- Week 7 steel structures
    - How to transport to site, how to erect on site, how to connect to other members such as concrete, how it transfer the loads, how do we fire rate and protect the steel
    - For each steel structure the frame system, the individual members, the connection details, the fabrication and erection techniques must all be considered
    - Steel connections can be flexible, rigid and semi-rigid – but these are determined by the possible loads and space available
    - Flexible connections are simply supported, easy to fabricate, easy to erect and are the least costly
    - Rigid connections require more fabrication, difficult to erect and cost more
    - Semi-rigid connections create difficulty in the frame analysis but permits redistribution of moments from beams to columns
    - The Framing Systems can be:
        - Two-way framework: rigid connections
        - One-way rigid framework: unbraced plane with rigid connections and braced plan with simple connections
        - Two-way braced framework: bracing with simple connections plus stabilizing elements
    - Stabilising Elements:
        - Triangulated steel bracing
        - Vierendeel truss or girder
        - Triangulated steel tower
        - Reinforced concrete or masonry shear walls
        - Reinforced concrete or masonry core or shear tubes
        - Light metal cladding as a stressed skin
    - Best Fabrication when there is high repetition, assembly is all done in the one position and there are minimal components
    - Steel erection requires that all members are in sizes and mass that there able to be transported, bolted instead of welded on-site, all with temporary bracing
    - MUST HAVE CORROSION AND FIRE PROTECTION
    - Welding processes
        - Manual metal arc
        - Submerged arc
        - Flux coated arc
        - Electroslag
- Week 8 materials handling systems
    - Materials make up 30-40% of building cost
    - All excavated material will bulk or swell on removal from the ground:
        - Bulked volumes = in-place volume x swell factor
    - Earthworks estimation includes capacity of truck tonnage and the transporting distance
    - Need to hire cranes – know about crainage types
    - Mobile Cranes – consider capacities/ratings/strengths/stability
        - Telescopic boom – truck mounted and rough terrain
            - Steel plates under crane spreads the load and adds stability
        - Strut boom – truck mounted and crawler mounted
    - Crane loading charts provide crane type, vehicle dimensions, working ranges and loading charts
    - Tower Cranes
        - Rope and ram-luffing: jib arm can luff up and down, raise and lower hook over A-frame, slew 360
        - Hammerhead (saddle-jib): slew 360, raise and lower hook, and travel in and out along the jib boom arm

- Self erecting
- Top slewing
- Electric luffing
- Ram-luffing crane – STD 1000E
- External crane climbing
    - The crane lifts an additional towe section and suspends
    - Bolts at top tower section are removed
    - Hydraulic rams lift the top tower section of crane and the climbing frame
    - The additional lifted tower section is drawn into the climbing frame and bolted in
- Internal climbing
    - Telescopic internal sections are extended at both ends and supported on the building
    - The crane, tower and climbing frame are lifted by hydraulic rams
    - Telescopic sections are extended to support the crane at the higher level, and the telescopic sections on the lower level are retracted and lifted up
- Crane ties ensure the structural stability of the tower sections – the maximum distance between crane ties is between 13.5m and 16.5m
- Man and material Hoists
    - May be sing and double caged, used as emergency access for accidents
    - Elevated work platform
    - Formwork hoists – 4 levels
- Concrete pumping: high-capacity pumps with specialized pumpable concrete mix design
- Pump types
    - Flat-gate or side valve
    - Swing-tube valve
    - Rocker valves
- Typical concrete pumping: 25m^3/h delivery output – 125 pipeline diameter – 350m total equivalent length of pipeline – 80mm slump – 5MPa pipeline pressure
- Concrete skips for concreting columns, walls and slabs via crane
- Type of concrete pumps, how to pump high distances
- Pour from back of truck into hoper to pump up 60 floors
- Chemical additives
- Man and material hoists – temporary material distribution through building