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Mechanics of Materials

Lecture 2 – Mechanical Properties of Materials

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- Aims

- To determine that stress can be related to strain. This can be done using experimental methods to determine the stress-strain diagram.
- To gain the knowledge on the properties of the stress-strain diagram for materials used in engineering.
- To learn other mechanical properties and tests related to mechanics of materials.

- Main References

Statics and Mechanics of Materials, 3rd Edition, Russell C. Hibbeler 2011, Pearson

This lecture slides gives the idea on real applications / cases based on the theory discussed in the class.

Horizontal ground displacements caused by an earthquake resulted in excessive strains in these bridge piers until they fractured. The material properties of the concrete and steel reinforcement must be studied so that engineers can properly design this structure. Thereby avoiding such failures.

Source:
https://en.wikipedia.org/wiki/Earthquake_engineering#/media/File:Northridge_earthquake_10_frwy2.png

An resistive foil strain gauge used to determine the stress – strain properties of common engineering materials.

Source: https://en.wikipedia.org/wiki/Strain_gaugehttps://en.wikipedia.org/wiki/File:King_tie_rod.jpg

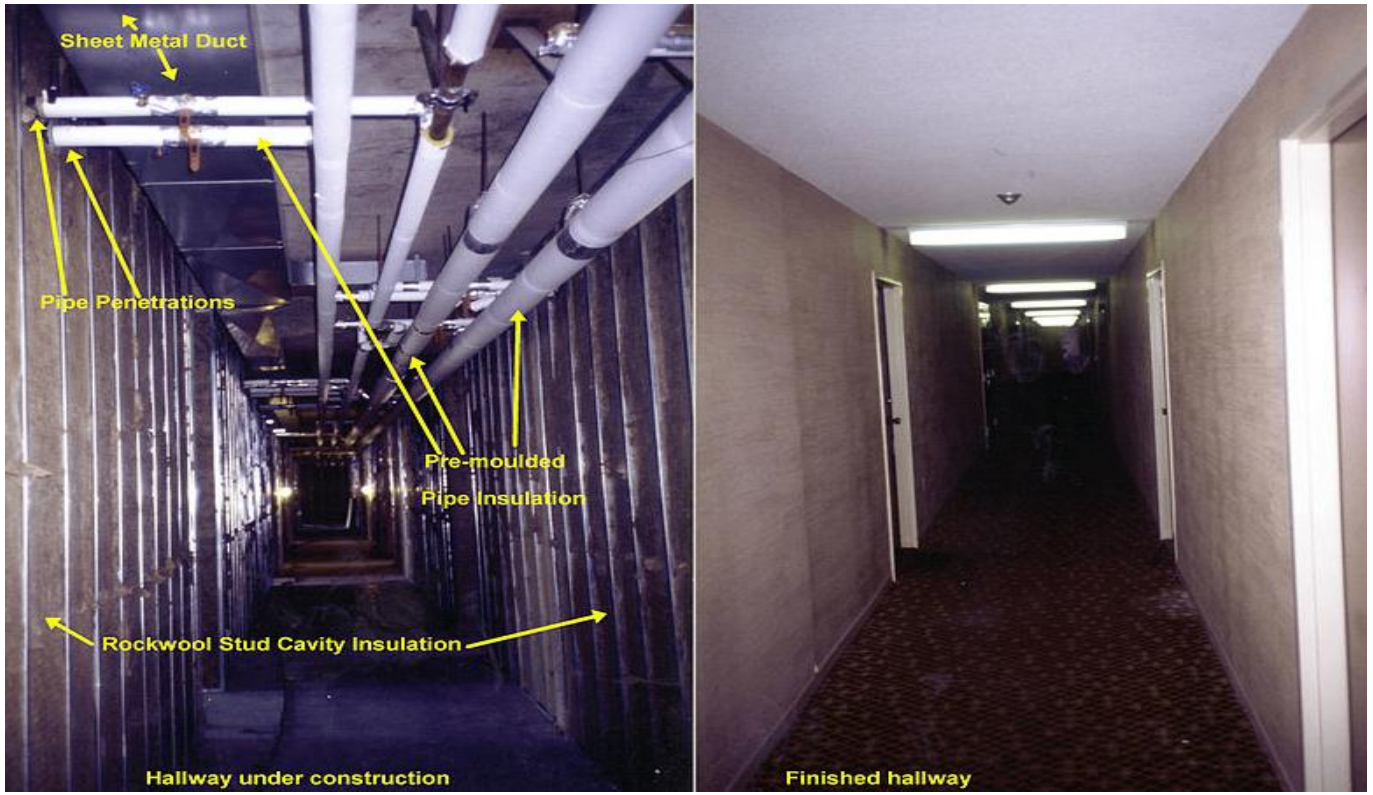
This aluminium specimen indicates the necking that occurred just before the specimen failed. This resulted in the formation of cup-coned shape at the fracture location. This is the characteristic of ductile materials.

Source: https://commons.wikimedia.org/wiki/File:Al_tensile_test.jpg

Concrete used for structural purposes such as bridges must be routinely tested in compression. This to make sure that it provides the necessary strength.

Source: https://en.wikipedia.org/wiki/Precast_concrete#/media/File:Precast_parking_structure.jpg

Steel rapidly loses its strength when exposed to high temperature. For this reason most main structural members are to be insulated in case of fire



Source: https://commons.wikimedia.org/wiki/File:Hallway_insulation.jpg

This knife was made from a hardened steel alloy (high carbon content). It has the potential to fail due to brittle fracture.

Source: https://en.wikipedia.org/wiki/Knife