of the suspension bridge is parabolic; to analyze the curve type structure in SAP or Staad we have to first draw it. Generally, to draw directly in these structural software is very complicated so the shapes are first created in drawing based programs like AutoCAD and then it is saved as .dxf (Drawing Exchange Format), which can then be imported to the structural analysis programs. Here, a simple method to draw the parabolic curve in AutoCAD is illustrated,

The equation of parabola is:

$$y = 4\, y_c * x\, (L-x)/L^2$$

Now, lets Say the value of Span L = 80m and the Sag y_c = 12m, and we have to draw the parabolic curve in AutoCAD.



Suspension Bridge with Parabolic

In finite element based software's like SAP and Staad, the curve is break into a straight line with a negligible but finite length. The same approach is used here to draw the curve, i.e. the parabolic curve is drawn in AutoCAD as a combination of small straight line segments. We generally use MS Excel to find out the coordinates of the starting and ending points of the finite straight lines composing the parabolic curve.

Let's break the curve into 80 small lines with each lines horizontal length equal to 1m. Now to find the y co-ordinates of the lines the value of x is put in the above equation of parabola in MS Excel Cells, as shown below in tabular form.

	A	B	C
1	X	Y	(X,Y)
2	1	-0.5925	1,-0.5925
3	2	-1.17	2,-1.17
4	3	-1.7325	3,-1.7325
5	4	-2.28	4,-2.28
	..	..	..
	80		

Formula in Cell B for 2th Row,
= 4 * (-12) * A2 * (80-A2)/80^2

Formula for Cell C for 2th Row,
= Concatenate (A2, ",", B2)

For other rows the formula in cell 2 can be dragged down.

After having the coordinates of the finite lines it can easily be drawn in AutoCAD using the Script file. The curve can also simply be drawn by pasting the coordinates of the points into AutoCAD after giving 'line' Command in the command prompt.

5. Drawing the Tachometric Survey data

One of the most important uses of script file is to draw the survey data. In tachometric survey we have to draw the points with specific coordinates in AutoCAD drawing. This can be done very conveniently using the script file as given below.

-Layer_m_"Station A"_C_5
_
_
Text_2,2,5_5_0_2,2,5
Point_2,2,5
Text_12,10,25_5_0_12,10,25
Point_12,10,25
-Layer_m_"Station B"_C_15
_
_
Text_42,50,65_5_0_42,50,65
Point_42,50,65
Text_52,60,75_5_0_52,60,75
Point_52,60,75

6. Creating Simple Animations

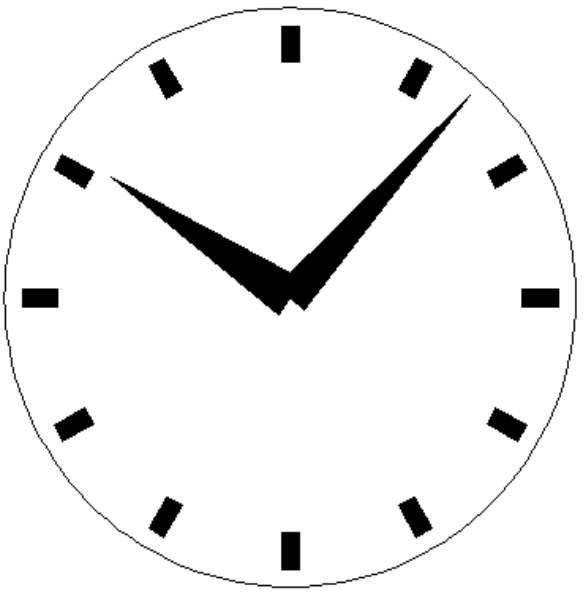
Animated Clock

This example simply draws the Clock and rotates its hands continuously.
Two separate script files are written in Notepad, and the first script file is run to draw the clock and the second script is run to animate i.e. continuously rotate the hands of the clock.

; Creates a Clock	; Animate (Rotate) Clock
Erase	Rotate
All	C
-	3,3
Circle	6,6
5,5	R
4	L
Pline	-
5,8.75	5,5

W
0.25
0.25
@0.5<270
-
Array
L
-
P
5,5
12
360
Y
Pline
5,5
W
0.5
0
@3.75<90
-
Pline
5,5
W
0.6
0
@3<90

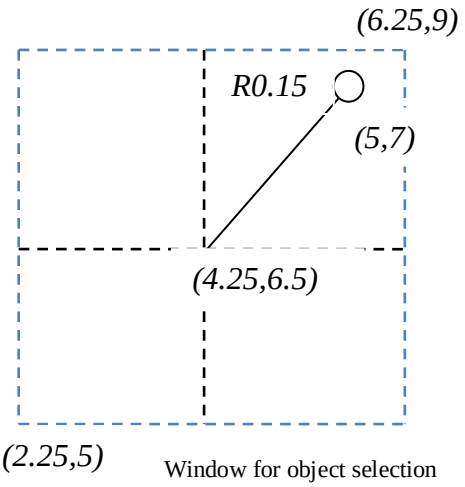
-6
Rotate
L
-
5,5
-0.5
Rscript



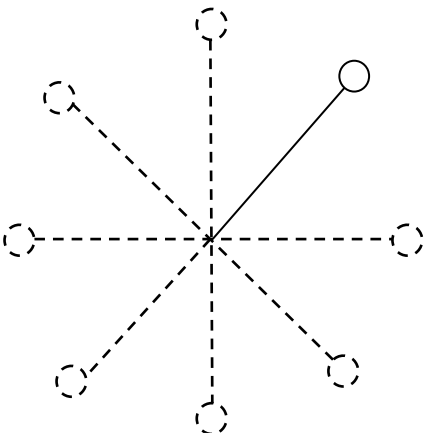
Animated Circle

This example rotate the circle and a line around the lower end point of the line through 45° increments as shown in fig. the object is continuously rotated with a time delay of 2 seconds after every 45° rotation.

Rotate
W
2.25,5
6.25,9
_
4.25,6.5
45
Delay_2000
Rscript



Window for object selection



Object Rotation

Animated Line

Similarly a script can be written that will continuously rotate a line in 10° increments around its midpoint with time delay of 1 second.

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4. *AutoCAD Manual, PNET, Alin C. Shakya*
5. *AutoCAD Manual, CSE*
6. *Finite Element Method, Bathe*
7. *Discrete Mathematics, Johnsonbaugh*

ढलानकार्यको लागि सिमेन्ट एक जानकारी

जगदिश्वर मान श्रेष्ठ
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जगदिश्वर मान श्रेष्ठले वी.ई. (सिभिल) र एमएस्सी (स्ट्रक्चर) ई.अ.स. पुल्चोक क्याम्पसबाट क्रमश २०४७ र २०५६ मा गर्नु भएको थियो । सिंचाई विभागमा १९ वर्षदेखि अनवरत कार्य गर्दै सिक्टा सिंचाई आयोजनाको सम्पूर्ण डिजाइनमा संलग्न भई हेडवर्क्स निमार्ण कार्यको Quality Control Engineer भएर चार वर्ष भित्र १,६७,८१० घ.मि.कन्क्रिट कार्य सम्पन्न गर्नुको साथै, उक्त कार्यको २०,१३६ वटा Sample cube test समेत गर्नु भएको थियो । हाल १०० घ.मि. क्षमताको रानी जमरा कुलरिया सिंचाई आयोजनाको डिजाईन तथा शुरु भएको निर्माण कार्यमा संलग्न हुनुहुन्छ ।

ढलान गरिएको कंक्रिट एक अप्राकृतिक ढुङ्गाको रुपमा लिन सकिन्छ, जसमा सिमेन्ट, गिट्टी र वालुवाको समिश्रणमा पानी मिसाइएको हुन्छ । ताजा कंक्रिट जुनसुकै आकारमा पनि बनाउन सकिने हुँदा र अन्य वस्तुभन्दा अत्यधिक बलियो हुनाको कारण निर्माण सामाग्री मध्य हिजो-आज ज्यादै लोकप्रिय रहेको छ । तर कंक्रिट मात्रको ढलानमा तन्काई प्रतिरोधक क्षमता (Tension Resistane Capacity) कमी भएको कारण जहां तन्किने ठाउँ छ त्यहां डण्डी (Rebar) राखी बलियो बनाइन्छ । यसैलाई नै डण्डी राखिएको ढलान अर्थात आरसीसी (Reinforced Concrete) ढलान भन्ने गरिन्छ । हिजो-आज विश्वभरी भवन, बांध, पुल, सुरुङ आदिको इन्जिनियरिङ क्षेत्रमा यसको माथि उल्लेखित फाइदाको कारण प्रचुर मात्रामा प्रयोग भएको देखिन्छ । यसो हुनुको मुख्य कारण यसका लागी चाहिने सामाग्रीहरु ढुङ्गा, बालुवा स्थानीय तवरमा अधिकांश रुपमा उपलब्ध हुनु र यातायातमा सुविधा भएको जुनसुकै ठाउँमा पनि सिमेन्ट तथा डण्डी सजिलैसँग उपलब्ध हुनु नै रहेको छ । अहिले त गाउँघरमा समेत ढलान भन्ने कुरो देखासिकीमा दाल-भात खाएको बरावर गरी विना प्राविधिक सल्लाह निर्माण कार्य बढ्दै गएको देखिन्छ । ढलान कार्यमा प्रयोग हुने मुख्य सामाग्री डण्डी तथा सिमेन्टको गुणस्तर उत्पादनकर्ताले नै गुणस्तरको मापदण्ड अनुसार जिम्मेवारी लिई गरिन्छ । यसको निश्चित गुणस्तर सम्बन्धमा ठूला निर्माण कार्यको हकमा आफै टेष्ट गर्ने प्रावधान हुन्छ भने साना निर्माणकार्य घर आदिको कुरा जसमा अत्यधिक जनताहरु निर्भर रहन्छ, तिनीहरुले अनुभवी प्राविधिक सल्लाह अनुसार गर्न उचित रहन्छ । प्राविधिक पनि एक सामाजिक प्राणी भएको नाताले हरेक व्यक्तिले घर बनाउनु अगाडी नजिकको प्राविधिकसँग नक्सा बनाउने देखि लिएर निर्माण पूर्व सिमेन्ट, छड आदिको जानकारी लिने गरिन्छ । तर हरेक प्राविधिक (ईन्जिनियर) भवन निर्माणमा दखल भएको हुँदैन र आफुलाई थाहा छैन भन्न पनि लाज हुने भएकोले अज्ञानको कारण जवाफ दिइहाल्नाले प्राविधिकहरुको फरक मतले भ्रम सृजना भएको पाइन्छ । तसर्थ यस समस्या निराकरणको लागि सिमेन्टको वारेमा जानकारी दिने हेतुले यो लेख लेख्ने जमर्को गरिएको छ ।

१. परिचय

सिमेन्ट एउटा जोड्ने चीज हो, जुन अरु सामाग्रीहरु गिट्टी र बालुवा संग जोड्ने कार्य भई आफैमा कडापन आई एक ढिक्का हन्छ । सिमेन्ट मिसावटको हिसावले साधारण तथा दुई किसिमको ओ.पी.सी. (Ordinary Portland Cement) र पीपीसी (Pozollona Portland Cement) हुन्छ । प्रयोजनको हिसाबले धेरै किसिमको सिमेन्ट पाइन्छ तर नेपालमा त्यतिको प्रचलनमा आएको देखिदैन ।

२. ओ.पी.सी. (OPC) : निर्माण कार्यमा सवभन्दा बढी प्रचलनमा आउने नै ओ.पी.सी. सिमेन्ट हो । यो सिमेन्ट उत्पादनको लागी चुनढुङ्गा संग केही अरु पदार्थ (क्ले,सेल,आदि) मिसाई १४५० सेन्टिग्रेड सम्म तताई पिंधेर अलि कडा चीज बनाइन्छ जसलाई क्लिन्कर भनिन्छ । यस क्लिन्करमा केही मात्रामा जिप्सम मिसाई धुलो बनाएको चीज नै ओ.पी.सी. हो ।

३. ओ.पी.सी. का ग्रेडहरु

शुरुमा ओपीसीको ग्रेड भन्नाले आई.एस.२६९ मात्र थियो , जसको स्ट्रेन्थ (Strength) २८ दिनको कम्तीमा ३३ एम.पी.ए. अर्थात ३३ न्यूटन प्रति व.मि.मि. भए पुग्थ्यो । तर कालान्तरमा धेरै तल्लाका भवनहरु, प्रीस्ट्रेस कंक्रिटहरु, औद्योगिक भवन आदिको लागि यस सिमेन्टको स्ट्रेन्थले मात्र पर्याप्त नभई भारतीय गुणस्तरको निकायबाट ओ.पी.सी. लाई पुनः स्ट्रेन्थको आधारमा निम्नानसार वर्गीकरण गरिएको थियो ।

क) ३३ ग्रेड ओ.पी.सी. : आईएस २६९-१९८९
ख) ४३ ग्रेड ओ.पी.सी. : आईएस ८११२-१९८७
ग) ५३ ग्रेड ओ.पी.सी. : आईएस १२२६९-१९८७

माथि उल्लेख भए अनुसार विभिन्न ग्रेडले सिमेन्टको २८ दिनको कम्प्रेसिभ स्ट्रेन्थ एम.पी.ए. अर्थात न्यूटन प्रति व.मि.मि. लाई जनाउँछ । सिमेन्टको स्ट्रेन्थको लागी विशेष किसिमको प्रयोगशालाबाट छानिएको बालुवासंग १:३ अनुपातमा सिमेन्ट वालुवा मिसाई ७ दंशमलव ०६ से.मी.को सानो क्यूव वक्समा ढलान गरी २८ दिनमा टेष्ट गरिन्छ ।

४. पी.पी.सी. (PPC) : ओपीसीका क्लिन्कर र पोजोलोना संगै पिसेर अथवा पी.पी.सी.मा मसिनो पोजोलोनालाई-आय्स या क्यालसिनेटेड क्ले मिसाएर पिसिन्छ । यसरी मिसाइएको पी.पी.सी.लाई क्रमशः आइएस १४८९-१९९१ को पार्ट १ र पार्ट २ भनेर मापडण्ड गरिएको छ । यसरी मिसाउने पोजोलोनाको भाग ३५ प्रतिशत सम्म हुन सक्छ । जसको कारण पीपीसी सिमेन्ट ओपीसी सिमेन्ट भन्दा करिब २० प्रतिशत सम्म सस्तो हुने गर्दछ । भौतिक रुपमा ओपीसी र पीपीसी उस्तै नै हो, तर स्ट्रेन्थको मामिलामा पी.पी.सी.मा ढलान पश्चात विस्तारै स्ट्रेन्थ वढ्ने क्रम रहन्छ भने ओ.पी.सी.मा पी.पी.सी.भन्दा छिट्टै नै स्ट्रेन्थ प्राप्त हन्छ । यसकारण पीपीसीमा क्यूरिङ्ग (ढलान पश्चात चिसान गर्ने कार्य) को अवधि लामो हन्छ, तर चिरा पर्ने सम्भावना कम देखिन्छ । हिजो-आज मोटो ढलान गर्ने कार्य, जग, प्लास्टरीङ्ग, बुट्टाहरु, प्रिकाष्ट आदिमा चिरा पर्ने सम्भावना कम भएको कारण तथा स्ट्रेन्थको त्यत्तिको महत्व नभएको ठाउँमा व्यापक रुपमा प्रयोग हुँदै गएको छ ।

५. पी.पी.सी.को ग्रेड

धेरैजसो विदेशमा पी.पी.सी.लाई पनि ओ.पी.सी.जस्तै स्ट्रेन्थको आधारमा वर्गीकरण गरिएको छ । तर भारतमा ओ.पी.सी.को ३३ ग्रेड बराबरलाई नै आधार मानिएको छ । तसर्थ पी.पी.सी.को सिमेन्ट वोरामा ग्रेड उल्लेख गरिएको हुँदैन । नेपालको सन्दर्भमा ओ.पी.सी.को लागी भारतको प्रलेख (code) आई.एस. २६९ को अधिकांश बुँदा समेटी बनाएको एन.एस.४९-२०४१ र त्यस्तै पी.पी.सी.को लागी अधिकांश भारतको आई.एस. १४८९ पार्ट १ र २ दुबैलाई समाहित गरी एन.एस. ३८५-२०५४ को नाममा नेपाल गुणस्तरवाट प्रलेख प्रकाशित हुँदा नेपाल प्रलेख एन.एस.४९-२०४१ ले पछि भारतबाट प्रकाशित भएका ४३ ग्रेड र ५३ ग्रेड को प्रलेखहरुको प्रतिनिधित्व गरेको देखिँदैन । तसर्थ यी ग्रेडमा स्ट्रेन्थ तोकिएको ग्रेडभन्दा कम तर ३३ भन्दा बढी भएमा नेपालको प्रलेख एन.एस.४९-२०४१ को आधारमा न्यूनतम ३३ मात्र भए पनि पुग्ने हुनाले भारतको प्रलेख अनुसार गुणस्तर नभएको तर नेपालको अनुसार भएको भन्ने जस्ता द्विविधा उत्पन्न हुन सक्छ । तसर्थ

सम्बन्धित निकाय गुणस्तरवाट वजारमा उपलब्ध थप ग्रेडमा पनि प्रलेखहरु ल्याउन अति जरुरी भएको छ ।

६. अन्य सिमेन्टहरु

नेपालमा ओ.पी.सी. र पी.पी.सी. बाहेक अन्य सिमेन्टमा व्हाइट सिमेन्ट (White Cement) प्रयोग भएको देखिन्छ । यसको प्रयोग मार्बल विछ्याउने, राम्रो तथा बुट्टेदार कामको लागी गरिन्छ । अन्य उत्पादन विशेष प्रयोगको आधारमा थुप्रो सिमेन्टहरु पाइन्छ जुन नेपालमा प्रयोगमा आएको देखिदैन ।

७. सिमेन्टको आवश्यक भौतिक गुणहरु

नेपालमा पाइने केही सिमेन्टहरुको न्यूनतम आवश्यक भौतिक गुणहरु तालिका नं. १ मा प्रस्तुत गरिएको छ ।

तालिका नं. १

S.N.	Type of Cement	Code	Fineness	Soundness (max) by		Setting Time		Compressive Strength		
			Min. (m^2/kg)	LeChatelier (mm)	Autoclave (%)	Initial min. (minute)	Final max. (minute)	3 Day MPa	7 Day MPa	28 Day MPa
1	OPC	NS 49-2041	225	10	0.8	45	600	16	22	33
2	33 Grade OPC	IS 269-1989	225	10	0.8	30	600	16	22	33
3	43 Grade OPC	IS 8112-1989	225	10	0.8	30	600	23	33	43
4	53 Grade OPC	IS 12269-1987	225	10	0.8	30	600	27	37	53
5	PPC	NS 385-2054	300	10	0.8	45	600	16	22	33
6	PPC	IS 1489-1991(I)	300	10	0.8	30	600	16	22	33
7	White Cement	IS 8042-1989	225	10	0.8	30	600	14.4	19.8	29.7

८. टेष्ट सर्टिफिकेट

सिमेन्ट उत्पादन कर्ताले आफ्नो उत्पादनको स्ट्रेन्थ अनुसार तथा अधावधिकको लागी लगातार आफ्नो प्रयोगशालामा टेष्ट गरिएको हुन्छ । तिनीहरुसँग भौतिक तथा रसायन दुवैको राम्रोसँग व्याचनम्बर, मिति (हप्ता र वर्ष) को रेकर्डहरु हुन्छ । हरेक खरिदकर्ताले चाहेको खण्डमा उक्त टेष्ट सर्टिफिकेट माग गर्न सकिन्छ ।

९. सिमेन्टको भण्डारण

सिमेन्ट भण्डारण मुख्यतया विक्री वितरण तथा प्रयोग गर्नुपूर्व निर्माण स्थलमा चिस्यानबाट बचाउने उद्देश्यले गरिन्छ । भण्डारणको चिस्यान अनुसार सिमेन्टको स्ट्रेन्थ घट्दै जान्छ । त्यसैले भण्डारण गर्दा पिंधमा सुख्खा काठको फल्याकहरु राख्न जरुरी छ । साथै भित्तामा छुने गरी कहिल्यै पनि सिमेन्ट राख्नहुँदैन । सिमेन्ट राखेको कोठा हावा नछिर्ने सुखा ठाउँ हुनुपर्दछ । सिमेन्टको उत्पादन मितिबाट प्रयोग गर्ने समयावधि धेरै भएमा स्ट्रेन्थ निकै घट्न सकिन्छ । त्यसैले सकभर ताजा सिमेन्ट प्रयोग गर्न ध्यान दिनु जरुरी छ ।

तल दिइएको तालिका नं. २ र ३ वाट साधारण तया भण्डारण गरेको अवधिको कारण मोटामोटी सिमेन्टको समयानुसार स्ट्रेन्थ घट्ने प्रतिशत र कडापन ल्याउने दर दिइएको छ ।

तालिका नं. २

सम्भावित घट्न सक्ने स्ट्रेन्थ	
भण्डारण अवधि	स्ट्रेन्थ घट्ने दर
ताजा	० %
३ महिना	२०%
६ महिना	३०%
१ वर्ष	४०%
२ वर्ष	५०%

तालिका नं. ३

कडापन हुने दरमा ह्रास		
.	१:५ कन्क्रिट ६ महिनाको	१:५ कन्क्रिट ताजा सिमेन्टको
७ दिन	७३ %	१०० %
२८ दिन	७५ %	१०० %
६ महिना	८४ %	१०० %

माथिको तालिकाहरु सुचकांक रुपमा मात्र मोटामोटी रुपमा लिन सकिन्छ ।

How Search Engines Work

Shayak Raj Giri
Department of Electronics and Computer Engineering
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Introduction

If you want to get information about something, of course your first choice will be search in the internet. But you may not know that how you are getting those informations. A search engine is playing major role in this process. The search engine is a program designed to help find information stored on a computer system such as the World Wide Web, inside a corporate or proprietary network or a personal computer. The search engine allows one to ask for content meeting specific criteria (typically those containing a given word or phrase) and retrieves a list of references that match those criteria. Search engines use regularly updated indexes to operate quickly and efficiently. Without further qualification, search engine usually refers to a Web search engine, which searches for information on the public Web. Other kinds of search engine are enterprise search engines, which search on intranets, personal search engines, which search individual personal computers, and mobile search engines. However, while different selection and relevance criteria may apply in different environments, the user will probably perceive little difference between operations in these.

Operations in Search Engine

- Web crawling
- Indexing
- Searching

Web search engines work by storing information about a large number of web pages, which they retrieve from the WWW itself. These pages are retrieved by a web crawler- an automated web browser which follows every link it sees, exclusions can be made by the use of robots.txt. The contents of each page are then analyzed to determine how it should be indexed. Data about web pages is stored in an index database for use in later queries. Some search engines, such as Google, store all or part of the source page (referred to as a cache) as well as information about the web pages, whereas some store every word of every page it finds, such as AltaVista.

The cached page always holds the actual search text since it is the one that was actually indexed, so it can be very useful when the content of the current page has been updated and the search terms are no longer in it. This problem might be considered to be a mild form of link rot, and Google's handling of it increases usability by satisfying user expectations that the search terms will be on the returned web page. This satisfies the principle of least astonishment since the user normally expects the search terms to be on the returned pages. Increased search relevance makes these cached pages very useful, even beyond the fact that they may contain data that may no longer be available elsewhere.

When a user comes to the search engine and makes a query, typically by giving key words, the engine looks up the index and provides a listing of best-matching web pages according to its criteria, usually with a short summary containing the document's title and sometimes parts of the text. Most search engines support the use of the Boolean terms AND, OR and NOT to further specify the search query. An advanced feature is proximity search, which allows you to define the distance between keywords.

The usefulness of a search engine depends on the relevance of the result set it gives back. While there may be millions of Web pages that include a particular word or phrase, some pages may be more relevant, popular, or authoritative than others. Most search engines employ methods to rank the results to provide the "best" results first. How a search engine decides which pages are the best matches, and what order the results should be shown in, varies widely from one engine to another. The methods also change over time as Internet usage changes and new techniques evolve.

Challenges faced by Search Engines

The web is growing much faster than any present-technology search engine can possibly index. Many web pages are updated frequently, which forces the search engine to revisit them periodically. The queries one can make are currently limited to searching for key words, which may result in many false positives, especially using the default page-wise search. Better results might be achieved by using a proximity-search option with a search-bracket to limit matches within a paragraph or phrase, rather than matching random words scattered across large pages.

Trans-Boundary Water Resource Management: Challenges & Practices

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Abstract
The growing global competition for water is the challenging scenario to manage the water resources on hydrological boundaries. The need for water management is also triggered by the need to cooperate in an upstream downstream relation. For an institution operating on political boundaries, not coinciding with the boundaries of the river basin, it is very difficult to allocate or prioritize water or carry out flood control measures.
This paper aims to make general concept on trans-boundary and its different management approaches. The over view of the global practice on trans-boundary water resource management and the regional need of the collective approaches to manage the regional trans-boundary water resources management issue is main issues to discuss in this paper. An overall framework of regional cooperation is required among the co-riparian countries to set principles of trans-boundary water resources management on the basis of broad political and social consensus. Integrated management of shared basins is arguably a promising option. It strongly argues for establishing River Basin Organization (RBO) as an apex body for coordination of watershed management and avoidance of conflicts in trans-boundary River. Sustainable river basin management through RBO will create a common platform and a joint forum for all expertise for promoting the concept of Multipurpose River Basin Development (MRD). It will seek a reasonable solution for water resources management shared by all and renewable energy schemes at river basin level.
Keywords: *trans-boundary, river basin, water allocation, institutional framework and riparian*

Introduction

River basins are the natural systems for our water resources. The best way to deal with water resources is to recognize the boundaries of the natural water systems rather than the administrative boundaries. The situation becomes complicated when the river basin covers more than two neighboring states and trans-boundary issues and items are to be addressed. More than 260 river basins covering almost 50% of the earth's land area are shared by at least two countries and over three billion people depend on hundreds of Trans -boundary aquifers, making many countries dependent on the use of common water resources for national development (Wolf, et al, 1999).
Water conflicts are becoming prevalent at all levels. Fresh water resources are extremely limited in supply only 2.79 percent of the global water resources on the earth, of which 0.03 percent are available for human use. The rapid increase in world population by about 80 million a year is escalating pressure on freshwater demands of about 64 billion cubic meters a year.
Water is a vital resource, critical for healthy living conditions and sound ecosystems. Drinking water, food production, energy supply, and industrial development are dependent on water availability. The demands associated with rapid population growth and economic development place increasing pressure on this fragile and finite resource. This is already evidenced at the sectoral level by insufficient and inadequate supplies, at the national level, by competing demands between sectors, and at the international level, by conflicts – or the threat thereof – between nations sharing trans-boundary water resources. The situation is expected to worsen, with a quarter of the world's population predicted to face severe water scarcity in the next 25 years, even during years of average rainfall (Schiff and Winters, 2002). The water management challenge is, thus, enormous. The manner in which it is confronted will determine future patterns of development, macroeconomic growth potentials, and the extent of poverty burdens.

1. Policy, Legal and Institutional Framework

Principles of Trans-boundary Water Resources Management

The convention on the law of the Non-Navigational Uses of International Water courses provides the principles and rules to guide states in negotiating future agreement on specific water courses. The Convention was adopted by the United Nations General Assembly on May 21, 1997, following years of work by the International Law Commission, (UN,2005).The Dublin Principles and internationally agreed principles and norms must be translated into practice. Conflict management and negotiation are and will be key to enable IWRM implementation. For this, enforcement of the aforesaid conventions and agreements is necessary. Water legislation has to be strengthened for river basin management to reinforce IWRM at basin level for reducing poverty and maintaining environment.

The basic principle of TBM is the development and management of water to maximize the benefit keeping the resources in a sustainable form. In the context of global water crisis, IWRM is drawing the attention of decision-makers, planners and professional of water sector as tool to face the challenge. The important principles are:

- Act locally but think globally putting people at the center
- No harm principle: obligation not to cause significant harm (UN,2005)
- More potential for shared waters
- Justice and Equity
- Free flow of data and information
- Co-ordination within trans-boundary river basins
- Techno-economic feasibility studies
- Notification concerning planned measures
- Political and public awareness.
- Strengthening regional co-operation

2. Current Status of Trans-boundary water resource management

2.1. Critical Review of Indo Nepal TBM

As an upper riparian, Nepal has a special relationship with India and faces many problems in constructing its dams due to opposition by the lower riparian and has serious doubts about the projects proposed by India. Nepal's mistrust, beside other factors, has been reinforced by what it perceives to be various unequal treaties -- starting from Sharada Dam construction (1927), 1950 Treaty and Letters of Exchange of 1950 and 1965, Koshi Agreement (1954), Gandak Agreement ((1959), Tanakpur Agreement (1991) and the Mahakali Treaty (1996). Since 400 million people live in the Ganges, Brahmaputra and Meghna region, India needs Nepal to meet its energy needs and for management of water.

Water issues between India and Nepal are affected to a considerable extent, by the bilateral relations between the two. The Koshi Agreement has not gone off very smoothly between the two countries. India and Nepal signed the Koshi agreement in 1954 to regulate the flow of the river and ensure flood management. A barrage straddling the India- Nepal border was to be constructed for this purpose, and embankments were to be raised on either side of the river. At the same time, the project was also to be utilized for power generation and irrigation purposes. There have been various disputes over this agreement fueled by floods in the Koshi region. In April 2008, there was a devastating flood in the Koshi Basin, which displaced 30 lakh people in India and around 50,000 people in Nepal. Both the sides blame each other for failing to prevent such a massive disaster. India and Nepal have traditionally disagreed over the interpretation of the Sugauli Treaty signed in 1816 between the British East India Company and \\Nepal, which delimited the b oundary along the Mahakali River in Nepal.The disput e intensified on 1997 when Nepal was planning to cons ider a treaty on hydroelectric development of the river. India and Nepal differ as to which stream constitutes th e source of the river. Nepal regards the Limpiyadhura as the source; India claims the Lipu Lekh. The dispute between India and Nepal might seem minor but it gains strategic importance, because the disputed area lies near the Sino- Indian border.

2.2. Water sharing issues in South Asia

The Northern part of the Indian sub-continent in South Asia consists of two major water systems that commonly originate in the Himalayas and are trans-boundary in nature. For almost half the world's population, water-related dreams and fears intersect in the Himalayas and the Tibetan plateau. On the Western side of this region, is the Indus river system with its extensive network of tributaries namely the Ravi, Beas, Sutlej, Chenab and Jhelum that begin in Tibet and flows out into the Arabian Sea near the Karachi port. On the Eastern side one finds the Ganga-Brahmaputra-Meghna river system that is commonly shared among Nepal, Bangladesh and India and supports the largest number of the world's poor in one region. The Indus river system in the West finds its origin in the Tibetan plateau in the vicinity of China, runs a course through the Ladakh district of Jammu and Kashmir, and finally merges into the Arabian Sea near Pakistan's port city of Karachi.

South Asia has four major rivers basins, i.e., the Brahmaputra, Indus, Ganges and the Meghna which provide livelihood to millions of people in this region. The South Asian river basins irrigate millions of hectares of fields and provide livelihood to millions of people in this geographical location. South Asian region's four main co-riparian states are India-Pakistan and India–Bangladesh–Nepal lying in the west and in the east respectively. Water distribution, its utilization, its management and above all the hydro-electric power projects are affecting the upper and lower riparian countries. Water security is gradually becoming an epicenter of interstate relations and water scarcity is increasing the miseries of people of this area. In South Asia's case, timing is also an important issue. As in the case of Pakistan 'if India fill its dams when water is needed for crops in Pakistan, it will be disastrous for Pakistani peasants and the planting season over there.'

South Asia is increasingly becoming a water-stressed region. Water shortage is triggering conflict in the region of South Asia. With the growing population, industrial, agricultural and domestic uses, glaciers are melting, and environment is degrading, resultantly, the rivers are also becoming a bone of contention between countries and communities in this area. The question of utilization of water for hydropower generation and commercial irrigation is a matter of great concern and causing conflicts. Pakistan is one of the world's most arid countries in which average rainfall is less than 240mm a year. According to a UN report, Pakistan is about to become a 'water scarce' country. Pakistan has limited water resources. Indus River and its tributaries are the largest water source in here and about two-thirds of water supply for irrigation and in homes is gained from the Indus and its associated rivers.

The River Brahmaputra, originates from the Manas Sarobar glacier on the northern slope of the Himalayas in Chinese Tibet, and is called as Tsang-Po. It then flows into the Indian states of Arunachal Pradesh, Assam and Meghalaya and then it enters Bangladesh where it is called river Jamuna till it joins river Ganges. The total length of the river from the source to the sea is about 2997 km. The Brahmaputra is part of the third largest water resources in the world. Yet, the region has one of the lowest per capita water availability because of the huge population of half a billion people living within the basin stretching from Tibet to the southern region of Bangladesh. Increasing population and accelerating economic development activities in the basin have now made the sustainable water management of the region even more critical than in the past. Moreover, the sharing of water resources of the Brahmaputra river basin has been a long matter of dispute due to the absence of a well-coordinated process of sharing and prioritizing diverse uses within the riparian countries. In 1980, the Indian government established unilaterally the Brahmaputra Board as a statutory body under the Ministry of Water Resources to plan for and implement projects to harness the river for hydropower, flood control, and economic development. It is estimated that the Brahmaputra's power potential could provide about 48,000 MW which constitutes as much as 30 % of the total hydropower reserves of India. Currently there are no large dams on the river Brahmaputra in the Indian Territory. But the Indian Government has been working for implementing the plan of diverting water from Brahmaputra and Ganges basin through linking the rivers. Water would be diverted to the water deficit Hariana, Rajasthan, Gujarat and the southern regions. This initiative of diverting water from 'surplus' eastern rivers to 'deficit' regions of India is a matter of grave concern for riverine Bangladesh. Concerns are equally made on both India and Bangladesh over the much-published Chinese mega dam project across the river Tsang-Po and diversion of river water to the Gobi region. The proposed Indian River linking project and Chinese dams are supposed to be completed before 2013.

2.3. Global Practices of TB water resource management

There are several ways to manage the trans-boundary water resources. Some global practices are presented here which will help to compare and to make the concept of different ways of trans-boundary management. For example, as part of the 1961 Columbia River Treaty, the US paid Canada for the benefits of flood control and Canada was granted rights to divert water between the Columbia and Kootenai for hydropower purposes (Giordano and Wolf, 2003). In addition to the direct payment for benefits (or compensation for costs) other mechanisms exist, including direct payment for water itself, power-purchase agreements, and financing and ownership arrangements. These mechanisms have been adopted both independently and jointly, as detailed in a study of 18 agreements of a benefit sharing nature (Klaphake, 2005). Most of the cases centered on dam construction designed to generate and use hydropower. The Lesotho Highlands Project on the Senqu/Orange river basin utilizes a number of mechanisms, including direct payments for water, purchase agreements and financing arrangements. On the Senegal River, Senegal, Mali and Mauritania agreed to share the development costs and benefits of jointly-operated common infrastructure using a burden-sharing formula (la clé de répartition). The agreement between India and Nepal on the Mahakali River includes cost sharing and a power purchase arrangement. The India-Bhutan agreement on the Chukha hydropower project includes payments made by India to Bhutan for power exports (which represents some 70% of total power generated and is a significant source of revenue for Bhutan). The agreement between Kazakhstan, the Kyrgyz Republic, Uzbekistan, and Tajikistan in the Syr Darya basin/Aral Sea involves an arrangement for bartering hydropower, gas, coal and oil. Distributional issues are of vital importance. The opportunity cost of not reaching agreement because of a failure to establish compensation mechanisms is strikingly clear in the case of the Nile River basin. Egypt and Sudan concluded a treaty in 1959, which included building the Aswan High dam (and allocating the total yearly flow between them). By reducing seepage and evaporation losses, building dams upstream on

Ethiopia's Blue Nile would have increased available water supply by an estimated 6 billion cubic meters, in addition to generating three times more hydropower than that which was produced by the Aswan Dam. However, riparian were unable to address the unbalanced distribution of benefits and costs – with Ethiopia gaining the equivalent of US$1.2 billion in benefits and Egypt and Sudan each losing US$ 300 million – and the 'next best' option was ultimately adopted by Egypt and Sudan (Schiff and Winters, 2002). It should be noted here that the benefits to be had from trans-boundary cooperation and the manner in which those benefits are distributed in-country is as significant as how they are distributed amongst countries.

3. Way Forward

Among the various ways to manage the trans-boundary water resources, here are some ways presented below which will help to allocate the water resources among all beneficiaries of upstream downstream riparian.

- To set regional shared water priorities
- To reach political consensus through multilateral efforts
- To take up detailed techno-economic feasibility studies
- To arrange finance
- To install hydropower plants and interconnections
- To develop riparian rights and agreements
- To develop strong mechanism for regional co-operation

3.1. A process-oriented approach

There are various degrees of cooperation, ranging from simple information and data sharing to joint management (including joint ownership of structures). In practice, cooperative arrangements develop in several stages, from convening to negotiation to conclusion of an agreement, and, finally, to implementation (Mostert, 2005).

3.2. Stakeholders and the State

Recognition must be given to the fact that the stakeholders involved are not homogeneous states (an abstract concept), but specific groups and individuals who make up the State. Stakeholders include national and sub-national government bodies and entities within these (such as sectoral ministries), water users, powerful or influential individuals, NGOs, the private sector, and supranational organizations (such as regional organizations). Each of these parties may adopt a very different stance on trans-boundary water issues and benefit sharing, and yet, be key to reaching an agreement and to successful implementation. An understanding of the different perceptions and motivations of the various stakeholders and the political-economic factors that influence these are, therefore, required. Ultimately, cooperation rests not on objective measures of gains to be had, but rather on the subjective perceptions held by these various groups and how these are played out in policies, institutional arrangements and, finally, treaties.

Wider stakeholder involvement can not only improve the identification of possibilities for benefit sharing, but is also essential for the realization of objectives, particularly at the sub-national level.

3.3. Bilateral versus multilateral cooperation

Although numerous international treaties for cooperative management have been negotiated (approximately 149 in the last century and about 300 since 1814), these are almost without exception bilateral. This fact supports the theory that achieving cooperative solutions becomes more difficult as the number of players increases. The difficulty is compounded when – as is often the case – riparian have heterogeneous capabilities (that is, relative economic, political and geographic power), interests, and perceptions.

History clearly shows that it is much more feasible to seek cooperative outcomes within a sub-unit of a river basin. In the best cases this is done on a hydrologic or sub-basin basis. For example, the Nile Equatorial Lakes and Eastern Nile—are treated separately; meaning that gains can be realized without causing significant harm to riparians not involved.

More commonly, this would mean having bilateral, rather than a multilateral, agreements (e.g. Lesotho and Africa on the Orange River, the Jordan River basin, Pakistan and India on the Indus river). Although bilateral management arrangements do not fully internalize externalities and are, therefore, suboptimal, they are useful as a first step in helping to separate out those issues that are of most interest to two riparians and in building a relationship that could potentially become more far-reaching in the future and involve wider sets of state and non-state actors.

3.4. The role of third parties

The involvement of third parties has been instrumental in promoting cooperative arrangements in the vast majority of cases. For example, arrangements on the Mekong, which is commonly taken as a success story, would not survive were it not for the dedicated support over several decades of the UNDP and other donors. The same is true of the World Bank and agreement between India and Pakistan on the Indus River. Third parties have played a central role in the more recent

moves towards cooperation on the Nile. Similarly, the cases of failure (the Ganges and the implementation of the Zambezi Action Plan, ZACPLAN) can to some degree be attributed to the ineffectiveness of third parties.

While third parties cannot alone create a conducive, political environment, they can provide direct and indirect incentives to cooperate through playing a brokerage role: (i) providing technical competence and examples of best practices; (ii) assisting in negotiation and mediation skills, including the provision of legal and other water experts; and (iii) facilitating investments in trans-boundary settings (Phillips, et al, 2006).

Third parties have work to do in their own right to ensure that they are in fact effective in promoting cooperation and that they do not come to dominate the process by generating first and second party dependency. For example, they must be willing to support long processes; they must ensure that riparians themselves drive the process; they must increase their perceived neutrality (for example, by identifying and using experts who are viewed as neutral); and they must develop clear and transparent exit strategies.

3.5. National water policies

A basin-wide perspective should not be adapted to neglect the national level policies; the two have to mesh effectively to enable effective benefit-sharing that, inter alia, leads to poverty reduction and the achievement of national and international development goals. Although an obvious point, it is often (conveniently) ignored that water management within a riparian country is a major contributing factor to trans-boundary water problems and conflicts. Water policy reforms within country would, therefore, go a long way to reducing stress across the system as a whole.

The importance of tackling national water management policies – particularly related to the agricultural sector – has been recognized in the Nile Basin Initiative. Efficient water use in the agricultural sector is one of seven projects being implemented. This project is specifically designed to show that actions at the ground level are possible in the short-run and can lead to higher impacts at the national (and international) level in the longer-term (NBI, 2001).

There are, thus, many actions 'close to home' that can lead to greater efficiency in water use at the national level, improving availability at the basin-wide level and opening up 'policy space' for benefit sharing arrangements. Instituting such policy changes will, naturally, produce winners and losers. Any reform program should address the potential negative effects on the most vulnerable sectors of society. This is as true for agriculture – which provides the principal means of employment in many developing countries (e.g. Egypt) – as it is for domestic water use.

Targeted subsidies, including cross-subsidization schemes, can be adopted as one means of protecting the poorest of society, while ensuring that those who can (and should) do pay for water services.

3.6. Monitoring and evaluation

The success of any trans-boundary water management regime must ultimately be judged according to its impact on national development, welfare, and environmental sustainability, in other words, results that are not instant or easily measurable. However, establishing indicators can be used to provide information on whether progress is being made and targets are met in the shorter-term. They do not replace the need for more comprehensive and in-depth evaluations, but can provide a significant degree of information, while being less of a burden in terms of collection and analysis.

The monitoring and evaluation framework focus on three types of indicators: (i) process indicators, which track the agreed processes (policy, legal, regulatory and institutional reform); (ii) stress reduction indicators, which focus on actual implementation of measures that will reduce stress and are also linked to socio-economic improvements; and (iii) environmental status indicators (Uitto, 2004).

The purpose of these or similar such indicators is to track implementation of agreements on a real-time basis, thereby alerting the relevant parties to any problems or deviations and allowing for remedial action. Equally important, the ready availability to all parties of concrete quantitative and qualitative data on compliance builds mutual trust and a common understanding of the potential constraints and opportunities.

4. Recommendations

- Multi-scale and multilateral cooperation must be achieved for
  - Reducing water stress and
  - Flood management at regional and trans-boundary basins through provision of advisory services by the RBO (River Basin Organization).
  - India, Bangladesh, Bhutan, Nepal and China should come forward in view of the recent water stress in the Himalayan countries, fostered by the GWP.
- Common storage reservoir should be undertaken at a suitable location to meet up the scarcity of water during the dry season.

- A vast hydro-electric potential should be developed drawing technical support and representatives from the region and outside to maximize and share water benefits.
- MRD should act as instrumental and catalysts in ensuring solidarity among co-riparian countries for regional security, economic development and world peace.
- The co-riparian countries must be brought under consensus among different political parties and civil societies to rationalize the water resources management.
- Lower riparian countries must have voices to create strong public opinion and to participate in all decision making processes which may affect the stakeholders at the sub-regional level.
- Attempts to be made to implement allied treaties properly for sharing the water of other common rivers immediately through a process of mutual consultation.
- Strong leadership, political commitment, formulation of relevant rules, regulations, laws and principals are urgently needed to avoid extreme conflicts for water and resolve the dispute by enhancing sustainable regional cooperation.
- Long-term research should be undertaken by the national, regional and global water experts under the umbrella of an apex body.

5. Conclusion

There is no systematic and well researched work on water issues in South Asia, which is a glaring discrepancy considering that this is an issue that seriously impacts most of the countries in South Asia. The published work on water issues, in South Asia, is mostly in the form of newspaper articles and reports and there is a noticeable absence of scholarly work on the same. There are almost no journal articles and the newspaper articles also tend to be biased, depending on the place of publication. India along with the smaller countries must think of creating new avenues for cooperation. To make joint water management more effective, it would be helpful to include people from different strata of society as it could help in minimizing risks that could adversely affect the lives of common people in the long term. Multi-stakeholders here would be the private sector, the state government, representatives of civil society and experts on dams who take into account the ecological and social aspects. The discussion made in above pages reflects that nothing is straight forward or simple in this region. Disputes over water are central to the political economy of South Asia. At the broadest level, the management and utilization of water resources in South Asia is important in the geo politics of the region. Trans-boundary disputes are playing important role in disputes about water. Retreat of glaciers and water scarcity are the new growing challenges. Environmental cooperation may offer pathways to confidence building. The passable will can help to resolve the future contestations over water in the region. In spite of the established agreements and treaties it is a fact that matters of water sharing, management and the hydropower projects are consistently the bone of contention between India and rest of the countries i.e. Pakistan, Bangladesh and Nepal. There is a need to develop a regional cooperative approach to resolve the problems like glaciers retreat and water management along with the environmental degradation.

Availability of fresh water is being limiting factor for economic development and livelihood in this region, conflicts and disputes have already been started and widening day by day among the co-riparian countries for water sharing of the trans-boundary rivers. All concerned organizations as yet could not find any satisfactory way to solve the problem. Each country is trying in isolated way as a result of which disputes are increasing rather than its solution. To solve this problem, a common platform is yet to form.

Here in this paper, River Basin Organization (RBO) an Apex Body has been proposed which would serve as a common institution for co-basin states to establish judicious water allocation and using issues. The riparian disputes can be resolved through this institution to promote rational utilization and management of the resources by adopting and implementing no harm principle of the trans-boundary conventions and agreements. The co-basin countries must move forward to a long term sustainable development establishing viable RBO to be formed with the Government nominated experts of the co-riparian countries.

Drawing on experience from a number of river basins, this paper has discussed several practical mechanisms that might foster movement towards cooperation. Recognition of the link between national water policies and trans-boundary water issues is essential, and actions taken within a country can go a long way to both reducing water stress and improving relations with other riparian. The involvement of all stakeholders is essential to achieving viable solutions, but a balance amongst the various ‘voices’ of these groups must be struck. Finally, monitoring and evaluation, and in particular the use of key indicators to measure short-term progress, is vital as both a learning tool and a consensus builder. The mechanics of

institution-building remain a major challenge to benefit-sharing. Additional work is also required in creatively applying existing economic tools to assess potential 'win-win' scenarios in trans-boundary river basin settings and in better linking trans-boundary benefit sharing with local level impacts (including equity effects).

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The Evolution of Web

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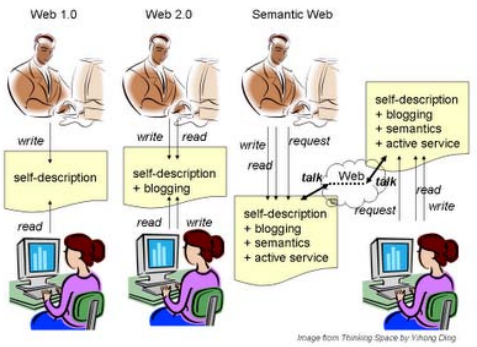
It all started in 1989 when Berners-Lee proposed a global hypertext project while working as a consultant software engineer at CERN, the European Particle Physics Laboratory in Geneva, Switzerland. He sought a way to record random associations between objects, a system that could view information regardless of the format or platform it was on, and was easy to use without merging link databases. What began as a project to allow high energy physicists to share data, news and documentation has certainly evolved far beyond imagination.

Different stages of web evolution



The traditional World Wide Web, also known as Web 1.0, is a Read-or-Write Web. In particular, authors of web pages write down what they want to share and then publish it online. Web readers can watch these web pages and subjectively comprehend the meanings. There was a linear transactional relationship and unless writers willingly release their contact information in their authored web pages, the link between writers and readers was generally disconnected on Web 1.0. The basic idea during this phase was to put the content on the web. On Web 1.0, resources are raw data, hardcoded links, and passive, non-portable services. This phase was much more associated with the search for online viability and device/software independence. Limited content, limited creativity and limited business were some of its drawbacks.

The second phase of the web evolution is the Web 2.0. Though still not properly defined, it is a Read/write web where the line between the consumer and the content publisher is seemingly getting blurred. User generated content is the main feature of this phase. Users are consuming as well as contributing information and nobody (or a very few) are getting paid for it. It fixes the previous disconnection between web readers and writers. On Web 2.0, resources in web spaces become labeled data, labeled links, and active, portable services. This phase really has sparked the World Wide Web revolution and the power of networks, collaboration, and friends are leading the wave. It was much of a social change than the technological change in the web.

Web 2.0 may seem very attractive and complete but still there are areas and demands that are left unaddressed. The next vision of the web is the semantic web or web 3.0. This will be driven by the technological change and will be about the meaning of data, personalization, intelligent search and behavioral models. Agreements are made on the structure of data and the way data is described. The vision of this model is to create a big collection of database which can be connected on demand. Linking data will be a power of web3.0 and open identities, SAAS (Software As A Service) will be some of its features.

Where are we???

We are presently somewhere in between web 2.0 and web3.0. Blogging, collaborative wiki and social networking are dominating and we are moving to the semantic web. In the semantic era, a web space will be no longer a simple web page as on Web 1.0. Neither will a web space still be a Web-2.0-style blog/wiki that facilitates only human communications. Every ideal semantic web space will become a little thinking space. It contains owner-approved machine-processable semantics. Based on these semantics, an ideal semantic web space can actively and proactively execute owner-specified requests by themselves and communicate with other semantic web spaces. In short, Semantic Web, when it is realized, will connect virtual representatives of real people who use the World Wide Web. It thus will significantly facilitate the exploration of web resources.

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भूकम्प प्रतिरोधात्मक भवन निर्माण नै किन ?

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'घर भनेको जीवनमा एकपल्ट बनाइन्छ' यो उक्ति यसकारण प्रचलनमा छ कि घरको आयु कम्तिमा ८०/९० वर्षको हुनुपर्छ । मानव जीवनको विकासक्रम सँगसँगै निर्माणको तरिका तथा सामाग्री समेत अत्याधुनिक हुँदै आइरहेको छ । पक्कै पनि भवनको भार गारोले लिने (load bearing) घरको विकल्पको रुपमा भवनको भार पिलरले लिने (Frame system) घर आएको छ । भार गारोले लिने भएकोले यो तरिकाबाट निर्माण गर्दा गारोको मोटाइ बढी हुनुपर्छ । नेपालको विभिन्न ऐतिहासिक मठ्-मन्दिर, दरबार र घरहरु समेत यही तरिकाले बनाइएको हँदा यसको उदाहरण तथा प्रयोग गर्दाको फाइदा-बेफाइदा हामीले थाहा पाइसकेका छौं । यस्तो खालको घर बनाउँदा के कस्तो सावधानी अपनाउनुपर्छ भन्ने कुरा वि. सं. १९९० र २०४५ सालको भूकम्पबाट पाठ सिकिसकेका छौं । यस्ता भवनमा जग, टाइबीम, गारोको मोटाइ, भ्याल ढोका राख्ने स्थान, कुना बन्धन, फ्लोर बिम, सीलब्याण्ड, लिन्टेल ब्याण्डमा विशेष ध्यान दिएर गुणस्तरीय निर्माण सामाग्री प्रयोग गर्ने हो भने २ $^{१}/_{२}$ तल्ला सम्मको निर्माणमा लोड बियरिङ घरमा पनि कुनै समस्या हुदैन, साथै गारो मोटो हुने भएकोले यस्तो घरमा बस्दा स्वास्थ्यलाई फाइदा नै गर्छ । तर २ $^{१}/_{२}$ तल्ला भन्दा बढी बनाउँदा फाइदा नहुने भएकोले आजकल मानिसहरु पिल्लर भएका घर बनाउनतिर तल्लिन छन् । तर पिल्लर राखेर घर बनाउँदा अझ बढी ध्यान दिनु जरुरी छ, किनभने भूकम्पको बेला यस्तो घरमा जोखिम बढी हुन्छ । भूकम्पले मान्छे मार्दैन, असुरक्षित निर्माणले बनाएका घरका कारण धेरै मान्छेहरु मर्छन् ।

भूकम्प प्रतिरोधात्मक भवन भन्नाले के बुझिन्छ ?

भूकम्प प्रतिरोधात्मक भवनको मूल उद्देश्य निम्न अनुसार छन् :

क) सानो खाले (minor) भूकम्प आएमा घर हल्लिन सक्ने तर कुनै चिरा (cracks) नआउने हुन्छ ।

ख) मध्यम खाले (moderate) भूकम्प आएमा भार थाम्ने स्ट्रक्चरल पार्टहरुमा असर नपारी घरमा केही चिराहरु देखा पर्न सक्ने तर मर्मत गर्न मिल्ने हुन्छ ।

ग) ठूलो खाले (major) भूकम्प आएमा घर काम नलाग्ने गरी असर पर्ने तर ढल्न नदिने हुन्छ ।

(म्याग्नेच्युड ७ वा त्यो भन्दा बढीलाई ठूलो भूकम्प भनिन्छ भने ८ वा त्यो भन्दा बढीलाई महाभूकम्प भनिन्छ ।)

भूकम्प प्रतिरोधात्मक भवन निर्माणको पूर्व तयारी कसरी गर्ने ?

भूकम्प प्रतिरोधात्मक भवन निर्माणका लागि भवनको ज्यामितीय आकृति सरल, एकरुपता र सन्तुलित हुनुपर्छ । त्यसै अनुसार नक्सा तयार पारेर नक्सा अनुसार स्ट्रक्चरल डिजाइन, विस्तृतिकरण तथा गुणस्तरिय निर्माण सामाग्रीको लागि सम्बन्धित प्राविधिकसँग छलफल गर्नुपर्छ । विस्तृतिकरण भन्नाले जगको तरिका, जगको गहिराई, पिलर र बिम जोड्ने तरिका, बिम र पिलरमा डण्डी गास्ने तरिका, स्लाब तथा भऱ्याङमा डण्डी राख्ने तरिका आदिको विस्तृत विवरण सहितको नक्सा भन्ने बुझिन्छ । त्यतिमात्र नभई जग, पिलर, बिम र स्लाबको डण्डी कहाँनेर राख्नुपर्छ भन्ने जानकारी समेत यसमा समाविष्ट हुन्छ । त्यसैगरी भूकम्प प्रतिरोधी भवनको डिजाइन पूर्व निर्माण स्थलको अध्ययन गर्नुपर्छ, जसले गर्दा जुन ठाउँमा भवन निर्माण गर्न लागेको हो त्यस ठाउँको माटोमा त्यो भवनलाइ थाम्न सक्ने क्षमता छ कि छैन पत्ता लगाउन सकिन्छ ।

भूकम्प प्रतिरोधात्मक भवनको डिजाईन कसरी छुट्याउने ?

भवनको डण्डी (structural design) को नक्सा सक्कली हो वा नक्कली भनेर कति सर्वसाधारण झुक्किने गरेका छन् । अझ कति इन्जिनियरले सजिलोको लागि नक्सा (डण्डीको) चाहिँ बनाइदिन्छन् तर डिजाइन नै नगरिकन । यसरी छुट्याउनको लागि केही प्रस्तुत बुदाँलाई ध्यान दिए पुग्छ ।

- सबै जगहरुको साइज (लम्बाई,चौडाई) एउटै हुँदैन । साधारण तथा घरको बनोट अनुसार कुनाको जग सानो, छेउको त्यो भन्दा ठूलो र बीचको सबभन्दा ठूलो हुन्छ ।
- जगको (हात्तीपाइला) को गहिराई साइज अनुसार फरक हुन्छन् ।
- सबै पिलरको डण्डीको सँख्या र साइज पनि एउटै हुँदैन । कुनाको कम छेउको त्यो भन्दा बढी र बीचकोमा सबभन्दा बढी डण्डी हुन्छ । किनभने भवनले मागे अनुसार राखिने भएकोले आवश्यकता अनुसार बढी घटी हुने गर्छ ।
- सबै बीमको साइज एउटै हुन वा नहुन सक्छ तर त्यसमा प्रयोग गरिने डण्डीको सँख्या र साइज फरक हुन्छ ।
- स्लाब भन्दा बिम र बिम भन्दा पिलर बलियो बनाइन्छ ।

भूकम्प प्रतिरोधात्मक भवनको डिजाइन किन गर्ने ?

माथि उल्लेख गरिए अनुसार भूकम्पीय जोखिमबाट मानवीय क्षतिलाई कम गर्न भूकम्प प्रतिरोधात्मक भवनको डिजाईन गराइनु पर्छ । यसरी ढलान गरी बनाइने घर प्राविधिक (Structural Engineer) को सल्लाह सुझाव अनुसार नबनाएमा वा माथिका उद्देश्य अनुरुप काम नगरे मध्यम खाले मात्र भूकम्प आएपनि घर भत्किन सक्छ भने ठूलो भूकम्प आएमा त एक्कासि ढल्ने सम्भावना बढी हुन्छ । नेपाल दक्षिणतिर इन्डियन प्लेट र उत्तरतिर तिबेतियन प्लेटको बीचमा पर्छ । इन्डियन प्लेट तिबेतियन प्लेटतिर घुसिरहेको हुँदा घुसिने क्रममा चाप पैदा हुन्छ र सञ्चित चाप धान्न नसकेपछि पृथ्वीको माथिल्लो तहमा रहेको चट्टानहरुमा नयाँ चिराहरुको सिर्जना हुन्छ । अथवा पुराना चिराहरुमा विस्थापन हुन्छ । यसरी चिराहरुको सिर्जना वा पुराना चिराहरुमा विस्थापनको क्रममा सँयौ वर्षदेखि सञ्चित उर्जा तरंगहरुको रुपमा प्रसारण भई केन्द्रविन्दुको क्षेत्रमा तापशक्ति उत्पन्न भई नाश हुन पुग्छ । यसरी शक्ति पैदा हुने क्रममा जोडदार कम्पन हुन्छ । जसलाई भूकम्प भनिन्छ । भूकम्पबाट हुने क्षति सामान्यतया यसको शक्ति, हलचलको अवधि, मानव जनघनत्व, स्थानिय भौगर्भिक बनावट तथा मानव निर्मीत संरचनामा भर पर्छ । अव्यवस्थित तथा अनियन्त्रित सहरीकरण, कमजोर निर्माण संरचना सबैभन्दा बढि भयपूर्ण हुने भएकोले यसको जोखिमबाट निश्चिन्त रहन भुकम्प प्रतिरोधात्मक भवन निर्माण गर्नुपर्छ ।

3D Semantic City Modelling

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3D City modelling is defined as the virtual 3D view of any city objects like buildings, bridge, vegetation, water bodies, roads and road furniture such as traffic light, spot light, electric pole, plantation etc. City modelling gives the complete imaginary view of any city area with its geometric model. The 3D city model can be used for different purposes and applications like design review, marketing, tourism, location analysis, urban management etc.

The demand of 3D modelling is increasing rapidly because of the necessity of 3D GIS and technology in the various fields due to their easy availability and rapid capturing of 3D data. But, 3D City models having only geometric information without semantic and thematic information can't be very useful for task-specific applications such as query and spatial analysis of different vector data. Geometric modelling only gives the geometric and visualization information. 3D semantic modelling is useful for visualization, query and spatial data analysis. Semantic modelling means defining a feature's type and application-specific data in the geometric model of different city objects. 3D modelling with semantic information can be used in different fields like administrative, management, Urban Planning, Civil Engineering, Cadastral Mapping, Real Estate Management, environmental protection, tourism and to preserve historical places etc.

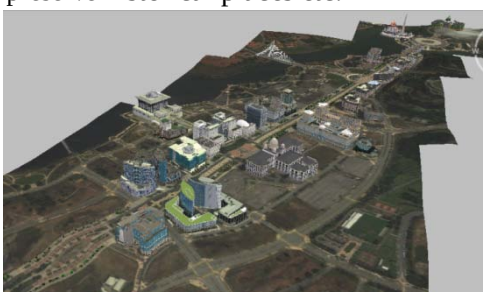

Fig: Visualization of 3D city models, Putrajaya Area, Malaysia

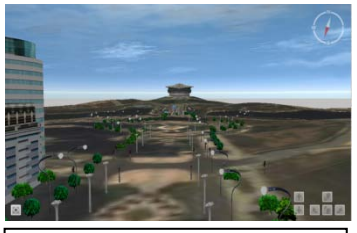

Fig: 3D modelling of vegetation and city furniture

Figure: 3D Cad model of city: Source: Paul M. Torrens

3D modelling is useful for efficient visualization; it also gives the necessary information about the city, so it saves both time and money. Most of the 3D models are generally pure graphical and geometrical models, which can only be used for the visualization purposes. 3D geometric with semantic and thematic information is required for the spatial data analysis and thematic queries. To increase demand and marketing of 3D models, the 3D city models also have to be designed in such a way that it does not only consists of geometric information, it should contain the semantic and thematic information as well.

For the preparation of 3D city modelling, different hardware and software, techniques and methods like automatic, semi- automatic and manual and different types of data like LiDAR data, aerial photographs, terrestrial laser scanning data, topographic maps and CAD data are used according to the requirement of the field aspect and financial aspect.

Generally CAD data is used as primary data with photographs and images as supporting data are mainly used for 3D city modelling, if the area is small and financial support is not so high. In the geometric modelling, photographs are mainly used for texturing in 3D city objects and for the aesthetic view of City modelling. Different software like AutoCAD, Adobe Photoshop, Google SketchUp, CityServer3D, Autodesk LandXplorer, Code Synthesis XSD, tridicon CityDiscovererf, BS Contact Geo, CityGRID etc can be used for designing the 3D city modelling.

Different supporting tools such as CityGML model and, IFC model can be used to define the semantic and thematic information in the geometry of the objects. CityGML, adopted by OGC, is an open data model and XML-based format for the storage and exchange of virtual 3D city models. It is a common information model for the representation of 3D city object models which defines the classes and relations of most relevant objects and models of cities with respect to geometrical, semantical, topological and appearance properties. BIM is the digital representation of building with all building components. It gives the semantic information of building like material of elements, opening directions of Doors/Windows, state of elements, and date of construction.

Solar Tracking System

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Background

How much energy does a man consume daily? Sometimes we might have played our mind on that, especially when we talk about energy crisis. Obviously, 16 hours daily load shedding, how we Nepalese can forget that? And some scholars would be happy to run their mind on the matter in the dark, resting on bed. They must have asked themselves, from where does the energy for the human come? Ultimately they will find that the Sun is the ultimate source of energy for human in the Earth. No doubt the energy that every living being extract from nature is due to sun.

Since sun is the ultimate source of energy, scientists have performed many researches, and experiments to find out the way to directly convert sun light to usable form of energy. Now the world has many direct ways to utilize the solar energy to useful work. The most important one is the conversion of the solar energy to electrical energy. Solar thermal system such as Parabolic Trough System, Power Towers, Dish/Engine System are thermal system for collecting solar energy.

Direct solar energy to electricity conversion is achieved by photovoltaic systems. But the major problem with the solar energy extraction systems is that the sun is not available for 24 hours continuously at a location. During night period and on rainy & cloudy periods it is not available.

But again solar energy is still being popular and attractive as we grapple with global climate changes. The fixed solar collectors are being used from years. But it is not the efficient use of the materials and the solar energy as well. And scientists have developed, used in practice the better & efficient way to extract solar energy. The technique is the Solar Tracking System.

Fig: Solar Totem Tracker at the PVTech 2008 exhibition

Introduction

From our childhood we have seen that sun rises in the east and sets in the west. We see the sun moving in the sky from east to west. And we must have noticed that the sun is lower in the winter period than the summer period. From this observation we can depict that the position of the sun with respect to that of the earth changes in a cyclic manner during the course of a calendar year.

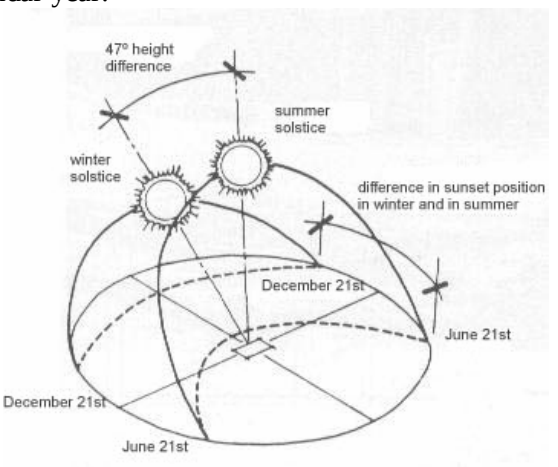

Fig: Position of sun, changing in cyclic manner

The solar energy collecting system is the most efficient if the collecting system e.g. photovoltaic cell faces the sun directly. The PV panel should be such that the sunlight falling on the panel is perpendicular to it for efficient use of the system. Is their any system to maintain this? It would be nice to have a system that makes the solar collector to face the sun every time, isn't it? Solar Tracking System is the one which does this job, to track the sun as it moves. Tracking the position of the sun in order to expose a solar panel to maximum radiation at any given time is the main purpose of a solar tracking system. The one type to move the collector is from east to west during day period and the less noticing one is the seasonal correction of the panel position.

Solar tracking system can be operated in manual, semi manual or automatic modes. In manual mode, the designer makes markings in the system so that a person can set the position on regular period basis say hourly, half hourly. This is the simplest one to do the job. Paying less, costs more. This type of tracking is not so economic and efficient as a man is needed everytime. In semi manual, sensors are used to guard the sun's position to move the solar collector on the daily basis and the seasonal compensation is provided manually

once a month or twice a month. This mode is most economic for medium sized solar collecting systems. Such tracking will increase the output by 20-30%. The third one, automatic mode is the challenging as well as interesting one. It consists of sensor based control system equipped with two essential features.

a) Azimuth tracking for adjusting the tilt angle of the surface of the PV array during changing seasons, and

b) Daily solar tracking for maximum solar radiation incidence to the PV array.

This type of tracker is also known as automatic dual axis tracker. As the name says, the system is designed to track the sun in both the axis. This increase the output of the system by 30-36% but may not necessarily be the most efficient and economic one. The system also consumes energy and the system is economical only if the increase in the generation is more than the consumption. If you spent 100 then it is obvious that you will expect 110(more than 100), think!!

Components

Automatic Solar Tracking System is seen as a control system in engineering view. It may be closed loop or open loop control system, but the components are more or less same except some parts. Due to development of the digital processor the ease in control system has increased. So, all the modern solar tracking systems uses digital controller. It may be said that all the solar tracking systems are digital control systems. Following are the general components used in solar tracking system

a. Sensor

If you want to eat then first ensure if it is cooked. Sensor plays the important role in closed loop control system. The sensors normally used are LDR, Photodiode, phototransistor and photocell. The job of sensor is to sense the position of sun. It senses whether the sunlight is perpendicular to the solar collector and generates appropriate signal.

In timer tracking system, there is no need of a sensor. These use a timer to move the tracker across the sky.

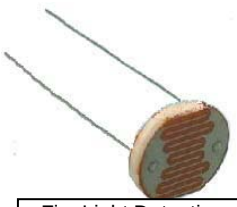

Fig: Light Detecting Resistor (LDR)

Incremental movement throughout the day keeps the solar modules facing the general direction of the sun. Trackers of this type can utilize one or two axes depending on their application. The main disadvantage of timed system is that their movement does not take into account the seasonal variation in the position of sun. Unless measures are taken to adjust the tracker position seasonally, there will be a noticeable difference in efficiency depending on the season.

b. ADC

ADC is one of the signal processing equipment. ADC converts the signal from the sensor to the usable form to be used by the microprocessor. ADC converts the analog signal from the sensor into digital signal. It is an Integrated circuit chip.

c. Microprocessor

It is the heart of the system. It process the signal obtained from the sensor and send appropriate signal to the actuator. Microcontroller such as 8051, PIC, FPGA etc are used as processing element.

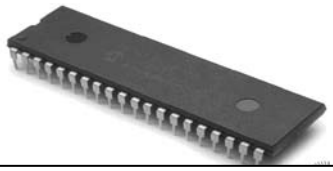

Fig: PIC **16F877A** microcontroller

d. Electric motor

It is the actuator of the system. It takes the input from the microprocessor and actuates the output quantity to the desired state. Obviously, the interfacing circuitry is needed to make the interconnection between the low power microprocessor and high power motors. Generally, stepper motor is used as the output actuator but some designers use permanent magnet dc motor as well.

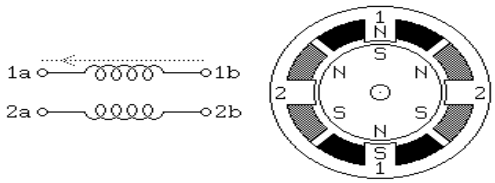

Fig: A two phase (winding) bipolar stepper motor

The following figure shows the complete structural diagram of a microprocessor based solar tracking system. It uses LDR as the sensor to sense the direction of the sunlight. The output from the LDR is fed to ADC through the processing circuit. The digital signal is now fed to the microprocessor through the input port of the processor. The signal is processed as programmed in the chip. Then it drives the motor to take the desired action. The figure shows the power supply needed for its operation which it derives from the storage battery from the solar system. The RAM section, ROM section and the system bus are internal to the microcontroller.

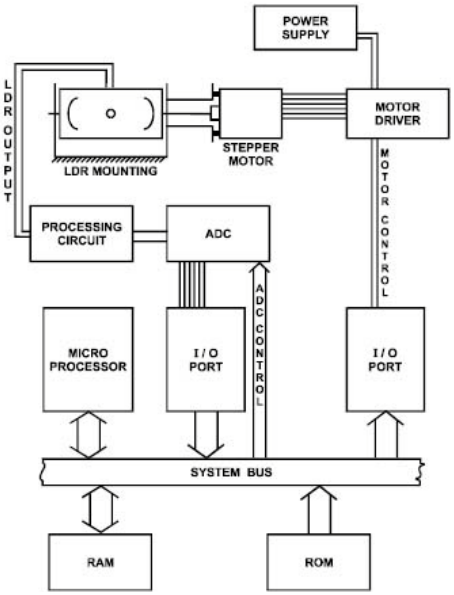

Fig: diagram consisting of various components

Conclusion

Solar Tracking System is a hybrid hardware/software prototype, which provides best alignment of solar panel with the sun, to get maximum output (electricity). For many years, several energy companies and research institutions have been performing solar tracking for improving the efficiency of solar energy production. A variety of techniques of solar energy production used have proven that up to 30% more solar energy can be collected with a solar tracker than with a fixed solar system. But it doesn't guarantee economic use of resources. A simpler and low cost design is necessary for the economic viability of such tracking systems. Due to advancement in the digital technology, the digital control systems are common nowadays for many systems, including solar tracking system.

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Sustainable Building

Kailash Suwal
Architecture 5th Year

Introduction- Sustainability

At a certain point . . . – very recently in historical terms – we started worrying less about what nature can do to us, and more about what we have done to nature. This marks the transition from the predominance of external risk to that of manufactured risk.

'Sustainable' is defined in dictionaries in terms of continuity and maintenance of resources, for example: sus.tain.able adj 1: capable of being sustained 2 relating to, or being a method of harvesting or using a resource so that the resource is not depleted or permanently damaged <~ techniques> <~ agriculture> b: of or relating to a lifestyle involving the use of sustainable methods <~ society> – sus.tain.abil.i.ty n (Merriam-Webster 1994)

This and similar definitions present sustainability from an essentially anthropocentric and instrumental position, concerned with how to maintain and even improve the quality of human life within the carrying capacity of supporting ecosystems. The acronym ESD is often adopted as fuzzy code expressing a concern for sustainability issues in the way that human beings impact on this carrying capacity in the future. The meaning of E varies between *environmental*, *ecological* and even *economic*, while the D sometimes means *development* and sometimes *design*. While the S stands for *sustainable* (and *sustainability*), this term in recent usage has come to denote a broader perspective and a new way of looking at the world.

At certain times in the practice of a discipline, concepts and strategies based on common themes or concerns can be seen to arise. The continuation, small shifts, fundamental transformations, or replacement of issues can be affected by institutional settings such as political events, changes in technologies, scientific discoveries, calamities (actual or imagined) or economic practices and processes. Viewed in this way, 'green', 'ecological', and 'environmental' are labels that embody the notion that the design of buildings should fundamentally take account of their relationship with and impact on the natural environment. The formation of these concepts can, more or less, be traced to the early 1970s. Emerging from the same period, labels such as 'low energy', 'solar' and 'passive' are used to denote approaches to designing concerned with the concept of reducing reliance on fossil fuels to operate a building. In general, the labels refer to a particular strategy employed to achieve the conceptual outcome, and the strategies that occur in a discourse must be understood as instances from a range of theoretical possibilities. The promotion of a restricted range of strategic options regulates the discourse and the ways of practicing the discipline. An examination of sustainable design discourse and practice will reveal something of this regulation. Overall, practitioners modify their concept of their discipline to embrace these new themes, concerns and ways of practice.

Sustainability means "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Taking the idea a step further, sustainable buildings are those that have been designed deliberately to have a minimal impact on the environment. A partial list of things designers might consider when doing a sustainable building includes decreasing resource consumption during construction and operation, the source and composition of a building's materials, and sitting a building to minimize environmental damage and soil erosion. When properly designed, sustainable buildings can produce many benefits: Operating costs are lower than those of similar buildings, and occupants often report that they are more comfortable and productive in them. Post-occupancy studies, which have been rare in the world of architecture, increasingly show these benefits to be measurably true.

Sustainable Architecture

Sustainable architecture, then, is a revised conceptualization of architecture in response to a myriad of contemporary concerns about the effects of human activity. The label 'sustainable' is used to differentiate this conceptualization from others that do not respond so clearly to these concerns. Not long ago a major part of the image of good architecture was a building that was suitable for its environmental context – one that would adequately protect the inhabitants from the climate. More recently it is 'the environment' that has been seen as needing protection. The concept of good architecture has shifted to encompass the notion of a building that is sensitive to its environment, one that will adequately protect the environment from the potential pollution and degradation caused by human habitation. In many ways the built environment, the very means by which we attempt to create secure

conditions, is itself seen as becoming (or having become) a source of danger and threat.

Sustainable Architecture is a review of the assumptions, beliefs, goals and bodies of knowledge that underlie the endeavour to design (more) sustainable buildings and other built developments.

Much of the available advice and rhetoric about sustainable architecture begins from positions where important ethical, cultural and conceptual issues are simply assumed. If sustainable architecture is to be a truly meaningful pursuit then it must be grounded in a coherent theoretical framework. Through a series of self-reflective questions for designers, the authors argue the ultimate importance of reasoned argument in ecological, social and built contexts, including clarity in the problem framing and linking this framing to demonstrably effective actions. Sustainable architecture, then, is seen as a revised conceptualization of architecture in response to a myriad of contemporary concerns about the effects of human activity.

SUSTAINABLE DEVELOPMENT

"Sustainable development is development which meets the needs of the present without compromising the ability of future generation to meet their own needs." -- World Commission on Environment and Development, *Our Common Future*, pp. 4, Oxford University Press, New York, 1987.

This definition has been formulated by the World Commission on Environment and Development (WCED), led by the Norwegian prime minister Gro Harlem Brundtland, in 1987.

The word development in this definition implicates two important aspects of the concept: It is omnidisciplinary, it cannot be limited to a number of disciplines or areas, but it is applicable to the whole world and everyone and everything on it, now and in the future. Secondly, there is no set aim, but the continuation of development is the aim of the development.

The definition is based on two concepts:

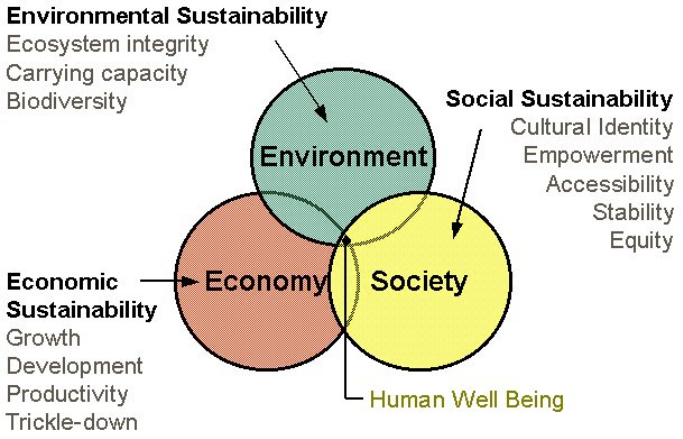
The concept of *needs*, comprising of the conditions for maintaining an acceptable life standard for all people, and **the concept of *limits*** of the capacity of the environment to fulfill the needs of the present and the future, determined by the state of technology and social organization.

The needs consist firstly of basic needs such as food, clothing, housing and employment. Secondly, every individual, in every part of the world should have the opportunity to try and raise his or her life standard above this absolute minimum. The limits consist of natural limitations like finite resources, but also of declining productivity caused by overexploitation of resources, declining quality of water and shrinking of biodiversity. For our common future, it would therefore be best if needs are best fulfilled while limits are not increased, but preferably decreased. This would lead to the quite simple conclusion that all political, technical and social developments can easily be evaluated in the light of sustainable development by these two arguments. Any development should help fulfill needs and should not increase limitations.

Sustainable development means

- Requires meeting the basic needs of all people and extending opportunities for economic and social advancement. Finally, the term also implies the capacity of development projects to endure organizationally and financially. A development initiative is considered sustainable if, in addition to protecting the environment and creating opportunity, it is able to carry out activities and generate its own financial resources after donor contributions have run out." *Bread for the World*, Background Paper No. 129, Washington, DC, March 1993.
- "[Improves] . . . the quality of human life while living within the carrying capacity of supporting ecosystems." International Union for the Conservation of Nature and Natural Resources (IUCN), World Conservation Union, United Nation Environment Programme (UNEP), and World Wide Fund for Nature (WWF), *Caring for the Earth*, pp. 10, IUCN/UNEP/WWF, Gland, Switzerland, 1991.
- A sustainable system delivers services without exhausting resources. It uses all resources efficiently both in an environmental and economic sense.

Three Dimensions of sustainability



Economic dimensions of sustainability:	Environmental dimensions of sustainability	Social dimensions of sustainability
• Creation of new markets and opportunities for sales growth • Cost reduction through efficiency improvements and reduced energy and raw material inputs • Creation of additional added value	• Reduced waste, effluent generation, emissions to environment • Reduced impact on human health • Use of renewable raw materials • Elimination of toxic substances	• Worker health and safety • Impacts on local communities, quality of life • Benefits to disadvantaged groups e.g. disabled

Sustainable Construction

Sustainable construction is defined as "the creation and responsible management of a healthy built environment based on resource efficient and ecological principles". Sustainably designed buildings aim to lessen their impact on our environment through energy and resource efficiency.

It includes the following principles:

- minimizing non-renewable resource consumption
- enhancing the natural environment
- eliminating or minimizing the use of toxins

"Sustainable building" can be defined as those buildings that have minimum adverse impacts on the built and natural environment, in terms of the buildings themselves, their immediate surroundings and the broader regional and global setting. "Sustainable building" may be defined as building practices, which strive for integral quality (including economic, social and environmental performance) in a very broad way. Thus, the rational use of natural resources and appropriate management of the building stock will contribute to saving scarce resources, reducing energy consumption (energy conservation), and improving environmental quality. Sustainable building involves considering the entire life cycle of buildings, taking environmental quality, functional quality and future values into account. In the past, attention has been primarily focused on the size of the building stock in many countries. Quality issues have hardly played a significant role. However, in strict quantity terms, the building and housing market is now saturated in most countries, and the demand for quality is growing in importance. Accordingly, policies that contribute to the sustainability of building practices should be implemented, with recognition of the importance of existing market conditions. Both the environmental initiatives of the construction sector and the demands of users are key factors in the market. Governments will be able to give a considerable impulse to sustainable buildings by encouraging these developments.

Some objectives for sustainable buildings:

- Resource Efficiency
- Energy Efficiency (including Greenhouse Gas Emissions Reduction)
- Pollution Prevention (including Indoor Air Quality and Noise Abatement)
- Harmonization with Environment (including Environmental Assessment)
- Integrated and Systemic Approaches (including Environmental Management System)

Theme	Environmental	Economic	Social
Sub-theme	- Global - Local and site - Internal	- Construction - Materials - Infrastructure	- Equity - Community
Issues	- Climate change - Resources - Internal environment - External environment - Wildlife	Profitability - Employment - Productivity - Transport and utilities - Building stock value	Poverty - Minorities - Inner cities - Transport - Communications

Sustainable or Green Building

"...the modern architect has produced the most flagrantly uneconomic and uncomfortable buildings ... inhibited only with the aid of the most expensive devices of heating and refrigeration ... glass-sheathed buildings without any contact with fresh air, sunlight or view." Louis Mumford, architectural critic and social commentator, 1960

Forty years of building and not much has changed. For the most part, today's buildings, whether office complexes or homes, are designed and constructed with little thought given to the environmental impacts of building materials used, land use patterns, long-term maintenance and operation and, most importantly, comfort for the occupants. And while it's true that today's buildings are more energy efficient than those of forty years ago, the average home, school, office, hotel or commercial structure still wastes large amounts of energy and water. They are far more expensive to heat and cool than necessary, and they over-use resources in their construction and operation. And the occupants are still uncomfortable.

There is, however, a small and growing contingent that recognizes the need for not continuing "business as usual" and is willing to buck a conservative industry by "going sustainable and green." These architects, builders and developers are beginning to capitalize on the growing trend of sustainable design that makes their projects more marketable, saves money and wastes fewer resources, even as it makes the building occupants comfortable and productive.

Sustainable buildings are not a new style of construction - they represent a change in how we think about, design, construct and operate buildings. Sustainable and green buildings use "off the shelf materials and equipment" and, in fact, as architectural and environmental issues become more interwoven, can be very compelling to the architect, builder and owner.

Sustainable building integrates building materials and methods that promote environmental quality, economic vitality, and social benefit through the design, construction and operation of the built environment. Sustainable building merges sound, environmentally responsible practices into one discipline that looks at the environmental, economic and social effects of a building or built project as a whole. Sustainable design encompasses the following broad topics: efficient management of energy and water resources, management of material resources and waste, protection of environmental quality, protection of health and indoor environmental quality, reinforcement of natural systems, and integrating the design approach.

Green Building, also known as green construction, is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle: from sitting to design, construction, operation, maintenance, renovation, and deconstruction. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort. The green movement is related to green economics, green management, green energy and green architecture.

"Green building" is defined by the act as "an integrated, whole-building approach to the planning, design, construction, operation, and maintenance of buildings and their surrounding landscapes that helps mitigate the environmental, economic, and social impacts of buildings, so that they are energy efficient, sustainable, safe, cost-effective, accessible, healthy, and productive."

Five Basic Principles of Sustainable Building

Sustainable building practices consider environmental factors, human health and well-being, in addition to the traditional criteria of function, cost and aesthetics. According to the Primer on Sustainable Building by *the Rocky Mountain Institute;* there are five "must do" principles an architect, developer and builder should consider before starting a sustainable building project.

1. **Green is a building philosophy not a building style.** It's not the green features that dominate the architecture. Energy efficiency and sustainable measures are basically invisible and can be blended into any design.

2. **Thorough planning.** There is no substitute for taking enough time to "think through" all the sustainable features you want included in the structure. Sustainable buildings are front-loaded - extra work must be done in the planning stage to incorporate green features into the design.

Green buildings are not after-thoughts. The green agenda is an ambitious one and, at first glance, is intimidating. Today, these building types require more planning and thought for the developer and builder. More lead time is needed to understand new information and become comfortable with new building products and approaches.

3. **Sustainable buildings aren't necessarily more expensive or complicated.** You could spend more, and it certainly would be justified with all the quick paybacks from reduced operating costs; however it's not necessary. The success of sustainable buildings

comes not from what mechanical features are included but rather, which ones are left out. The best systems are the ones you no longer need.

4. **An integrated approach is critical.** You cannot design a conventional building and then decide to add efficient technologies, natural day lighting, and green materials as an afterthought. You cannot design a green building without considering the site, the placement of the building or its impacts on the surrounding environment. Try that approach and what you get is a building that ends up as an expensive, piecemeal mess that performs only slightly better than a conventional structure that appears as a wart on the landscape.
Integration is the name of the game. For instance, upgrading windows to super efficient ones can reduce the size of the heating and cooling system you need. By spending more up front, you will have lower operating costs down the road.

5. **Minimizing energy consumption is the central goal and organizing principle.** Design elements fall into three categories: energy - saving architectural features, an energy-conserving building shell and energy-efficient mechanical devices such as water heaters and lights.
Remember, going green isn't a yes or no, all-or-nothing proposition. Once you make the decision to move down the sustainable path, do what you can handle. A building that has thoughtfully incorporated a few well-designed sustainable features is far better than one that doesn't. So, as the Rocky Mountain Institute suggests, " Go as green as your time, skills, client and project allow. If your decisions save some lumber, some energy, or even water, you're definitely doing the right thing."

Energy Efficient Design
Energy efficient design is a climate sensitive design that should corporate in design features that optimizes use of available and affordable energy sources. Efficient design incorporates everything for its inception to its inception to its construction. It involves everything from its sitting on the site, planning of spaces, more efficient heating, ventilation and air conditioning system and more efficient management and control of energy in the building.
Energy efficient design involves “passive solar” or “design with climate” principle, as well as the material used in construction, the gas, and fuel infrastructure that support the building, and more. A well design climate sensitive building uses the sun’s energy directly for heating and lighting the interior and natural breezes for cooling depending on the local climate, which reduce the energy bill considerably. The benefit from the energy efficient sitting and design of buildings are economic (money saving), social (reducing fuel poverty) and ecological (reducing and resources exploitation and emissions). Every new development ideally should have an explicit energy strategy, setting out how these benefit are to be achieved.

8-R PRINCIPLES OF A GREEN BUILDING
In present world of technology people seem more dependent on mechanical energy. Energy consumption

Fig: Green Concept: 8R’s

is growing at such a rate that it seems the resources won’t last longer for future generation. The consumption is being done without any conscious effort to pay them back. Moreover it is causing unrepairable damage to the environment and the ecological system. Thus the concept of green is introduced these days as a conscious effort against these problems.
The concept of green can be understood through 8R’s. Although new technologies are constantly being developed to complement current practices in creating greener structures, the common objective is that green

buildings are designed to reduce the overall impact of the built environment on human health and the natural environment by:

- Efficiently using energy, water, and other resources
- Protecting occupant health and improving employee productivity
- Reducing waste, pollution and environmental degradation.

Hence, the major principles of a green building are to conserve non renewable energy and scarce materials and use renewable energy and materials that are sustainably harvested for minimizing life cycle ecological impact. This thus helps to protect and restore local air, water, soils, flora and fauna; and reduce human exposure to noxious materials. Inclusion of greenery in a building is also an important aspect of achieving green. Excessive consumption of non-renewable and exploitation of resources without any mechanism to pay back in a useable form have resulted in environmental pollution and damaged the ecological balance.

Conclusion

Many developers, building owners and facility managers are advancing the state of the art in commercial and large residential buildings through new modeling tools, design techniques and creative use of financial and regulatory incentives. For the past years, in ever-increasing numbers, we have begun to see development of commercial structures using green building techniques and technologies. Architect and engineer want to locate in a space that reflects their values, and a high-performance building goes a long way toward satisfying sustainable and green requirement.

Most long-time participants in the real estate, architectural design and building construction industries realize that sustainable design is the biggest *sea change* in their business careers. The urgency of global warming and the increasing dependence on imported fuels have led architects to urge more concerted action to reduce energy use in buildings. One can achieve a 50% reduction with existing building technology at no extra cost by simply using the right design strategies, such as proper orientation and form, day lighting, solar control and passive heating and cooling techniques.With the skyrocketing population and growing civilization, there has always been an increasing demand for energy throughout the world. So, it's high time we explored various architectural and building technologies that will achieve a low energy built environment. The alternative energy option should be developed and used to minimize the negative environmental impact as well as to conserve the non-renewable energy sources.

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Basic Introduction to Seismic Retrofitting of a Structure

Satish Bhagat
Civil 4th Year

What is a Seismic Retrofit?

Seismic retrofit is a field of construction engineering that focuses on the modification of existing structures to enhance their capability to resist earthquakes. Retrofitting are measures taken for older buildings to meet current codes by increasing its structural integrity to withstand moderate earthquakes with minor structural damage and major earthquakes with moderate structural damage. Seismic retrofitting is achieved by the inclusion of structural improvements that may prevent the building, people and the equipment from damage by seismic waves. In seismic zones, retrofitting may be essential for the bridges, overpasses, tunnels, and buildings, while the new construction would require compliance to seismic standards. Seismic retrofit may be executed on concrete masonry, unreinforced masonry, soft story, and concrete tilt-up construction. Soft story building is a multi-story building with abundant open space, and in concrete tilt-up construction, concrete is filled in the panels that form the walls of the structure. Since the concrete tilt-up walls are normally heavy, the seismic retrofit may be necessary. The motive for the concrete tilt-up retrofit is to prevent the separation of the roof from the building walls.

Objectives of Retrofitting

In the past, seismic retrofit was primarily applied to achieve public safety, with engineering solutions limited by economic and political considerations. However, with the development of **Performance Based Earthquake Engineering (PBEE)**, several levels of performance objectives are gradually recognized:

Public safety: The goal is to protect human life, ensuring that the structure will not collapse upon its occupants or passersby, and that the structure can be safely exited. Under severe seismic conditions the structure may be a total economic write-off, requiring tear-down and replacement.

Structure survivability: The goal is that the structure, while remaining safe for exit, may require extensive repair (but not replacement) before it is generally useful or considered safe for occupation. This is typically the lowest level of retrofit applied to bridges.

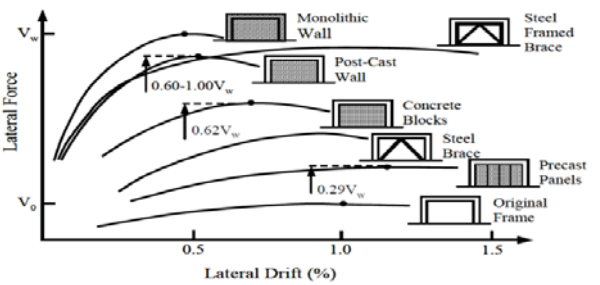
Structure functionality: Primary structure undamaged and the structure is undiminished in utility for its primary application. A high level of retrofit, this ensures that any required repairs are only "cosmetic" - for example, minor cracks in plaster, drywall. This is the minimum acceptable level of retrofit for hospitals.

Structure unaffected: This level of retrofit is preferred for historic structures of high cultural significance.

Methods of Retrofitting

Conventional Strengthening Methods

Conventional retrofitting methods include addition of new structural elements to the system and enlarging the existing members (Newman, 2001). Addition of shear walls and bracings shown in Fig. 1(a) is the most popular strengthening method due to its effectiveness, relative ease, and lower overall project cost compared to column and beam jacketing shown in Fig. 1(b) and (c), respectively. Relative effectiveness of various wall and bracing configurations are compared in Fig. 1(a). From this figure, it is seen that post-cast shear walls and steel braced frames are the most effective strengthening techniques. Although the latter is more effective due to its much higher ductility, post-cast concrete shear walls are the most commonly applied method due to their lower cost and familiarity of the construction industry with the method. Design of additional shear walls is performed to resist a major fraction of the lateral loads likely to act on the structure. This reduces the demand on the beams and columns, hence increasing their safety. Those still likely to be overstressed are strengthened through concrete or steel jacketing, which are relatively more laborious applications.



(a) Effectiveness of structural walls and bracings (Sugano, 1989; CEB, 1997)

(b) Column jacketing (c) Beam jacketing

Fig. 1 Conventional strengthening methods used for seismic retrofitting

(a) additional shear wall (b) additional foundations (c) jacketing (d) additional columns

Fig. 2 Applications of conventional strengthening methods

Fig. 2 shows applications of various conventional strengthening methods such as post-cast shear wall (a), additional foundation to support the shear walls to be constructed around the stairs (b), concrete jacketing of a column (c), and addition of column members to remedy vertical irregularities (d). The main research need associated with conventional strengthening methods is optimization of the retrofit design to achieve a satisfactory structural performance level at a minimum cost based on reliably characterized seismic demand and structural capacity.

Retrofit of Structures Using Innovative Materials

Current research on advanced materials in civil engineering is mainly concentrated on high performance concrete and steel, and fiber reinforced plastic (FRP) composites. FRP composite materials have experienced a continuous increase of use in structural strengthening and repair applications around the world in the last fifteen years. High specific stiffness and specific weight combined with superior environmental durability of these materials have made them a competing alternative to the conventional strengthening methods. It was shown through experimental and analytical studies that externally bonded FRP composites can be applied to various structural members including columns, beams, slabs, and walls to improve their structural performance such as stiffness, load carrying capacity, and ductility (Büyüköztürk and Hearing, 1998). FRP composites have enjoyed varying degrees of success in different types of applications. In general, applications that allow complete wrapping of the member with FRP have proven to be effective.

Wrapping of columns to increase their load and deformation capacity is the most effective and most commonly used method of retrofitting with composites. However, certain failure mode issues regarding different wrapping configuration and fiber orientations, shown in Fig. 3, still need to be well understood (Au, 2001). When wrapping is difficult or not allowed, such as when strengthening beams, slabs, or walls, success of the method is sometimes hindered by premature debonding failures (Günes, 2002).

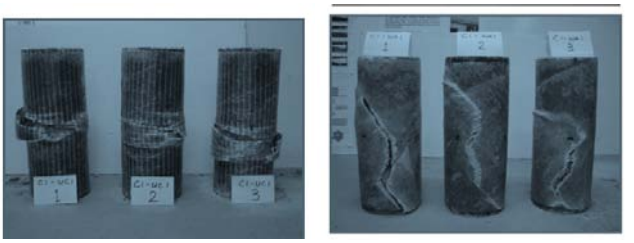
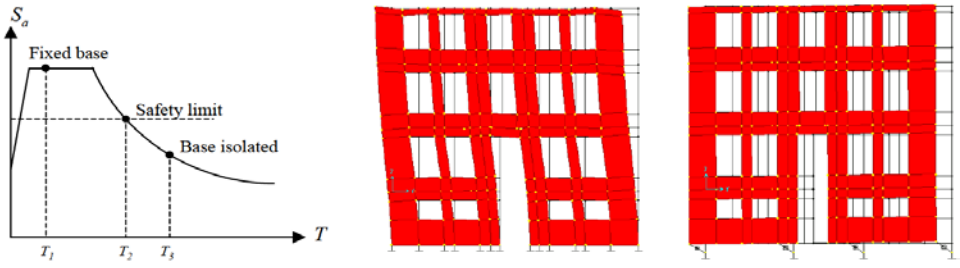


Fig 3: Failure modes of concrete cylinders wrapped with FRP composites in various fibre orientations

Base Isolation

The seismic base isolation technology involves placing flexible isolation systems between the foundation and the superstructure. By means of their flexibility and energy absorption capability, the isolation systems reflect and absorb part of the earthquake input energy before this energy is fully transmitted to the superstructure, reducing the energy dissipation demand on the superstructure. Base isolation causes the natural period of the structure to increase and results in increased displacements across the isolation level and reduced accelerations and displacements in the superstructure during an earthquake. This not only provides safety against collapse, but also largely reduces damage, which is crucial for facilities that should remain operational after severe earthquakes such as emergency response centers, hospitals, and fire stations (EERI, 1990; ATC, 1993; Kelly, 1993; Skinner et al., 1993; Connor and Klink, 1996; Komodromos, 2001). Base isolation can also be used in seismic retrofitting of historic structures without impairing their architectural characteristics by reducing the induced seismic forces.



(a) Design of base isolation (b) Deformations before base isolation (c) After base isolation

Fig 4: Analysis and design of base isolation

Fig. 4 shows the results of a feasibility study for base isolation of a historical school building in Istanbul (Bachas et al., 2001). The structural system of the building is formed by thick exterior unreinforced concrete walls resisting lateral loads and interior steel frames carrying the vertical loads. A combination of lead-plug rubber bearings and natural rubber bearings were considered for the exterior walls and the interior frames, respectively. The basic design philosophy shown in (a) is to increase the fundamental period of the structure so that the effective seismic demand on the structure is less than that can safely be resisted by the structure. Analysis results showing the deformed shape of the building before and after the base isolation in (b) and (c), respectively, make it clear that base isolation reduces the deformations and hence the stresses in the building.

Conclusion

Selection of a particular retrofitting technique depends on the seismic demand, structural capacity, the required performance level, functional characteristics and the importance of the structure. The main challenge is to achieve a desired performance level at a minimum cost, which can best be achieved through a detailed nonlinear analysis as discussed above. Ideally, each structure must be evaluated in detail to determine the optimum retrofit strategy compatible with its characteristic. In the case of large building stocks, however, a classification of structures according to their current and required performance levels may lead to development of common standardized retrofit strategies for structures in the same group, which in turn may prove to be a more rapid and cost effective overall methodology.

Residence Design for Nuclear Family

Ananda Manandhar
Architecture 2nd Year

Project Information

- Nuclear family residence
- Client : Musician
- Site given : 90'*30'
- Orientation :

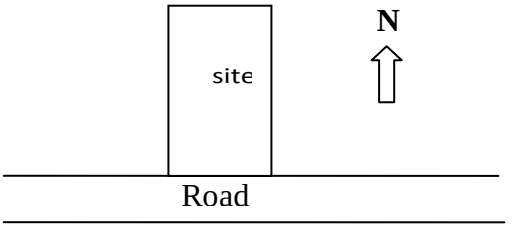


Fig: Orientation

Design Concept

As the residence is designed for a musician, the form is derived from the perception of guitar in plan which helps to divide the whole residence in two blocks connected by a bridge. This division into two blocks make easy in receiving light from south. On the other hand, zoning is also easy as front block is used for family and circular block at back can be used completely for musician. In between these two blocks is the open space with bridge where interesting environment can be created.

Guitar strings in guitar is shown horizontally. This concept is applied in this residence in verandas, windows and white bands as design elements. Use of brick exposed walls and plastered walls painted with dark blue in different blocks has also made building pleasant in look and also gives feeling of separation at the same time.

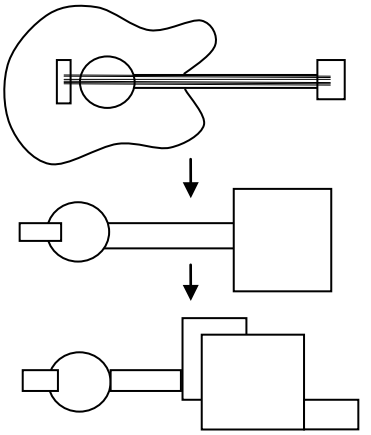


Fig: Design concept derived from Guitar

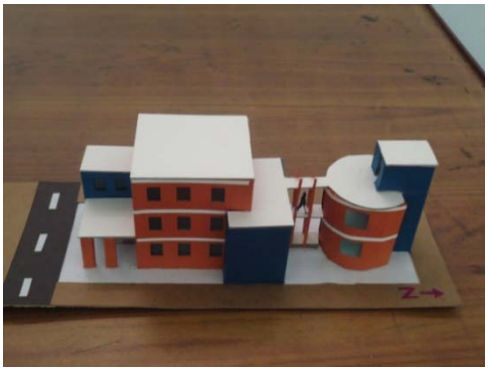
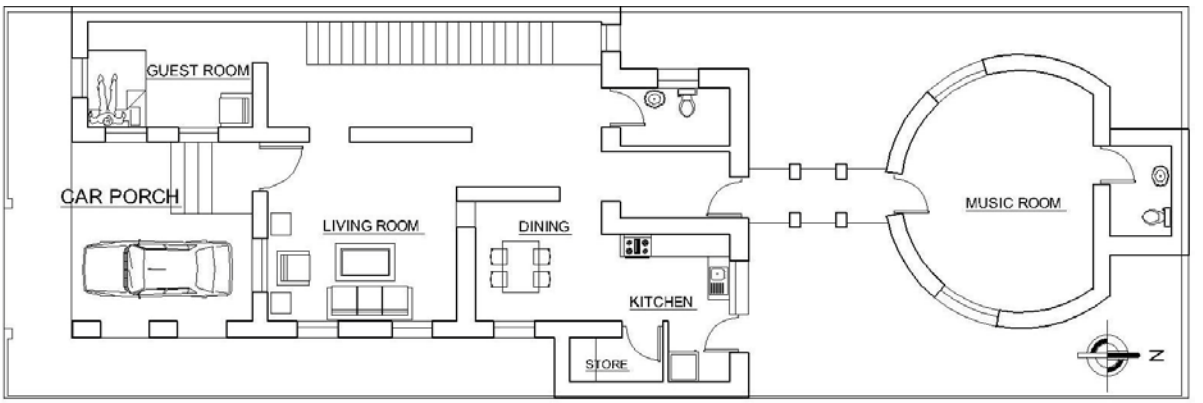


Fig : 3D Model



GROUND FLOOR PLAN

Trail Bridge Technology in Nepal

Gopal Tamakhu
Civil 4th Year

Background

Nepal is predominantly a mountainous country, situated in the middle section of Great Himalayan Range with the total area of 147,181 sq. km. The mountains and the hills together comprise 80% of Nepal's landmass where the majority of the population live. Diversities result in the highest concentration of rivers and rivulets isolating the numerous communities, forced to the poverty. The majority of the roads have been developed in Terai. The cost of road construction increases exponentially with altitude. The viability of roads in Nepal diminishes with increasing altitude technically and economically. Topographically, it is very hard job to make accessible road in hilly areas. Development of alternative means of transportation for these people deprived of road access is very important. Besides, the effects of vehicular roads on the fragile mountain ecology, environment and socio-economic and cultural life of the inhabitants can yield negative results. Walking along foot trails is the main and often the only mode of transport for more than 2.2 million hill dwellers on the move any time of the day. And for all of them, every day, safe river crossings are an acute need not just for growth and development but for their very existence and survival. Therefore, the only means of infrastructure that meets the prerequisites of the remote people are trail and trail bridges.

History

The introduction of trail bridges in Nepal was made by the Rana- Rulers about a hundred years ago. The bridges were erected at locations convenient to the royal family .There were 30 bridges completed, started by Chandra Shumsher till the end of Rana Regime in 1950. The bridges were fabricated in Scotland and constructed by a Scottish firm. Dr. K. I. Singh was the first promoter of trail bridge construction in the 1950's after the downfall of Ranas in Nepal. The initiator of trail bridge development in Nepal goes to Tony Hagen, a Swiss geologist. He advised Nepal government to unlock the interior of Nepal to improve accessibility promoting trail bridges. In 1964, at the initiative of U.S Aid the Suspension Bridge Division (SBD) was established under the umbrella of the Public Works Department.

Construction of trail bridges grew rapidly after the establishment of the division. The steel parts manufacturing companies have been established and necessary norms, standards, technologies, management procedures etc. have been developed. The periods 1964-2000 has become the development period of trail bridge technology in Nepal. There were numerous bridge requests in main trail as well as in local trail. More than 900 trail bridges have been constructed with the assistance of Swiss Agency for Development and Co-operation (SDC). The suspension bridge 271 meters is constructed over Trishuli River at Jugedi (Tanahun/Chitwan), completed in 2000 and the longest suspended bridge 350 meters is constructed over Sunkoshi river at Bunwajor Ghat (Khotang/Udayapur), completed in 1996. Helvetas Nepal re-started its involvement in 1972 with support from SDC. With this involvement, pedestrian trail bridge building in Nepal, which till then crawled *ad hoc* on a piecemeal basis, took on the form of an institutionalized development activity to be sustained into the future.

Based on the practices and performance, it has concluded to a demarcation convention. The cut-off point was established at 120 meters. Consequently, the bridge standards were developed: Short Span Trail Bridge (SSTB) and Long Span Trail Bridge (LSTB). The technical manuals have been subsequently reviewed observing the newly set Demarcation Convention .The harmonization of technologies, the documentation of the managerial as well as social approach led to the development of a National Policy.

Development of a National Policy: The Trail Bridge Strategy

The LSGA, 1999 and the Local Self-Governance Rules, 1999, together with the LIDP, 2004 devolves responsibilities for planning, implementing, operating, repairing and maintaining local infrastructure development programs , previously operated by the central agencies, to the local bodies with the objective of making them more active, people-oriented and accountable under the local self-governance system.

In order to facilitate pragmatic decentralization and avoid confusions and conflicts in a multi-donor, multi-stakeholder scenario, it became imperative to outline a national strategy for trail bridge construction. TBSSP supported the government to promulgate the Trail Bridge Strategy, 2006 that seeks not only to bring uniformity in technologies, standards, norms and specifications of bridges but also to ensure that all bridge builders follow a similar implementation approach. The strategies adopted for the trail bridge program are:

- To provide trail bridge facilities to the local people at convenient and feasible locations for their movement
- To devolve the trail bridge program to the local bodies

- To select and use the right technologies for trail bridge construction
- To adopt the right approaches for construction and maintenance of trail bridges
- To enhance institutional capacities and development of trail bridge technology
- To demark roles and responsibilities of all stakeholders

The strategy envisions trail bridges to be constructed at locations that would avoid the need for people to detour more than an hour to reach a safe crossing. Trail bridges are to be included in the DTMPs to lend perspective to equity and balanced growth. Trail bridge program and resources are to be devolved from the central agencies to the local governments. On the basis of the grants to be made available by the centre, as well as their own internal resources, the local governments are to plan and implement construction, operation and regular and major maintenance of trail bridges.

The following working policies are being adopted to implement the above-mentioned strategies:

- Trail bridge facilities will be made available at locations deemed convenient for the local people to cross river, streams and ravines along trails.
- Trail bridges will be constructed at locations that would avoid the need for local people to detour more than an hour to cross a river, stream or raving.
- The tasks of planning, implementation, operating and maintaining trail bridge programs will be accomplished with the participation of the local people.

Standard Bridge Types and Demarcation Convention

- Short Span Tail Bridge (SSTB): A Short Span Tail Bridge means 32 to 120 meters span trail bridges constructed by steel cables. The walkway width is 70 cm or 106 cm for suspended and 106 cm for suspension type bridge.
- Long Span Trail Bridge (LSTB): A Long Span Tail Bridge means more than 120 meters span trail bridge constructed by using steel cables. Ordinarily, a suspended type long span trail bridge will have a length of not more than 350 meters, while a suspension type long span trail bridge will have a length of not more than 280 meters.

- Steel Truss Bridge (ST): A steel truss bridge means one not more than 32 meters in length constructed by using steel truss.

Efficiency and Beneficiaries

Standardization of technology lead to uniformity in design facilitated bulk fabrication, procurement of steel parts and reduced civil construction costs. Improved planning, tendering and contracting processes at the centre also helped to increase efficiency and reduce costs. With the advent of SSTB technology and community involvement in civil construction, irrespective of inflation effects, the cost line continued to dip.

Demarcation Convention

(As per National Trail Bridge Policy)

The Norms, Standards and Technology shall be applied as follows:

For Spans up to 120 m. (120 m. inclusive)	Short Span Trail Brides (SSTB) Norms, Standards and Technology (Both Suspended and Suspension Type Bridge) as expressed in SSTB-Manuals)
For Spans more than 120 m. and Less than 350 m.	Long Span Trail Bridge (LSTB) Norms, Standards and Technology For the Suspended Bridge Type
Less than 275 m.	For the Suspension Bridge Type As expressed in the LSTB-Manuals
For Spans up to 32 m. (32 m. inclusive)	Steel Truss Bridge

Present Scenarios

The trial bridge development program in Nepal has been supported for more than 40 years by SDC/Helvetas. Because of the successful decentralization, the other donors notably DFID, the World Bank and the ADB have joined for supporting the Sub-Sector. This has made the Sub-Sector less dependent on SDC/Helvetas.

This Sector envelopes some $ 12 million p. a. of which the Government provides 42% and the remainder is provided by Local Governments (5%), Communities (5%), as well as a multitude of donors (SDC,DFID,WB,ADB) and projects (RAIDP, DRILP, RRRSDP). Donor- funds are channeled through Local Governments (DDCs) who in turn provide supports to communities to build their bridge.

Challenges Ahead

Technical as well as administrative and managerial procedures for a decentralized transformation of this sub-sector have been successfully put into effect. Further challenges, overall, comprise of capacitating local bodies to bear their respective responsibilities as outlined in the Trail Bridge Strategy, addressing new technological challenges and fine tuning policies, facilitation and monitoring tools. The "acuteness" of the need for a bridge and the "will" factor of the local bodies and communities are the primary energizing and motivating factors that would ensure a bridge in the shortest possible time.

Transfer of Technology

The success of the trail bridge sub-sector in Nepal has resulted in requests for support from Bhutan, Ethiopia, Tanzania, Mocambique, Indonesia and Honduras. Helvetas-Nepal has established a "South-South Collaboration Unit" to which many Nepalese, from Helvetas- proper, the Government and the private sector can and will contribute. Ethiopia in particular is quite advanced and a trail bridge program has been launched. Trail bridge technology developed in Nepal is being transferred to the countries. Nepal has pioneered the trail bridge technology.

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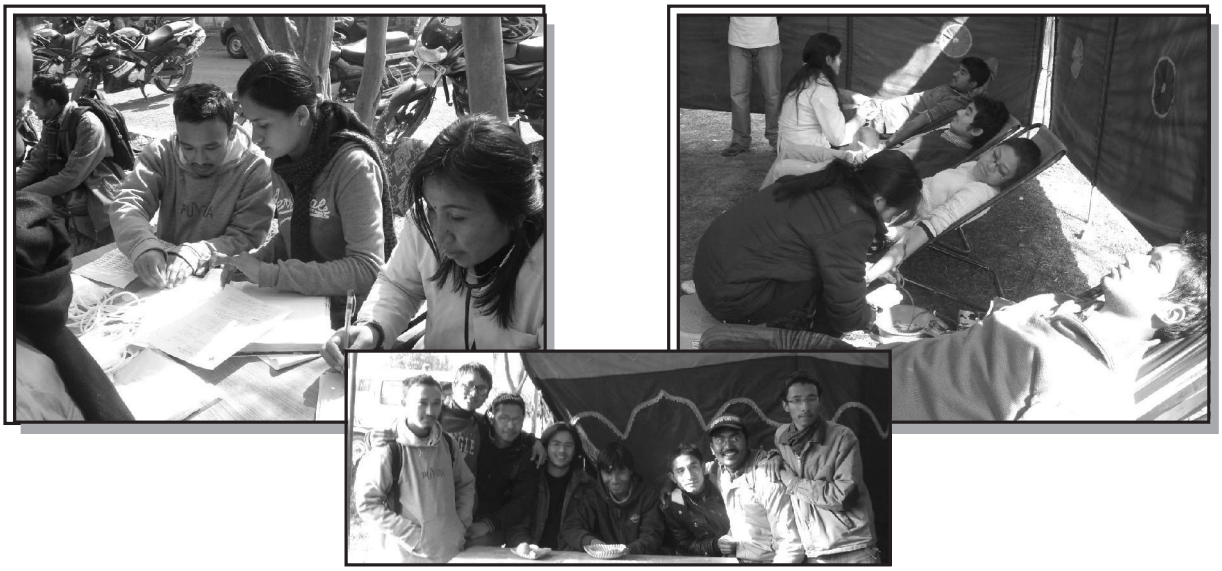

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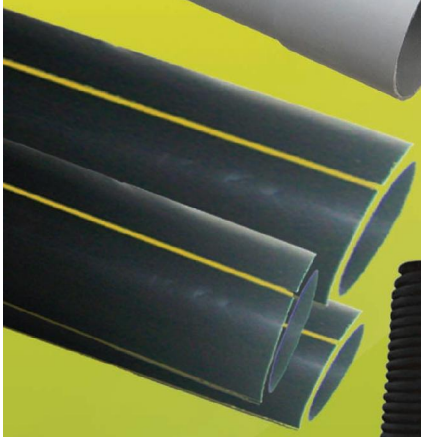

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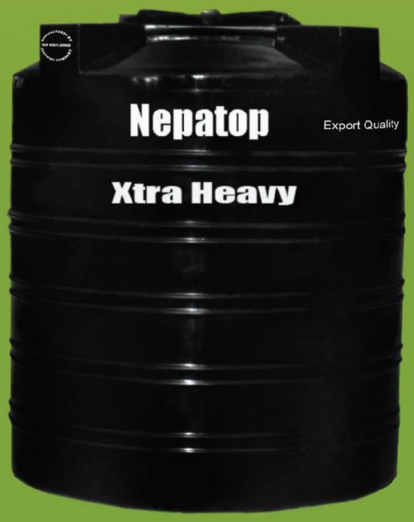

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