VOLUME : 7

2020-2021

A Civil Engineering Magazine

Civil-o-sphere

by Department of Civil Engineering
Technique Polytechnic Institute

- **STUDY OF NEW TRENDS IN ROAD CONSTRUCTION**
- **ARTIFICIAL INTELLIGENCE IN CIVIL ENGINEERING**
- **7 MAJOR ENVIRONMENTAL MOVEMENTS IN INDIA**
- **CARBON FIBER AS A RECENT MATERIAL USED IN CONSTRUCTION**
- **BUILDING COLLAPSES IN BOW-BAZAR DUE TO METRO WORK**

Vision of Our Institute

To be a premier institute in pursuit of excellence in technical education and skill development committed to serve the society.

Institute Mission Statements

1. **To promote excellence in learning, teaching and technology transfer.**
2. **To improve the quality of skilled workforce through a structured programme and professional skills training.**
3. **To inspire students to learn and facilitate their overall development with social orientation and values.**

Vision of the department:

To become excellent in the field of Civil Engineering in developing highly competent technically skilled manpower to meet the current and future challenges.

Mission of the department:

1. To impart quality education and consultancy services to the community in all areas of Civil engineering.

2. To impart knowledge with emphasis on the development of leadership qualities among students in a congenial learning environment.

3. To impart knowledge and to equip students with skills to prepare them for successful diverse professional career.

4. To promote among the students attitude to serve society and the nation by providing solutions to the challenges in the field of Civil Engineering.

5. To provide opportunities to students and faculty members to innovate and disseminate knowledge.

Civil-o-sphere

Civil Engineering Magazine

August - 2020

Editor-in-chief

Editorial Board

Published by

Department of Civil Engineering

Technique Polytechnic Institute

Civil-o-sphere

Civil Engineering Magazine

2020

Edition 7

Contents

Published by :

Department of Civil Engineering

Technique Polytechnic Institute

STUDY OF NEW TRENDS IN ROAD CONSTRUCTION

By – **ARGHA KUMAR DAS; SOUMYA THAKUR**

(Lecturer Civil Engineering Department; Student 3rd Year DCE)

ABSTRACT- The aim of paper is to emphasize on sustainable development and environmental protection by promoting green road construction. The paper discusses the significance and scope of green technology with references to road construction. It focus on the viability of using fly ash, waste plastic and marble waste in road construction projects. The main object of paper is to analyze & to make use of mentioned waste material effectively in construction of various aspect of roads.

INTRODUCTION:

Today, in the developing nations, roads play important part of infrastructure of country. Any damage may cause lots of inconvenience to the transportation system which ultimately will affect the future growth of countries. Steady increase in high traffic intensity in terms of commercial vehicles, and the significant variation in daily and seasonal temperature demand improved road characteristics. On the other side with increased global warming and climate change, go green movement is gaining awareness overall. The combined solution for above problems can be green road. Using environmental friendly material in transportation projects implies eco-friendly construction of roads with alternative materials over the conventional materials. of Most difficult task in disposal of non-decaying waste material which is hazardous to environment can be solve to some extent by using waste material like plastic, fly ash and marble waste. Advances in science and technology, the use of non-decaying materials such as Plastic, Fly ash, Marble dust etc, offer an economically and sustainable alternative towards increasing demand for better road construction. Hence these materials can be utilized in an eco-friendly way, providing solutions to their disposal with a commitment towards development of infrastructure and contributing for the betterment of society.

REASONS TO USE ECONOMICAL ALTERNATIVE MATERIALS

- Increased global warming and climate changes.
- The problem of creation and disposal of non- decomposing materials.
- Increased demand for infrastructures like road with increase in population
- Limited natural resources for road construction.
- Depletion of good quality material for road construction.
- Increased cost and to achieve economy.
- To reduce bad impact on environment due to increasing construction demand.

A) Plastic Waste

Disposal of waste plastic is major major issue. It is non-degradable and it mainly consists of low density polyethylene. Burning of these waste plastic bags cause environmental pollution, thus it can be used as a modifier in bitumen and aggregates to increase its strength.

Methods

- **Dry Process**

1. Plastic wastes are cleaned and dried (For ex: disposed carry bags, glasses etc) with a thickness of 60 microns is shredded into small pieces (2.36 mm – 4.75mm size).

2. Aggregate are weighed and heated to 170˚C in mini hot plant.
3. This hot aggregates are mixed with plastic and thus plastic coated aggregates (PCA) are formed.
4. Finally bitumen (160˚C) is added to PCA to formed polymer-bitumen-aggregate-mixture.
5. Final mixture is used to laying road.

- **Wet Process**

1. Plastic waste is ground and made into powder.
2. Blending of waste plastics with hot bitumen at 160 ^{0}C.
3. Mechanical Stirrer is needed as the mixing is difficult because of difference in viscosities of molten polymer and bitumen.
4. Aggregates are added to this mixture
5. This mixture is known as waste-plastic-bitumen- mixture and used for road laying.

Advantages

- Strong and durable roads with increased marshall value (measures the maximum load sustaind by the bituminous material)
- Provide good drainage system.
- Stripping and potholes on roads are reduce to greater extent.
- The cost of road construction is decreased due to reduction in bitumen consumption.
- Waste plastic in roads increases the stability value and durability to a greater extent as it decreases proportion of voids.

Disadvantages

- May lead to leaching
- Construction of roads releases some noxious gases.
- Wet process required a lot of investment and bigger plants it is not generally used.

B) Fly ash

Coal Fly ash, or pulverized fuel Ash (PFA) has been used for many years in road construction as a fill material, in concrete, lean mix sub-bases and in more recent years as a binder and aggregates in hydraulically bound materials. Around 110 million tonnes of fly ash accumulated every year at the thermal power plant. Its use reduces material being sent to landfill and preserves virgin aggregate reducing overall greenhouses gas emissions.

Advantages

- Fly ash is a light weight material as compared to commonly used filler material (local soil). Helps to prevent settlement.
- Easy to handle and compact because there is no lumps formation.
- High permeability ensures free and efficient drainage.
- Can replace a part of cement and sand in concrete pavements thus making road construction more economical.
- Higher value of C.B.R.

Disadvantages

- The quality of fly ash affects quality and strength of cement concrete.
- Poor quality fly ash increases permeability of concrete.

C) Marble Dust

Indiscriminate disposal of marble slurry dust (M.S.D.), mostly on road sides, is causing problem of drainage, flow regime, air pollution and damage of agricultural land. Marble waste flow in river and streams is hazardous to Aquatic life & this waste has been major pollutant to land, air and water bodies. Research work has been carried out for bulk utilization of this waste in road pavement layers, embankments and concrete work**.**

- It can be used for construction of road embankments.
- MSD utilized in bulk quantities in laying of pavement.

CONCLUSION:

- Green road construction technology aims at low cost road construction, offering employment opportunities to the masses– generating income at the disposal of the people involved. Thus improving the standard of living of the community at large.
- The durability of the roads laid out with the waste material is much more compared with roads with asphalt with the ordinary mix. Roads laid with plastic waste mix are found to be better than the conventional ones.

ARTIFICIAL INTELLIGENCE IN CIVIL ENGINEERING

By – **RABI DAS; SOUMALYA HAZRA**

(Lecturer Civil Engineering Department; Student 3rd Year DCE)

INTRODUCTION The research of artificial intelligence has been developed since 1956, when the term "Artificial Intelligence, AI" was used at the meeting hold in Dartmouth College. Artificial intelligence, a comprehensive discipline, was developed based on the interaction of several kinds of disciplines, such as computer science, cybernetics, information theory, psychology, linguistics, and neurophysiology. Artificial intelligence is a branch of computer science, involved in the research, design and application of intelligent computer [1, 2].The goal of this field is to explore how to imitate and execute some of the intelligent function of human brain, so that people can develop technology products and establish relevant theories [3]. The first step: artificial intelligence's rise and fall in the 1950s. The second step: as the expert system emerging, a new upsurge of the research of artificial intelligence appeared from the end of 1960s to the 1970s. The third step: in the 1980s, artificial intelligence made a great progress with the development of the fifth generation computer.

The fourth step: in the 1990s, there is a new upsurge of the research of artificial intelligence: with the development of network technology, especially the international internet technology, artificial intelligence research by a single intelligent agent began to turn to the study of distributed artificial intelligence based on network environment. People study not only the same goal-based distributed problem solving, but also the multiply intelligent agents problem solving, which made the artificial intelligence more practical. Additionally, a thriving scene of artificial neural network research and application emerged and it had been deep into all areas of life as the Hopfield multilayer neural network model put forward. The main theories and methods of artificial intelligence are summarized as symbolism, behaviorism, and connectionism approach [4]. Since the appearance of artificial intelligence AI in the 1950s, a lot of hopes and dreams about it have been generated. Now we will elaborate the latest progress of artificial intelligence technology in all aspects of civil engineering and their relationship as follows.

The objective of this paper is to present highlights of references pertaining to artificial intelligence in civil engineering that have been published prior to 2012. Such papers will complement previously published literature survey articles that (1) would provide the theoretical foundation or may play an important role in the development of artificial intelligence in civil engineering; (2) would represent the levels and hotspots of current research of artificial intelligence in civil engineering; and (3) would facilitate continued research efforts. The rest of the paper is synthesized as follows: Section 2 describes artificial intelligence in civil engineering, Section 3 depicts reasoning classification, and learning of artificial intelligence in civil engineering, Section 4 introduces some other theories and methods. Finally we discuss some future trends in Section 5 and conclude in Section 6.

INTELLIGENT OPTIMIZATION METHODS IN CIVIL ENGINEERING

Artificial intelligence is a science on the research and application of the law of the activities of human intelligence. It has been a far-reaching cross-frontier subject, after the 50 years' advancement. Nowadays, this technology is applied in many fields such as expert system, knowledge base system, intelligent database system, and intelligent robot system. Expert system is the earliest and most extensive, the most active and most fruitful area, which was named as "the knowledge management and decision-making technology of the 21 century." In the field of civil engineering, many problems, especially in engineering design, construction management, and program decision-making,

were influenced by many uncertainties which could be solved not only in need of mathematics, physics, and mechanics calculations but also depend on the experience of practitioners. This knowledge and experience are illogically incomplete and imprecise, and they cannot be handled by traditional procedures. However, artificial intelligence has its own superiority. It can solve complex problems to the levels of experts by means of imitate experts. All in all, artificial intelligence has a broad application prospects in the practice of civil engineering.

Adam and Smith [5] presented progress in the field of adaptive civil-engineering struc- tures. Self-diagnosis, multi-objective shape control, and reinforcement-learning processes were implemented within a control framework on an active tensegrity structure. Among artificial intelligence-based computational techniques, adaptive neuro-fuzzy inference sys- tems were particularly suitable for modelling complex systems with known input-output data sets. Such systems can be efficient in modelling nonlinear, complex, and ambiguous behaviour of cement-based materials undergoing single, dual, or multiple damage factors of different forms in civil engineering. Bassuoni and Nehdi [6] developed neuro-fuzzy based prediction of the durability of self-consolidating concrete to various sodium sulfate exposure regimes. Prasad et al. [7] presented an artificial neural network (ANN) to predict a 28- day compressive strength of a normal and high strength self-compacting concrete (SCC) and high performance concrete (HPC) with high volume fly ash. Lee et al. [8] used an artificial intelligence technique of back-propagation neural networks to assess the slope failure. The numerical results demonstrate the effectiveness of artificial neural networks in the evaluation of slope failure potential. Shaheen et al. [9] presented a proposed methodology for extracting the information from experts to develop the fuzzy expert system rules, and a tunneling case study was used to illustrate the features of the integrated system described two artificial intelligence techniques for prediction of maximum dry density (MDD) and unconfined compressive strength (UCS) of cement stabilized soil. Forcael et al.presented the results of a study that incorporates computer simulations in teaching linear scheduling concepts and techniques, in a civil engineering course "Construction Planning and Scheduling." To assess the effect of incorporating computer simulation in teaching linear scheduling, the students' evaluations and answers to the questionnaire were statistically compared. Krcaronemen and Kouba [12] proposed a methodology for designing ontology- backed software applications that make the ontology possible to evolve while being exploited by one or more applications at the same time. The methodology relies on a contract between the ontology and the application that is formally expressed in terms of integrity constraints. In addition, a reference Java implementation of the methodology and the proof-of-concept application in the civil engineering domain was introduced.

Due to a lot of uncertain factors, complicated influence factors in civil engineering, each project has its individual character and generality; function of expert system in the special links and cases is a notable effect. Over the past 20 years, in the civil engineering
field, development and application of the expert system have made a lot of achievements,
mainly used in project evaluation, diagnosis, decision-making and prediction, building design and optimization, the project management construction technology, road and bridge health detection and some special field, and so forth.

Artificial Immune Systems

Provoked by the theoretical immunology, observed immune functions, principles, and mod- els, artificial immune system (AIS) stimulates the adaptive immune system of a living creature to unravel the various complexities in real-world engineering optimization problems [15]. In this technique, a combination of the genetic algorithm and the least-squares method was used to find feasible structures and the appropriate constants for those structures. The new approach overcomes the shortcomings of the traditional and artificial neural network- based methods presented in the literature for the analysis of civil engineering systems. Dessalegne and Nicklow employed an artificial life algorithm, derived from the artificial life paradigm [16]. The resulting multi-

reservoir management model was successfully applied to a portion of the Illinois River Waterway.According to characteristics of diversity of the immune system, a variety of immune algorithms have proposed by realization form. But since the immune system characteristics of the application exploration is still in its initial stage, the algorithm design has many aspects for improvement, such as the realization of the algorithm, parameter selection, the theory discussion, and the immune system in civil engineering application, still needing further development

Genetic Programming

Genetic programming is a model of programming which uses the ideas of biological evolution to handle complex optimization problems [17]. Aminian et al. [18] presented a new empirical model to estimate the base shear of plane steel structures subjected to earthquake load using a hybrid method integrating genetic programming (GP) and simulated annealing (SA), called GP/SA. Hsie et al. [19] proposed a novel approach, called "LMGOT," that integrates two optimization techniques: the Levenberg Marquardt (LM) Method and the genetic operation tree (GOT). The GOT borrows the concept from the genetic algorithm, a famous algorithm for solving discrete optimization problems, to generate operation trees (OTs), which represent the structures of the formulas. Results show a concise formula for predicting the length of pavement transverse cracking and indicate that the LMGOT was an efficient approach to building an accurate crack model.

REASONING, CLASSIFICATION, AND LEARNING

Go¨ ktepe et al. [87] presented the applicability of a fuzzy rule-based system for choosing swelling/shrinkage factors affecting the precision of earthwork optimization. This approach may assist in any highway alignment procedure to handle cut and fill volumes more accurately. Zanaganeh et al. [88] developed a hybrid genetic algorithm-adaptive network-based FIS (GA-ANFIS) model in which both clustering and rule base parameters were simultaneously optimized using GAs and artificial neural nets (ANNs). Results indicate that GA-ANFIS model is superior to ANFIS and Shore Protection Manual (SPM) methods in terms of their prediction accuracy. Bianchini and Bandini [89] proposed a neuro-fuzzy model to predict the performance of flexible pavements using the parameters routinely collected by agencies to characterize the condition of an existing pavement. The proposed neuro-fuzzy model showed good generalization capability, and the evaluation of the model performance produced satisfactory results, demonstrating the efficiency and potential of these new mathematical modeling techniques.

Eliseo et al. [90] presented a case study showing the potential of the ontology to reasoning about temporal changes in architectural space. This work shows a domain ontology with temporal relations to record changes in a building throughout time and shows how this ontology can be used as a support for learning in History of Architecture class to motivate students. Lee and Mita [91] proposed a moving sensor agent robot with accelerometers and a laser range finder LRF. To achieve this purpose the robot frame was modified to move down to the ground and to provide enough rigidity to obtain good data.

El-Sawalhi et al. introduced an evolved hybrid genetic algorithm and neural network (GNN) model [92]. The results revealed that there was a satisfactory relationship between the contractor attributes and the corresponding performance in terms of contractor's deviation from the client objectives. Lee and Bernold [93] presented the result of an effort to test the functionality of ubiquitous communication applications over a wireless fidelity infranet installed on an unfriendly construction site. Its value was the lessons learned and the outcome of a variety of field tests with the prototype system. Kovacevic et al. [94] developed a question-and-answer (Q-A) system (reported elsewhere). To support this system, authors developed an automated crawler that permits the establishment of a bank of relevant pages, and adopted to the needs of this particular industry-user community. O'Brien et al. [95] describes an architecture informed by a working first generation prototype. Details of the prototype, lessons learned, and specific

advancements were detailed. Future algorithm is applied to the structural design optimization of a vehicle component to illustrate how the present approach can be applied for solving structural design problems. Results show the ability of the CS to find better optimal structural design. A new robust optimization algorithm, which can be regarded as a modification of the recently developed cuckoo search by Walton et al. [106], was presented. The modification involves the addition of information exchange between the top eggs, or the best solutions. In particular the modified cuckoo search shows a high convergence rate to the true global minimum even at high numbers commercial implementation of the architecture will make construction-specific visions for ubiquitous computing possible by enabling flexible and robust discovery and use of data in an ad hocmanner. Luna et al. [96] developed a geographic information system (GIS) learning tool using a series of learning objects. These learning objects were designed to support supplemental instruction in GIS and were integrated seamlessly into the course curriculum. Singh et al.[97] propose the use of a novel image-based machine-learning (IBML) approach to reduce the number of user interactions required to identify promising calibration solutions involving spatially distributed parameter fields. The IBML approach was tested and demonstrated on a groundwater calibration problem and was shown to lead to significant improvements, reducing the amount of user interaction by as much as half without compromising the solution quality of the IMOGA. Civil engineering students need to learn how to deliver practical sustainable solutions for engineering projects. Thompson [98] demonstrated that applied assessment and award techniques can be usefully used as teaching tools. Overall the case study work certainly appears to fulfill the main learning objective of giving students an understanding of a breadth of practical solutions in sustainability. Obonyo [99] describe the deployment of an e-learning environment for construction courses based on enhancing virtual computing technologies using agent-based techniques. The proposed agent-oriented methodology and resulting application organizes construction knowledge into a structure that enables the students to undertake more self-directed, systematic and scientific exploration. Zhu et al.explore the effectiveness of using simulation as a tool for enhancing classroom learning in the Civil Engineering Department of the University of Minnesota at Twin Cities. Findings in this research could have significant implications for future practice of simulation-based teaching strategy. Das et al. [101] describes two artificial intelligence techniques for prediction of maximum dry density (MDD) and unconfined compressive strength (UCS) of cement stabilized soil. Newson and Delatte [102] described the differences between two of the most familiar types: “case-histories” and “case-studies.” These methods are presented using the Kansas City Hyatt Regency walkway collapse as an exemplar.

Others

Chaos Theory

Lu et al. [103] develop conceptual frameworks that approach the current model methodologies and applications from the theoretical perspective provided by chaos theory. Though the proposed applications as well as the illustrative example are weighted towards phenomena suggesting chaos, there was no intent here to make a case for the relative importance between chaotic and traditional models. Authors do not propose to replace current approaches to theory generation by one based on chaos theory, rather authors suggest extending current theory by introducing a chaos layer. Kardashov et al. [104] proposed a unit analytical approach that could be associated with real ECG and pressure pulses signal processing. Results shows that analytical dynamic models coupled with the available signal processing methods could be used for describing the self-organization and chaos degree in the heartbeats propagation and pressure pulses in ventricular at ejection phase. Enterprise Architecture (EA) models capture the fundamental elements of organizations and their relationships to serve documentation, analysis and planning purposes. As the elements and their relationships change over time, EA planning becomes increasingly complex. An analysis of existing methods shows that the

complexity of dynamics is not sufficiently addressed.

Cuckoo Search

Durgun and Yildiz [105] introduced a new optimization algorithm, called the Cuckoo Search (CS) algorithm, for solving structural design optimization problems. This research was the first application of the CS to the shape design optimization problems in the literature. The CS of dimensions. Li and Yin used an orthogonal learning cuckoo search algorithm used to estimate the parameters of chaotic systems [107]. This algorithm can combine the stochastic exploration of the cuckoo search and the exploitation capability of the orthogonal learning strategy. The proposed algorithm was used to estimate the parameters for these two systems.

Firefly Algorithm

Gandomi et al. [108] used a recently developed metaheuristic optimization algorithm, the Firefly Algorithm (FA), for solving mixed continuous/discrete structural optimization problems. FA mimics the social behavior of fireflies based on their flashing characteristics.
The results of a trade study carried out on six classical structural optimization problems taken from literature confirm the validity of the proposed algorithm. Lukasik and Zak [109] provided an insight into the improved novel metaheuristics of the Firefly Algorithm for constrained continuous optimization tasks. Some concluding remarks on possible algorithm extensions are given, as well as some properties of the presented approach and comments on its performance in the constrained continuous optimization tasks. Xin-She [110] intend to formulate a new metaheuristic algorithm by combining L'evy flights with the search strategy via the Firefly Algorithm. Numerical studies and results suggest that the proposed L'evy-flight firefly algorithm is superior to existing metaheuristic algorithms. Implications for further research and wider applications were discussed.

Knowledge-Based Engineering

Sapuan [111] studies various work on the development of computerized material selection system. The importance of knowledge-based system Z˘ KBS. In the context of concurrent engineering was explained. The study of KBS in material selection in an engineering design process was described. Lovett et al. [112] describes a Knowledge Based Engineering (KBE) project currently in progress at Coventry University. The need for a methodology for KBE system development was examined, as are the differing requirements in this respect of small and large organizations. Chapman and Pinfold [113] discussed the current limitations of Computer Aided Design (CAD) tools and reports on the use of knowledge Based Engineering (KBE) in the creation of a concept development tool, to organize information flow and as an architecture for the effective implementation of rapid design solutions. These design solutions can then represent themselves in the correct form to the analysis systems. Kulon et al. developed a knowledge-based engineering (KBE) system for hot forging design using state-of-the-art technology and the Internet [114]. The benefits of a KBE approach over a traditional design process are emphasized. The aim of the proposed KBE system was to integrate the hot forging design process into a single framework for capturing knowledge and experience of design engineers.

Simulated Annealing

Mahfoud and Goldberg [115] introduced and analyzed a parallel method of simulated annealing. Borrowing from genetic algorithms, an effective combination of simulated annealing and genetic algorithms, called parallel recombinative simulated annealing, was developed. Dekkers and Aarts [116] presented a stochastic approach which was based on the simulated annealing algorithm. The approach closely follows the formulation of the simulated annealing algorithm as originally given for discrete optimization problems. The mathematical formulation was extended to continuous optimization problems, and we prove asymptotic convergence to the set of global optima. Bouleimen and Lecocq described new simulated annealing (SA) algorithms for the resource-constrained project scheduling problem (RCPSP) and its multiple mode version (MRCPSP) [117]. The objective function considered was minimization of the makespan. Chen and Aihara [118] proposed a neural

network model with transient chaos, or a transiently chaotic neural network (TCNN) as an approximation method for combinatorial optimization problems, by introducing transiently chaotic dynamics into neural networks.

Synthetic Intelligence

Prada and Paiva [119] described a model to improve the believability of groups of autonomous synthetic characters in order to promote user collaboration with such groups. This model was successfully used in the context of a collaborative game. The experiment conducted in this scenario demonstrated the positive effect that the model can have on the user's interaction experience. The development of engineered systems having properties of autonomy and intelligence had been a visionary research goal of the twentieth century. These developments inspire the proposal of a paradigm of engineered synthetic intelligence as an alternative to artificial intelligence, in which intelligence is pursued in a bottom-up way from systems of molecular and cellular elements, designed and fabricated from the molecular level and up.

FUTURE TRENDS

We have summarized the main bio-inspired methods for SCM system design and optimization. It is deserved to note that swarm-based methods and artificial immune systems are not yet mature and thus are expected to gain more research interests. In civil engineering field, in the present situation, the research and development of artificial intelligence is only just starting, so far failing to play its proper role. The combination including Artificial intelligence technology and object-oriented and the Internet is the artificial intelligence technology the general trend of development. Artificial intelligence is in its development for civil engineering in the following aspects.

1) Fuzzy processing, integrated intelligent technology, intelligent emotion technology in the civil engineering.

2) To deepen the understanding of the problems of uncertainty and to seek appropriate reasoning mechanism is the primary task. To develop practical artificial intelligence technology, only to be developed in the field of artificial intelligence technology, and the knowledge to have a thorough grasp.

3) According to application requirements of civil engineering practical engineering, the research and development of artificial intelligence technology in civil engineering field were carried out continually. Many questions in civil engineering field need to used artificial intelligence technology. Due to the characteristics of civil engineering field, artificial intelligence technology was used in many areas for civil engineering field, such as civil building engineering, bridge engineering, geotechnical engineering, underground engineering, road engineering, geological exploration and structure of health detection, and so forth.

(1) Hybrid intelligence system and a large civil expert system research.

(2) With the development of artificial intelligence technology, some early artificial intelligence technology need enhance and improve for knowledge, reasoning mechanism and man-machine interface optimization, and so forth.

(3) To some related problems, many single function of artificial intelligent system integration can carry out, integrated as a comprehensive system of artificial intelligence, and expand the artificial intelligence system to solve the question ability.

(4) Artificial intelligence technology was used in the actual application, only in the practical application of artificial intelligence technology, to test the reliability and give full play to the role of the artificial intelligence technology and to make artificial intelligence technology to get evolution and commercialize. In the commercialization of artificial intelligence technology, there are many successful examples abroad, for enterprise and socially brought considerable benefit.

CONCLUSION

This paper summarizes and introduces the intelligent technologies in civil engineering with recent research results and applications presented. All aspects of applications of the artificial intelligence technology in civil

engineering were analyzed. On the basis of the above research results, prospects of the artificial intelligence technology in civil engineering field application and development trend were represented. Artificial intelligence can help inexperienced users solve engineering problems, can also help experienced users to improve the work efficiency, and also in the team through the artificial intelligence technology to share the experience of each member. Artificial intelligence technology will change with each passing day, as the computer is applied more and more popularly, and in civil engineering field.

CARBON FIBER AS A RECENT MATERIAL USED IN CONSTRUCTION

By – SOMEDEB SAHA; ARITRA SHOW

(Lecturer Civil Engineering Department; Student 3rd Year DCE)

Abstract

Over the past few decades, our research and technical skills has increased a lot. Even today we are innovating and developing the new trends in technology in pursuit of a safe and sustained future as the innovation leads to invention. Throughout this evolution, engineers are in constant research for new and better building materials and carbon fiber is one of these materials, which is used with some other fibers and a specific polymer to form a high performance composite mixture. The aim of this research paper is to study the benefits of using carbon fiber in different types of industry &this paper also overcomes the drawbacks of using other building materials. The amazing properties of carbon fiber such as high tensile strength, high stiffness, low weight & high resistance to chemical and temperature makes it one of the most popular materials in construction industry due to these properties it has enormous applications in military, medical science, construction, automobile, aircraft industry etc. It actually works as a robust building material. It produces the structure that possesses both flexibility and durability. It is incredibly strong that's why it can also withstand earthquakes. It is more flexible in wind than the regular structures. It is also listed in the top 20 engineering achievements of 20th century. It is definitely the next generation building material as it can replace steel in the many structures and can reduce its construction and maintenance cost.

Keywords : carbon fiber, building material, steel, polymer, tensile strength, stiffness.

INTRODUCTION:

HISTORY

In the 18th century, Thomas Edison carbonized cotton and bamboo to make filaments for his early incandescent light bulbs.

In the late 1950s-ryan made high tensile carbon fiber and in early 1960s first and commercial and practical use of carbon fiber is made in aircraft which makes them lighter and faster due to the light weight and high stiffness of carbon fiber. During 1970's experimental work to find alternative raw materials led to the introduction of carbon fibers made from petroleum pitch derived from oil processing. Unfortunately they have only limited compression strength and were not widely accepted.

The 20th century saw a tremendous increase in the demand for carbon fiber. Threats to peace increased the demand for carbon fiber for defense purposes, mid-century. By the beginning of 21st century, new applications and new market sent the production of carbon fibers on an upswing. Despite a global downturn in 2008-2009, worldwide demand for carbon fiber increased up to 45,000 metric tons in 2010. According to the global market forecasts, the annual growth rate of carbon fiber is expected to be around 17% by 2017.

WHAT IS CARBON FIBER?

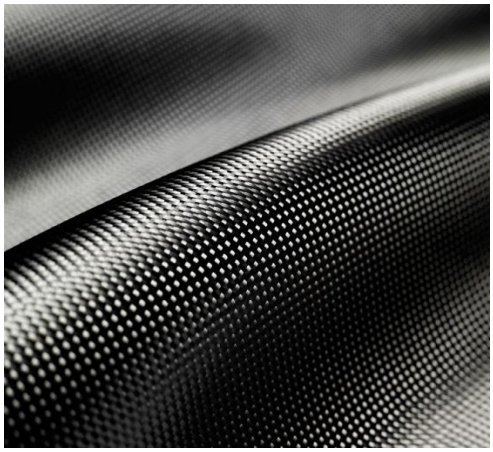
METHODOLOGY

Carbon fiber is a composite mixture of fiber such as aramid, aluminum or glass fibers bound

together by a polymer which is most often epoxy or may be polyester, nylon etc.

The raw material used to make carbon fiber is the precursor. About 90% of the carbon fibers produced are made from polyacrylonitrile (pan). The remaining 10% are made from rayon. All these materials are organic polymers having long strings bound together by carbon atoms. During the manufacturing of carbon fiber variety of liquids and gases are used and the process is part mechanical and part chemical. Each fiber is 5-10 microns in diameter. Carbon fibers are 2 times stiffer than steel and has high tensile strength. In fact the carbon fiber might be the strongest material.

Carbon fiber is mostly used where the combination of high strength and light weight is required.5 steps of production of carbon fiber are shown in the figure.



CARBON FIBER

PROPERTIES OF CARBON FIBER:-

1) CARBON FIBER HAS HIGH SPECIFIC STRENGTH:

Strength of a material is the ratio of force per unit area at the failure to the density. Any material which is strong and light such as aluminum, titanium, carbon, glass etc. has always high specific strength. The strength to weight ratio of carbon fiber is much more than that of steel, aluminum, or glass fiber. Table showing the specific strength of various materials. The units are in KN.m/Kg

Spectra fiber	3619
Kevlar	2514
Carbon Fiber	2457
Glass Fiber	1307
Spider Silk	1069
Carbon Epoxy Composite	785
Balsa axial load	521
Steel alloy	254
Aluminum alloy	222
Polypropylene	89
Oak	87
Nylon	69

1) CARBON FIBER IS ELECTRICALLY CONDUCTIVE:

This property of carbon fiber is both useful and bit harmful too. In construction of ships, this property comes into play. Carbon fiber's conductivity can increase the galvanic corrosion in electrical fittings but proper and careful installation can reduce this problem. Carbon fiber dust is also harmful, which can cause short circuit in electrical appliances.

2) FATIGUE RESISTANCE IS GOOD:

Carbon fiber has a good resistance to fatigue. Carbon fibers when placed perpendicular to the direction of applied stress produced the most favorable condition of increased

resistance to bending and to flexural fatigue. Resistance to fatigue greatly depends upon the orientation of fibers. Damage in tensile fatigue will lead to the reduction in stiffness with large no. of stress cycles.

3) CARBON FIBER HAS HIGH TENSILE STRENGTH:

Tensile strength is the maximum stress that a material can withstand safely while being stretched before failing. Carbon fiber does not losses its shape and dimensions on stretching. It is highly flexible and after stretching it regains its shape almost completely.

4) FIRE RESISTANCE:

Fire resistance of carbon fiber is excellent. Depending upon the type of process and the type of precursor used, carbon fiber can be made into protective clothing for fighting fire. Carbon fiber blanket is also used in welding.

5) HIGH CORROSION RESISITANT:

Carbon fiber is chemically inert and stable. It does not corrode easily by the environmental factors such as temperature, humidity, moisture etc. although epoxy polymer used in carbon fiber is sensitive to light and needs protection.

6) CARBON FIBER IS VERY RIGID:

Rigidity or stiffness of any material is measured by its young modulus; it measures how much a material deflects under stress. Reinforced carbon fiber plastic is 4 times stiffer than glass and around 20 times stiffer than pine.

APPLICATIONS OF CARBON FIBER:-

1) CIVIL ENGINEERING:

Carbon fiber is used in several structural engineering applications due to its construction benefits and optimum cost. The applications include strengthening of structures made with concrete, steel, timber, cast iron etc. it can also replace steel due to its high tensile strength and light weight. It is also used to increase the shear strength of old structures like bridges.

2) INDUSTRIAL AUTOMATION & ROBOTICS:

Carbon fiber reduces the motor and actuator loads and increases the response time. In the business of automation, where machines often run as fast as 24x7, carbon fiber reduces the inertial loads by replacing heavy metal components, which further reduces part fabrication time and which in turn increases the profit. In developed countries carbon fiber is used in making car's roof, alloys and other accessories.

3) AIRCRAFTS AND SPACECRAFTS:

It is widely used in aircrafts and spacecraft components where its strength to weight ratio exceeds much more than that of any other material. It is applied in helicopters, gliders, flying jets where high strength and low weight is required. Carbon fiber increases the durability and lowers the maintenance cost.

4) SPORTS GOODS:-

It has wide applications in sports goods and equipments such as stiffening of shoes, hockey sticks, tennis racquets, golf balls etc. it is also to make helmets which act as a protector while playing games. It has high damage tolerance which can be very useful to save lives

CONCLUSIONS:-

- Carbon fiber plates are very thin, strong, flexible and durable. They can be installed to provide the optimum cost solution and to give a sustainable future design.
- It has high tensile strength, high stiffness, low thermal expansion, high resistance to fire and corrosion than any other material like stainless steel, glass or aluminum thus making it one of the most important composite materials in industry.
- The golden factor of carbon fiber is that it possesses strength up to 5 times than that of steel and weight one third to that of steel.
- It has enormous applications in civil engineering, medical field, sports, military, automobile and music industry.

Building collapses in Bow-bazar due to metro work

Incident time:- 31 Aug,2019

By – AVIJIT GANGULY

(Student 2nd Year Civil Engineering Department)

Introduction

The Building, the second one on Bowbazar Street in central Kolkata, came crumbling down on Tuesday. The first house collapsed on Saturday night following the boring for the 16.6 km of East-West flank of the Metro. The Metro will run underground for a stretch of 10 km, connecting twin cities of Howrah and Kolkata, before taking the surface.

About 52 houses in the central part of the city developed cracks and 70 families had to be evacuated in apprehension of further cave-ins. The condition of a dozen of houses is quite bad.

West Bengal Chief Minister Mamata Banerjee held a meeting with Metro officials on Tuesday and asked them to compensate each of the affected families with a minimum of Rs 5 lakh.

Situation :-

At around 7pm last Saturday night the entire area started shaking. Many locals thought there might be

an earthquake. Meanwhile 14m underground TBM Chandi boring tunnel. It was 7pm, suddenly groundwater rushed into the tunnel through the cutter head of the giant TBM Chandi. In such a case the mixture of concrete and different chemical were forced to stop the water from leak. But no matter how much they tried water leakage could not be stopped. From 7pm Saturday to 5pm Sunday even after fighting ten long hours leakage could not be stopped. By the many buildings above developed cracks.

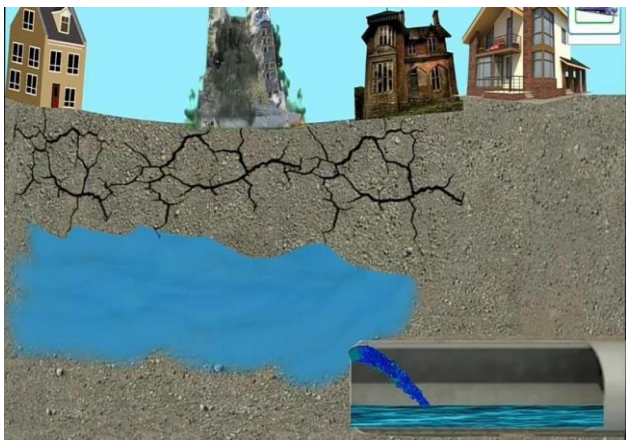
Evacuation of the residence started. By Monday morning metro rail block visited the area to have a look at the situation. Nobody not even the press was allowed to get even close to the buildings. The Durgapituli lane and sakrapara lane have been abandoned from any movement. The kolkata Police is guarding the area 24/7. Special team including disaster management team have been posted.

Ambulance and civil defence trucks have also been parked near the effected areas. Trunks are often falling from the effected buildings and it can be noted that the rest of the buildings can be collapsed at any time.

The cause :-

Why and how did it happen?

TBM Chandi actually hit an aquifer. An aquifer is basically a reserve of groundwater. When water from the surface, usually rain water drips into the soil, it passes through the permeable soil and rocks. After reaching certain depth, there is a layer of impermeable rock which doesn't allow water to further settle down. This creates a huge reserve of groundwater. TBM Chandi on its way to Sealdah hit a huge aquifer. It punched into the aquifer as a result the groundwater rushed inside the tunnel. Now as the tunnel water rushed inside, the soil above the aquifer gradually settled. The soil actually holes these

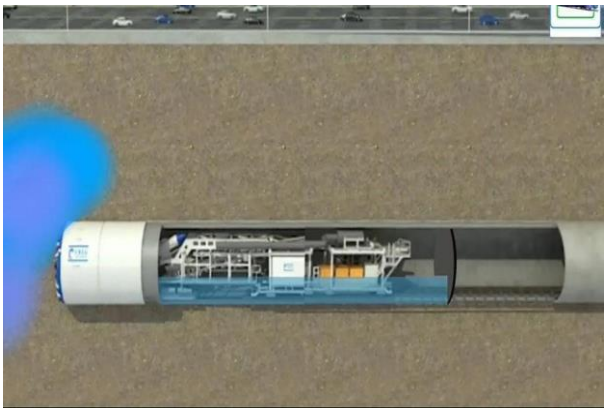


buildings which also settled into the soil. Until and

unless the water is stop from flowing into the tunnel, more buildings will gradually collapsed.

How to control the situation?

The only way to stop any further buildings from collapsing is simply to seal the metro tunnel making a wall. These wall could act as a dam stopping any further leakage of water. With a TBM in front it is almost impossible to build the wall before the cutter head of the TBM. So KMRC has decided to build the wall after the TBM. Although the water can be stopped from flowing inside the tunnel the TBM will probably be submerged into the water. According to KMRC, the wall has already been made with concrete and steel. Two lanes named Durgapituli lane and sakrapara lane have been closed. The number of evacuated residence has increased from 254 to 375 by Monday evening. Engineers of KMRC will further inspect the effected buildings, they will check whether they can be kept or not. If the buildings can not be kept or repaired they will bring then now new building construct by kmrc in return their in bow bazar or some where else further next few days evacuated resident stay and hotel ranging apartment for them where they are shift wake up soon.



Conclusion:-

As the third house at Bowbazar, the oldest part of 300-year-old Kolkata, came crashing on Durga Pituri Lane on Tuesday morning, Namita Baral (59) stared blankly at the labyrinth of narrow lanes leading towards her home at the adjacent Sakharipara Lane.

“I heard from people that a part of the roof of our three-storeyed house has collapsed. We are doomed,” muttered her 69-year-old husband Kesto Baral.

There has been no loss of life due to the incident but the residents of a roughly 300 square metre pocket in Bowbazar are living like refugees in a war zone since August 31, when the tunnel boring machine of the Kolkata Metro Rail Corporation Ltd (KMRCL), which is working on the East-West Metro project, accidentally hit an aquifer beneath the affected zone.

Water and sludge started to gush into the tunnel, gaps developed in the layer of soil above it and tremors hit the surface. The houses in that area which suffered severe damage are old, stand dangerously close to each other and some even share common outer walls. The railway authorities stopped work and moved 254 residents to nearby hotels on Saturday evening. Till Tuesday evening, around 375 people had to evacuate.

East-West Metro will connect Howrah to Salt Lake. A part of the tunnel runs beneath the Hooghly river, a first of its kind in the country. However, the residents of Bowbazar which happens to be the gold and jewellery hub of Kolkata, are currently unimpressed with the marvels of engineering.

“I am undergoing treatment for a fracture in my back. I am in extreme pain. All my medicines and medical reports are lying in the house,” said 51-year-old, Mamata Sen who is wearing the same saree since August 27 when her family of seven members were hurriedly moved to a hotel.

7 Major Environmental Movements in India

By – SAYANTIKA SAHA; GOURAB SAHA

(Lecturer Civil Engineering Department; Student 3rd Year DCE)

Environmental Movement

- An environmental movement can be defined as a social or political movement, for the conservation of environment or for the improvement of the state of the environment. The terms 'green movement' or 'conservation movement' are alternatively used to denote the same.
- The environmental movements favour the sustainable management of natural resources. The movements often stress the protection of the environment via changes in public policy. Many movements are centred on ecology, health and human rights.
- Environmental movements range from the highly organized and formally institutionalized ones to the radically informal activities.
- The spatial scope of various environmental movements ranges from being local to the almost global.

Major Environmental Movements in India

Some of the major environmental movements in India during the period 1700 to 2000 are the following:

1. Bishnoi Movement

- Year: 1700s
- Place: Khejarli, Marwar region, Rajasthan state.
- Leaders: Amrita Devi along with Bishnoi villagers in Khejarli and surrounding villages.

Aim: Save sacred trees from being cut down by the king's soldiers for a new palace.

What was it all about: Amrita Devi, a female villager could not bear to witness the destruction of both her faith and the village's sacred trees. She hugged the trees and encouraged others to do the same. 363 Bishnoi villagers were killed in this movement. The Bishnoi tree martyrs were influenced by the teachings of Guru Maharaj Jambaji, who founded the Bishnoi faith in 1485 and set forth principles forbidding harm to trees and animals. The king who came to know about these events rushed to the village and apologized, ordering the soldiers to cease logging operations. Soon afterwards, the maharajah designated the Bishnoi state as a protected area, forbidding harm to trees and animals. This legislation still exists today in the region.

2. Chipko Movement

- Year: 1973
- Place: In Chamoli district and later at Tehri-Garhwal district of Uttarakhand.
- Leaders: Sundarlal Bahuguna, Gaura Devi, Sudesha Devi, Bachni Devi, Chandi Prasad Bhatt, Govind Singh Rawat, Dhoom Singh Negi, Shamsher Singh Bisht and Ghanasyam Raturi.

Aim: The main objective was to protect the trees on the Himalayan slopes from the axes of contractors of the forest.

What was it all about: Mr. Bahuguna enlightened the villagers by conveying the importance of trees in the environment which checks the erosion of soil, cause rains and provides pure air. The women of Advani village of Tehri-Garhwal tied the sacred thread around trunks of trees and they hugged the trees, hence it was called 'Chipko Movement' or 'hug the tree movement'. The main demand of the people in these protests was that the benefits of the forests (especially the right to fodder) should go to local people. The Chipko movement gathered momentum in 1978 when the women faced police firings and other tortures. The then state Chief Minister, Hemwati Nandan Bahuguna set up a committee to look into the matter, which eventually ruled in favor of the villagers. This became a turning point in the history of eco-development struggles in the region and around the world.

3. Save Silent Valley Movement

- Year: 1978
- Place: Silent Valley, an evergreen tropical forest in the Palakkad district of Kerala, India.
- Leaders: The Kerala Sastra Sahitya Parishad (KSSP) an NGO, and the poet-activist Sughathakumari played an important role in the Silent Valley protests.

Aim: In order to protect the Silent Valley, the moist evergreen forest from being destroyed by a hydroelectric project.

What was it all about: The Kerala State Electricity Board (KSEB) proposed a hydroelectric dam across the Kunthipuzha River that runs through Silent Valley. In February 1973, the Planning Commission approved the project at a cost of about Rs 25 crores. Many feared that the project would submerge 8.3 sq km of untouched moist evergreen forest. Several NGOs strongly opposed the project and urged the government to abandon it. In January 1981, bowing to unrelenting public pressure, Indira Gandhi declared that Silent Valley will be protected. In June 1983 the Center re-examined the issue through a commission chaired by Prof. M.G.K. Menon. In November 1983 the Silent Valley Hydroelectric Project was called off. In 1985, Prime Minister Rajiv Gandhi formally inaugurated the Silent Valley National Park.

4. Jungle Bachao Andholan

- Year: 1982
- Place: Singhbhum district of Bihar
- Leaders: The tribals of Singhbhum.

Aim: Against governments decision to replace the natural sal forest with Teak.

What was it all about: The tribals of Singhbhum district of Bihar started the protest when the government decided to replace the natural sal forests with the highly-priced teak. This move was called by many as "Greed Game Political Populism". Later this movement spread to Jharkhand and Orissa.

5. Appiko Movement

- Year: 1983
- Place: Uttara Kannada and Shimoga districts of Karnataka State
- Leaders: Appiko's greatest strengths lie in it being neither driven by a personality nor having been formally institutionalised. However, it does have a facilitator in Pandurang Hegde. He helped launch the movement in 1983.

Aim: Against the felling and commercialization of natural forest and the ruin of ancient livelihood.

What was it all about: It can be said that Appiko movement is the southern version of the Chipko movement. The Appiko Movement was locally known as "Appiko Chaluvali". The locals embraced the trees which were to be cut by contractors of the forest department. The Appiko movement used various techniques to raise awareness such as foot marches in the interior forest, slide shows, folk dances, street plays etc. The second area of the movement's work was to promote afforestation on denuded lands. The movement later focused on the rational use of ecosphere through introducing alternative energy resourceto reducece pressure on the forest. The movement became a success. The current status of the project is – stopped.

6. Narmada Bachao Andholan (NBA)

- Year: 1985
- Place: Narmada River, which flows through the states of Gujarat, Madhya Pradesh and Maharashtra.
- Leaders: Medha Patker, Baba Amte, adivasis, farmers, environmentalists and human rights activists.

Aim: A social movement against a number of large dams being built across the Narmada River.

What was it all about: The movement first started as a protest for not providing proper rehabilitation and resettlement for the people who have been displaced by the construction of Sardar Sarovar Dam. Later on, the movement turned its focus on the preservation of the environment and the eco-systems of the valley. Activists also demanded the height of the dam to be reduced to 88 m from the proposed height of 130m. World Bank withdrew from the project.

The environmental issue was taken into court. In October 2000, the Supreme Court gave a judgment approving the construction of the Sardar Sarovar Dam with a condition that height of the dam could be raised to 90 m. This height is much higher than the 88 m which anti-dam activists demanded, but it is definitely lower than the proposed height of 130 m. The project is now largely financed by the state governments and market borrowings. The project is expected to be fully completed by 2025.

Although not successful, as the dam could not be prevented, the NBA has created an anti-big dam opinion in India and outside. It questioned the paradigm of development. As a democratic movement, it followed the Gandhian way 100 per cent.

7. Tehri Dam Conflict

- Year: 1990's
- Place: Bhagirathi River near Tehri in Uttarakhand.
- Leaders: Sundarlal Bahuguna

Aim: The protest was against the displacement of town inhabitants and environmental consequence of the weak ecosystem.

Tehri dam attracted national attention in the 1980s and the 1990s. The major objections include, seismic sensitivity of the region, submergence of forest areas along with Tehri town etc. Despite the support from other prominent leaders like Sunderlal Bahuguna, the movement has failed to gather enough popular support at national as well as international levels.