Construction Practice

- Robotic construction
- IMI workshop
- TMS 602 specifications

Renzo Piano
Maison Hermes
15 story, glass block
Tokyo, 2001

Maison Hermes

Renzo Piano
Tokyo, 2001

Maison Hermes

Renzo Piano
Tokyo, 2001

Maison Hermes

Renzo Piano
Tokyo, 2001

Maison Hermes

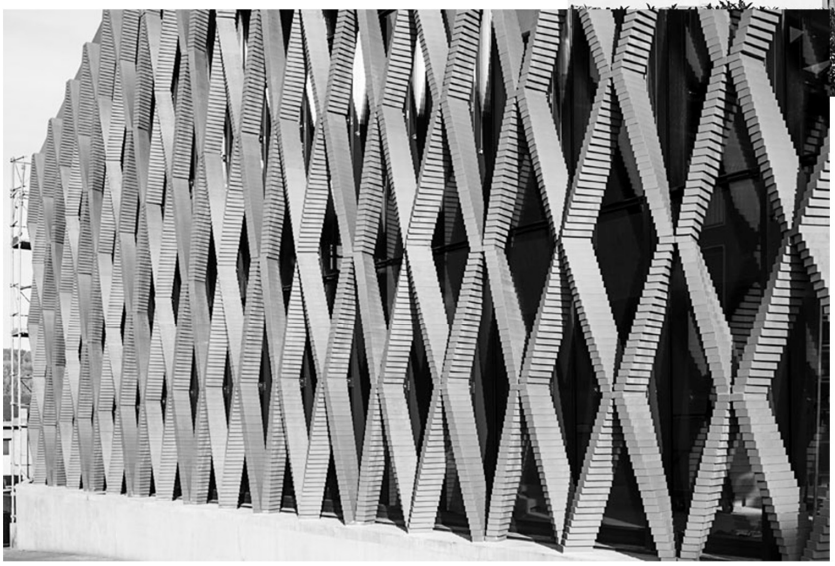
Renzo Piano
Tokyo, 2001

Maison Hermes

Renzo Piano
Glass Blocks by Vetroarredo, Florence
450 mm (17.72 in.)

Robotic Brickwork

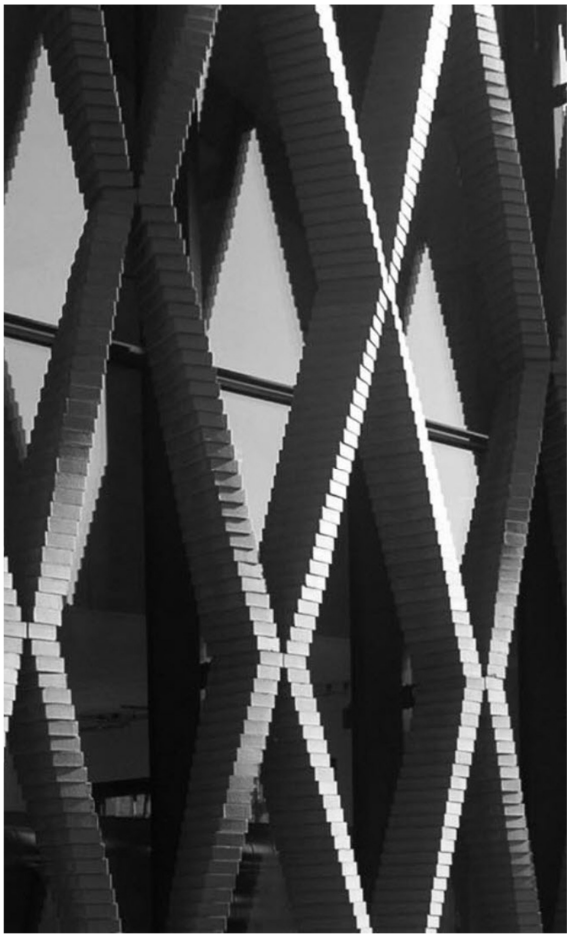
ROB Technologies
Switzerland



ROB Brick
Keller AG Headquarters
Pfungen, Switzerland

Robotic Brickwork

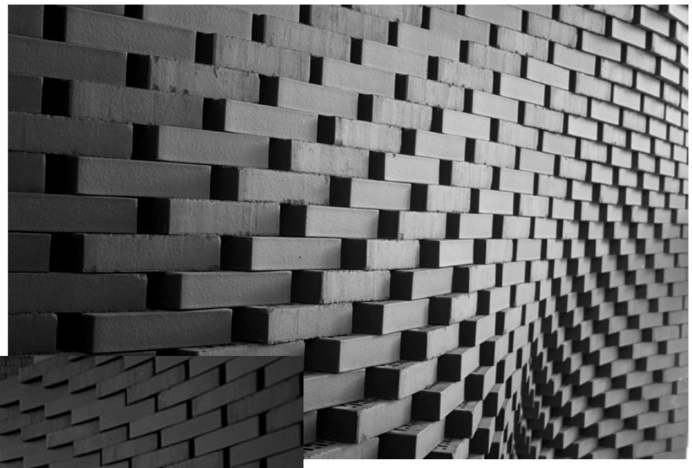
ROB Technologies - Switzerland

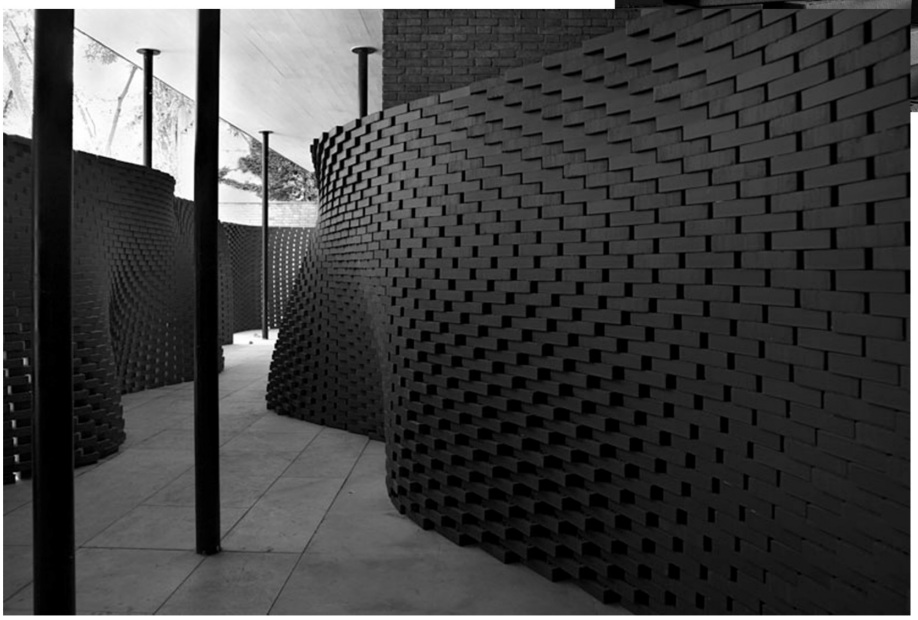


ROB Brick
Keller in Pfungen

Structural Oscillations

11th Venice Architectural Biennale
Gramazio Kohler Research





Structural Oscillations

11th Venice Architectural Biennale
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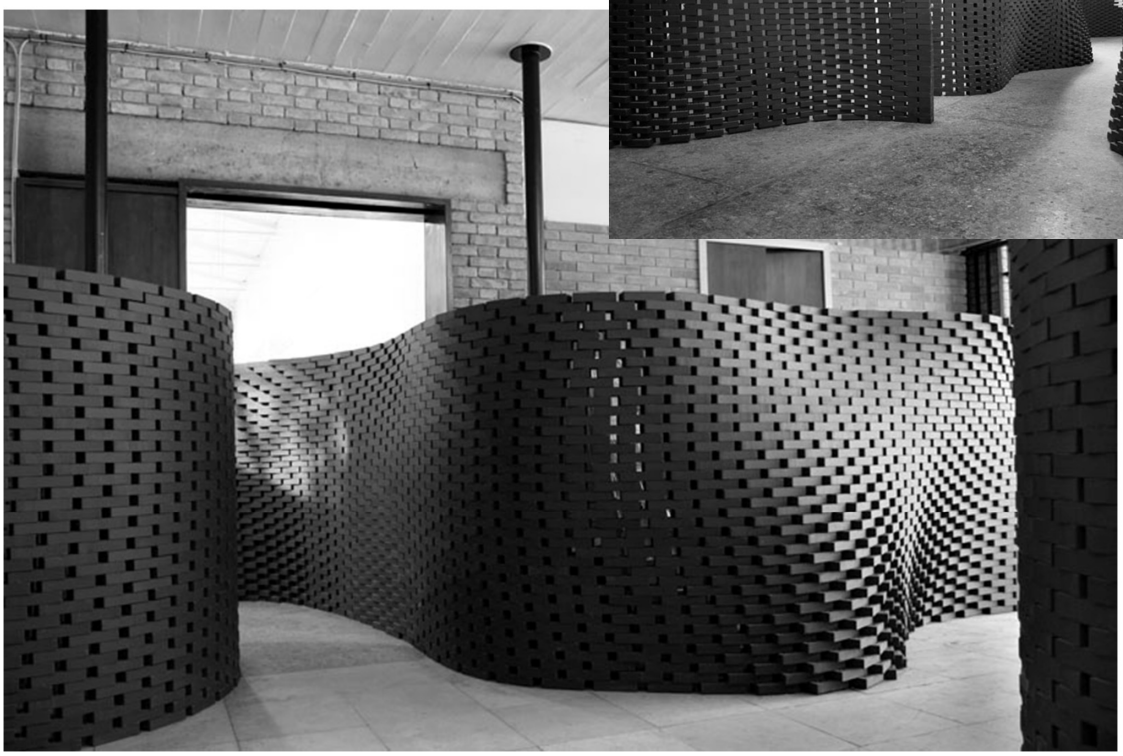
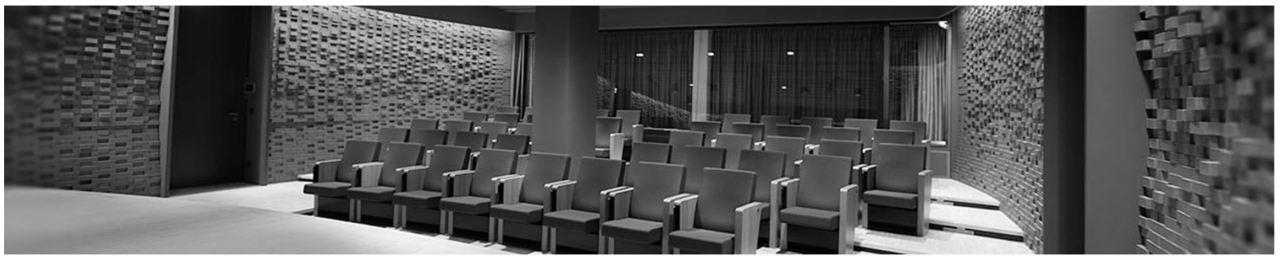
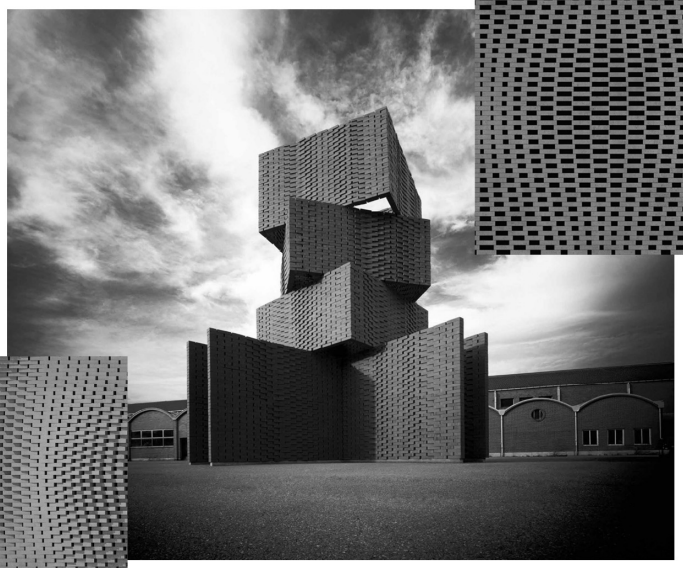
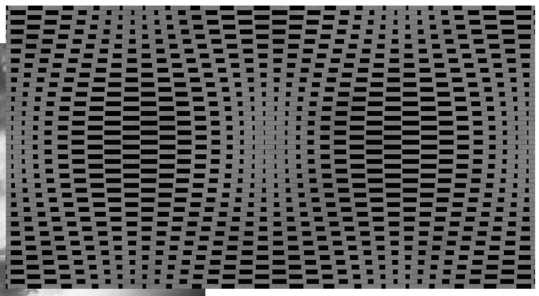


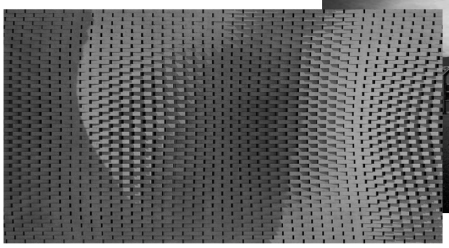
Robotic Masonry



Max-Plank-Institut
Frankfurt







IMI Workshop

International Masonry Institute

Coming Oct 21st

tuck-pointing

IMI Workshop

International Masonry Institute
brick laying

IMI Workshop

International
Masonry Institute
Laying Tile

IMI Workshop

International Masonry Institute
the Mule

IMI Workshop

International Masonry Institute
Flashing

IMI Workshop

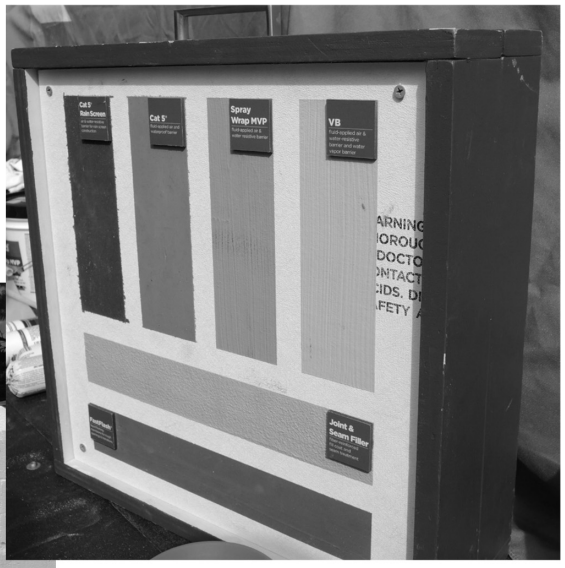
International Masonry Institute
expansion joint

IMI Workshop

International Masonry Institute
brick laying

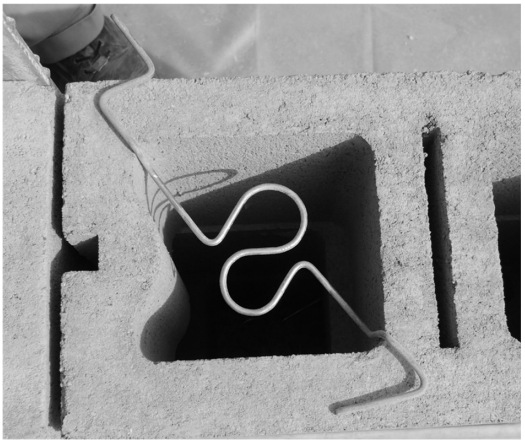
IMI Workshop

International Masonry Institute
Prosoco water repellent

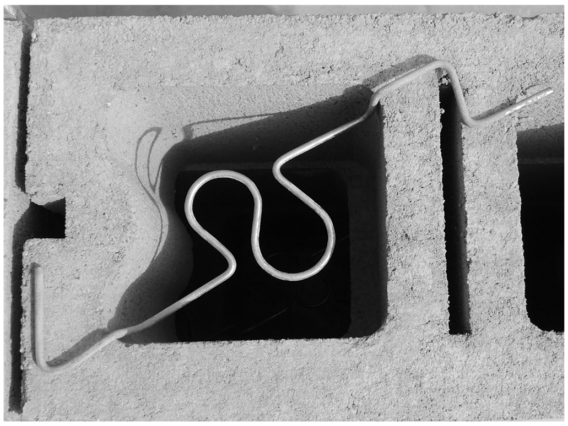


IMI Workshop

International Masonry Institute
Wall Grouting



Wrong way



Right way

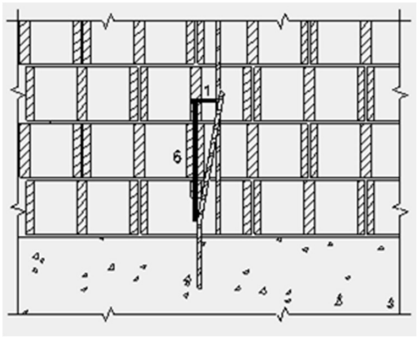
IMI Workshop

International Masonry Institute
Wall Grouting

Construction Practices

Preparations for laying masonry

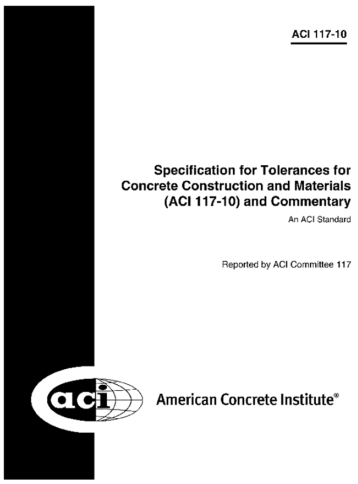
- Clean laying surfaces just prior to laying for good bond
- Check alignment of dowels
- Check foundation tolerances with respect to ACI 117



Slope of 1:6 allowed for dowels (TMS 602 3.4.B.11.d)

Level alignment of footings: ±½ in.

Relative alignment: slope not more than 1 inch in 10 feet



Construction Practices

Protection of Masonry During Construction

Avoid premature loading (TMS 602 1.8.A)
- An example is backfilling a basement wall before the top is supported by the ground floor.

Cover top of unfinished masonry (TMS 602 1.8.B)
- Efflorescence is often caused by water in cells evaporating through the faces of the wall.

Bracing of structure (TMS 602 3.3.E)
- Wind forces on walls are more severe during construction due to:
  - Lack of development of full strength
  - Lack of support (cantilever vs. simple support)
  - Increased wind pressure due to lack of enclosure
- Internal bracing
  - Use of reinforced wall itself to provide stability

Construction Practices

Cold Weather Construction

- Objectives
  - Allow sufficient strength gain from hydration of cement in mortar
  - Allow sufficient moisture reduction of mortar before it freezes

- Problems
  - Units with frozen moisture absorb less water, leading to reduced bond and lower quality mortar because of higher remaining moisture content in the mortar
  - Cold units drain heat from mortar, possibly causing it to freeze before adequate moisture can be absorbed
  - Freezing water can expand and rupture mortar

Cold Weather Construction

Construction Preparation

- Do not lay masonry units having a temperature below 20˚F
  - containing frozen moisture
  - visible ice
  - snow on the surface
- Remove visible ice and snow from top surface of masonry or foundation containing frozen moisture
  - Heat surface to above freezing. TMS 602 1.8C

Ambient Temperature	Requirement
40˚F to 32˚F	Do not heat water or aggregates above 140˚F Heat sand or mixing water so mortar is between 40˚F and 120˚F Heat materials of grout to above 32˚F
32˚F to 25˚F	Produce mortar between 40˚°F and 120˚F; maintain mortar above freezing until used. Produce grout between 70˚F and 120˚°F; maintain grout above 70˚F at time of placement.
25˚F to 20˚F	Heat masonry surfaces under construction to 40˚F Heat masonry to 40°F prior to grouting Use wind breaks when wind speed exceeds 15 mph
20˚F and less	Provide enclosure with temperature above 32˚F in enclosure

Cold Weather Construction

Construction Protection

Mean Daily Temperature[1]	Requirement
40˚F to 25˚F	Cover with weather-resistant membrane for 24 hours
25˚F to 20˚F	Cover with weather-resistive insulating blankets for 24 hours Extend time period to 48 hours for grouted construction unless only type of cement in grout is Type III
20˚F and less	Maintain masonry above 32˚F for 24 hours using heated enclosures, heating blankets, or other methods Extend time period to 48 hours for grouted construction unless only type of cement in grout is Type III

[1] Minimum daily temperature for grouted masonry

Construction Practices

Hot Weather Construction

- Objective
  - Prevent dryout of mortar and grout and allow for proper curing.
- Protection
  - Fog spray newly constructed walls three times a day for three days when mean daily temperature exceeds 100°F or 90°F and wind speed greater than 8 mph.

TMS 602 1.8 D

Ambient temp > 100˚F or 90˚F and wind speed greater than 8 mph.	Ambient temp > 115˚F or 105˚F and wind speed greater than 8 mph.
Maintain sand in damp, loose condition	Shade materials and equipment from direct sunlight
Produce mortar below 120˚F	
Maintain mortar and grout below 120°F	Use cool mixing water. Ice is permitted in mixing water prior to use. Ice is not permitted in water when added.
Flush mixer, transport containers, and mortar boards with cool water	
Retemper mortar with cool water	
Use mortar within 2 hours	

Construction Practices

Embedded Conduits, Pipes, and Sleeves
(TMS 602 3.3 D)

- Space not more than 3 diameters on center.
- Should not displace more than 2% of cross section in columns and pilasters.
- Do not embed aluminum unless coated.
  - Electrical fields from conduits make the problem worse.