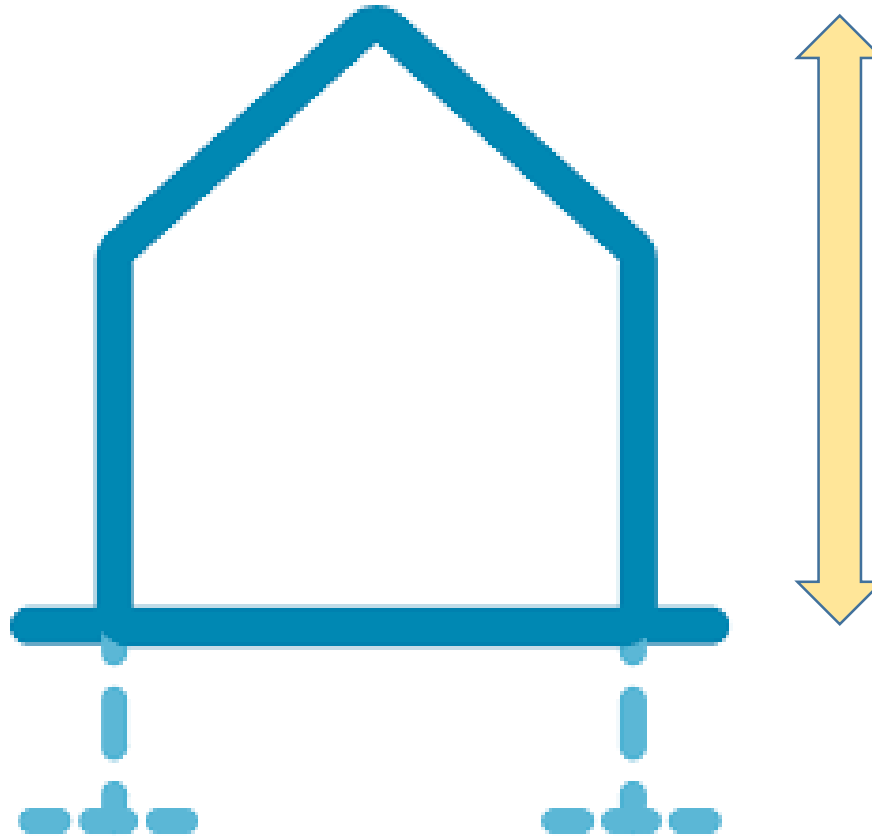
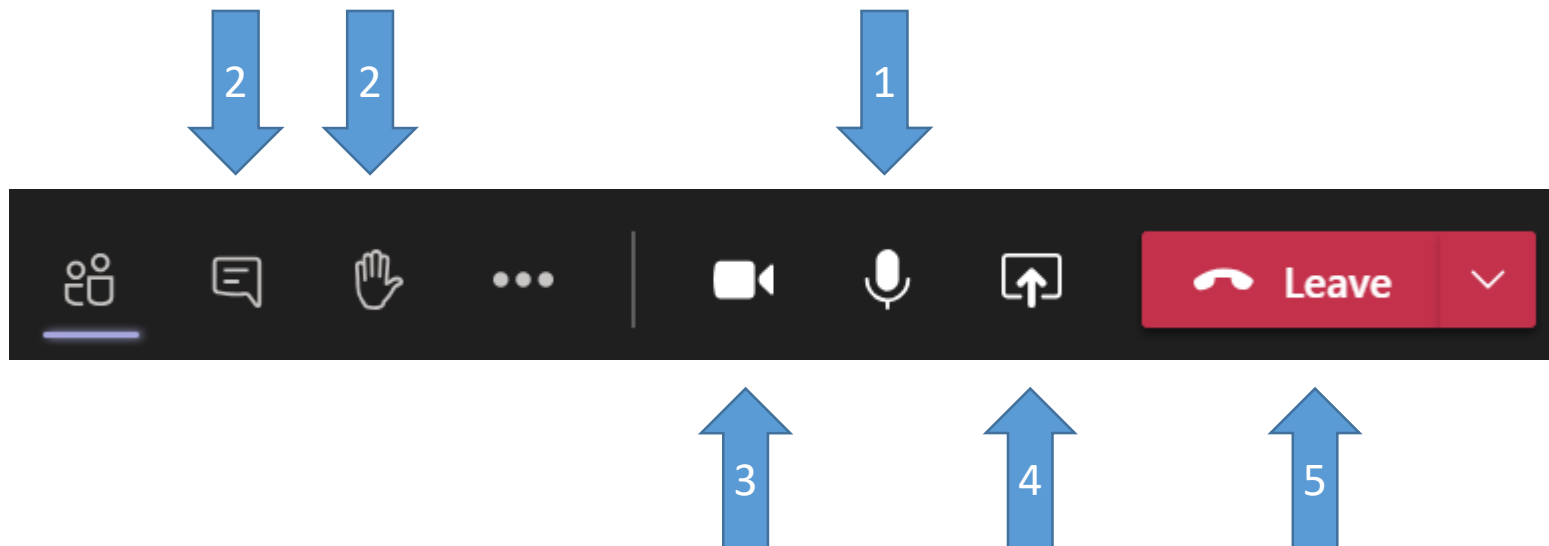


Superstructure 5: Fundamentals of Construction Technology



MS TEAMS HOUSEKEEPING

1. Mute your Microphone
2. Use Chat to Ask Questions or Put your hand Up
3. If you have a poor connection switch off Camera
4. I may ask you to share your screen.
5. When the lecture ends please hang up



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Search

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Activity

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FUNDAMENTALS OF CONSTRUC...

...

General

GROUND WORKS 2

GROUND WORKS 3

Groundworks 1

GROUNDWORKS 5

SUB-STRUCTURE and GROUNDWORK INTROD...

Superstructure wk1

1 hidden channel

FO

General

Posts

Files

Class Notebook

Assignments

Grades

Insights

+

↗ ↺

Meet

⌵

+ New ⌵

↑ Upload ⌵

↻ Sync

🔗 Copy link

↓ Download

+ Add cloud storage

🔗 Open in SharePoint

☰ All Documents ⌵

General

📄	Name ⌵	Modified ⌵	Modified By ⌵
📁	Class Materials		Alan Nantel
📄	ACBA4001 Assignment 1 - brief.docx	October 14	Oliver James Macki...
📄	ACBA4001 Assignment 1...		
📄	Assignment 1.docx		
📄	Borehole Log to print for		
📄	Construction Management		
📄	CPD Presentation.pptx		
📄	EXAMPLE-Site-Investigati		
📄	FOUNDATIONS1.pptx		
📄			

General > Superstructure Lectures

📄	Name ⌵	Modified ⌵	Modified By ⌵
📄	Fundamentals Con Tech Superstructure 1.pdf	November 10	Gavin Traylor
📄	Fundamentals Con Tech Superstructure 2.pdf	6 days ago	Gavin Traylor
📄	Wk 01 Superstructure - Introduction.mp4	6 days ago	Gavin Traylor
📄	Wk 01a Superstructure - Walls.mp4	6 days ago	Gavin Traylor
📄	Wk 02 Superstructure Walls Openings.mp4	6 days ago	Gavin Traylor
📄	Wk 02a Superstructure - Building Regs.mp4	6 days ago	Gavin Traylor

Fundamentals of Construction Technology (ACBA4001)

[Home](#)[My modules](#)[ACBA4001](#)

ExLibris
Leganto Online Resources List



Fundamentals of Construction Technology (ACBA4001)

PUBLISHED ACBA4001 (2019-20) 14 items in 2 sections

LIST SENT NEW SECTION ADD ITEMS +

Essential reading (4) Material which is an essential part of the course and students are expected to draw on as a core part of their learning. Must be available from the library and should be available online.

	BOOK Construction technology. 1, House construction Riley, Mike., Cotgrave, Alison., Third edition., Basingstoke, Hampshire :, Palgrave Macmillan, 2013., Total Pages vii, 382 pages, 8 pages of unnumbered plates : Essential Complete Check holdings	11
	BOOK Construction technology : industrial and commercial building. 2 Riley, Mike., Cotgrave, Alison., 3rd edition., Basingstoke :, Palgrave Macmillan, 2014., Total Pages 427 p. : Essential Complete Check holdings	8
	BOOK Building construction handbook Chudley, R., Greeno, Roger., 8th ed. , Oxford ;, Butterworth-Heinemann, 2010., Total Pages xi, 828 p. : Essential Complete Check holdings	6
	BOOK Architectural technology [electronic resource] Emmitt, Stephen., 2nd ed., Hoboken, N.J. :, Wiley-Blackwell, 2012., Total Pages 1 online resource (265 p.) Essential Complete Check availability >	2

Further reading (10)

ACBA 4001
FUNDAMENTALS OF CONSTRUCTION
TECHNOLOGY: LEVEL 4

Week 5:

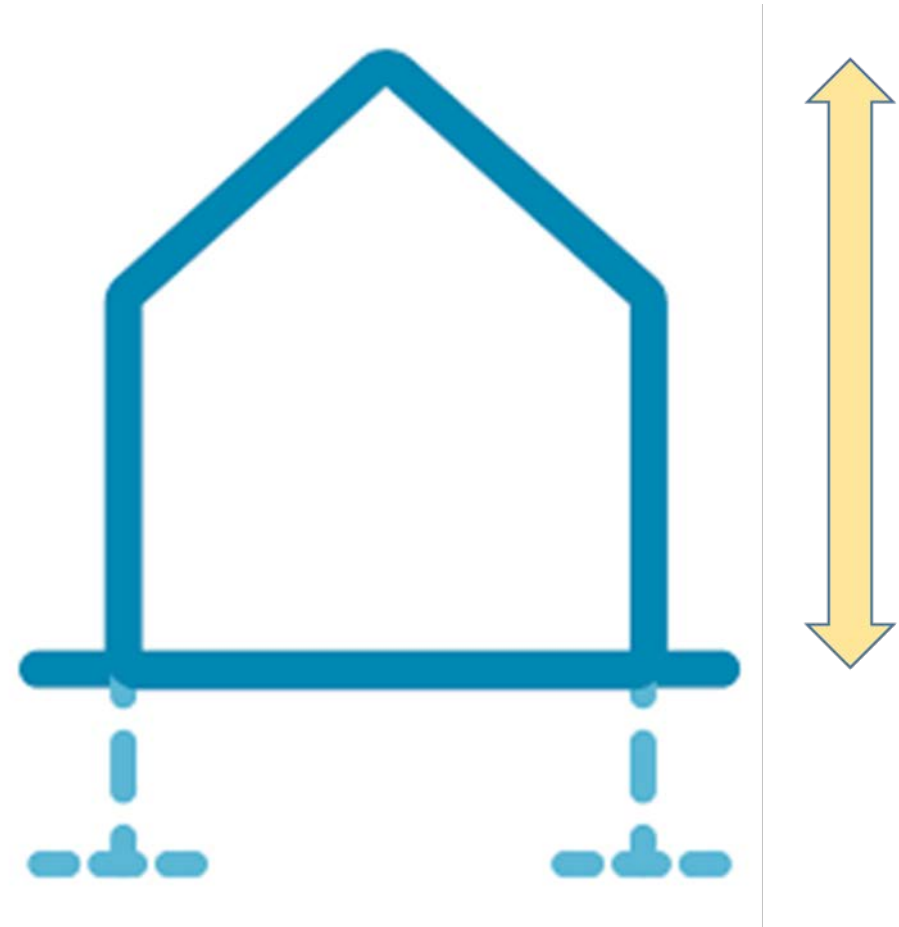
Recap on assignment

Structures

- Forces – Stress – Balance
- Types of structure

Structural Frames

- Timber
- Steel
- Concrete
- Mixed



Assessment 2

Submission
deadline:

22nd January 2021

Module Learning Outcomes (from module syllabus)

- Identify the different types of substructure available for a range of low-rise building systems and techniques used in their production.
- Define and produce annotated sketches that illustrate a broad range of common constructional forms, demonstrating understanding of their potential defect and repair needs.



APPENDIX GA36a

LEVEL 4 ASSESSMENT SPECIFICATION

Student name:		Student ID number:	
Programme:	Construction Portfolio		
Module:	Fundamentals of Construction Technology		
Module code:	ACBA4001	Contribution to Overall Module Assessment (%):	50%
Lecturer:	Gavin Traylor	Internal Verifier:	Allan Nantel
Assignment Title:	New Build Dwelling: Technical report with drawings	Word count (or equivalent):	2,500 words (or equivalent)
Submission deadline:	Friday 22 nd January	Return date of provisional marks & written feedback:	Within 20 working days
Submission method:	All written assessments, where practical and possible, must be submitted via Turnitin unless otherwise instructed by the Lecturer. (Please DO NOT put this assessment specification into Turnitin or it will match many similarities with other students' submissions.) Alternative submission method (if applicable): Late submission of the assessment will result in a late penalty mark. Penalties for late submission: Up to one week late, maximum mark of 40%. Over one week late, 0%. Only the Extenuating Circumstances Panel may approve a change to submission dates.		
Academic honesty / referencing:	Academic honesty is required. In the main body of your submission you must give credit to authors on whose research and ideas your work is based. Append to your submission a reference list that indicates the books, articles, etc. that you have used, cited or quoted in order to complete this assessment.		

Module Learning Outcomes (from module syllabus)

- Identify the different types of substructure available for a range of low-rise building systems and techniques used in their production.
- Define and produce annotated sketches that illustrate a broad range of common constructional forms, demonstrating understanding of their potential defect and repair needs.

Assessment 2

Submission
deadline:

22nd January 2021

New Build Dwelling: Technical report with drawings (weighting 100%)

Scenario:

You have been approached by Miss A Client who has received planning consent for her single, two storey detached domestic building. [See attached floor plans and elevations].

It is to be built on a level but reclaimed site, which prior to advanced ground works had been used as agricultural land. There is a retaining wall structure to the south of the site and the Ground Investigation report suggests a suitable raft foundation be constructed for the property.

The building is a timber framed construction where the inner skin of the 'cavity wall' is 140mm thick insulated C16 timber frame. The outer skin consists of stack bonded facing brick work and blockwork with a smooth render finish. Additional PIR insulation is contained within the cavity to improve the thermal performance. There is to be an insulated ground floor with underfloor heating in the screed with upper floors to be traditional solid timber with tongue and groove softwood flooring.

Windows and external doors are to be powder coated aluminium with triple-glazed units.

Roof structure is to be trussed rafters with a metal profile sheeting finish installed on OSB sheathing boards.

The client has asked you to prepare a technical report that addresses some of the construction details required as they are unfamiliar with timber frame construction. Your technical report should be graphical and contain the tasks highlighted below:

Assessment 2

Submission
deadline:

22nd January 2021

*The following tasks are allocated a percentage to emphasise the suggested **time** you should spend on each individual task. Marks will be allocated against the set Marking Criteria indicated on page 5.*

1. Produce **neatly drawn, proportionate and suitably annotated sections and sketches** that illustrate the materials and methods for the detailing of the following building elements and construction inter-faces. Ensure that detailing shows how the design will meet the current **Building Regulations for a domestic new-build**:

The Ground floor Construction, detailing and junctions with external walls. (20%)

The First floor Construction, detailing, junctions with external walls and restraints. (20%)

Eaves detailing and roof covering – indicating appropriate weathering, fixing and laps. (20%)

The main roof **structure**. Construction, detailing and fixing. (20%)

2. Given the specified roof structure and finish describe the advantages and disadvantages of such a method. Give an example of an alternative method of construction and describe what advantages or disadvantages that it may have. (10%)

3. Appropriate ventilation can play an important part of the design of a domestic building and is even more critical when considering a timber framed construction. Clearly describe the causes and sources of condensation, and the detrimental effects of condensation upon building fabric. (5%)

Using neat, annotated, proportional sketches where necessary, describe the appropriate methods of ventilation that will reduce condensation within this proposed building. (5%)

Assessment 2

Guidance specific to this assessment:

Engagement with Literature Skills

Where techniques are suggested in the report make reference to the sources such as the Building Regulations and Good Practice. Use sources such as the CIS.

Knowledge and Understanding Skills

Demonstrate your understanding of the methods and techniques. This will be assessed by the depth and awareness of a professional context within this scenario.

Cognitive and Intellectual Skills

Demonstrate your knowledge and skills and present the work in a coherent and professional manner. This will also be assessed by the quality of your evaluation and conclusions.

Practical Skills

This will be assessed via the scenario and how your knowledge has been applied.

Transferable Skills for Life and Professional Practice

The report and drawings should be presented in a professional manner with all work clearly labelled and cross-referenced.

Submission
deadline:

22nd January 2021

STUDENT FEEDBACK FORM		
This section details the extent to which the assessment criteria are demonstrated by you, which in turn determines your mark. The marks available for each category of skill are shown. Lecturers will use the space provided to comment on the achievement of the task(s), including those areas in which you have performed well and areas that would benefit from development/improvement.		
Generic Assessment Criteria	Marks available	Marks awarded
1. Engagement with Literature Skills	10	
2. Knowledge and Understanding Skills	25	
3. Cognitive and Intellectual Skills	25	
4. Practical Application Skills	25	
5. Transferable Skills for Life and Professional Practice	15	
Assessment Mark (Assessment marks are subject to ratification at the Exam Board. These comments and marks are to give feedback on module work and are for guidance only until they are confirmed.)	Late Submission Penalties (tick if appropriate) (Up to 1 week late (10% loss)) (Over 1 week late (20% loss))	%

Assessment 2

Submission
deadline:

22nd January 2021



FRONT VIEW

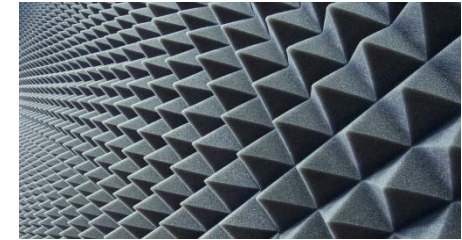
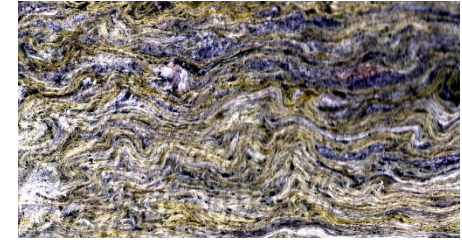


FRONT VIEW

The use of buildings to house people, equipment and processes have resulted in the development of buildings that can control these internal environments with greater accuracy.

As well as protection and enclosure we can now consider:

- Thermal Insulation and temperature control
- Acoustic insulation
- Provision of Light (natural and artificial)
- Controls for humidity and ventilation
- Exclusion of contaminants.



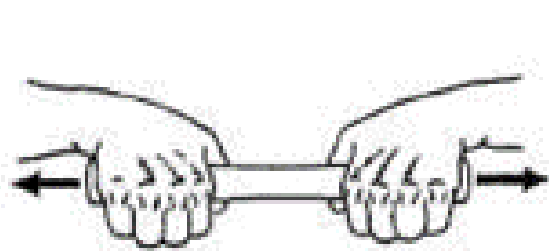
Performance Requirements of the Building Fabric

What are the key drivers in providing a building that is suitable for the need?

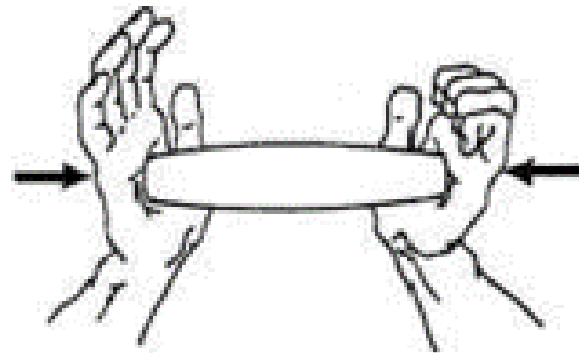
- Structurally Stable
- Durability
- Thermal insulation
- Protection from weather and exclusion of moisture
- Acoustic performance
- Flexibility to change to changing needs
- Aesthetics
- Buildability
- Sustainability



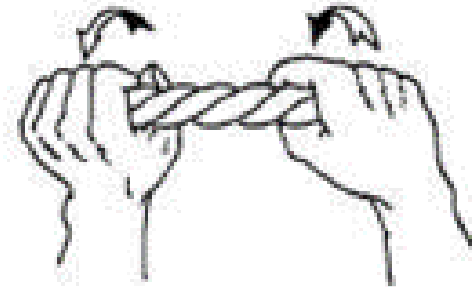
STRUCTURES



(A) TENSION



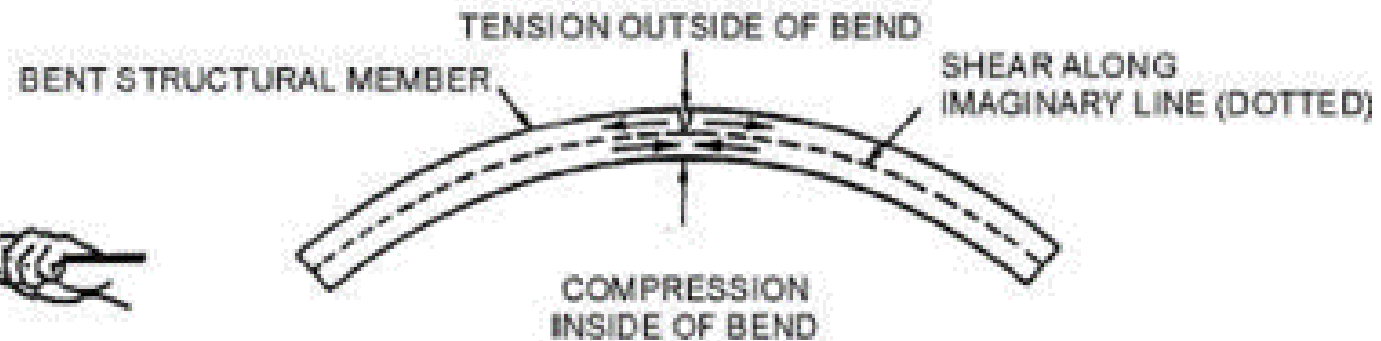
(B) COMPRESSION



(C) TORSIONAL



(D) SHEAR



(E) BENDING (THE COMBINATION STRESS)

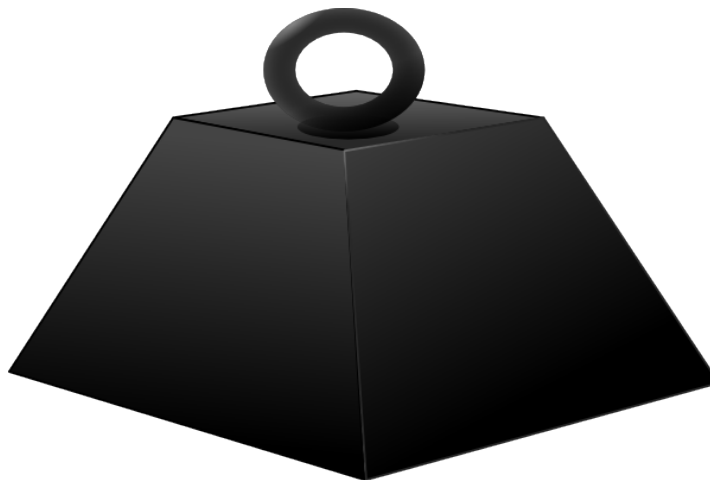
Art0401

Loads/Forces on Building Frames

Structural loads or actions are forces, deformations, or accelerations applied to a structure or its components

Loads cause stresses, deformations, and displacements in structures. Assessment of their effects is carried out by the methods of structural analysis. Excess load or overloading may cause structural failure, and hence such possibility should be either considered in the design or strictly controlled.

Dead load is the load from the self weight of the structure and whatever is permanently attached to it.



Live loads are loads that may or may not act, fully or partially, and vary with time and exact location on the structure.

Live Loads/Imposed/Transient



Environmental Loads

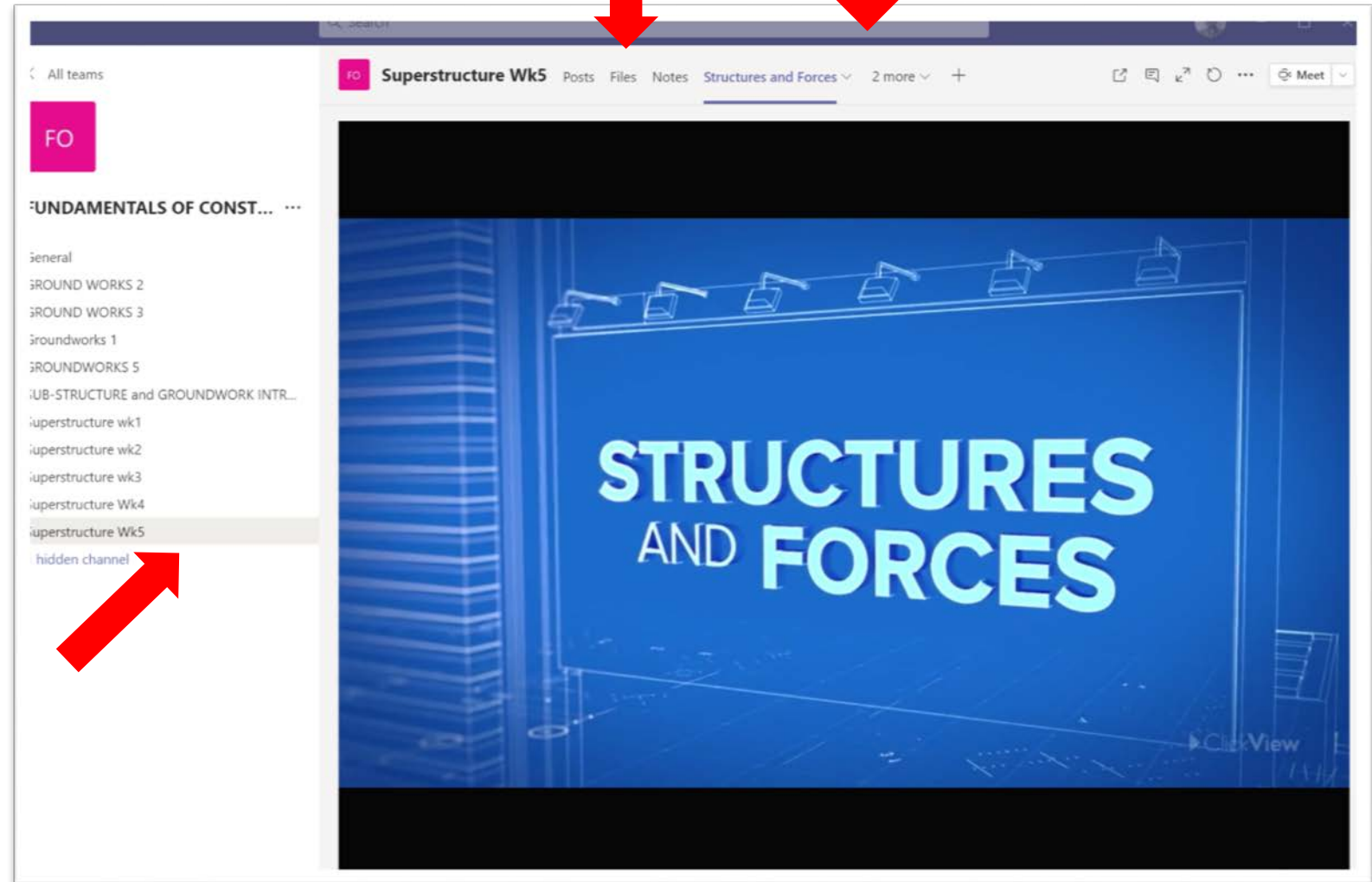


Structures: Forces – Stress – Balance

On Teams review the 3 videos

- Structures and Forces
- Structures and Stress
- Structures and Balance

Answer the questions on each Video saved under 'Files'



Structures and Forces:

- C

A force pushing a body in a sideways direction. (*Shear*)

A

A force stretching a body from end to end. (*Tension*)

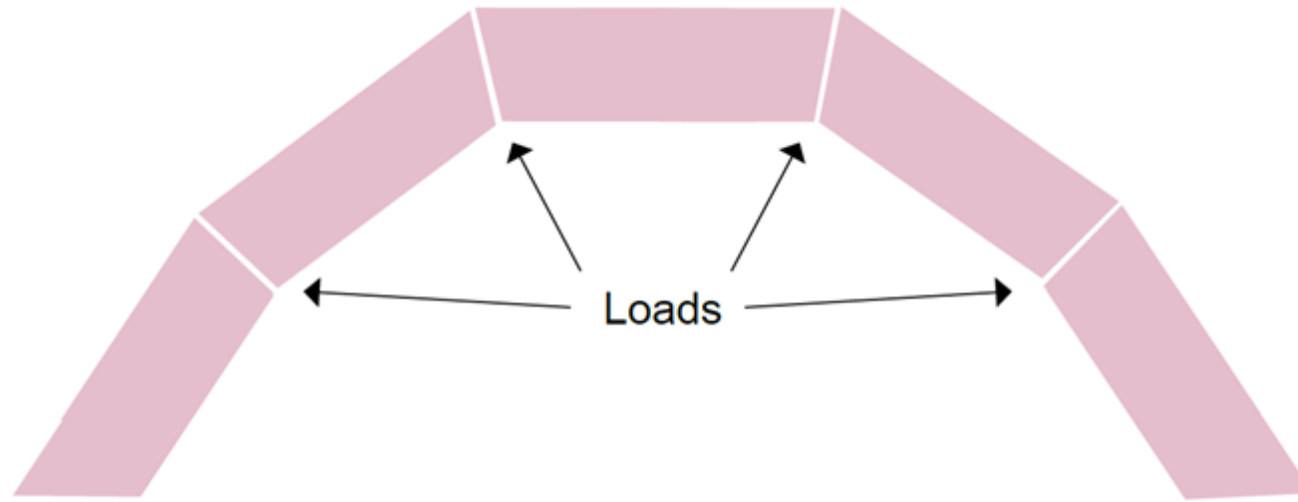
B

A force squeezing or squashing a body. (*Compression*)

D

A force twisting a body. (*Torsion*)
- A key part of good design is being able to identify the **forces** acting on structures and how to **balance** or counteract them.
- a) Inflating a balloon; b) Pulling back an archer's bow; d) Erecting a tent
- A power line is supported only at its ends by two power poles. There is tension on the cable, as it is stretching from one pole to the other. It doesn't matter how far the poles are apart, gravity will always cause the cable to sag in the middle, creating a catenary curve.

5.

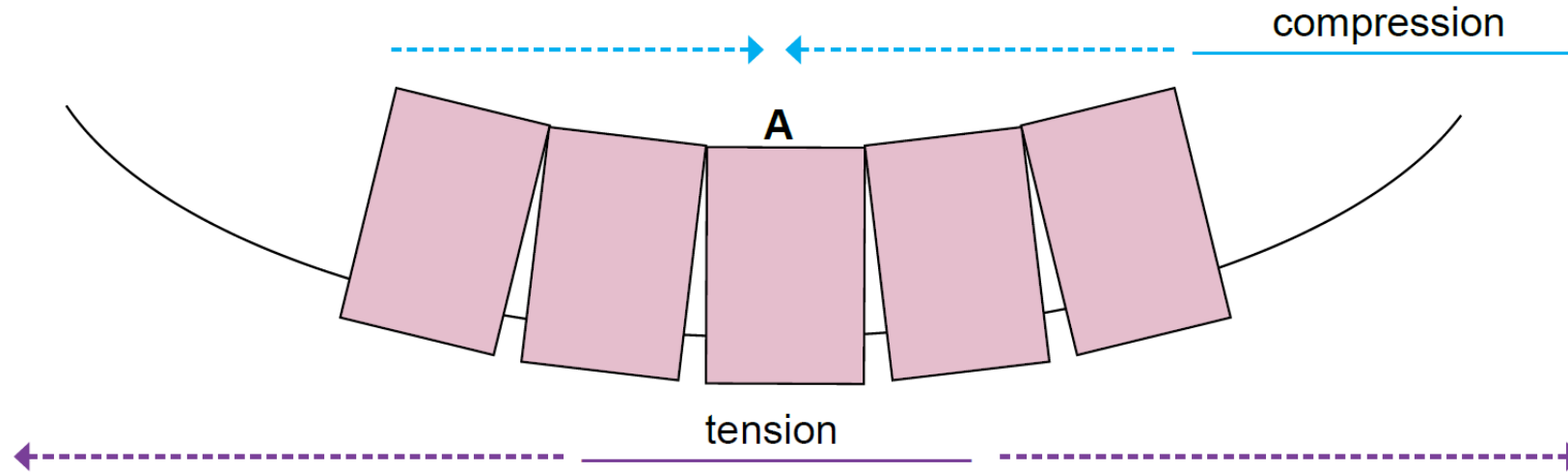


6. Arches form when compression forces are distributed evenly throughout the material. The Romans leaned stones against each other, using compression forces to hold them in place. The heavier the load, the tighter the stones pressed together, creating a stable arch without cement.
7. The weight of the load on a bicycle (i.e. the rider) needs to be counteracted by the tension of the spokes on the wheels. If some spokes are removed, the remaining ones will be put under more compression force by the rider and may fail.
8. True

Structures and Stress:

1. Bending occurs when a **perpendicular** force is applied to an object along its longitudinal axis, or along its **longest** dimension.

2.



3. d) steel.
4. a) Tightening the reinforcements to compress a material, such as concrete, before putting it in place is called **pre-stressing/pre-tensioning**.
b) Tightening the reinforcements after a structure has been built is called **post-tensioning**.

5. c)



6. The steel reinforcing cables provide strength where the concrete is weak in tension. For example, the base of the bridge is under tension where it is between two supports, so the reinforcement needs to be along the base.
7. If a bridge is not reinforced for torsion, or a twisting force, it might twist in the wind and ultimately fail.
8. Shear is a pair of sideways forces going in opposite directions. This gives metal shears their name because they cause a material to break as the two blades apply shear force to whatever is in between them.

Structures and Balance:

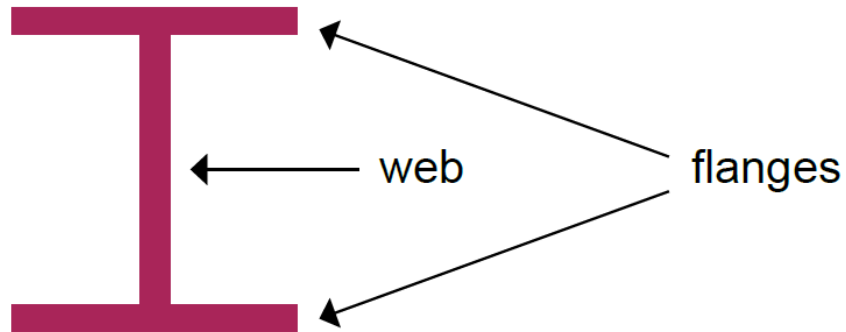
1. A column is a **vertical support**, which sits on the ground or is partially buried in the foundation.
2. When a load is added to the top of a column, it may buckle under the weight of the load if it is not rigid or braced enough using guy ropes.
3. a) the less guy ropes are required.
4. A cantilever is a type of **lever** with a long beam, or girder, that's fixed at **one end**.
5. b) **A** = tension **B** = compression
6. Student responses may vary, however examples mentioned in the video include (human) arms, street lamps, some street signs, cranes, cantilever bridges, aeroplane wings.

7. c) C

8. The very end of a cantilever arm cannot take heavy loads because of the leverage offered by the fulcrum, which is far away. The closer to the crane tower, the heavier the loads the crane can lift because the leverage offered by the fulcrum is less.

9. Beams are **horizontal** and can take loads along their entire **length**.

10.



11. I-beams use less steel or timber than solid beams, so they are lighter (and also therefore cheaper), but just as strong.

Structural Systems

The term **structural system** or **structural frame** in structural engineering refers to the load-resisting sub-system of a structure.

The structural system transfers loads through interconnected structural components or members.



Commonly used structures can be classified into five major categories:

However, any two or more of the basic structural types described in the following may be combined in a single structure, such as a building or a bridge in order to meet the structure's functional requirements.

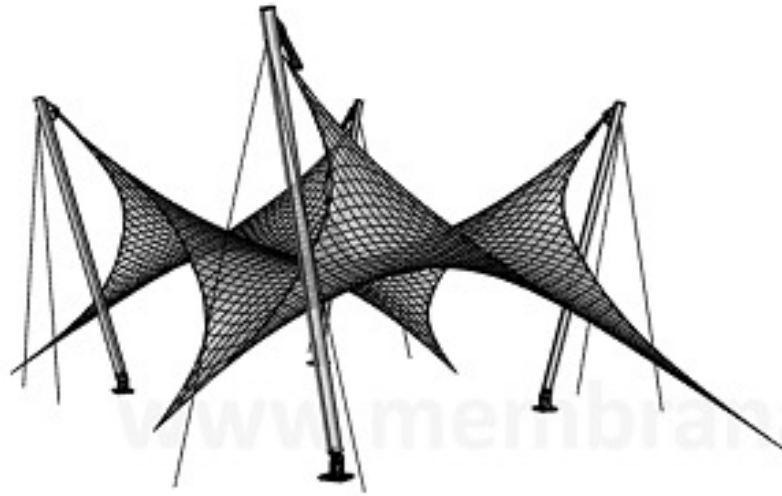
- Tensile structures
- Compressive structures
- Trusses
- Shear structures
- Bending structures

Tensile structures

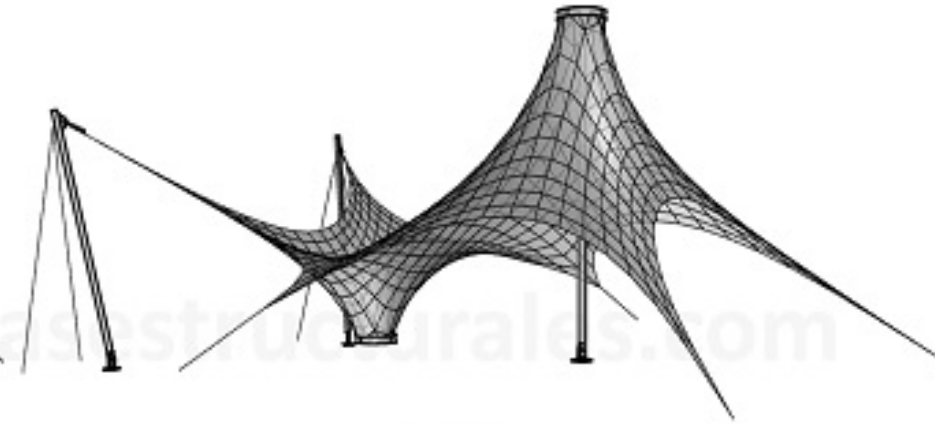
Members of tensile structures are subject to pure tension under the action of external loads. Because the tensile stress is uniformly distributed over the cross-sectional area of members, the material of such a structure is utilized in the most efficient manner.



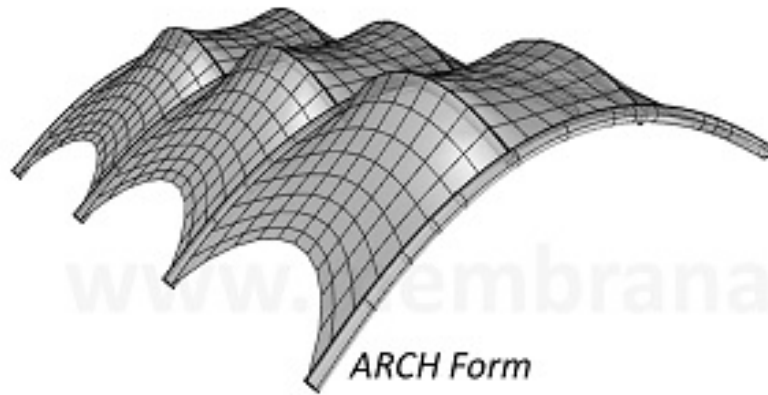




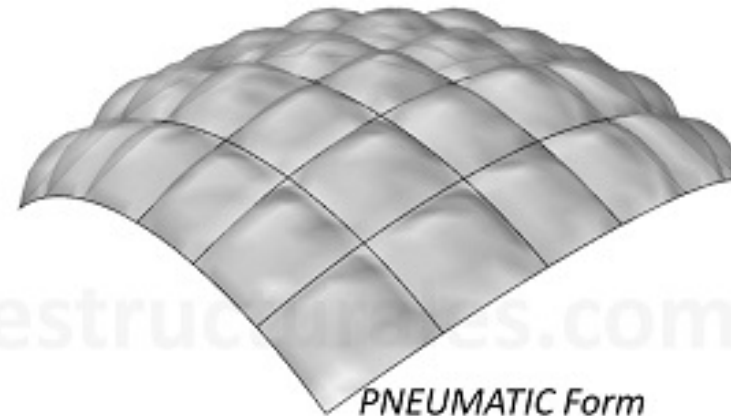
HYPAR Form



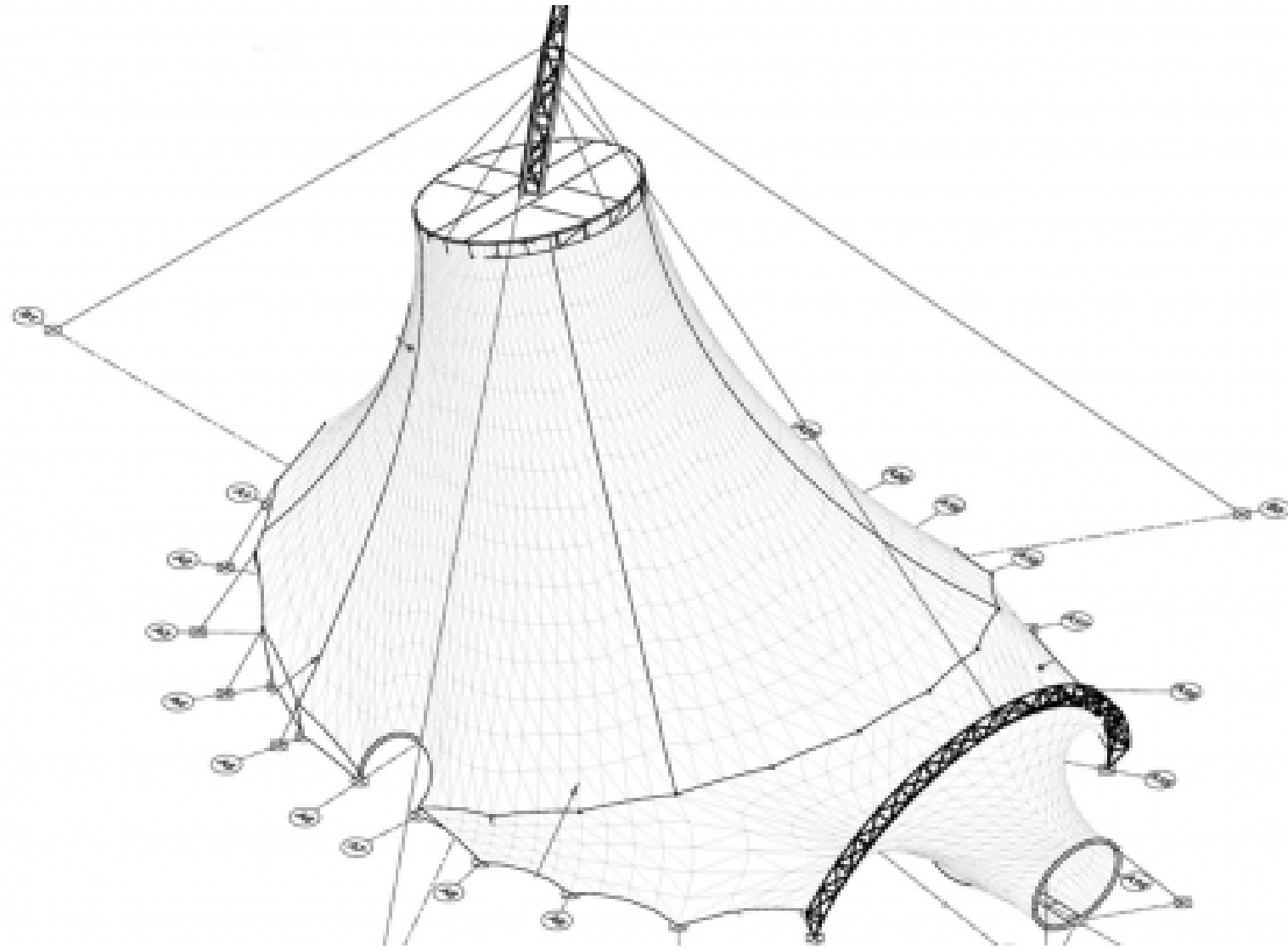
CONIC Form



ARCH Form



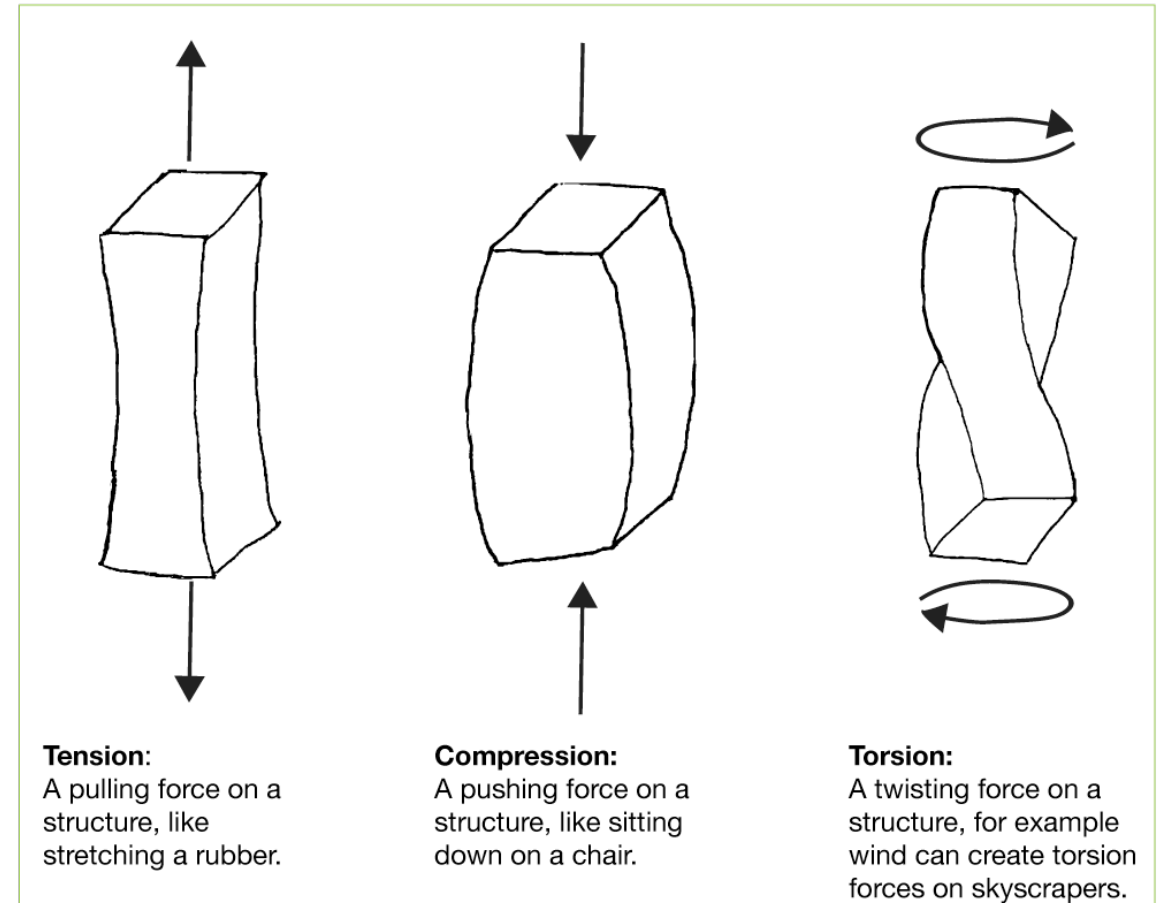
PNEUMATIC Form

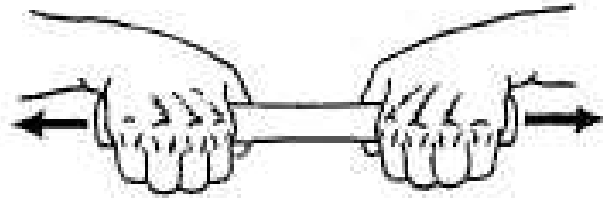




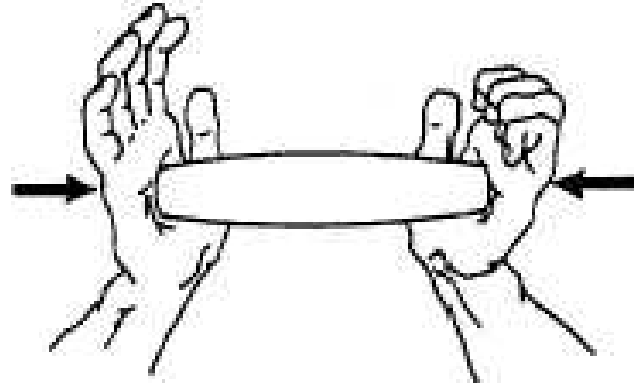
Compressive structures

Compression structures develop mainly compressive stresses under the action of axial loads. Because compressive structures are susceptible to buckling or instability, the possibility of these failures should be considered in their design. If necessary, adequate bracing must be provided to avoid such failures.

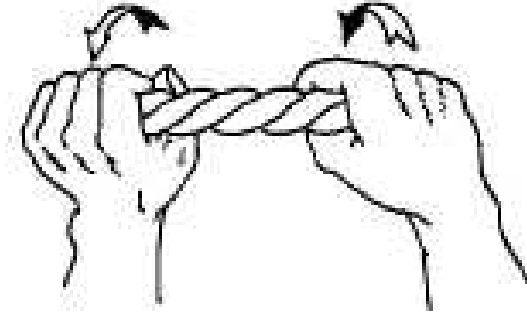




(A) TENSION



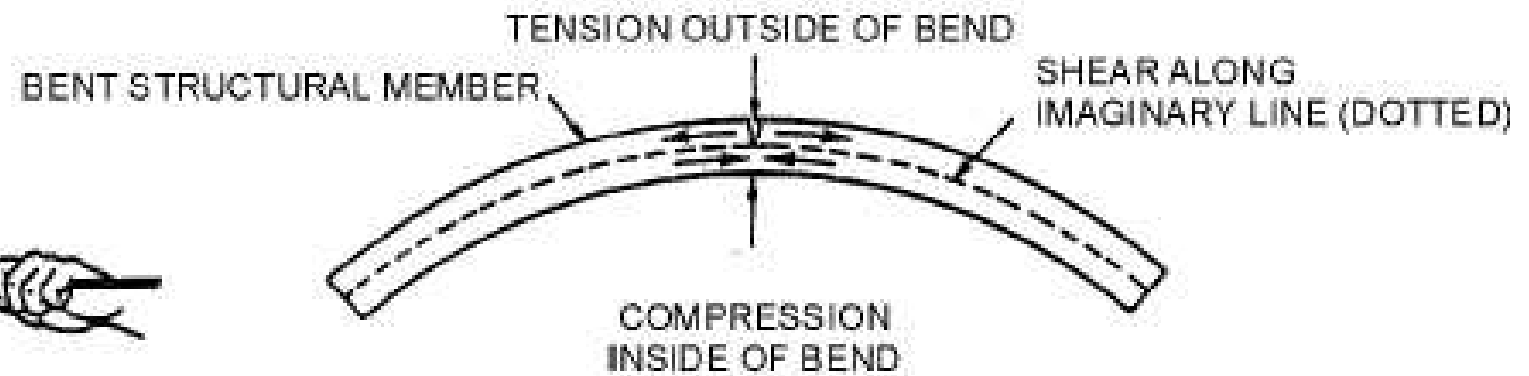
(B) COMPRESSION



(C) TORSIONAL



(D) SHEAR



(E) BENDING (THE COMBINATION STRESS)

Ans#401

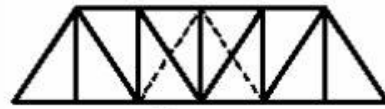


Figure 13 Completed shell and a demonstration of the structural strength



Trusses

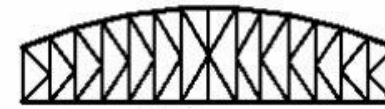
Trusses are composed of straight members connected at their ends by hinged connections to form a stable configuration. Because of their light weight and high strength, they are among the most commonly used types of structure.



Pratt



Parker



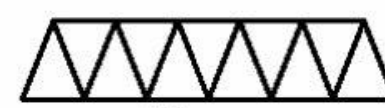
K-Truss



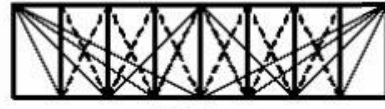
Howe



Camelback



Warren



Fink



Double Intersection Pratt



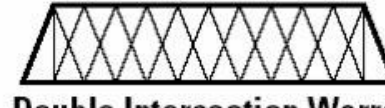
Warren (with Verticals)



Bowstring



Baltimore



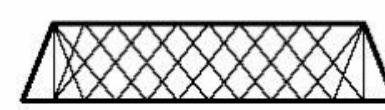
Double Intersection Warren



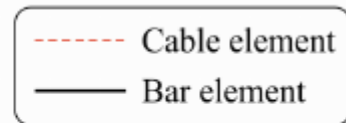
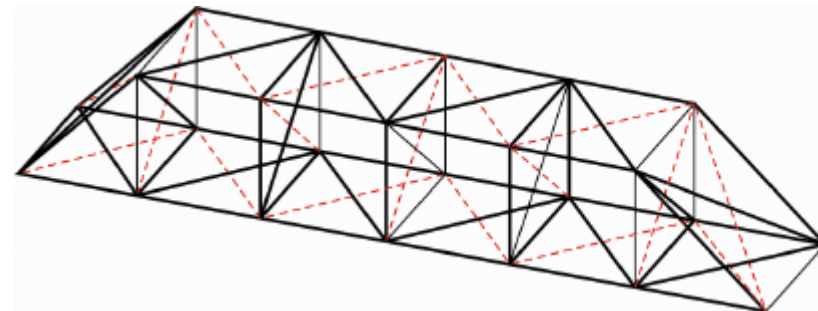
Waddell "A" Truss

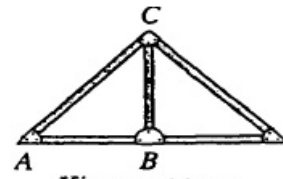


Pennsylvania

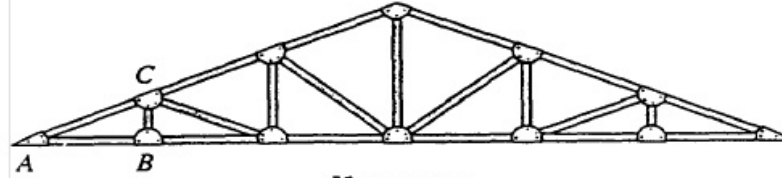


Lattice

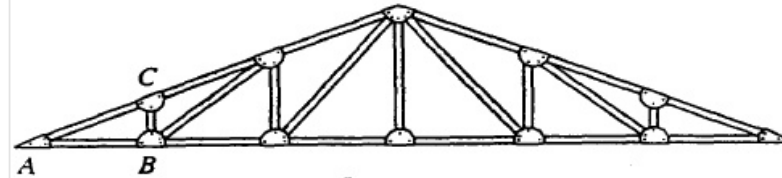




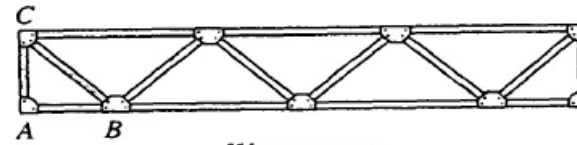
King post truss



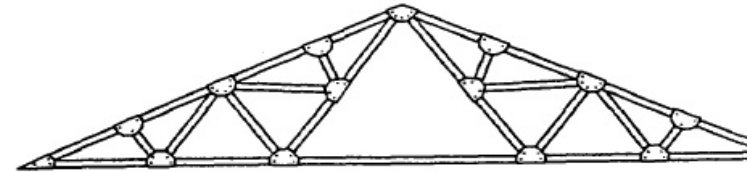
Howe truss



Pratt truss



Warren truss



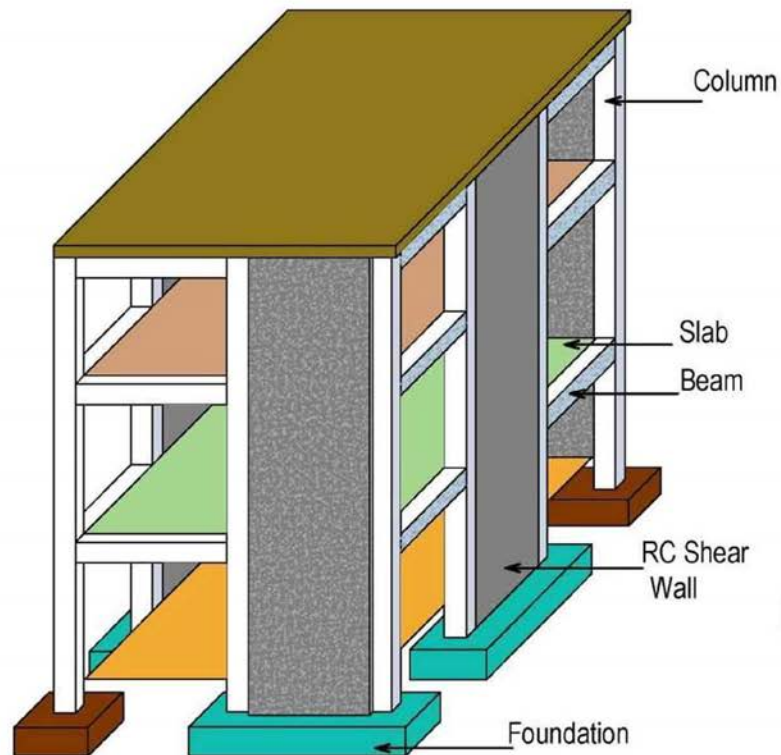
Fink truss

Common Roof Trusses

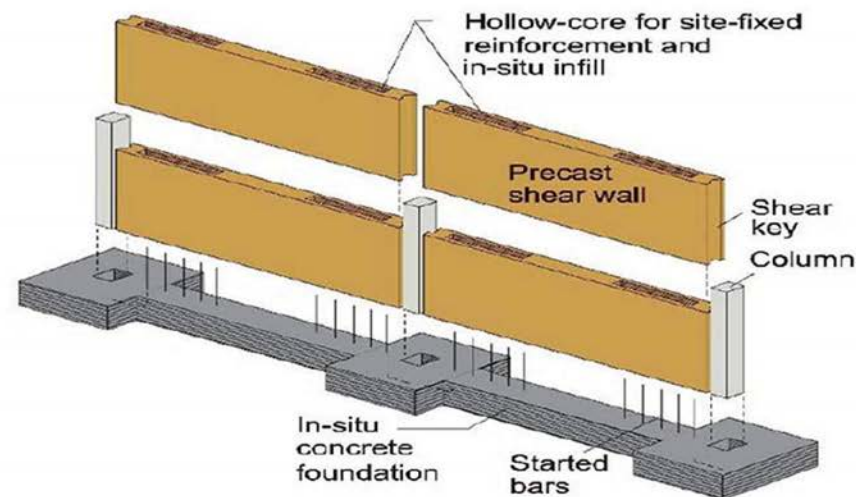


Shear structures

These are structures such as reinforced concrete or wooden shear walls, which are used in multi-story buildings to reduce lateral movements due to wind loads and earthquake excitations. Shear structures develop mainly in-plane shear with relatively small bending stresses under the action of external loads.

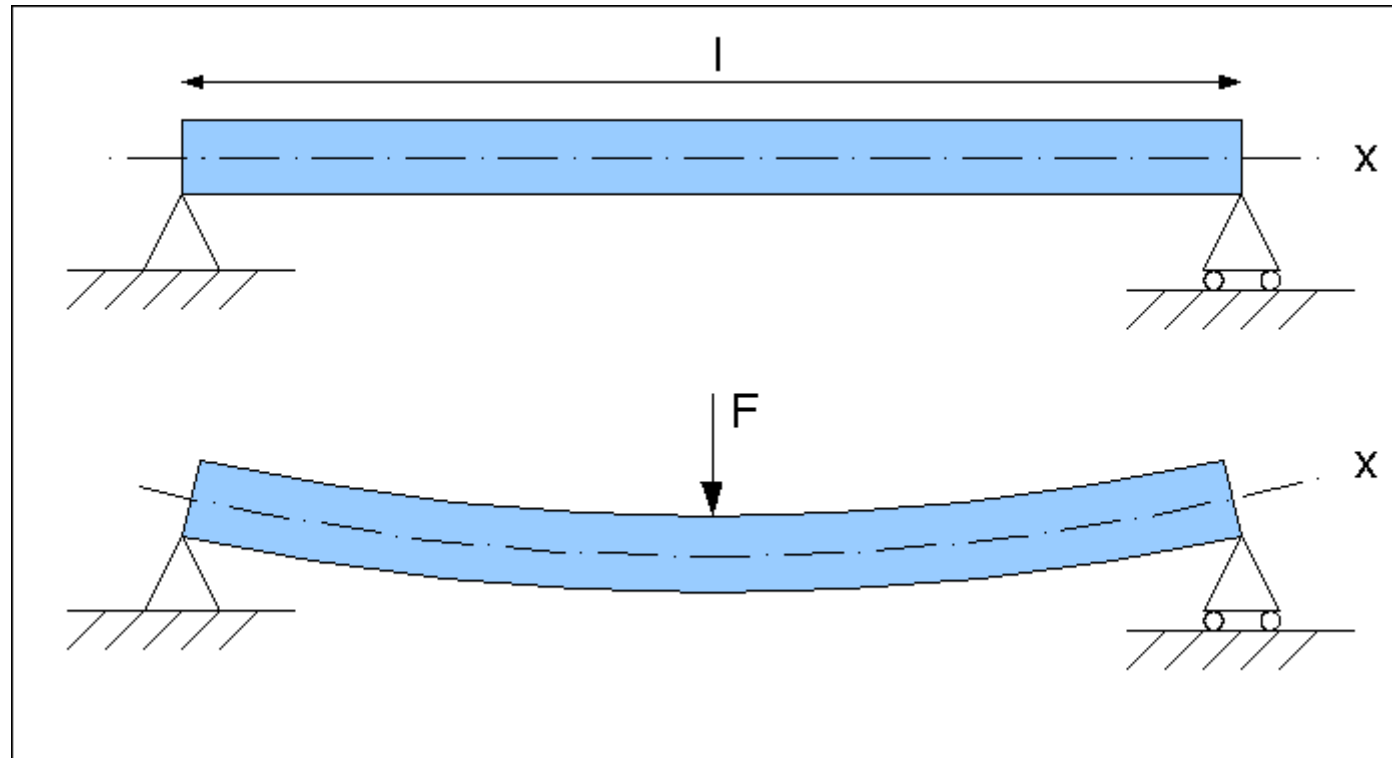


Difference Between Shear Wall And Column



Bending structures

Bending structures develop mainly bending stresses under the action of external loads. The shear stresses associated with the changes in bending moments may also be significant, and should be considered in their design.







Waterloo Station

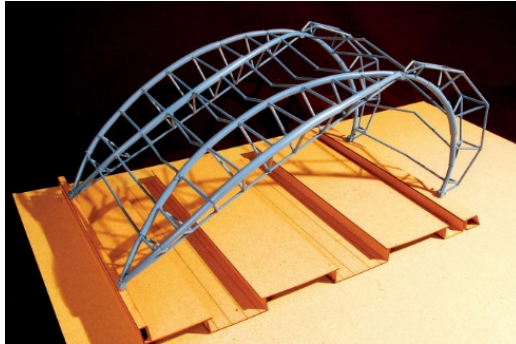
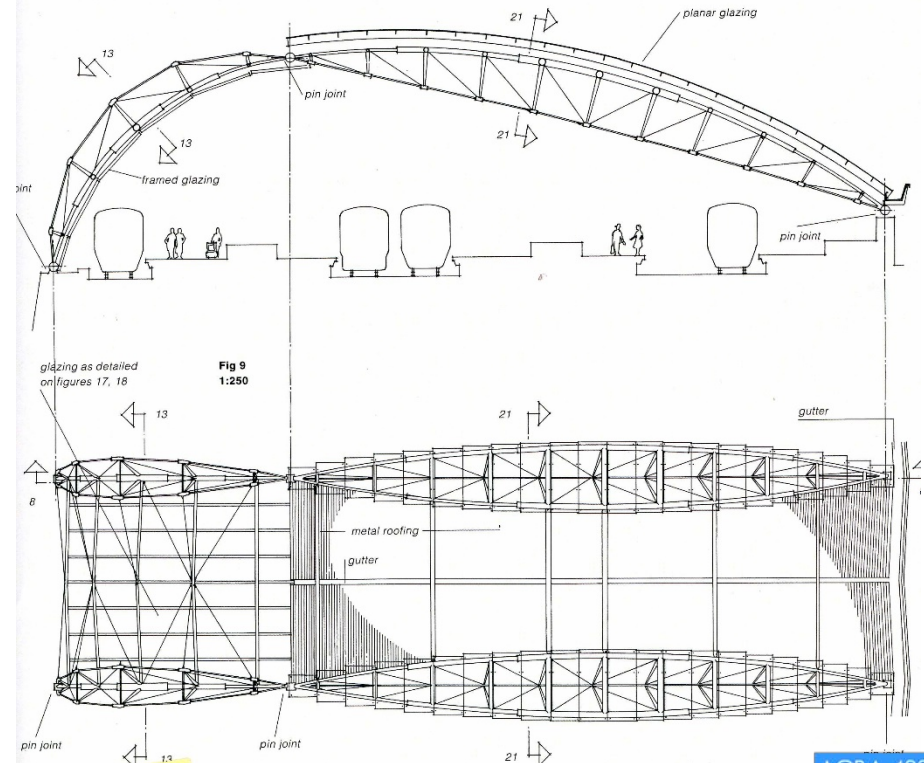


Fig 8
1:250

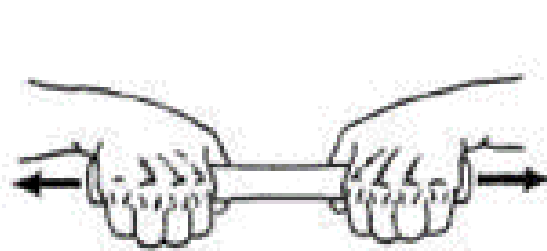


8. Cross section looking in the opposite direction to figure 20;
9. Plan of bay at northern end of vault

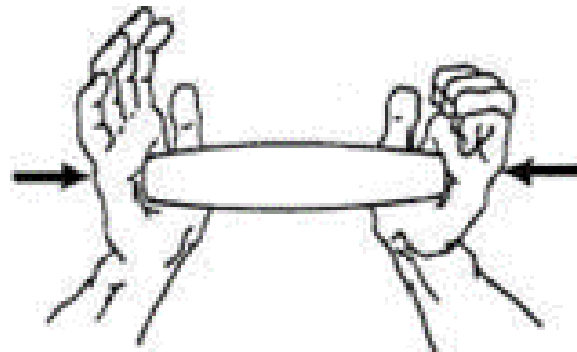


STRUCTURE FRAMES

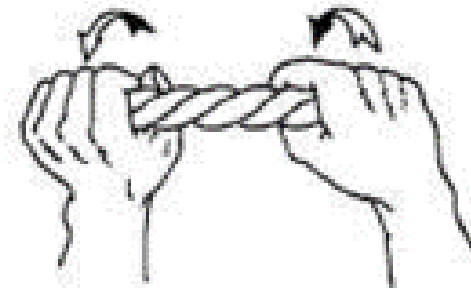
Introduction



(A) TENSION



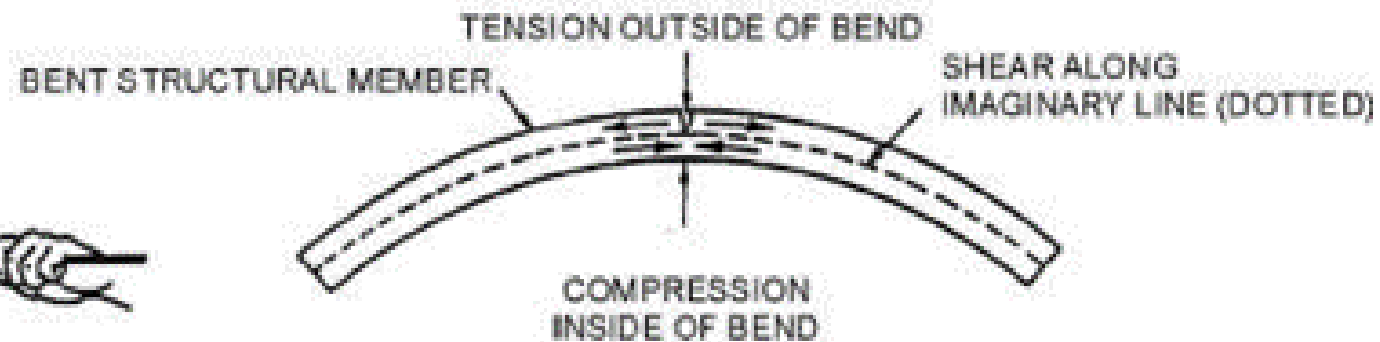
(B) COMPRESSION



(C) TORSIONAL



(D) SHEAR



(E) BENDING (THE COMBINATION STRESS)

Art0401

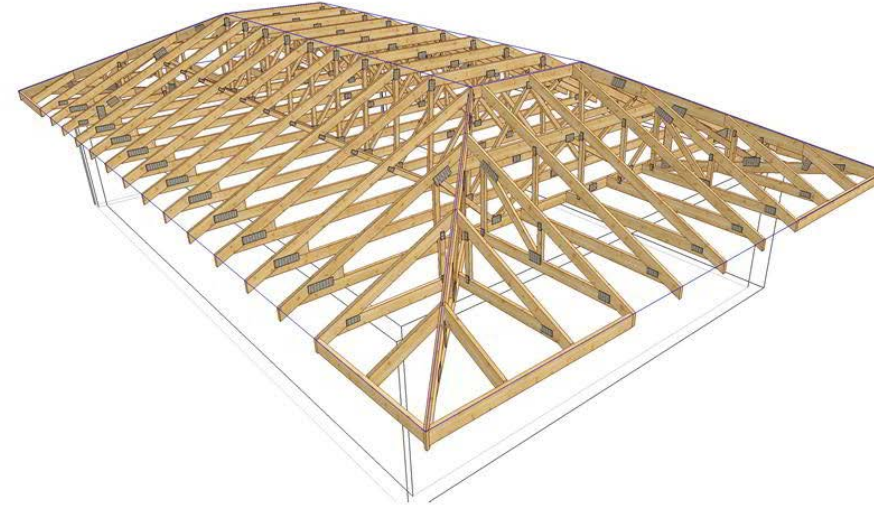
Materials used in structural frames

- Timber
- Steel
 - Standard sections
 - Compound elements
- Concrete
 - Mass concrete
 - Reinforced concrete
 - Precast concrete frames
- Mixed

Timber

Characteristics

- Tensile strength
- Light weight
- Aspect
- Conservation
- Deformation



Use

- Laminated wood
- Building roofs
- Beams
- sheets



Timber Frame Construction

Timber frame is very much on the ascendancy as a mainstream construction method for dwellings and medium rise buildings in the UK. Financial and time savings are there to be had providing the method of construction is understood.

Timber frame construction is not a system of building, although there are a number of well-researched systems that use timber frame as a basis.

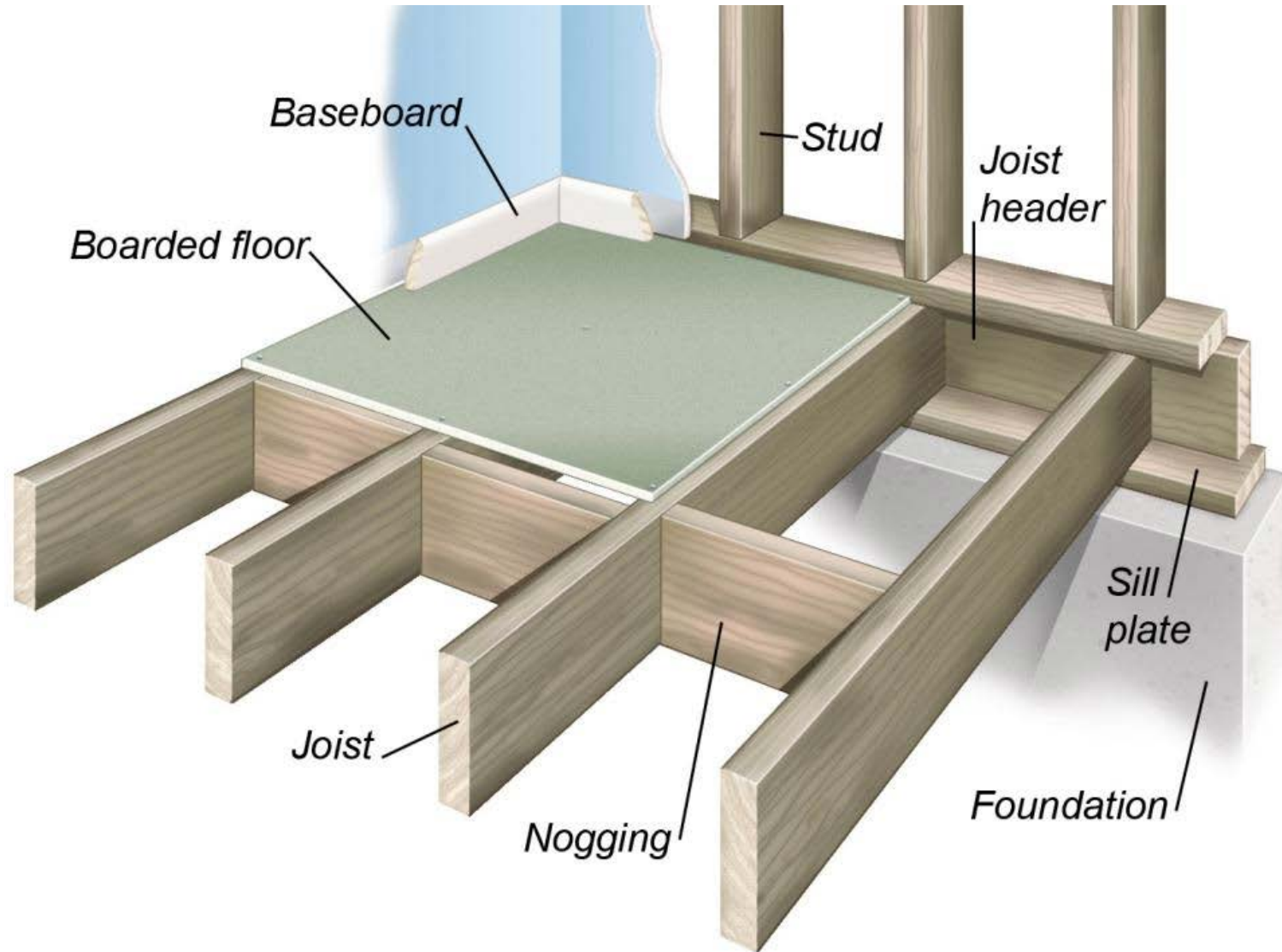
Timber frame construction uses timber studs and rails, together with a structural sheathing board, to form a structural frame that transmits all vertical and horizontal loads to the foundations.

Timber Frame Construction

Platform frame is the most commonly used method in the UK. Each storey is framed with floor-to-ceiling height panels and the floor deck of one floor becomes the erection platform of the next.



Timber Frame Construction





Timber Frame Construction

Other timber building methods include:

SIPs (structural insulated panels) consist of a layer of oriented strand board (OSB) bonded onto each side of an insulating foam core. These composite engineered products can be used as a structural loadbearing element.

<https://www.macmillanihe.com/companion/Riley-Construction-Technology-1/resources-zone/Chapter-07-Case-Study-3/>



Timber Frame Construction



Timber Frame Construction

CLT (cross-laminated timber) uses wood panels in which the thickness is made up of a number of narrow widths of timber laid together with each layer at right angles to the previous layer. These panels can be pre-cut in the factory to form wall, roof and floor elements.



Timber Frame Construction



Timber Frame Construction

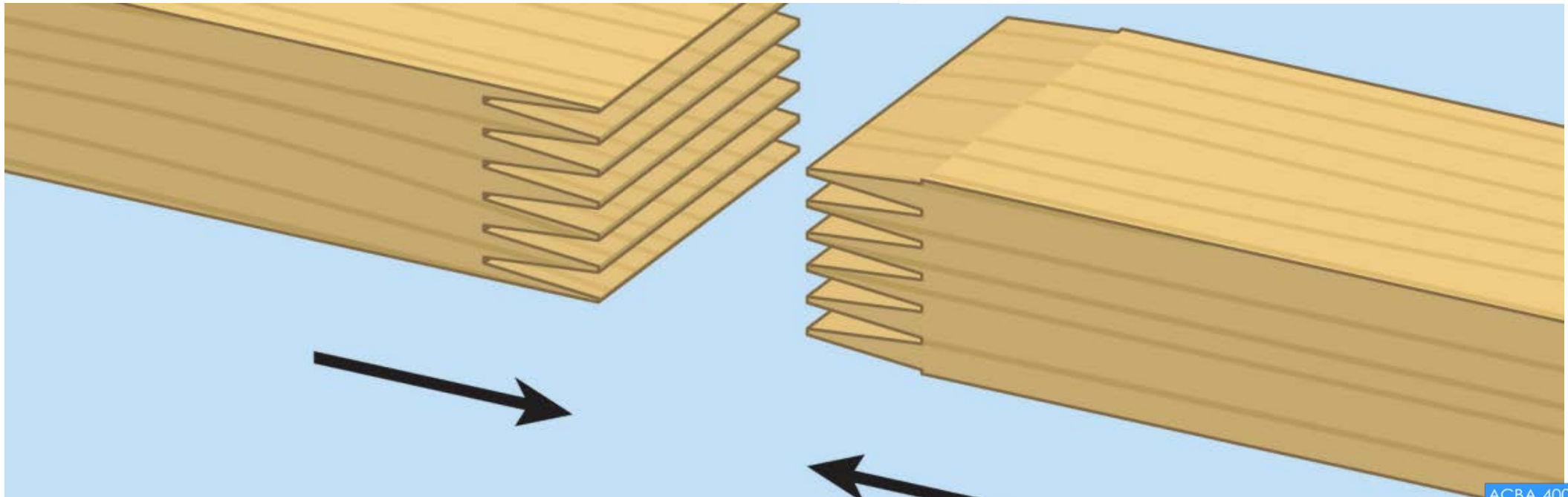
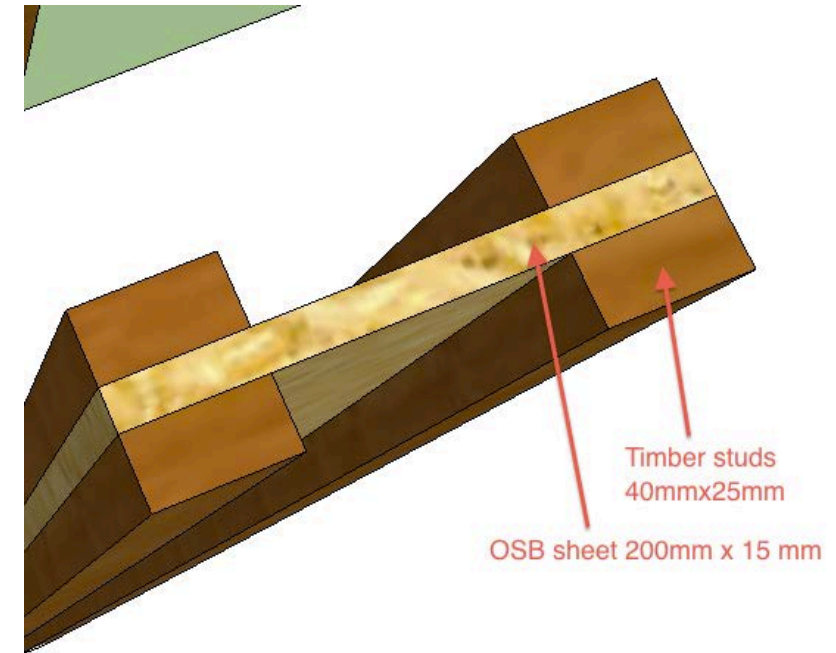


Timber Frame Construction

Engineered stud is a simple way to allow a large depth of insulation to be installed between the loadbearing timber studs used for timber frame wall panels. A number of different types of engineered stud are available, using either I-joist or metal web joist designs.



Timber Frame Construction



Timber Frame Construction



Timber Frame Construction



Timber Frame Construction

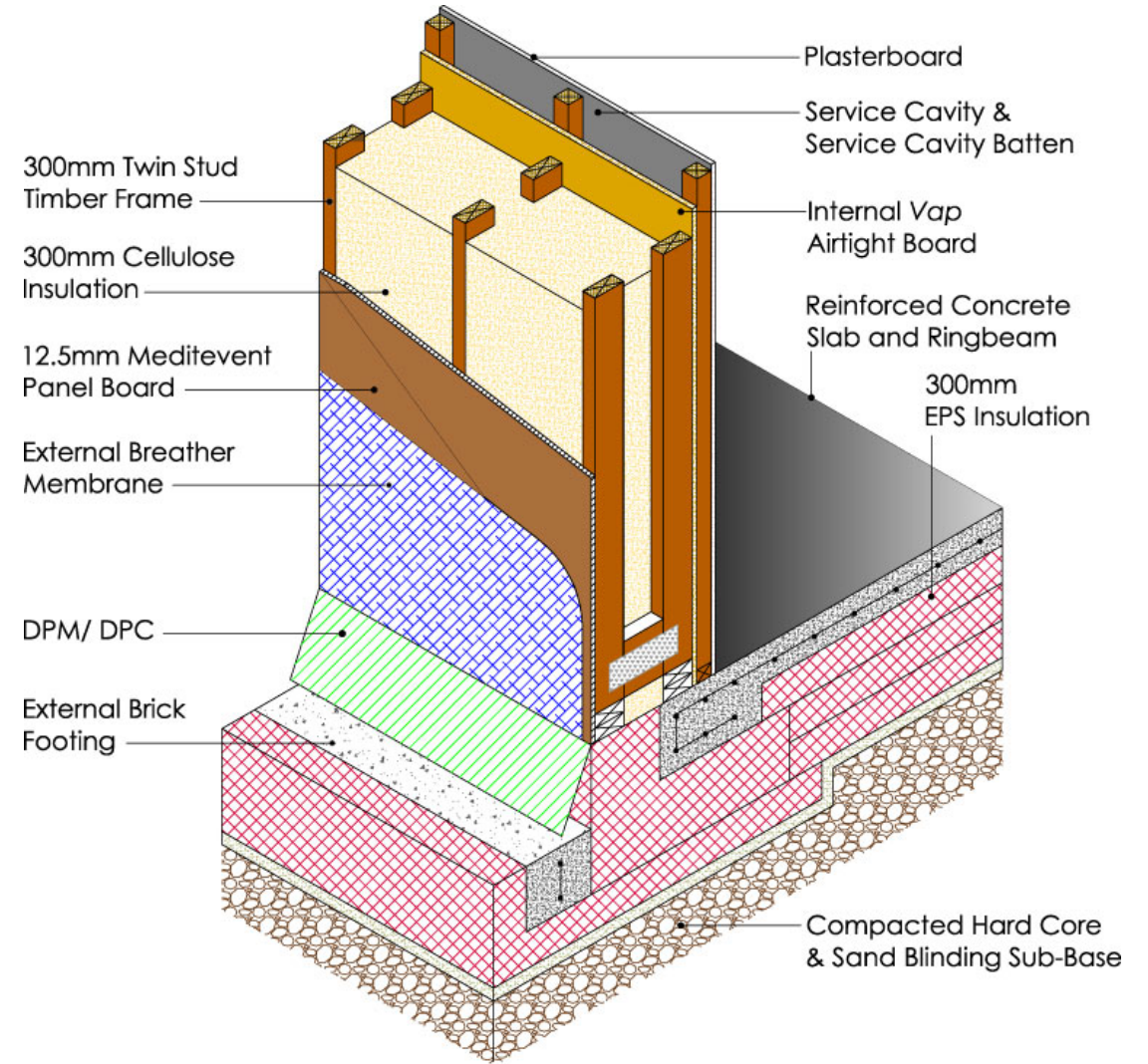


Timber Frame Construction



Timber Frame Construction

Twin stud is two timber frame stud walls in parallel, separated by a cavity, but only one of these carries the vertical load of the building.



Passive Wall & Foundation Junction

Timber Frame Construction



Timber Frame Construction

Current timber frame construction incorporates high levels of insulation within structural elements, but clients are now seeking designs that can deliver improved thermal performance.

This can be achieved by using:

- deeper solid timber studs
- deep engineered timber studs (typically timber I-joists or open web joists)
- additional layers of insulation material (internally or externally)
- novel construction methods such as SIPs

Timber Frame Construction

Options for improving the thermal performance of existing timber frame buildings include:

- improving airtightness
- increasing roof insulation
- upgrading windows
- adding floor insulation
- upgrading wall insulation.

Timber Frame Construction

Fire protection

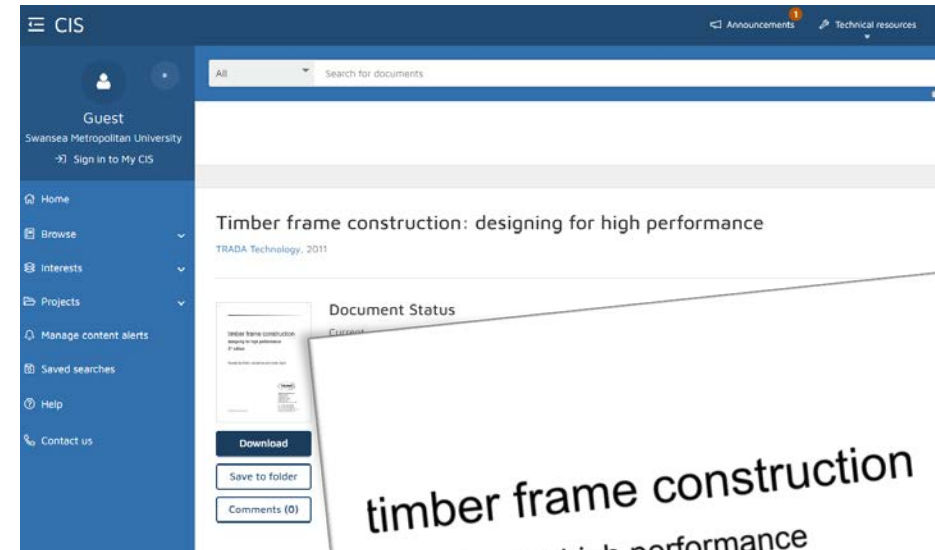
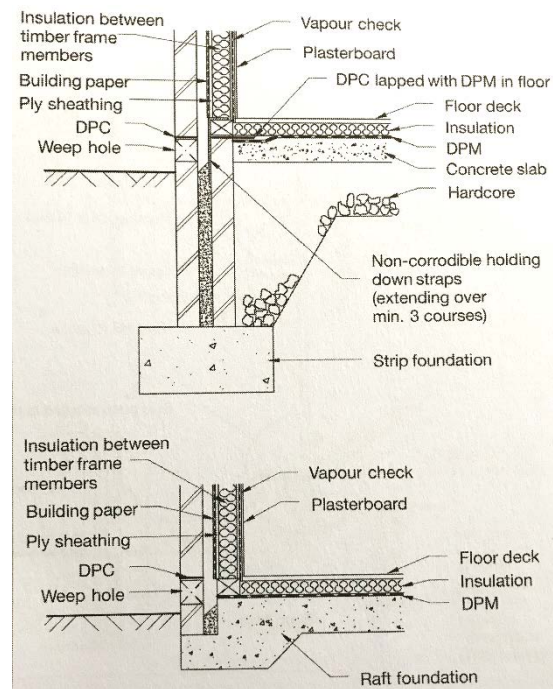
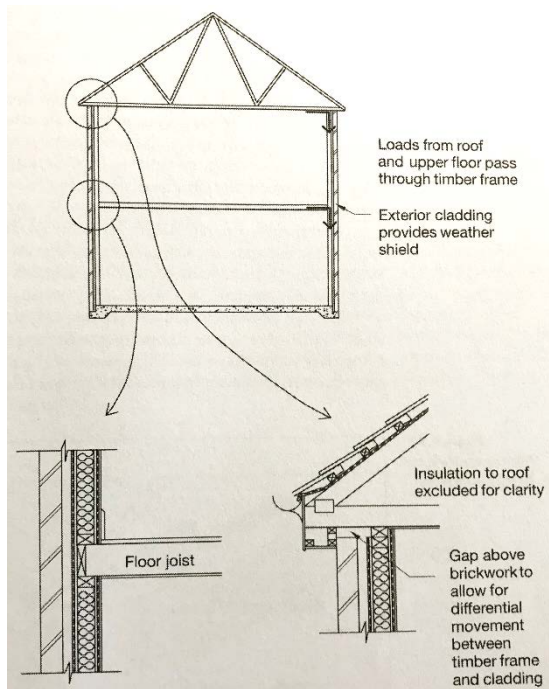
All forms of construction need to comply with the fire performance requirements laid down by national building regulations. Timber frame dwellings have no difficulty in meeting the required levels, given correct design, standards of manufacture and workmanship. The following are important considerations:

- Internal linings, usually plasterboard, limit the potential for a fire to develop and provide the period of fire resistance required by the building regulation.
- Cavity barriers prevent a fire from entering a cavity and prevent a fire from escaping to an adjacent cavity zone. **Their correct installation on a timber frame site is of paramount importance.**

Timber Frame Construction

Sources for Timber construction

<https://www.macmillanihe.com/companion/Riley-Construction-Technology-1/resources-zone/Chapter-07-Case-Study-2/>



timber frame construction
designing for high performance
5th edition

Revised by Robin Lancashire and Lewis Taylor



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Steel

Characteristics

- High compression and tension strength
- Relatively light weight
- Beams and columns
- Wires and cables
- Made before arriving at the site
- Large deformation

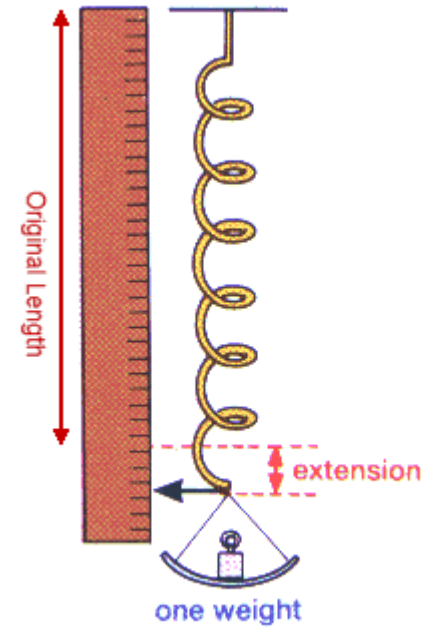
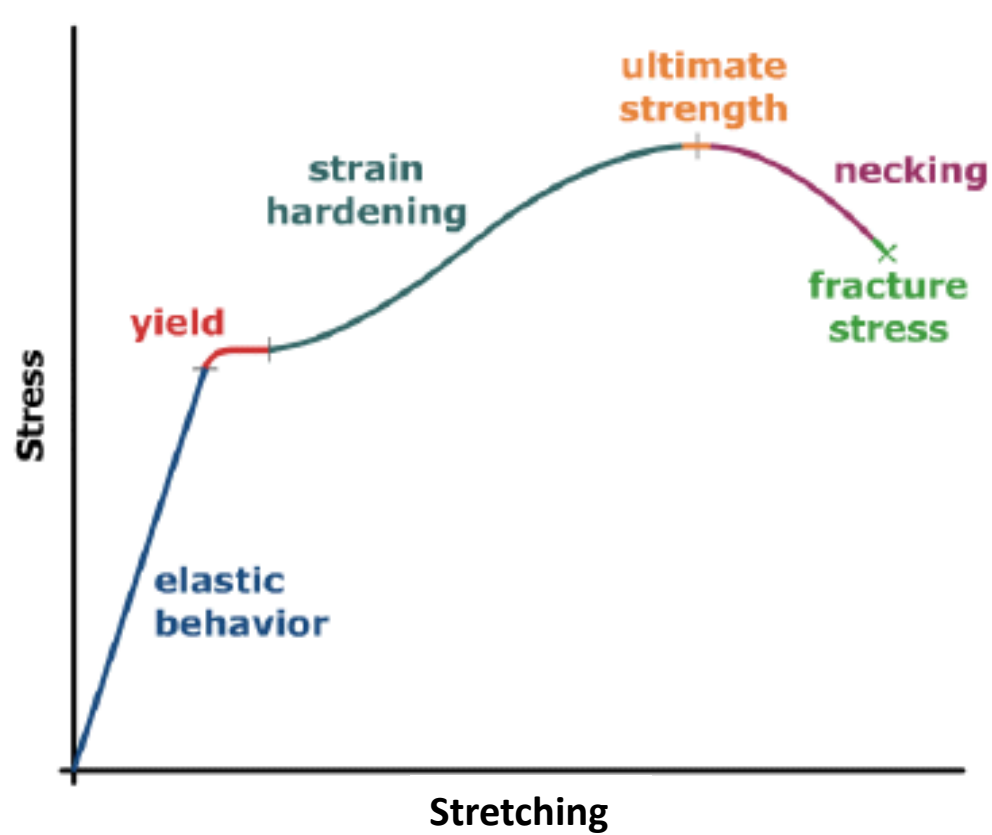


Uses

- Buildings
- Industrial buildings

Steel

Hooke's law



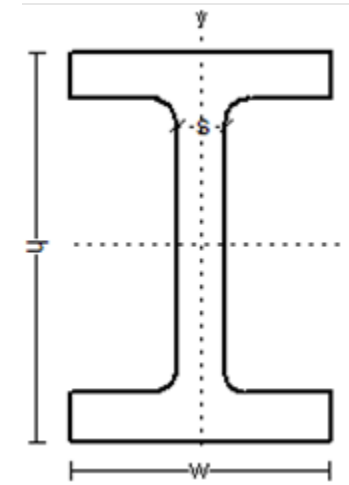
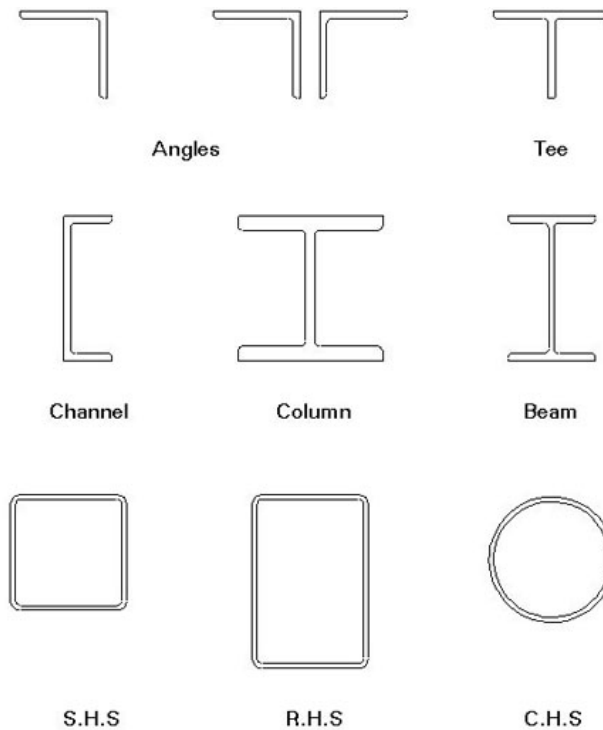
https://youtu.be/kw_kthwCdNY

Steel

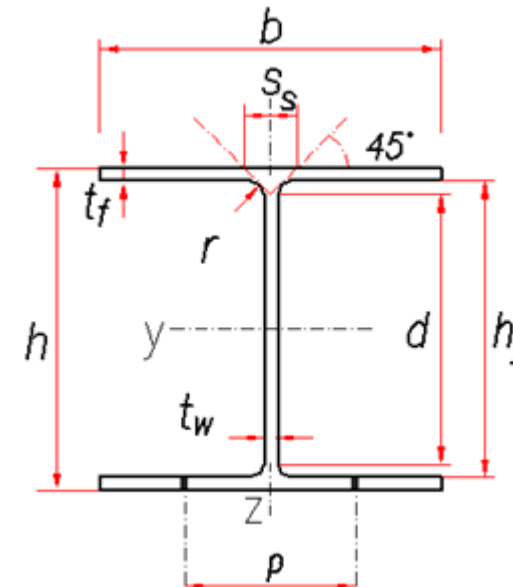
Types

Universal beams and columns

Channels



UB



UC

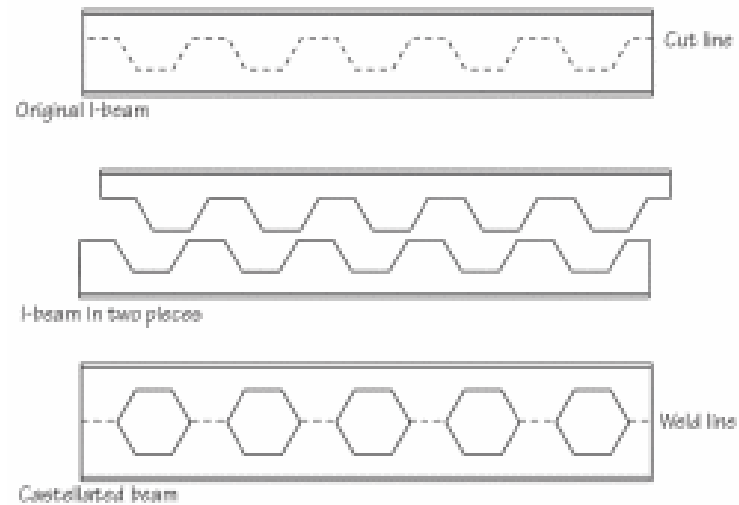
Steel

Types

Universal beams and columns Channels



Castellated Universal Beam Sections

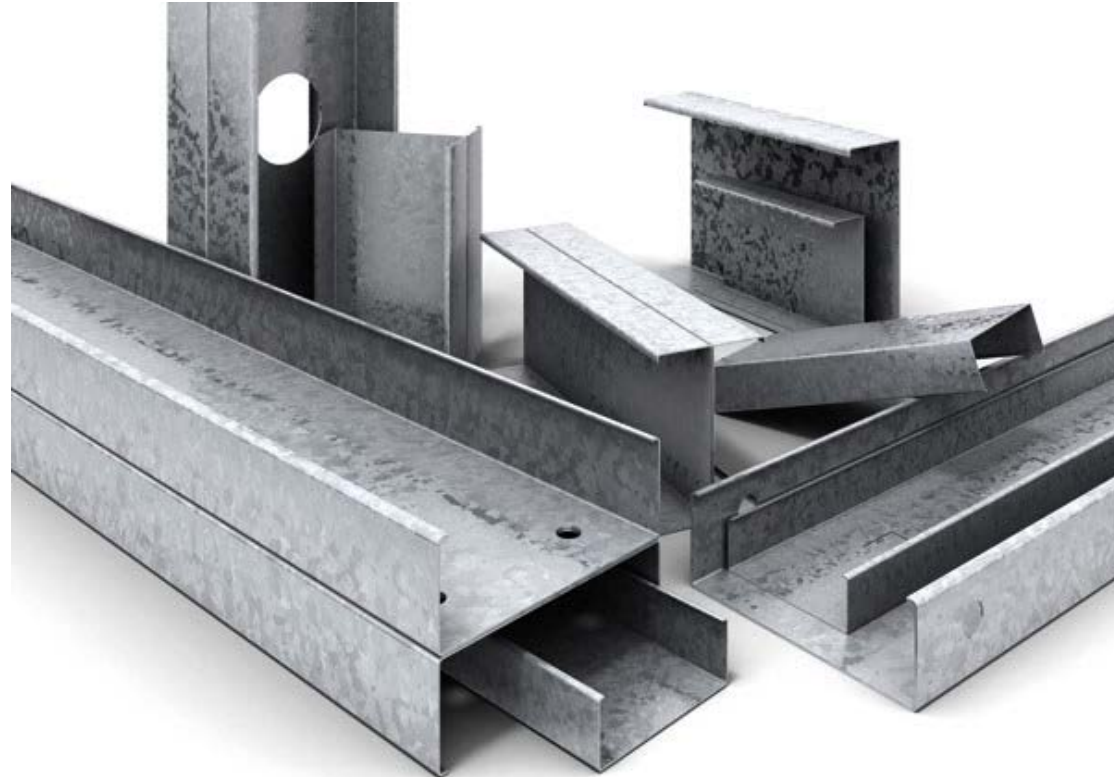


Steel

Types

Universal beams and columns

Channels





Portal frames



Trusses



Steel Frame Construction

Most steel construction is done with a type of steel called *mild steel*. Mild steel is a material that is immensely strong.

Take a circular bar of steel 1 inch / 25mm in diameter. If you were to attach this bar securely to your ceiling, you could hang from it 20,000 Kg (which is 20 tons), or any one of the following:

18 Honda City Cars

2 and a half African Elephants

1 and a half London City Routemaster Double-Decker Buses

Steel Frame Construction



Steel Frame Construction

This immense strength is of great advantage to buildings.

The other important feature of steel framing is its flexibility.

It can bend without cracking, which is another great advantage, as a steel building can flex when it is pushed to one side by say, wind, or an earthquake.

The third characteristic of steel is its plasticity or ductility. This means that when subjected to great force, it will not suddenly crack like glass, but slowly bend out of shape. This property allows steel buildings to bend out of shape, or *deform*, thus giving warning to inhabitants to escape.

Failure in steel frames is not sudden - a steel structure rarely collapses. Steel in most cases performs far better in earthquake than most other materials because of these properties.

Steel Frame Construction



Steel Frame Construction

However one important property of steel is that it quickly loses its strength in a fire.

At 500 degrees celsius (930 degrees F), mild steel can lose almost half its strength. This is what happened at the collapse of the World Trade Towers in 2001.

Therefore, steel in buildings must be protected from fire or high temperature; this is usually done by wrapping it with boards or spray-on material called *fire protection*.

Steel Frame Construction



Steel Frame Construction

Steel construction is most often used in:

High rise buildings because of its strength, low weight, and speed of construction

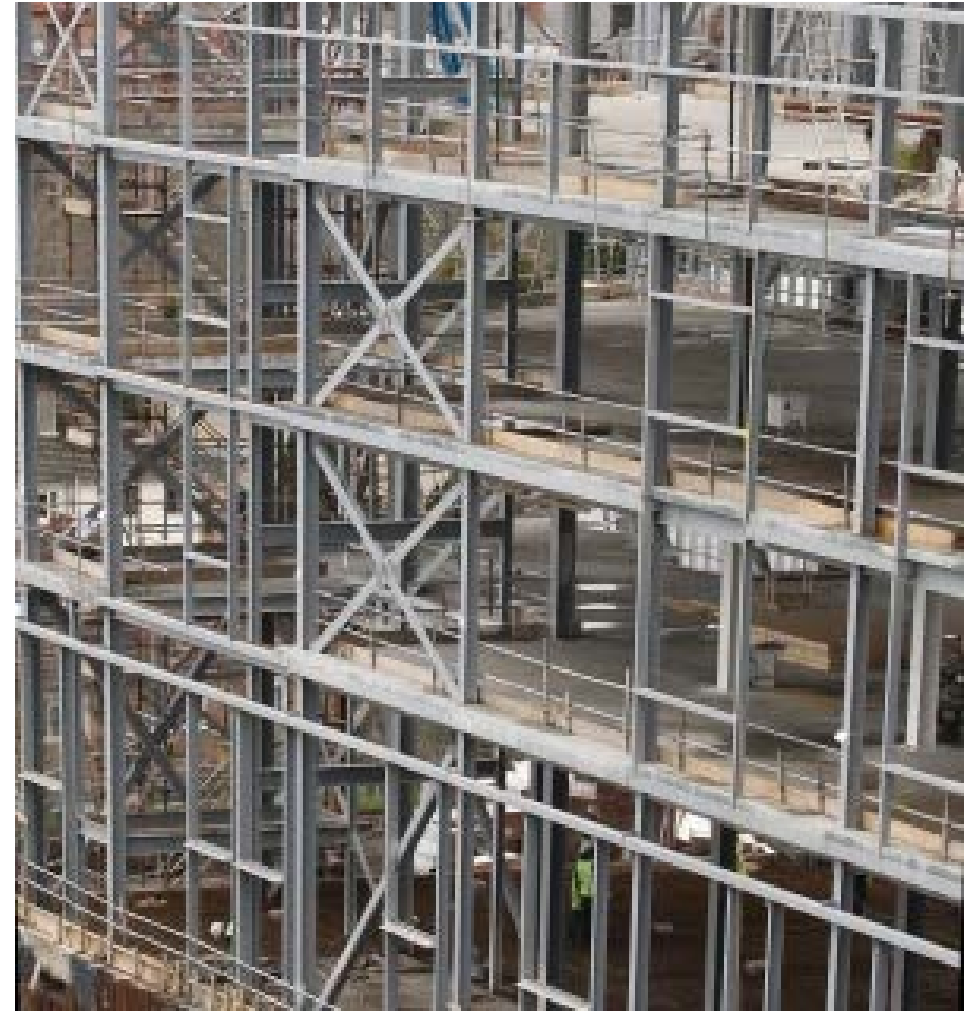
Industrial buildings because of its ability to create large span spaces at low cost

Warehouse buildings for the same reason

Residential buildings in a technique called *light gauge steel construction*

Temporary Structures as these are quick to set up and remove

Steel Frame Construction – High Rise



Steel Frame Construction – Industrial Buildings



Steel Frame Construction – Warehouse Frames



Steel Frame Construction



Steel Frame Construction – Temp Structures



Steel Frame Construction

Conventional Steel Fabrication

is when teams of steel fabricators cut members of steel to the correct lengths, and then weld them together to make the final structure. This can be done entirely at the construction site, which is labour-intensive, or partially in a workshop, to provide better working conditions and reduce time.



Steel Frame Construction

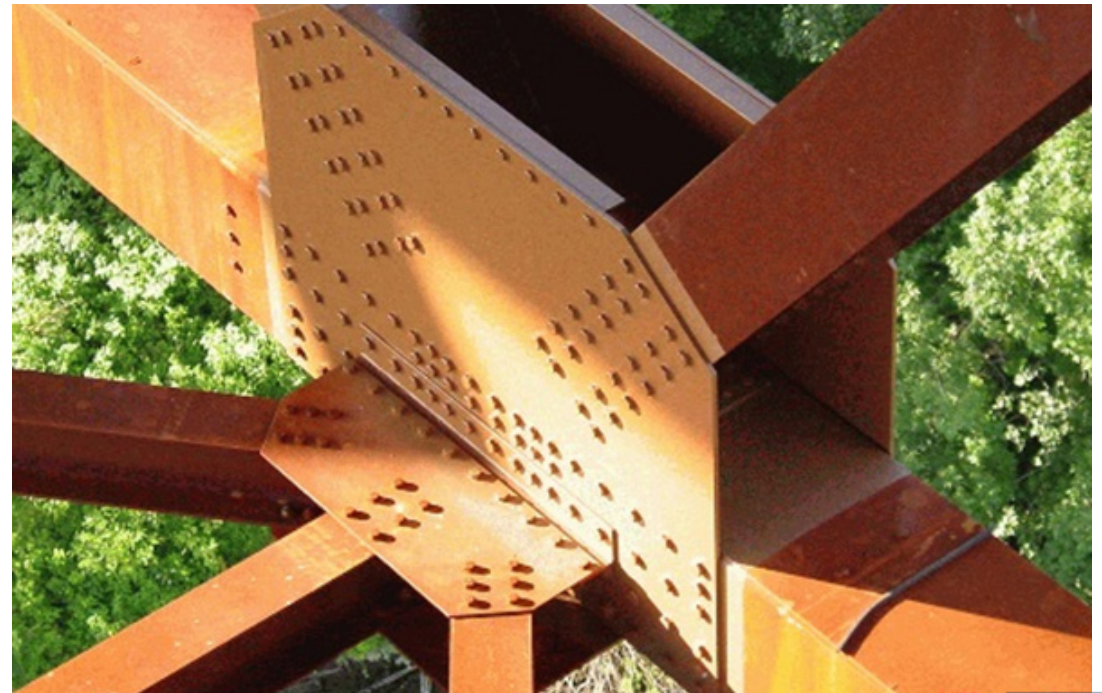
Bolted Steel Construction occurs when steel fabricators produce finished and painted steel components, which are then shipped to the site and simply bolted in place.

This is the preferred method of steel construction, as the bulk of the fabrication can be done in workshops, with the right machinery, lighting, and work conditions.

The size of the components are governed by the size of the truck or trailer they are shipped in, usually with a max length of 6m (20ft) for normal trucks or 12m (40ft) for long trailers.

Since the only work to be done at site is lifting the steel members into place (with cranes) and bolting, the work at site is tremendously fast.

Pre-engineered buildings are an example of bolted steel construction that is designed, fabricated, shipped and erected by one company to the owner.



Steel Frame Construction

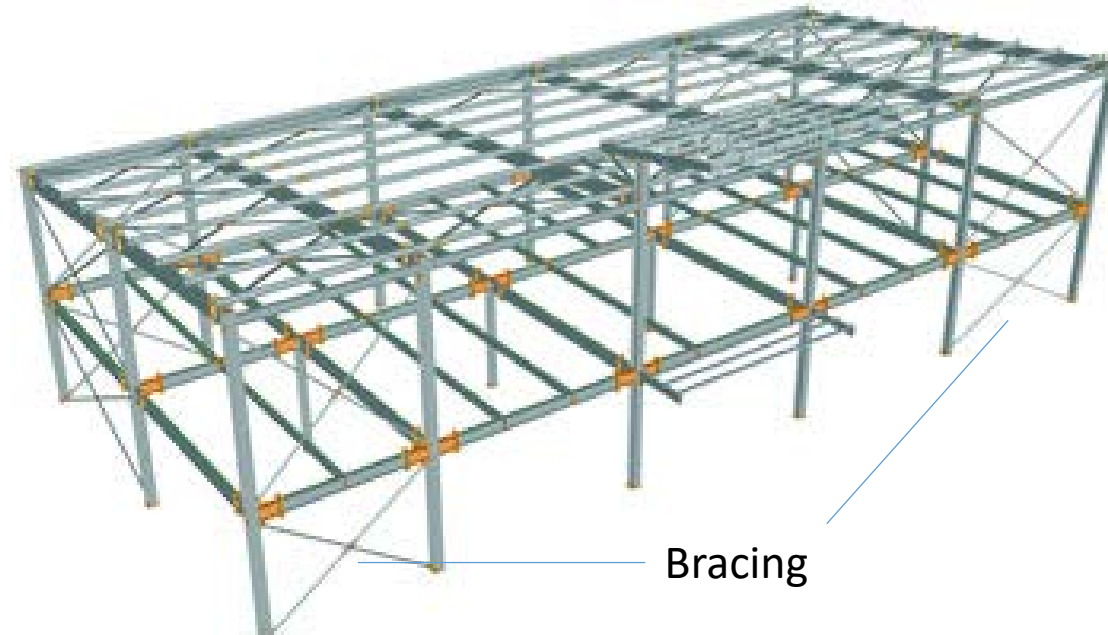
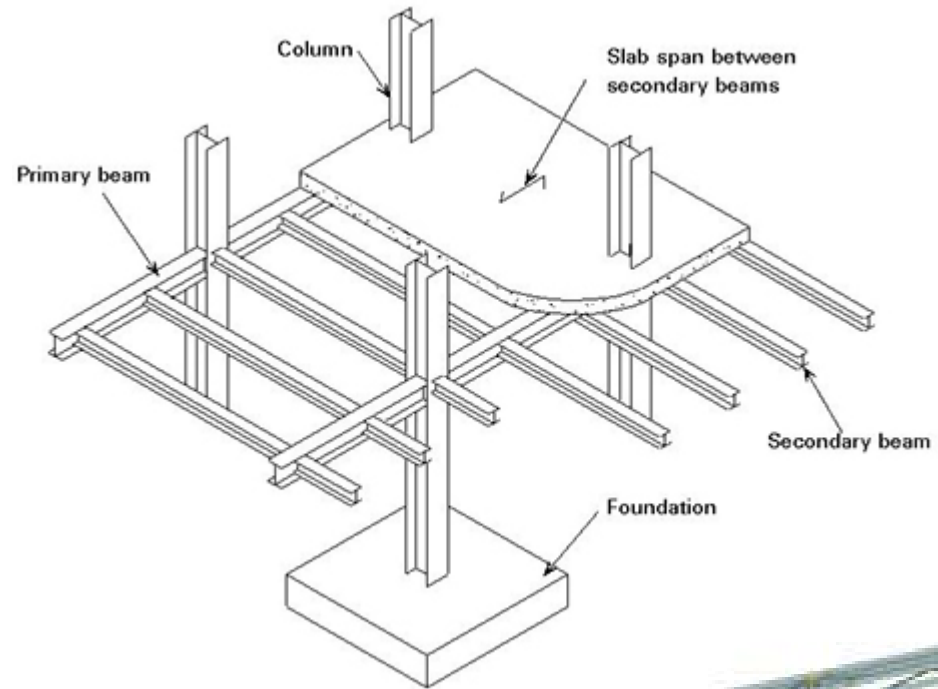
Light Gauge Steel Construction is a type of construction that is common for residential and small buildings. This is similar to timber framed construction, except that light gauge steel members are used in place of wood two-by-fours.

Light gauge steel is steel that is in the form of thin (1-3mm) sheets of steel that have been bent into shape to form C-sections or Z-sections.

Steel Frame Construction



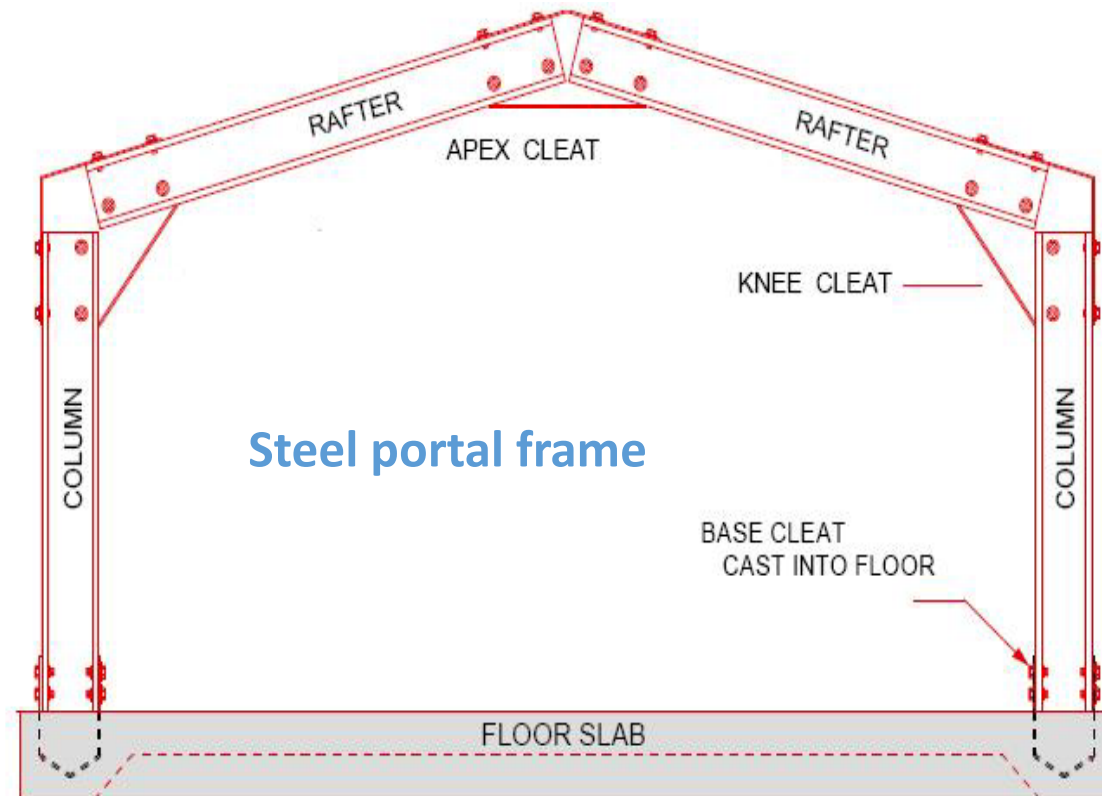
Steel structure performance



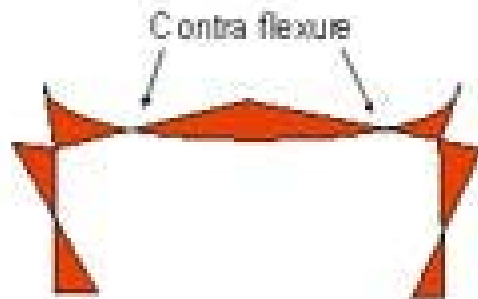
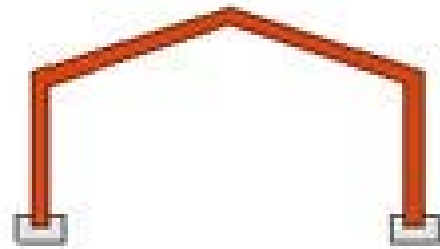
Bracing

PORTAL FRAMES

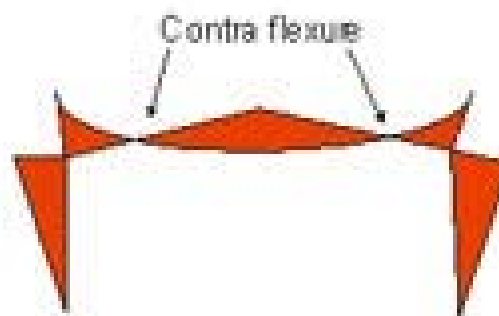
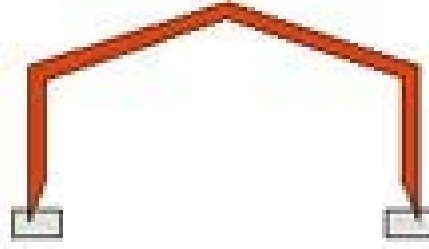
Continuous, rigid frame where all joints are rigid
Connections between columns and rafters are moment-resistant
They transfer bending moments to each other



RIGID BASE



2 PIN



3 PIN



Steel Frame Construction

Steel structures have the following advantages:

They are **super-quick** to build at site, as a lot of work can be pre-fabbed at the factory.

They are **flexible**, which makes them very good at resisting dynamic (changing) forces such as wind or earthquake forces.

A wide range of **ready-made structural sections** are available, such as I, C, and angle sections.

They can be made to take any kind of **shape**, and clad with any type of **material**.

A wide range of **joining methods** is available, such as bolting, welding, and riveting.

Steel Frame Construction

Steel structures have the following disadvantages:

They lose strength at high temperatures, and are susceptible to **fire**.

They are prone to **corrosion** in humid or marine environments.

Steel Frame Construction



Steel Frame Construction



Concrete

Characteristics

- High compression strength
- Cast in site
- Easy to shape
- Monolythical behaviour once hardened
- Heavy
- Very low tension resistance



Use

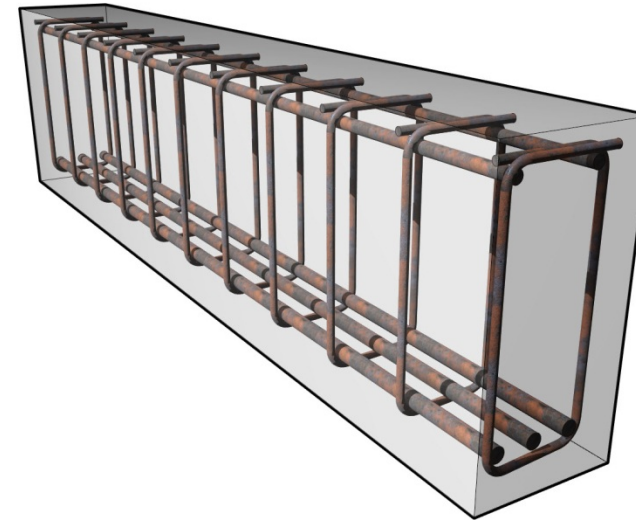
Reinforced
concrete

- Common use in structures
- Reinforced concrete
- Precast concrete

Reinforced concrete

Combination of:

- Compressive strength of concrete
- Tension strength of steel



Reinforced concrete

Analysis of loads

Compressed and tensioned fibres



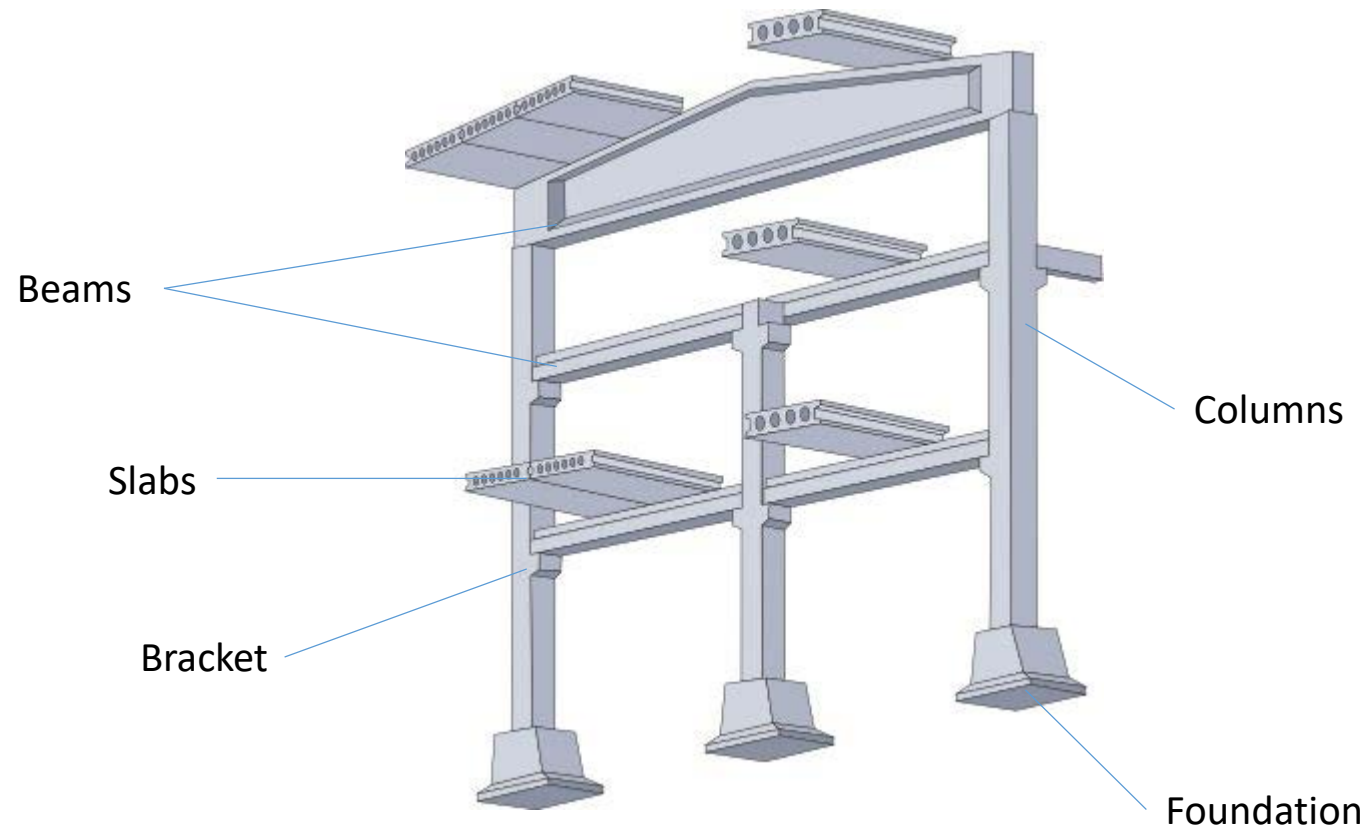
Where should the reinforcement be put? Up or down?







Precast concrete

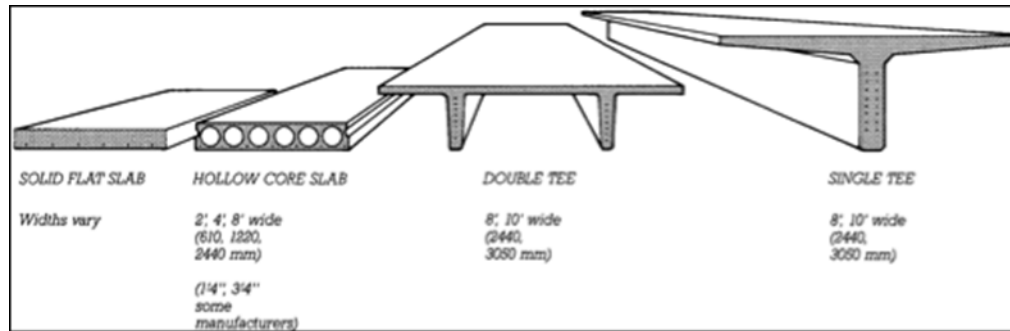




Columns and beams



Slabs

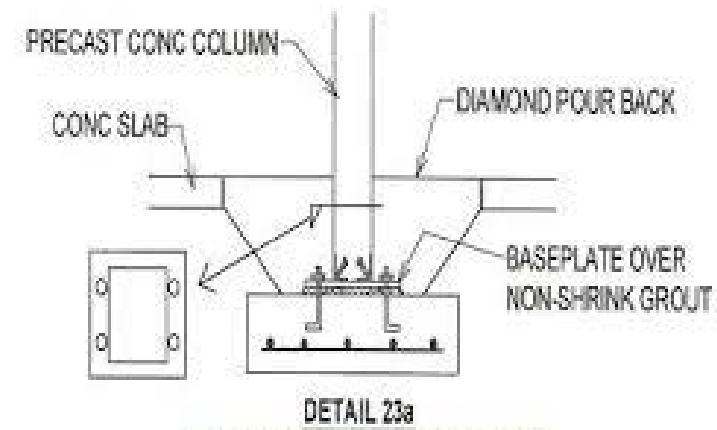


Joints: adhesives or concrete





Foundations



© all-concrete-cement.com

CONCRETE FRAME STRUCTURES

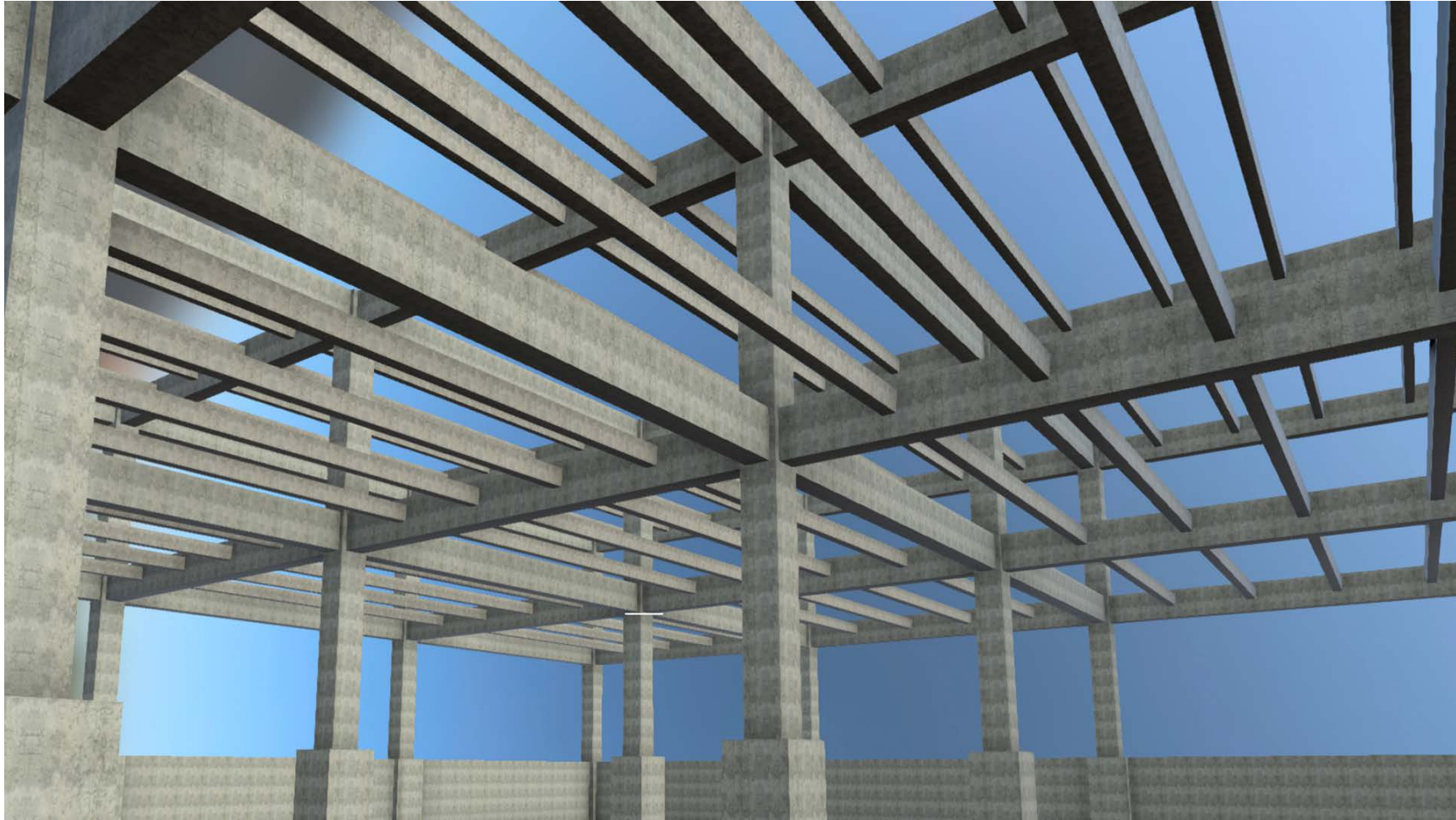
Concrete frame structures are a very common - or perhaps the most common- type of modern building internationally.

As the name suggests, this type of building consists of a frame or skeleton of concrete. Horizontal members of this frame are called *beams*, and vertical members are called *columns*.

CONCRETE FRAME STRUCTURES



CONCRETE FRAME STRUCTURES



CONCRETE FRAME STRUCTURES



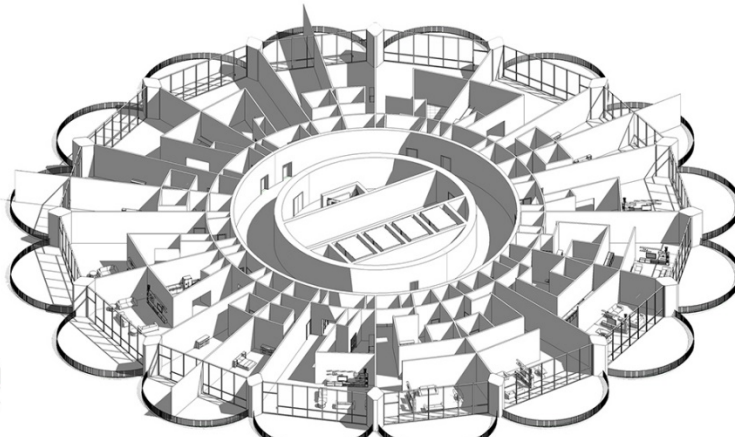
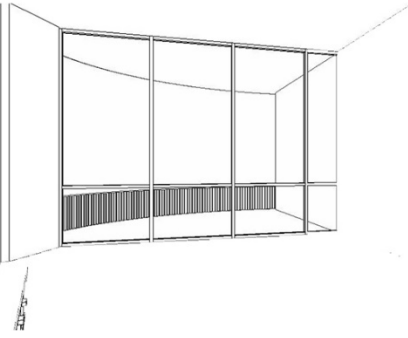
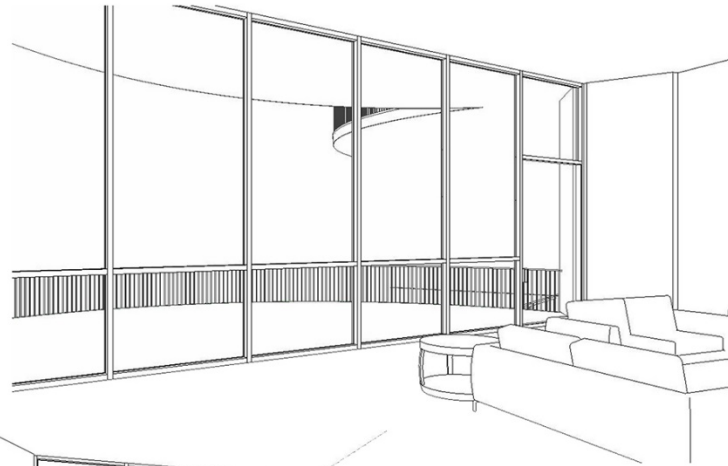
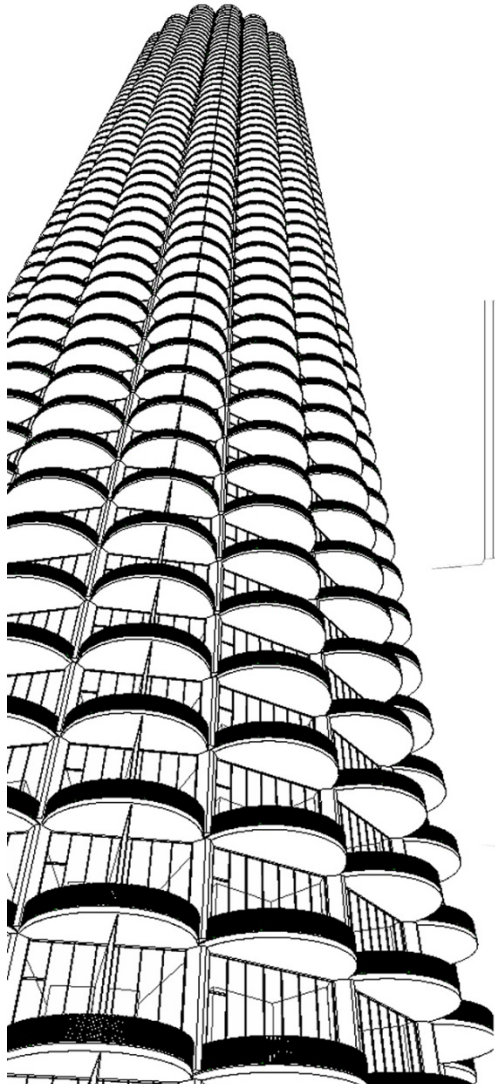
CONCRETE FRAME STRUCTURES



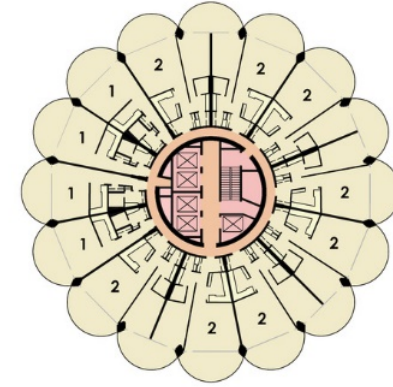
CONCRETE FRAME STRUCTURES



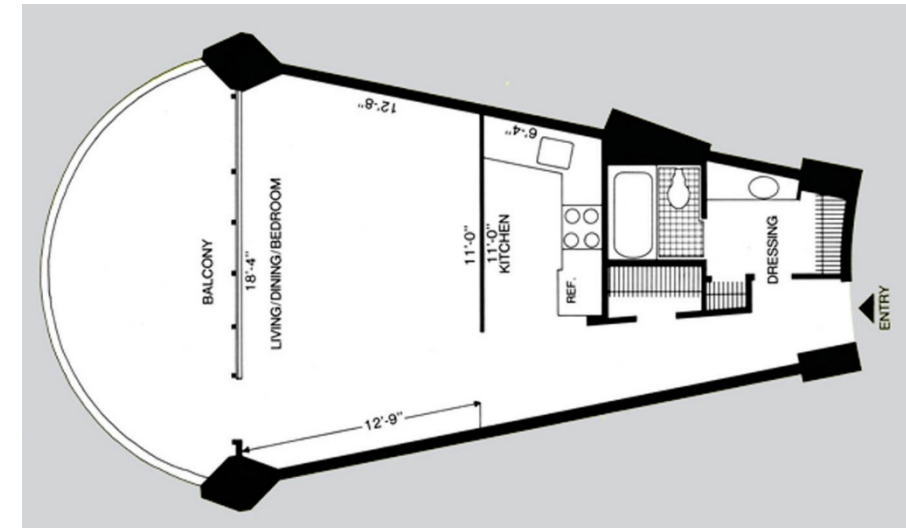
CONCRETE FRAME STRUCTURES



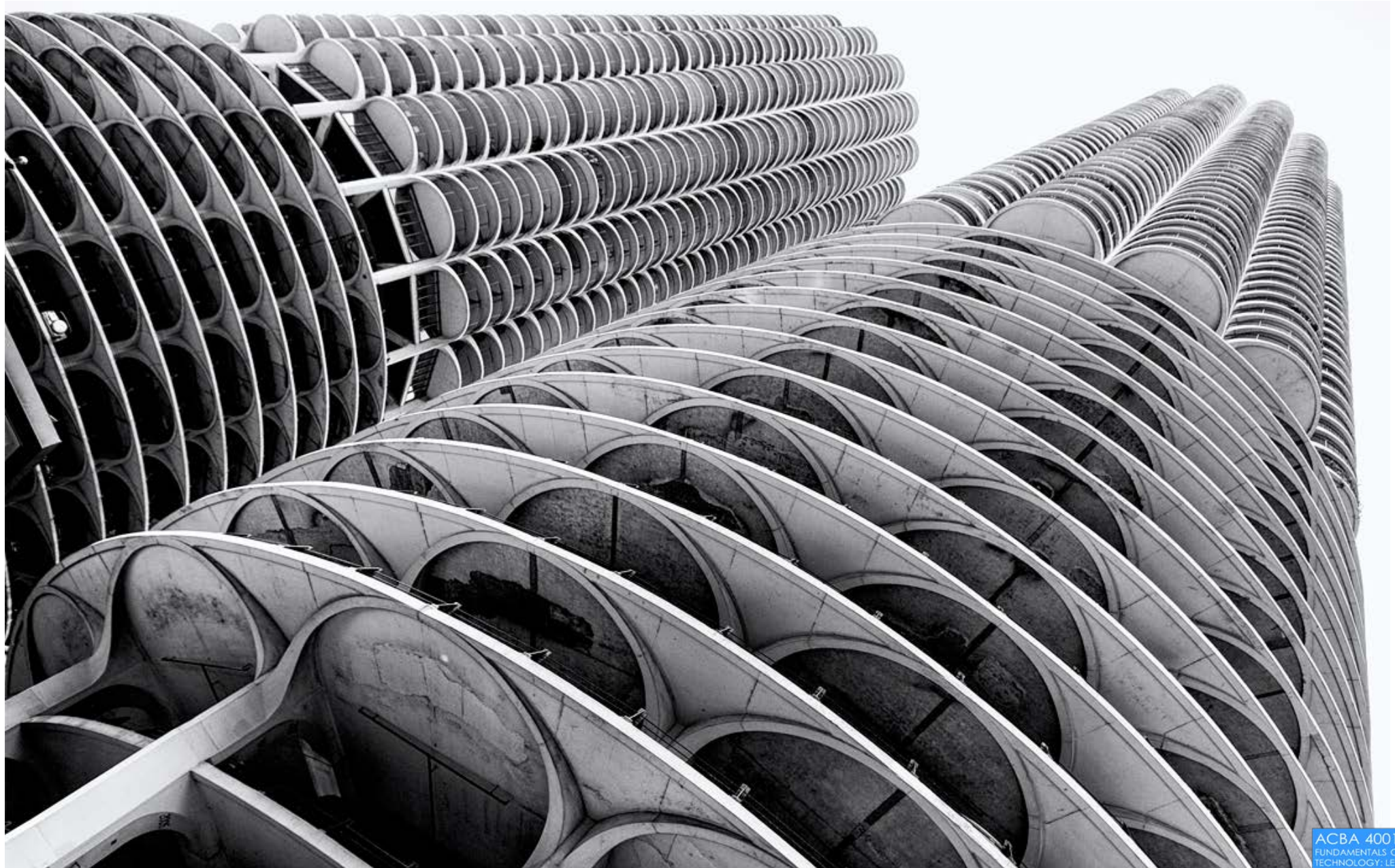
4 Floorplan
Marina City Tower
 Chicago, USA, 1964
 300 North State Street
 G. Goldberg + Associates



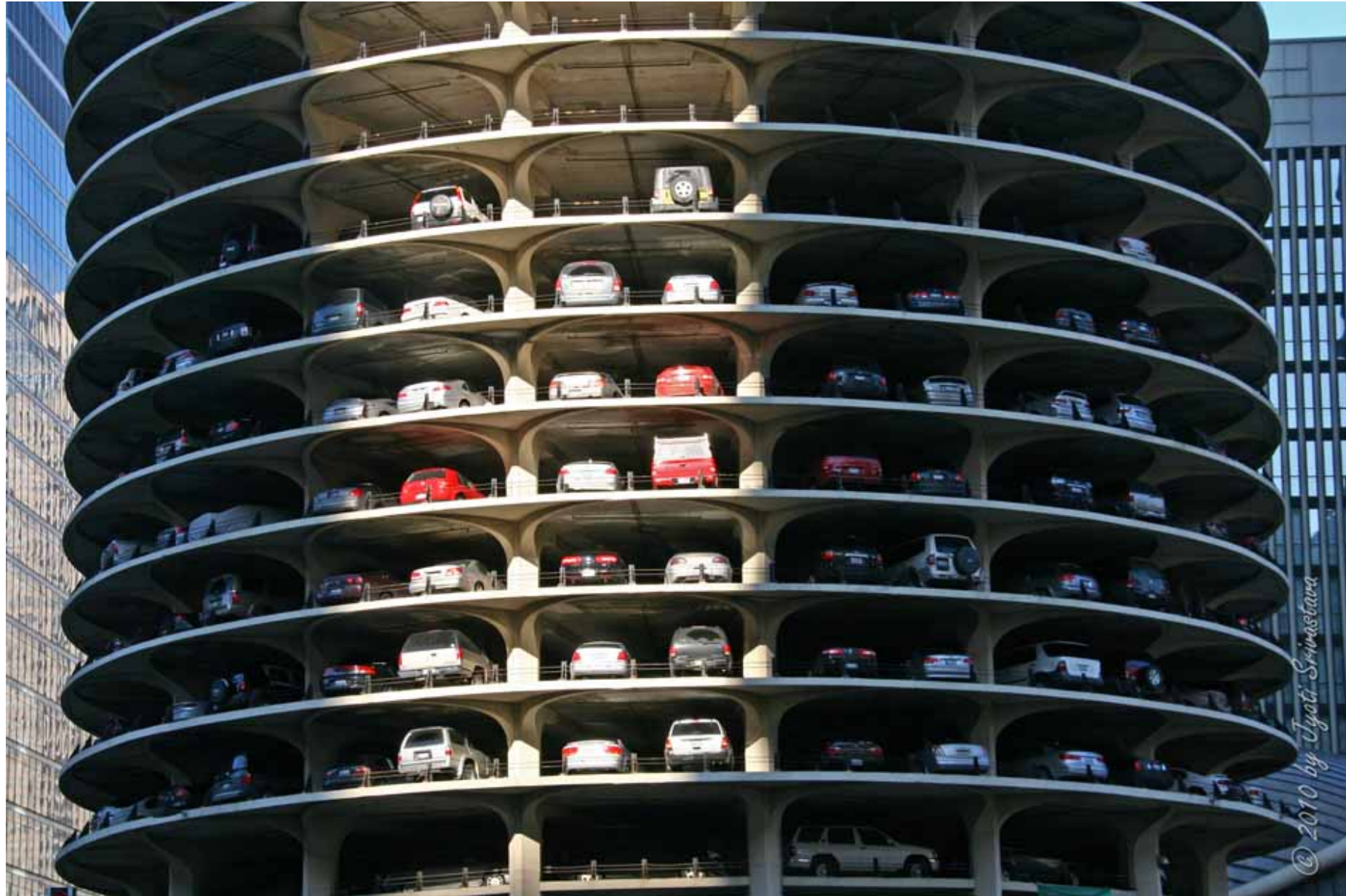
- 3 Number of Bedrooms — 10pt
 ▶ Apartment Entrance
 ■ Apartments
 ■ Horizontal Circulation
 ■ Vertical Circulation
 ■ Communal Areas
- 0 20 40 80 Feet



CONCRETE FRAME STRUCTURES



CONCRETE FRAME STRUCTURES



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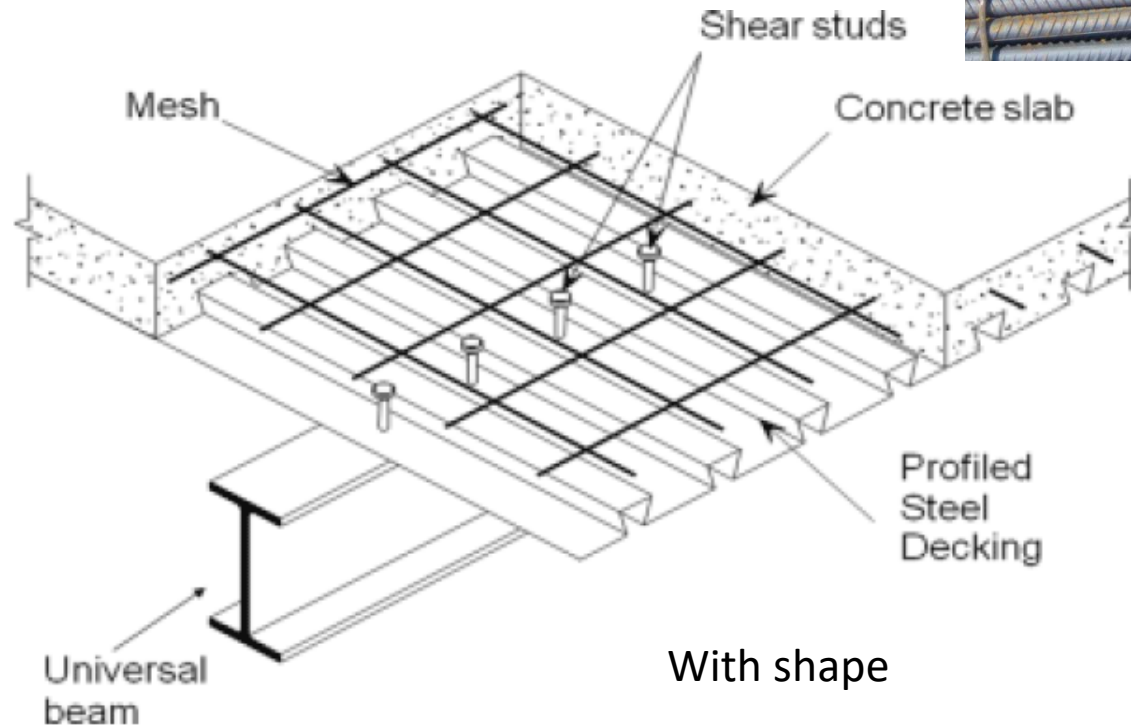
CONCRETE FRAME STRUCTURES



Mixed structures

Steel – concrete

Adherence



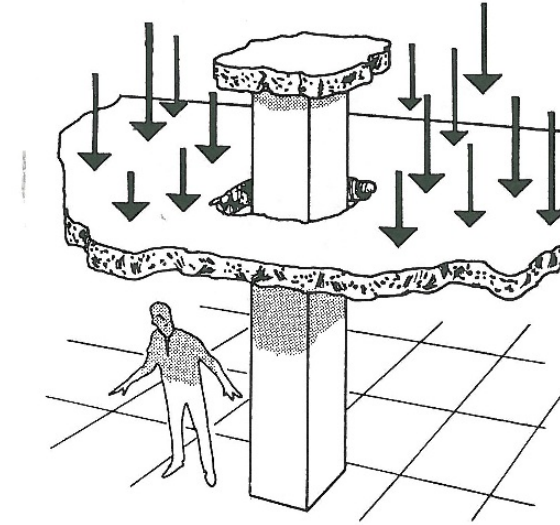
Corrugated

With shape

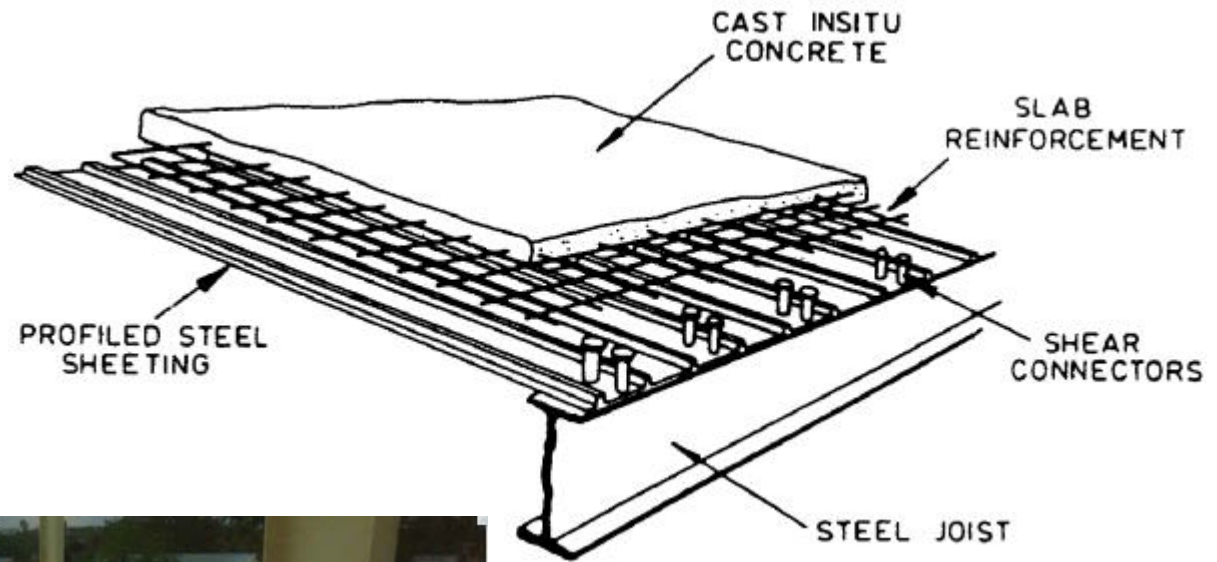
Mixed structures

Steel – concrete

Careful with shear stress



Steel – concrete



Questions

Which material do you think is better for the following situations and why?

High-rise buildings

Fire resistance

Earthquake resistance

Covering an Exhibition Centre

Further Reading:

Building Construction Illustrated

Wiley

Francis D.K. Ching

AJ Handbook of Building Structure

Architectural Press

Allan Hodgkinson

The Construction of Buildings 3 & 4

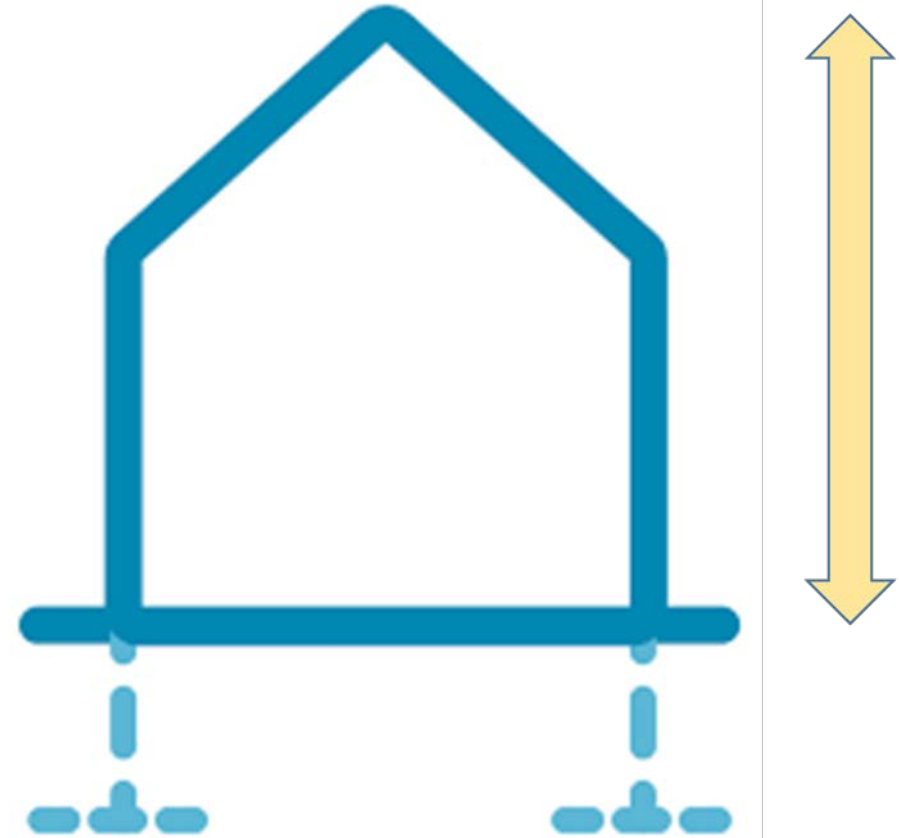
Blackwell Scientific Publications

R Barry

Summary Week 5:

Structures

Structural Frames



Nadolig Llawen
Merry Christmas