MATERIALS AND THEIR PROPERTIES USED IN CIVIL ENGINEERING STRUCTURES: AN ANALYSIS

Ujjawal Pandey[1], Bharat Phulwari[2], Shishir Kumar Maharjan[3], Amar Prasad Jayasawal [4]

[1,3,4] *M.Tech Research Scholar, Deptt. of Civil Engineering, Bhagwant University, Rajasthan, India*
[2]*Assistant Professor, Deptt. of Civil Engineering, Bhagwant University, Rajasthan, India*

ABSTRACT

For a civil engineer, the performance of materials in structures and their ability to resist various stresses are of major importance. This laboratory experimental work is intended to help students in civil engineering to understand the physical and structural properties of common building materials. This includes the study of Portland cement concrete and concrete making materials (cement, aggregates, etc.), asphalt concrete, steel, and wood, with slight reference to other advanced materials. Structural building hypothesis depends on connected physical laws and exact learning of the basic execution of various materials and geometries. Basic building configuration utilizes various moderately basic Structural components to manufacture complex basic frameworks. Structural architects are in charge of making innovative and effective utilization of assets, basic components and materials to accomplish these objectives. In this paper presents the structural engineering of materials and their properties. Significant research on these materials led to a better understanding of these materials and improved their strength and durability performance. Traditional materials used today are much better than in the past, and new materials are being developed specifically to meet the needs of civil engineering applications.

Keyword: - *Traditional, Materials, Properties, Execution, Applications and Building etc.*

1. INTRODUCTION

Modern civil engineers need to deal with traditional construction materials as well as advanced materials. Traditional construction materials, such as wood, steel, asphalt and Portland cement concrete, are often used in many construction projects. Modern materials, such as polymers and composites are entering the manufacturing industry. The construction of buildings and structures depends on a deeper understanding of building materials. Without this knowledge it would not be possible to build safe, efficient and long lasting buildings, structures and dwellings. Building materials in civil engineering provide an overview of the full range of construction materials available to civil engineers and all those involved with the building and construction industry. The book begins with an introductory chapter describing the basic properties of building materials. Also the basic properties of chapter building materials, air hardening cement materials, cement, concrete, building mortar, wall and roofing materials, construction steel, wood, waterproof materials, plastic construction, heat-insulating materials and sound-absorbing materials and finishing materials. Let's cover. . Each chapter includes a series of questions, allowing readers to test the knowledge they gain. A detailed appendix gives information about testing of building materials. With its distinguished editor and eminent editorial committee, Building Engineering in Civil Engineering is a standard introductory reference book on the full range of construction materials. It is aimed at students of civil engineering, construction engineering and allied courses in water supply and drainage engineering.

In this modern era of technology, building materials or building materials are the major requirement. Many types of building materials are used for various construction works. [6] This capability is often measured through experimental fire testing or, for the most part, fire resistance assessment. In such an evaluation, it is of interest in the thermal and mechanical characteristics of building materials because two-step analysis needs to be performed for fire resistance evaluation; Thermal and structural. In the first step, an increase in the temperature and the associated temperature propagation in the load bearing member is obtained by examining the fluctuations with increasing temperature, density, thermal conductivity and specific heat properties.

2. STRUCTURAL FAILURE

From the point of view of this work, it is appropriate to perform temperature-dependent tests on the material on a regular basis - given the diversity in compositions, origins and mixes. Thus, a dilemma highlights the need for a

uniform and modern model for building materials at arising temperatures. With the hope of overcoming this challenge, and in support of current inertia aimed at promoting standardization for fire resistance assessments, the purpose of this study is to use Artificial Intelligence (AI) for commonly used building materials Modern and updated temperature-dependent models have to be developed - and this may be the first step towards realizing a uniform (universal / standardized) constitutional material model.

Structural architects frequently represent considerable authority specifically sorts of structures, for example, structures, spans, pipelines, modern, burrows, vehicles, boats, air ship and rocket. Structural architects who spend significant time in structures regularly have practical experience specifically development materials, for example, solid, steel, wood, workmanship, compounds and composites, and may concentrate on specific sorts of structures, for example, workplaces, schools, medical clinics, private, etc.

Structural building has existed since people originally begun to develop their very own structures. It turned into an increasingly characterized and formalized calling with the rise of the design as particular calling from the building amid the mechanical insurgency in the late nineteenth century. Up to that point, the planner and the basic specialist were typically one and something very similar – the ace manufacturer. Just with the advancement of specific information of Structural hypotheses that developed amid the nineteenth and mid twentieth hundreds of years, did the expert basic designers appear?

The job of a basic designer today includes a huge comprehension of both static and dynamic stacking, and the structures that are accessible to oppose them. The intricacy of present day structures frequently requires a lot of innovativeness from the designer so as to guarantee the structures backing and oppose the heaps they are exposed to. A basic specialist will commonly have a four or multi year college degree, trailed by at least three years of expert practice before being considered completely qualified. Basic specialists are authorized or certify by various scholarly social orders and administrative bodies far and wide (for instance, the Institution of Structural Engineers in the UK). Contingent upon the degree course they have considered and additionally the ward they are looking for licensure in, they might be authorize (or authorized) as simply Structural designers, or as structural specialists, or as both common and basic architects. Another global association is IABSE(International Association for Bridge and Structural Engineering).[7] The point of that affiliation is to trade information and to propel the act of basic building worldwide in the administration of the calling and society.

3. STRUCTURAL ELEMENTS

- Columns
- Beams
- Trusses
- Plates
- Shells
- Arches
- Catenaries

Many of these elements can be classified according to form (straight, plane / curve) and dimensionality (one dimensional / two-dimensional):

	One-dimensional		**Two-dimensional**	
	straight	**curve**	**plane**	**curve**
(predominantly) bending	beam	continuous arch	plate, concrete slab	lamina, dome
(predominant) tensile stress	rope, tie	Catenary	shell	
(predominant) compression	pier, column		Load-bearing wall	

Resources: Wikipedia

4. MATERIALS

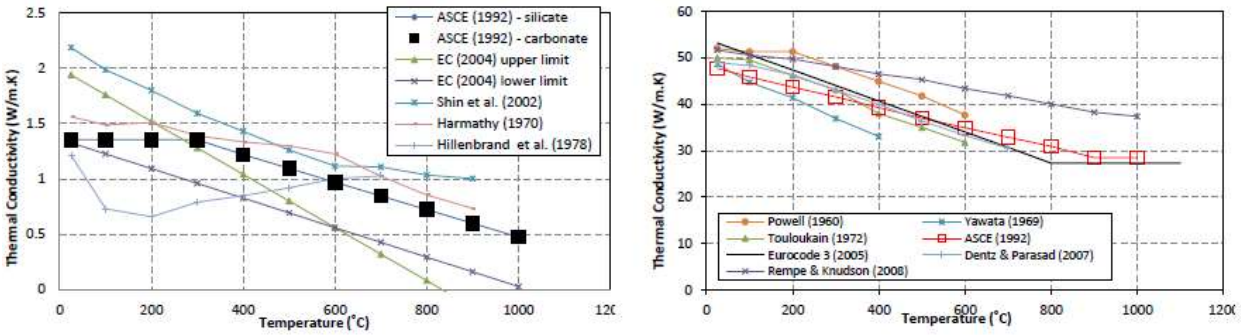
Structural engineering depends on the knowledge of materials and their properties, in order to understand how different materials support and resist loads.

Common structural materials are:

Iron: wrought iron, cast iron
Concrete: reinforced concrete, prestressed concrete
Alloy: steel, stainless steel
Masonry
Timber: hardwood, softwood
Aluminium
Composite materials: plywood
Other structural materials: adobe, bamboo, carbon fibre, fiber reinforced plastic, mudbrick, roofing materials

5. BUILDING STRUCTURES

Structural structure designing incorporates all basic designing identified with the plan of structures. It is a part of basic building firmly associated with engineering.



(a) Normal strength concrete (b) Structural/cold-formed steel

Basic structure designing is principally determined by the innovative control of materials and frames and the basic numerical and logical plans to accomplish an end which satisfies its practical necessities and is fundamentally protected when exposed to every one of the heaps it could sensibly be required to involvement. This is quietly unique in relation to structural plan, which is driven by the imaginative control of materials and structures, mass, space, volume, surface and light to accomplish an end which is tasteful, utilitarian and regularly aesthetic.

The modeler is generally the lead fashioner on structures, with a basic specialist utilized as a sub-expert. How much each control really drives the plan depends intensely on the kind of structure. Numerous structures are basically straightforward and driven by design, for example, multi-story places of business and lodging, while different structures, for example, malleable structures, shells and gridshells are vigorously subject to their structure for their quality, and the designer may affect the structure, and thus a great part of the tasteful, than the engineer.

The Structural plan for a structure must guarantee that the structure can stand up securely, ready to work without over the top redirections or developments which may cause weakness of basic components, splitting or disappointment of installations, fittings or parcels, or inconvenience for inhabitants. It must record for developments and powers because of temperature, creep, splitting and forced burdens. It should likewise guarantee that the structure is for all intents and purposes buildable inside adequate assembling resistances of the materials. It must enable the engineering to work, and the structure administrations to fit inside the structure and capacity (cooling, ventilation, smoke separate, electrics, lighting and so forth.). The Structural structure of an advanced structure can be incredibly intricate, and regularly requires an extensive group to finish.

Structural engineering specialties for buildings include:
Earthquake engineering
Façade engineering
Fire engineering
Roof engineering
Tower engineering
Wind engineering

6. CIVIL ENGINEERING STRUCTURES

Civil structural engineering includes all structural engineering related to the built environment. It includes:
Bridges
Dams
Earthworks
Foundations

Offshore structures
Pipelines
Power stations
Railways
Retaining structures and walls
Roads
Tunnels
Waterways
Reservoirs
Water and wastewater infrastructure

The structural engineer is the lead designer on these structures, and often the sole designer. In the design of structures such as these, structural safety is of paramount importance (in the UK, designs for dams, nuclear power stations and bridges must be signed off by a chartered engineer).

Civil engineering structures are often subjected to very extreme forces, such as large variations in temperature, dynamic loads such as waves or traffic, or high pressures from water or compressed gases. They are also often constructed in corrosive environments, such as at sea, in industrial facilities or below ground.

7. PROPERTIES OF BUILDING MATERIALS

For a material to be considered as building material, it should have required engineering properties suitable for construction works. These properties of building materials are responsible for its quality and capacity and helps to decide applications of these material.

Such properties of building materials are categorized as follows.

Physical properties
Mechanical properties
Chemical properties
Electrical properties
Magnetic properties
Thermal properties

The physical properties of engineering materials are as follows.

Bulk density.
Porosity.
Durability.
Density.
Density index.
Specific gravity.
Fire resistance.
Frost resistance.

8. CONCLUSION

Today's highways, bridges, tunnels, and other public constructions have to deal with the challenges of an increasingly complex world. A world with more people, more vehicles and less space. A world of rising temperatures and increasingly unpredictable weather patterns and a world where security, stability and energy efficiency are non-negotiable. For civil engineers and architects, the stakes have never been higher. To meet these challenges, the industry needs better solutions. And this means alternatives to steel and standard reinforcement materials. Wood has many excellent properties, such as high tensile strength, a high elastic modulus and an aesthetically pleasing appearance, and has consequently been used in many applications. But it also has various disadvantages due to its biological nature: it can be destroyed by the long-term effects of oxygen, light and water under environmental conditions. Currently only a few old wooden buildings have survived. The wood needs to be modified to increase its durability. Many materials are required for construction. Materials used in the construction of engineering structures such as buildings, bridges and roads are called engineering materials or building materials. They include brick, wood, cement, steel and plastic. It is necessary for an engineer to interact with the properties of engineering materials. The correct selection of materials can only be made for a construction activity when the properties of the material are fully understood.

9. REFERENCES

[1]. Labrum, E.A. (1994). Civil Engineering Heritage. Thomas Telford. ISBN 0-7277-1970-X.

[2]. Lewis, Peter R. (2004). Beautiful Bridge of the Silvery Tay. Tempus.

[3]. Mir, Ali (2001). Art of the Skyscraper: the Genius of Fazlur Khan. Rizzoli International Publications. ISBN 0-8478-2370-9.

[4]. Rozhanskaya, Mariam; Levinova, I. S. (1996). "Statics" in Morelon, Régis & Rashed, Roshdi (1996). Encyclopedia of the History of Arabic Science, vol. 2–3, Routledge. ISBN 0-415-02063-8

[5]. Whitbeck, Caroline (1998). Ethics in Engineering Practice and Research. Cambridge University Press. ISBN 0-521-47944-4.

[6]. Hoogenboom P.C.J. (1998). "Discrete Elements and Nonlinearity in Design of Structural Concrete Walls", Section 1.3 Historical Overview of Structural Concrete Modelling, ISBN 90-901184-3-8.

[7]. Nedwell, P.J.; Swamy, R.N.(ed) (1994). Ferrocement:Proceedings of the Fifth International Symposium. Taylor & Francis. ISBN 0-419-19700-1.

[8]. Blockley, David (2014). A Very Short Introduction to Structural Engineering. Oxford University Press ISBN 978-0-19967193-9.

[9]. Bradley, Robert E.; Sandifer, Charles Edward (2007). Leonhard Euler: Life, Work and Legacy. Elsevier. ISBN 0-444-52728-1.

[10]. Chapman, Allan. (2005). England's Leornardo: Robert Hooke and the Seventeenth Century's Scientific Revolution. CRC Press. ISBN 0-7503-0987-3.

[11]. Dugas, René (1988). A History of Mechanics. Courier Dover Publications. ISBN 0-486-65632-2.

[12]. Feld, Jacob; Carper, Kenneth L. (1997). Construction Failure. John Wiley & Sons. ISBN 0-471-57477-5.

[13]. Galilei, Galileo. (translators: Crew, Henry; de Salvio, Alfonso) (1954). Dialogues Concerning Two New Sciences. Courier Dover Publications. ISBN 0-486-60099-8

[14]. Kirby, Richard Shelton (1990). Engineering in History. Courier Dover Publications. ISBN 0-486-26412-2.

[15]. Heyman, Jacques (1998). Structural Analysis: A Historical Approach. Cambridge University Press. ISBN 0-521-62249-2.