P.S.R. ENGINEERING COLLEGE

An Autonomous Institution (Approved by AICTE & Affiliated to Anna University, Chennai)

Accredited by NAAC and listed under 12(B) of the UGC Act,1956.

An ISO 9001:2008 Certified Institution

Sivakasi - 626140, Tamilnadu, India.

CIVIL ENGINEERING

NEWS LETTER

Nov 2018

VOLUME 8 ISSUE 1

DEPARTMENT OF CIVIL ENGINEERING

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CIVIL ENGINEERING NEWSLETTER

NOV 18

VOLUME 7 ISSUE 1

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P.S.R. ENGINEERING COLLEGE
(An Autonomous & ISO 9001:2008 certified Institution)
Sivakasi-626 140, Virudhunagar Dt., Tamil Nadu

INSTITUTION VISION AND MISSION

VISION

- To contribute to the society through excellence in technical education with societal values and thus a valuable resource for industry and the humanity.

MISSION

- To create an ambience for quality learning experience by providing sustained care and facilities.
- To offer higher level training encompassing both theory and practices with human and social values.
- To provide knowledge based services and professional skills to adapt tomorrow's technology and embedded global changes.

DEPARTMENT OF CIVIL ENGINEERING

VISION

- The vision of the Civil Engineering Department is to produce the Civil Engineers to meet the dynamic problems in the society with human values.

MISSION

- To provide high-class engineering education.
- To join hands with organizations to provide training and internship.
- To facilitate the students for research and development.
- To deliver good Civil Engineering graduates with human values.

PROGRAM OUTCOMES (PO's) OF CIVIL ENGINEERING

The Program Outcomes of B.E in Civil Engineering are:

1. Apply knowledge of mathematics, physical sciences and Civil Engineering fundamentals.
2. Able to identify, formulate, analyze and solve for Civil Engineering problems.
3. Able to design and realize civil structures to meet desired needs within practical constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
4. Able to investigate and conduct experiments, as well as to analyze and interpret data.
5. Use of techniques, skills and modern engineering tools necessary for engineering practice
6. Contextual knowledge to assess societal, health, safety, legal and cultural issues related to Engineering.
7. Realize the impact of Civil Engineering solutions in a global, economic and environmental context.
8. Apply ethical principles and commitment to professional ethics and responsibility.
9. Function as an individual and as a member or leader in multidisciplinary teams.
10. Communicate effectively with the engineering community and society at large.
11. Knowledge and understanding of management and business practices and their limitations.
12. Recognize the need and have the ability to engage in life-long learning.

PROGRAM SPECIFIC OUTCOMES (PSO's) OF CIVIL ENGINEERING

The Program Specific Outcomes of B.E in Civil Engineering are:

- Proficiency in Civil Engineering problem identification, formulation, analysis, design, execution and safety using appropriate tools.
- Solve problems in the hydraulics, transportation geotechnical and Surveying disciplines of Civil Engineering with competence in modern tool usage.
- Apply modern construction techniques, equipment and management tools so as to complete the project within specified time and funds.
- Graduates will have a broad understanding of economical, environmental, societal and health involved in infrastructural development and ability to function within multidisciplinary teams.

JUNE – NOVEMBER 2018

CONTENT

FACULTY ACTIVITIES

JOURNALS

1. **Mr. S. Karthik Ragunath, Dr.M. Shahul Hameed**, "Ranking of Key Delay Factors in Multi Storey Building Projects" International Research Journal of Engineering and Technology (IRJET), Volume 5, Issue 6, June 2018.

2. **Mr. L. Arun Raja,Dr.M. Shahul Hameed,** "Durability Studies of Fiber Reinforced Self Compacting Concrete with Alccofine" International Journal of Science Technology and Engineering(IJSTE), Volume 4, Issue 12, June 2018.

3. **Mr.L.Arun Raja,Dr.M. Shahul Hameed,**"Non-Destructive Test on Fiber Reinforced Self Compacting Concrete" Journal of Non-Destructive Test, June 2018.

4. **Mrs.A.Dhanalakshmi,Dr.M.Shahul Hameed,** "Review Study on High Strength Self Compacting Concrete" International Journal of Science Technology and Engineering (IJSTE), Volume 4, Issue 12, June 2018.

5. **Mr.L. Arun Raja,Dr.M. Shahul Hameed,** "Experimental Investigation on Rock filled Self Compacting Concrete" International Journal of Advanced Research in Basic Engineering Sciences and Technology(IJARBEST), Oct 2018.

6. **Mr.L. Arun Raja,Dr. M.Shahul Hameed,** "Study on Rock Filled Self Compacting Concrete" Journal of Ceramic and Concrete Sciences Vol-3, Issue 3, Dec 2018.

7. **Mr.K. Mahendran K,Dr.M. Shahul Hameed**, "Comparative Study of Physical and Chemical Properties of Geo-Textiles and Sub Grade Soil withCBR Usedfor Foundation Concrete, International Research Journal of Engineering and Technology, volume-05, issue -12, Dec 2018, ISSN - 2395-0056.

8. **Mr.K. Mahendran,Dr.M. Shahul Hameed,**“Comparative Study of Stabilization of Black Cotton Soil and Clay Soil using Bagasse Ash and Tyre Cord” International Research Journal of Engineering and Technology,volume 06, issue-01, Jan. 2019, ISSN-2395-0056.

9. **Mrs.A. Dhanalakshmi, Dr.M. Shahul Hameed,** “Physical Properties of High Strength Self CompactingConcrete using Silica fume and Quarry dust” International Journal of Advanced Research in Basic Engineering Sciences and Technology (IJARBEST), ISSN (ONLINE):2456-5717, Vol.4, Issue.11, November 2018.

10. **Mrs.A. Dhanalakshmi,Dr.M. Shahul Hameed,** “Experimental Investigation of Self Compacting Concrete by Partially Replacing Fine Aggregate with Quartz Sand with Use of RecronFibre” International Research Journal of Engineering and Technology (IRJET), ISSN: 2395-0056Volume: 05 Issue: 11 | Nov 2018.
11. **Ms.A. Leema Margret,** successfully completed the 12-week NPTEL course titled on Design of Reinforced Concrete Structures.

S.No.	**Number of Faculty**	**Title of the professional development Programme**	**Date and Duration**
1	Mrs.A.Dhanalakshmi	STTP on “Numerical Analysis Using Mat lab “at National Institute of Technology,	15.05.2019 to 19.05.2019.
2	Ms.A.Dhanalakshmi	STTP on “Numerical Analysis Using Mat lab “ at National Institute of Technology,	15.05.2019 to 19.05.2019
3	Mr.G.Baskar Singh	Three days FDP on "PMO-IEDP" at Anna University regional campus, Tirunelveli.	27.08.2018 to 29.08.2018
4	Mr.M. Venkatasubramanian	Three days FDP on "PMO-IEDP" at Anna University regional campus, Tirunelveli.	27.08.2018 to 29.08.2018
5	Mr.S.Vijayabaskar	Three days FDP on "PMO-IEDP" at Anna University regional campus, Tirunelveli.	27.08.2018 to 29.08.2018
6	Mr.K.Mahendran	One day FDP on "Outcome Based Education and AICTE model Curriculum" at P.S.R. Engineering College, Sivakasi.	28.07.2018

DEPARTMENT ACTIVITIES

EVENTS

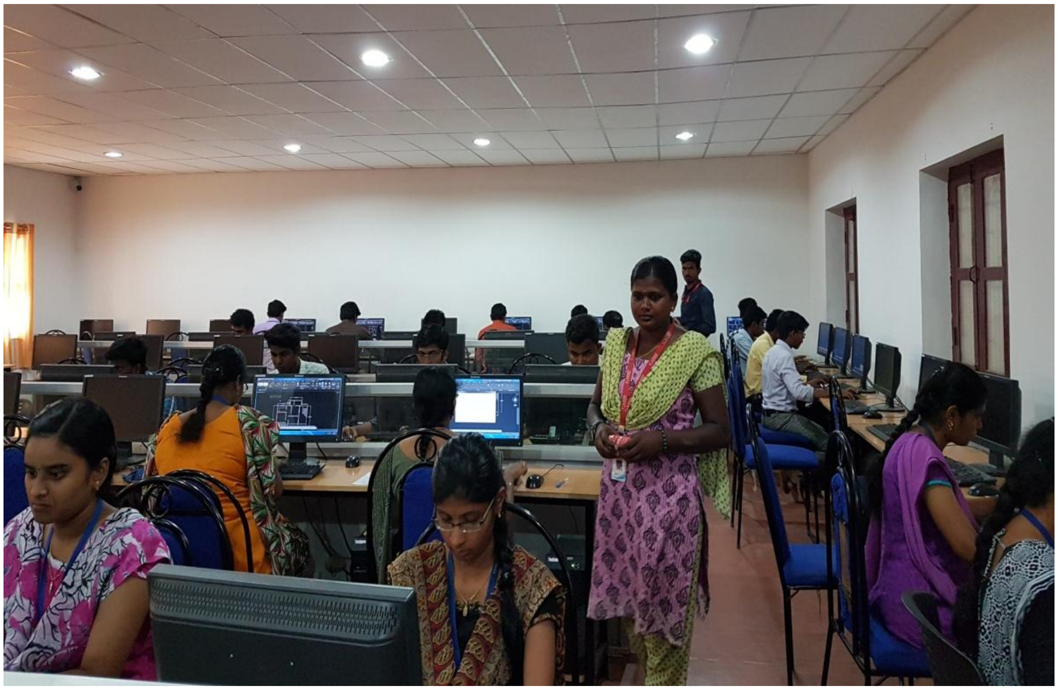
1. Inauguration of Civil Engineering Department on 28.07.2018. Our Honorable Chief Quest, Dr. K. Renji, Group Director, Structures, ISRO,Bangalore.

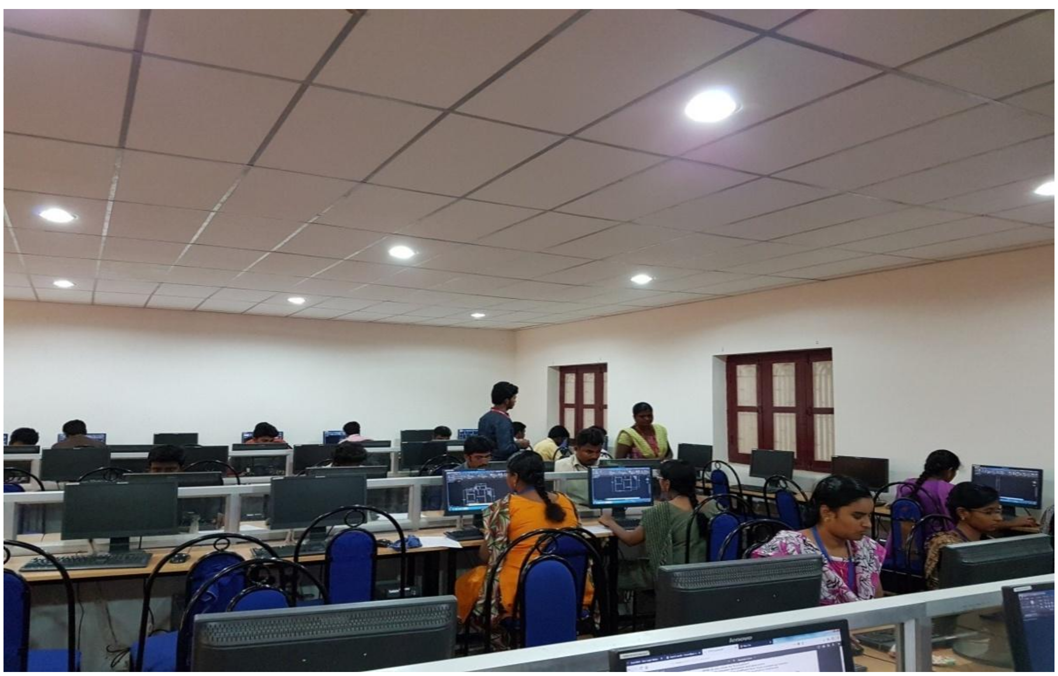
2. FDP on "**Outcome Based Education And AICTE Modal Curriculum"**on 28.07.2018(AN) by Dr. G. Sankara Subramanian, Professor and Head, PSG College of Technology, Coimbatore.

3. Seminar on **“Career Opportunities for Civil Engineering at ISRO”** on 27.07.2018 by Ms. Josephine Kelvina Florence Senior Scientist, ISRO, Bangalore.

4. One day Workshop on **"Innovative User of Home Lifting Techniques"** on 21.08.2018 by Mr. A. Anbil Tharmalingam, Sri Meenakshi Associate, Madurai.

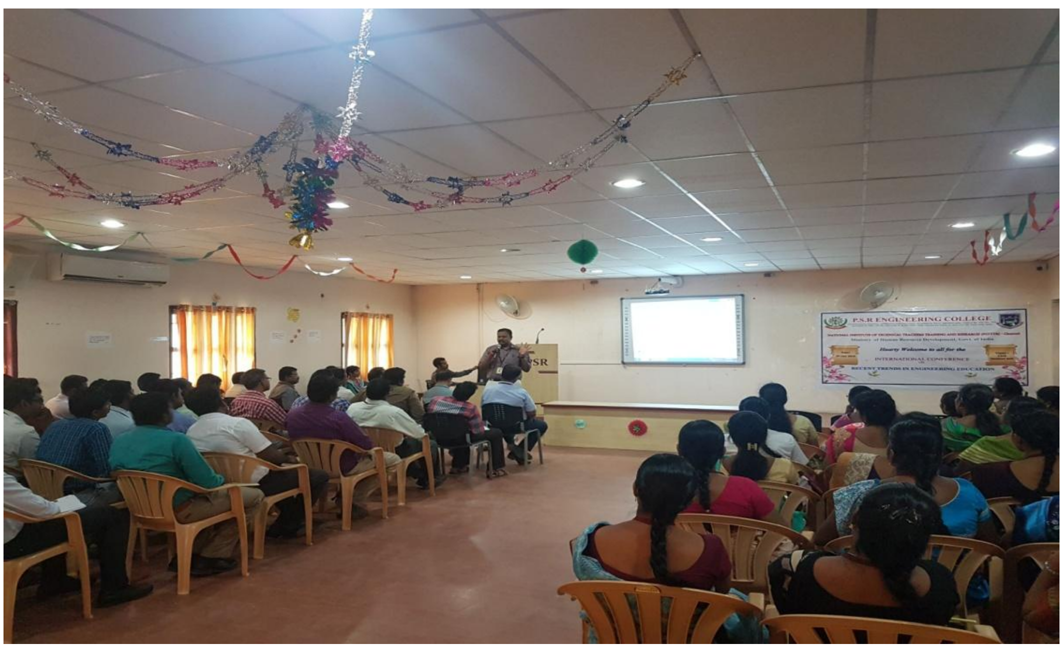
5. **"Design Competition in Association with CADD Center"** for Final Year Civil Engineering Students on 20.09.2018.





6. **"Hands on Training on Remote Sensing and GIS"** by Dr. K. Chandra Mohan, Professor, Krishna College of Agriculture & Technology, Madurai on 24.09.18 & 25.09.18.

7. One Day workshop on **“E-learning Resource – Google Classroom”** by Dr. S. Ramesh, Department OF EEE, PSR Engineering College, Sivakasi on 31.10.18.



8. A guest lecture on **"Technical Paper Writing"** by Dr. K. Ganesan, Principal, PSR Engineering College, Sivakasi on 14.11.18

9. One day workshop on **"Tips & Tricks in Microsoft Office"** by Dr. K. Ruba Soundar, HOD & Professor CSE, Mr. D. Arun Shanmugam, Associate Professor, CSE, PSREC.

10. One day Workshop on **“Research Avenues of Neural Network in Engineering & Technology”**by Dr. Narasimhan Sundarrajan, Professor, School of Electrical & Electronics Engineering, Nanyan technological University, Singapore on 24.11.18.

11. A guest lecture on **“Work Life Balance”** by Dr. M. Jeyakumaran, Professor, Department of MBA, PSR Engineering College, Sivakasi.

CENTER OF EXCELLENCE PROGRAMS

The Department of Civil Engineeringwas organisedthe following value added course to our students,

S. No	COURSE NAME	PARTICIPANTS	TOTAL NO OF PARTICIPANTS	DATE
1.	Revit Architechture	III	86	06.08.2018 to 13.08.2018and 26.09.2018 to 28.09.2018
2.	STADD PRO	III	86	26.11.2018 to 30.11.2018

STUDENT ACTIVITIES

NPTEL COURSE

S.No.	Name of the Students	Name of the Course	Date of Completion
1	S. Shanmuga Raj	Design of Reinforced Concrete Structures	12 Week

WORKSHOP

Second Year

S.No.	NAME	Year /Sec	EVENT	COLLEGE	Date
1.	Sivachandran	II/II	Quiz Connection	P.S.R.Engineering College, Sivakasi.	14.09.2018
2.	Sudalai Thiraviyam				
3.	S.Surya	II/II	Technical Presentation	Alagappa Chettiar Government College of Engineering and Technology, Karaikudi	20.10.2018
4.	B.Vishal				
5.	T.VasanthaRuban				
6.	E.Vipurajan				
19.	Varalakshmi.M				
20.	Thenmozhi.R				
21.	E.Vipurajan				
22.	S.Sivachandran				
23.	S.Divya Lakshmi				
24.	N.Kowsika				
25.	V.Murugaveni				
26.	S.Aswitha				

Third Year					
1.	M.Sridhar	III/II	Entrepreneurship Training Program	P.S.R. Engineering College, Sivakasi.	27.12.2018 to 29.12.2018
2.	R.Vignesh				
3.	B. Yogeshwaran				
4.	J. Sankara subbu				
5.	N. Susindran				
6.	R. Madhavan				
7.	B. Dhanapal				
8.	S. Mathankumar				
9.	S. Sakthi Ganesh				
10.	Ajithkumar.V	III/I	Workshop	Ramco Institute of Technology, Rajapalayam.	31.08.2018
11.	S. Karthik Kumar				
12.	J. Sankara Subbu	III/I	Workshop	Anna University, Tirunelveli.	10.09.2018
13.	P. Karthik	III/I	Construction Training	Unite Technology, Coimbatore.	19.11.2018 to 25.11.2018
14.	S. Karthik Kumar				
15.	N. Susindran	III/II	Training	URC Construction Pvt.Ltd, Chennai.	19.11.2018 to 25.11.2018

STUDENTS ARTICLES

EXPERIMENTAL STUDY IN ACID ATTACK ON HIGH STRENGTH OF SELF COMPACTING CONCRETE

Concrete is a very strong and versatilemoldable construction material. It consists of cement, sand and aggregate mixed with water. When the cement had chemically reacted with the water, it hardens and binds the whole mix together. Theinitial hardening strength attains within the hours and some weeks to achieve concrete gets hardened and strength. Concrete can attains continue hardened and gain strength throughout the years. Self-compacting concrete(M_{70}) produces resistance to segregation by using mineral fillers or lines and using special admixtures. It is required to flow and fill special form under its own weight.it can be flow through the highly reinforced areas and must able to avoid aggregate segregation.

As per IS code provision, we have followed the some codes for using the concrete.IS 1489(part 1)-1991,the Portlandpozzolana concrete of grade 53 and the properties of ppc utilized is introduced, coarse aggregate under the zone II(As per IS 456:2000).We have to use the filler materials are Quartz sand and Marble sludge powder ratio of 0,7.5%,15%,32.5%,40%.The cube of 150x150x150mm and cylinder of 150x300mm size is casted with Self compacting concrete(M_{70}) with replaced materials (Quartz sand and Marble sludge powder).We have to calculate the material test for cement(Fineness test and specific gravity test)and Fine aggregate(Sieve analysis and specific gravity test)and coarse aggregate(Bulk density and sieve analysis).The physical properties of material test result of Marble sludge powder is 2.91 for specific gravity(IS 1122:1974) and 3.5% of Fineness(IS 516:1959) and result for Quartz sand is 2.52 for Specific gravity and 5.52 for Fineness modulus.

Sulphuric acid interaction with concrete surface leads to serious adverse to concrete as it combines an acid assault and sulfate attack.Consider Sulfuric acid with different concentrations and mixing separately into water and treating cubes which contain acid mixed water. We have to add the sulphuric acid is increased by 0%,2%,4%,6%.After treating for 7,28 and 60 days we use to take cubes out for the interval of times and test the cube.The high compressive strength achieves the ratio for M-Sand(60%), Marble Sludge Powder(15%), Quartz Sand(25%).

-Mr.M. Sridhar

III Civil

STUDENT ARTICLES

Heat of Hydration in the Placement of Mass Concrete

Introduction:

Mass concrete elements generate substantial thermal gradients between the core and the surface of concrete that pose a considerable risk of thermal damage. This phenomenon is called as Thermal Cracking. As a result of which, extra precautions have to be undertaken. Cracks parallel to the axis of the dam endanger its structural stability by remaining in intimate contact with its foundation and abutments. Their behavior is as predicted by design stress distributions. There are three circumstances that contribute to cracking and reduce the durability of mass concrete elements, these are internal restraint, external restraint, and delayed ettringite formation. Proper understanding and design of mass concrete provides elements free of cracks and thermal damage.

Restraint and Thermal Stress:

Cracking in mass concrete is the result of restraint, which in turn induces tensile stresses that exceed the relatively low tensile strength of the concrete. All of mass concrete is restrained both internally by the element itself, and externally by the support system of the element.

A. Internal Restraint

When mass concrete is placed, the core of the concrete experiences large temperature increases due to the heat of hydration, and then the concrete becomes unable to efficiently transfer heat to the surrounding environment. As a result of which temperature in the core of the concrete increases. The proximity to the surrounding environment, results in quick cooling of the surface of the concrete in comparison with the core, due to thermal expansion. The respective volume changes in the concrete causes compressive forces to develop in the core, and tension forces to develop at the surface as shown by Fig. (b). Thermal cracking is experienced when the tensile stress in concrete exceeds the tensile strength of concrete for which it is designed.

B. External Restraint

After the concrete has reached its peak temperature the placement begins to cool, and subsequently contracts in volume. The contraction of the concrete is resisted by external restraints, such as the sub-base, rigid supports or adjoining structure supporting the mass concrete element. Fig. 3 shows how the volumetric changes of mass concrete are resisted by external restraint. The contracting volume of concrete will develop tensile stresses resulting from the resistance provided by the external restraint. If the tensile stresses are larger as compared to the developed tensile strength of the concrete, then the mass concrete placement will experience cracking. Degree of restraint is a factor influencing the tensile stresses resulting from an external restraint. This degree of restraint in turn depends on strength, relative dimensions and modulus of elasticity of the restraining material. ACI 207.2R defines the equation for the developed tensile strength at the centerline of the placement by the following equation

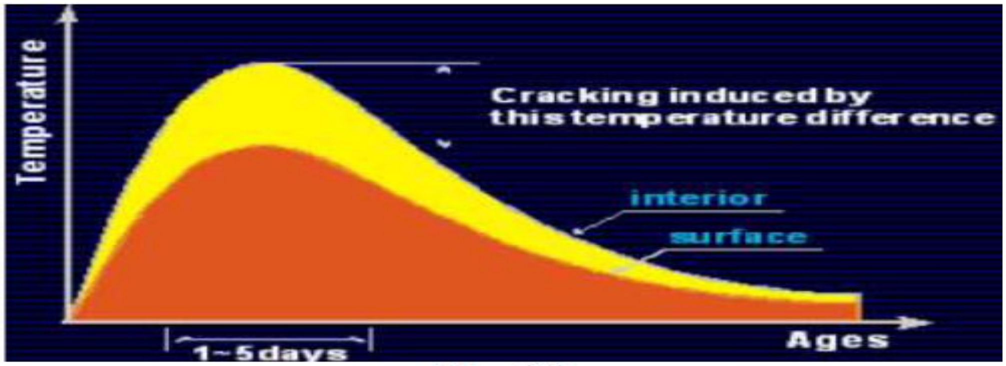


Fig. (a)

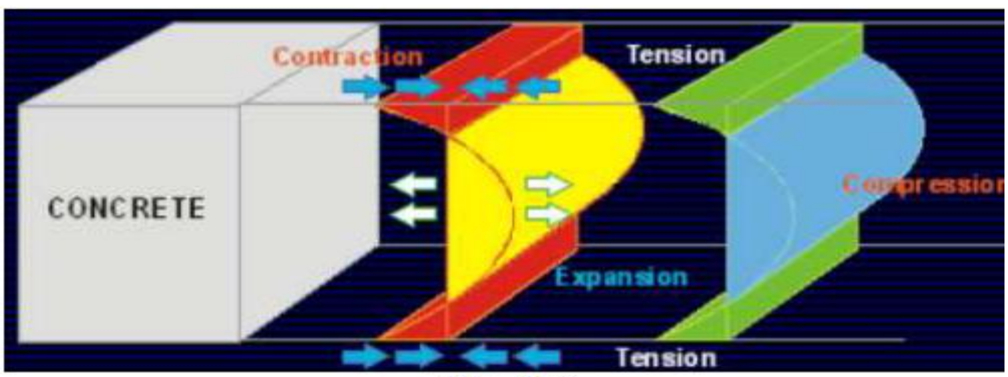
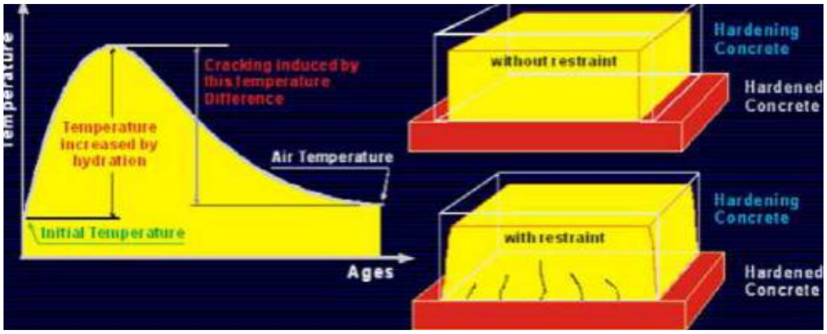


Fig. (b)

Designation	Meaning
ft	Tensile stress at any point on the centreline of the placement
KR	Degree of restraint expressed as a percentage
Δc	Contraction of the concrete if there was no restraint
Ec	Modulus of elasticity

Refer to Equation (1); $Ft = KR\ \Delta c\ Ec$ ... (1)



C.Delayed Ettringite Formation

Delayed ettringite formation (DEF), is also known as heat induced delayed expansion (HIDE). It is the process of formation of ettringite in matured concrete which causes expansive pressures. Only certain concrete mixes are susceptible to delayed ettringite formation when they reach an extreme temperature. The use of fly ash and slag may help to reduce HIDE. For the prevention of DEF, specifications are undertaken that typically limit the maximum temperature of concrete to 160°F (71°C). Mass concrete elements generate extreme temperatures during hydration. If the temperature of the concrete becomes excessive, ettringite formed previously in concrete may begin to decompose, and no further ettringite is formed.

SHRINKAGE

Shrinkage is an effect of the hydration of concrete that cannot be avoided. As shrinkage in concrete gradually increases, stresses are developed resulting from internal and external restraint

Types of Shrinkage

A. Drying shrinkage.

B. Chemical shrinkage.

C.Autogenous shrinkage.

WAYS TO LOWER THE HEAT OF HYDRATION

A. Cement Content

With the help of several methods cement contents as low as 100 kg/m3 in mass concrete suitable for the interior structure of gravity dams can be achieved. With such low cement contents, even ASTM Type II Portland cement is considered adequate. 20 %

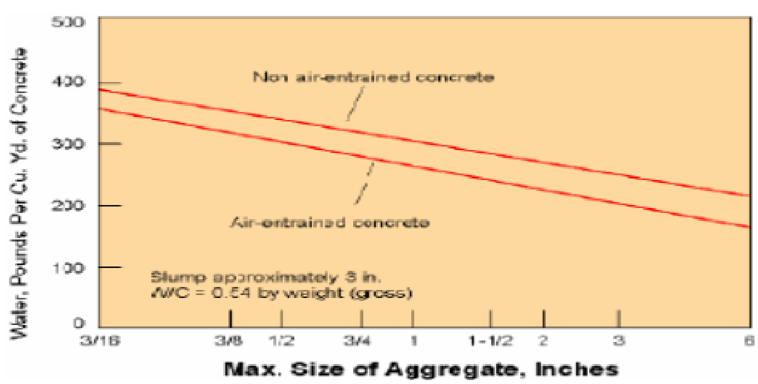
pozzolan is substituted by volume of Portland cement which leads to a further drop in the adiabatic temperature.

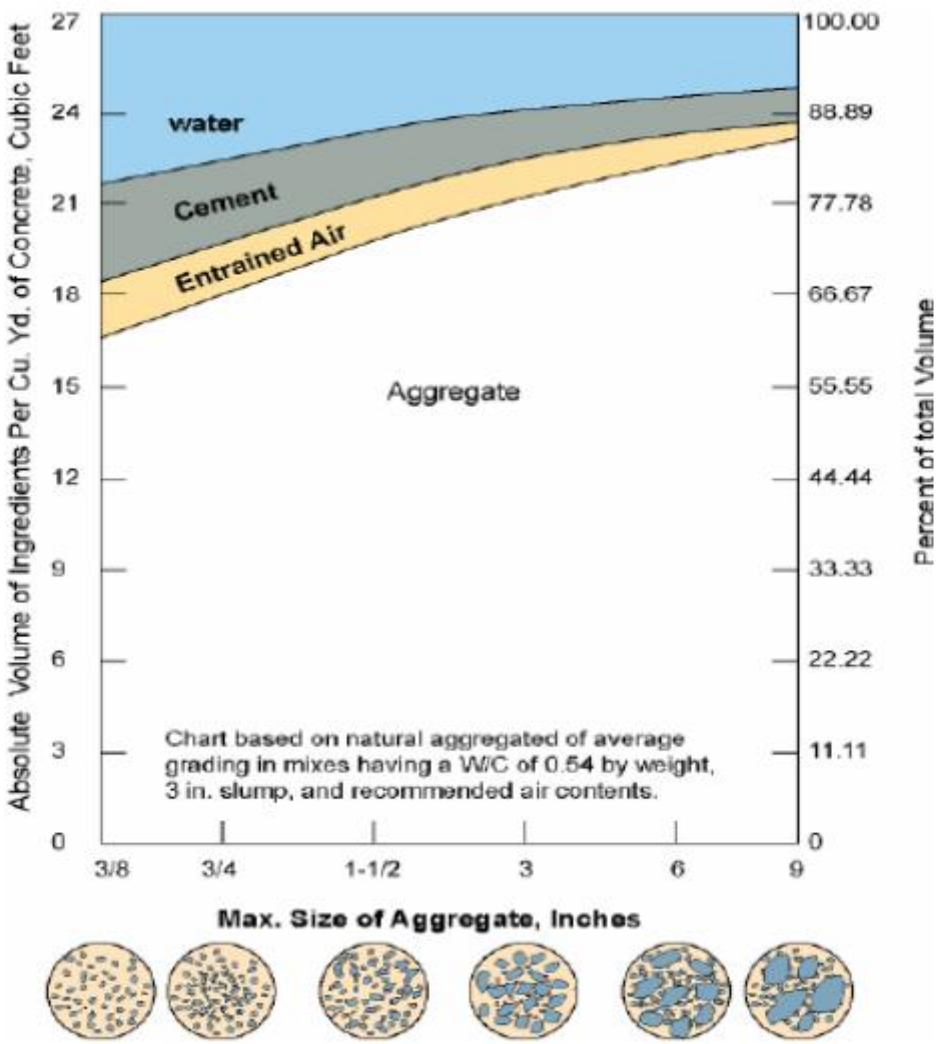
B. Admixtures

For cement contents as low as 100 kg/m3, it is necessary to use a low water content so as to achieve the designed one year compressive strength which falls in the range of 13 to 17 MP which is normally specified for interior concrete of large gravity structures. Around 4 to 8 % of entrained air is routinely incorporated into the concrete mixtures for the reduction of water content while maintaining the desired workability. A constant increase in water-reducing admixtures is being employed for the same purpose. Pozzolans are used primarily as a partial replacement for Portland cement for the reduction of heat of hydration; most fly ashes upon their use as pozzolans have the ability of improving the workability of concrete whereas reducing the water content by 5 to 8 %

C.Aggregate

With concrete mixtures for dams, every probable method of reduction of water content which would eventually lead to a corresponding reduction in the cement content (i.e.maintaining a constant water-cement ratio) has to be looked upon. In this context, the two economic methods are the choice of the largest possible size of coarse aggregate and the selection of two or more individual size groups of coarse aggregate that should be combined to produce a gradation approaching maximum density after compaction (minimum void content). An example of this way is shown by the U.S.





D.Strain Capacity

According to the data shown, in comparison to mortar and concretes, the neat cement paste of the same water cement ratio has a considerably greater amount of tensile strain capacity. In practice, the tensile strain capacity increases with the period of hydration and subsequently decreases with the size of coarse aggregate. A table supporting this statement is shown as follows

E.Mix Design

In addition to the largest size of aggregate, determination of the water content should be on the basis of the consistency of fresh concrete that can be adequately mixed, placed and compacted. If the job-site equipment is inadequate for handling concrete alternative equipment should be sought instead of increasing the water and the cement contents of the concrete mixture. In case of precooled concrete, the laboratory trial mixtures should also be made at low temperature because less water will be needed to achieve the given consistency at 5°C than at normal ambient temperatures (20°C), due to the slower hydration of cement at low temperatures.

CONSTRUCTION PRACTICES FOR CONTROLLING TEMPERATURE RISE

A.Post cooling

The first major use of post cooling of in-place concrete was done in the construction of Hoover Dam (1930). In addition to control of temperature rise, another primary objective of post-cooling was to shrink the columns of concrete composing the dam to a stable volume so as to fill the construction joints with grout for ensuring the monolithic action of the dam. Due to the low diffusivity of concrete, it would have taken more than 100 years for dissipation of 90 % of the temperature rise if left to natural processes. Thin steel pipes typically around 25mm in diameter were used. Through these pipes, cold water was continuously circulated. This circulation of water was started when the concrete temperature had reached around 65°C. This process of cooling proved to be fruitful as a result of which the U.S.

B.Pre-Cooling

The first use of precooling was done by Corps of Engineers during the construction of Norfork Dam in the early 1940s. A part of the mixing water was introduced into the concrete mixture as crushed ice so as to limit the temperature of in-place fresh concrete to about 6 C. Subsequently, combinations of crushed ice, cold mixing water, and cooled aggregates were utilized by Corps of Engineers in the construction of a number of large concrete gravity dams (60 to 150 m high) so as to achieve placing temperatures as low as 4.5 degree C

C.Surface Insulation

The main purpose of surface insulation is not to restrict the temperature rise, but to regulate the rate of temperature drop so as to lower the stress differences due to steep temperature gradients between the concrete surface and the interior

PLACEMENT OF MASS CONCRETE

The location of the pump depends on the site conditions and on the optimal placement procedure. The number of pumps depends on the volume to be poured and the pump rate. The pumping sequence shall be made in a way decreasing the surface exposure to less than one hour avoiding possibility of cold joints. Municipality laws limit working time. Stair-step is the process used for placement –

• Place concrete in layers not more than 450 mm thick.

• Extend vibrator heads into the previously placed layer of plastic concrete.

• Immediately return to place on the freshly consolidated concrete before initial set and construct the placement in a stair stepped fashion.

CONCLUSION

This paper presents various circumstances that contribute to cracking of a structure having undergone mass concreting. This paper also illustrates the various ways of preventing the structure to fail because of the increase of heat of hydration. Various important measures for the reduction of this heat of hydration are also highlighted in this paper

A. RAMESHKANNA

II YEAR

STUDENT ARTICLES

STRENGTHENING OF COLUMN

Strengthening methods depend on the type of structure and loading. Improving column ductility and rearranging column stiffness can also be achieved with strengthening methods. Damages to RC columns may include slight cracks without damage to reinforcement, superficial damage in concrete without damage to reinforcement, concrete crushing, reinforcement buckling, or tie rupture. On the basis of the degree of damages, techniques such as injections, removal and replacement, or jacketing can be applied. Three principal techniques are available for strengthening RC columns: concrete jacketing, steel jacketing, and composite jacketing (FRP).

Strengthening of RC Columns by FRP Composites

The concept

- Involves wrapping of RC columns by high strength-low weight fiber wraps to provide passive confinement, which increases both strength and ductility.
- FRP sheets are wrapped around the columns, with fibres oriented perpendicular to the longitudinal axis of column, and are fixed to the column using epoxy resin.
- The wrap not only provides passive confinement and increases the concrete strength, but also provides significant strength against shear.

Advantages of FRP for strengthening RC columns

- It provides a highly effective confinement to columns.
- The original size, shape and weight of the members is unaltered (unlike any otherjacketing), thus not attracting higher seismic forces.
- No drilling of holes is required as against concrete and steel jacketing.
- The FRPs have extremely good corrosion resistance, which makes them highly suitable for marine and coastal environments.
- FRP wraps prevent further deterioration of concrete and inside reinforcement.
- As the wraps are available in long rolls, construction joints can be easily avoided.

- Ease of installation, which is similar to putting up wall papers, makes the use of FRP sheets a very cost-effective and efficient alternative in the strengthening of existing buildings.
- Provides minimal disturbance to existing structure and generally the strengthening work can be performed with normal functioning of structure.

Design of FRP Strengthening

The design of FRP strengthening is performed on the well established principles of mechanics. Most major codes like ACI, CEB-FIP, Euro Code, Japanese code, Swedish bridge code, Chinese Standard, Turkish code etc give guidelines for the design of FRP system for wrapping of concrete columns to increase their capacity. Various institutes like NCHRP, Caltrans, CPWD etc., recommend the use of FRP Composites for strengthening of concrete structures. For design of strengthening, a composite action is assumed between fiber and existing concrete.

The design is based on following assumptions

- No slip between FRP and Concrete.
- Shear deformation within adhesive layer is neglected.
- Tensile strength of concrete is neglected.
- FRP jacket has a linear elastic stress-strain relationship up to failure.

Onsite Application of FRP Wrapping

A proper application procedure involves following steps:

1. Surface preparation: This includes
   a. Grinding to he column surface to remove dust and cement loose layer.
   b. Repair of hairline cracks, if any.
   c. Rounding off of column corners to specified rounding radius
2. Once the surface is prepared and primer dried, the next step is application of saturant.
3. The fiber wrap is then wetted with saturant.
4. Fiber is then wrapped on the column skilfully so that there are no undulations in the wrap.

5. After wrapping, the fiber is again wetted with one more layer of saturant to make sure that the fiber is soaked fully with saturant.

Summary:

Fiber Reinforced Polymers (FRP) composites comprise fibers of high tensile strength within a polymer matrix such as vinylester or epoxy. FRP composites have emerged from being exotic materials used only in niche applications following the Second World War, to common engineering materials used in a diverse range of applications such as aircraft, helicopters, spacecraft, satellites, ships, submarines, automobiles, chemical processing equipment, sporting goods and civil infrastructure. The role of FRP for strengthening of existing or new reinforced concrete structures is growing at an extremely rapid pace owing mainly to the ease and speed of construction, and the possibility of application without disturbing the existing functionality of the structure.

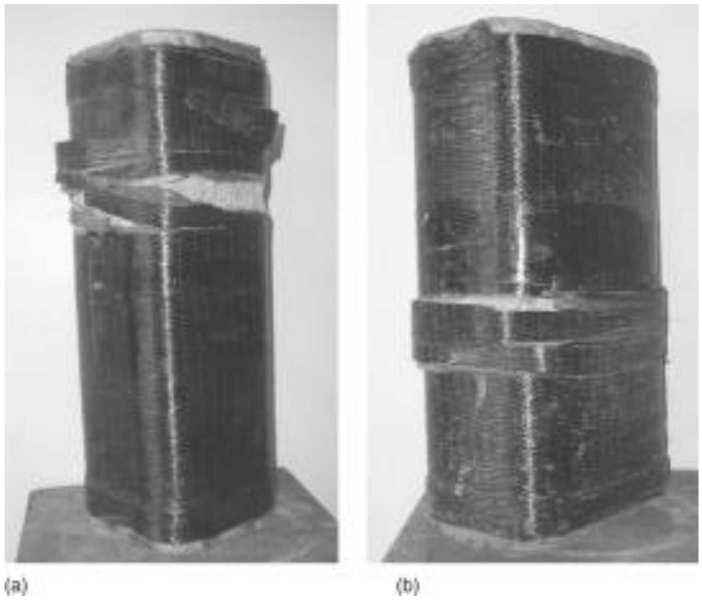


Fig.1 Strengthening of reinforced concrete (RC) columns with fibre-reinforced polymer (FRP) composites

MS.S. SOWMYA

II YEAR PG

STUDENT ARTICLES

Green Building

Current BIM software is used by individuals, businesses and government agencies who plan, design, construct, operate and maintain diverse physical infrastructures, such as water, refuse, electricity, gas, communication utilities, roads, railways, bridges, ports and tunnels.

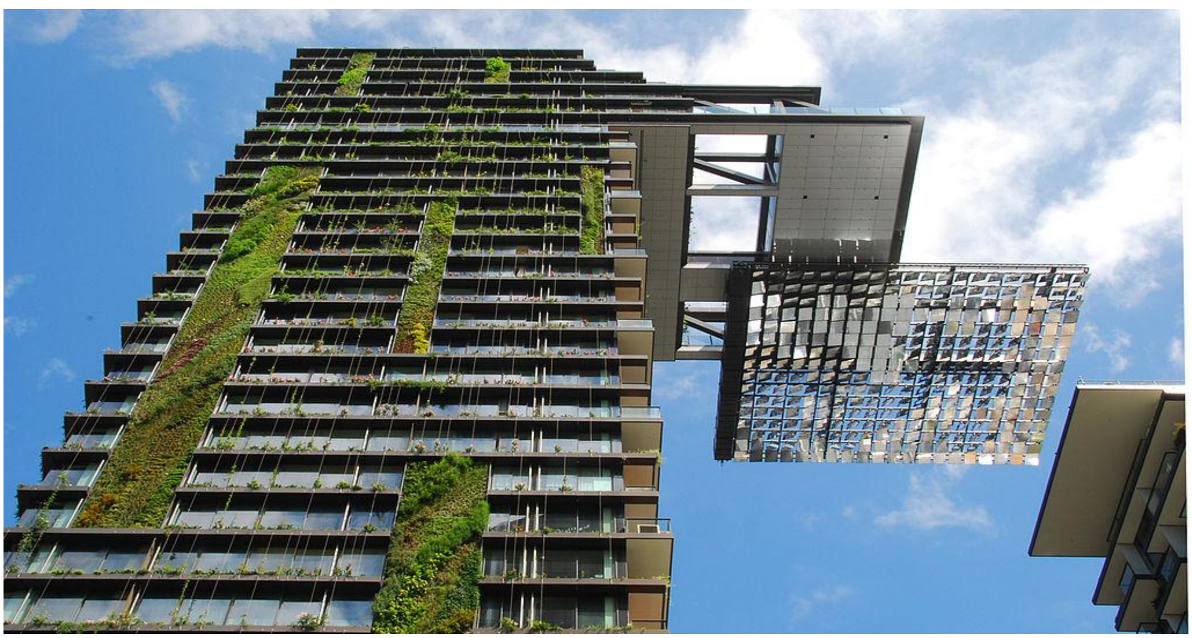
Although new technologies are constantly being developed to complement current practices in creating greener structures, the common objective of green buildings is to reduce the overall impact of the built environment on human health and the natural environment by:

- Efficiently using energy, water, and other resources
- Protecting occupant health and improving employee productivity (see healthy building)
- Reducing waste, pollution and environmental degradation

Reducing environmental impact

Globally, buildings are responsible for a huge share of energy, electricity, water and materials consumption. The building sector has the greatest potential to deliver significant cuts in emissions at little or no cost. Buildings account for 18% of global emissions], or the equivalent of 9 billion tons of CO2 annually.] As of 2018, buildings account for 28% of global emissions or 9.7 billion tons of CO2. Including the manufacturing of building materials, the global CO2 emissions were 39%. new technologies in construction are not adopted during this time of rapid growth, emissions could double by 2050, according to the United Nations Environment Program. Green building practices aim to reduce the environmental impactof building. Since construction almost always degrades a building site, not building at all is preferable to green building, in terms of reducing environmental impact. The second rule is that every building should be as small as possible. The third rule is not to contribute to sprawl, even if the most energy-efficient, environmentally sound methods are used in design and construction.

Buildings account for a large amount of land. According to the National Resources Inventory, approximately 107 million acres (430,000 km^2) of land in the United States are developed. The International Energy Agency released a publication that estimated that existing buildings are responsible for more than 40% of the world's total primary energy consumption and for 24% of global carbon dioxide emissions.



Goals of green building

Green building brings together a vast array of practices, techniques, and skills to reduce and ultimately eliminate the impacts of buildings on the environment and human health. It often emphasizes taking advantage of renewable resources, e.g., using sunlight through passive solar, active solar,and photovoltaic equipment, and using plants and trees through green roofs, rain gardens, and reduction of rainwater run-off. Many other techniques are used, such as using low-impact building materials or using packed gravel or permeable concrete instead of conventional concrete or asphalt to enhance replenishment of ground water.

While the practices or technologies employed in green building are constantly evolving and may differ from region to region, fundamental principles persist from which the method is derived: siting and structure design efficiency, energy efficiency, water efficiency, materials efficiency, indoor environmental quality enhancement, operations and maintenance optimization and waste and toxics reduction. The essence of green building is an optimization of one or more of these principles. Also, with the proper synergistic design, individual green building technologies may work together to produce a greater cumulative effect.

Life cycle assessment

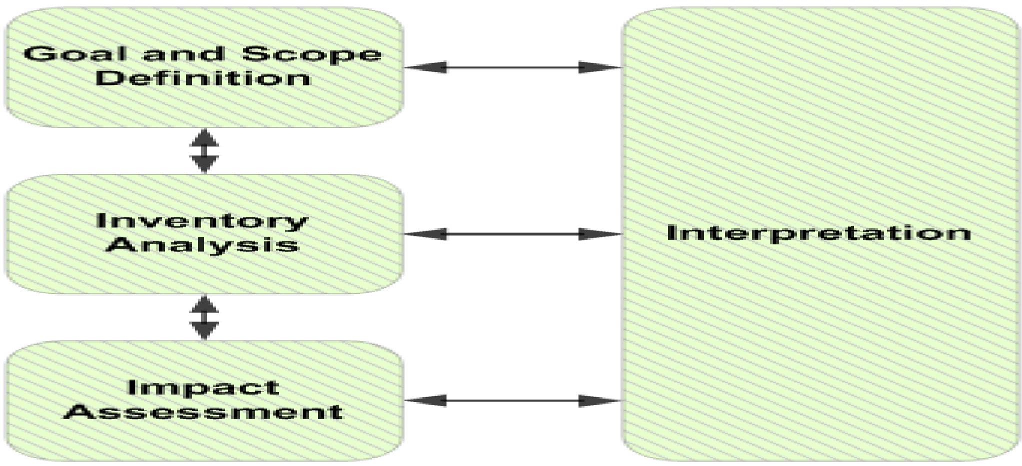
In terms of green building, the last few years have seen a shift away from a prescriptive approach, which assumes that certain prescribed practices are better for the environment, toward the scientific evaluation of actual performance through LCA.

Although LCA is widely recognized as the best way to evaluate the environmental impacts of buildings (ISO 14040 provides a recognized LCA methodology), it is not yet a consistent requirement of green building rating systems and codes, despite the fact that embodied energy and other life cycle impacts are critical to the design of environmentally responsible buildings.

In North America, LCA is rewarded to some extent in the Green Globes rating system, and is part of the new American National Standard based on Green Globes, ANSI/GBI 01-2010: Green Building Protocol for Commercial Buildings. LCA is also included as a pilot credit in the LEED system, though a decision has not been made as to whether it will be incorporated fully into the next major revision. The state of California also included LCA as a voluntary measure in its 2010 draft Green Building Standards Code.

Although LCA is often perceived as overly complex and time consuming for regular use by design professionals, research organizations such as BRE in the UK and the Athena Sustainable Materials Institute in North America are working to make it more accessible

In the UK, the BRE Green Guide to Specifications offers ratings for 1,500 building materials based on LCA.



Siting and structure design efficiency

The foundation of any construction project is rooted in the concept and design stages. The concept stage, in fact, is one of the major steps in a project life cycle, as it has the largest impact on cost and performance. In designing environmentally optimal buildings, the objective is to minimize the total environmental impact associated with all life-cycle stages of the building project.

However, building as a process is not as streamlined as an industrial process, and varies from one building to the other, never repeating itself identically. In addition, buildings are much more complex products, composed of a multitude of materials and components each constituting various design variables to be decided at the design stage. A variation of every design variable may affect the environment during all the building's relevant life-cycle stages

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