***COURSE: BASIC CIVIL ENGINEERING [CVE 301]***

***GROUP: THREE***

***PROJECT NAME: DIFFERENT CONSTRUCTION MATERIALS***

***GROUP MEMBERS* AND THEIR TOPICS**

1. **BAKARE KEHINDE HAMEEDAT – INTRO & OUTRO.**
2. **AL-HASSAN TIMOTHY – MODERN MATERIALS.**
3. **NNACHETTA KENECHUKWU – COST OF MATERIALS**
4. **SULE MUBARAK ADEDEJI – ENVIRONMENTAL IMPACT OF CONSTRUCTION MATERIALS.**
5. **ADEGOKE-ALAGBE SAMUEL CHARLES – TRADITIONAL MATERIALS.**

***GROUP MEMBER: AL-HASSAN TIMOTHY***

MODERN MATERIALS

**We cannot talk about new materials without taking into consideration Sustainability and the materials' impact on the environment. A number of modern materials have been developed to curb the negative impact of the use of some construction materials**

Advancements in Concrete

Concrete, which has been used for millennia in some form for structures and roadways, is developing in ways that make its use easier, less expensive, safer, more varied and even more environmentally friendly.

For example, self-consolidating concrete, a type that flows into forms with no mechanical compaction required, was proposed in theory in the late 1980s by a Japanese scientist. Since then the technology has become viable and is being used in infrastructure projects around the world. The properties of SCC are achieved by using high-range-water-reducing admixtures, increasing the total quantity of fines and/or using admixtures that modify its viscosity in its plastic state. This type of concrete has numerous benefits and has expanded the role of concrete in architecture because it can be used in shapes and places conventional concrete cannot.

Without standardized testing, self-consolidating concrete could not be effectively manufactured or even 7used in the field. As with all types of concrete, in-situ testing is of paramount importance to ensure the integrity of the structure being built.

Self compacting concrete (SCC) can be classified as an advanced construction material. The SCC as the name suggests, does not require to be vibrated to achieve full compaction. This offers following benefits and advantages over conventional concrete.

Improved quality of concrete and reduction of onsite repairs.

Faster construction times.

Lower overall costs.

Facilitation of introduction of automation into concrete construction.

Improvement of health and safety is also achieved through elimination of handling of vibrators.

Substantial reduction of environmental noise loading on and around a site.

As research and development in materials science advance, new ways of constructing buildings are emerging. Some will inevitably find their places in small niches, others might turn out to have broad applicability, but what is certain is that the buildings of the next decade will be stronger, more environmentally friendly, and more cost-efficient than the buildings of the last one.

**OTHER ADVANCED MATERIALS INCLUDE**

Structural Glazing

Structural glazing is a technology in which glass is attached to a building using sealant adhesives. Although it first appeared into the 1960s, structural glazing has, in the last 20 years, experienced exponential growth; it is now a familiar sight in high-rises and other buildings in cities all over the world.

e. Since one of the main concerns about structural glazing in its early days was of course due to the fact that enormous glass panels were hanging from buildings by 12 mm beads of adhesive, standards such as these were, and continue to be, crucial to allowing marketplace and public acceptance of the technology

Wood-Plastic Composites

Since the early 1990s, wood-plastic composites — made from recycled wood and plastic waste — have been used as economical and environmentally friendly alternatives for decks; components such as railings, cladding, siding, molding and trim, window and door frames; and small structures such as park benches.

1. Mass Timber

Humans have been building with wood since they first moved out of caves, but in modern times, materials like cement and steel have all but supplanted it for tall buildings. There’s a good reason for that: Wood is generally weaker than other materials and it is vulnerable to fire.

Following federal research into more advanced wood building techniques, though, the old dog of the construction industry is getting some new tricks. Mass timber – in which solid wood is panelized and laminated for increased strength and other useful properties – is helping tall wood buildings to appear in cities again.

The mass timber category includes several types of laminated timber, most notably cross-laminated timber and glue-laminated timber. Glue-laminated timber is composed of several pieces of lumber that are glued together and is useful for creating strong beams. Cross-laminated timber is made up of pieces of lumber stacked in alternating directions and makes large panels that can support a lot of weight.

Both types of timber are surprisingly fire resistant. The Atlantic reports that the outer layers create a char when burned that helps to insulate the rest of the wood. In fire testing, they have demonstrated the ability to maintain their structural integrity.

Mass timber supports the capture of carbon as the trees grow and its subsequent sequestering in buildings. According to one study in the Journal of Sustainable Forestry, with sustainable forestry techniques, 14 to 31 percent of global emissions could be averted by replacing materials used in buildings and bridges with wood.

6. Trash

Plastic bottles can be repurposed for a variety of uses.

Yes, trash. Architects and builders on the cutting edge of the environmental movement are using recycled materials like scrap metal, cardboard, and even plastic bottles to create new buildings with smaller carbon footprints.

Recycled cardboard, for example, is being used to create high-quality cellulose insulation that outperforms insulation made with traditional processes. UltraCell Insulation makes use of a wet process, as opposed to older dry processes that result in contamination and dusty products.

Plastic soda and water bottles have always been recycled, but generally, they can only be used to create new bottles a few times before they need to be disposed of. In the last few decades, plastic bottles have increasingly found new, longer life in the form of PET (polyethylene terephthalate) carpets. The PET in bottles is ideal for making soft, fibrous carpets, and when it reaches the end of its life as a carpet it can be used again in car parts, stuffing, and insulation.

On New York City’s Governors Island, a competition was held recently to see how design can be used to tackle environmental problems. The result was a fascinating mix of art and sustainable design. The five-member Team Aesop laid out five tons of clay to dry, resulting in large, organic cracks. These were then filled with melted-down aluminum cans from a local recycling center to create pavilion panels that are strong, lightweight, and naturally attractive.

As the federal government steps away from leadership on environmental issues, states, private businesses, and consumers are stepping in to fill the gap. Expect to see more new materials finding their way into construction as they become financially sustainable.

7. Light generating cement

Dr. José Carlos Rubio Ávalos from UMSNH of Morelia, has created cement that has the ability to absorb and irradiate light. With this new light generating cement the potential uses and application of it can be huge.

The construction industry is evolving and one of the main trends is the move towards a more resource and energy efficient way of creating structures. Therefore, the implications of cement acting as a ‘light bulb’ are very broad. We can use them in swimming pools, parking lots, road safety signs and much much more.

8. Application of Nano Technology

Reducing particle size of a material to nano–scale often imparts new properties or enhances existing ones. This is typical of nano particles of titanium dioxide, which maintains its photocatalytic activity even when mixed with cement. External cement based surfaces become strongly photocatalytic, leading to a much better appearance and a significant reduction in concentration of pollutants in the surrounding air.  
  
The photoactive titanium dioxide was found to be a more powerful photocatalytic agent when its particle size decreased to non size. This makes it a ideal vehicle for application in construction. A cement binder containing about 5% of active titanium dioxide produces concrete with a smooth surface and also converts the pollutants, removes them from the surrounding air. In a typical application on a building in France completed in 2000, the quality of concrete surface have remained unchanged till date.

REFRENCES

Peter J M Bartos, e-GRC, CONCRETE, UK April 2009

Concrete that cleans itself and the air,” Concrete International Feb. 2009 Vol. 31 vNo. 2, The Magazine of the American Concrete Institute.

https://en.wikipedia.org/wiki/Fiber-reinforced\_concrete

https://theconstructor.org/question/what-type-of-reinforcement-used-in-prestressing-concrete/

https://civiltoday.com/civil-engineering-materials/concrete/225-pre-stressed-concrete

https://en.wikipedia.org/wiki/Fiber-reinforced\_concrete

<https://www.designingbuildings.co.uk/wiki/Prestressed_concrete>

***GROUP MEMBER: NNACHETTA KENECHUKWU***

Cost of Building Materials

The building materials used for construction such as naturally occurring substances and man-made products. The manufacturing of such man-made products and the preparation of the initial natural products costs the user that desires the final product. Building materials such as Cement, Granite, Sand , Laterite ,Blocks ,Steel rods ,Binding wires,, Roofing sheets etc.

The cost of building materials depend on various factors such as;

quality of the product

brand of the product

location of the market

durability of product

Being aware of the cost of building materials in Nigeria can help be used to make adequate planning towards upcoming building projects. Although, it is higher by 15% than imported building materials, Nigerians can benefit from the market survey to estimate a budget for construction cost at home.

Below is a compilation of the current cost of building materials in Nigeria.

Cement

The price of cement has had a hot demand in the country due to its various uses. The price of a bag of cement has steadily increased due to the rate of infrastructure being raised in the country. Nigeria branded cement differ in price due to those factors written above. Such examples are

Dangote Cement42.5N :NGN 2800 per bag

Elephant Cement 32.5R: NGN 2400 per bag

Tuffcrete: NGN 1800 per bag

UNICEM: NGN 2500 per bag

Granite

Granite is another vital building material used when casting a building to make concrete for the decking .The price varies in size and tonnes

¾ Inch clean: NGN 90000 per trip

½ Inch clean: NGN 85000 per trip

1 Inch clean: NGN 120000 per trip

Laterite

It is a red like brick type that is rich in iron and aluminium oxides, formed by weathering of igneous rocks in moist warm climates . The price depends on the colour of the laterite

Laterite( Highly Clayey,Red): NGN 15000 per 10 tonnes

Laterite( Highly Clayey, Dirty-White): NGN 11000 per 10 tonnes

Laterite( Fairly Clayey, Yellowish-Brown) : NGN 12000 per tonnes

Sand

In a building project, various sand samples are used depending on the part different sand samples.

Sharp sand ( High Silty): NGN 2250 per tonne

Smooth Plaster sand(Fairly Smooth Clean) : NGN 2000 per tonne

Smooth Plaster sand(Sticky/Gum Cleam): NGN 1250 per tonne

Roofing Sheets

There are different types of roofing sheets in the market and the price differences due to their durability

Shingle design(0.55mm thick): NGN 3500 per square meter

Aluminium step tile sheet( 0.55mm thick): NGN 2500 per square meter

Swiss roofing sheets: NGN 4000 per square meter

References

Priceinnigeria.ng

Wikipedia.org

***GROUP MEMBER: ADEGOKE-ALAGBE SAMUEL CHARLES***

**TRADITIONAL MATERIALS**

MATERIALS FOR CONSTRUCTION

* Stones
* bricks
* cement
* lime and
* timber are the traditional materials used for civil engineering constructions for several centuries

**STONE:**

* Stone is a ‘naturally available building material’ which has been used from the early age of civilization. It is available in the form of rocks, which is cut to required size and shape and used as building block. It has been used to construct small residential buildings to large palaces and temples all over the world. Red Fort, Taj Mahal, Vidhan Sabha at Bangalore and several palaces of medieval age all over India are the famous stone buildings

**TYPE OF STONES**

Stones used for civil engineering works may be classified in the following three ways:

• Geological

• Physical

• Chemical

Geological Classification Based on their origin of formation stones are classified into three main groups— **IGNEOUS, SEDIMENTARY AND METAMORPHIC ROCKS**.

1. **IGNEOUS ROCKS**: These rocks are formed by cooling and solidifying of the rock masses from their molten magmatic condition of the material of the earth. Generally igneous rocks are strong and durable. Granite, trap and basalt are the rocks belonging to this category, Granites are formed by slow cooling of the lava under thick cover on the top.
2. **SEDIMENTARY ROCKS**: Due to weathering action of water, wind and frost existing rocks disintegrates. The disintegrated material is carried by wind and water; the water being most powerful medium. Flowing water deposits its suspended materials at some points of obstacles to its flow. These deposited layers of materials get consolidated under pressure and by heat. Chemical agents also contribute to the cementing of the deposits. The rocks thus formed are more uniform, fine grained and compact in their nature.
3. **METAMORPHIC ROCKS**: Previously formed igneous and sedimentary rocks under go changes due to metamorphic action of pressure and internal heat.

**Physical Classification Based on the structure**

* • Stratified rocks
* • Unstratified rocks

1. **Stratified Rocks**: These rocks are having layered structure. They possess planes of stratification or cleavage. They can be easily split along these planes. Sand stones, lime stones, slate etc. are the examples of this class of stones.
2. **Unstratified Rocks:** These rocks are not stratified. They possess crystalline and compact grains. They cannot be split in to thin slab. Granite, trap, marble etc. are the examples of this type of rocks.
3. **Foliated Rocks:** These rocks have a tendency to split along a definite direction only. The direction need not be parallel to each other as in case of stratified rocks. This type of structure is very common in case of metamorphic rocks.

**Properties of Stones:**

The following properties of the stones should be looked into before selecting them for engineering works:

(i) **Structure:** The structure of the stone may be stratified (layered) or unstratified. Structured stones should be easily dressed and suitable for super structure. Unstratified stones are hard and difficult to dress. They are preferred for the foundation works.

(ii) **Texture:** Fine grained stones with homogeneous distribution look attractive and hence they are used for carving. Such stones are usually strong and durable.

(**iii) Density**: Denser stones are stronger. Light weight stones are weak. Hence stones with specific gravity less than 2.4 are considered unsuitable for buildings.

(iv) **Appearance:** A stone with uniform and attractive colour is durable, if grains are compact. Marble and granite get very good appearance, when polished. Hence they are used for face works in buildings.

(v**) Strength:** Strength is an important property to be looked into before selecting stone as building block. Indian standard code recommends, a minimum crushing strength of 3.5 N/mm2 for any building block. Table 1.1 shows the crushing strength of various stones.

OTHER PROPERTIES INCLUDE**: porosity and absorption, weathering, Toughness, Resistance to fire, seasoning.**

**BRICKS:**

Brick is obtained by moulding good clay into a block, which is dried and then burnt. This is the oldest building block to replace stone. Manufacture of brick started with hand moulding, sun drying and burning in clamps. A considerable amount of technological development has taken place with better knowledge about to properties of raw materials, better machinaries and improved techniques of moulding drying and burning. The size of the bricks are of 90 mm × 90 mm × 90 mm and 190 mm × 90 mm × 40 mm. With mortar joints, the size of these bricks are taken as 200 mm × 100 mm × 100 mm and 200 mm × 100 mm.

**Types of Bricks**

* Bricks may be broadly classified as:
* (i) Building bricks
* (ii) Paving bricks
* (iii) Fire bricks
* (iv) Special bricks.

**(i) Building Bricks**: These bricks are used for the construction of walls.

**(ii) Paving Bricks**: These are vitrified bricks and are used as pavers

**. (iii) Fire Bricks**: These bricks are specially made to withstand furnace temperature. Silica bricks belong to this category.

**(iv) Special Bricks**: These bricks are different from the commonly used building bricks with respect to their shape and the purpose for which they are made. Some of such bricks are listed below: *(a) Specially shaped bricks (b) Facing bricks (c) Perforated building bricks (d) Burnt clay hollow bricks (e) Sewer bricks ( f ) Acid resistant bricks.*

**Properties of Bricks**

The following are the required properties of good bricks:

**(i) Colour:** Colour should be uniform and bright.

**(ii) Shape**: Bricks should have plane faces. They should have sharp and true right angled corners.

**(iii) Size:** Bricks should be of standard sizes as prescribed by codes.

* **(iv) Texture:** They should possess fine, dense and uniform texture. They should not possess fissures, cavities, loose grit and unburnt lime.
* **(v) Soundness**: When struck with hammer or with another brick, it should produce metallic sound.
* **(vi) Hardness**: Finger scratching should not produce any impression on the brick.
* **(vii) Strength**: Crushing strength of brick should not be less than 3.5 N/mm2. A field test for strength is that when dropped from a height of 0.9 m to 1.0 mm on a hard ground, the brick should not break into piece

**Classification of Bricks Based on their Quality**

* **(i) First Class Bricks:** These bricks are of standard shape and size. They are burnt in kilns. They fulfill all desirable properties of bricks.
* **(ii) Second Class Bricks**: These bricks are ground moulded and burnt in kilns. The edges may not be sharp and uniform. The surface may be some what rough. Such bricks are commonly used for the construction of walls which are going to be plastered.
* **(iii) Third Class Bricks**: These bricks are ground moulded and burnt in clamps. Their edges are somewhat distorted. They produce dull sound when struck together. They are used for temporary and unimportant structures.
* **(iv) Fourth Class Bricks**: These are the over burnt bricks. They are dark in colour. The shape is irregular. They are used as aggregates for concrete in foundations, floors and roads.

**CEMENT**

* Cement is a commonly used binding material in the construction. The cement is obtained by burning a mixture of calcarious (calcium) and argillaceous (clay) material at a very high temperature and then grinding the clinker so produced to a fine powder.

**Types of Cements:**

* **(i) White Cement**: The cement when made free from colouring oxides of iron, maganese and chlorium results into white cement. In the manufacture of this cement, the oil fuel is used instead of coal for burning.
* **(ii) Coloured Cement**: The cements of desired colours are produced by intimately mixing pigments with ordinary cement. The chlorium oxide gives green colour. Cobalt produce blue colour. Iron oxide with different proportion produce brown, red or yellow colour. ad of coal for burning.
* **(iii) Quick Setting Cement**: Quick setting cement is produced by reducing the percentage of gypsum and adding a small amount of aluminium sulphate during the manufacture of cement. Finer grinding also adds to quick setting property.
* **(iv) Rapid Hardening Cement**: This cement can be produced by increasing lime content and burning at high temperature while manufacturing cement. Grinding to very fine is also necessary. Though the initial and final setting time of this cement is the same as that of portland cement, it gains strength in early days.
* **(v) Low Heat Cement**: In mass concrete works like construction of dams, heat produced due to hydration of cement will not get dispersed easily. This may give rise to cracks. Hence in such constructions it is preferable to use low heat cement.

OTHER TYPES ARE:

**Pozzulana Cement, Expanding Cement, High Alumina Cement, Blast Furnace Cement,e.t.c.**

**PHYSICAL PROPERTIES**

* (a) Fineness :: It is measured in terms of percentage of weight retained after sieving the cement through 90 micron sieve or by surface area of cement in square centimeters per gramme of cement. According to IS code specification weight retained on the sieve should not be more than 10 per cent. In terms of specific surface should not be less than 2250 cm2/gm.
* (b) Setting Time:A period of 30 minutes as minimum setting time for

initial setting and a maximum period of 600 minutes as maximum setting

time is specified by IS code, provided the tests are conducted as per the procedure prescribed by IS 269-1967.

* (c) Soundness: Once the concrete has hardened it is necessary to ensure that no volumetric changes takes place. The cement is said to be unsound, if it exhibits volumetric instability after hardening. IS code recommends test with Le Chatelier mould for testing this property. At the end of the test, the indicator of Le Chatelier mould should not expand by more than 10 mm.
* (d) Crushing strength: For this mortar cubes are made with standard sand and tested in compression testing machine as per the specification of IS code. The minimum strength specified is 16 N/mm2 after 3 days and 22 N/mm2 after 7 days of curing

**LIME**

It is an important binding material used in building construction. Lime has been used as the material of construction from ancient time. When it is mixed with sand it provides lime mortar and when mixed with sand and coarse aggregate, it forms lime concrete.

**Types of Limes their Properties**

The limes are classified as **fat lime, hydraulic lime and poor lime**:

**(i) Fat lime**: It is composed of 95 percentage of calcium oxide. When water is added, it slakes

vigorously and its volume increases to 2 to 5/2

times. It is white in colour. Its properties are:

hardens slowly (b) has high degree of plasticity (c) sets slowly in the presence of air (d) white in colour

**(ii) Hydraulic lime:** It contains clay and ferrous oxide. Depending upon the percentage of clay present

1. **Poor lime**: It contains more than 30% clay. Its colour is muddy. It has poor binding property. The mortar made with such lime is used for inferior works.

***GROUP MEMBER: SULE MUBARAK ADEDEJI***

***TOPIC OF INTEREST: ENVIRONMENTAL IMPACT OF CONSTRUCTION MATERIALS***

*Some materials used in construction include bamboo, wood, bricks, cement blocks, earth, gravel, sand, cement and clay, steel, concrete and stone.*

*STEEL*

*Steel is ‘iron with most of the carbon removed’*

*Iron constitutes about five per cent of the Earth's crust and is the fourth most abundant element in the crust.*

*98% of the iron ore mined is used to make steel*

*Steel represents around 95% of all metals produced.*

*Steel production has a number of impacts on the environment, including air emissions (CO, SOx, NOx, PM2), wastewater contaminants, hazardous wastes, and solid wastes. The major environmental impacts from integrated steel mills are from coking and iron-making.*

*Climate change*

*Virtually all of the greenhouse gas emissions associated with steel production are from the carbon dioxide emissions related to energy consumption.*

*Emissions to air*

*Coke production is one of the major pollution sources from steel production. Air emissions such as coke oven gas, naphthalene, ammonium compounds, crude light oil, sulfur and coke dust are released from coke ovens.*

*Emissions to water*

*Water emissions come from the water used to cool coke after it has finished baking. Quenching water becomes contaminated with coke breezes and other compounds. While the volume of contaminated water can be great, quenching water is fairly easy to reuse. Most pollutants can be removed by filtration.*

*Waste*

*Slag, the limestone and iron ore impurities collected at the top of the molten iron, make up the largest portion of iron-making by-products. Sulfur dioxide and hydrogen sulfide are volatized and captured in air emissions control equipment and the residual slag is sold to the construction industry. While this is not a pollution prevention technique, the solid waste does not reach landfills.*

*Gaseous emissions and metal dust are the most prominent sources of waste from electric arc furnaces.*

*Recycling*

*42% of crude steel produced is recycled material*

*Re-melting proportion of steel scrap is constrained by availability. Availability can sometimes be defined as cost effective recovery.*

*Iron and steel are the world's most recycled materials, and among the easiest materials to reprocess, as they can be separated magnetically from the waste stream. Recycling is via a steelworks: scrap is either re-melted in an electric arc furnace (90-100% scrap), or used as part of the charge in a Basic Oxygen Furnace (around 25% scrap). Any grade of steel can be recycled to top quality new metal, with no 'downgrading' from prime to lower quality materials as steel is recycled repeatedly.*

*CONCRETE*

*Concrete is a material used in building construction, consisting of a hard, chemically inert particular substance, known as an aggregate (usually made from different types of sand and gravel), that is bonded together by cement and water.*

*The material is the foundation of modern development, putting roofs over the heads of billions, fortifying our defences against natural disaster and providing a structure for healthcare, education, transport, energy and industry.*

*Concrete is how we try to tame nature. Our slabs protect us from the elements. They keep the rain from our heads, the cold from our bones and the mud from our feet. But they also entomb vast tracts of fertile soil, constipate rivers, choke habitats and – acting as a rock-hard second skin – desensitise us from what is happening outside our urban fortresses.*

*Our blue and green world is becoming greyer by the second. By*[*one calculation*](https://www.vox.com/science-and-health/2018/5/29/17386112/all-life-on-earth-chart-weight-plants-animals-pnas)*, we may have already passed the point where concrete outweighs the combined carbon mass of every tree, bush and shrub on the planet. Our built environment is, in these terms, outgrowing the natural one. Unlike the natural world, however, it does not actually grow. Instead, its chief quality is to harden and then degrade, extremely slowly.*

*All the plastic produced over the past 60 years amounts to 8bn tonnes. The cement industry pumps out more than that every two years. But though the problem is bigger than plastic, it is generally seen as less severe. Concrete is not derived from fossil fuels. It is not being found in the stomachs of whales and seagulls. Doctors aren’t discovering traces of it in our blood. Nor do we see it tangled in oak trees or contributing to subterranean fat bergs. We know where we are with concrete. Or to be more precise, we know where it is going: nowhere. Which is exactly why we have come to rely on it.*

*This solidity, of course, is what humankind yearns for. Concrete is beloved for its weight and endurance. That is why it serves as the foundation of modern life, holding time, nature, the elements and entropy at bay. When combined with steel, it is the material that ensures our dams don’t burst, our tower blocks don’t fall, our roads don’t buckle and our electricity grid remains connected.*

*Solidity is a particularly attractive quality at a time of disorientating change. But – like any good thing in excess – it can create more problems than it solves.*

*Concrete is a thirsty behemoth, sucking up almost a 10th of the world’s industrial water use. This often strains supplies for drinking and irrigation, because*[*75% of this consumption is in drought and water-stressed regions*](https://www.nature.com/articles/s41893-017-0009-5)*. In cities, concrete also adds to the heat-island effect by absorbing the warmth of the sun and trapping gases from car exhausts and air-conditioner units – though it is, at least, better than darker asphalt.*

*Concrete can take our civilization upwards, up to 163 storey’s high in the case of the Burj Khalifa skyscraper in Dubai, creating living space out of the air. But it also pushes the human footprint outwards, sprawling across fertile topsoil and choking habitats. The biodiversity crisis – which many scientists believe to be*[*as much of a threat as climate chaos*](https://www.theguardian.com/environment/2018/mar/23/destruction-of-nature-as-dangerous-as-climate-change-scientists-warn)*– is driven primarily by the conversion of wilderness to agriculture, industrial estates and residential blocks.*

*For hundreds of years, humanity has been willing to accept this environmental downside in return for the undoubted benefits of concrete*.

*WOOD*

*Today, building "green" is good business. As a building material, wood offers many environmental benefits that matter to communities across the country.* ***It is the only major building material that is renewable and sustainable.*** *Compared with concrete and steel, wood products help to increase a building’s energy efficiency and minimize the energy consumed throughout the life of the product. Using wood also helps keep carbon out of the atmosphere, helping to mitigate climate change. Trees store carbon dioxide as they grow. After harvest, wood products continue to store much of this carbon. These benefits continue when wood is reclaimed to manufacture other products.  Wood. It’s a better way to build.*

*Wood is better for the environment in terms of greenhouse gas emissions, air and water pollution, and other impacts. Steel and concrete consume 12% and 20% more energy, emit 15% and 29% more greenhouse gases, and release 10% and 12% more pollutants into the air, and generate 300% and 225% more water pollutants than wood, respectively.*

*Wood helps reduce energy consumption across the life cycle of growth, harvest, transport, manufacture and construction compared to other structural building products according to life cycle assessment (LCA).*

*Wood can improve energy efficiency.  An excellent insulator, wood has a cellular structure that allows for air pockets, helping to slow the conductivity of heat.*

*Wood products store carbon, helping to mitigate climate change while also providing a good alternative for materials that require large amounts of fossil fuels to produce.*

*Using wood helps to sustain our forests and increases our carbon storage potential by helping to ensure that it is affordable for forest owners to continue sustainably managing their forestland.*

*EXAMPLES*

*Constructing a wall using kiln-dried wood studs, oriented strand board (OSB) sheathing, and vinyl siding instead of concrete with an exterior stucco coating results in 15 pounds of avoided CO2 emissions for every square foot of wall area.*

*Using engineered wood I-joists with an OSB sub-floor rather than steel joists and OSB sub-flooring results in 22 pounds of avoided CO2 emissions for every square foot of floor area.*

[*https://www.theguardian.com/cities/2019/feb/25/concrete-the-most-destructive-material-on-earth*](https://www.theguardian.com/cities/2019/feb/25/concrete-the-most-destructive-material-on-earth)

*https://www.greenspec.co.uk/building-design/steel-products-and-environmental-impact/#:~:text=Steel%20production%20has%20a%20number,from%20coking%20and%20iron%2Dmaking*.

<https://www.researchgate.net/publication/40497595_Environmental_Impact_of_Concrete>