Public Bathhouse, Hammam for Aït Benhaddou, Morocco
Structure of Presentation:

1. Introduction & Solar Research
2. Concept Development
3. Design & Technology
INTRODUCTION
Designing with Sunlight
Aït Benhaddou

Historical Importance

Trans-African trading routes, villages created as trading posts and housing for wealthy families along river
RHYTHM # 1 SUNLIGHT
Old Ksour in the foreground with the new town across the river
Living Link Business

New Town / Bridge / Old Town
No current defined public realm
Towns are separated
Difference is good

BUT

Separation produces dissidence

Need for better integration between old Ksour and New town
P3 PERIOD
Concept Development
Art
As seen in these paintings, the bathhouse has a strong sense of community gathering
- Jean Auguste Dominique Ingres
Traditional Bathhouses - Turkey, Morocco
Atrium

- Bath Master’s room

Apodyterium (Dressing room)

- Frigidarium (cold room)
- Tepidarium (Warm room)

Caldarium (Hot room)

Laconicum (Sweating room)

W.C.
Contemporary Bathhouse
Therme Vals - Peter Zumthor
Boa Nova Restaurant
Alvaro Siza
Querini Stampalia, Venice

Carlo Scarpa
DESIGN
Hammam, Aït Benhaddou
River’s Flow

Crossing
Concept Sketch
RHYTHM # 2 FLOW OF WATER
62°C 58°C 48°C

Hot Room  Warm Room  Cold Room
Underground floor plan
Routing
Initial

Tilt
πr \gamma (\cos \theta_R - \cos \theta_A) > \rho V g \sin \alpha

r is the radius of the contact line
\gamma and \rho are the surface tension and density of the liquid,
g is the gravity acceleration,
V is the volume of the drop,
\alpha is the angle of the plane
Satellite image showing solar radiation levels in Morocco. Ouargzazate receives so much solar energy, it can produce up to 9.04 kW of power per meter squared per day.

Map showing the location of Desertec company planned CSP plants. Many are currently on hold due to North African conflicts.
Calculation for Yearly kw usage for Hammam

Approx 60 000 kw/h needed to keep Bathhouse in operation
Programme Volume
1059 m³

Parabolic Trough Efficiency @ 70% in Moroccan Climate

Heating Requirements
60 000 kw/h per year

39 m² Solar Collectors Needed
60 - 80 % Thermal efficiency of Parabolic Trough Collectors, hence
Approx. $40 \text{m}^2$ of Panels needed for heating of the Hammam
Sun’s Path

Heated Water to Reservoir
~70°C

Cold water pumped back to CSP
~35°C
Service ducts on backwall

Hot water ~50°C

Cold water ~15°C

Basin for scooping water for washing
Water fed from local mains

Hot water taps for interior

Open CSP system
Hammam

Public Sphere

Very Private
Design & Light 58

110 @ Highest Point South at concrete upstand

110 @ Lowest Point North above concrete stand

Gasket to vent at low side

Drip Overhang

Steel Angle Fixed to Concrete upstand

Stone Finish

1100 Lowest Point North above concrete stand

Glass Fixed to Gasket

Chamfered Concrete Corner

Light Rays

Hammam

Private

Public Sphere

M 40 Bolt

Inside

75

237

250

70

Inside
1. area of each face = \( l \times w = 3'' \times 3'' = 9 \text{ in}^2 \)
   total SA = 6 faces x 9 in\(^2\) = 54 in\(^2\)
2. area of each face = \( l \times w = 1.5'' \times 1.5'' = 2.25 \text{ in}^2 \)
   total SA = 6 faces x 8 blocks x 2.25 in\(^2\) = 108 in\(^2\)
3. area of each face = \( l \times w = 1'' \times 1'' = 1 \text{ in}^2 \)
   total SA = 6 faces x 27 blocks x 1 in\(^2\) = 162 in\(^2\)