

TOPIC SCHEDULE

LECTURE			PRACTICAL
week	Date	Topics	Topics
9.		Building materials and their applications: METAL (STEEL, ALUMINIUM, COPPER, ZINC)	

Today's Lecture: Building materials: metals in building constructions

In the ancient times metals were used nearly exclusively as jointing elements, roof coverings or tools. Metal fixing in stone constructions was made of bronze or lead, while in timber structures later iron nails, screws, and bolts were used. Lead and bronze sheets appeared as roofing materials. The progress of the steel industry at the end of 19th century offered new ways for casting, hot rolling, welding and later pressing, cold rolling, and opened a new perspective for the application of metals.

a) Physical Properties:	Density:	Steel:	7850 kg/m ³ (learn all of these)
		Aluminium:	2600 kg/m ³
		Copper:	8900 kg/m ³

b) Steel

Iron is harvested as raw ore and is thus transformed into raw iron with a high carbon content. Steel is produced when the raw iron is mongered into a lower carbon content material with higher brittleness and tensile strength: steel. Steel may be further modified with various mixing processes and treatments, thus resulting with steel that has special properties such as extra hardness (Chrom, Vanadium) or stainlessness.

Iron	Steel	High tension steel	Hardened steel	Stainless steel
cast iron products	steel products	tension products	modified steel products	stainless products
cast iron chandelier	steel beams and pillars	wires, reinforcement for concrete	tools, machine parts	external or health product steel

(to-be-learned steel products)

Sections of steel elements beyond 4 mm thickness are generally hot rolled, and smaller may be cold rolled. The surface of iron and steel has to be protected against corrosion. The protection can be:

Red lead primer / Stoving / Sheradizing / Galvanizing (means hot dipping into the molten zinc).

LEARN SKELETON FRAME COMPONENTS FROM ENCLOSED EXAMPLES, BE PREPARED TO SKETCH AND NAME ELEMENTS.

c) Aluminum:

In our country it was the aluminium which extended the range of metals used in the construction as rolled, corrugated sheets on roofs or walls, and as extruded profiles for windows, and doors, etc. They are also used as louvers, brise-soleils or ornamental grids.

Special attention is to be paid to aluminum combinations with copper. While aluminum will not oxidize under normal conditions (the oxides seal the pores, thus protecting from further oxidation) the ionizing effect of copper and/or copper ions will deteriorate aluminum.

d) Copper:

Copper is a very prestigious and expensive material that ages beautifully and is easy to use, fix and re-use. Cast copper is usually used in small quantities and is modified to give the much harder bronze for fixtures.

e) Zinc:

Used more abundantly in modern times, zinc sheets are preferred to copper due to the relative cheapness of the material.

APPLICATIONS FIELDS OF VARIOUS METALS (simplified must-learn list):

Dimensions of metal elements depend on the type of metal and application fields. This can be from less than 1 mm until 3 cm thick.

1. Load bearing and supporting constructions - steel
 - 1.1. Load bearing columns and beams
 - 1.2. Load bearing slab elements

2. Coverings - steel, aluminium, copper, zinc
 - 2.1. Floor coverings
 - 2.2. Wall coverings
 - 2.3. Roof coverings

3. Doors and windows frame – steel, aluminium

REFERENCE:

/In the tropics, the water/cement ration is usually 0.5-0.55./

Dry materials take up approximatively 50% more space before being mixed with water into concrete and compacted into position. Thus 4:2:1 boxes of cement and aggregate produce an equivalent of 4.66 boxes of concrete /and not 7 boxes./.

The explanation is that the smaller aggregates fill up the gaps between the larger. If a cube contains a maximum size sphere, which can be inserted, a certain amount of vacant space is left over. If the same cube is filled with smaller spheres, but the diameter of spheres is identical, the cubature of the gaps remains unchanged. One can fill up the cube most densely when a definite variety of diameters is used.

For placing concrete, the framework must be cleaned out and brushed with mould oil or white-washed /both have a bound-breaking effect/, in order to facilitate striking. Compacting can be done either by hand or by mechanical means. Hand-ramming is normally done with wooden tampers or steel-rods, helped by hammering the outside of the formwork. Mehcanical tamper: an internal vibrator /"poker"/ is held by hand.

After the concrete is set it is necessary to keep it moist for several days in order that it can be thoroughly cured. This enables the strength of the concrete to increase with the passage of time. It will also increase its impermeabilty, reduce shrinkage and harden the surface against abrasion. Striking time varies with the climate, and type of cement, etc. Vertical formwork can be removed after two days, horizontal after three, while beams and slabs need to be propped without shuttering for a further week.

In certain developing countries, the sandy soil itself is mixed with lime or cement and blocks produced in this way are used as inexpensive masonry units. The process is called soil stabilization.



In the ancient times metals were used nearly exclusively as jointing element, roof coverings or tools. Metal fixing in stone structures was made of bronze or lead, while in timber structures later iron-nails, screws and bolts were used. Lead and bronze sheets appeared as roofing materials. The progress of the steel industry at the end of the 18th century offered

new ways for casting, hot-rolling, welding, and later pressing, cold-rolling, and opened a new perspective for the application of steel.

The crude ore is melted out and the "pig" depending of the carbon content may be: gray /with high carbon content/
pitted /with medium carbon content/
white /with low " " /

Iron is used in the form of:

cast iron /of high carbon content gray pig/

wrought iron /with low carbon content which makes it malleable /.

Steels can be classified as:

- mild /for reinforcement bars/
- medium
- hard

Anneal means to heat and slowly cool to toughen and reduce brittleness.

- is temper means to toughen by alternate heating and cooling.

Sections beyond 4 mm thickness are generally hot-rolled, and smaller may be cold rolled. ^{Def}

Sheets may be pressed or cold rolled, i.e., corrugated to sinusoid or trapezoid or trapezoid type sheets.

Iron is also used in the form of wires, and cables, nails, screws and bolts.

Except for these latter jointing elements, the surface of iron and steel has to be protected against corrosion. Used as a reinforcement in concrete, a

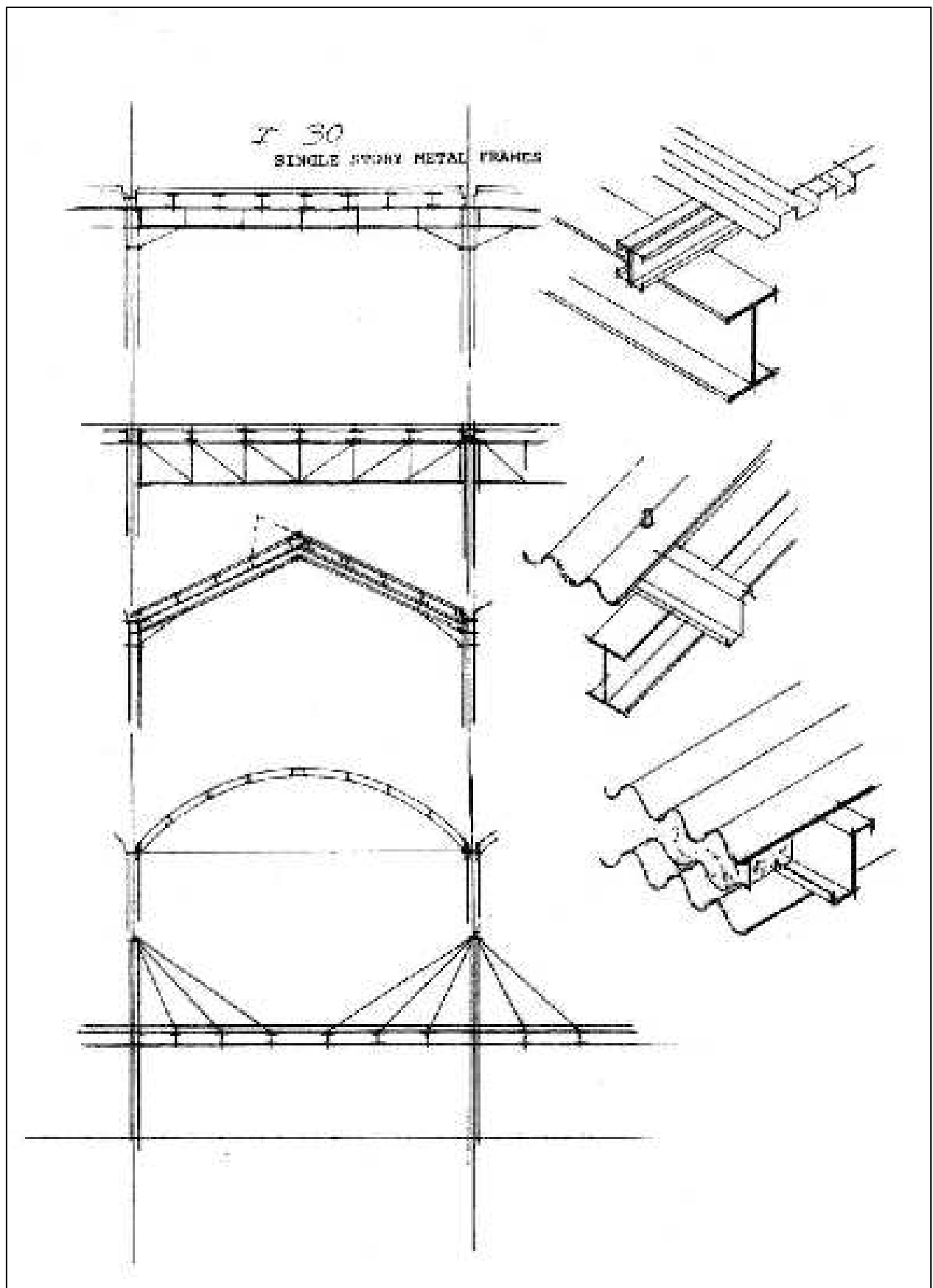
concrete cover equal to the diameter of the steel bar has to be provided for.

The protection of structural steel components are:

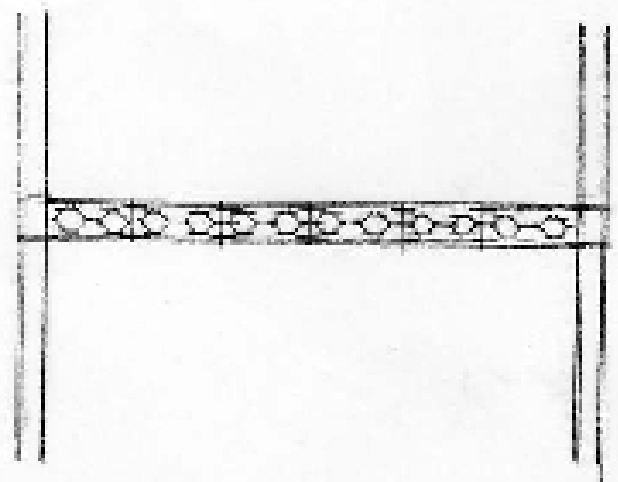
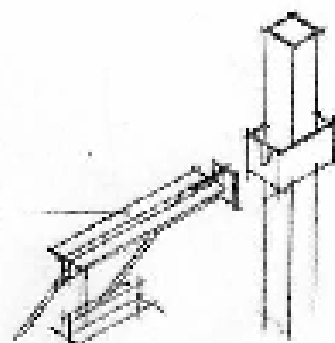
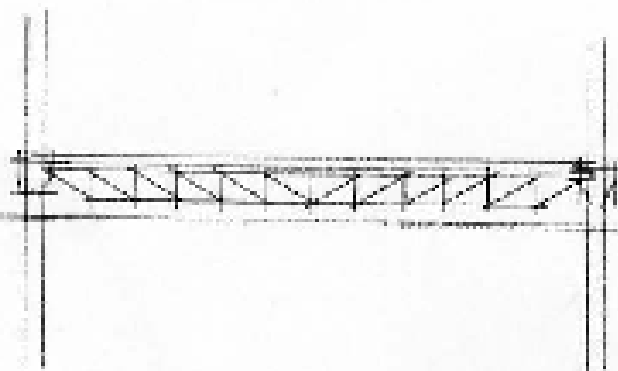
- red lead primer
- stoving this means that on the heated surface, synthetic varnish is applied.
- Shardizing means heating with zinc powder and heated until molten.
- A similar process is applied now with aluminium powder: zandery.
- Galvanizing means hot dipping into the molten zinc.

In our century, it was the aluminium which extended the range of metals used in the construction as rolled, corrugated sheets on roofs or walls, and

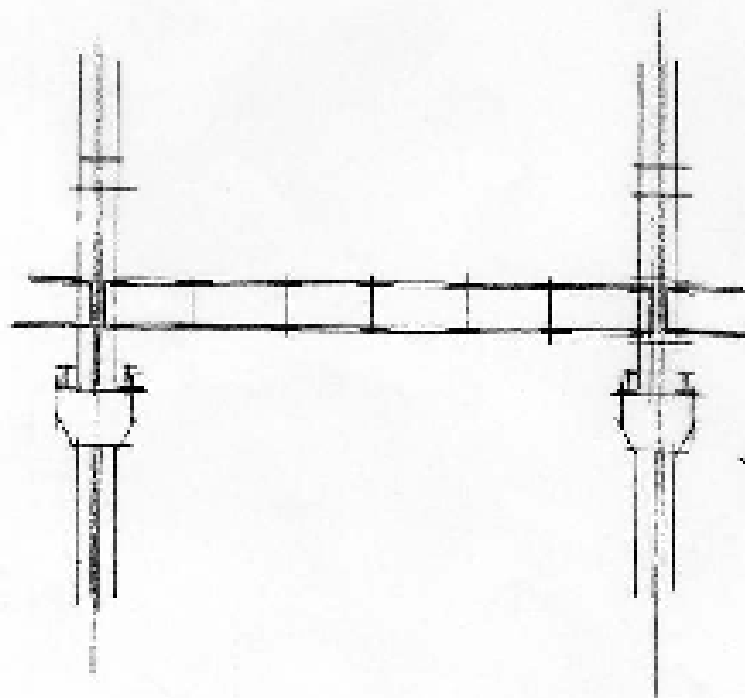
STEEL STRUCTURAL ELEMENTS:



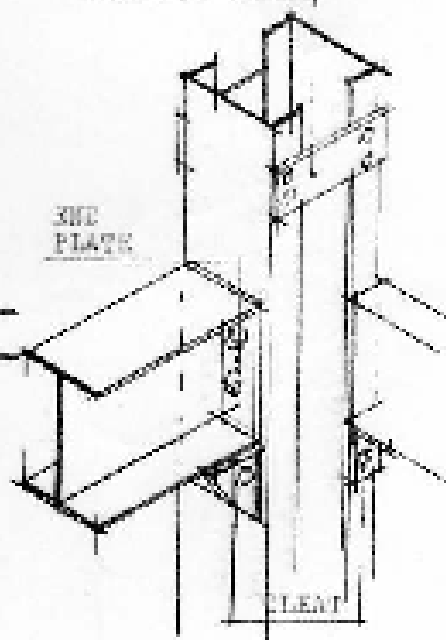
MULTISTORY STEEL FRAMES



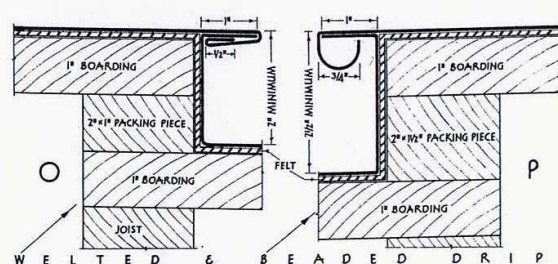
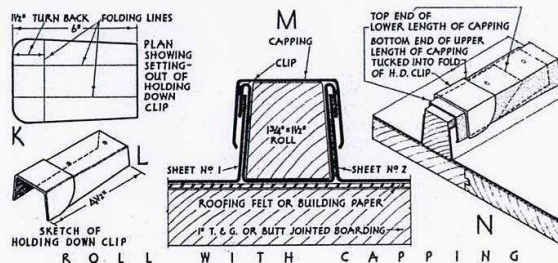
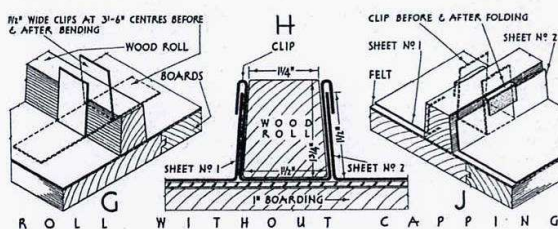
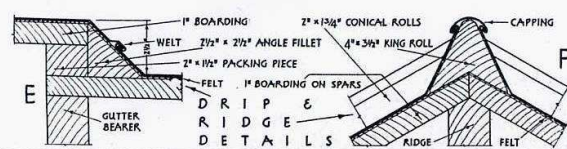
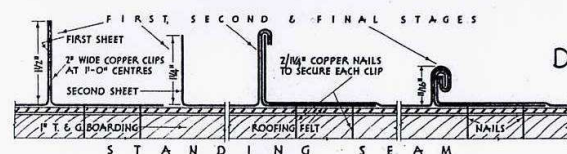
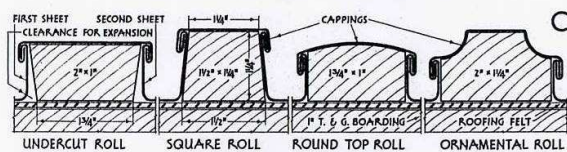
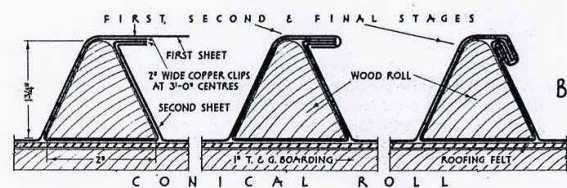
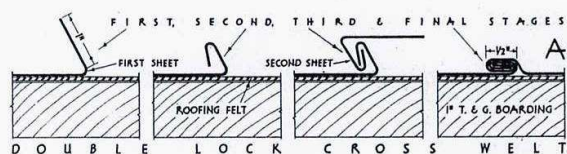
BATTEN
PLATES



END
PLATE



PLATE

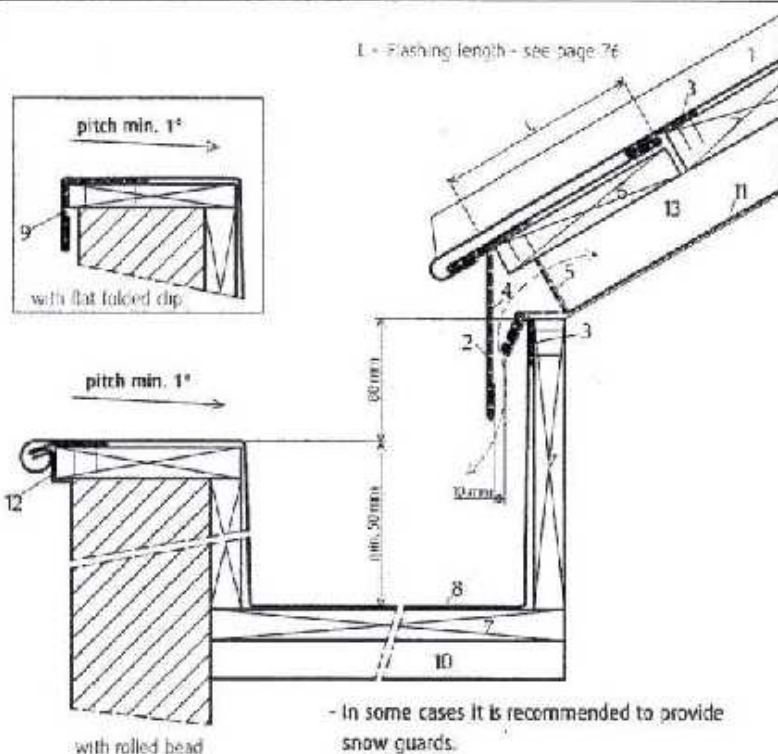


SCALE FOR A, B, C, D, H, M, O, L, F INCHES
SCALE FOR E, F, G, J, K, L, N INCHES

FIGURE 50

Standing Seam - Roofing

Ventilated roof on roof boarding

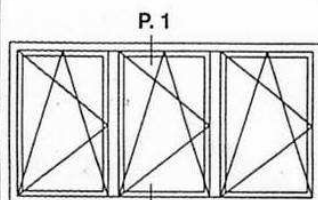


- In some cases it is recommended to provide snow guards.
- When rendering a wall it is recommended to protect the VM ZINC®.

Box gutter (gutter inside or on the wall, ventilation inlet through gutter)

1. standing seam in VM ZINC®
2. continuous eaves apron strip in VM ZINC®
3. sheet clip in VM ZINC®, th = 0.8 mm, w = 80 mm, 2 per m
4. folded clip in VM ZINC®, th = 1 mm, w = 250 mm, 2 per m or in galvanised steel, th = 0.8 mm
5. mesh (2 mm maximum weave)
6. eaves boards, 5 mm thinner than adjacent boards
7. roof boarding
8. box gutter in VM ZINC®
9. bracket in VM ZINC®, th = 1 mm, w = 250 mm, 2 per m
10. packers fixed to gutter fall
11. breather membrane (optional)
12. continuous sheet strip in VM ZINC®, th = 0.8 mm
13. ventilated space

Baukörperanschlüsse
(Maßstab 1:2)



P. 1

P. 2

Punkt 1

Punkt 2

