CARBON REDUCTION

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1.INTRODUCTION

In the 21st century ,product design comforts with serious challenges from environment worsening. In 2016 ,US industrial sector contributes to 26.84% of energy related carbon dioxide emissions and 30.84% of energy consumption. Design and production of products with low carbon emissions have become a hot throughout the world . Relevant standards including ISO 14064, PAS 2050 , and ISO/TS 14067 have formulated to encourage the design and popularization of low carbon products, presently , product carbon emission (carbon footprint) is widely accepted as an important indicator of the environmental impact of a product during its entire life cycle.

1.1 The purpose of structure design

- Structural design is the methodical investigation of the stability, strength and rigidity of structures. The basic objective in structural analysis and design is to produce a structure capable of resisting all applied loads without failure during its intended life. The primary purpose of a structure is to transmit or support loads. If the structure is improperly designed or fabricated, or if the actual applied loads exceed the design specifications, the device will probably fail to perform its intended function, with possible serious consequences. A well engineered structure greatly minimizes the possibility of costly failures.

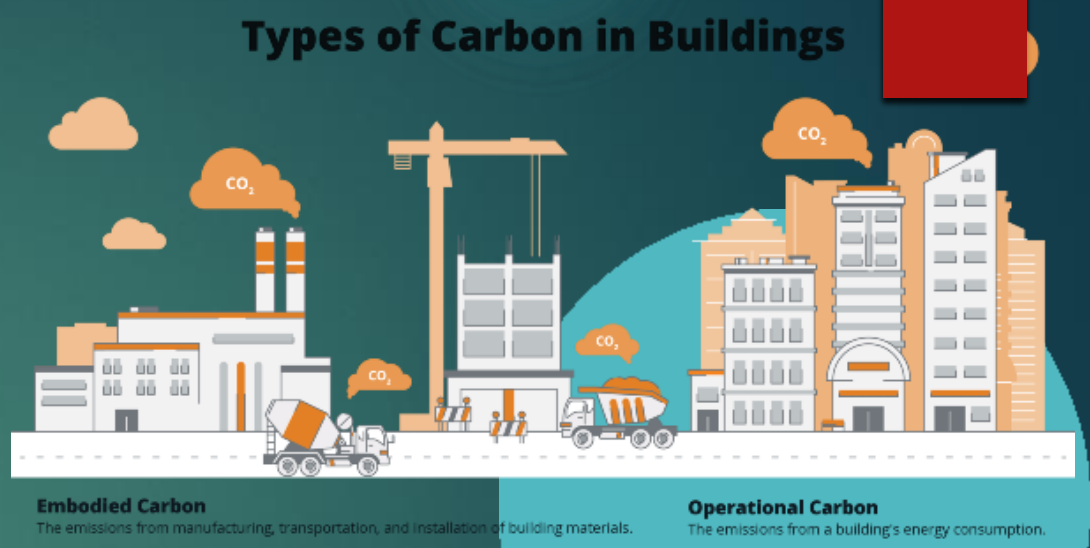

Mortgage Application
Mortgage Application

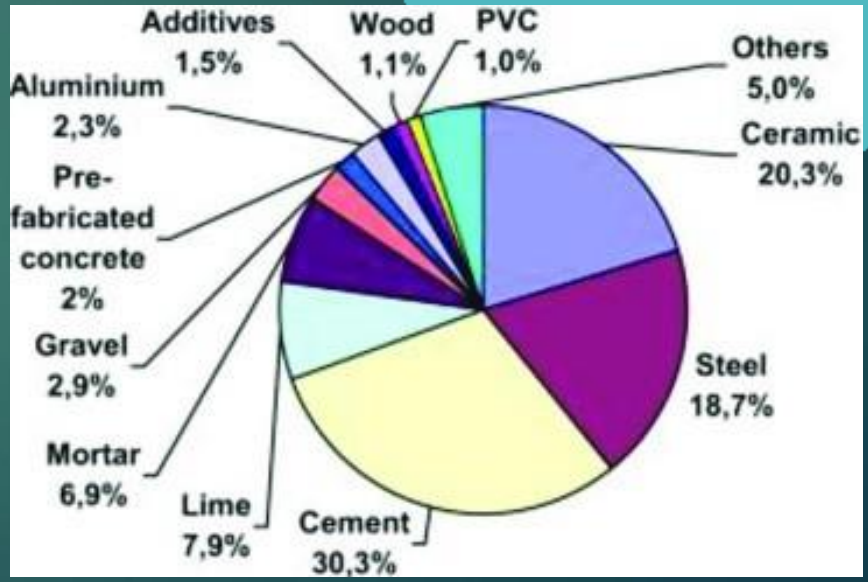
1.2 Where is carbon producing / emitting in construction?

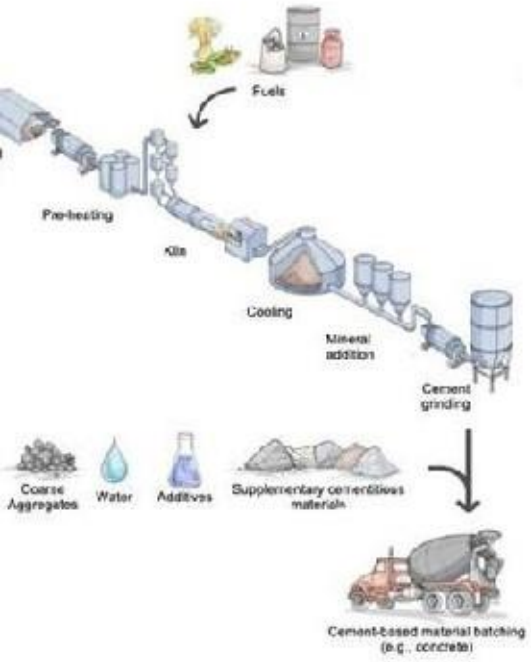
I. It is emitted during transportation of cement from mixture.

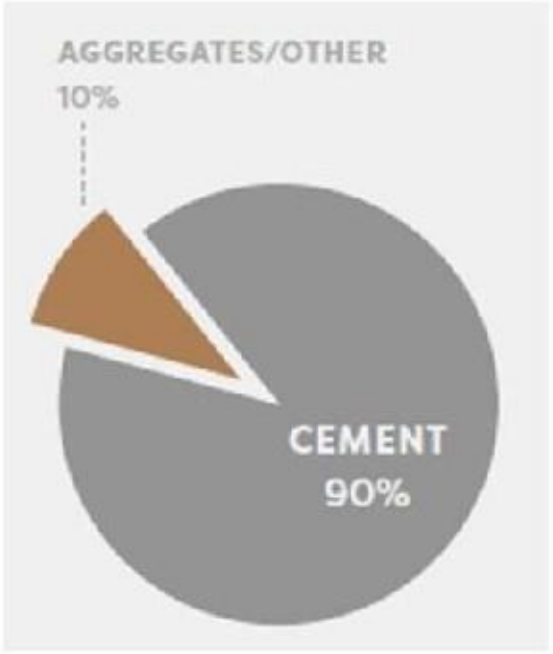
II. CO_2 is released during upliftment of goods in lift during construction from diesel generator.

III. Rebar construction also use carbon.

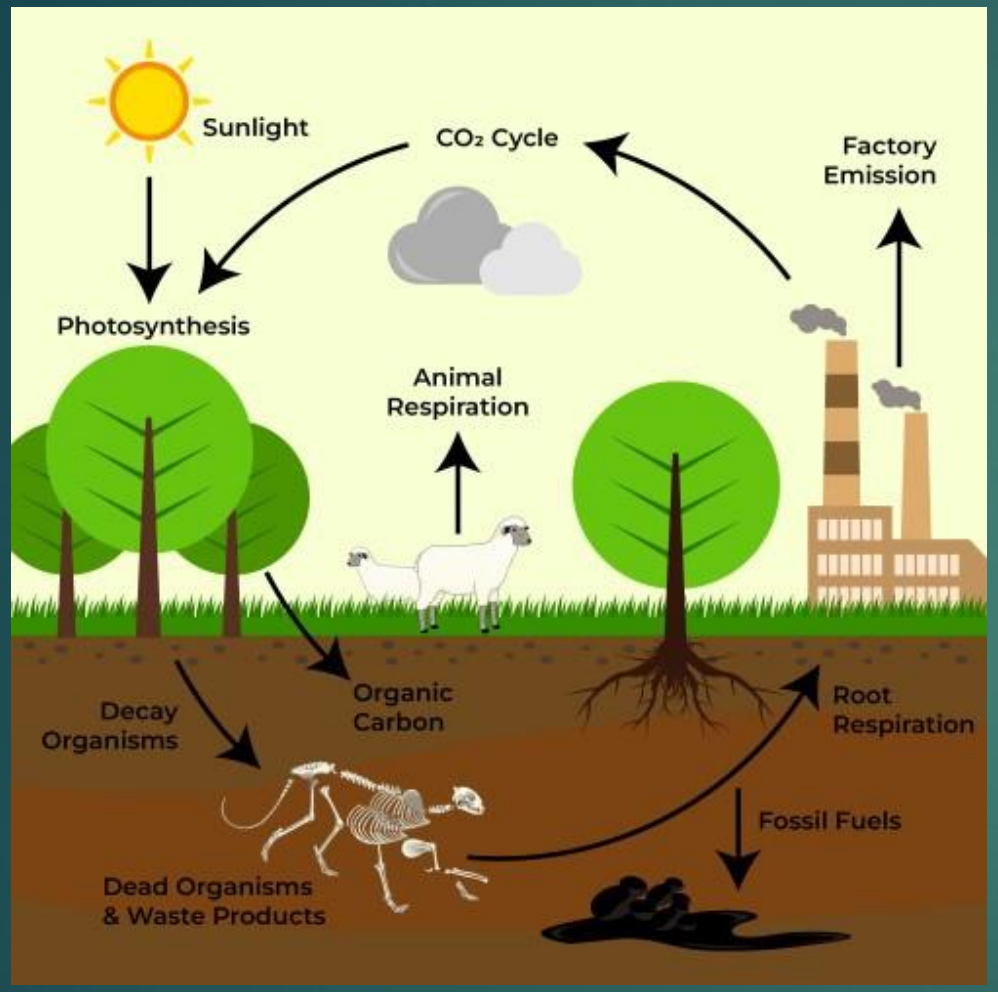








Components that uses carbon.



Carbon Cycle getting disturbed due to this lethal release of C-gases

What is Carbon Footprinting?

"Commonly used to describe the total amount of CO_2 and other greenhouse gas (GHG) emissions attributable to an organisation, project or product."

Process for designing for carbon reduction

Case Study – Retrofitting: the Art of the Possible

- 1950's Semi-D Residential House, Retrofit. A range of energy and water efficient approaches, materials and equipment installed:
- • Insulation: walls, floors, roofs, loft, exterior walls cavities filled, high performance double-glazed windows
- • Underfloor space heating & hot water: wood burner with back boiler, solar thermal panels, condensing boiler w ith weather compensating controls and thermal store
- • Energy: Solar PV generated 3,100kWh in 1st year
- • Ventilation: mechanical ventilation heat recovery recovers 90% of heat
- • Natural light: sun pipes in toilet, landing, dining areas
- • Energy-efficient appliances: LEDs, passive infra-red motion detectors
- • Water-efficient appliances: dual low flush toilets, rainwater harvesting for toilets, clothes, gardening
- • Energy use before: 133 kWh/m2 .yr electricity + gas
- • Energy use after: 37 kWh / m2 .yr electricity = 72% reduction

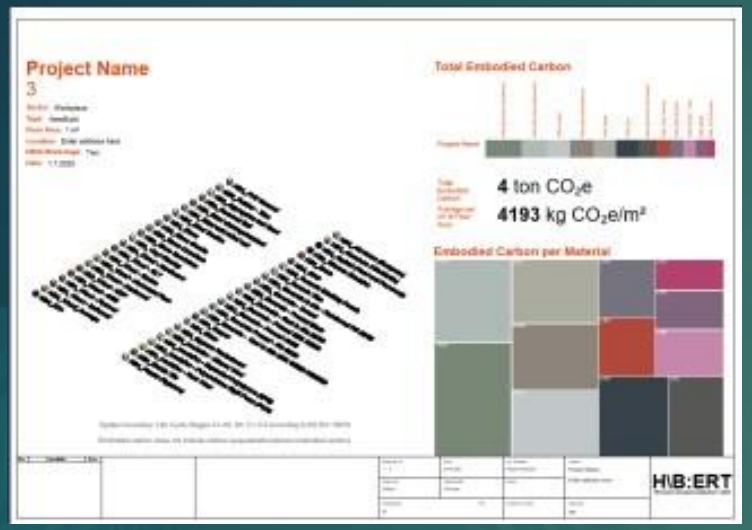
Carbon Design Options

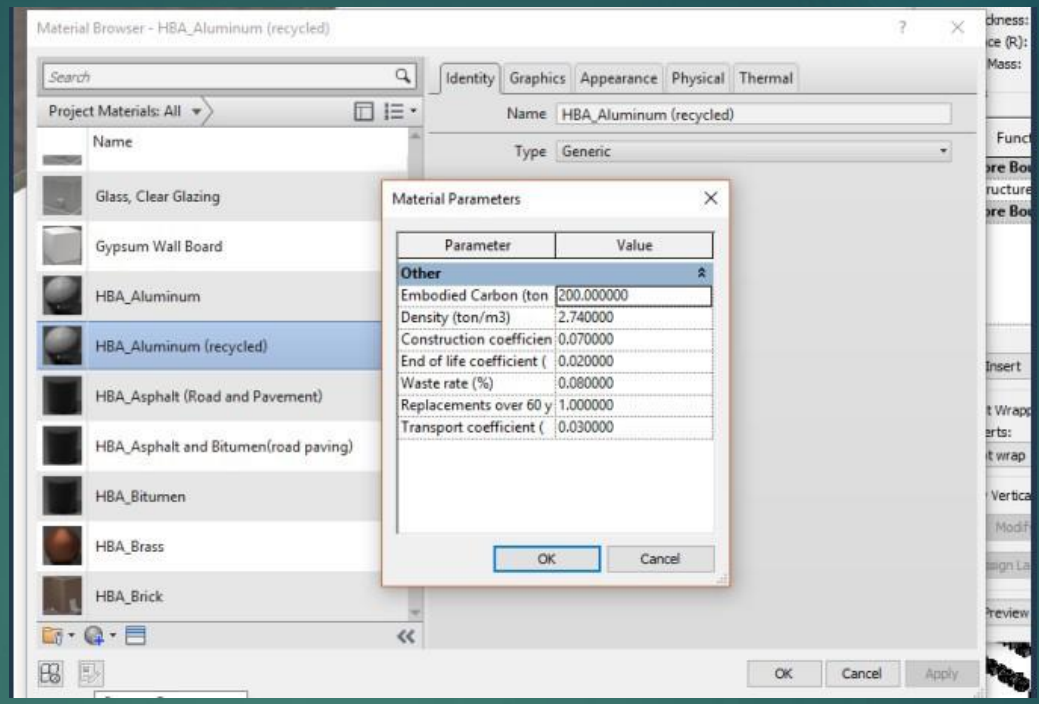
- Design, energy sources, equipment and transport
- • Consider infrastructure: provision of charging points for EV, access to public transport, suitable spaces for cyclists…
- • Allow for future needs including ease of maintenance access, as well as change of purpose
- • Service station – consider if a service model is appropriate
- • Design for Adaptation to a changing climate: SUDS, Green roofs and walls, greywater and rainwater harvesting capability

Continue....

- Products, materials, maintenance and upgrade
- • Use less material in absolute terms – work with design and procurement teams
- • Switch to materials with lower carbon impacts, either the same material or a different material – encourage innovation
- • Increase reuse and the recycled content of materials – engage suppliers
- • Eco-design to enable easier maintenance, repair and upgrade later in the asset's lifetime – DfMA for 'future proofing'

Stakeholders



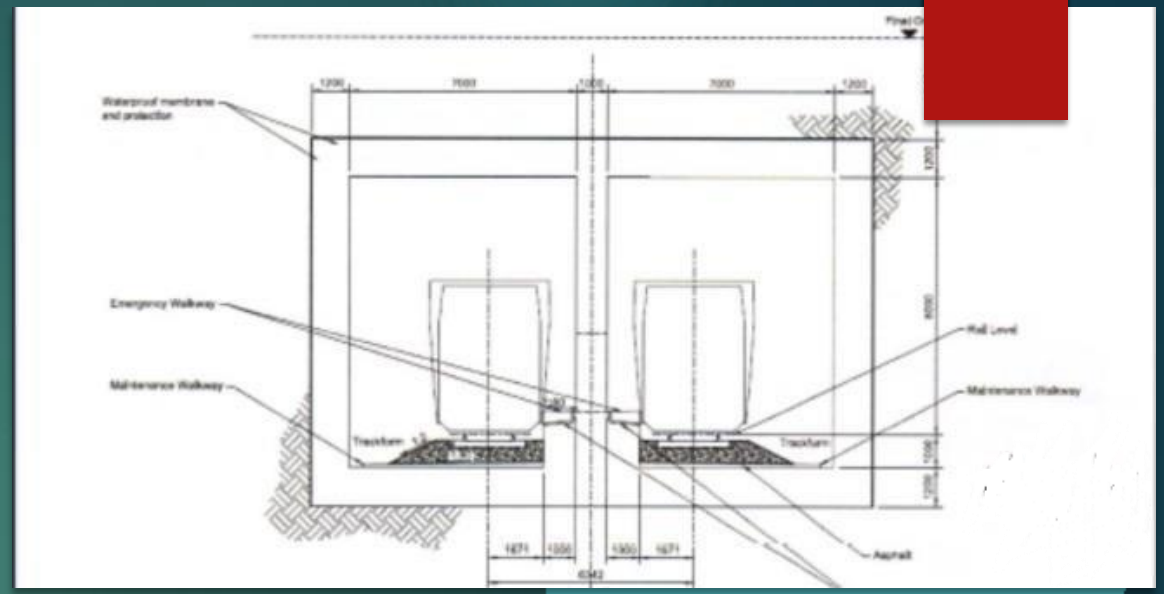


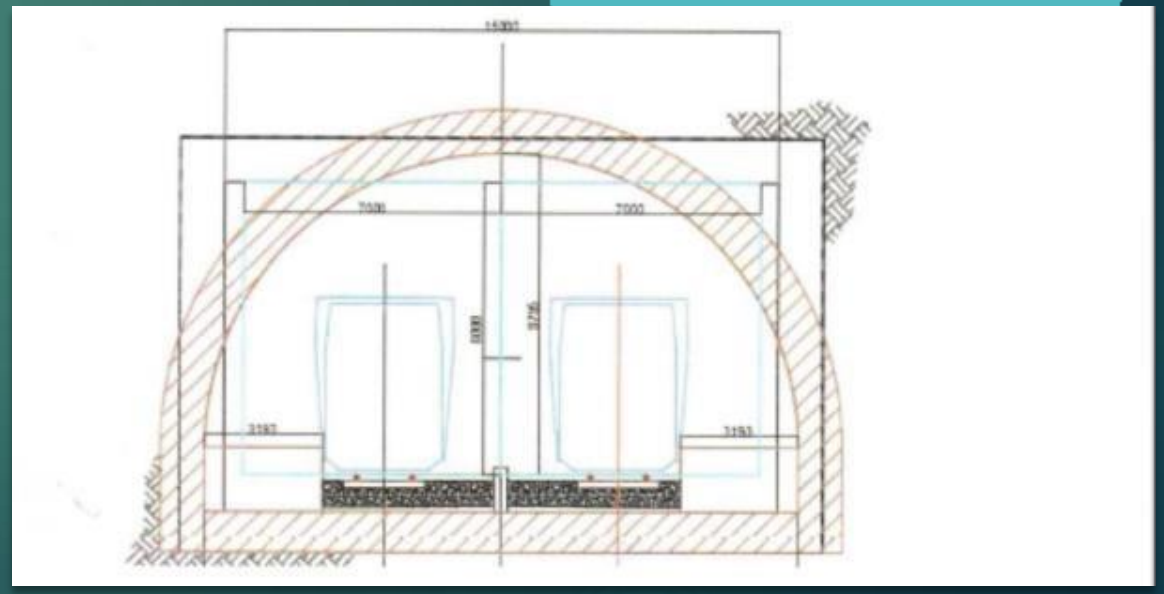
Engineers must use this program to know the minimum usage of carbon in architechture.

Example: building a train tunnel

Different Engineering Options

- Variations on
- Cut & cover and/or mining
- Concrete and/or steel
- Boxes and/or arches





Resources Guidance – Free Carbon Data and Tools

- Defra/BEIS 2021 Greenhouse gas reporting conversion factors : the UK Government's database of carbon factors for fuel, ener gy, t ransport, and materials, updated annually. https://w w w.gov.uk/government/publicat ions/greenhouse-gas-report ing-conversion-factors-2021

- Bath Inventory of Carbon and Energy (ICE) database: a w ell-established database of embodied carbon factors for a variety of materials, updated periodically. http://w ww.circularecology.com/embodied-energy-and-carbon-footprint-database.html

- Supply Chain School Carbon Calculator: a free tool from the School to measure scope 1, 2 and 3 emissions in your supply chain. https://carbon.sustainabilitytool.com/

- The Embodied Carbon in Construction Calculator (EC3)Tool: a database of EPDs for construction productshttps://buildingtransparency.org/ec3

- Carbon Trust Carbon Calculator for SMEs: The Carbon Footprint Calculator has been designed to help UK based SMEs measure their corporate emission footprint follow ing GHG Protocol Guidance, including direct emissions from fuel and processes (Scope 1 emi ssions) and those emissions from purchased electricity (or Scope 2 emissions) for the assets they operate https://w ww.carbontrust.com/resources/tools/carbon-footprint-calculator

- Highw ays England Carbon Tool: a free-to-dow nload Ex cel tool to calculate carbon emissions for operational, construction and maintenance activities undertaken on behalf of Highw ays England that draw s on Defra and Bath ICE datasets w ww.gov.uk/government/publications/carbon-tool

- The RSSB Rail Carbon Tool is a w eb-based tool that allow s you to calculate, assess, analyse, report and reduce your rail project carbon footprint by evaluating low -carbon options using verified, centrally -available carbon factor data that draw s on Defra and Bath I CE datasets https://w ww. railindustrycarbon.com/

- Environment Agency Carbon Calculator: a free-to-dow nload tool to calculate the carbon impact of different material and t ransport options in your project w w w.ice.org.uk/know ledge-and-resources/best-pract ice/environment -agency-carbon-calculator-tool

- Haw kins\Brow n: Emission Reduction Tool \. An open source Revit -based tool that enables design teams to quickly analyse and clearly visualise the embodied carbon emissions of different building components and construction material options at any t ime during the design process. https://w ww.haw kinsbrow n.com/services/hbert

The end of the training… for now…

…but the beginning of your carbon reduction plans!....