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Engineering Studies Teacher Development Session - Engineering Fundamentals

Bringing Schools and the Engineering
Industry together

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History of Engineering

- Ancient:



- Middle Ages:

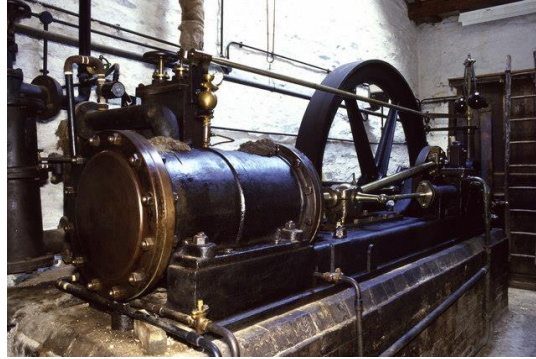




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History of Engineering

- Renaissance:



- Modern Era:





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Engineering Disciplines



- Civil



- Water



- Structural



- Electrical

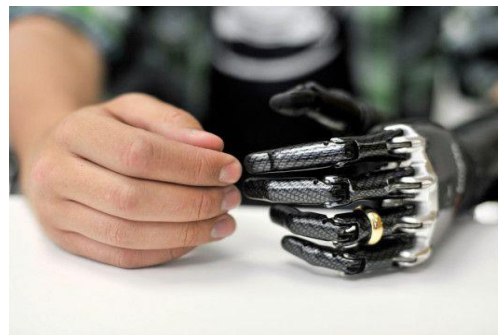


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Engineering Disciplines



- Mechanical



- Biomedical



- Chemical



- Software



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Civil Engineering

- “An engineer who designs and maintains roads, bridges, dams and similar structures”
- Civil engineers are involved in a wide variety of projects and have a great deal of input into public infrastructure such as roads, water supply, bridges etc.

- Parkes Bypass Rd →





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Structural Engineering

- “A specialty within Civil Engineering that primarily focuses on the design and construction of structures”
- A structural engineer gets the challenging yet rewarding task of ensuring the built environment remains standing. Whether it be a multistorey tower or a single bolt.

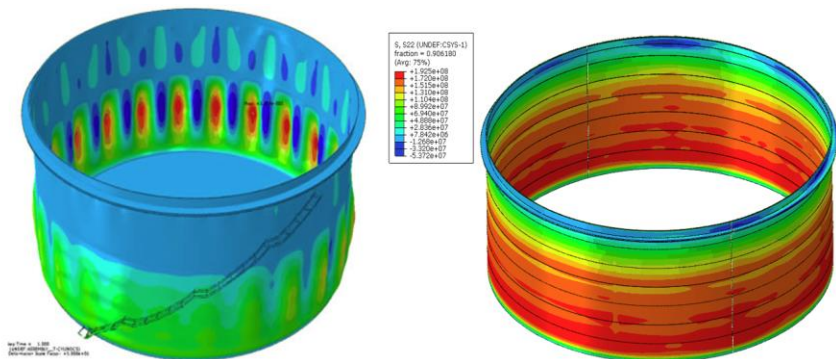




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Water Engineering

- “A specialty within Civil Engineering that primarily focuses on the design and construction of structures that control water resources”
- Includes the design of water mains, dams and reservoirs.

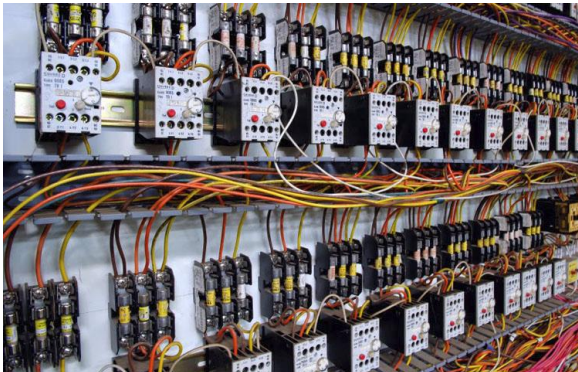




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Electrical Engineering

- “Deals with the technology of electricity, especially the design and application of circuitry and equipment for power generation and distribution, machine control and communications”
- Includes the design of power lines, building circuitry and have vast input into solar power generation.

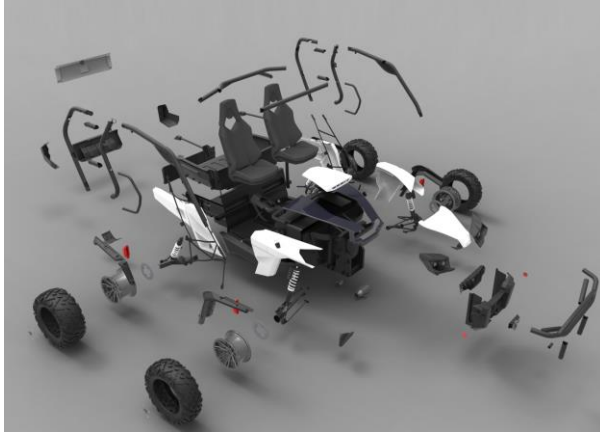




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Mechanical Engineering

- “The branch of engineering dealing with the design, construction, and use of machines”
- Includes the engineering of tools, cogs, moving components and machines.





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Chemical Engineering

- “Deals with the technology of chemical production and the manufacturing of products through chemical processes”
- Includes the design and development of new materials and the design of treatment facilities.

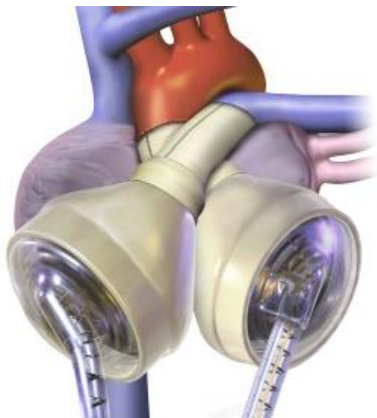




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Biomedical Engineering

- “Deals with the integration of engineering sciences with biomedical sciences and clinical practice”
- Includes the design of prosthetics, diagnostic devices and artificial organs.





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Software Engineering

- “Deals with the approach to development, operation and maintenance of software”
- Includes the design of games, programs, websites etc.

```
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2 <html style="height:100%;>
3 <head>
4   <meta http-equiv="Content-Type" content="text/html; charset=utf-8"/>
5   <meta http-equiv="X-UA-Compatible" content="IE=Edge"/>
6   <title>Untitled</title>
7 <!--Adobe Edge Runtime-->
8   <script type="text/javascript" charset="utf-8" src="http://animate.adobe.com/runtime
9   </script>
10   <style>
11     .edgeLoad-EDGE-113439313 { visibility:hidden; }
12   </style>
13   <script>
14     var link1="%reference%#eventHTML1%";
15     var link2="%reference%#eventHTML2%";
16     AdobeEdge.loadComposition('http://banners.adfox.ru/000000/adfox/000000/project',
17     scaleToFit: "none",
18     centerStage: "none",
19     minW: "0px",
20     maxH: "undefined",
21     width: "100%",
22     height: "100%"
23     }, {"dom":{}}, {"dom":{}});
24   </script>
25 <!--Adobe Edge Runtime End-->
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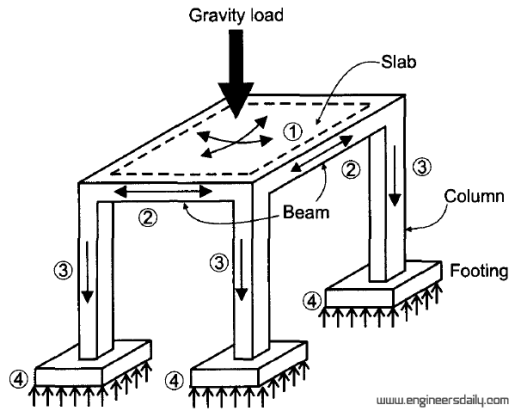




Load Paths

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- It is important to understand where a load must go when looking at a structure. Where does it start, where will it end up and how does it get there?



www.engineersdaily.com

1. Slab
2. Beam
3. Column
4. Footing

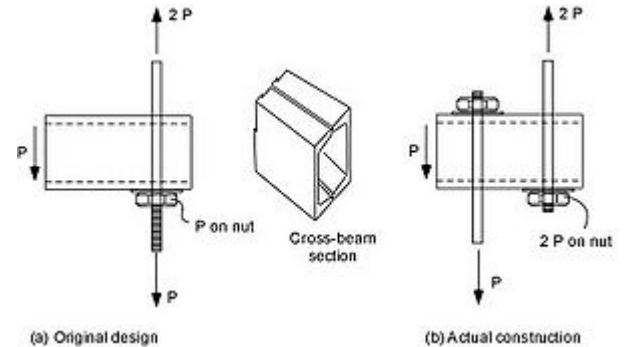
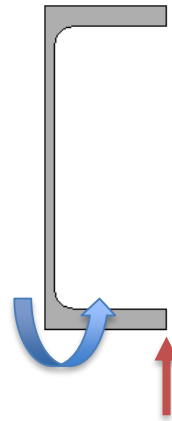
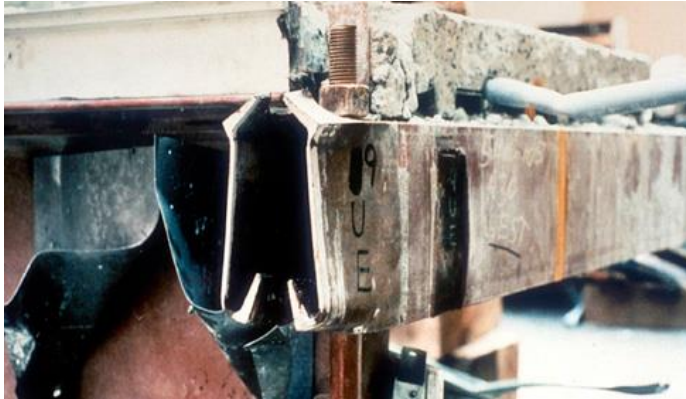
- Follow the load



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Hyatt Regency - Kansas City

- Walkway collapse due to a simple detail change that wasn't given appropriate consideration.





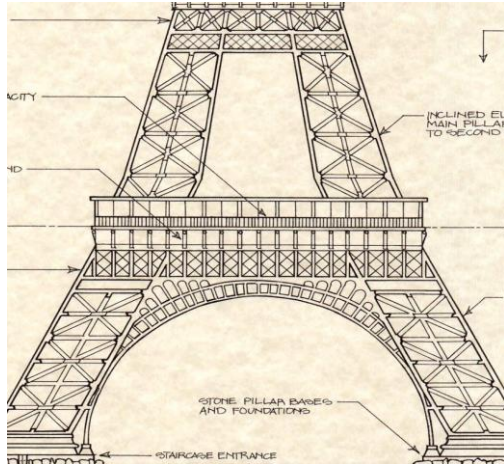
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Case Studies



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Eiffel Tower



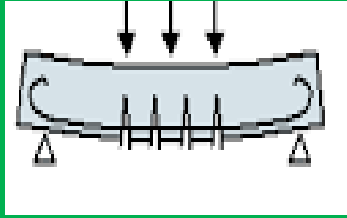
Which
person is
easier to
push over ?





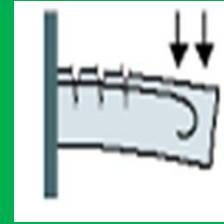
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Simply supported beam



***Tension in bottom
(steel in bottom)***

Cantilevered beam



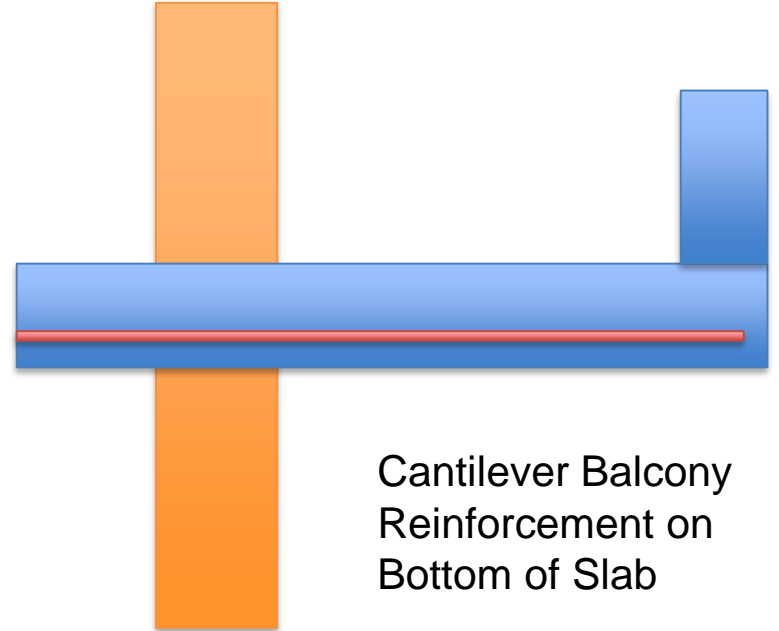
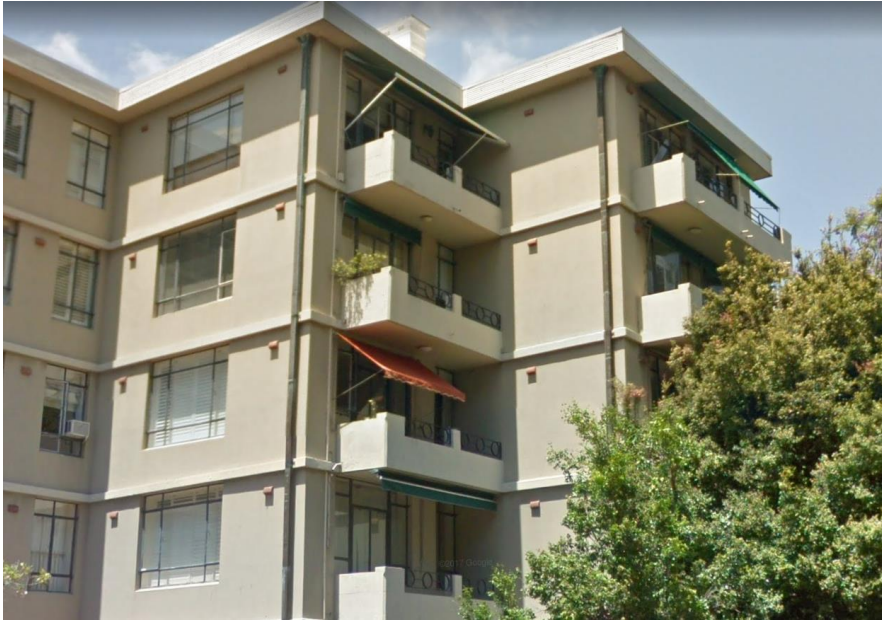
***Tension in top
(steel in top)***

***“Steel is great in tension
Concrete is great in compression”***



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Darling Point Apartment Building



Cantilever Balcony
Reinforcement on
Bottom of Slab



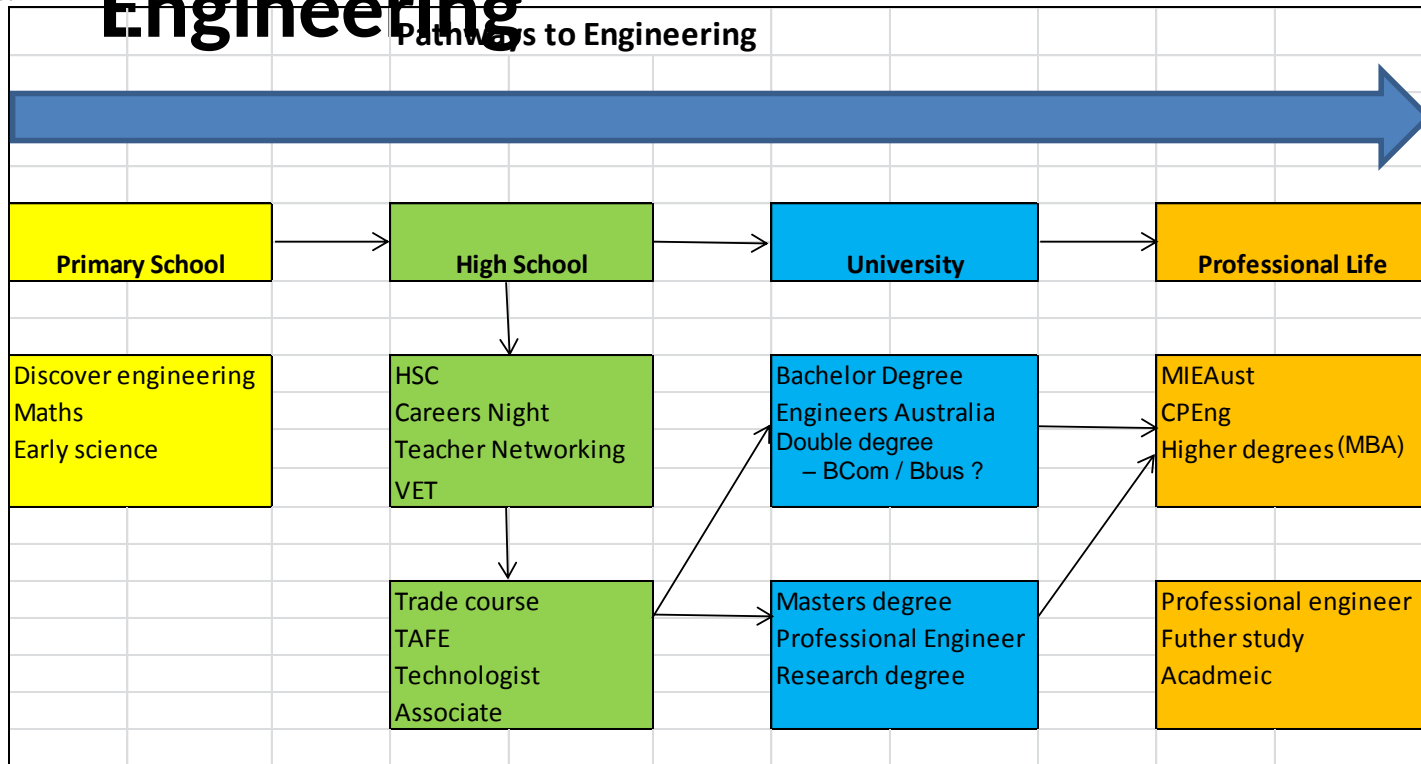
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Pathways To Engineering



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Pathways To Engineering





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Australian Defence Force

Officer Entry

- Rapid entry into management (example – Lt commanding a platoon)

Non Commissioned

- Trade course
- 'Muster' to degree (commission)

Medical benefits

Navy : 60% female intake



NAVY



ARMY



AIR FORCE



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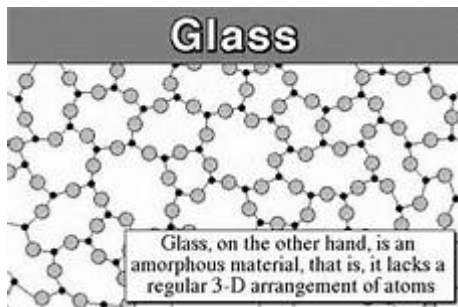
Engineering Materials



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Engineering Materials

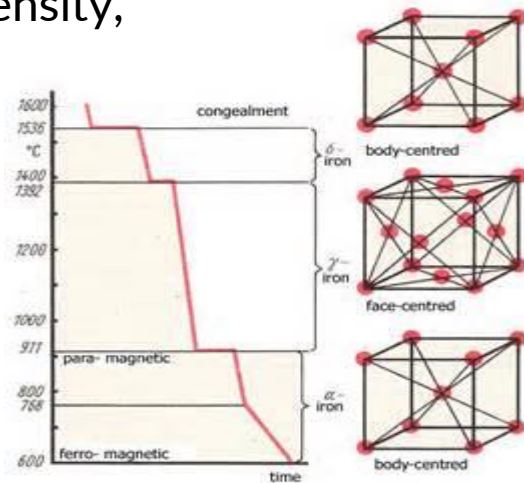
Classification of materials by properties; weight, density, strength, stiffness



Amorphous (Glass)



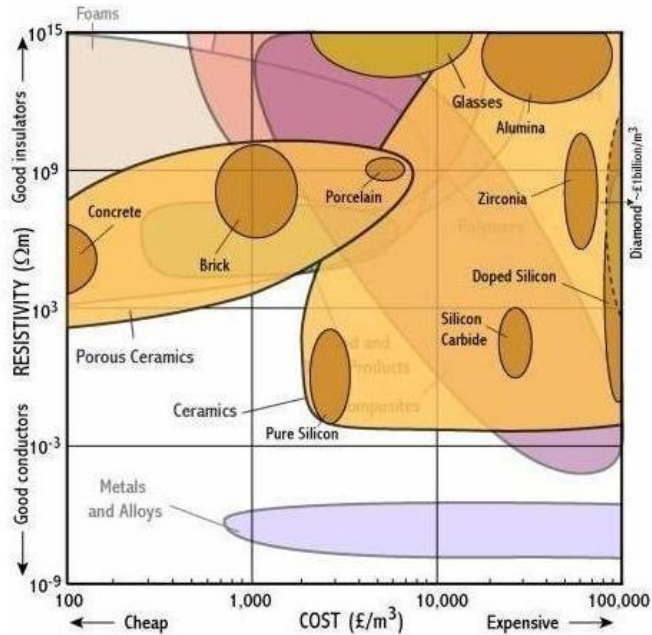
Crystalline
(Sand Aggregates)



Lattice (Metals)

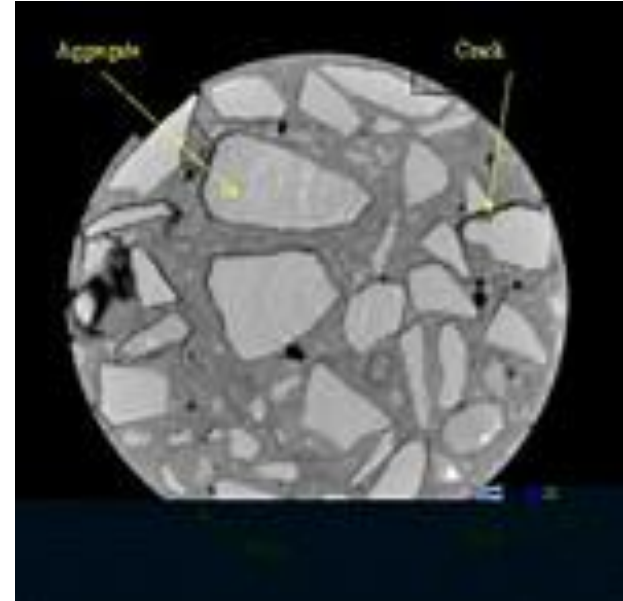


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Issue of "Material selection and processing"
<http://www-materials.eng.cam.ac.uk/mpsite/>

Ceramics (Industrial applications)

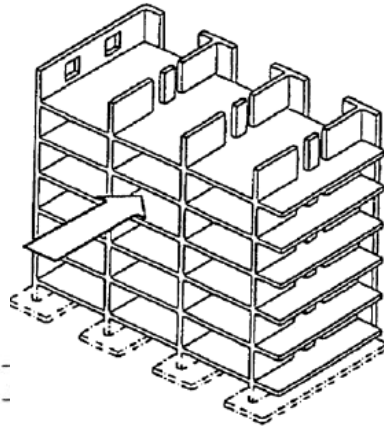
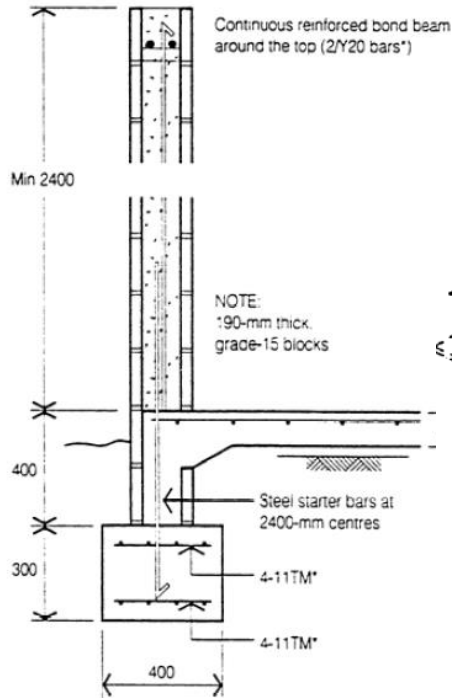


Composite (Concrete)

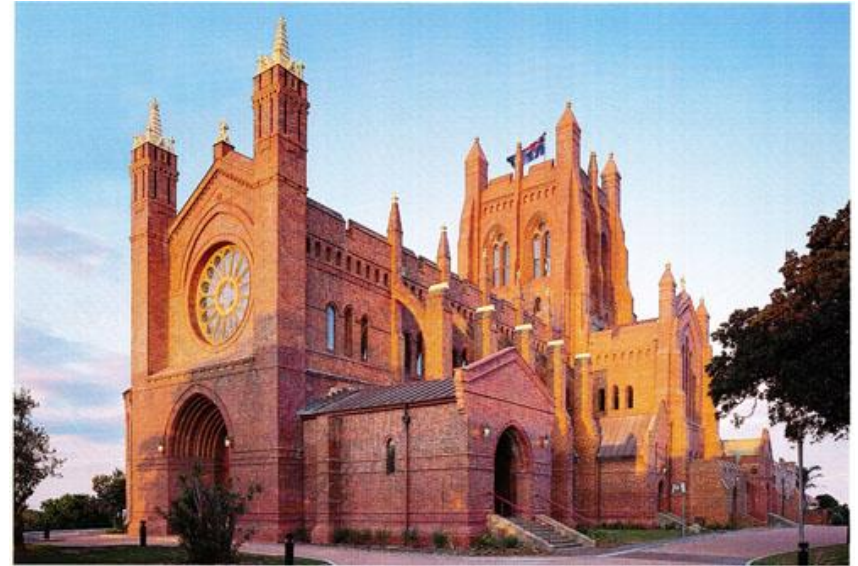


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Ceramics & Masonry



Load bearing
masonry
structure



Newcastle Cathedral



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Ceramics & Masonry



Mortar Weakened Wall



Salt Attack in Clay Bricks

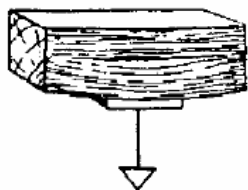


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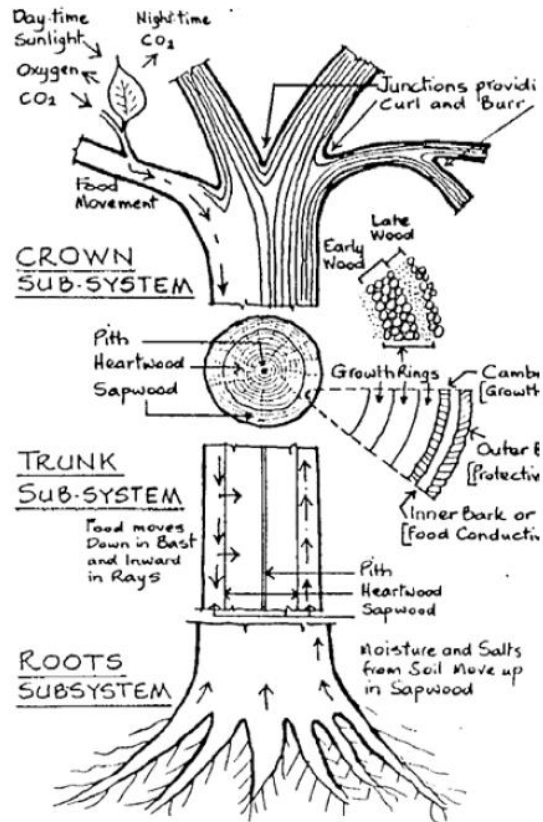
Timber



Tension
Parallel to Grain



Tension
Perpendicular to Grain



Tensile Stress in Timber



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Metals



2016 – Apple reclaimed 1,000kg in gold or approx. \$48 Million (Australian)



Quenching and tempering plus alloys produce armor



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Concrete



Concrete Cancer



Lloyd Wright
Waterfall House



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Concrete Forming



Sprayed Concrete



Slip-formed Concrete



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Concrete or Steel

When should reinforced concrete be used?





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Renewable Materials

- Carbon footprint -specific mats may be high to make (E.g. Cement)
- Process improvements to reduce carbon (E.g. Limestone / Cement)
- Use of low carbon materials in construction
- Incentives to reduce carbon- (Green star buildings etc).
- Recycled materials may not have suitable properties vs. virgin mats
- Cost of recycling may be more harmful to environment than virgin mats
- Environmental, social , economic risk to society of mats use or not?
- Waste management from production processes



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