IEP-SAC JOURNAL

2021-22

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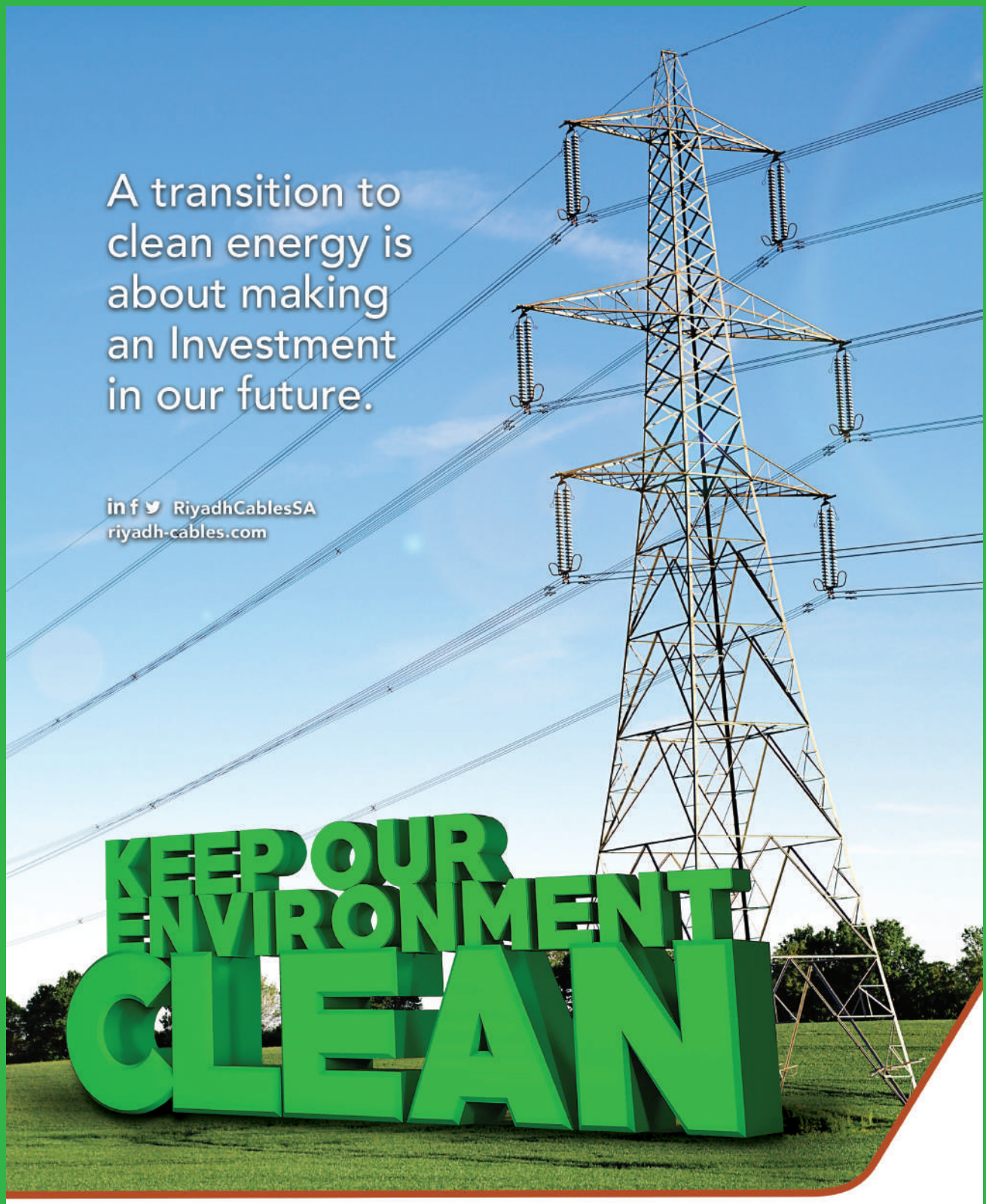

مجموعة كابلات الرياض
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IEP-SAC Journal is published yearly by the Institution of Engineers Pakistan, Saudi Arabian Center (IEP-SAC), Riyadh, and distributed to the engineering community in Saudi Arabia. To promote discussion of issues in the field of engineering and ensure coverage of all responsible points of view, conflicting opinions and views may appear, however, IEP-SAC cannot accept any liability for such views nor for any errors or omissions.

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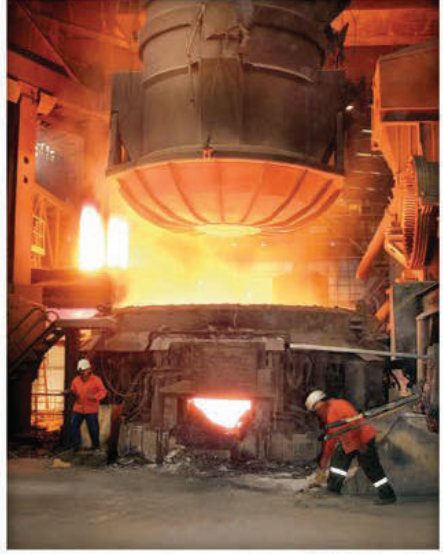

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FROM THE DESK OF CHAIRMAN

EXCEL YOUR TECHNICAL SKILLS

It is a moment of immense pleasure, delightfulness and gratitude to Allah Subhanahu-wa-Taa'la that today we have launched the IEP-SAC annual journal for 2021-22. Keeping our traditions intact, this year journal also contains technical papers and articles on various engineering disciplines, messages from various organizations and personalities, IEP-SAC annual report by the GS, Eastern region sub-centre report, scholarship committee report, pictures of various events in Central and Eastern regions and the famous Directory of Pakistani Engineers in KSA with recent updates. I urge all Pakistani engineers to come forward, become member of IEP-SAC as well as write technical papers in this journal. IEP-SAC has provided you a platform to excel your technical skills and upgrade your qualifications by writing papers in this journal.

After gone through the tough times of the year 2020, we were expecting 2021 to be smoother. However, we have to face new variants of Covid-19 in 2021 with higher intensities. Now it is obvious that this global pandemic has led to major changes in our life style impacting operation of all kinds of businesses throughout the world including engineering industry. It seems that it will take few years to come back to normal situation or we will become habitual to these social / economic changes and the present life style may be considered as normal way of life. I would like to mention that 'challenges always create opportunities' and engineers shall pick the opportunities to fight against threats in the life.

Alhamdulillah, we managed to hold five seminars in the year 2021, which is a great achievement as compared to past history of IEP-SAC. Starting with annual seminar in Jan 2021 on the topic of Cyber Security by Prof. Dr. Muhammad Khurram Khan. We hold another two seminars in March 2021, one on the topic Roshan Digital Account delivered by Director State Bank of Pakistan and the other one 3.5 hours training seminar on Lean Six Sigma White Belt delivered by Master trainer Engr. Adnan Rafique (Director and Founder of Smart Irtekaz, New Jersey, USA). In continuation to it, we had another 4 hours training seminar on Lean Six Sigma Yellow Belt in June 2021, also delivered by Engr. Adnan Rafique. The last seminar of 2021 was held in Nov 2021 on the topic of Artificial Intelligence (Deep Learning) delivered by Prof. Dr. Muhammad Hussain.

IEP-SAC is always striving to bring the information and knowledge of the most modern engineering techniques and trends to our fellow Pakistani engineers. Cyber Security, Lean Six Sigma operational excellence, Artificial intelligence and Machine Learning are the most modern topics and engineering techniques covered last year through various seminars organized by IEP-SAC. Our next annual seminar to be held on 11th Feb, 2022 is also covering the use of Hydrogen as alternate fuel, which is considered to be a modern technique leading towards

sustainability. In fact, we are stepping into the era of industry 4.0. Now a systems engineering practitioner understood it very well that the pathway from 'as-is' to the 'to-be' relies on effective modelling and decision-making tools covered under above mentioned topics.

These seminars and trainings are another tools to excel your skills. The improvement in your skills through knowledge based activities such as trainings, academic and industrial research on day to day and long term issues will definitely play important role in the economic growth of the nation. Like last year, I would like to raise the voice of all Pakistani engineers in KSA through this forum to our government to make appropriate legislation to support research and trainings, so that a knowledge sharing relationship between academia and industry could be developed.

The Institution of Engineers Pakistan – Saudi Arabian Centre (IEP-SAC) is providing a platform to all Pakistani engineers in KSA to excel their skills, share knowledge through seminars and technical papers, socialize among engineers along with their families, and help needy / meritorious engineering students in Pakistan; all done under the patronization of Pakistani Embassy.

On behalf of IEP-SAC, I would like to express the gratitude to the Custodian of the Two Holy Mosques, King Salman bin Abdul Aziz Al-Saud, Crown prince HRH Muhammad bin Salman bin Abdul Aziz and the Government of the Kingdom of Saudi Arabia for their hospitality and cooperation to Pakistani community and engineers in KSA. We are grateful to H.E. the Ambassador of Islamic Republic of Pakistan and embassy staff for their unceasing support and patronage to IEP-SAC. I extend my accolade to all of our council members in Central and Eastern regions for their dedication and commitment towards the IEP-SAC goals and objectives.

Finally, I would like to deliver a message in the form of two short hadiths about importance and rewards of seeking knowledge (علم). The Messenger of Allah, peace and blessings be upon him ﷺ said, "Whoever goes out seeking knowledge is in the way of Allah until he returns" and "The believer is never satisfied from learning good until he arrives in Paradise". So, we shall always put our efforts throughout the life to seek knowledge until death.

Best regards and good wishes for all

(Engr. Syed Muhammad Iqbal Ahmed)

Chairman, IEP-SAC, KSA

Friday 15th January, 2021G

From The
Ambassador of Pakistan

It is my pleasure to congratulate the Institution of Engineers of Pakistan Saudi Arabia Chapter (IEP-SAC) for keeping up with its tradition and publishing an informative annual Journal. I am confident that the Journal for the year 2021-22 would continue to provide useful and up to date information to the Pakistani Engineers, Architects, Town Planners and other professionals based in the Kingdom of Saudi Arabia.

I take pride in the fact that Pakistani Engineers have contributed immensely to the development of the Kingdom and have distinguished themselves through their hard work, competence and matchless dedication. Apart from laying the foundations of countless development projects, our Engineers have also cemented the strong friendship between Pakistan and Saudi Arabia. I am certain that our Engineers will keep up their excellent work and set a standard for other professionals to follow.

I must acknowledge and appreciate the social and philanthropic work that the Pakistani Engineers have been undertaking, especially the efforts of IEP-SAC for providing scholarships to deserving students in various engineering colleges and universities in Pakistan. I am hopeful that this spirit of kindness will continue to flourish every year.

The Embassy of Pakistan will always support the work generating goodwill between Pakistan and Saudi Arabia. I sincerely hope that the IEP SAC and Pakistani Engineers persist in their constructive efforts. I wish them all the success in their future endeavors.

Lt Gen (R) Bilal Akbar

Ambassador of Pakistan to the Kingdom of Saudi Arabia

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MESSAGE FROM THE PRESIDENT OF
THE INSTITUTION OF ENGINEERS PAKISTAN

It gives me immense pleasure to know that the Institution of Engineers Pakistan (IEP), Saudi Arabia Centre (IEP-SAC) is holding 60th Annual Technical Seminar on 11 th February 2022 and bringing out its annual publication, "The IEP-SAC Journal", on the occasion. On behalf of the Institution of Engineers Pakistan (IEP), I avail this opportunity to congratulate IEP–SAC for its continued and consistent efforts in making positive head way in pursuit of its enormous goals by providing unlimited opportunities, incentives, professional recognition and leadership potential. Your scholarship program for the needy students in Public Sector Engineering Universities in Pakistan and Azad Kashmir deserves all appreciations. In the present digital era of connectivity, the forgotten populations of the entire globe can now be out-reached. The United Nation's Sustainable Development Goals after 50 years of its inception, can now be fulfilled with ease. Now United Nation has decided to engage directly with the public through people-oriented people-centric organizations. The essence of the sustainable development is to not work for the vested interests of a few but for the long term benefits for the people as a whole. The Institution of Engineers Pakistan has joined hands in this effort and is well on the way on its own, as well as on its international coalitions with World Federation of Engineering Institutions (WFEO), Federation of Engineering Institutions of South and Central Asia (FEISCA), Federation of Engineering Institutions of Islamic Countries (FEIIC), Prince's Foundation (UK), Chinese Mechanical Engineering Society (CMES) and others. Engineers in the past have been looking forward to serving big businesses through big projects. Some of these projects have been meeting the interests of a few and have been less sustainable bringing diminishing returns. Engineers should now look forward to initiating projects that are long lasting and sustainable and meet the needs of people in whole some ways. In the past moneyed people pulled engineers with their skills and technologies to service them. Now the engineers will bring the moneyed people towards them to implement their proposals. The engineers have to make the most of this opportunity to come forward and rid the society from ills by thought out engineering projects. The future economic strength and sustainability of the society solely depends on steering engineering developments towards welfare of people. We have to inspire our youth to lead advancements of and applications

of engineering and digital technology to benefit people directly and build a better world. The digital world of today, has enabled a special power to the engineers and technologists to build better world. These are smart technologies. Smart technologies are the home grounds of the IT engineers, electronic engineers and the OT mechanical mechatronic engineers. Smart technologies are basically ICT and OT digital tools based integrated system in which a digital framework is essentially an intelligent network of connected objects and machines sensors that transmit data using wireless technology and also utilize Cloud-based IoT applications to receive, analyze, and manage data in real-time to help: 1. Accelerating national economic activity, 2. Achieving urban public quality living, 3. Creating foolproof security environment, 4. Preventing, locating and handling traffic accidents, 5. Improving sanitation and solid waste systems, 6. Enabling reliable water quality and supply system, and 7. 24/7 cost efficient power supply system. The time has come for engineers to change their focus and direction and that they now learn, train and use the smart technologies, effectively integrate designs with smart systems and devices, train themselves to use advanced modeling tools, rapid prototyping, 3D printing and advanced automation in engineering techniques. Let us think of what skills we can acquire ourselves and not passively wait for someone to bring it to you. In short, it is advice from myside, to be prepared to be competitive domestically and globally and boldly propose innovative engineering solutions and pursue opportunities. There are lots of opportunities domestically, those being outsourced globally as well for the innovative minds to come up with innovative solutions independently or reaching out to sponsoring agencies worldwide. The message in nutshell is; 'Go out there and prove your worth to the society- be ethical and be with likeminded people in the service to the society'. Publication of IEP-SAC Journal containing important Articles on current engineering issues and holding Technical Seminars always help to exchange knowledge and information for the best use of engineering profession and building professional ties among the professional engineers of different nationalities, thus building positive image of our country. We are proud of this achievement of IEP-SAC and wish for its great success in coming events and assure full support and acknowledgement on behalf of IEP

Engr. Dr. Javed Younas Uppal

President,

The Institution of Engineers, Pakistan

MESSAGE FROM THE SECRETARY GENERAL OF THE INSTITUTION OF ENGINEERS PAKISTAN

I am pleased to learn that the Institution of Engineers, Pakistan (IEP) Saudi Arabia Centre (IEP-SAC) is organizing its 60th Annual Seminar on 11th January, 2022 and publishing its Annual magazine on this occasion. Holding of technical Seminars and Publishing the technical Journals play an important role in sharing technical knowledge and expertise among the fellow Engineers and are a great contribution in disseminating the technical knowledge. The fund raising efforts of (IEP-SAC) through advertisement and personal contribution of Members for Award of scholarships, on merits / needy students in Public Sector Engineering Universities in Pakistan and also Azad Kashmir are commendable and deserve highest appreciation The seminar will definitely help advancement of Engineering Knowledge and welfare of Engineering Community working in Saudi Arabia. I pray for the success and useful outcome of the event. Engr. Amir Zamir Ahmed Khan Secretary General, The Institution of Engineers, Pakistan

Engr. Amir Zamir Ahmed Khan

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IEP-SAC Annual Report by General Secretary

We thank Allah SWT who enabled us to deliver another edition of IEP_SAC annual journal in 2022. It is always wise for organizations to look back, analyze and evaluate the performance of the organization during the year. This exercise is necessary to make continuous improvements in the organization. A dynamic organization is always agile enough to adopt new ideas and suggestions for useful enhancements. Your suggestions are more than welcome about any improvement, enhancement or to implement a new idea.

Below is an overview of the events conducted by IEPSAC during the year 2021-22.

Annual Seminar – Jan 15, 2021

The annual seminar for the year was arranged on January 15, 2021, at a local restaurant. Due to the pandemic restrictions, the seminar was a hybrid event where e limited number of guests were present physically in addition to a large number of online participants. Mr. Malik Abu Bakar, Welfare Attaché at the Embassy of Pakistan in Riyadh was the Chief guest who attended the event online. The keynote speaker for the seminar was Dr. Muhammad Khurram Khan, Professor of Cybersecurity at King Saud University Riyadh and the CEO of the Global Foundation for Cyber Studies. His topic was "Cybersecurity for Connected and Autonomous Vehicles: Trends and Future Directions". In his presentation, Dr Khurram Khan elaborated on the cybersecurity challenges and concerns that exacerbate these challenges, risks of data breaches, and Cyber-attacks in CAVs. He further shed light on future research trends and guidelines for tackling these challenges.

The proceedings began with the recitation of the Holy Qur'an by Engr. Dr. Hafiz Imran. The General Sec of IEPSAC, Engr. Mohammad Asim Siddiqui moderated the event and presented the Central region IEPSAC report. Engr. Rizwan Ahmed, Chairman of IEPSAC Eastern region presented the report of IEPSAC Eastern region. It was followed by the Scholarship report by Engr. Farooq Iqbal. He mentioned that IEPSC has been sponsoring scholarships since 1996. At present, 96 scholarships are being distributed annually in 12 public sector engineering universities in Pakistan for meritorious and needy students. He thanked the audience, sponsors, and advertisers for participating in this great cause and appealed to the Engineers to contribute more towards this great cause.

Convener of Technical Seminar Committee, Engineer Dr. Rafiq Chaudhry conducted the technical and Q&A session of the event. While addressing the participants through video link, the Chief guest Mr. Malik Abu Bakar appreciated IEPSAC for organizing the event on an important topic. He appreciated the efforts of Pakistani engineers in the development of the Kingdom of Saudi Arabia. The Chairman

of IEPSAC, Engr. Syed Muhammad Iqbal thanked Prof. Dr. Khurram Khan for his scholarly and informative lecture. He thanked the participants for joining the event and the Embassy of Pakistan for the continuous patronage of IEP_SAC. He also thanked the custodian of the two holy mosques, King Salman bin Abdul Aziz, and His Royal Highness Crown Prince Muhammad bin Salman for providing an excellent environment to foreign communities in the Kingdom of Saudi Arabia. Shields were presented to the Guest speaker and the writers of technical papers in the annual journal of IEP_SAC.

Seminar for Roshan Digital Account for Overseas Pakistanis

To support the Roshan Digital Account initiative of State Bank of Pakistan, IEPSAC in collaboration with Samba Bank Limited arranged a webinar on "Roshan Digital Account & Naya Pakistan Certificates" on Friday, 12th March at 1:30 PM. Scores of people attended the seminar, and it was useful in particular to the Pakistani Diaspora in KSA have been a backbone in uplifting Pakistan's economy. The Chairman of IEPSAC Engr. Syed Mohammad Iqbal delivered a welcome address and introductory remarks for the program. Mr. Shahid Sattar, the CEO and President of Samba Bank Limited provided an introduction about Samba Bank and various services provided by the bank. The main presentation was delivered by Mr. Talal Javed, Group Head consumer Banking for Samba Bank. He was supported by Mr. Syed Irfan Ali & Mr. Arshad Bhatti from the State Bank of Pakistan during the Q&A session. The Deputy Ambassador of Pakistan in Saudi Arabia, Mr. Muhammad Zeeshan Ahmed was the Chief Guest of the event who thanked IEPSAC and Samba Bank for arranging the informative seminar for overseas Pakistanis.

Lean Six Sigma White Belt Training

IEPSAC arranged FREE Lean Six Sigma White Belt training for the Engineers on Sat 13 Mar 2021. The 3-hour training session followed by the Questions & Answers provided basic information about Lean Six Sigma concepts leading to the right direction for optimizing the processes and improving business. The training was delivered by the founder of Smart Irtekaz, Mr. Adnan Rafique Ahmed. The Trainer said that the aim of the training was to get the professionals certified in less time so that they could get better productivity results by adopting the principles and procedures of Six Sigma in their jobs and businesses.

The Chairman of IEPSAC, Engr. Syed Iqbal said that along with engineering and other professional education, it is very important for the youth to get such certification which would enhance their abilities and enable them to run their business in a better and more professional manner. Other speakers at the event included Engineer Farooq Iqbal and Engineer Asim Siddiqui who termed such training as an asset for the youth which would improve their professional skills and give them a better position in the competitive market. The audience appreciated the efforts of the institution in conducting a popular training course in the market and expressed keen interest in such courses in the future.

Lean Six Sigma Yellow Belt Training

Due to the tremendous interest shown by the Engineers, IEPSAC arranged FREE Lean Six Sigma Yellow Belt training for Engineers and other professionals in continuation to the White

Belt training. This 4-hour training was arranged on June 26, 2021, delivered by Mr. Adnan Rafique Ahmed of Smart Irtekaz. Yellow Belt is the second level of certification that provides basic information and an overview of Lean Six Sigma concepts. The training covered basic concepts of Lean Six Sigma, DMAIC phases, and tools used in these phases that include Charter, SIPOC, COPQ, DPMO, Fishbone, Pareto, Control Tools, and LSS Case Study.

The participants who attended 75% of the training received Lean Six Sigma White and Yellow Belt certifications The audience appreciated the initiative taken by IEPSAC in uplifting the professional excellence of Pakistani Engineers.

Mid Term Seminar

A mid-term seminar was organized by IEP_SAC on the 19th of Nov, 2021. The topic of the seminar was "Deep Learning: A Struggle Towards Human Intelligence" which was delivered by Dr. Muhammad Hussain who is a Professor of Computer Science at King Saud University. It was a hybrid program where the audience was present physically as well as online. In his presentation, Dr. Hussain explained how digital devices are being made smart nowadays. The journey of Artificial Intelligence that began in the 1950s reached its evolutionary stage and reached deep learning in the present age. He mentioned the algorithms that work behind it and lead to the invention of modern devices.

The program started with the recitation of the Holy Qur'an by Dr. Hafiz Imran. The special guest of the event was Dr. Farrukh Aslam Khan, professoror at King Saud University. Convener of IEPSAC technical committee Engineer Dr. Rafiq Chaudhry conducted the technical session and introduced the speaker. On this occasion, General Secretary of IEP-SAC, Engineer Asim Siddiqui briefed the audience about the activities of the Center while Convener of the Scholarship Committee, Engineer Farooq Iqbal presented the scholarship report. The Chairman of IEP-SAC Engr. Syed Iqbal said that the organization has been distributing 96 scholarships in 12 public sector universities of Pakistan for the last 25 years.

At the end, the Chief guest presented a shield of honor to the speaker of the seminar, Dr. Muhammad Hussain. The event ended with a group photo and dinner with the audience.

All the activities of IEPSAC wouldn't be possible without the dynamic contribution of IEPSAC council members who worked diligently to plan and execute the activities throughout the year. The active participation of the Engineers in IEPSAC events provided the thrust and the energy to continue with the events during the difficult pandemic phase.

I want to thank you all for your valuable contributions to the organization and to the council leadership for continuous guidance advice. Our gratitude goes to the Custodian of the Two Holy Mosques, King Salman Bin Abdul Aziz, and His Royal Highness, Prince Mohammad Bin Salman Bin Abdul Aziz for their support to the Pakistani community in KSA.

Warmest regards,

Mohammad Asim Siddiqui

General Secretary, IEPSAC Central region

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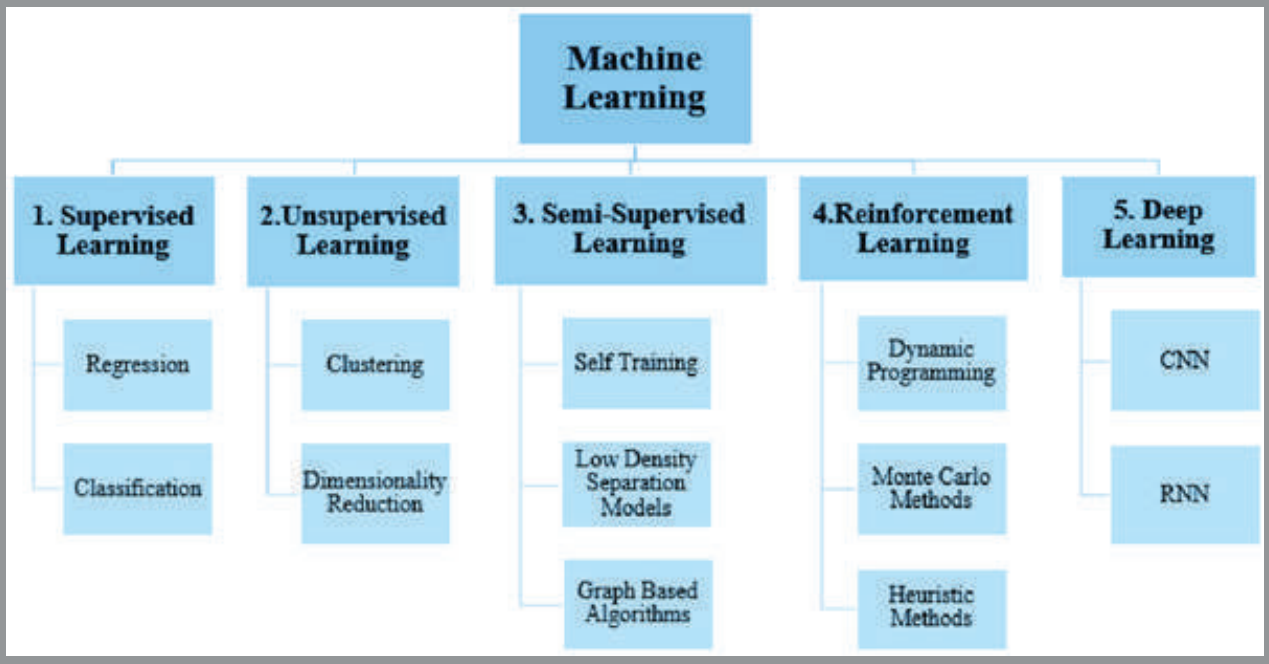

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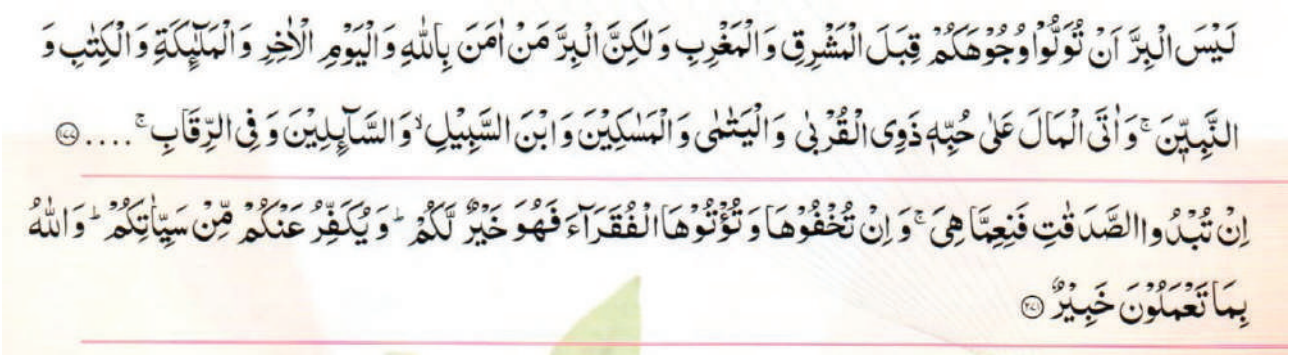
لَيْسَ الْبِرَّ اَنْ تُوَلُّوْا وُجُوْهَكُمْ قِبَلَ الْمَشْرِقِ وَالْمَغْرِبِ وَلٰكِنَّ الْبِرَّ مَنْ اٰمَنَ بِاللّٰهِ وَالْيَوْمِ الْاٰخِرِ وَالْمَلٰٓئِكَةِ وَالْكِتٰبِ وَ
النَّبِيّٖنَ ۚ وَاٰتَى الْمَالَ عَلٰى حُبِّهٖ ذَوِي الْقُرْبٰى وَالْيَتٰمٰى وَالْمَسٰكِيْنَ وَابْنَ السَّبِيْلِ ۙ وَالسَّآئِلِيْنَ وَفِي الرِّقَابِ ۚ ....۞
اِنْ تُبْدُوا الصَّدَقٰتِ فَنِعِمَّا هِيَ ۚ وَاِنْ تُخْفُوْهَا وَتُؤْتُوْهَا الْفُقَرَآءَ فَهُوَ خَيْرٌ لَّكُمْ ۚ وَيُكَفِّرُ عَنْكُمْ مِّنْ سَيِّاٰتِكُمْ ۚ وَاللّٰهُ
بِمَا تَعْمَلُوْنَ خَبِيْرٌ ۞

"But Al-Birr (righteousness, piety) is the quality of one who believes in Allah, and the Last Day, and the Angels, and the Book, and the Prophets and distributes his wealth, in spite of love for it, to the kinsfolk, and to the orphans, and to the needy, and to the wayfarer, and to those who ask, and to the ransom of prisoners." (Al-Baqarah-177)

"If you disclose your (acts of) charity, it is well, but if you conceal it, and give it those (really) in need, that is better for you; it will remove from you some of your (stains of) sins and Allah is well acquainted with what you do." (Al-Baqarah-271)

The Engineer plays an important role in the development of any country and build a better world. IEP-SAC, Saudi Arabian chapter of The Institute of Engineers Pakistan under the patronage of the Embassy of Islamic Republic of Pakistan in Saudi Arabia along with other technical and social activities is also playing its role in supporting Engineering education in Pakistan.

By the grace of Allah the Almighty, the IEP-SAC scholarship program for needy and academically sound students in the Engineering Universities and Colleges of Pakistan was launched 24 years ago in the year 1996. With the joint efforts of IEP-SAC, Local Council members, and others, it has been expanding ever since and presently 96 students from the below listed 12 public-sector universities and colleges are benefiting from this program.

1. University of Engineering and Technology, Lahore
2. University of Engineering and Technology, Taxila
3. University College of Engineering and Technology (Bahauddin Zakariya University), Multan
4. Institute of Chemical Engineering and Technology (University of the Punjab), Lahore
5. Dawood University of Engineering and Technology, Karachi

6. NED University of Engineering and Technology, Karachi

7. Mehran University of Engineering and Technology, Jamshoro

8. Quaid-e-Awam University of Engineering Sciences and Technology, Nawabshah

9. NWFP University of Engineering and Technology, Peshawar

10. Baluchistan University of Engineering and Technology, Khuzdar

11. Mirpur University of Science and Technology, Mirpur (AJ&K)

12. Khawaja Fareed University of Engineering and Information Technology, Rahim Yar Khan

As can be noted from the list, this scholarship program serves all the four provinces of the Islamic Republic of Pakistan and the State of Azad Jammu and Kashmir. The rules and regulations, selection criteria and application forms can be accessed and printed from IEPSAC website. By the blessings of Allah the Almighty, 22 batches of the scholarships have been completed so far and 23rd batch was launched in January 2021, benefiting meritorious and needy students from this scholarship program who will serve humanity and our homeland after graduation.

The continuity of the IEP-SAC scholarship program has not only been maintained during the last 24 years, but it has also been expanding gradually with the help of financial contributions from various philanthropists, individuals, and organizations in Saudi Arabia. I take the opportunity to offer the readers of these lines in general and the Pakistani community and engineers, in particular, to join hands with us in this noble and just cause. It is a great service to the Engineering community in Pakistan. It is my humble request to all to put our maximum efforts into contributing and expanding the scholarship program to the needy and deserving engineering students in Pakistan.

Your suggestions to improve this noble cause further will be most welcomed. Please do not hesitate to contact any of the members of the IEP-SAC Awards and Scholarships Committee or Local Council for any suggestion or information.

Arch. Farooq Iqbal, Convener

IEP-SAC Awards and Scholarships Committee

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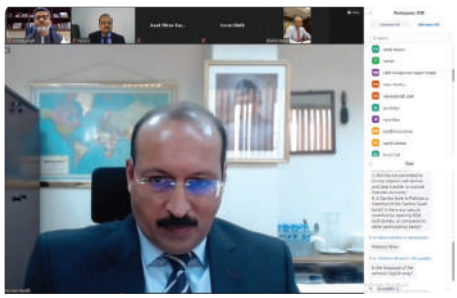

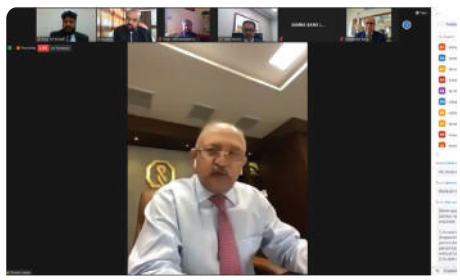

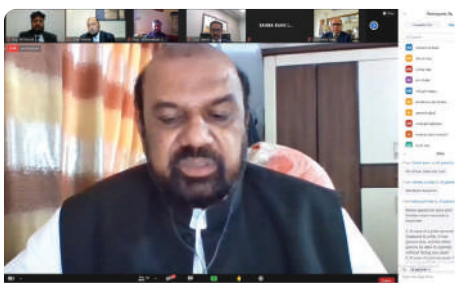

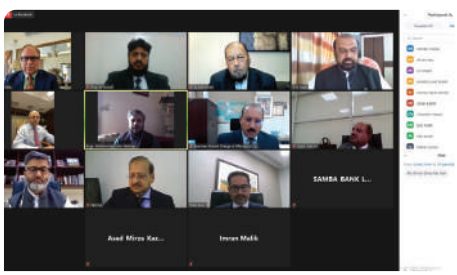

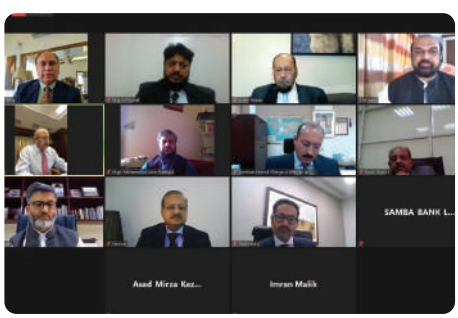

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Deep learning Seminar 19 November 2021










SCENES FROM IEP–SAC **Activities**

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Name of LC Member	Role
Engr. Prof. Dr. Rafiq M. Choudhry	Convener
Arch. Farooq Iqbal	Co-Convener
Engr. Dr. Awais Mahmood	Member
Engr. Rana Sarfaraz	Member
Engr. Ijaz Akhtar	Member

Scholarship Committee

Name of LC Member	Role
Arch. Farooq Iqbal	Convener
Engr. Ijaz Akhtar	Co-Convener
Engr. Prof. Dr. Rafiq M. Choudhry	Member
Engr. Dr. Fakhir Hasani	Member

Sponsorship & Advertisement Committee

Name of LC Member	Role
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Arch. Farooq Iqbal	Member
Engr. Shaikh Asrar Ahmad	Member
Dr. Hafiz Imran	Member
Engr. Abdul Qadir Akbani	Eastern Province

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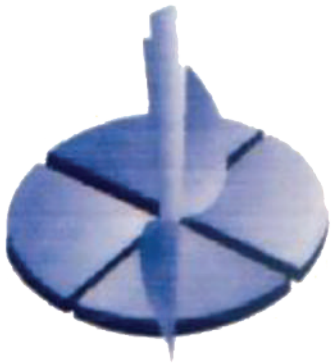

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Message from Chairman IEP -SAC
(Eastern Region)

We strive to get together and share current/innovative knowledge among engineers of all nationalities around us. We got involved with and take advantage for all to share and make use of each other's strength and new ideas purely on technical basis to serve our engineering communities/families. Recently we faced challenges of COVID 19 - experienced tough time to be together physically. We learned from these challenges new dimensions and online connectivity make it rather easier and more broadened our spectrum, making it global where i was "local" previously. More opportunities opened new doors for all of us all over the world. Now participation of our brother engineers is from all over the world. Pandemic restricted us by touching each other but connected us to see talk, meet and at the same time-sharing knowledge/ideas globally. Challenges bring new opportunities and open doors for new diversified areas of emerging societies. Likewise, traffic researchers of Saudi Aramco conducted scientific research in deployment of impactful mitigation measures in KSA, it is strange to note that major causes of death of road accidents is among 15–29-year-old people which is 30% of all deaths worldwide. We conducted webinar on this subject. Mankind is using wind energy since ages leading to the technological advancements in the modern era. Webinar covered wind energy potential, its availability and assessment. To promote awareness among public including global & regional wind power statistics by Prof Farooq Saeed of Imam A.R. bin Faisal university. A graduate of university of Illinois, USA, he holds 8 US patents & authored wind turbine design alongside 70 peer serviced publications. Eastern province sub-centre is actively performing its roles and responsibilities to establish and promote excellent relationship and interaction among its members and other professionals. We provide opportunities for the exchange of engineering and scientific information, organize technical visits, research studies, conferences, seminars, and workshops on engineering subjects. We have organized following technical seminars/ webinars this year.

1. *"A practical perspective on disruptive interventions for smart mobility and traffic safety deployments in Saudi Arabia"* by Engr. Muhammad Farhan Butt, Dr

Road traffic injuries account for 30% of all

deaths worldwide and are one of the major causes of death among people 15–29 years old. Saudi Aramco chair for traffic safety research, in collaboration with stakeholders, is making a real difference by conducting applied scientific research on deployment of impactful mitigation measures in Saudi Arabia. This webinar highlights some of the key efforts made by Aramco safety chair on the subject.

2. *"Wind Energy & The Regional Outlook"* by Engr. Farooq Saeed, Dr

The discussion focus was on the topic of wind energy, its history through the ages leading to the technological advancements in the modern era. A brief introduction to the basics of wind power will highlight key parameters that are essential for harnessing maximum energy from the wind, in that it will cover, wind energy resource potential, its availability and assessment. The seminar will cover topics that will help promote awareness among the public and promote knowledge about wind energy, global and regional wind power statistics.

We appreciate support of our sponsors, fellow engineers, local industries, Saudi Council of engineers and Jordanian Engineers Association for their valuable contribution in our success. Finally, Thanking Almighty ALLAH for providing us resources, energy and opportunities to serve our engineering community.

Rizwan Ahmed,

Chairman,
IEP-SAC-EP

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3D Printing in Construction Industry

3D printing has gained much popularity in the last one decade. Although, it was primarily used for developing/printing prototypes, however, recently has started to make its first immersions in the real construction sector.

In 2014, a house in Amsterdam was made by using 3D Printing

In 2016, a mansion in China was built using 3D Printing

In 2016, an office was built in Dubai using 3D Printing (17 days)

In 2017, an entire home in Russia using 3D Printing

In 2019, a house in Copenhagen using 3D Printing

In 2022, Oman has built a 190 sq. m. house with three bedrooms, a living room, and kitchen as well as reception area in a period of one week.

Benefits:

Speed
Waste reduction
Design freedom
Reduce human error
Fewer people means more safe construction

Challenges:

High costs
Skilled Workers shortage
Quality control in terms of Weather Challenges
Lack of building standards for this technology




از طرف – رضوان احمد

بیاد طارق بن ظفر

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ہم سمجھتے ہیں کہ وہ سب سے زیادہ ہمارے قریب تھے اور غالباً باقی لوگ بھی یہی سمجھتے ہوں ۔ عشاء کے بعد کافی ہاوس میں رات گئے جو گفتگو ہوتی تھی تو یوں لگا ۔

موج ہے دریا میں ، بیرونِ دریا کچھ نہیں

آپ ظاہری میل جول اور بے باک شخصیت کے برجستہ اظہار سے ان کے اندر کے انسان کو نہیں دیکھ سکتے ۔ تا آنکہ آپ اس گہرائی میں غوطہ زن نہ ہوں ۔ ان کے کھُلے گریبان سے اندر جھانکیں تو پتہ چلے گا اس گہرائی اور گیرائی کا ۔ جس کا اظہار سینکڑوں لوگوں نے اُن کے رخصت ہونے کے بعد کیا۔

خاندان اور دوستوں میں ہر کسی کی ہر ممکن عملی مدد کر کے انھیں زندگی کی کامیاب شاہراہ پر گامزن کیا ۔

ایک سیل رواں تھا اور وہ میرِ کارواں

کوالٹی کے گرو (guru) اور بین الاقوامی سطح پر مستند پہچان کے مالک ۔ ٹھرنا ان شعار نہیں تھا۔ وہ ایک کھرے اور بے باک شخصیت کے مالک تھے ۔ جس چیز کو غلط سمجھا اس کا اظہار فوراً ، بلا توقف اور برملا ببانگِ دہل کرنے میں دیر نہیں لگاتے تھے چاہے بعد میں معذرت کر لیں اگر کسی کی دل شکنی ہوتے دیکھتے ۔

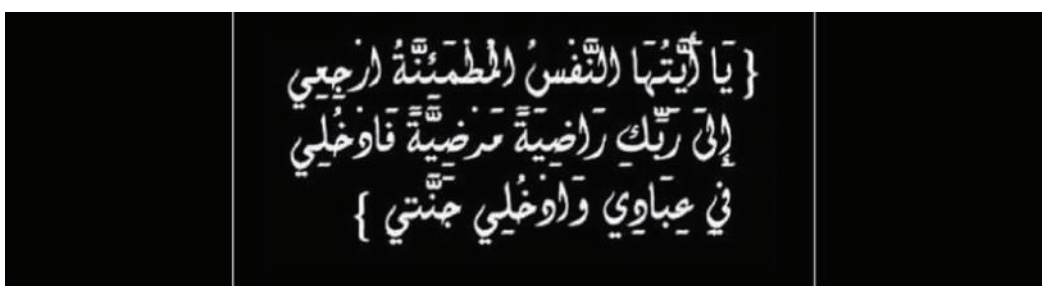
چمن میں تلخ نوائی مری گوارا کر

کہ زہر بھی کبھی کرتا ہے کارتریاقی

حقیقت کچھ بھی ہو ہمارا دل اب تک یہ ماننے کو تیار نہیں نجانے کیوں ہم self-denial کے اسیر ہیں ۔ یہ برحق ہے مگر دل کیوں حقیقت سے فرار کی راہ دکھا رہا ہے ۔

اللہ تعالیٰ غریقِ رحمت کرے ۔ اعلیٰ درجات سے نوازے کہ وہ یہاں پر بھی ہم پر سبقت لے گئے اللہ تعالیٰ جنت الفردوس میں اعلی مقام عطا فرمائے ۔ آمین ۔



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The Role Of Health And Safety In Project Management

SMH Kirmani

Abstract:

Inadequate or the lack of occupational health or safety not only negatively affects the traditional construction project parameters of cost, quality, and schedule, but the sustainability of the environment. Occupational fatalities, injuries, and diseases constitute defects as they are not project requirements. They also contribute to the cost of construction and development as worker's compensation insurance is included as labor overhead and the cost of accidents is integrated into the cost of the structure of the contractors.

Total Quality Management (TQM) is the strategy that links the processes of occupational health and safety, productivity, and quality; health and safety provide catalysts for realizing the synergy between the three processes. Although each member of the client, design, and construction team influences occupational health and safety, the project managers in their capacity as project leaders and coordinators are uniquely positioned to integrate occupational health and safety into all aspects of the design and construction process.

The purpose of this study is to identify the causes and most prevalent type of construction accident occurring at the sites and suggest preventive actions to mitigate accident rates at the sites.

Introduction:

Occupational fatalities and disease result in considerable human suffering and affect not only the workers directly involved but their families and communities and contribute to the national cost of medical care and rehabilitation.

However, occupational disease, fatalities, and injuries also contribute to the variability of resources which increases project risk. This risk is manifested in an increased cost of construction, damage to the environment, non-conformance to quality standards, and schedule overruns. Another aspect is that of the contractor and client image which is negatively affected by accidents.

Although each member of the client, design, and construction teams influences and contributes to occupational health and safety, project managers, in their capacity as project leaders and coordinators uniquely positioned to integrate health and safety into all aspects of the design and construction process.

Health and Safety is Quality:

In completing an activity on a construction site without injury or disease constitutes successful completion. As health and safety complement the successful completion of a project which includes completion of schedule within budget, quality requirements without damaging the environment, and without incurring disease fatalities or injuries, it is an indispensable project parameter. The performance standard for health and safety is within "zero injuries" as with "zero defect" for quality.

The system for health, safety, and quality is prevention as medical care, rehabilitation, pensions payable in the case of fatalities and rework, all result in the increased cause of resources. It is, therefore, imperative that health and safety should be in conformance to the requirements according to SABB and other contractional codes, legislations, and if applicable ISO environmental, health and safety, and quality management system.

Consequently, activity or project cannot be successful, if disabling injuries or fatalities have been incurred during the process [1]. A further aspect is that injuries and fatalities are not project requirements and consequently, constitute defects.

Type and Causes of Construction Accidents:

Kohen, Kothari, and Pan (1995) showed that construction accidents occur as a result of the negligence of safety precautions by the workers or unavailability of the same. Researchers emphasize safety culture as an important element in accident prevention. (Stanton and Willenbrock, 1996 [2] ; Toole T.M. 2002 [3]).

The number of fatal accidents in the construction industry is high compared to other industries. The study shows that falls are the most common cause of fatalities. This was followed by electrocutions and struck by incidents.

Table 1: 37th annual conference of the Australasian universities, Building Educator Association (AUBEA). The university of New South Wales, Australia.

Cause	(%) Fatal Accidents	(%) Non-fatal Accidents
Falling from a height	49	21
Struck by an object	21	61
Exposure or contact with electric current	22	01
Exposed or contact with harmful substance, radiation, fire	03	02
Other	05	15
:Total	100	100

Impact of inadequate health and safety:

Researchers conducted among project managers in South Africa investigated the impact of inadequate health and safety on various project parameters. Productivity (87.2%) and quality (80.8%) predominated, followed by cost (72.37%), client perception (68.1%), environment (66%) and schedule (57.4%) [1]. Health and safety are pre-requisite for productivity and quality. Accidents result in increased cost, damage to the environment and can substantially retard project progress as a result of either, decreased productivity or cessation of the worth. The client's perception may be adversely affected by accidents as accidents are not project requirements, and/or clients may schedule specific health and safety-related contractual requirements, particularly in the case of projects in or adjacent to an existing facility.

Synergy:

The associated general contractors of America (AGC 1992) define synergism as "the interaction

of different entities so that their combined effect is greater than the sum of individual efforts" To facilitate TQM and to enable it to proliferate in the organization, requires that quality efforts be linked to, among others, health and safety and productivity. Numerous construction health and safety practitioners maintain that a healthy and safe workplace complements productivity, quality, schedule and sustainability of the environment (Sandwood 1995).

Customer Satisfaction:

Shendlor, Levy, and Dvir[3] maintain that meeting budget, schedule, and technical goals are important in the early stages of a project. However, the criteria to determine the success of a project include:

Technical performance

Efficiency of execution

Managerial and organizational implications

Personal growth

Business performance

According to Levitt [4], health and safety conscious contractors are more efficient, and health and safety complement quality, which in turn complements technical performance and efficiency of execution respectively. Levitt also maintained that health and safety-conscious contractors are more attractive to clients. A further aspect is that it helps to promote the reliability of an organization

The influence of design:

According to Jeffry and Douglas [4], it has to be accepted that in terms of causation there is a link between design, decisions, and safe construction. This is based on research carried out by the European Foundation for the improvement of living and working conditions, which concluded that out of the site fatalities are 35% caused by falls, which could have been reduced through the design decisions.

Designers influence health and safety both directly and indirectly.

Directly as a result of:

- Design
- Supervisory
- Administrative interventions
- Design interventions include:
- Concept design
- General design
- Sub-soil investigation
- Selection of type of structural frame
- Site location
- Site coverage
- Details
- Method of fixing
- Specification of material and finishes
- Indirectly as a result of:
- Type of procurement system used

- Pre-qualifications
- Project time
- Partnering and facilitating per pre-planning. [5]

A further role identified by the designer is that of optimal interaction with the clients, particularly at the design brief stage. This is the most crucial phase for the successful, healthy, and safe completion of a project. Deviations from it at a large stage resulting in variation orders (V.O), can be the catalyst that triggers a series of events from the designer through to workers that culminate in an accident on site. Consequently, clients must know exactly what they require and develop a comprehensive brief for the design team. [4]

Cost of health and safety:

According to the business round table [6] data collected from a significant sample of contractors working at various construction sites in the United States of America in 1980 indicated that the cost of administrating a construction health and safety program usually amounts to about 2.5% of direct labor cost. The costs include health and safety performance, salaries for health and safety and certain administrative personnel, health and safety meeting, an inspection of tools, plant and equipment, site inspection, personnel protective equipment (PPE), and miscellaneous supplies and equipment.

Other important issues related to health and safety are:

- Procurement related issues
- Cost of accidents

Prevention:

Some of the important steps in preventing hazards are pre-planning for safety, safety orientation, safety training, and written safety policy. Out of these, it is found that training is an effective way of preventing accidents.

A safety and health policy is a written document that recognizes that safety and health are an integral part of the organization's business performance. This policy should be appropriate to the hazards and risks to the organization's work activities and includes a commitment to protect its employees and others, such as contractors and members of the public from safety and health risks associated with its objectives.

It includes a commitment to comply with relevant safety and health legislation, codes of practice guidelines. It provides a framework for measuring performance and ensuring continuous improvement by setting, auditing, and reviewing safety and health objectives (to mitigate the health and safety risks).

It should be documented, understood, implemented, and maintained at all levels of the organization to develop a health and safety culture in the organization.

The construction business can reduce workplace accidents and promote construction site safety by adopting an effective health and safety policy having followed main items:

- Documentation of a safety plan
- Awareness
- Training and induction
- Monitoring
- Supervision
- Proper equipment
- Reporting and follow-up

- Audit by specialists

Two types of monitoring are required:

1. Active system: That monitors the design, development, installation, and operation of health and safety arrangements and workplace precautions. Also, it includes the regular checking and calibration of equipment and tools.
2. Reactive system: That monitors accidents, ill health, incidents, and other evidence of deficient safety and health performance.

Auditing is the structured process of collecting independent information on the efficiency, effectiveness, and reliability of the total safety and health management system and drawing up plans for corrective actions.

To develop a safety management system the following steps will help:

Step 1: To create a health and safety governance system

Step 2: Set up a mechanism to consult your worker

Step 3: Develop health and safety policies and procedure

According to the national safety council, an effective safety management program should: "Reduce the risk of workplace incidents, injuries and fatalities through data driven measurements and improvements and to involve people from different parts of the organization to make safety a shared responsibility to follow and implement ISO-4500 occupational and health and safety management."

It may be noted that training is not a substitute for proper risk control, for example, to compensate for a poorly designed plant or inadequate workstation. It may be recalled that the collapse of the crane in Haram Makkah which caused the death of several workers was due to the poorly and inadequately designed of workstation.

Nonetheless, the workers are provided with all necessary protection requirements including:

- Protective eyewear
- Work boots
- Gloves
- Hard caps
- Ear protection
- Fall protection belts etc.

A Toolbox Talk is an informal but important group discussion that focuses on a particular safety issue.

:Procedure for investigating accidents/incidents should include

1. The event (cause of any injury, ill health or other losses, detail of outcome)
2. Potential consequences
3. Recommendations
4. Learning from and communicating results from investigations
5. Cautions in using accident and ill-health data.

As a result of the implementation of an effective occupational health and safety management

system, an organization can achieve several benefits, including:

1. Improved health and safety performance
2. The Reduced cost associated with accidents and incidents
3. Improved business efficiency
4. Improved staff relations in morale
5. Improved public images and PR
6. Lower insurance premium
7. Easier access to finance

Conclusion:

From the above discussion, it is concluded that "Cost", "Quality" and "Time" are the most important parameters in the construction industry. Whereas health and safety are perceived to be important to very important. Hence it is necessary to afford health and safety status equal to that afforded to cost, quality and time. Project managers should closely refer to health and safety plans during the upstream phases of design and relative of all aspects of design. A project manager should endeavor to:

- Integrate design and construction
- Realize and optimum client brief
- Finalize design before construction commenced
- Discourage client changes
- Prequalify contractors on health, safety, and quality
- Include a specific mention of, and a financial allowance for health and safety in contract documents
- Avoid competitive tendering
- Realize the implementation of QMS in design and construction
- Comply with the required health and safety code of the country

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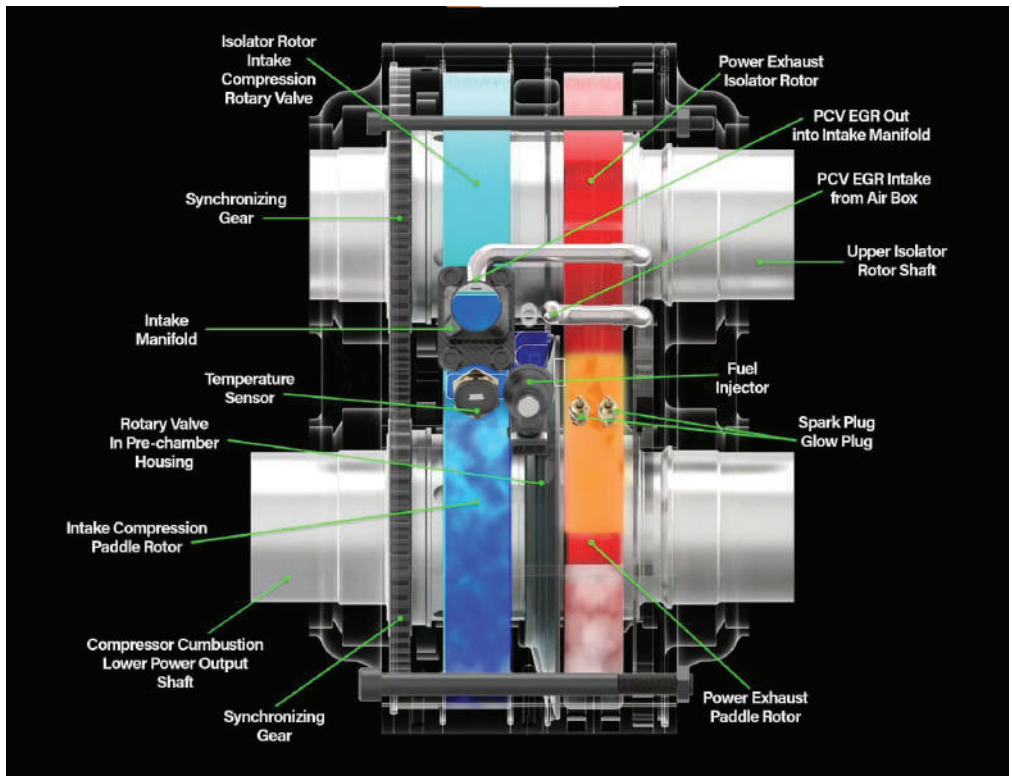
Are the days of internal combustion engines over?

By Dr. Fakhir Hasani

Since the introduction of electric vehicles (EV) in the automobile market and with emission standards getting tougher and tougher each passing day, there has been a debate in the academic circles if this is the end of the internal combustion engines (ICE) era that has dominated the auto industry for more than a century. French Automaker Renault earlier announced that they will end development of new Diesel Engines. Recently Nissan announced that they would halt all gasoline engine development and would shift to EV. While such news does strengthen the claims of those who feel that ICEs would soon be history. However, engineers at Astron Aerospace think otherwise and claim to have developed an almost zero emissions engine despite burning fuel inside the combustion chambers. Instead of pistons, the new engine contains a set of rotary gears that look more like old Wankel's rotary engine but without its drawbacks. Being a rotary engine, it has resemblance with gas turbine engines too used in aircrafts.



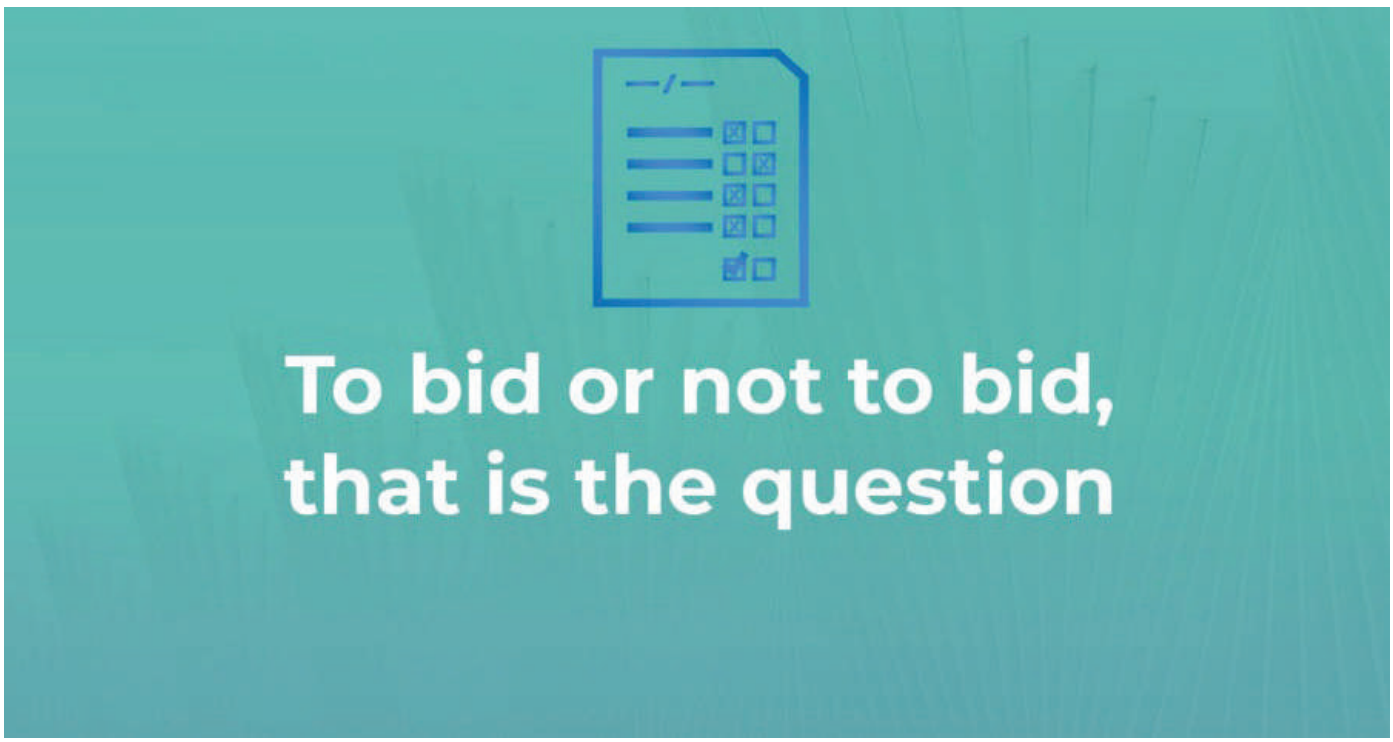
Astron named the new engine OMEGA-1 which takes the four strokes of a combustion engine and divides them into two independent chambers. The engine has two shafts that rotate in opposite directions via synchronizing gears, with four rotors running in pairs on the two shafts. The first pair takes care of the intake and compression, while the second pair does the combustion and exhaust strokes. These are complemented by a rotary disc valve and a pre-chamber that are located between the two sets of rotors. This is where the fuel is injected. The working cycle of this engine is a little complex to comprehend for non-technical people. The various engine parts are shown in Figure.

The company claims that with precision machining, this engine would not require any seals to keep the fluids inside. The simplicity of the design with very low emissions and little maintenance may pose a threat to the EV's future as the engine can be used in airplanes, cars, motorcycles, light and heavy machinery. The engine can run on multiple fuels with very little emissions. Astron's claims sound too good to be true but this new development needs to be followed closely as it has put a fresh breath of air into a technology that many believe is dying.

Factors Influencing The Bid/No-Bid Decision Of Construction Contracting Firms: **Impact Of Company Size And Experience**

By

Rafiq Muhammad Choudhry



Abstract

Construction contracting firms (CCFs) are functioning in a highly volatile and competitive industrial environment making it imperative to bid for the projects that can produce the most return and market share. The decision-making process to bid or not is based on various factors that vary from project to project and firm to firm. This work aims to analyze the impact of firm size and experience on extrinsic factors influencing the bid/no-bid decision for construction projects. The questionnaire was pilot tested and designed in three parts. The final questionnaire was sent to 300 CCFs registered with Pakistan Engineering Council (PEC) and respondents were asked to rate the factors on a Likert scale. Out of 300 questionnaires, 167 completed responses are returned representing a response rate of 56%. The collected data are then analyzed using the Mann-Whitney U test through Statistical Package for Social Sciences (SPSS). Findings show the various degrees of differences between small and large, and young and mature CCFs about factors influencing the bid/no-bid decision. Small firms need to overcome increasing market value and several competitors in the market. They need to develop a relationship with government officials to secure their bids. Mature firms need

to review the payment practices of clients, politician pressure, and business level of the client before entering into the bid. Availability of required material and skilled labor are of prime importance for the mature firms' success.

Introduction

Globally, the construction industry has continued to play a critical role in the economies of both developed and developing nations (Zhao et al., 2014). The developing countries' construction contracting firms (CCFs) are on the rise and are becoming important global players (Low et al., 2020). Developing countries' CCFs are playing an important role in the worldwide economy, and are nowadays open to different challenges as they need to operate in risky political conditions and markets (Korkmaz & Messner, 2008). Although these challenges carry new opportunities for firms to access new clients in the country, at the same time, firms also need to counter challenges like new project environment, political conditions, local laws for procurement, new competitors, and different quality demands of the clients (Ren et al., 2012; Zawawi et al., 2016).

To survive in the competitive construction industry, a firm must secure tenders and produce a profit (Egemen & Mohamed, 2007). There are two ways for a construction firm to obtain the job i.e. they can negotiate with the client or participate in competitive bidding to win the project (Shash, 1993). Scholars argue that construction firms need to make a critical decision of participating in the bid or not, once an invitation is received (El-Mashaleh, 2013; Ma, 2011). Wanous et al. (2003) found that winning the bid is extremely challenging especially in today's competitive construction markets. The most used technique in the construction market to avail a bid is competitive bidding (Fu et al., 2002). Under the competitive bidding technique, contractors face a large number of problems. Hence, the decision of actually participating in the bid is one of the first and most crucial steps that need to be taken (Ma, 2011) and involves a process of gathering information from disparate different sources (Bageis & Fortune, 2009).

Pakistan as an emerging economy is gradually becoming an important economic force in Asia because of its booming service sector and thriving small and medium enterprises (SMEs) (Maqsoom & Charoenngam, 2014; Ndubisi & Iftikhar, 2012). However, currently, it is suffering from COVID 19 and inflation crisis that adversely impact the construction industry (Maqsoom et al., 2020). As construction and infrastructure development is a key source for enhancing the economy and controlling the unemployment rate in any region, projects undertaken by construction firms are of extreme importance (Korkmaz & Messner, 2008). The construction industry has faced problems in many large projects, for example, Allama Iqbal International Airport (AIIAP) and Tarbela Dam extension project had faced time and cost overruns mainly due to incompetent firms won the projects (Ahmad et al., 2018; Razzaq et al., 2018; Shabbar et al., 2017; Ullah et al., 2016). Another example is of Neelum Jehlum Hydropower Project which has gone around seven times of its initial depicted cost because of an incompetent firm secured the bid by quoting lower rates (Ahmad et al., 2018; Razzaq et al., 2018; Shabbar et al., 2017; Ullah et al., 2016). Further, New Islamabad International Airport has faced time overrun of a year due to the inability of the winning firm to complete the project within its time constraints (Ahmad et al., 2018; Razzaq et al., 2018; Shabbar et al., 2017; Ullah et al., 2016).

The bidding decision is a complex process that is affected by numerous external factors (Chou et al., 2013). Choosing not to bid on a prospective project results in losing an opportunity to make

a substantial profit, whereas entering into bid may improve the strength of a contractor in the industry and gain positive relationships with the client (Jarkas et al., 2014). Large construction firms in Saudi Arabia, displayed greater tendency to bidding than small construction firms (Shash & Abdul-Hadi, 1993). In addition, few researchers (Bageis & Fortune, 2009) found that tendency to bid increases with the experience of construction firms, whereas Krasnokutskaya and Seim (2011) found the converse. For instance, longer experienced contractors prefer large-sized projects, while the less experienced contractors prefer small-sized projects (Enshassi et al., 2010; Nirab, 2007). Nonetheless, wide-ranging thoughts are evident from literature with little consensus on specific factors influencing the bid/no-bid decision for construction projects.

The objective of this work is to evaluate the extrinsic factors including market, politics, client and region related aspects that influence the CCF's bid/no-bid decision for construction projects. Specifically, the current research analyses differences in the bid decision of CCFs with respect to the firm size and experience. The findings of this study provide novel insight to the bid/no-bid decision making literature with emphasis on clients and stakeholders' obligations where these is scarcity of literature related to the association between influencing factors, firm size and industrial experience. Further, the current study includes variables related to the politics that have been neglected in the previous studies (Bageis & Fortune, 2009) in addition to the previous factors, thus making the current study unique in its examination for the bid/no-bid decision for construction projects.

According to the objective of the study, following research questions are proposed (see Figure 1):

RQ1. What are the market related factors that influence the bid/no-bid decision of CCFs of varied sizes and experience?

RQ2. What are the politics related factors that influence the bid/no-bid decision of CCFs of varied sizes and experience?

RQ3. What are the client related factors that influence the bid/no-bid decision of CCFs of varied sizes and experience?

RQ4. What are the region related factors that influence the bid/no-bid decision of CCFs of varied sizes and experience?

Many researches have contributed to the bidding decision literature. Nonetheless, a comprehensive model, which not only considers the project conditions but also includes the regional strategic considerations, take into account the viewpoint of clients, differentiate among varied sizes and experiences of CCFs and considers political factors present in developing countries could be of great value. In this regard, a comprehensive conceptual framework is drawn based on theoretical knowledge and is presented in Figure 1.

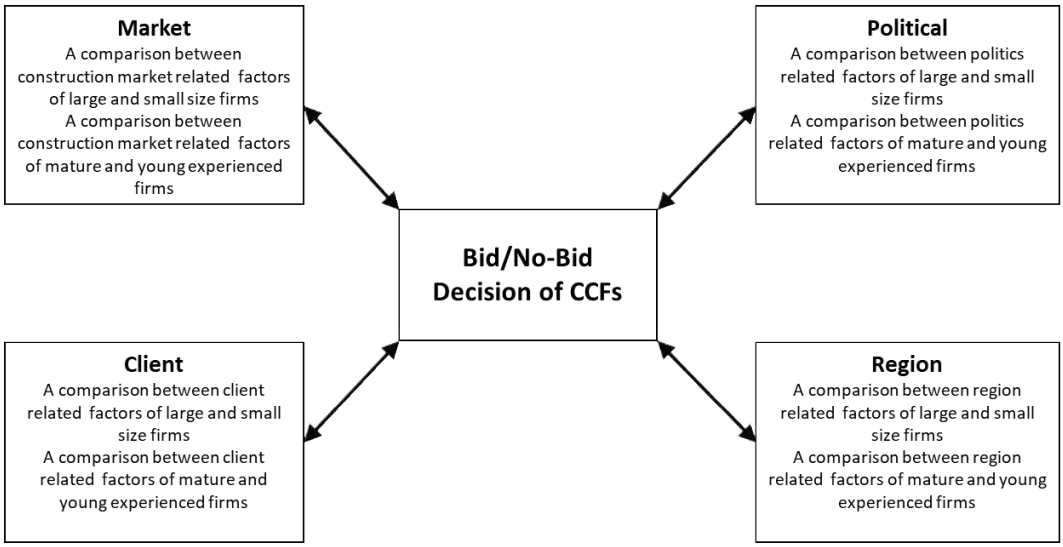


Figure 1. Conceptual Framework

Research methodology

The current study is conducted in several stages with the first stage being the development and verification of a questionnaire. The present study divided the questionnaire into three sections; the first section acquired general demographic information of the participants. The second section asked the information about the project and participant company. The third section is designed to assess the effect of different extrinsic factors on the bid/no-bid decisions of CCFs. The factors are classified as market related factors, politics related factors, client related factors and region related factors. The third section embraced scales adapted from the previous validated studies conducted by scholars to measure extrinsic factors influencing the bid/no-bid decision of firms (Bageis & Fortune, 2009; Egemen & Mohamed, 2007; Enshassi et al., 2010; Jarkas et al., 2014; Shash & Abdul-Hadi, 1993). For the pilot testing, interviews are conducted with two general managers and five project managers working in different firms. Necessary adjustments are made in the questionnaire based on the suggestions provided by the respondents during the pilot study. Political factors have not been examined so far in the previous researches related to bid/no-bid decision of firms; therefore, they were included in the questionnaire based on the strong recommendation from the pilot test participants. The feedback from the pilot testing improved the readability and quality of the questionnaire. Additionally, the purpose of pilot test was to examine the feasibility and establish the validity of the research instrument.

Once the questionnaire is finalized, data collection took place using the survey approach. This research used the purposive sampling method for the data collection. The target population was the CCFs working in Federal area of Islamabad and Punjab province. The list of CCFs is obtained from Pakistan Engineering Council (PEC), a body that register all the construction-contracting firms. The questionnaire is sent to 300 CCFs registered with PEC through post or directly at their companies by the research team. Respondent were asked to rate the factors from 1 to 5; with "1: strongly disagree" "2: disagree" "3: neutral" "4: agree" "5: strongly agree". Out of 300 questionnaires, 167 completed responses are returned representing a response rate of 56%. Therefore, the sample was 167 CCF who participated in the research. No

responses are collected from the remaining 133 firms due to their unwillingness to respond. The characteristics of the responding organizations are illustrated in Table 1.

Table 1. Responding organizations characteristics

Characteristics	Frequency	Percentage
Respondent's designation		
Chief Executive Officer/ Managing Director	17	10
Director / Chairman / Head	45	27
General Manager / Project Manager	40	24
Assistant Project Manager	65	39
Firm's specialization		
Civil	80	48
Building	47	28
Electrical and mechanical	26	16
Other	14	08
Firm's experience		
years 5>	31	19
years 6-10	45	27
years 11-15	50	30
years 15<	41	24
Number of employees in the firm		
employees 100≥	45	27
employees 101-500	51	30
employees 501-1000	39	24
employees 1000<	32	19

After collecting the responses, the researchers divided the sample into large vs small firms and mature vs young firm's categories according to firm size and industrial experience. There are different classifications for firm size and experience worldwide, which can vary by country, sector or region. For example, large firms are characterized as having more than 250 or 300 employees; similarly, mature firms are seen as having experience more than 5 or 10 years (Abdul-Aziz et al., 2013; Maqsoom & Charoenngam, 2014; Maqsoom et al., 2019). In this research large firms are classified as having more than 250 employees and mature firms having experience 10 or more years in the construction industry (Abdul-Aziz et al., 2013).

The data obtained from the respondents are analyzed using the Statistical Package for Social Sciences (SPSS) Version 25 for Windows. In the beginning, the Shapiro-Wilk test is utilized to examine the normality of the data. The results showed that the data are not normally distributed, necessitating the use of a non-parametric test for the comparison between the groups. Therefore, non-parametric Mann-Whitney U test is used to compare the scores given by firms of varied sizes and industrial experiences. Various scholars (Abdul-Aziz et al., 2013; Dulaimi & Shan, 2002; Maqsoom & Charoenngam, 2014) have used the same approach to test the significant differences among the CCFs.

Results of Research

The results obtained from the survey show the presence of some significant differences between CCFs of varied sizes and experiences for bid-no-bid decision. Only the factors that recorded statistically significant differences (*p*-value<0.1) between small and large or young and mature firms are presented in this section.

Market Related Factors

The first phase of analysis is linked to the market related factors influencing the bid/no-bid decision of CCFs. The Table 2 provides the results of market related factors that influence the bid/no-bid decision of CCFs with respect to size and experience. In terms of firm size, two variables are considered more important by small firms than large firms: market value (mean rank = 70.00 for large firms and mean rank = 87.85 for small firms, with *p*-value 0.043) and number of competitors in the market (mean rank = 62.19 for large firms, and mean rank = 89.99 for small firms, with *p*-value 0.002). Similarly, in terms of experience, there is significant difference regarding market related factors in young and mature firms. Two factors are considered more important by young firms than mature firms: availability of similar type of project in the market (mean rank = 80.02 for mature firms and mean rank = 92.80 for young firms, with *p*-value 0.099) and number of competitors in the market (mean rank = 78.16 for mature firms and mean rank = 96.91 for young firms, with *p*-value 0.016).

Table 2. Market related factors influencing the bid/no-bid decision vis-à-vis CCF size and experience

Market related factors	Mean rank for size			Mean rank for experience		
	Large firms	Small firms	Significant ((2-tailed	Mature firms	Young firms	Significant ((2-tailed
Taxes and other financial requirements on tender	83.46	84.15	0.938	82.15	88.09	0.453
Market value	70.00	87.85	**0.043	80.06	92.72	0.106
Quantity of overall projects in (the market (no of projects	74.47	86.62	0.170	85.55	80.58	0.528
Availability of similar type of project in the market	75.54	86.60	0.167	80.02	92.80	***0.099
Number of competitors in the market	62.19	89.99	*0.002	78.16	96.91	**0.016

**P ≤ 0.01, **P ≤ 0.05, ***P ≤ 0.1*

Politics Related Factors

The second phase of analysis is associated to the politics related factors influencing the bid/no-bid decision of CCFs. Table 3 shows the results of political factors that affect the bid/no-bid decision of CCFs with respect to size and experience.

Table 3. Politics related factors influencing the bid/no-bid decision vis-à-vis CCF size and experience

Politics related factors	Mean rank for size			Mean rank for experience		
	Large firms	Small firms	Significant ((2-tailed	Mature firms	Young firms	Significant ((2-tailed
Politician reference for the gaining of the project	76.36	86.10	0.269	79.80	93.30	0.383
Political conditions while construction	79.47	85.24	0.509	84.93	81.93	0.700
Government pressure during bidding	79.51	85.23	0.517	89.98	70.78	*0.014
Relationship with government	67.26	88.60	*0.016	86.80	77.82	0.256
Interference from the opposition parties	77.89	83.80	0.498	83.41	85.31	0.809
Public acceptance to projects	67.85	86.62	*0.031	84.54	82.81	0.825
Change in government policies	79.74	83.28	0.685	82.63	87.03	0.576

$P \leq 0.05$

In terms of firm size, two variables are considered as more important by small firms than large firms including relationship with government (mean rank = 67.26 for large firms, and mean rank = 88.60 for small firms, with *p*-value 0.016) and public acceptance to projects (mean rank = 67.85 for large firms, and mean rank = 86.62 for small firm, with *p*-value 0.031). In terms of experience, contrariwise, there is little difference regarding politics related factors in young and mature firms because there is only one factor, which is considered more important by mature firms than young firms i.e. government pressure during bidding (mean rank = 89.98 for mature firms and mean rank = 70.78 for young firms, with *p*-value of 0.014).

Client Related Factors

The third phase of analysis is connected to the client related factors influencing the bid/no-bid decision of CCFs. Table 4 provides the results of client related factors that affect the bid/no-bid decision of CCFs with respect to size and experience.

Table 4. Client related factors influencing the bid/no-bid decision vis-à-vis CCF size and experience

Client related factors	Mean rank for size			Mean rank for experience		
	Large firms	Small firms	Significant ((2-tailed	Mature firms	Young firms	Significant ((2-tailed
History of the client	87.88	82.94	0.576	91.88	66.58	*0.001
Current financial condition of the client	72.53	87.15	**0.095	84.45	83.00	0.852
Client attitude	87.78	82.96	0.587	85.26	81.21	0.607
Politicians pressure on the client	89.60	82.46	0.421	88.15	74.82	**0.090
Method of bid evaluation of the client	82.64	84.37	0.845	81.42	89.71	0.293
Business level of the client	93.63	81.35	0.166	88.45	74.16	**0.070
Project duration provided by the client	72.29	87.22	**0.090	84.89	82.04	0.715

*$P \leq 0.01$, **$P \leq 0.1$

In terms of firm size, two variables are considered more important by small firms than large firms. They include current financial condition of the client (mean rank = 87.15 for small firms, and mean rank = 72.53 for large firms, with *p*-value 0.095), and project duration provided by the client (mean rank = 87.22 for small firms and mean rank = 72.29 for large firms, with *p*-value 0.090). In terms of experience, significant differences are observed between young and mature firms regarding client related factors. In this context, three factors are considered more important by mature firms than young firms. They are history of the client (mean rank = 91.88 for mature firms and mean rank = 66.58 for young firms, with *p*-value 0.001), politician's pressure on the client (mean rank = 88.15 for mature firms and mean rank = 74.82 for young firms, with *p*-value 0.090), and business level of the client (mean rank = 88.45 for mature firms and mean rank = 74.16 for young firms, with *p*-value 0.070).

Region Related Factors

The fourth phase of analysis is connected to the region related factors influencing the bid/no-bid decision of CCFs. Table 5 indicates the results of region related factors that impact the bid/no-bid decision of CCFs with .respect to size and experience

In terms of size, only one variable is considered as more important by large firms than small firms in region related factors i.e. stability of the political situation (mean rank = 89.33 for large firms, and mean rank = 82.53 for small firms, with *p*-value 0.062). On the other hand, in terms of experience there is significant difference observed between young and mature firms because there are two factors, which are considered more important by mature firms than the

Table 5. Region related factors influencing the bid/no-bid decision vis-à-vis CCF size and experience

Region related factors	Mean rank for size			Mean rank for experience		
	Large firms	Small firms	Significant ((2-tailed	Mature firms	Young firms	Significant ((2-tailed
Availability of required material in the region	82.69	84.36	0.643	89.73	71.34	*0.020
Availability of skilled labor	96.86	80.47	0.252	89.66	71.48	*0.020
Number of projects started in the region	93.57	81.82	0.851	87.53	76.18	0.151
Stability of the political situation	89.33	82.53	**0.062	87.09	77.16	0.208
Availability of equipment in the region	80.78	84.89	0.170	82.25	87.87	0.476
Availability of unskilled labor in the region	91.94	81.37	0.444	86.13	79.28	0.383

*$P \leq 0.05$, **$P \leq 0.1$

young firms. One factor is availability of required material in the region (mean rank = 89.73 for mature firms, and mean rank = 71.34 for young firms, with *p*-value 0.020) and the other factor is availability of skilled labor (mean rank = 89.66 for mature firms, and mean rank = 71.48 for young firms, with *p*-value 0.020).

Discussion

Results of the current study are presented in the previous section shown in Table 2 to Table 5. Discussion is provided in this section especially on the significant factors. The findings are compared with previous studies for their implication in the construction industry.

During the first phase, three significant factors related to market are determined that influence the bid/no-bid decision of CCFs of varied sizes and experience. A change in the construction market, even one of infinitesimal value can have major effects on the smaller CCFs since these firms are producing a small quantity of business due to their limited human capital and other resources. In the situation of an increased 'market value', the chance of the wining a bid for a small firm is decreased due to entrance of numerous competitors and clients having a greater variety of choices. On the other hand, if the 'market value' is decreasing then large firms have more advantages than that of the small firms as small firms are unable to compete with larger firms due to limited experience and recognition of reputation in the market specifically if the 'market value' is negative (Staniewski et al., 2016).

Young firms consider 'availability of similar type of project in the market' more important as compared to large firms. Young firms believe that if there are more similar types of projects in the market, they have a greater chance to win the project because they have more experience with that specific type of project and at the same time these similar projects increases their annual revenue and their experience (Krasnokutskaya & Seim, 2011; Shokri-Ghasabeh & Chileshe, 2016).

'Number of the competitors in the market' is considered more important factor by small firms as compared to the large firms. Small firms have less equipment and managerial staff to overcome the weak points of their firm so they believe that if the 'numbers of competitors in the market' are more then there is a decreased chance of winning a tender (Bustos-Salvagno, 2015; Oyeyipo et al., 2016). This factor is also more important for the young firms as compared to the mature firms as young firms believe if numerous competitors are participating in the industry, clients have a greater pool of firms to choose from, which gives firms with a greater reputation an upper hand and minimizes their chances of winning a project.

During the second phase, three significant factors related to politics are determined that influence the bid/no-bid decision of CCFs of varied sizes and experience. Mature firms have lots of experience and they had built a significant reputation in the industry. Every mature firm competes for mega projects to acquire a large profit and for developing a long-term relationship with the government but numerous mature firms experience "government pressure during bidding' because a mega project is awarded to the firm with a strong relationship with the present government (Bageis et al., 2019; Bageis & Fortune, 2009). Nonetheless, numerous mature firms are discouraged from bidding due to fear of rejection.

Small firms consider the 'relationship with the government' more important factor as compared to large firms. They attempt to develop long-term relationships with every government in power. Small firms have less finance, experience and reputation as compared to large firms. This factor is imperative for larger firms but comparable less to smaller firms. Larger firms have robust relationships with a number of politicians in addition to a strong reputation in the market and they are not discouraged from competing in the market due to governmental factors.

'Public acceptance of projects' is considered more important factor by small firms as compared to the large firms. Small firms are well aware of the fact that to compete in the construction industry, they have to acquire projects that have public support in order to increase their chances of acquiring more projects in the future. On the other hand, public outcry and opposition to a large project acquired by a smaller firm face greater issues of acceptance to the project especially if there are aspects of shady business dealings. Due to their smaller capacity, small firms do not have the budget to build stakeholder relationships with the public or develop public relations programs.

During the third phase, five significant factors related to clients are determined that influence the bid/no-bid decision of CCFs of varied sizes and experience. Clients, whether they are from the public or private sectors need to make cash payments to CCFs on time. 'History of the client (payment in the past project)' is an imperative factor for mature firms. Mature firms usually take larger projects to make more profit and develop a portfolio that is extensive for marketing purposes. Larger projects are costly and more cash is needed in circulation for efficient output, and prompt payment habit of the client is more crucial for mature firms than it is for young

firms. If client is not habitual of paying on time, there is a greater risk for project delay or failure (Egemen & Mohamed, 2007; Shokri-Ghasabeh & Chileshe, 2016).

'Current financial condition of the client' is considered one important factor by the small firms as compared to large firms because small firms cannot take huge risks and are afraid that the client would not clear their bills on time so they would be unable to start a new project due to the limited finance. Large firms have more capital than that mall firms and the profit made by large firms is more than that of sallonese (Shokri-Ghasabeh & Chileshe, 2016).

According to the current findings, 'politician's pressure on a client' is more important factor for mature firms as compared to young firms. Politics is an influential factor that is critical to curing projects. Mature companies usually bid on larger projects to make more profit, and politician's pressure on the client can be a cause of various unexpected losses. It is iMature firms need to consider whereas young firms normally bid for smaller projects, which eliminates the need for excessive political maneuvering and favors.

"Business level of the client" is considered a more important factor by mature firms than young firms. The business level is classified as small, medium and large business level based on profit or revenue generated through projects. the mature firms want to make more profits by gaining larger projects, they prefer a higher business level than a medium or small business level. In contrast, young firms need projects despite looking at the business level of the client to gain fame the in construction market and profit (Krasnokutskaya & Seim, 2011).

'Project duration provided by the client' is very important to consider while bidding. According to the results, project duration given by the client is a more important factor for small firms compared to large firms. Small firms do not have much experienced staff, equipment, and managerial staff; also, they are not well familiar with the different site conditions, weather conditions, geological conditions, and uncertain risks as compared to the large firms. To overcome these uncertainties, enough time given to complete the project is much more important for small firms than large firms (Bageis & Fortune, 2009).

During the fourth phase, three significant factors related to the region are determined that influence the bid/no-bid decision of CCFs of varied sizes and experience. 'The availability of required materials in the region' is considered more important by mature firms than that of young firms. This is because these firms are experienced and well aware of the time and money spent on carrying materials from one place to another. Mature firms want to have as much profit as possible out of every project so it is important for them that the required material need to be procured near the construction site (Krasnokutskaya & Seim, 2011).

'Availability of skilled labor' is marked more important by the mature firms as compared to young firms. This is because transporting skilled labor from headquarters to the site is difficult and expensive as there are costs for food, accommodation, and transportation. Hence, mature firms attempt to hire skilled labor from places close to the construction site so that they can minimize expenses (Bageis et al., 2019; Krasnokutskaya & Seim, 2011).

Large firms rated 'stability of the political situation in the region' is more important than that of small firms. They are well aware of the fact that if the political situations in the region of the project are not favorable then taking the whole crew there and working would be highly risky, which can lead to severe losses in terms of both manpower and resources they are going to use on-site (Maqsoom et al., 2019). As large firms move with more crew and equipment as

compared to smaller firms, they face the chance of a higher degree of loss and hence, give this factor more important than that of small firms.

Table 6. Significant extrinsic factors influencing the bid/no-bid decision vis-à-vis CCF size and experience

Extrinsic factors	CCF size		CCF experience	
	Large firms	Small firms	Mature firms	Young firms
Market related factors				
Market value	×	✓	-	-
Availability of similar type of projects in the market	-	-	×	✓
Number of competitors in the market	×	✓	×	✓
Politics related factors				
Government pressure while bidding	-	-	✓	×
Relationship with government	×	✓	-	-
Public acceptance of projects	×	✓	-	-
Client related factors				
History of the client (payment in the past project	-	-	✓	×
Current financial condition of the client	×	✓	-	-
Politicians pressure on the client	-	-	✓	×
Business level of the client	-	-	✓	×
Project duration provided by the client	×	✓	-	-
Region related factors				
Availability of required material in the region	-	-	✓	×
Availability of skilled labor	-	-	✓	×
Stability of the political situation in the region	✓	×	-	-

To summarize, significant differences have been observed in the extrinsic factors influencing the bid/no-bid decision of CCFs vis-à-vis their size and experience. Market-related factors that influence the bid/no-bid decision of CCFs of varied sizes and experience include 'market value', 'availability of the similar type of projects in the market', and 'number of competitors in the make politics-related factors that influence the bid/no-bid decision of CCFs of varied sizes and experience include 'government pressure during bidding', 'relationship with government', and 'public acceptance of projects'. Client related factors that influence the bid/no-bid decision of CCFs of varied sizes and experience include 'history of the client (payment in the past project)', 'current financial condition of the client', 'politicians pressure on the client', 'business level of

the client' and 'project duration provided by the client'. Region-related factors that influence the bid/no-bid decision of CCFs of varied sizes and experience include 'availability of required material in the region' 'availability of skilled labor' and 'stability of the political situation in the region'. The significant differences in these 14 extrinsic factors influencing the bid/no-bid decision of CCFs are shown in Table 6.

Conclusions

The objective of this research is to explore the differences in extrinsic factors influencing the bid/no-bid decision of construction contracting firms (CCFs) having varied sizes and industrial experiences. The results of the study shed light on the various degrees of differences between small and large, and young and mature CCFs about factors influencing the bid/no-bid decision of CCFs. In terms of firm size, the results revealed that small CCFs are more affected by the market remarket-related such as market value and number of a competitors in the market and client client-related such as current financial condition of the client and project duration given by the client as compared to their larger counterparts. The importance relayed to these factors is reflective of the construction firms own standing in the market which is developed by its reputation, political ties, financial health, human capital, and adequate resources for competition. A significant finding in the current study leads to the conclusion that small CCFs are discouraged from bidding on large-scale projects, as they have limited political resources to acquire the projects.

In terms of firm experience, the results found that mature CCFs are more affected by the client-related regional connected factors as compared to the young firms. They are pressured by the government in various forms concerning ting. Additionally, mature CCFs are more concerned about the history and financial soundness of clients as well as the availability of required material and skilled labor in the market. Conversely, young CCFs are more influenced by market-related to such as the availability the of same types of projects in the market and the number of competitors in the market.

This study contributes to the previous literature by adding to the limited research work on the bid/no-bid decision of CCFs. This work provides novel insights on the bid/no-bid decision-making of CCFs by showing how firm size and experience are associated with their bidding decisions. Additionally, the findings of this study will help CCFs to capitalize on the key extrinsic factors influencing their bidding decision as per their respective size and experience. Lastly, the results of this study can be useful for the CCFs belonging to other regions and countries having the construction industry structure same as that of the developing country.

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AL-QAHTANI
PIPE COATING INDUSTRIES
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alfanar
AL-ITTEFAQ STEEL

Case Study: Corrosion Monitoring Of Real Reinforced Concrete Structures

Dr. Idrees Zafar

Reinforced concrete structures are an integral part of the modern-day world, however, when exposed to harsh weather conditions, their durability and service life can be challenged [1]. The durability of concrete structures along with the mechanical properties of concrete is one of the most significant factors that defines the service life of reinforced concrete structures such as high-rise buildings, long span bridges, etc. The corrosion of reinforcement in concrete has become one of the major deterioration factors in developed countries like the United States, the United Kingdom, Japan, and Canada, as billions of dollars are spent annually for the repairs caused by the corrosion of reinforcement [2]. The concrete researchers have targeted the new materials to improve the matrix of concrete and make it less permeable to minimize corrosion damage. Examples of such materials include fly ash, silica fume, nano-particles etc. [1, 3-5]. In addition, understanding the corrosion behavior of reinforcement embedded in concretes containing new material has become important. Therefore, the corrosion monitoring of reinforcement in a real structure incorporating fly ash is presented. The apparent diffusion coefficient and chloride ion concentration were obtained from the chloride ion analysis of the cores taken from the real structure. The prediction of the service life using JSCE (Japan Society of Civil Engineers) specifications was also done.

Structure Details and Experimental Methodology

The corrosion monitoring of a reinforced concrete waste water outlet structure incorporating fly ash cement at Date Power Plant, which is in service for the last 40 years was done. The Power plant is located near the sea shore to make use of the sea water for cooling down the steam. This structure takes the cooled water, through a water channel back to the adjoining sea. Figure 1 (a) shows the corrosion monitoring of the reinforced concrete waste water outlet structure. The corrosion meter was employed to measure the half-cell potential (Ecorr) and corrosion current (Icorr) of the rebars as shown in Figure 1 (b). The purpose of this measurement was to non-destructively evaluate the corrosion status of rebars embedded in the structure. The cover depth and diameter of the rebar were 80 mm and 13 mm respectively. The details of the waste water outlet structure are given in Table 1

Table 1 Details of the waste water outlet structure

Year of Construction	Cement Type	Water to Cement ratio	Design Strength (kgf/cm²)	In-Service
1974	Fly ash Cement Type B	55.5	210	yes

The cores were also drilled in order to estimate the apparent diffusion coefficient and chloride ion concentration near or at the reinforcement level. The drilled core section is represented by point 1 in Figure 1 (b). Cylindrical core specimens had a diameter and height of 100 mm and 80 mm respectively. The cores were cut in approximately 50 x 30 x 15 mm thick slices and then ground to get about 10 grams of powder for the chloride analysis. Japanese Industrial Standard (JIS A1154) was used to determine the total chloride ion concentration in each sample of the concrete.

(a) (b)

Figure 1: (a) Corrosion monitoring of an RC waste water outlet structure (b) Location of electrochemical measurements (A to D) and drilled cores (1 to 2) for chloride analysis

in the case of initiation concrete specimens, after the confirmation of corrosion initiation, chloride analysis was conducted to estimate the total chloride ion concentration for all concrete specimens. The entire chloride application zone (50 mm × 100 mm) of concrete specimens was used for chloride analysis. Japanese Industrial Standard (JIS A1154) was used to determine the total chloride concentration in each sliced layer of the concrete. As per the standard, the minimum weight of each sliced layer (powdered) should be around 10 grams. So to obtain the required weight of concrete powder, the concrete was sliced to approximately 7 mm thick layers. A nonlinear regression analysis was done to fit the experimental chloride profile with the solution of Fick's 2nd law of diffusion. Fick's second law of diffusion has been used under the assumption that concrete cover under the application zone was fully saturated because during the experiment the concrete surface was continuously subjected to the application of the salt solution. The surface chloride ion concentration (C_s) and diffusion coefficient (D_o) were obtained from the fitting curve. The obtained values of C_s and D_o were then used to evaluate the chloride profiles at the estimated corrosion initiation time.

Results and Discussions

Electrochemical Measurements

Figure 2 is the scanning electron microscope image of the concrete core taken from the RC waste water outlet structure (courtesy by Hokkaido Electric Power Co. Inc.). It clearly shows the presence of fly ash particles in the concrete.

The results of the half-cell potential (Ecorr) and corrosion current density (Icorr) measurements for the RC structure are shown in Figure 3. It was observed that almost all the measured points have shown the values of half-cell potential less than -350 mV vs CSE except point C, whose value is also not very high i.e. -371mV vs CSE. According to ASTM C 876, the steel reinforcement is still is the passive state for A, B, and D points while there is a likely hood of corrosion initiation at point C. On the other hand, the values of corrosion current density for all the points are less than 0.1 μA/cm² which is also suggesting the passive state of rebars embedded in fly ash concrete. The electrochemical results of rebars have clearly suggested that the corrosion has yet to initiate for the rebars and is mainly because of the high durability of fly ash concrete against aggressive agents even after the exposure of 40 years.

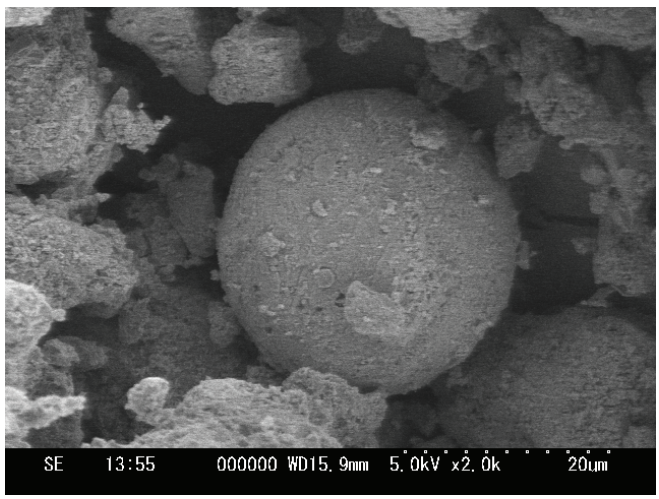

Figure 2: The presence of fly ash particle by Scanning Electron Microscope (Courtesy by Hokkaido Electric (.Power Co. Inc

Chloride ion Concentration Analysis

Figure 4 shows the distribution of chloride ion concentration along with the depth for the core specimens. It was noticed that the value of chloride ion concentration is approaching the zero mark at a depth of 60 mm from the exposure surface which relates that the chloride ion has not yet reached the level of rebar i.e. 80 mm. The dense microstructure of concrete incorporating fly ash has restricted the chloride ion from reaching the rebar level and initiated corrosion. The average value of surface chloride ion concentration and apparent diffusion coefficient for the cores was found to be 13.2 kg/m³ and 0.101 cm²/year respectively.

Verification for Corrosion Reinforcement with regard to Service life

The performance of concrete structures is different over time due to environmental and loading conditions. The inspection on whether such change brought to concrete structures by the various factors is in the permissible range is necessary. In order to conduct these inspections various standards like JSCE, ACI and RILEM are followed. In this study, JSCE Standard Specifications for Concrete Structures-2012 are used to obtain the values of chloride threshold level and apparent diffusion coefficient for the current fly ash concrete structure and

compared with the already obtained experimental values in the previous section. In addition, the amount of chloride ion concentration and apparent diffusion coefficient will be predicted after 50, 100, and 125 years of service life. Furthermore, for the comparison purpose, the chloride ion concentration and apparent diffusion coefficient will also be calculated for normal Portland cement concrete with the same W/C ratio and service life. According to JSCE, the critical chloride ion concentration required to initiate the corrosion can be estimated using the following equations:

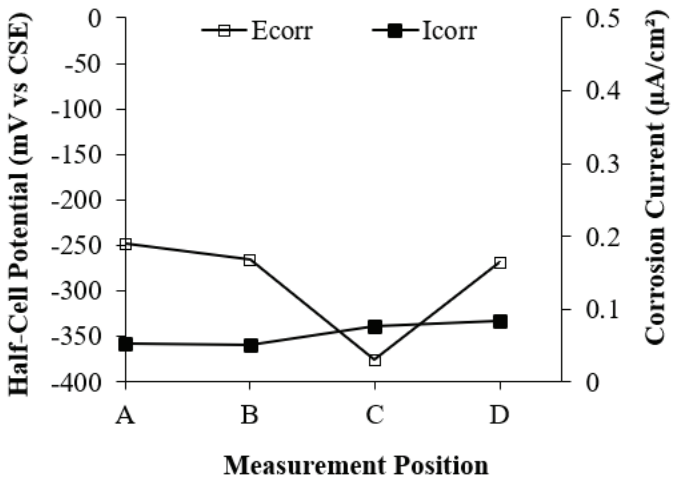

Figure 3: Half-Cell Potential (Ecorr) and Corrosion Current (Icorr)

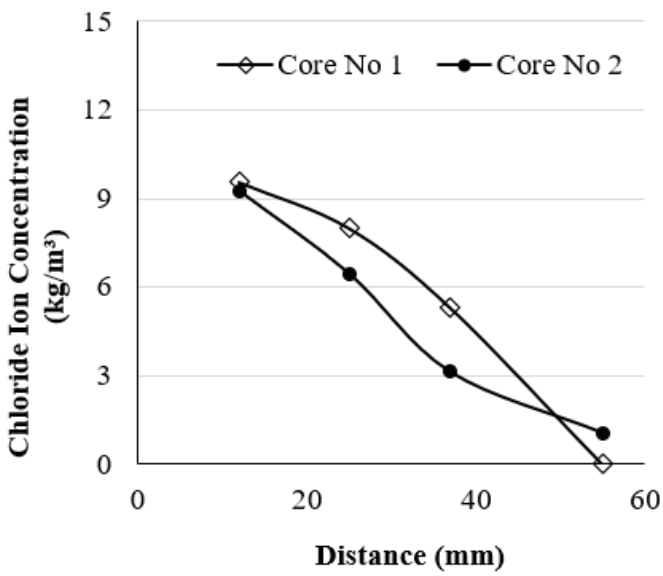

Figure 4: The profiles of chloride ion concentration for core specimens

For Normal Portland cement Concrete:

$$C_{lim} = -3.0\left(\frac{W}{C}\right) + 3.4 \quad \text{---------- (1)}$$

For Fly ash Concrete:

$$C_{lim} = -2.6\left(\frac{W}{C}\right) + 3.1 \text{ ---------- (2)}$$

Where

C_{lim} : Critical chloride concentration for initiation of steel corrosion embedded in concrete.

W/C is the water to cement ratio, in the case of fly ash concrete, C is the blended cement i.e. fly ash cement. As described in Table 1, Type B fly ash cement was used in the current structure and W/C for this structure is 0.55.

From Equations 1 and 2, the critical chloride concentration for normal Portland cement concrete and fly ash concrete at W/C of 0.55 are found to be 1.75 kg/m³ and 1.67 kg/m³ respectively.

According to JSCE Standard Specifications for Concrete Structures-2012, the apparent diffusion coefficient can be estimated by using the following equations:

For Normal Portland cement Concrete:

$$log\ D_{ap} = 3.0\left(\frac{W}{C}\right) - 1.8 \text{ ---------- (3)}$$

For Fly ash Concrete:

$$log\ D_{ap} = 3.0\left(\frac{W}{C}\right) - 1.9 \text{ ---------- (4)}$$

Where

D_{ap} : Apparent diffusion coefficient of chloride ions into concrete (cm^2 /year)

W/C is the same as described above for equations 1 and 2.

From equations 3 and 4, the values of apparent diffusion coefficient for normal Portland cement concrete and fly ash concrete at W/C of 0.55 are found to be 0.71 cm²/year and 0.56 cm²/year respectively. The following order of the apparent diffusion coefficient was observed:

D_{ap}-OPC-est (0.71 cm²/year) > D_{ap}-FA-est (0.56 cm²/year) > D_{ap}-FA-exp (0.101cm²/year)

Where

D_{ap}-OPC-est is the apparent diffusion coefficient of normal Portland cement concrete estimated by using JSCE specifications

D_{ap}-FA-est is the apparent diffusion coefficient of fly ash concrete estimated by using JSCE specifications

D_{ap}-FA-exp is the apparent diffusion coefficient of fly ash concrete, experimentally obtained by chloride ion analysis of the cores taken from the reinforced structure.

It was noticed that the apparent diffusion coefficient estimated using the JSCE specifications, especially for fly ash concrete are on the higher side as compared to the experimental values. This may be because the equations 3 and 4 provide the apparent diffusion coefficient for the design purpose incorporating safety factors to be on the safe side.

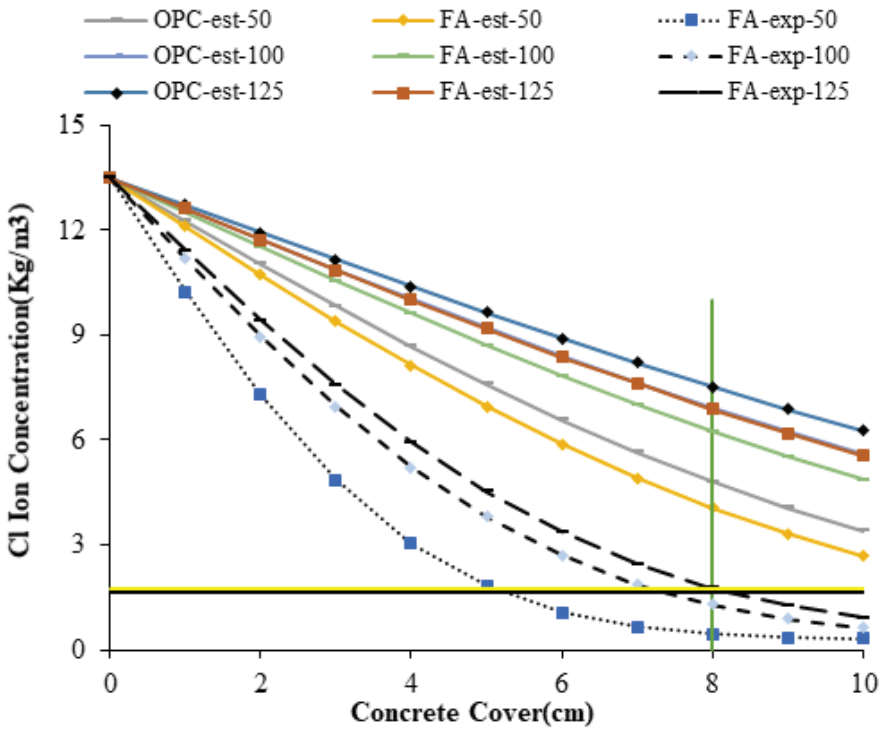

Figure 5: The predicted profiles of chloride ion concentration after a service life of 50, 100 and 125 years for normal concrete and fly ash concrete {Legend: [Type of cement] - [Estimated(est) or Experimental (exp) diffusion coefficient was used to predict the chloride ion values] - [service life in years]}.

The estimated chloride ion concentration for the normal concrete and fly ash concrete after a service life of 50, 100 and 125 years is shown in figure 5. The surface chloride ion concentration value was taken as 13.2 kg/m³, experimentally obtained from the core specimens. OPC-est stands for normal Portland cement concrete and estimated diffusion coefficient was used for predicting the chloride ion concentration values while FA-exp stands for fly ash concrete and experimentally obtained diffusion coefficient was used for predicting the chloride ion concentration values. It was observed that at any time period of service life fly ash concrete had shown low chloride ion concentration as compared to the normal Portland cement concrete. The values of chloride ion concentration further dropped when the experimental diffusion coefficient was used as shown in Table 2. The service life of the fly ash concrete with regard to corrosion initiation, using the critical chloride ion concentration as 1.67 kg/m³ (estimated by equation 2), was found to be around 125 years. While the service life with regard to corrosion initiation using 'D_{ap}-FA-est' as the apparent diffusion coefficient, was found to be around 25 years. It was noticed that the service life of the reinforced structure incorporating fly ash occurred to be five times less when the apparent diffusion coefficient estimated by JSCE specifications instead of the experimental apparent diffusion coefficient was used. This difference in the predicted service life is mainly because of the difference in the apparent

diffusion coefficients. The estimated apparent diffusion coefficient, D_{ap}-FA-est, is used for the design purpose with an aim to be on the safe side and ultimately push the predicted service life values on the lower side.

Table 2: Predicted chloride ion concentration values at cover depth after a certain period of service life

Service Life after 1974 (years)	at cover depth (Chloride ion Concentration (kg/m^3		
	OPC-Est	FA-Est	FA-Exp
50	4.82	4.06	0.46
100	6.93	6.24	1.29
125	7.54	6.89	1.77

Summary

The corrosion monitoring of an in-service reinforced waste water outlet structure incorporating fly ash was done. The structure had been in service for the last 40 years. The scanning electron microscope image of the concrete core has clearly shown the presence of fly ash particles in the structure. The results of electrochemical measurement and chloride ion analysis had shown that the rebars embedded in the reinforced structure are still in the passive state. From the visual observation, it was found that the virgin skin of the rebars is still in contact clearly representing the high durability of fly ash concrete even in real structures exposed to harsh environments. The results of the simulation have shown that the service life of the reinforced structure incorporating fly ash was underestimated by using the apparent diffusion coefficient, estimated by JSCE specifications.

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مجموعة كابلات الرياض
Riyadh Cables Group
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PIPE COATING INDUSTRIES
شركة القحطاني
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الفنار
alfanar
حديد الإتفاق
AL-ITTEFAQ STEEL

An Autonomous Mechanism For Real Time Blade Pitch Actuation For A Straight-Bladed Vertical Axis Wind Turbine

Farooq Saeed

Abstract:

A new idea for an autonomous mechanism for real time blade pitch actuation for a straight-bladed vertical axis wind or water turbine (VAWTs) for improved power production is proposed. VAWTs are omni-directional, that is the main rotor shaft is set transverse to the wind direction vertically, and as such VAWTs do not need to be pointed into the wind, which removes the need for yawing and furling mechanisms as in the case of Horizontal axis wind turbine (HAWTs). The blades of a typical VAWT are usually fixed to the struts and thus cannot rotate freely about their attachment points. As these blades rotate about the turbine rotor axis under the influence of the wind, they undergo a cyclic variation of pitch, defined as the relative angle between the tangential velocity vector and the wind direction, during a single rotation of the rotor. The magnitude of this cyclic pitch variation is a direct function of the turbine rpm and the wind speed. It is typical for a VAWT blade to experience positive as well as negative stalls during a single rotation of the rotor as a consequence of the variation in the blade pitch. As the blades undergo stall, positive or negative, they negatively impact the performance of the turbine. One way to enhance turbine performance is to prevent the blades from undergoing stall by actively or passively de-pitching the blades as they enter the stall regions and then resetting the pitch once the blades exit the stall regions. Since the location and extent of these stall regions are dictated directly by the wind speed and direction and indirectly by turbine rpm (since it is dependent on wind speed), a mechanism is needed to sense both the wind speed and turbine rpm to be able to locate the stall regions accurately and in real time. The idea disclosed here describes a simple mechanism for an autonomous and real time blade pitch actuation in order to not only preserve the omni-direction character of the VAWT but also yield enhanced performance. The idea has been awarded the USPTO Patent.

Introduction

Vertical axis wind or water turbines (VAWT) are a type of wind turbine where the main rotor shaft of a VAWT is set vertically transverse to the wind direction. A sketch of a typical straight-bladed VAWT with two fixed-pitch blades is shown in Fig. 1. One of the main advantages of the VAWTs is in its omni-direction character and as such the VAWTs do not need to be pointed into the wind. The omni-direction character, therefore, eliminates the need for wind-direction sensing and orientation mechanisms such as the one required for the horizontal axis wind turbines (HAWTs).

Proposed Idea

The blades of a typical VAWT are usually fixed to either the struts as is the case with straight-bladed VAWT shown in Figs. 1 and 2 or in other configurations to the turbine shaft and thus cannot rotate or twist freely about their attachment points. As these blades rotate about the turbine rotor axis under the influence of the aerodynamic forces, they undergo a cyclic variation

of pitch angle α, defined as the relative angle between the tangential velocity vector (wR) and the wind direction vector V shown in Fig. 3, during a single rotation of the rotor. Figure 3 shows a typical variation in the blade pitch angle α for different locations in terms of the azimuthal angle θ in the equatorial plane (or the mid-rotor height shown in Fig. 2). The variation in the resultant velocity vectors W at the four different azimuthal locations θ are also shown in terms of the vector addition of the tangential velocity vectors (wR) and the wind direction vectors V. As a consequence, the blades undergo a cyclic variation of pitch angle α. The magnitude of this cyclic pitch variation is a direct function of the turbine rpm and the wind speed.

Figure 4 shows a plot of the variation of the blade pitch angle α as a function of the azimuthal angle θ indicating positive and negative stall regions (shaded areas). It is typical for a VAWT blade to experience positive as well as negative stall during a single rotation of the rotor as a consequence of the variation in the blade pitch. The dashed line in Fig. 4 represents the case of the blade that is fixed at its attachment point and experiences a variation in pitch by virtue of its rotation around the rotor axis. This case is referred to as the fixed-pitch case in this disclosure. The performance of a fixed-pitch VAWT is shown again in terms of dashed lines in Figs. 5(a) and (b). Figures 5(a) and 5(b) show plots of the tangential force and the torque coefficient for fixed and variable pitch blades as a function of the azimuthal angle θ, respectively. As evident from the figure, the fixed pitch VAWT experiences a sharp drop in the tangential force and the torque coefficient within and in the vicinity of the stall regions in comparison with Fig. 4. Thus, for a fixed-pitch case, as the blades undergo stall, positive or negative, they negatively impact the performance of the turbine. One way to enhance trubine performance is to prevent the blades from undergoing stall by actively de-pitching the blades as they enter the stall regions and then resetting the pitch once the blades exit the stall regions. In order to avoid the stall regions, the pitch variation in the case of the blade that can be rotated about its attachment points to avoid stall is shown with a solid line in Fig. 4 and is referred to as the variable-pitch case in this disclosure. The plots of the tangential force and the torque coefficient for the variable pitch blades are shown in solid lines in Figs. 5(a) and (b), respectively. Clearly, the effect of varying (decreasing) the blade pitch within and in the vicinity of the stall regions results in a more steady cyclic variation of the tangential force and the torque coefficient. As a consequence, the variable-pitch VAWT shows an almost 30-40% increase in the power output of the turbine.

Since the location and extent of these stall regions are dictated directly by the wind speed and direction and indirectly by turbine rpm (since it is dependent on wind speed), a mechanism is needed to sense both the wind speed and turbine rpm to be able to locate the stall regions accurately and in real time. The idea disclosed here describes a simple mechanism for an autonomous and real time blade pitch actuation in order to not only preserve the omni-direction character of the VAWT but also yield enhanced performance.

Although many different configurations of the proposed idea are possible, the basic configuration of the proposed idea and its utility are shown in Figs. 6 and 7. Figure 6 is a perspective view while Fig. 7 shows the same configuration as viewed from the top of the turbine. The main components of the variable-pitch mechanism consist of a sensor, a controller, and an actuator. In the very basic configuration, the sensor is activated by a contact wire attached to the wind vane.

In another configuration, the sensor could be replaced with absolute and incremental rotary/shaft encoders to indicate the wind vane location (angular position) and shaft rpm, respectively (see Fig. 8). The drawback here is that the encoders will require power for operation. This can be provided with the aid of solar/PV panels mounted on top of the rotor mast or colocated with it.

In another configuration, the sensors/rotary encoders could be mounted in the mast with an upper/outer part connected to the wind vane, the lower/inner part connected to the mast, and the actuator motors mounted inside the blades (see Fig. 9). Such an "embedded" construction/setup will help eliminate the drag/resistance due to the sensor and actuator assemblies exposed to air.

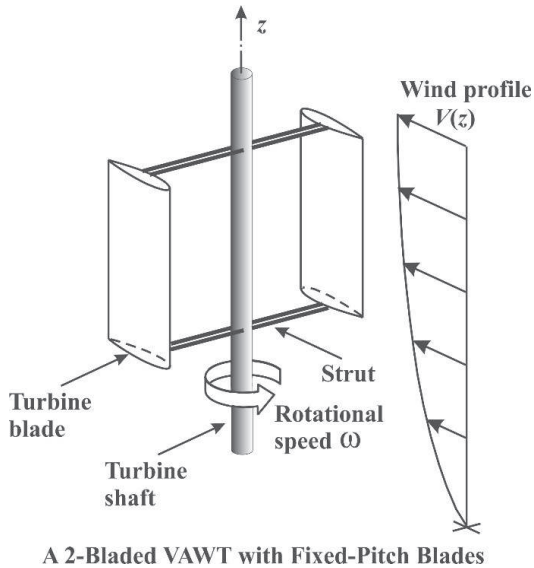


Figure 1: A typical straight-bladed VAWT with two fixed-pitch blades.

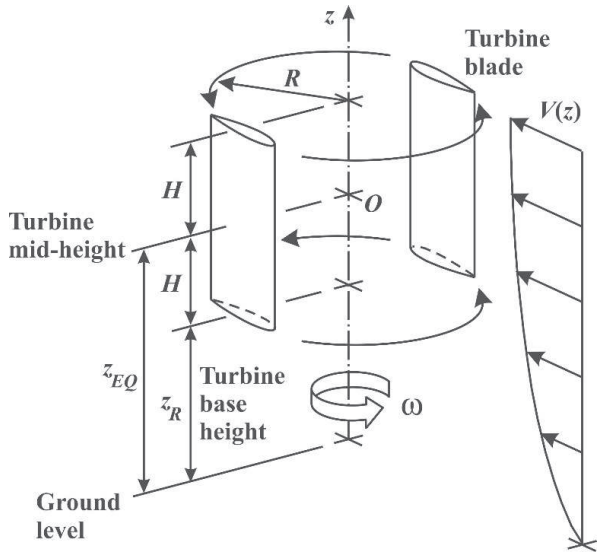


Figure 2: A Sketch of the straight-bladed VAWT model to identify important terms.

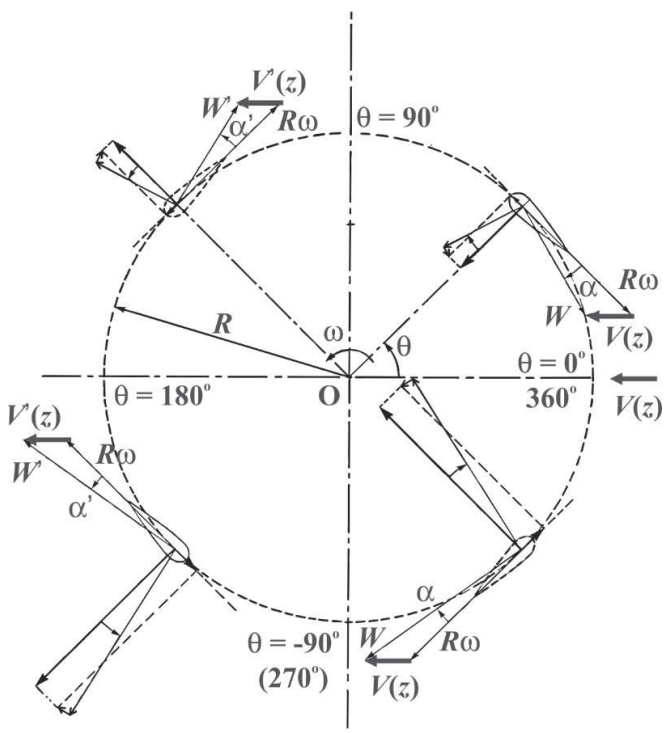


Figure 3: Depiction of the blade pitch angle α, the azimuthal angle θ and velocity vectors in the equatorial plane.

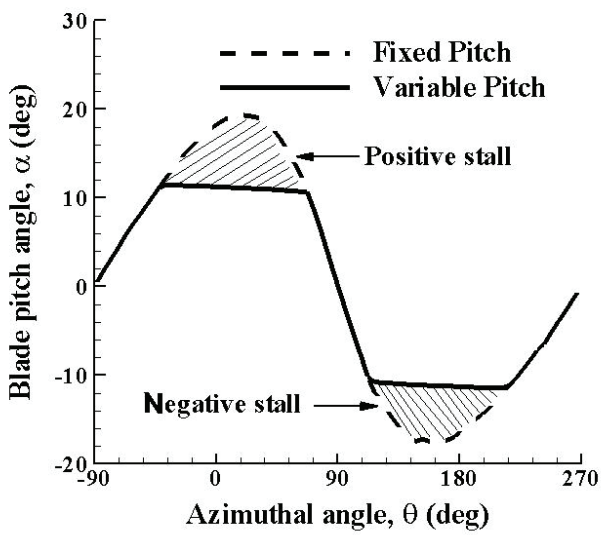


Figure 4: Variation of the blade pitch angle α as a function of the azimuthal angle θ indicating positive and negative stall angles.

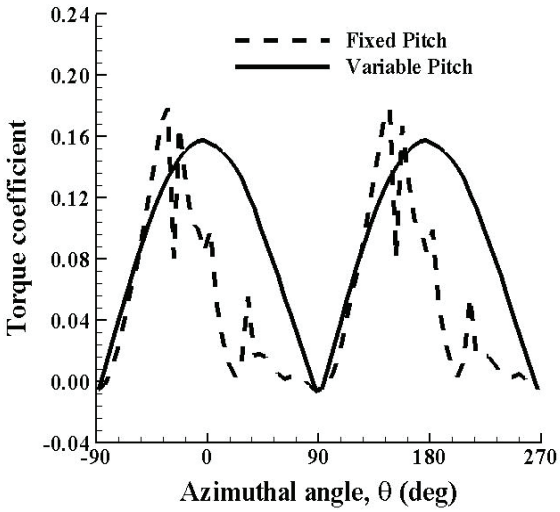


Figure 5: Comparison of (a) the tangential force and (b) the torque coefficient results for fixed and variable pitch blades as a function of the azimuthal angle θ.

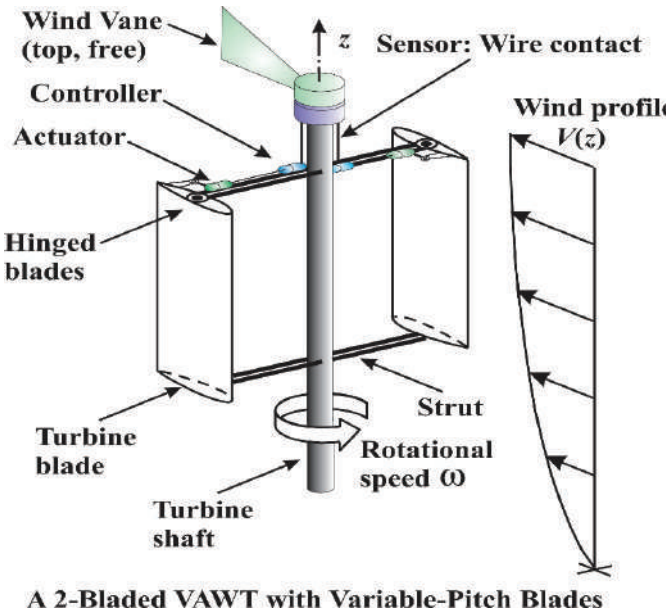
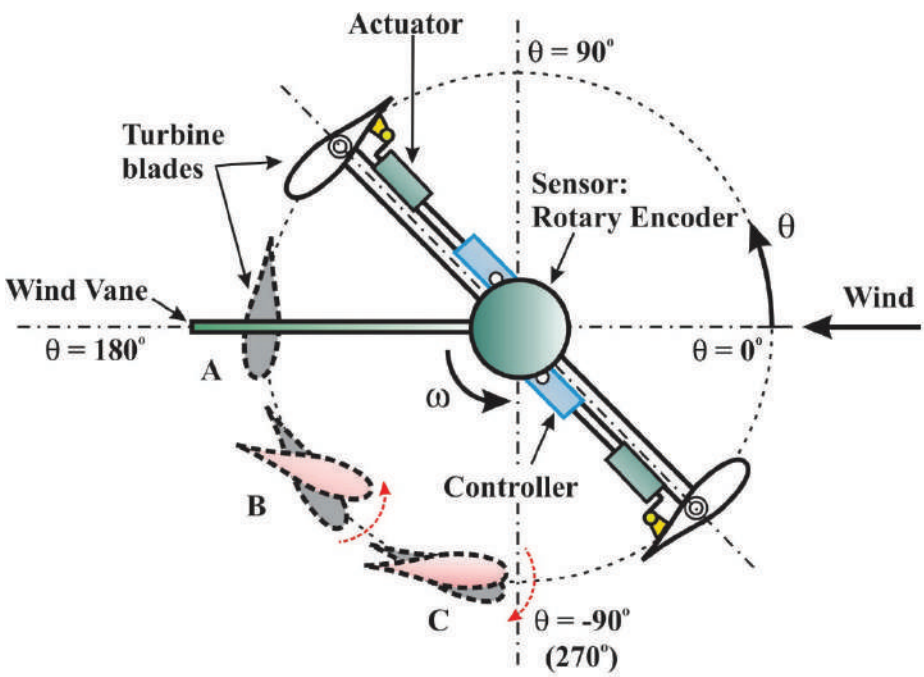


Figure 6: The proposed idea and its utility



Pitch Actuation Sequence
A: Sense wind vane location (to serve as reference), and rotor rpm
B: Initiate pitch activation based on programmed increment from reference
C: Trigger to reset blade pitch back to initial value

Figure 7: The proposed idea operational sketch.

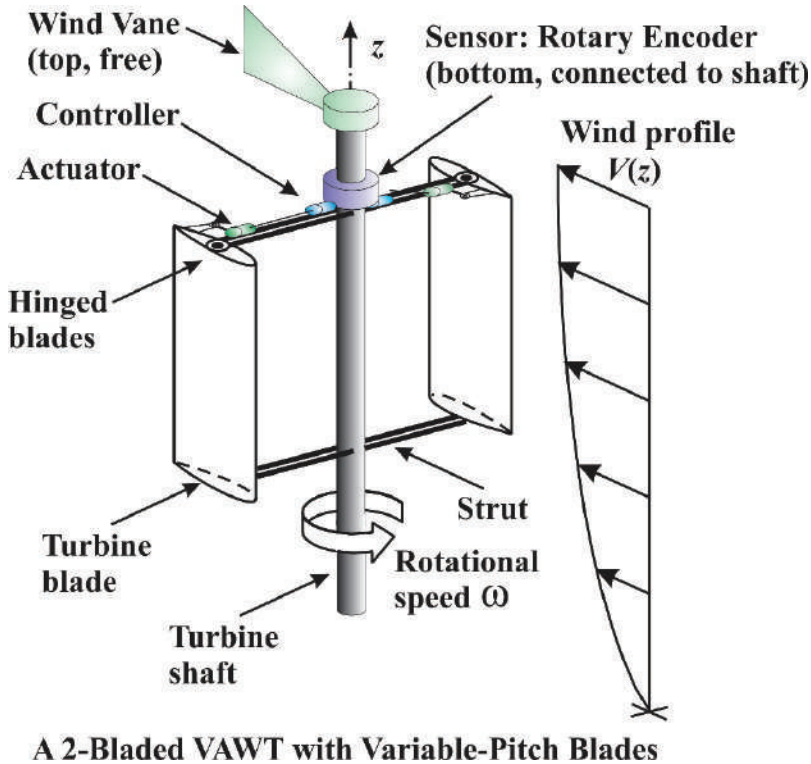


Figure 8: The proposed idea in another configuration employing rotary encoder for sensing wind direction.

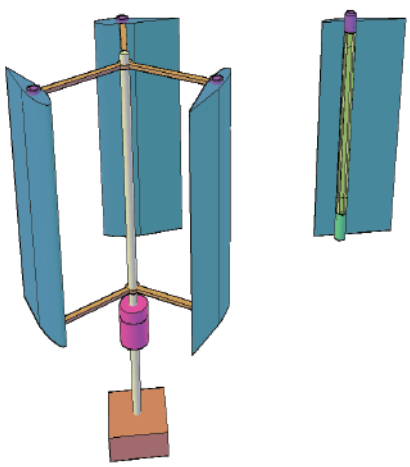


Figure 9: The proposed idea in another configuration with actuator motors embedded or mounted inside the blades.

In Summary

The proposed idea suggests a simple solution of enhancing wind power by use of a wind speed and direction sensing mechanism that passively activates individual blade pitch at the right azimuthal locations and as such further improves upon the performance of the generally accepted previous highest standard for a vertical axis wind turbine.

The proposed idea retains mechanical simplicity by avoiding the use of linkages and tilt

mechanisms or complicated electro-mechanical systems to control or determine the blade pitch. Moreover, there are no electrical parts to burn out.

Reference:

Saeed, F., "Wind power generation device with real time pitch actuation", U.S. Pat. No. 11,236,725, issued February 01, 2022.

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شركة القحطاني
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P-Δ AND P- δ Case Study using STAAD PRO SOFTWARE

Yasir Farid Khan, Uday Chaudhari, Dr Shahid Iqbal

Staad pro is structure Analysis & design software by Bentley. P-Δ and P- δ effects are the effects of loads acting on the displaced location of joints or nodes in a structure. P-δ effects are the effect of loads acting on the deflected shape of a member between joints or nodes.

Staad claims that P-Δ and P- δ effects are considered in design but there is the uncertainty of a number of iterations to be considered and whether results are within the range specified by AISC Code. Therefore, two test cases from AISC 14th edition were used to test the staad software. Analysis results were compared with the results mentioned in AISC 14th edition and concluded that Staad consider the effect of P-Δ & P- δ and results are within limits of Code. Moreover, it was also observed that at least 15 Iterations should be specified. After 15 iterations in P-Delta Analysis, results will remain the same up to two digits in staad pro. After this case study, structure design engineers using Staad pro for design will get more confidence over a number of iterations and accuracy of Pdelta staad pro results.

Introduction.

PDELTA effects

The movement of the structural mass to a deformed position in the analysis of building and other structural systems subjected to lateral displacements generates second-order overturning moments that are normally not accounted for in static and dynamic analysis. This second-order behavior has been termed the P-Delta effect since the additional overturning moments on the building are equal to the sum of story weight “P” times the lateral displacements “Delta”. The effect of P-Delta is mainly dependent on the applied load and building characteristics. In addition to this

it also depends upon the height, stiffness and asymmetry of the building. The building asymmetry may be unbalanced mass, stiffness, in plane. There are two distinct types of P-delta effects: P- Δ (sometimes referred to as "large P delta" or "P-Big delta"), and P- δ (sometimes referred to as "small P-delta" or "P-Small delta"); which are explained as under;

a). P- Δ EFFECT (P-BIG DELTA)

P-Δ has reference to the effects of the vertical loads acting on the laterally displaced structure. For example, wind or seismic forces (V) cause a horizontal displacement (Δ) of the structure, while the gravity loads (P) simultaneously act vertically on this displaced structure. Secondary moments are induced into the structure equal to the total vertical load P times the structural displacement Δ. Shown in Figure 1.

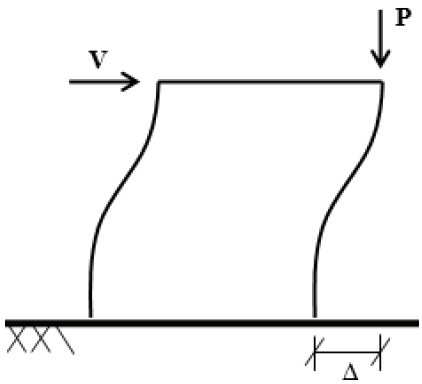


Fig-1: P- Δ EFFECT

b) P- δ EFFECT (P-SMALL DELTA)

P-δ has reference to the effects of the axial load in an individual member subject to a deflection (curvature) between its endpoints. For example, column loads (P) due to gravity, wind, and/or seismic forces act on a column that has a curvature induced by the connection conditions of supported beams. Moments are induced in the member proportional to the axial load P times the member deflection δ. Note that axially loaded beams also experience these effects. It is shown in figure 2.

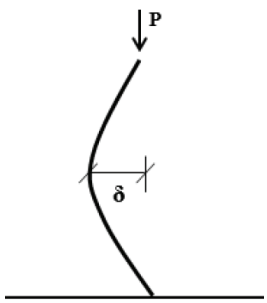


Fig-2: P- δ EFFECT

c). COMBINE EFFECT OF P - Δ - δ

Since both of these contribute to the deformation of the frame as shown in figure 3, it is important to consider their combined effect. These secondary effects cause the member to deform more and induce additional stresses in the member and there are also reductions

of their strength and stiffness. This reduction in strength and stiffness results weakening or destabilizing effect on the structure.

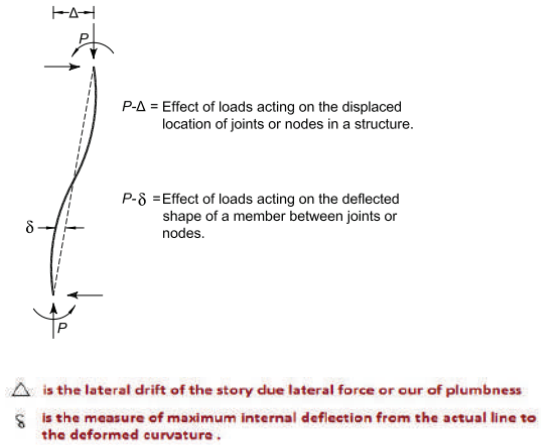


Fig 3:- COMBINE EFFECT OF P - Δ - δ

Second Order Analysis

The AISC 360-05 code states that any second order method that includes the P-Δ and P δ effect may be used, but the following two methods are mostly used.

Moment Magnification factor method

This is a second order analysis done by magnifying the moments determined in the first order elastic analysis. This is an approximate method which is also popularly known as B1 - B2 method as the code specifies the AISC equations eqn- C2-2 and C2-3 to determine the amplification factors for a member's internal deformation (B1) and for the drift (B2) respectively and use them to calculate the second order flexural and axial strength of the member by AISC eqn- C2-1a and C2-1b .

2.2 Direct, Rigorous Second order analysis

Rigorous second-order analyses are those that accurately model all significant second-order effects. One such approach is the solution of the governing differential equation, either through stability functions or computer frame analysis programs that model these effects.

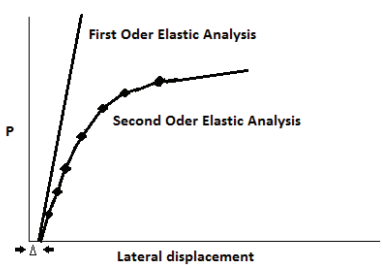


Fig 4: lateral displacement under First order and second order

Due to the iterative process involved in determining the actual value of forces and displacements on account of the second order effect, it is mostly performed by computer programs.

Stability Design Approaches

From stability consideration of a structure, AISC chapter C suggests the three approaches for determining the required flexural and axial strength of a member in the structure

- Effective length method (ELM)
- First-order analysis method (FAM)
- Direct Analysis method (DM)

Second order effects (PDELTA effects) are used in ELM and DM methods. However, FAM addresses these requirements in an indirect manner using mathematical manipulation of direct Analysis

Effective length method

Unless the *First Order to Second Order drift ratio* is not greater than 1.1, this method demands the determination of the actual "K" value of compression members. It is a conventional method that has been adopted by engineers for designing steel columns for a long time. Determination of the Effective Length factor "K" of a member is the essence of this method. The K value accounts for the contribution of boundary conditions to the axial load carrying capacity of a steel column. Since the ELM approach is based on several assumptions on geometry, boundary condition, and material properties of columns, sometimes this approach may be very conservative and inappropriate for the design of compression members.

First Order Analysis

Generally, the analysis is done by using linear elastic methods, which is first order structural analysis. In a first order analysis displacements and internal force are evaluated in relation to the geometric undeformed structure. It does not consider buckling and material yielding. In the case of first order elastic analysis, the deformations and internal forces are proportional to the applied loads. However, in some cases, the deflection of the structure can have a geometric second order effect on the behavior of the structure, which is not evaluated by the linear first order analysis. This type of geometric non-linearity can be analyzed by performing through iterative processes which are only practicable by using computer programs. It is generally known as second order analysis. In this type of analysis, the deformations and internal forces are not proportional to the applied loads

This method suggests performing the first order elastic analysis using nominal geometry and nominal stiffness. Although the method is derived from the Direct Analysis Method (DAM), it is only applicable when the sidesway

$$B_2 = \frac{\Delta_{2nd-order}}{\Delta_{1st-order}} \leq 1.5$$

amplificationfactorB2<1.5

Direct Analysis Method (DM):-

The AISC 360-05 introduced the DAM for addressing all the necessary stability requirements suggested by the code. Performing the rigorous Direct Analysis is an advanced approach of stability analysis that considers both geometric and material non-linearity and is far more accurate when compared with the other approximate methods.

Effect of Neglecting P- δ :

A common type of approximate analysis is one that captures only P-Δ effects due to member end translations (for example, inter story drift) but fails to capture P-δ effects due to curvature of the member relative to its chord. This type of analysis is referred to as a P-Δ analysis. Where P-δ effects are significant, errors arise in approximate methods that do not accurately account for the effect of P-δ moments on amplification of both local (δ) and global (Δ) displacements and corresponding internal moments. These errors can occur both with second-order computer analysis programs and with the B1 and B2 amplifiers.

The engineer should be aware of this possible error before using a P-Δ-only analysis in such cases.

PDELTA effects in STAAD Pro:

Some—but not all, and possibly not even most—modern commercial computer programs can perform a rigorous second-order analysis, although this should be verified by the user for each particular program but staad claims that it performs PDELTA effects, and it is verified here.

STAAD.Pro performs rigorous second order analysis. However, the moment magnification factor approach is not implemented in STAAD.

STAAD forms the (K+Kg) matrix which accounts for the Geometric non-linearity, which is the combination of the global stiffness matrix and the Global Geometric Stiffness matrix. For the material non-linearity, the program reduces the axial and flexural stiffness in accordance to the code guidelines.

Analysis Benchmark Problems in AISC 14th edition.

AISC provided two benchmark problems as a first-level check to determine whether an analysis procedure meets the requirements of a rigorous second-order analysis adequate for use in the direct analysis method and the effective length method. Some second-order analysis procedures may not include the effects of P-δ on the overall response of the structure. These benchmark problems are intended to reveal whether or not these effects are included in the analysis. In confirming the accuracy of the analysis method, both moments and deflections should be checked at the locations shown for the various levels of axial load on the member and in all cases should agree within 3% and 5%, respectively.

The benchmark problem descriptions and solutions are shown in AISC 14th edition chapter C. Figures C-C2.2and C-C2.3.

6.1- Case 1:- Simply supported beam-column subjected to an axial load concurrent with a uniformly distributed transverse load between supports. This problem contains only P-δ effects because there is no translation of one end of the member relative to the other.

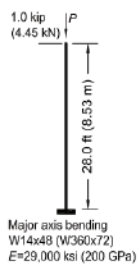
Axial Force, P (kips)	0	150	300	450
M_{mid} (kip-in.)	235 [235]	270 [269]	316 [313]	380 [375]
Δ_{mid} (in.)	0.202 [0.197]	0.230 [0.224]	0.269 [0.261]	0.322 [0.311]

Axial Force, P (kN)	0	667	1334	2001
M_{mid} (kN-m)	26.6 [26.6]	30.5 [30.4]	35.7 [35.4]	43.0 [42.4]
Δ_{mid} (mm)	5.13 [5.02]	5.86 [5.71]	6.84 [6.63]	8.21 [7.91]

Analyses include axial, flexural and shear deformations.
[Values in brackets] exclude shear deformations.

Fig-5 : AISC test case-1

Case 2:- Fixed-base cantilevered beam-column subjected to an axial load concurrent with a lateral load at **6.2** its top. This problem contains both P-Δ and P-δ effects. In confirming the accuracy of the analysis method, both moments and deflections should be checked at the locations shown for the various levels of axial load on the .member and in all cases should agree within 3% and 5% respectively



Axial Force, P (kips)	0	100	150	200
M_{base} (kip-in.)	336 [336]	470 [469]	601 [598]	856 [848]
Δ_{tip} (in.)	0.907 [0.901]	1.34 [1.33]	1.77 [1.75]	2.60 [2.56]

Axial Force, P (kN)	0	445	667	890
M_{base} (kN-m)	38.0 [38.0]	53.2 [53.1]	68.1 [67.7]	97.2 [96.2]
Δ_{tip} (mm)	23.1 [22.9]	34.2 [33.9]	45.1 [44.6]	66.6 [65.4]

Analyses include axial, flexural and shear deformations.
[Values in brackets] exclude shear deformations.

Fig-6 : AISC test case-2

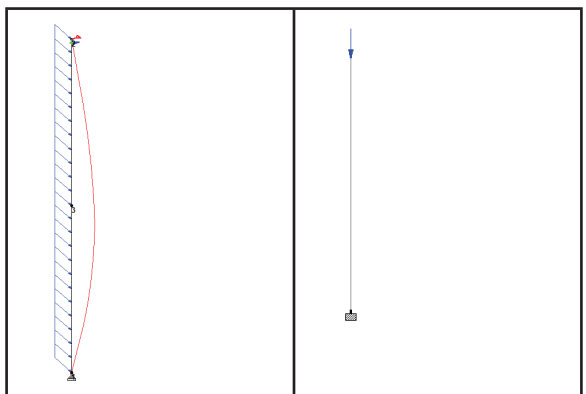


Fig-7:- Staad Models for test case-1 & 2

Results and Discussion

Results of Test case-1 and 2 in staad pro shows that variance in the moment between AISC & staad Pro is ranging between 1.69% to 1.92% and variance in deflection have ranged between 2.43% to 2.52% which is less the specified limit of AISC code (3% and 5% respectively). Therefore

we can conclude that staad performs large delta (P-Δ) and small delta (P-δ) effects.

Test Case-1						
L.C AISC -Mz KN-m		Staad -Mz KN-m	AISC-Dff-mm	Staad -Dff mm	Vari - Mz	Vari-Dff
1	26.6	26.55	5.02	5.11	0.16%	1.76%
2	30.5	30.32	5.71	5.82	0.58%	1.92%
3	35.7	35.30	6.63	6.69	1.10%	0.93%
4	43	42.17	7.91	7.71	**1.92%**	**2.43%**
Test Case-2						
1	38	37.95	23.1	23.01	0.11%	0.38%
2	53.2	53.10	34.2	34.02	0.19%	0.50%
3	68.1	67.77	45.1	44.72	0.47%	0.83%
4	97.1	95.46	66.6	64.92	**1.69%**	**2.52%**

Table-1:- Comparison of AISC Moment & Deflection with Staad pro results

Always use the "P-delta Analysis" Command instead of the "Pdelta Large Analysis" Command. In the case of "Pdelta Analysis" Command in Staad, it will take effect of Pdelta small+ Large delta (P-Δ and P-δ) and with "Pdelta large" command it will consider the only effect of large delta (P-Δ).

Fig-8 indicates that an increase in load P-δ effect considerably adds to moment value. In load case-4, under test case-2, with P-δ effect, moment increased from 82.348 KN-m to 95.463 KN-m ie 16% increased.

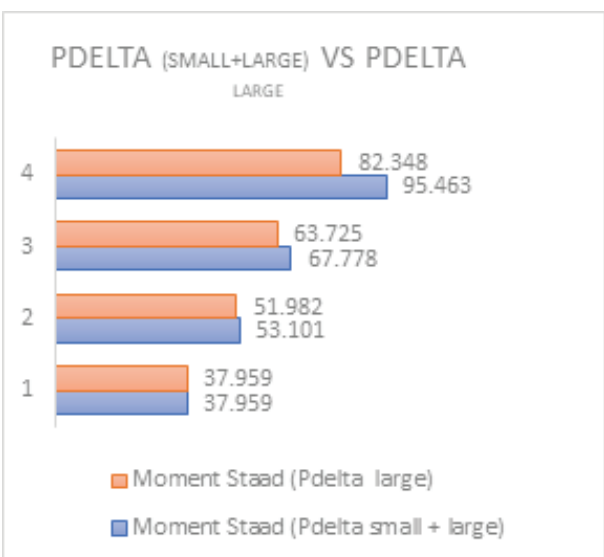


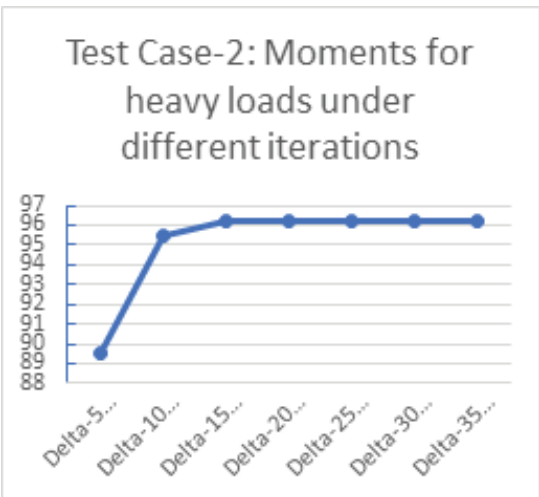
Fig-8:- Comparison of Staad Commands

Number of iterations are important for the accuracy of results. In the case of complex models, an increase in iterations will increase analysis time (depending on computer specifications and staad pro model complexity) and fewer iterations will lead to inaccurate results. Therefore, optimum iterations were worked out. Figure-8 shows that the difference in moments under P-delta analysis for higher loads (load case-4) is higher. Hence load case-4 in test case-2 was used to quantify the number of optimum iterations.

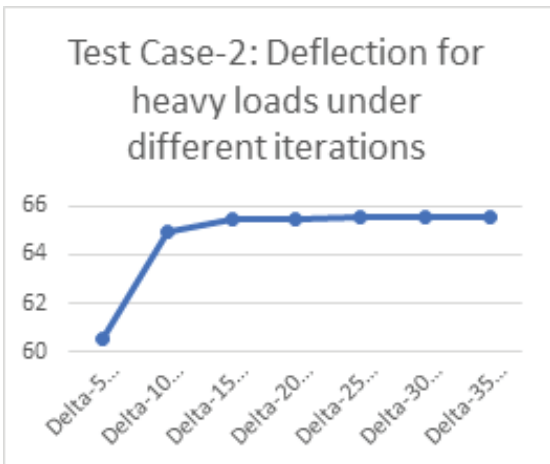
Under the vertical load of 890 KN, Fig-9 shows that the moment with 5 iterations is 89.5 KN-m and with 15 iterations it increased to 96.155 KN-m. This means the moment is increased by 7.4% under the same load with increased iterations.

Moreover, under the vertical load of 890KN, Fig-10 shows that the deflection with 5 iterations is 60.565 mm whereas deflection with 15 iterations is 65.4525 mm under the same load. It means deflection is increased by 8.1% when iterations are increased from 5 to 15. Fig 9 and 10 shows that after 15 iteration change in moment and deflection are minimal ie 0.09% & 0.1%. Therefore, we can conclude that the optimum number of iterations in staad pro are 15 and the same should be used in the Analysis of all type of structures.

Further added, after 30 iterations results do not change at all.



(Fig-9 Effect of iteration on moment (KN-m



(Fig-10 Effect of iteration on Deflection (mm

Results for command “Pdelta analysis” and “Pdelta analysis small delta” is same. As staad by default consider the effect of small delta and large delta when we perform Pdelta Analysis. Moreover, if second order analysis is not performed (Pdelta analysis) then the results will be inaccurate. Fig 11 & 12 shows that under load case-4 in test case-1&2 moment has increased upto 58% & 151% respectively with Pdelta analysis. With Pdelta analysis deflection is increased by 51% & 182%. Therefore, the design engineer should perform second order analysis.

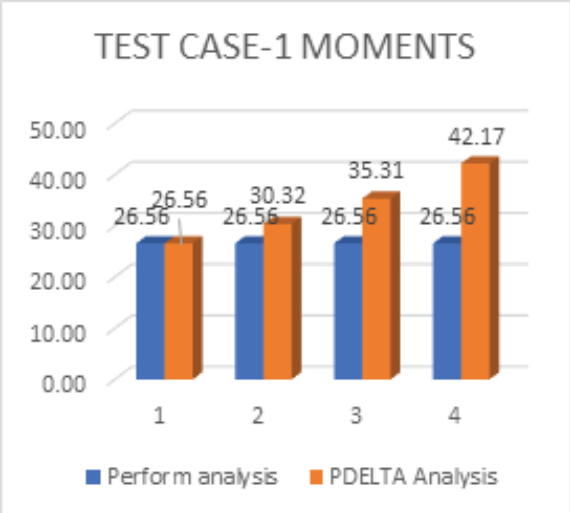


Fig-11 Perform Analysis Command Vs Pdelta Analysis Command

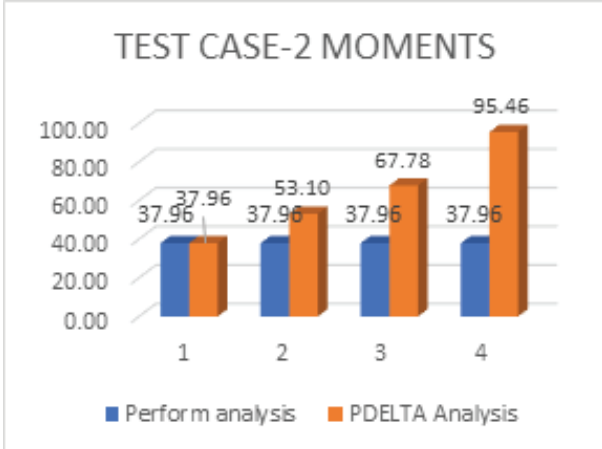


Fig-12 Perform Analysis Command Vs Pdelta Analysis Command

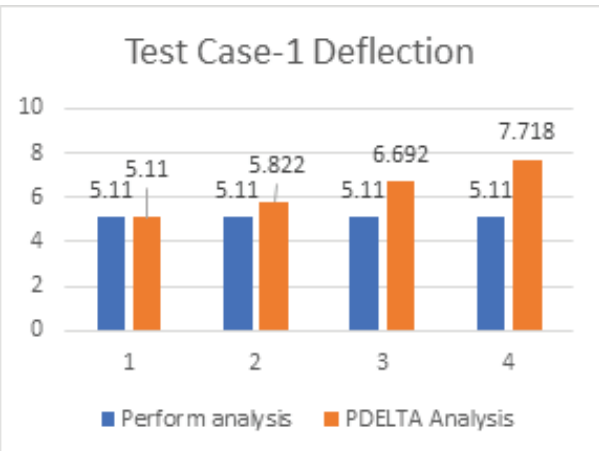


Fig-13 Perform Analysis Command Vs Pdelta Analysis Command

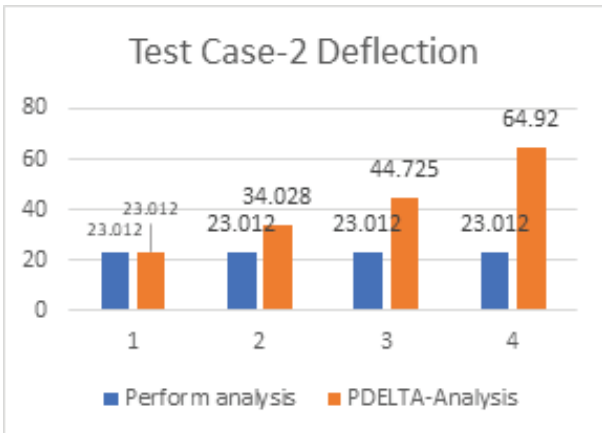


Fig-14 Perform Analysis Command Vs Pdelta Analysis Command

Conclusions

Staad Pro performs Pdelta effects and considers the effect of both (P - Δ) & (P- δ)

An Optimum number of iterations for second order analysis in staad pro are 15. So always use command Pdelta 15 Analysis in Staad pro for section order analysis.

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Deep Learning

Artificial neural networks are used in deep learning to execute complex computations on enormous volumes of data. It›s a sort of machine learning that›s based on the human brain›s structure and function.

Machines are trained using deep learning algorithms that learn from examples. Deep learning is extensively used in industries such as health care, eCommerce, entertainment, and advertising.

How Deep Learning Algorithms Work

While deep learning algorithms use self-learning representations, they rely on artificial neural networks (ANNs) that mimic how the brain processes information. Algorithms leverage unknown elements in the input distribution to extract features, organize objects, and uncover important data patterns throughout the training phase. This happens at various levels, employing the algorithms to develop the models, much like training machines for self-learning.

Several algorithms are used in deep learning models. While no network is flawless, certain algorithms are better suited to specific jobs than others. To select the best, it›s necessary to have a thorough understanding of all primary algorithms.

Types of Algorithms used in Deep Learning

Here is the list of top 10 most popular deep learning algorithms:

1. Convolutional Neural Networks (CNNs)
2. Long Short Term Memory Networks (LSTMs)
3. Recurrent Neural Networks (RNNs)
4. Generative Adversarial Networks (GANs)
5. Radial Basis Function Networks (RBFNs)
6. Multilayer Perceptrons (MLPs)
7. Self Organizing Maps (SOMs)
8. Deep Belief Networks (DBNs)
9. Restricted Boltzmann Machines(RBMs)
10. Autoencoders

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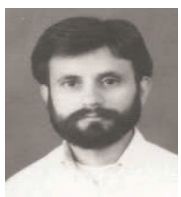

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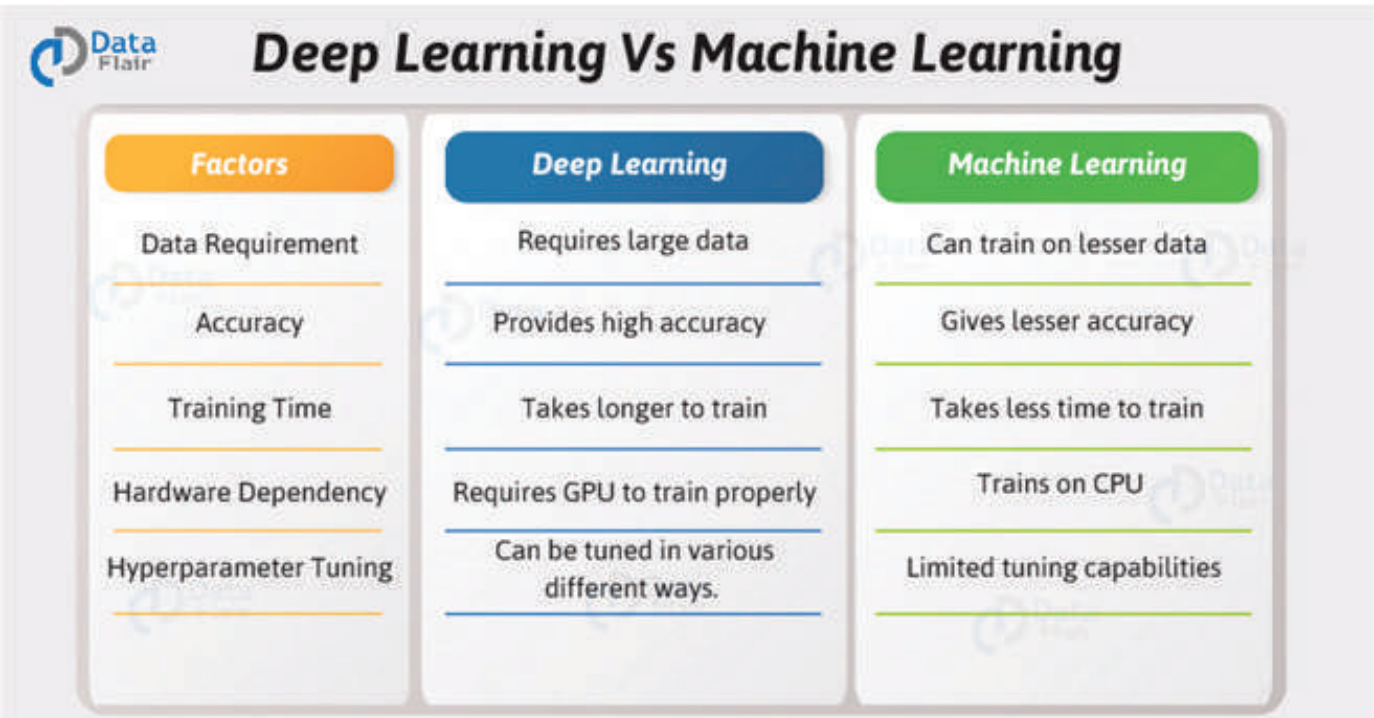

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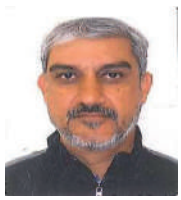

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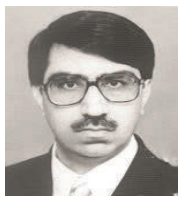

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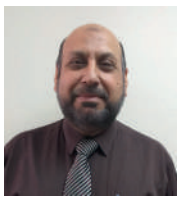

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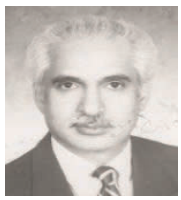

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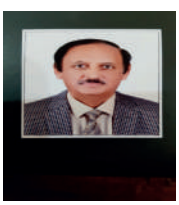

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(www.iep.com.pk)

Affix latest passport size photograph

1. Name in Full in Block Letters
2. Father's Name
3. NIC Number
4. Date of Birth
5. Permanent Address
6. Present / Postal Address
7. Telephone Number — Office _____ Residence _____
   Mobile _____ Email _____
8. Basic Education _____
   Certificate/Degree Obtained _____ Year _____
   College / University _____
9. Engineering Education _____
   Degree Obtained _____ Year _____
   College / University _____
10. Post-Graduate Education _____
    Degree Obtained _____ Year _____
    College & University _____
11. Professional Training & _____
    Names of Organizations _____
    where Obtained _____
12. Membership (s) of other _____
    Professional Bodies, If Any _____
13. Practical Experience:

Sr. No.	ORGANIZATION	POSITION HELD	FROM	TO	Total Years
1.					
2.					
3.					
4.					
5.					

PLEASE ATTACH A COPY OF DETAILED BIO-DATA

14. Class of membership in which admission is sought

☐ Chartered Engineers ☐ Fellow ☐ Member ☐ Associate ☐ Affiliate ☐ Subscriber

Current Membership Number _____

PEC Registration Number _____

_____
Applicant's Signature

Proposer's Name (in block letters)	Signature	Date	Class of Membership

Seconder's Name (in block letters)

Grade of Membership General Requirements	Transfer Fee Fellow to Chartered Engineer	Age (Minimum) Years	Entrance Fee	Transfer Fee Member to Fellow	Life Fee	Life Membership fee for Pakistan Engineer Readers Club	Annual Sub-Scription	Diploma / Certificate Fee	Total
	Rs.		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1. **Chartered Engineer** (A) Must be a Fellow of IEP (B) Must be holding, or must have held in the past, positions of high responsibility in the Engineering profession, for a minimum of 20 years.	--	45	--	--	2000/-	1500/-	--	200/-	3700/-
2. **Fellow** Must have all the qualifications of a Member and must be holding or must have held, in the past, position(s) of high responsibility in the Engineering profession for a minimum of 10 years. The applicant must have at least one technical paper (published in a journal of repute) to his credit. *Please enclose four hard copies and one soft copy of the technical paper for IEP's record.*		40	--	1000/-	2000/-	1500/-	--	150/-	4650/-
3. **Member** Must be in possession of: (A) Section A & B of IE (Pak), or (B) Degree in Engineering from any recognized University, or (C) Any other qualifications exempting the applicant from the above.		21	150/- 150/-	--	-- 1100/-	1500/- 1500/-	100/- --	100/- 100/-	1850/- 2850/-
4. **Affiliate** Must be an engineer, or a person, or a body of persons not belonging to other categories of corporate membership, whose interests are related to engineering profession by virtue of his/her occupation.		25			2000/-	1500/-	--	150/-	3650/-
5. **Subscriber** Any Business Enterprise, Company, Government Department, Registered Film or individual not eligible for Fellow, Membership, Affiliate Membership or students Membership who wishes to be so attached with IEP.		30 (For Individual)	--	--	5000/-	1500/-	--	150/-	6650/-

N.B.: 1. Proposer & Seconder must be Corporate Members of IEP.

2. This Application Form must be properly filled in and signed by the applicant, proposer and seconders & submitted to the H.Q. Office through the Local Centre concerned, together with attested copies of the Matriculation Certificate, Engineering Degree & CNIC Copy.

3. Please enclose a bank draft or crossed cheque in favor of IEP HQ for:
   a) Life Membership Fee
   b) Subscription for IEP Journal "The Pakistan Engineer"
   c) Fee for Life Membership of Readers Club to receive monthly Journal of IEP as and when published.
   d) Diploma Fee

4. When applying for fellowship of I.E.P. please quote current Membership Number.

5. Only Members of IEP are eligible for Fellow Membership.

If the applicant is not already a member of the Readers' Club.