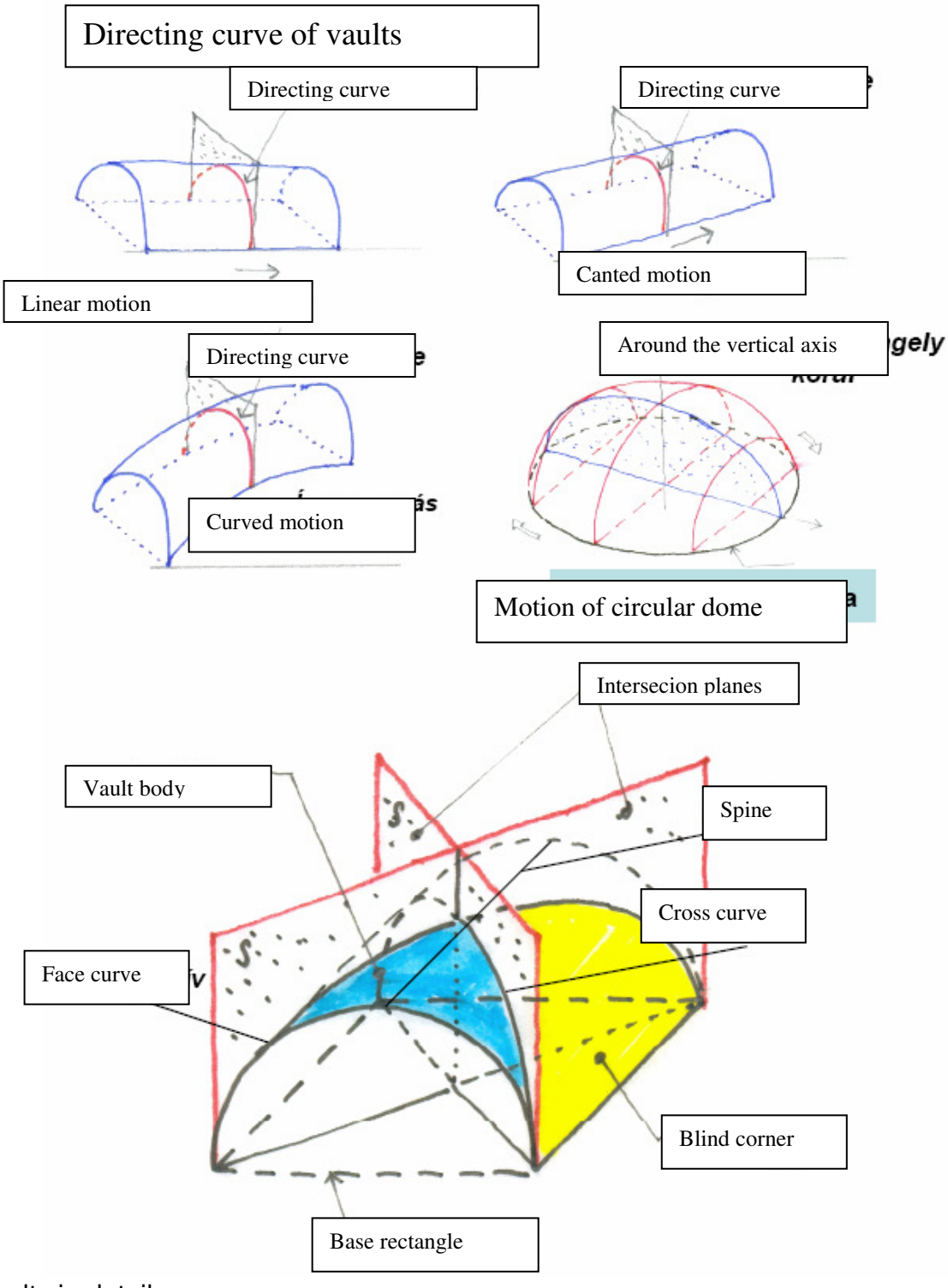
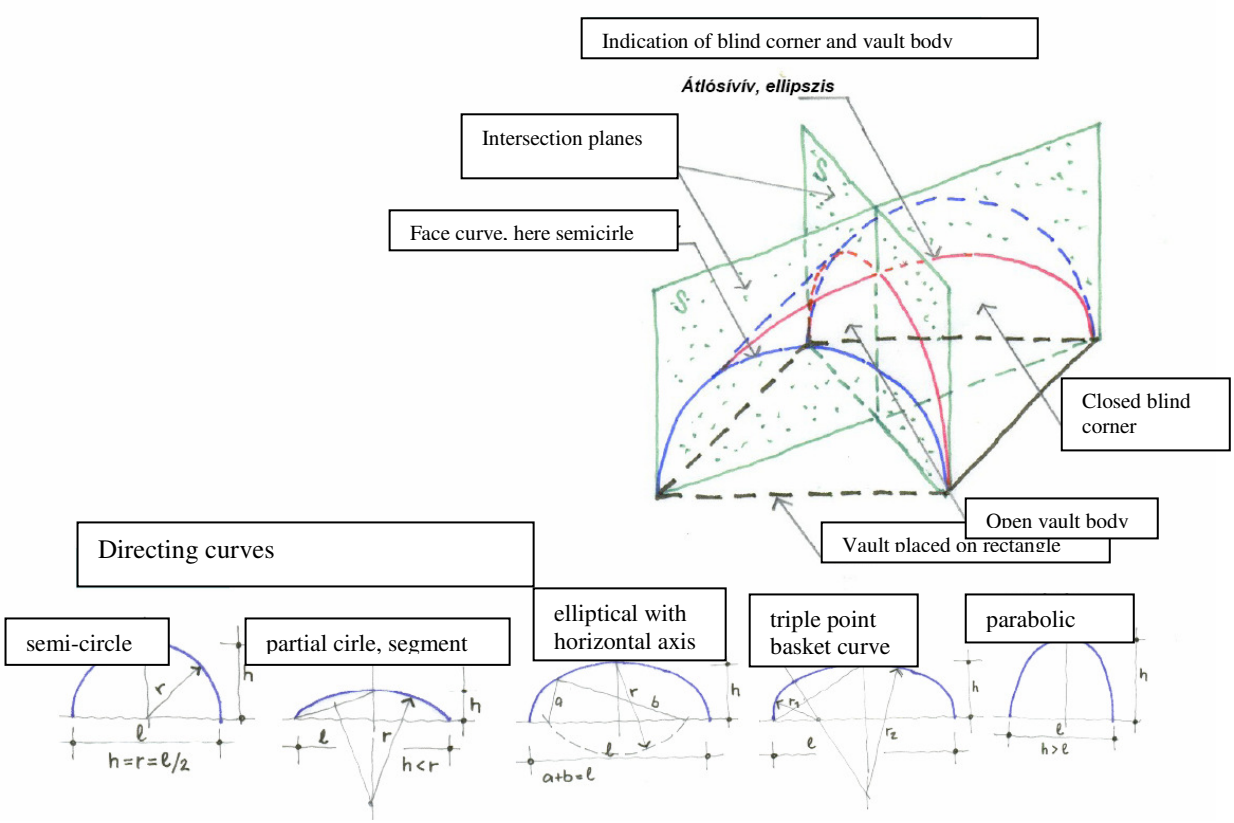
□ VAULTS

Floor ==> To transport vertical forces from one place to another
Vaulted floor NO TENSION IN THEM

- defining vaults:
  - cylinder → barrel, cloister, tunnel, wagon vaults, roman cross vault
  - sphere → or circular rotation objects → domes, saucer domes, ribbed domes
- vault shape terminology:
  - directing curve, vault body, blind quarter, face curve, cross curve, spine – closure curve



- barrel vaults in detail
  attributes:
  - may be erected on top of any shaped floorplan
  - directing curve: half-circle, cirle segment, parabolic, elliptical



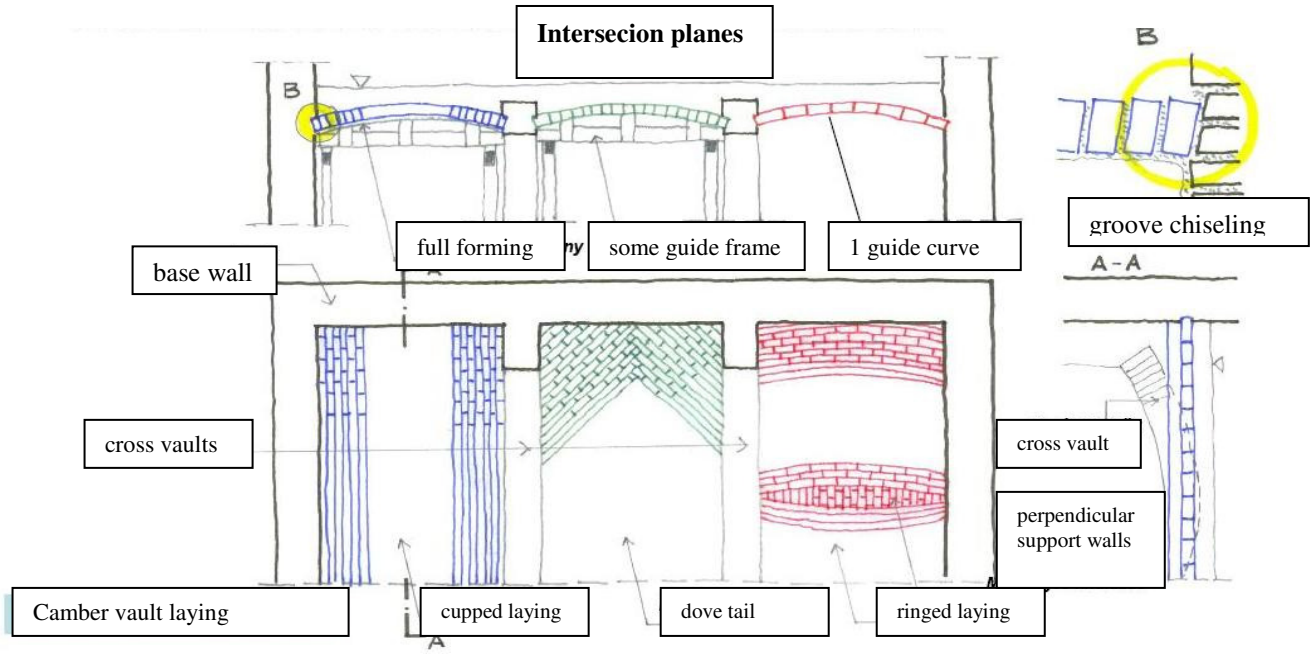
various derived shapes:

- **cloister (also on top of polygons other than rectangles)**
- simple straight vault (barrel, cradle, tunnel, wagon etc.)
- romanesque cross vault (elliptical cross curve, closing curve is straight)
- gothic cross vault (decreased incline of the face curve)
- many different cross vaults may be generated (face curve → motion → <u>trans….. surface)</u>

- <u>spheres and other rotation derived spherical vaults</u>
  - cupola (floor plan may be circular or elliptical rotation axis may be vertical or horizontal)
  - chech sail dome (floor plan corner points are located on a circle)
  - chech bishop sail dome (floor plan corner points are located within a circle)

- <u>vault materials</u>
  - before: stone, brick, nowadays concrete, false vault out of wire latice

- <u>building construction aspects of vaults:</u>
  - arch → bent pillar
  - vault → bent wall
  - barrel type vault → face brick laying (wedge type gaps)
  - support wall and arch connection masonry work
- <u>vault symbols</u>
  - on floor plans indicate rotated face curves, cross curves with dashed lines, indicate drafted intersection lines
- flat curve barrel vault = CAMBER VAULTED vault
  - brick laying: cupped, ring, dovetail

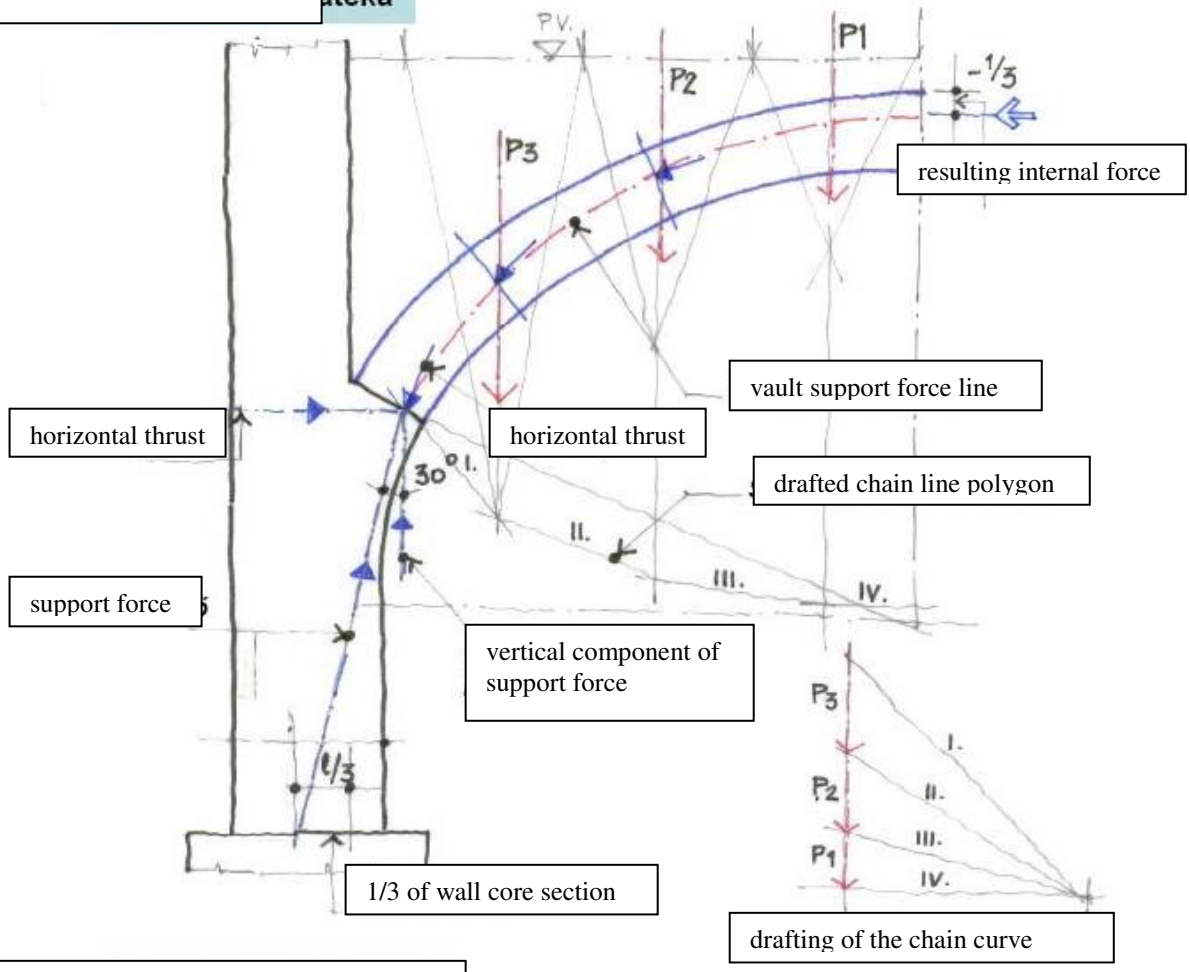


Vaulted floors (book 2. p 181-194.)
Supported (time, material, labor force) **OR** **Self supported**
building method → foil

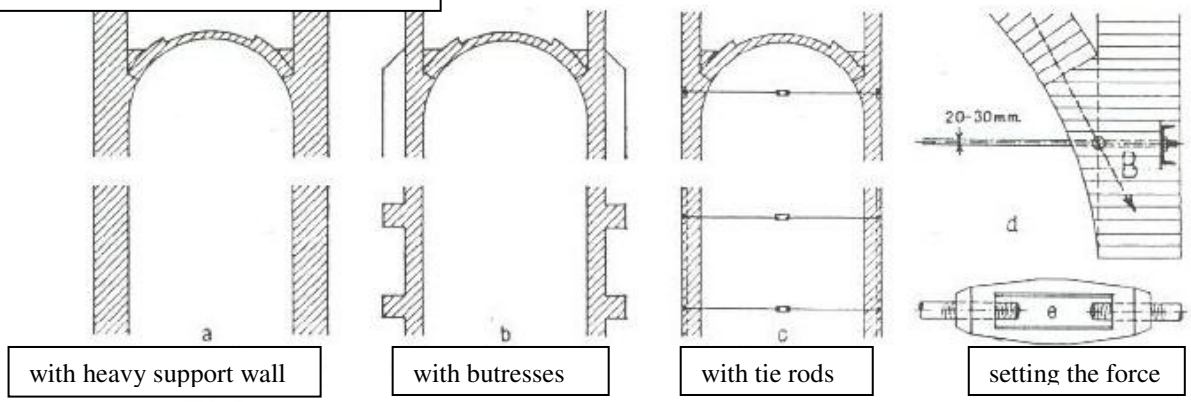
- **Forces in arches**
  - Vertical forces transfer to horizontal (just pressure) for this reason level difference is necessary between the attack point and the support.
  - Arches (book 1. p 46.)
  - **Flat** OR **Curved** → foil
  - Connection between the height of the arch and the horizontal force level

- **vault static play:**
  - statically 3x –n undefined
  - force polygon = support line
  - resulting support force = stress on vault base
  - core section
  - chain curve
  - cupola vaults have ring tensions

Vault statics play



Compensating horizontal thrust



- **<u>vault renewal issues:</u>**
  - vault damages may be: motions of support walls
    overloading
    loss of stability due to reduced stress cap.
    faulty construction

- <u>Differences in use (basement, intermediate floor, roofing)</u>
- <u>Fire protections point-of-wiev</u>

- Historical sample - Cathedral in Florence by Brunelleschi (cupola)
  - beginning in the 14th century (1296 –
  - to finish the cupola
  - cupola with a span of 45 m
  - octagon floor shape
  - 107 m high
  - technical difficulties – different ideas (total builders' staging and centering, building artificial hill with money in it, …)
  - competition in 1417
  - Brunelleschi won (small model in 1:10 scale)
  - double-layer cloister vault (gothic)
  - ribs between the layers
  - 64 spiral ribs with fishbone brick arrangement in the internal layer
  - self-supporting construction without builders' staging, or arch centering (the builders' staging was hanged onto the construction)