CURVED MEMBERS – MASONRY ARCHES

Uniformly distributed loading

Free-standing parabolic arch (stable)

Line of action of internal force in structure (funicular line)

Free-standing circular arch with narrow voussoirs

Uniformly distributed plus concentrated loading

Free-standing circular arch with added concentrated load

Free-standing arch with no horizontal restraint

Tension causes cracks to open

Collapse mechanism (minimum of four hinges)

Collapse mechanism (rotational)

Collapse mechanism (sliding)

Uniform compression

Free-standing arch on blocks

Nonuniform compression

Free-standing arch partly braced by blocks or part of wall

Tension develops on one face (thus possible cracking)

Force

Middle third

Walls distribute concentrated forces

Walls prevent cracks from opening

Free-standing arch (stable due to width of voussoirs)

Arch stabilized by surrounding masonry wall (also makes carrying moving loads feasible)

Loading

Collapse tendency

Loads reduced at haunches

Varying the dead weight to control the location of the line of force and reduce collapse tendencies