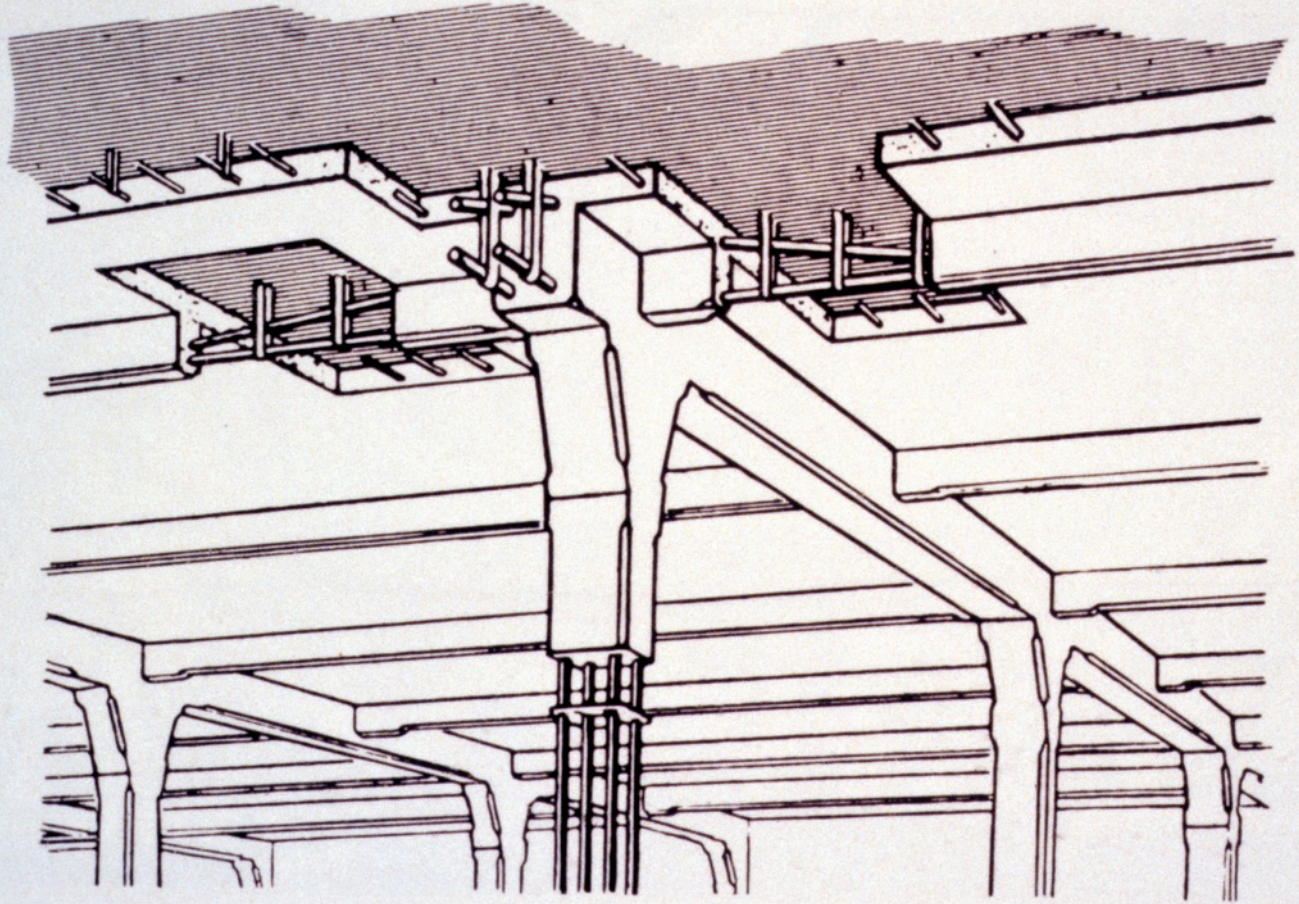
Modern Concrete Construction

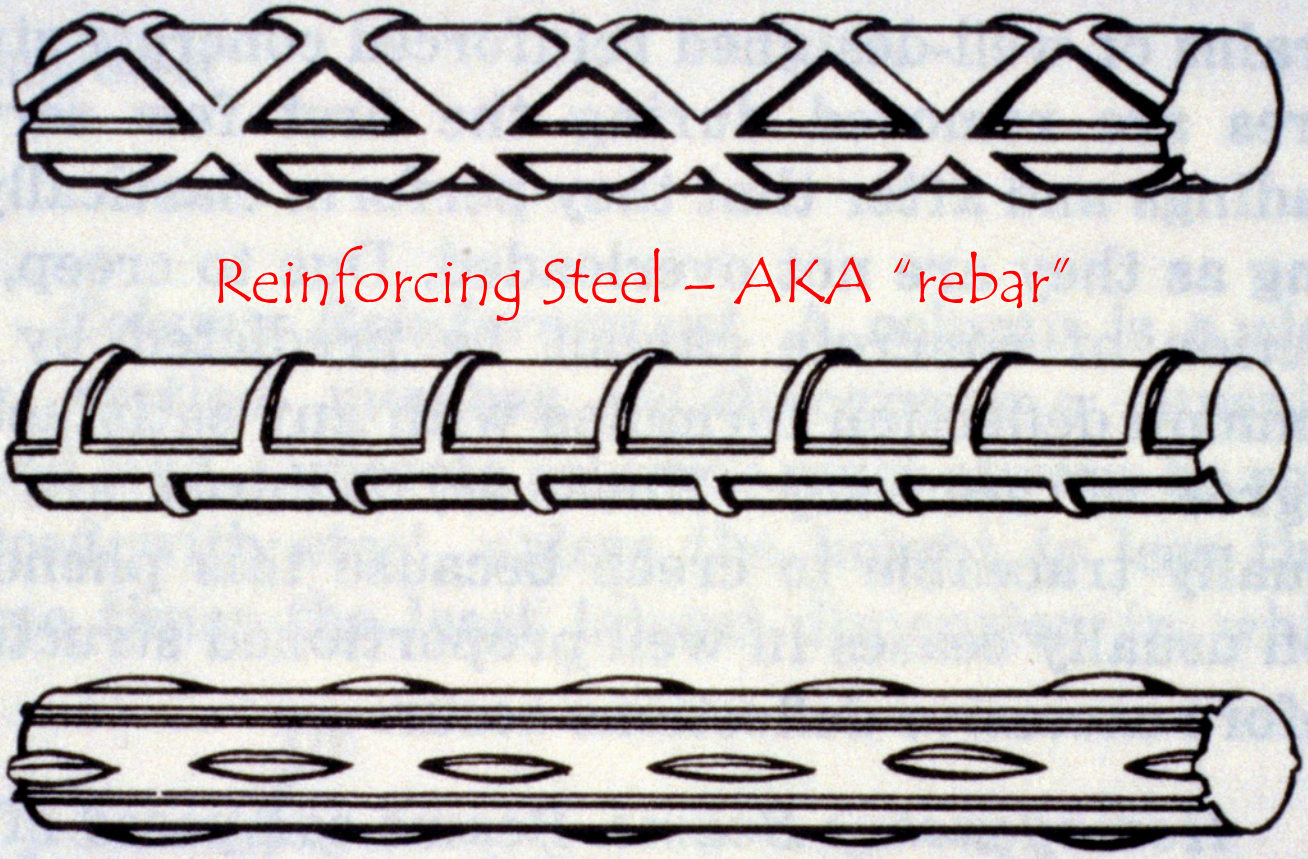
Arch 173: Building Construction 2
Winter 2025
Terri Meyer Boake



16 Hennebique, patent reinforced concrete frame construction, 1892.

Primary ingredients of CONCRETE:

Large aggregates
Small aggregates
Cement
Water



Reinforcing Steel – AKA "rebar"

Steel Reinforcing Bars
Figure 19-2

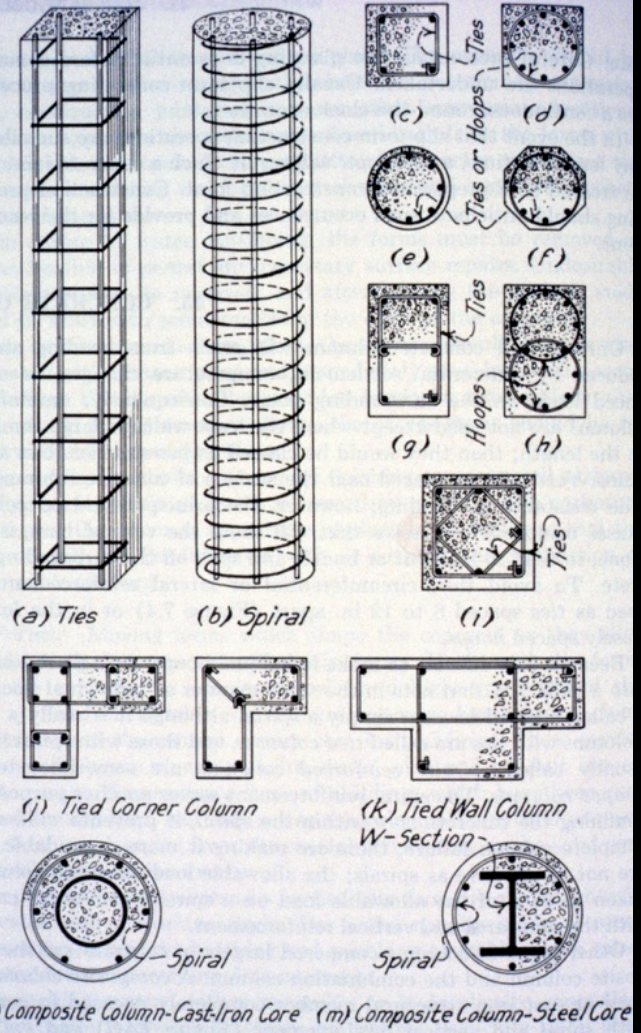


FIGURE 7.4 Reinforced concrete columns.

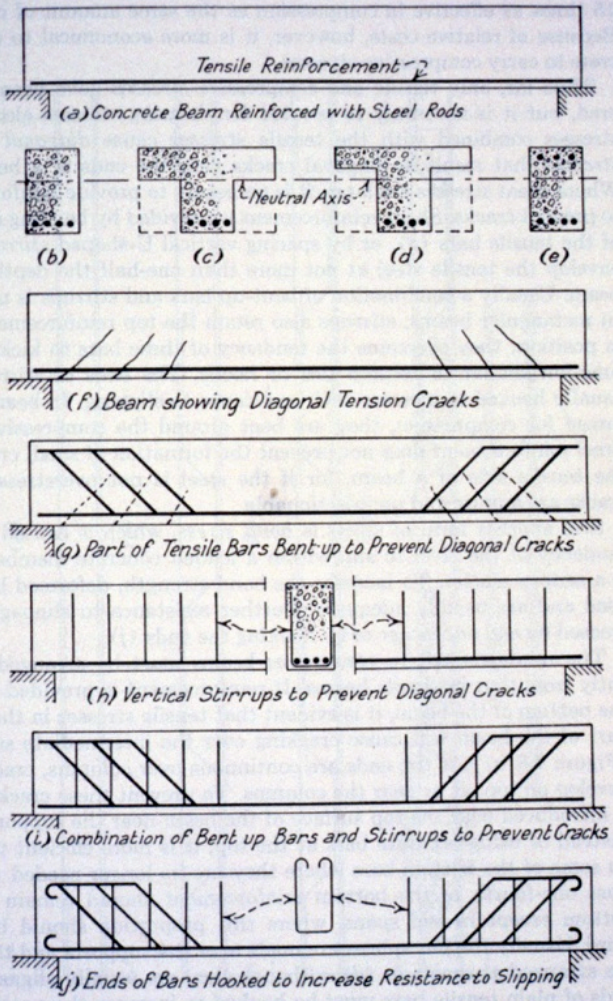


FIGURE 7.5 Simple reinforced concrete beams.

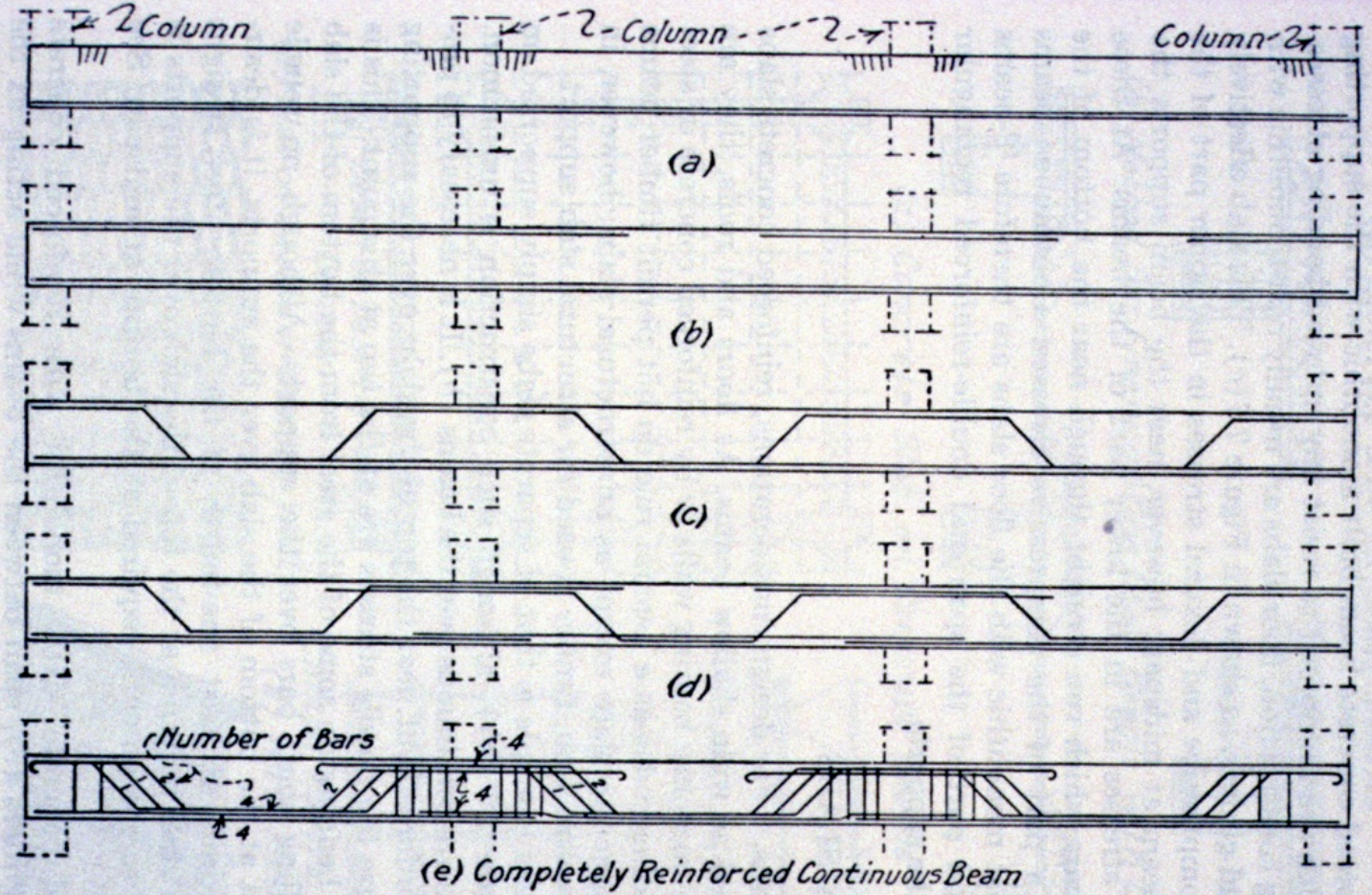
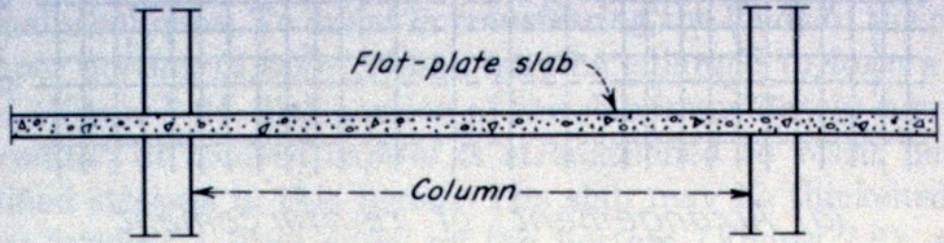
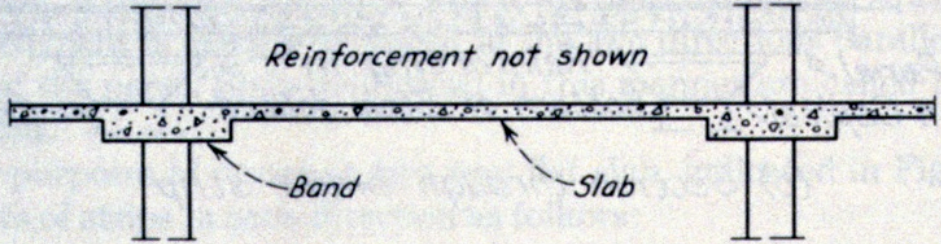


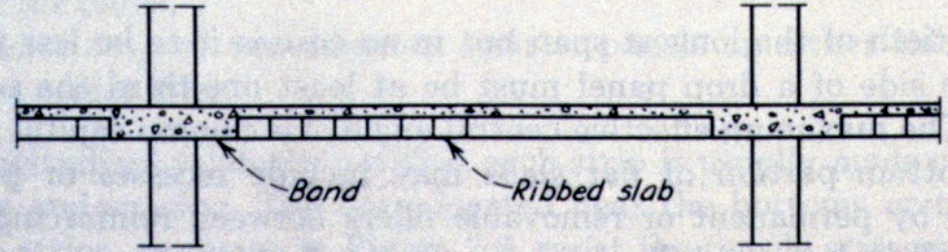
FIGURE 7.6 Continuous reinforced concrete beams.



(a) Flat-plate construction



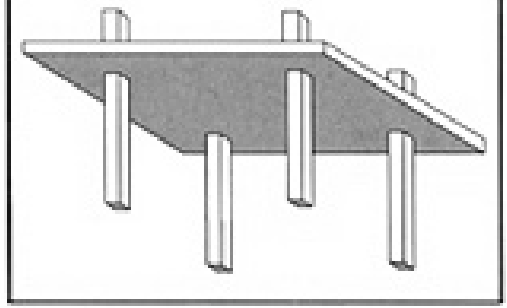
(b) Slab-band construction



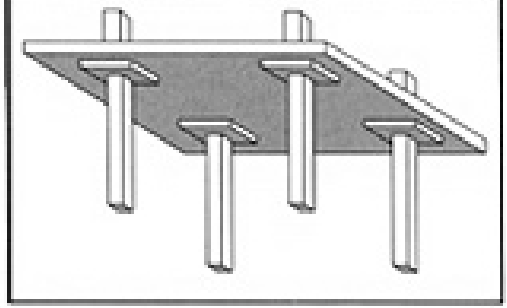
(c) Ribbed slab-band construction

FIGURE 7.9 Flat-plate and slab-band floor construction.

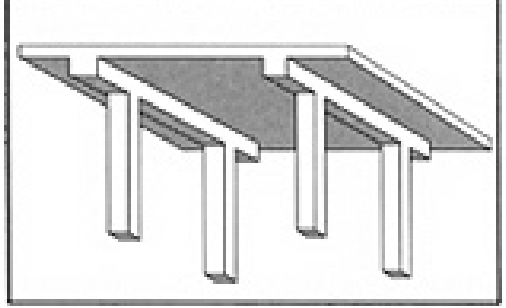
Two-Way Flat Plate



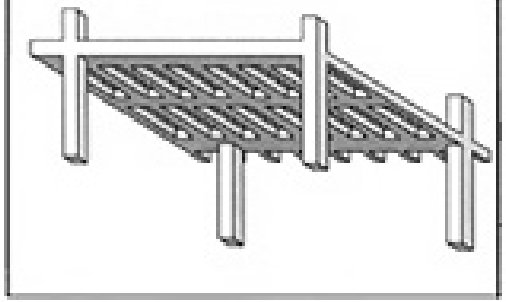
Two-Way Flat Slab with Drop Panels



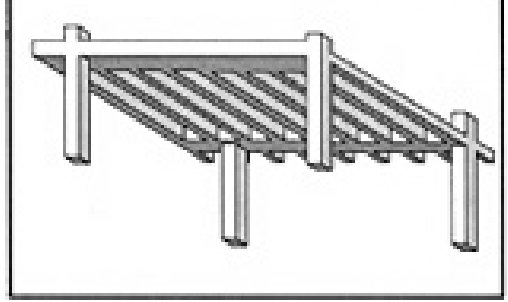
One-Way Beam and Slab



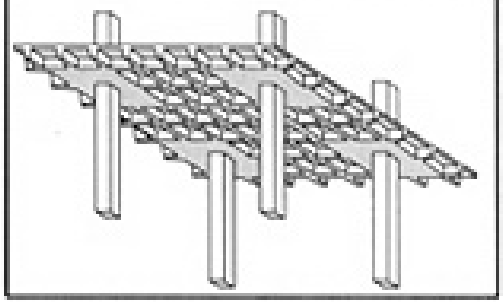
One-Way Joist Slab



One-Way Wide Module Joist Slab



Two-Way Joist Slab (Waffle)



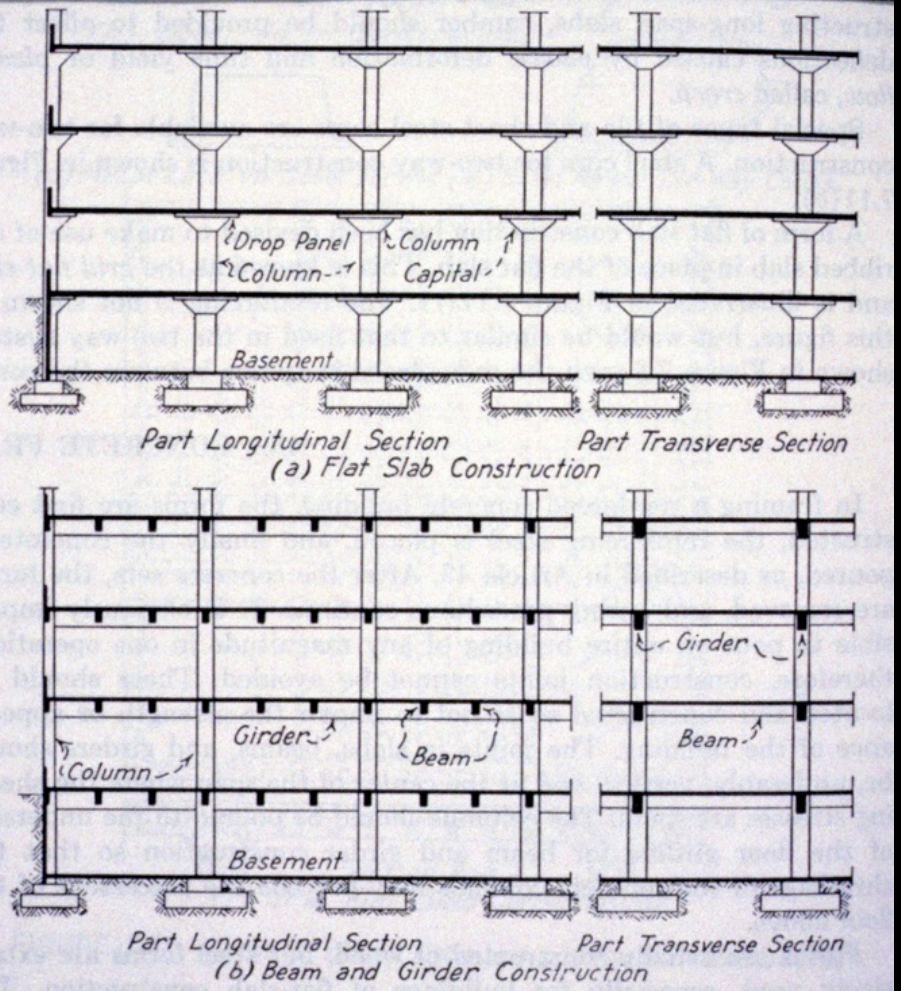


FIGURE 7.12 Types of reinforced concrete framing.

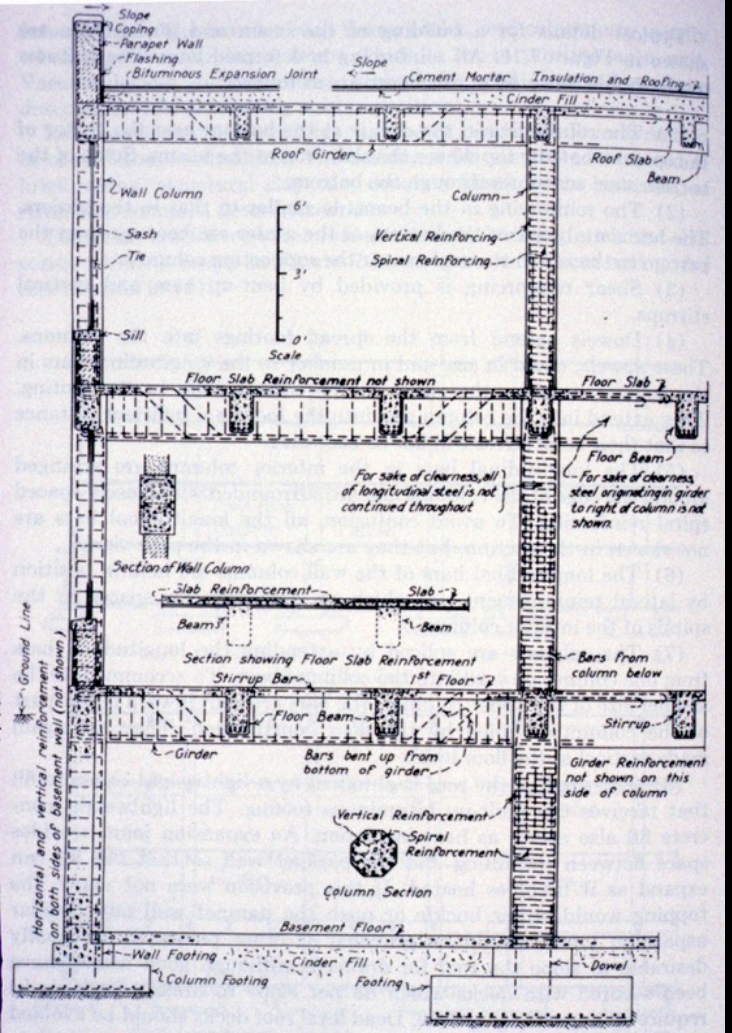


FIGURE 7.13 Beam and girder construction.

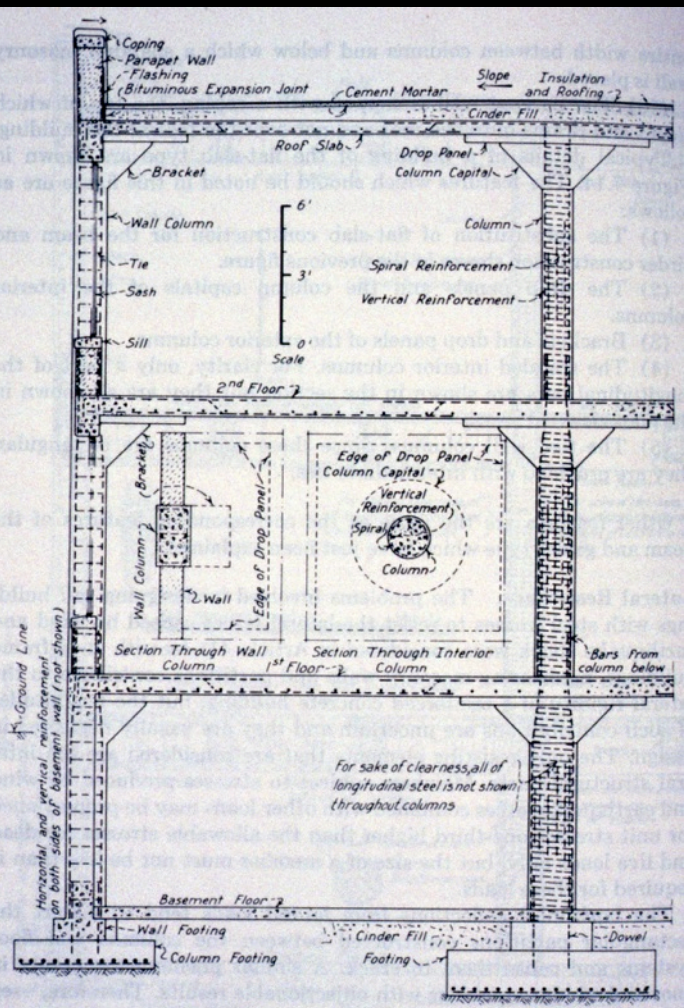


FIGURE 7.14 Flat-slab construction.


MARINER
POINT

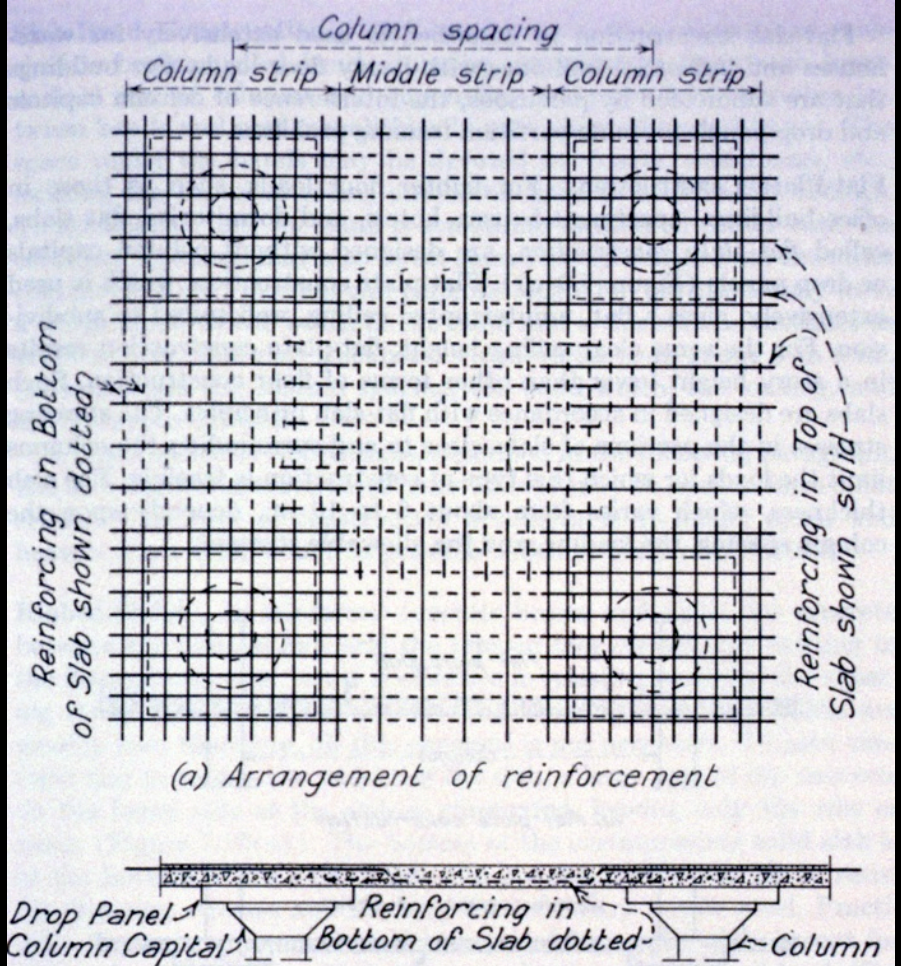
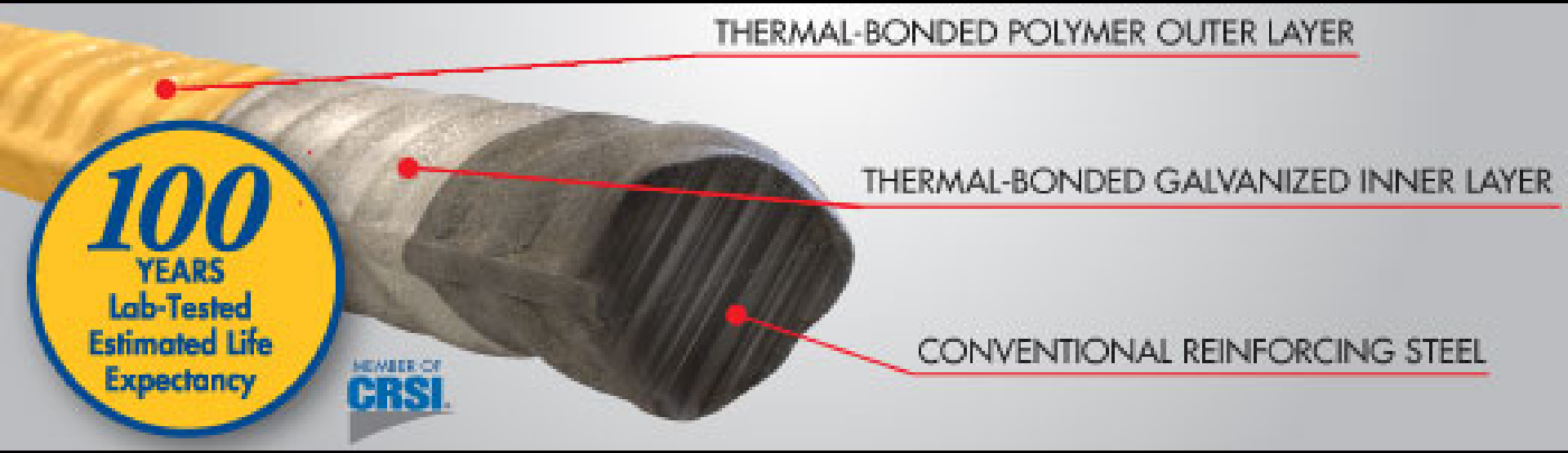
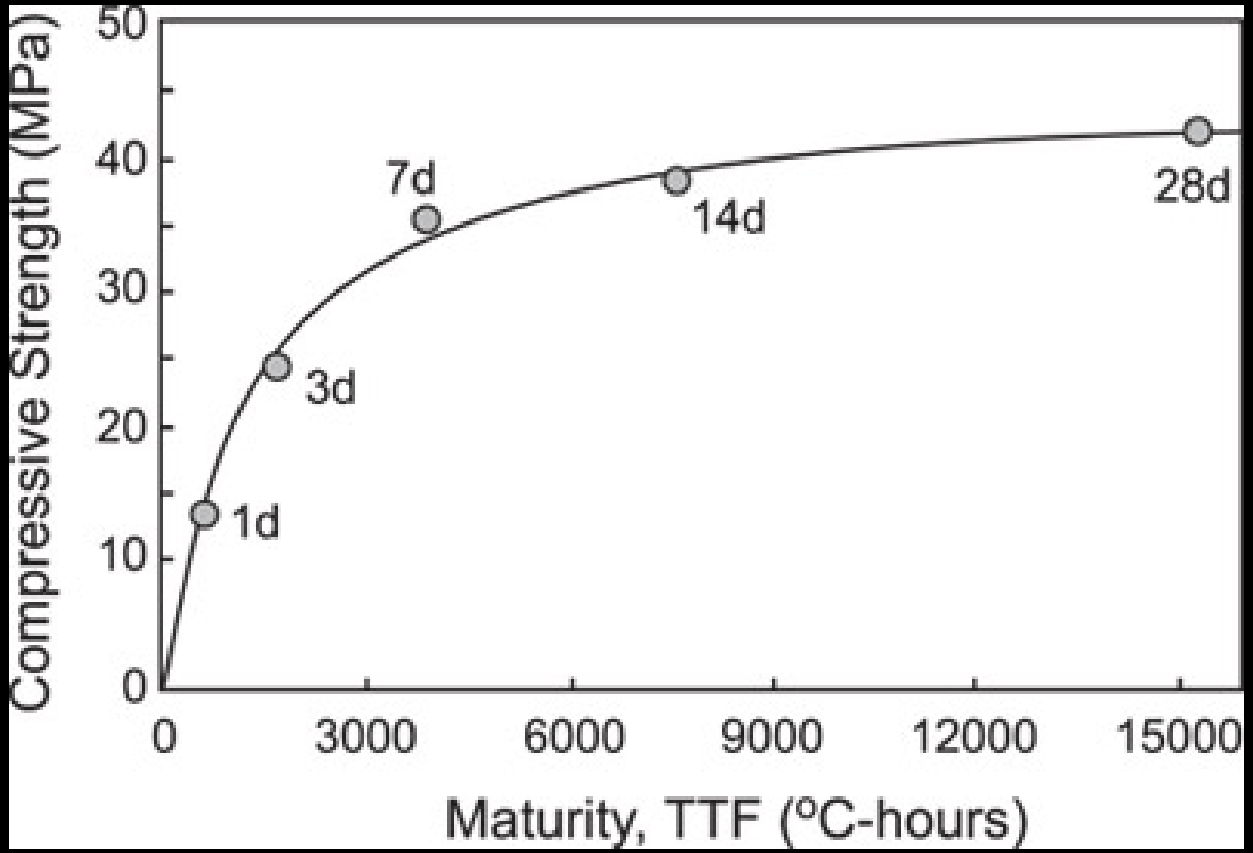


FIGURE 7.8 Two-way flat-slab construction.


THERMAL-BONDED POLYMER OUTER LAYER
THERMAL-BONDED GALVANIZED INNER LAYER
CONVENTIONAL REINFORCING STEEL
100
YEARS
Lab-Tested
Estimated Life
Expectancy
MEMBER OF
CRSI

Admixtures are materials other than cement, aggregate and water, that are added to the concrete to alter its properties:

- Workability
- Air entraining
- Curing temperatures range
- Time set
- Colour

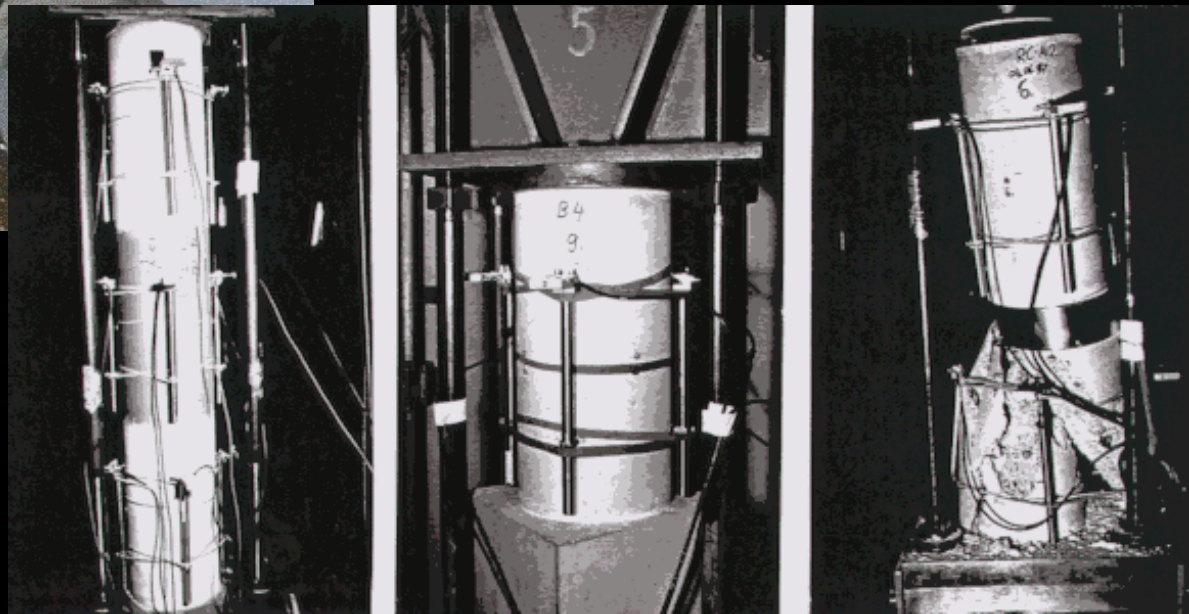


The compressive strength of concrete improves over time

The slump test measures the workability/moisture content of the concrete

Cylinder Test is done to verify the strength of the concrete – but after it has reached its 28 day full strength.

The hardened cylinder samples are put in a test machine and crushed to the point of breaking



Concrete CREEP

Concrete continues to "cure" forever. Though its strengthening drops off to nil, it continues to SHRINK over time.

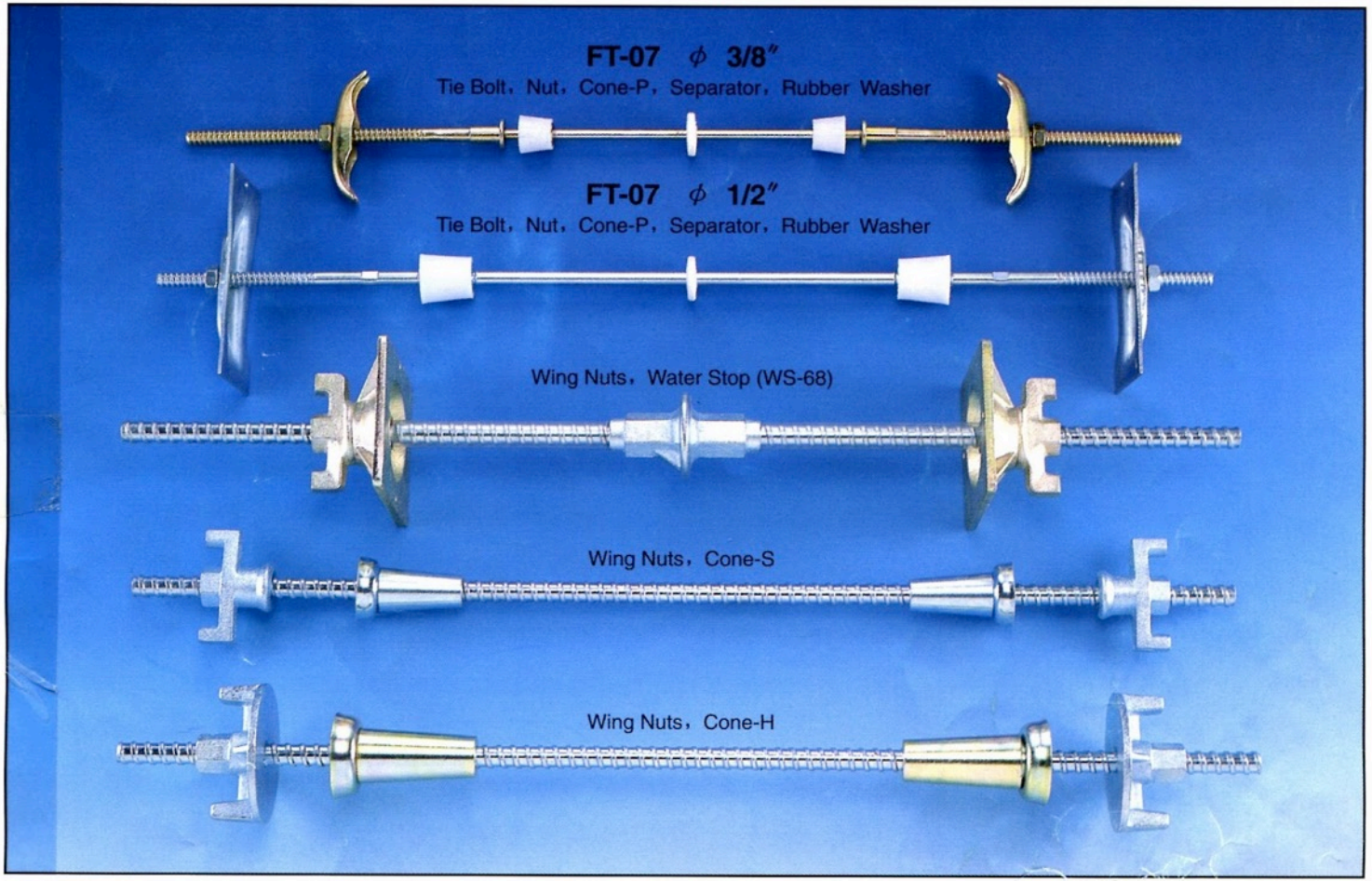
This means buildings get shorter over time.

Must detail for differential shrinkage with cladding materials.

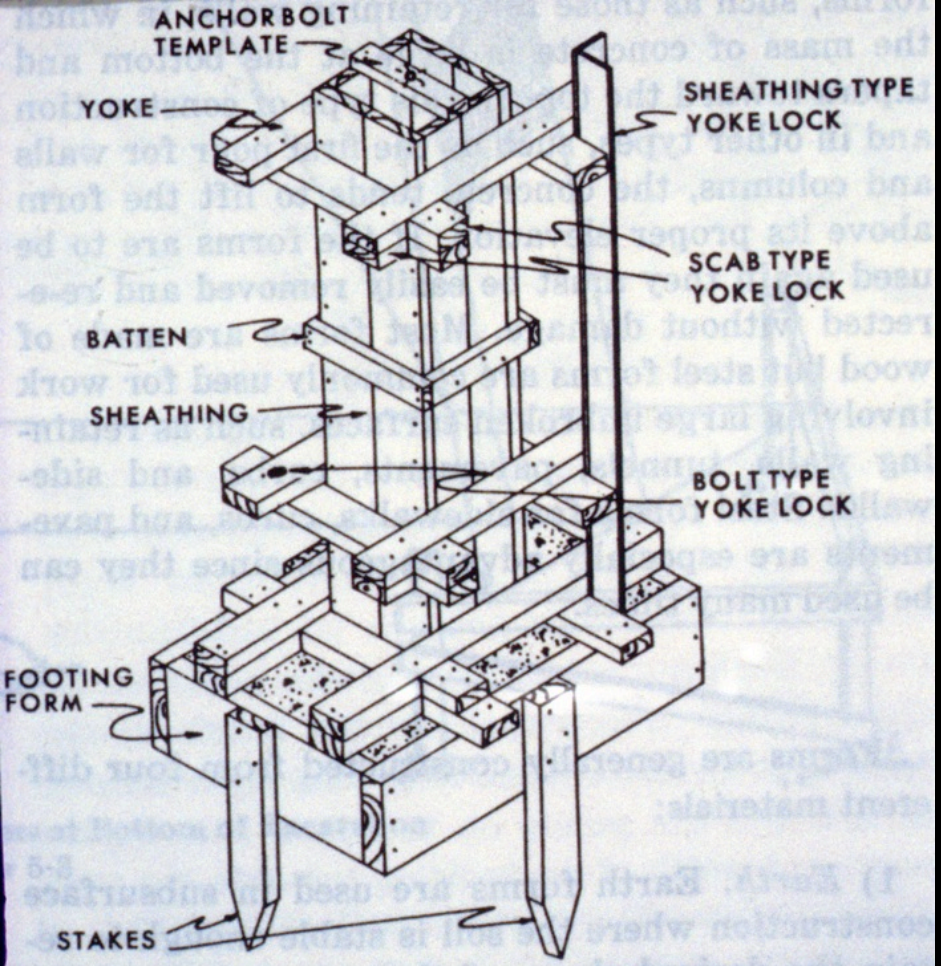
The need for and design of FORMWORK is a unique aspect of concrete construction.

Impacts the time to construct and cost of the project.

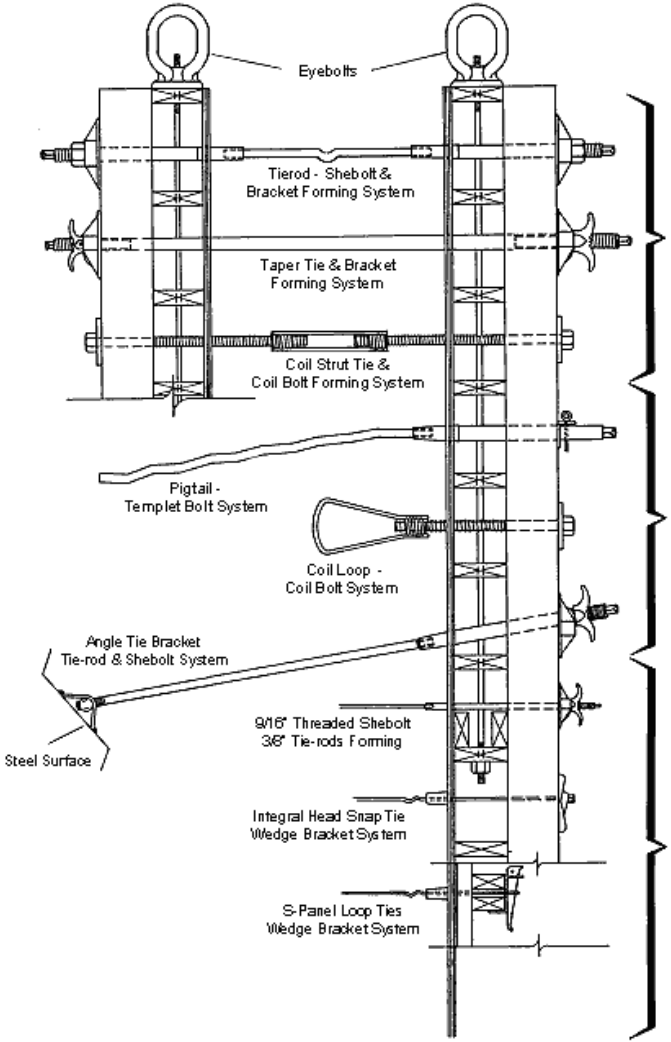
Form Tie System (Wall Forming Fastener)



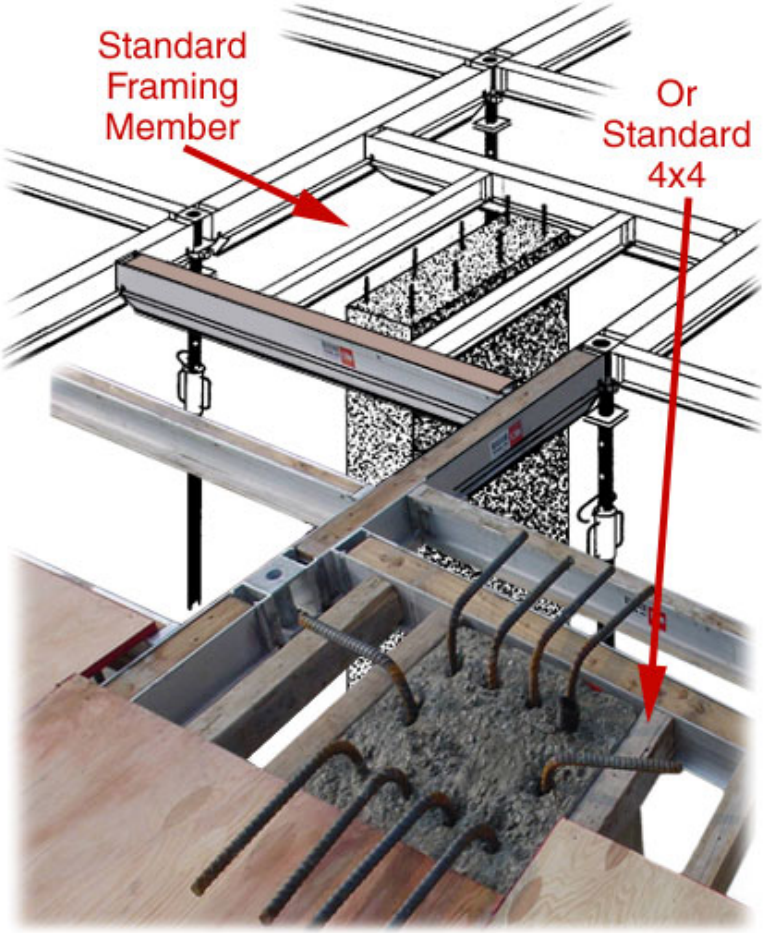
Insulated concrete forms for cold weather pouring at Skydome (Rogers Centre) Toronto



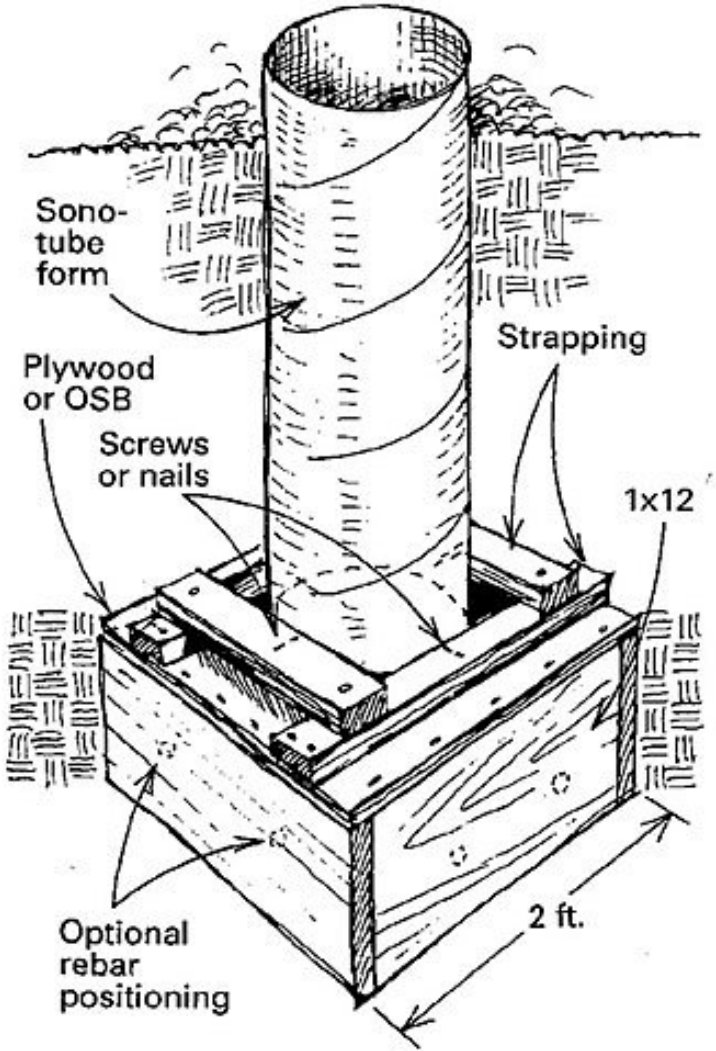
Form for a concrete column
Figure 6-2

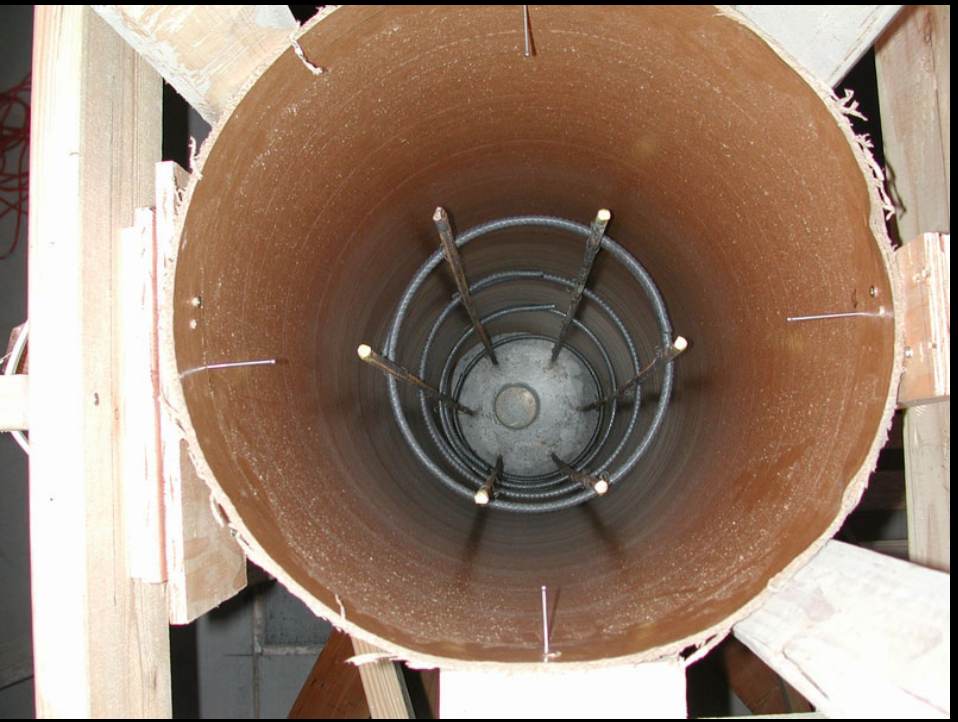


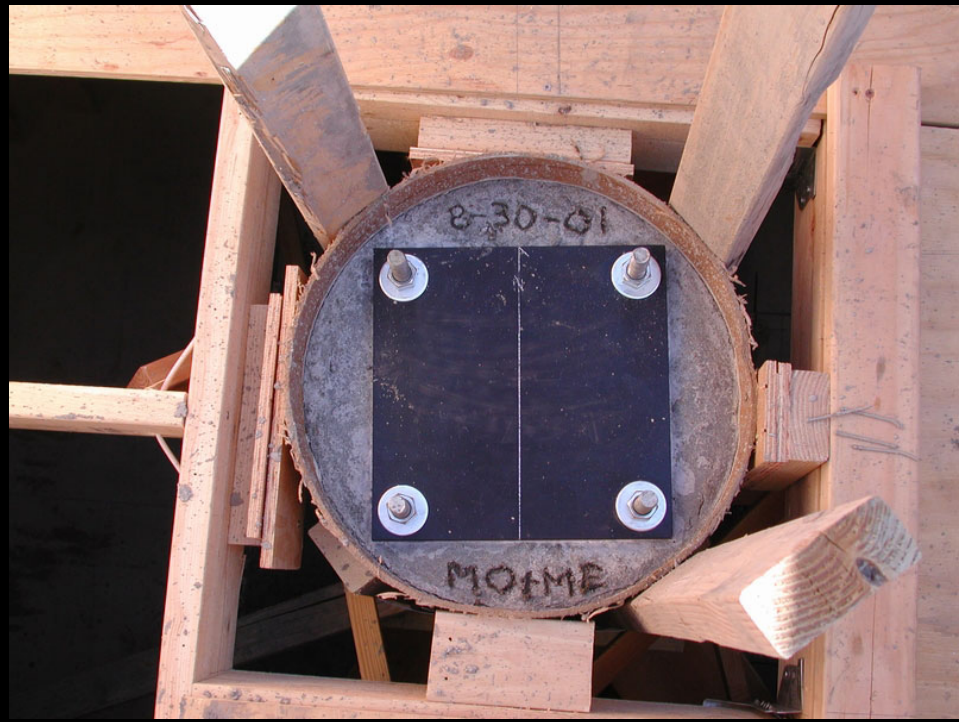
Fast & Simple Framing Around Columns and Walls.

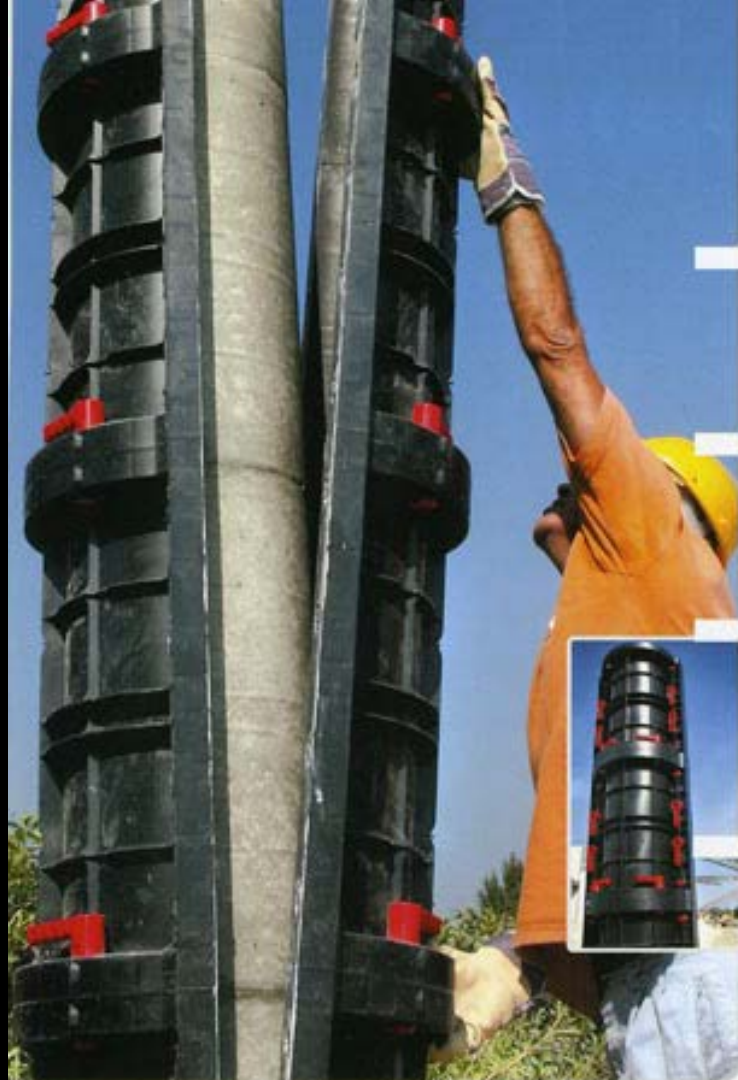


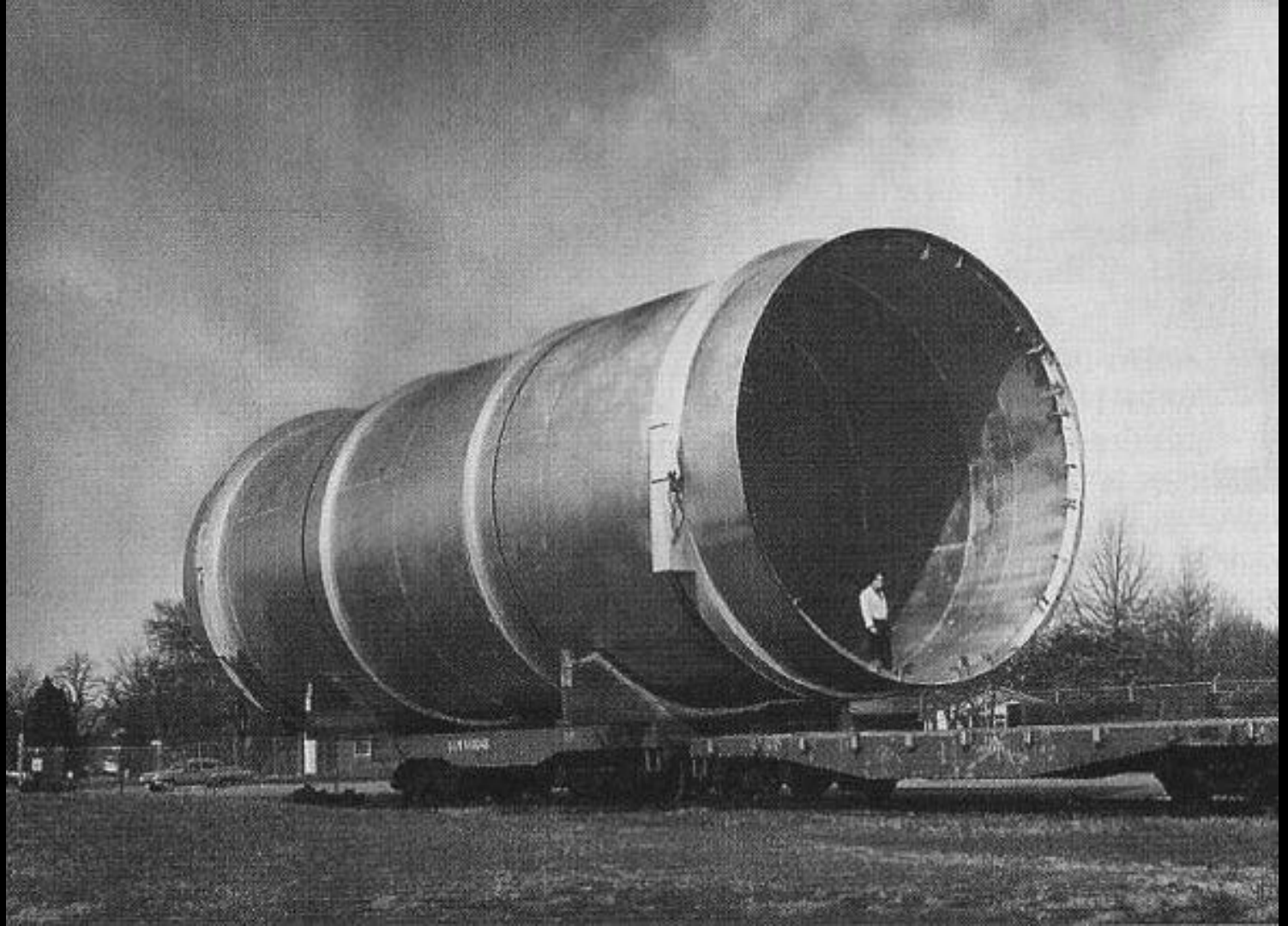

Sonotube forms


Sono-
tube
form
Strapping
Plywood
or OSB
Screws
or nails
1x12
Optional
rebar
positioning
2 ft.




8-30-01
MOtME





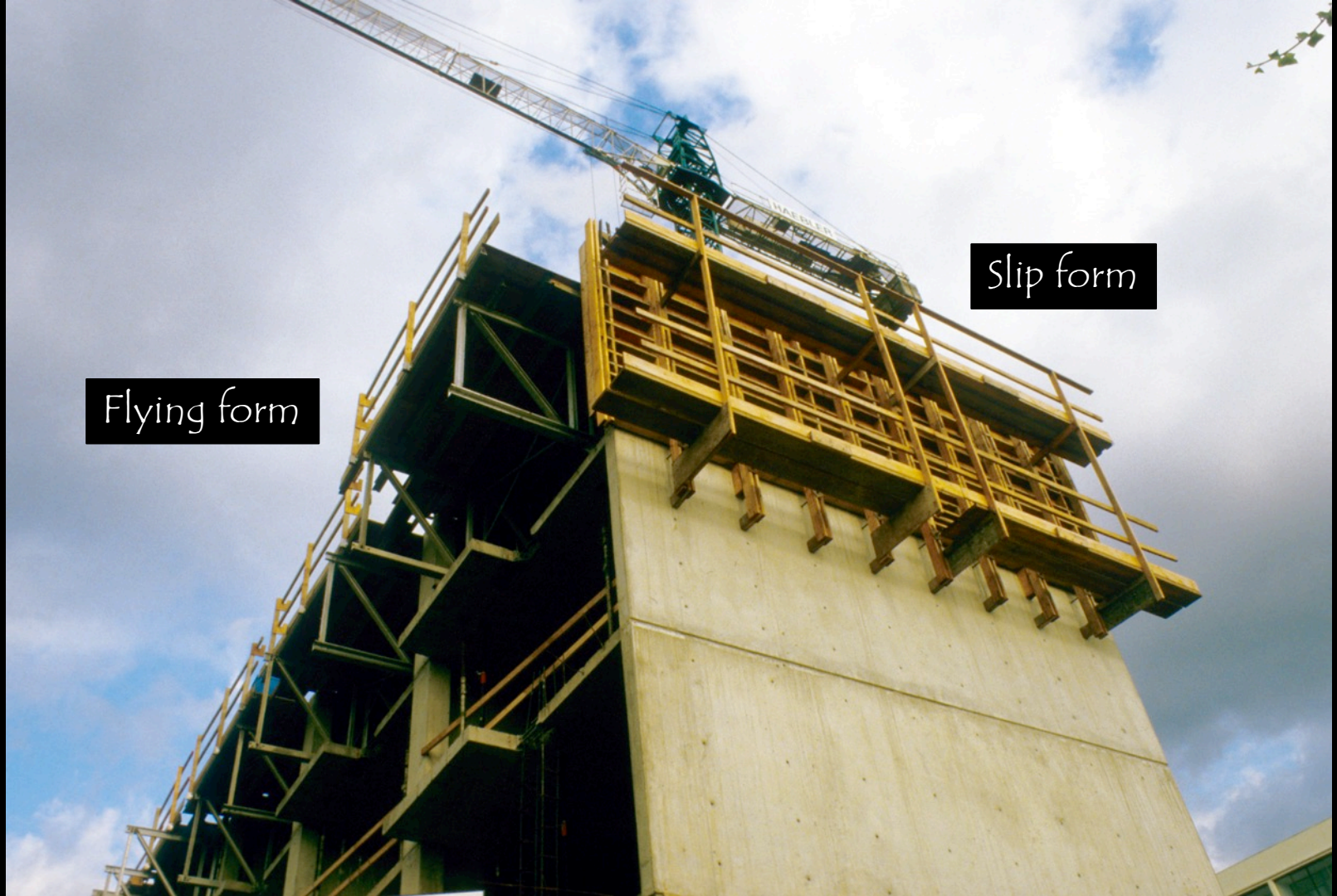

Reusable Metal Forms


PCL

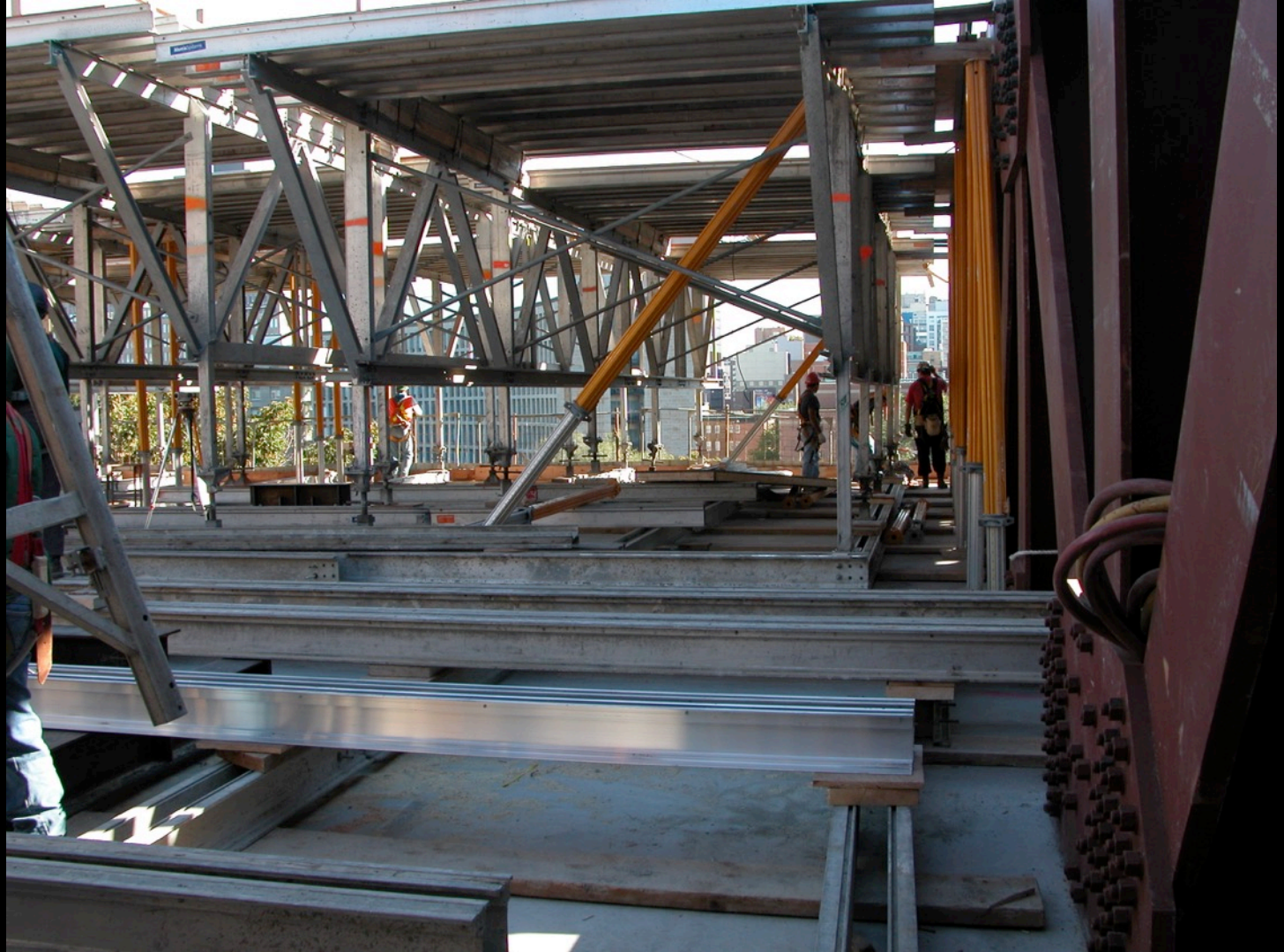

CONSTRUCTION
College St
Spadina to
Bathurst St
July 12- Nov 12
DOUBLING THE
ENROLMENT
AT ONTARIO'S
ONLY FACULTY
OF PHARMACY
CAT


Snorkelift
500 LBS.

Slip forms, as this name suggests, is a sliding-form construction method of supporting the pouring of concrete structures. Slip forms are pulled along horizontally or raised vertically as concrete is placed.


Slip form
Flying form

Flying forms



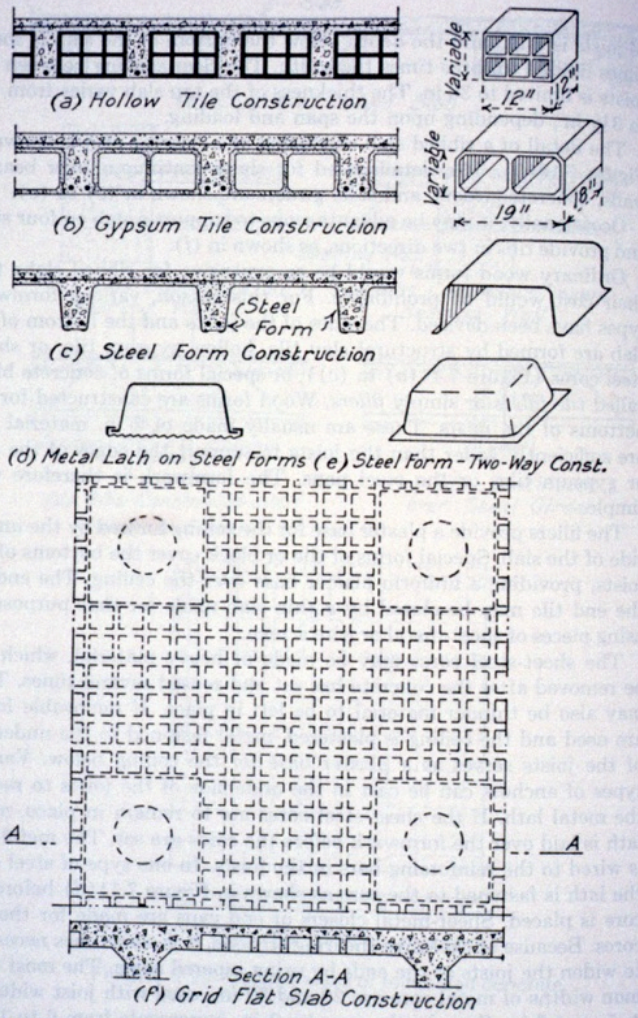


FIGURE 7.11 Cores for ribbed slabs and grid flat-slab construction.

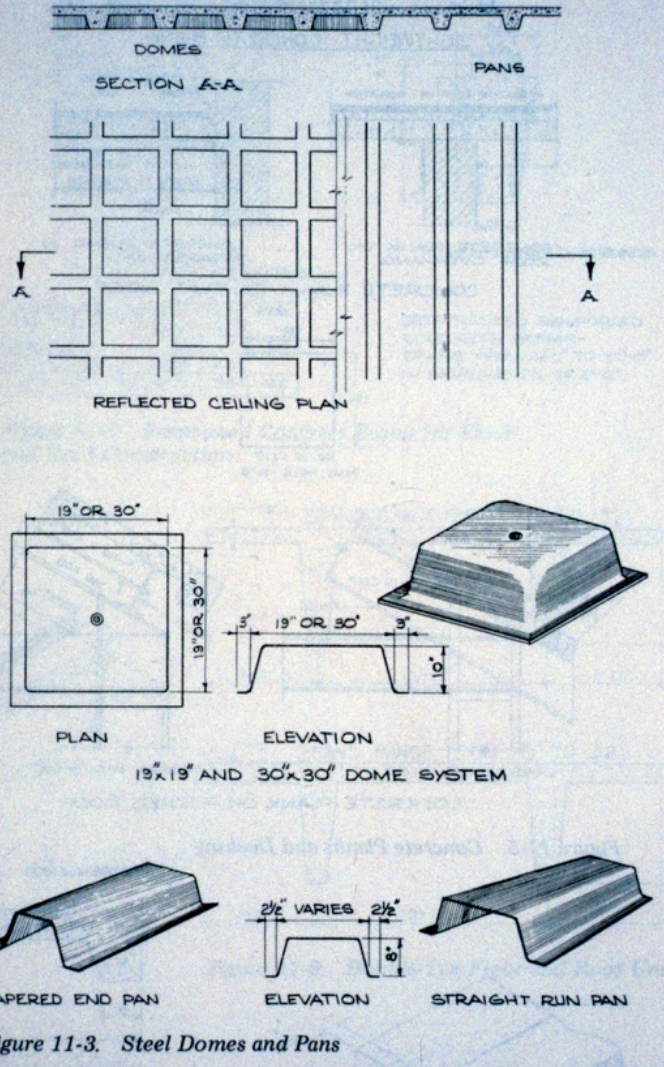
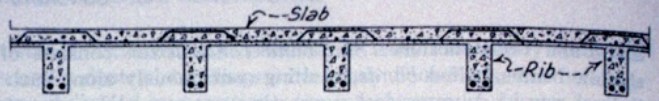
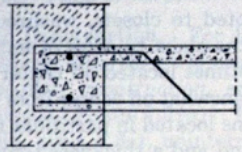


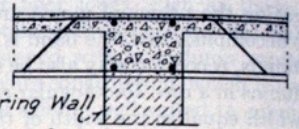
Figure 11-3. Steel Domes and Pans



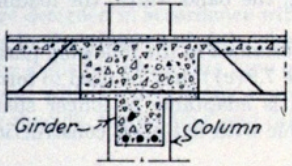
(a) Concrete Ribbed Slab



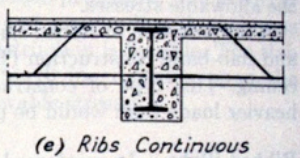
(b) Ribs Supported on Bearing Wall



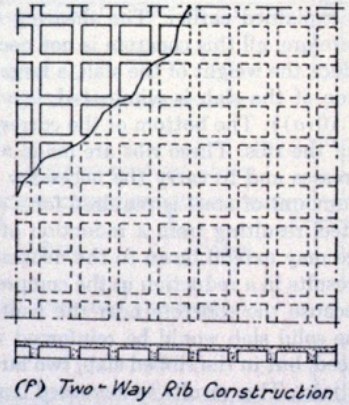
(c) Ribs Continuous over Bearing Wall



(d) Ribs Continuous over Concrete Girder



(e) Ribs Continuous over Steel Girder



(f) Two-Way Rib Construction

FIGURE 7.10 Ribbed slabs of reinforced concrete.


DILLY
PLACE


Exit to D
Exits to
Marylan
L'Enfant
THIS EXIT IS CLOSED ON
SATURDAYS AND SUNDAYS.
PLEASE USE THE EXIT AT
7th and MARYLAND AVENUE OR
9th AND D STREETS.


L'Enfant Plaza

Composite decks use the combined strength of steel decking, reinforcing and the concrete slab

The steel deck acts as a permanent form as well as adding strength

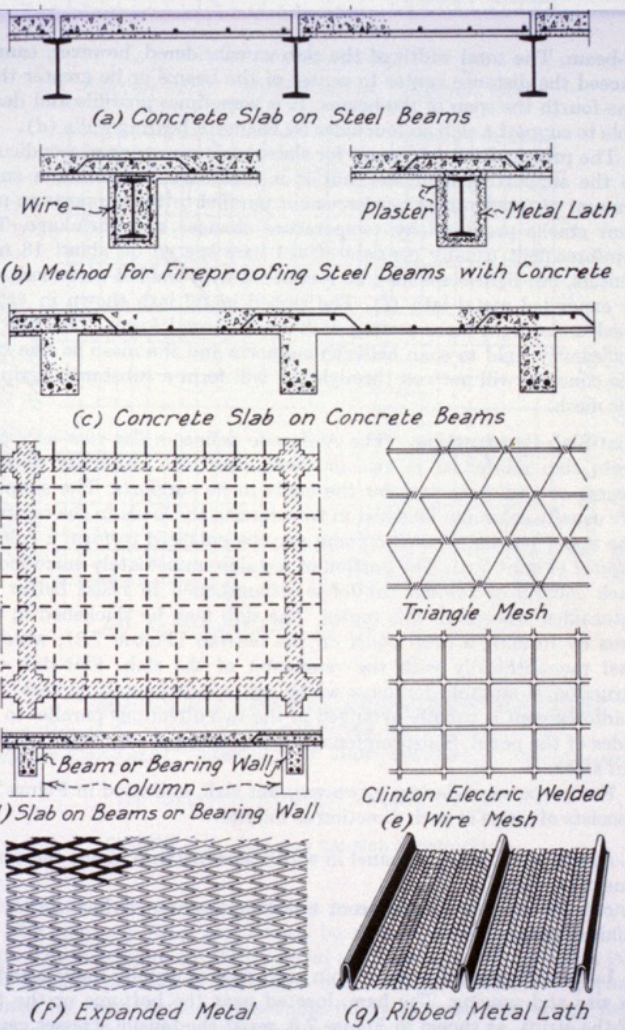


FIGURE 7.7 Reinforced concrete slabs.

Shear walls are solid concrete walls that are placed perpendicular to the long dimension of the building to make the rectangular form stiffer to resist collapse

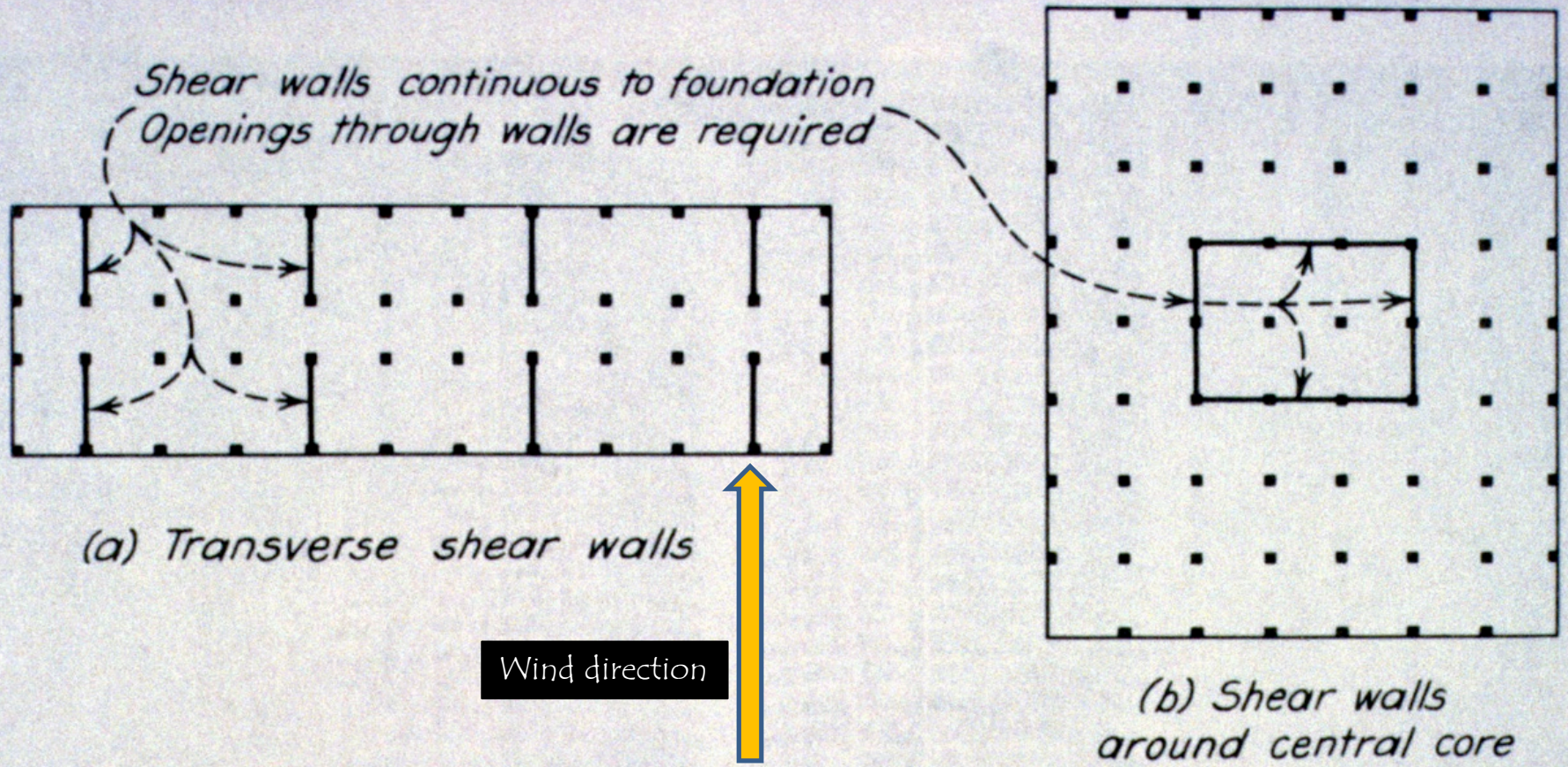
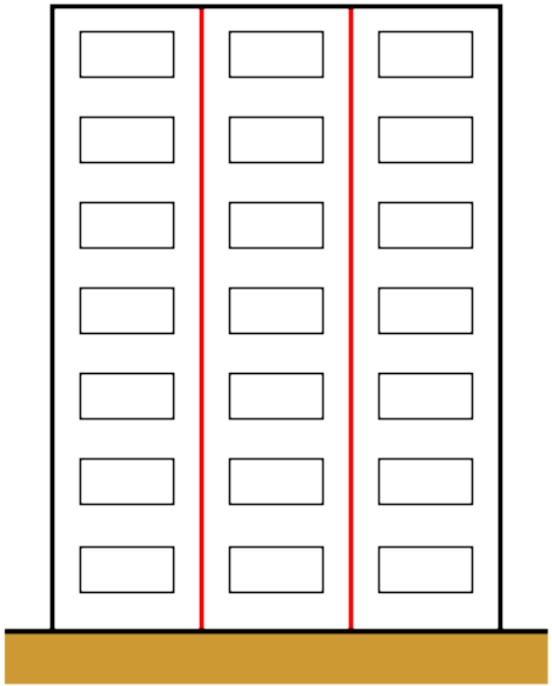


FIGURE 7.16 Shear walls.



Elevation

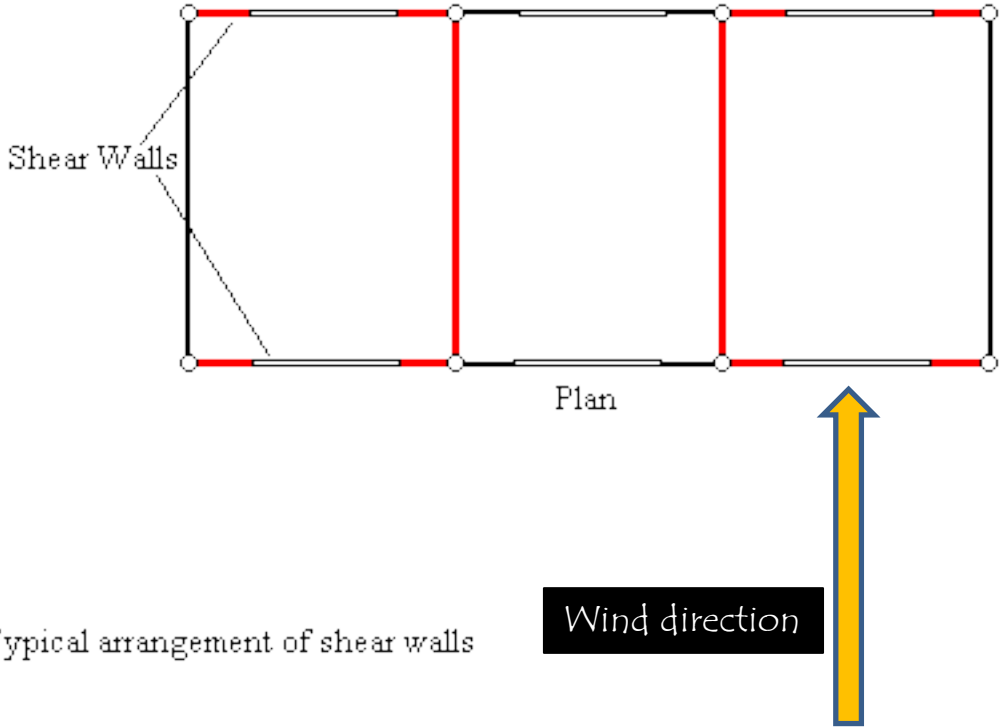


Fig 2. Typical arrangement of shear walls

Thin shell roofs get their strength from the geometry of their shape or cross section

-

Material is moved away from the centre of gravity of the section

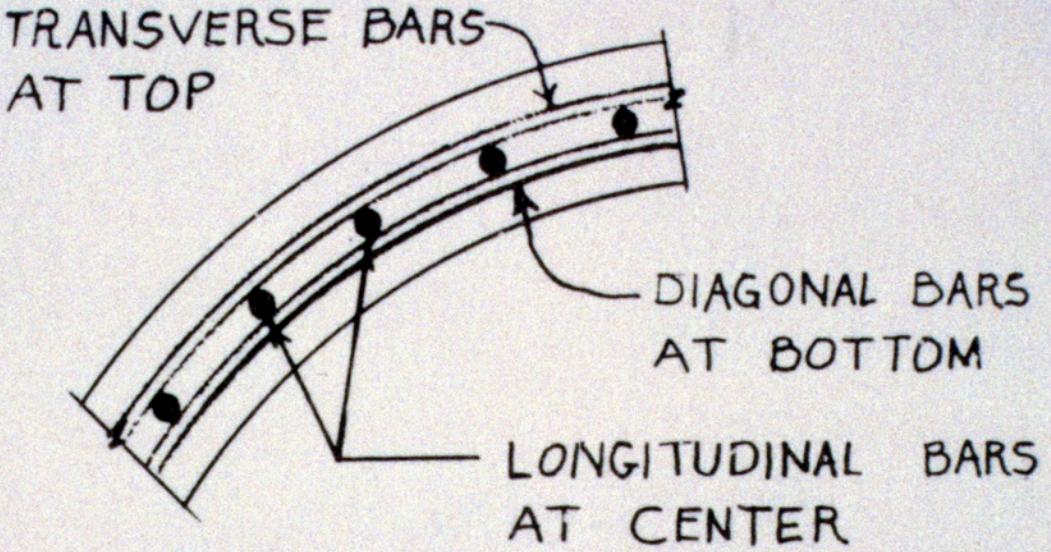
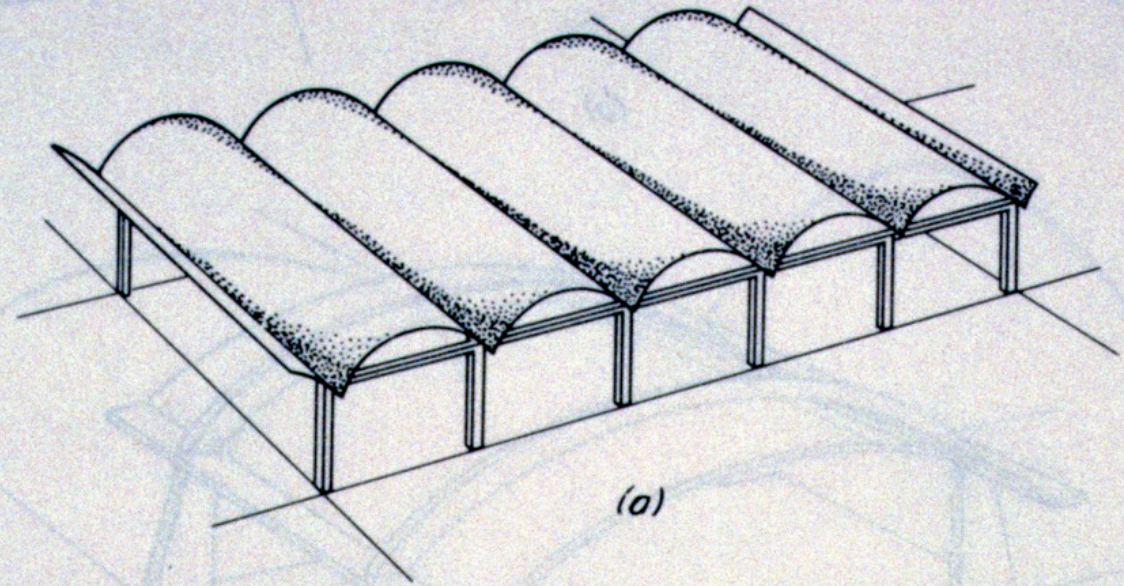
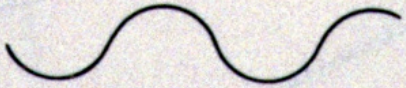


Figure 11-16. Placement of Reinforcing Bars in Thin Shell



(a)

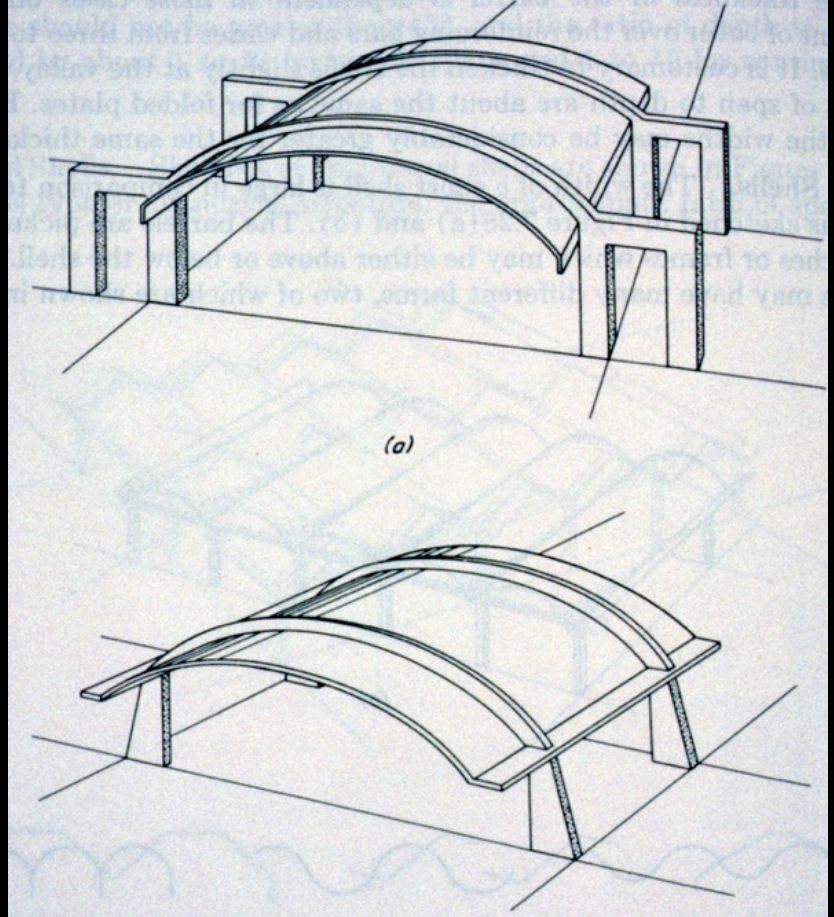
(b)



(c)

(d)

FIGURE 7.25 Long-barrel shell roof.



(a)

(b)

FIGURE 7.26 Short-shell roofs.

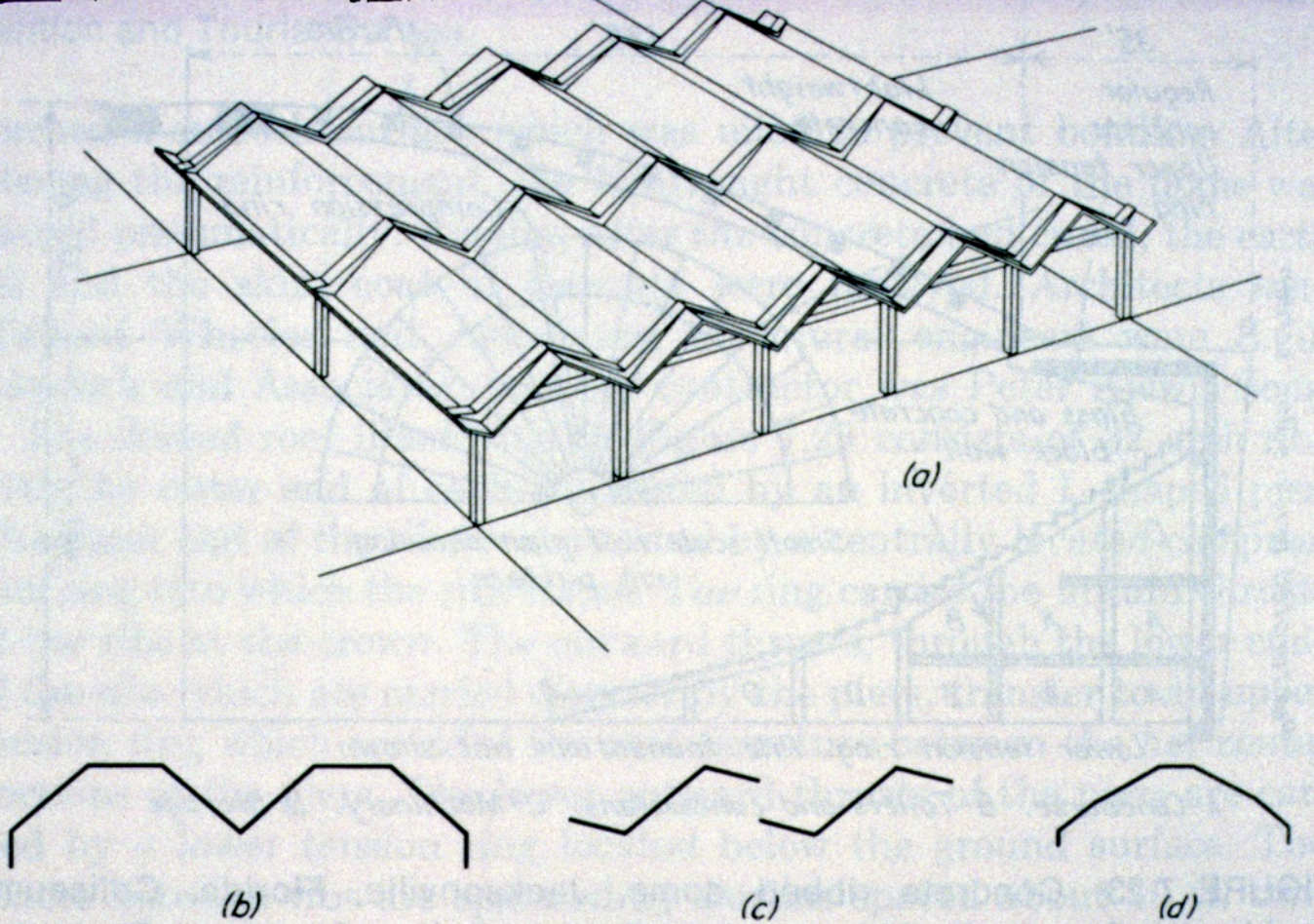
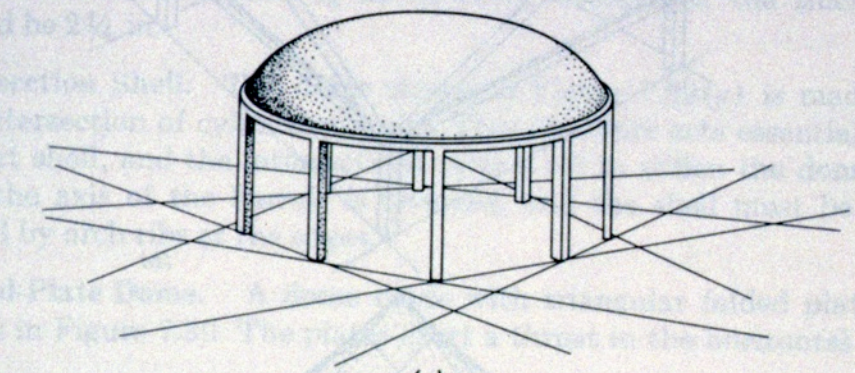
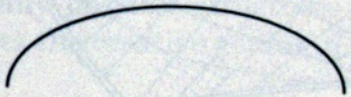


FIGURE 7.24 Folded plate roofs.

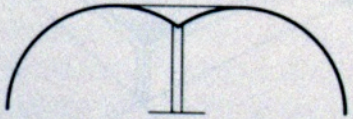


(a)

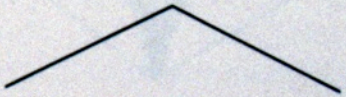


(b)

(c)



(d)



(e)

FIGURE 7.27 Domes of revolution.

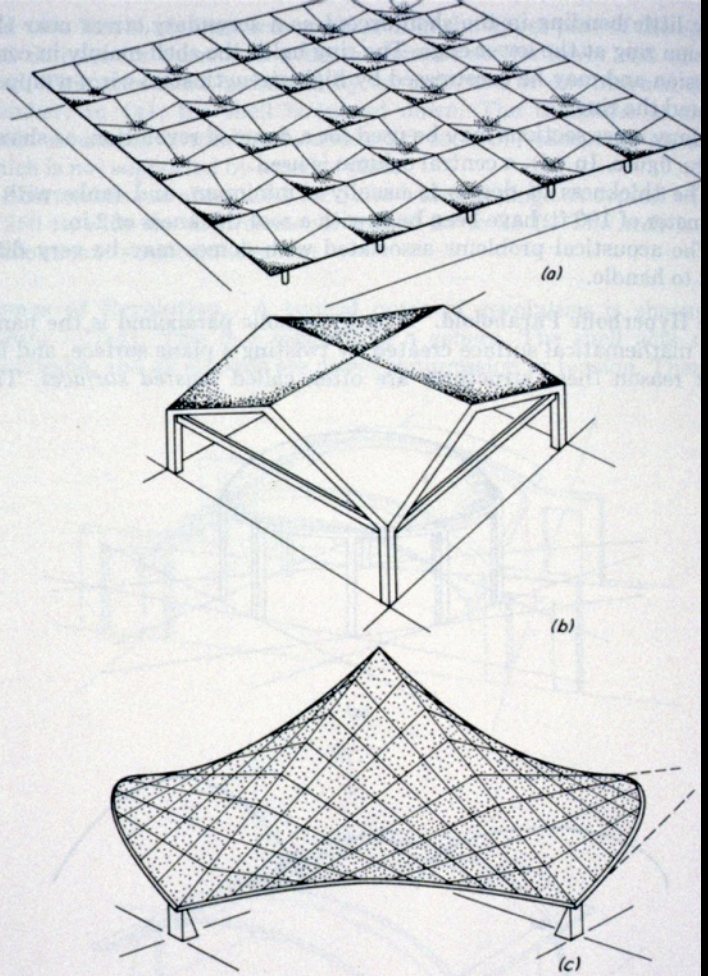


FIGURE 7.28 Hyperbolic paraboloid roofs.

Valencia, Spain – Felix Candela


OCEANO

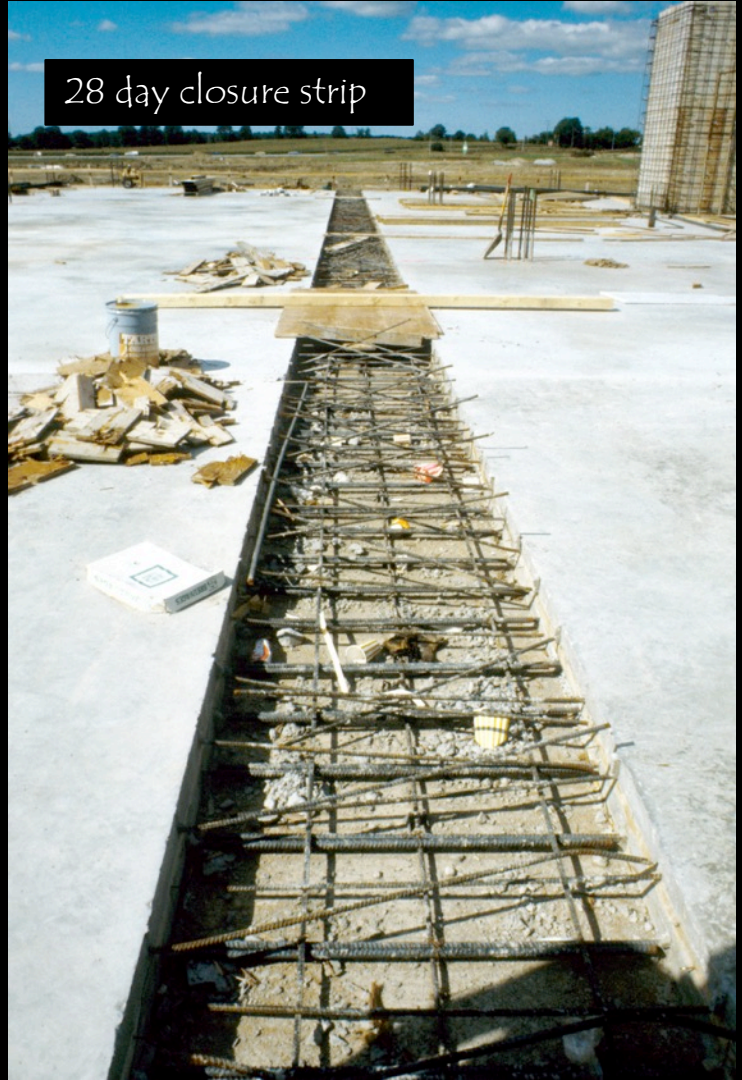
La Concha, Las Vegas


La Lonja

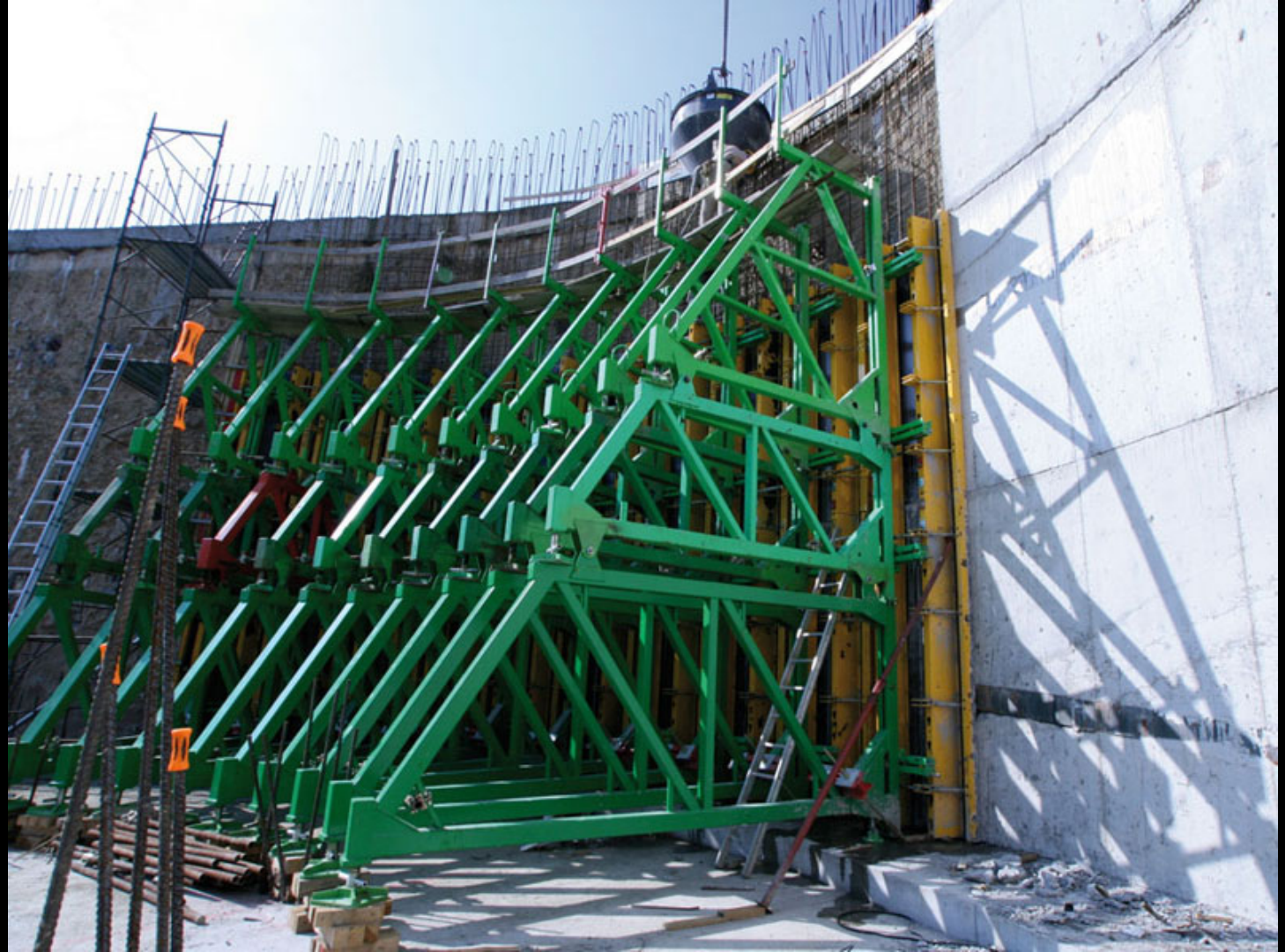
the details of construction practice


PERMAFORM

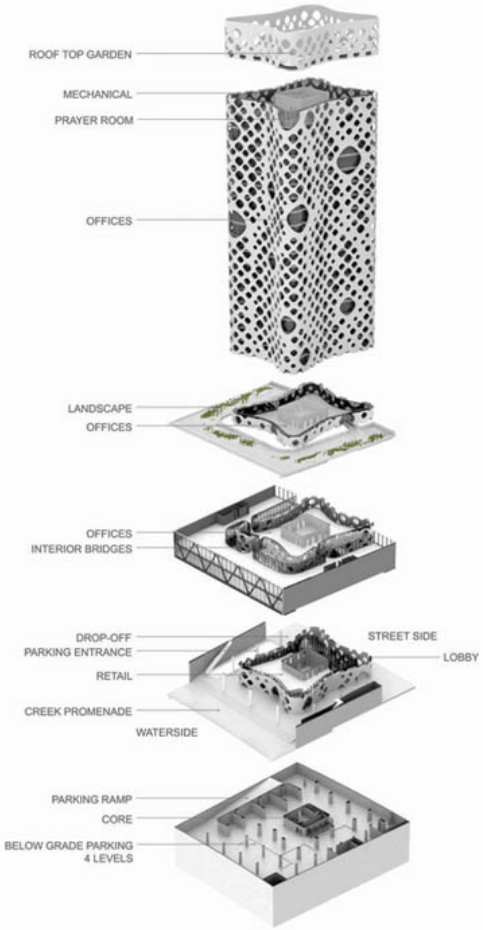

Expansion joint


28 day closure strip

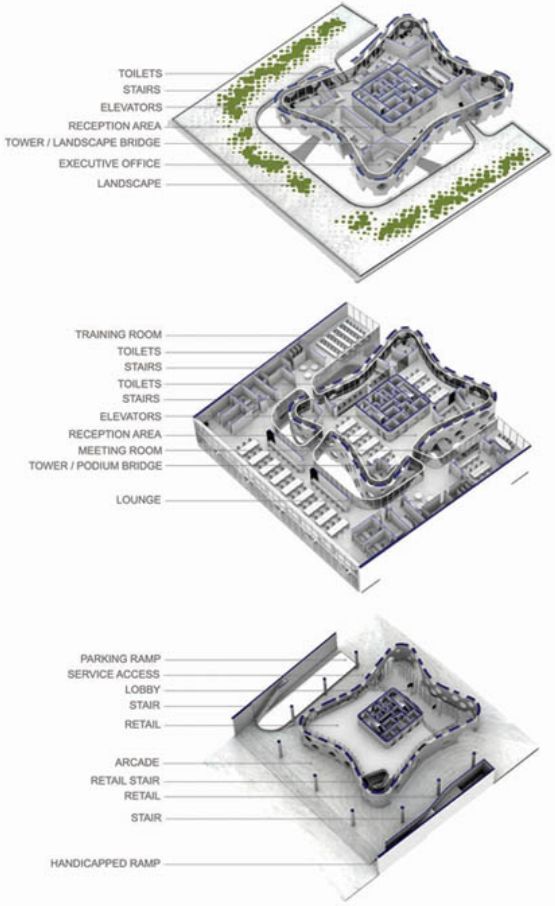
Expansion joint



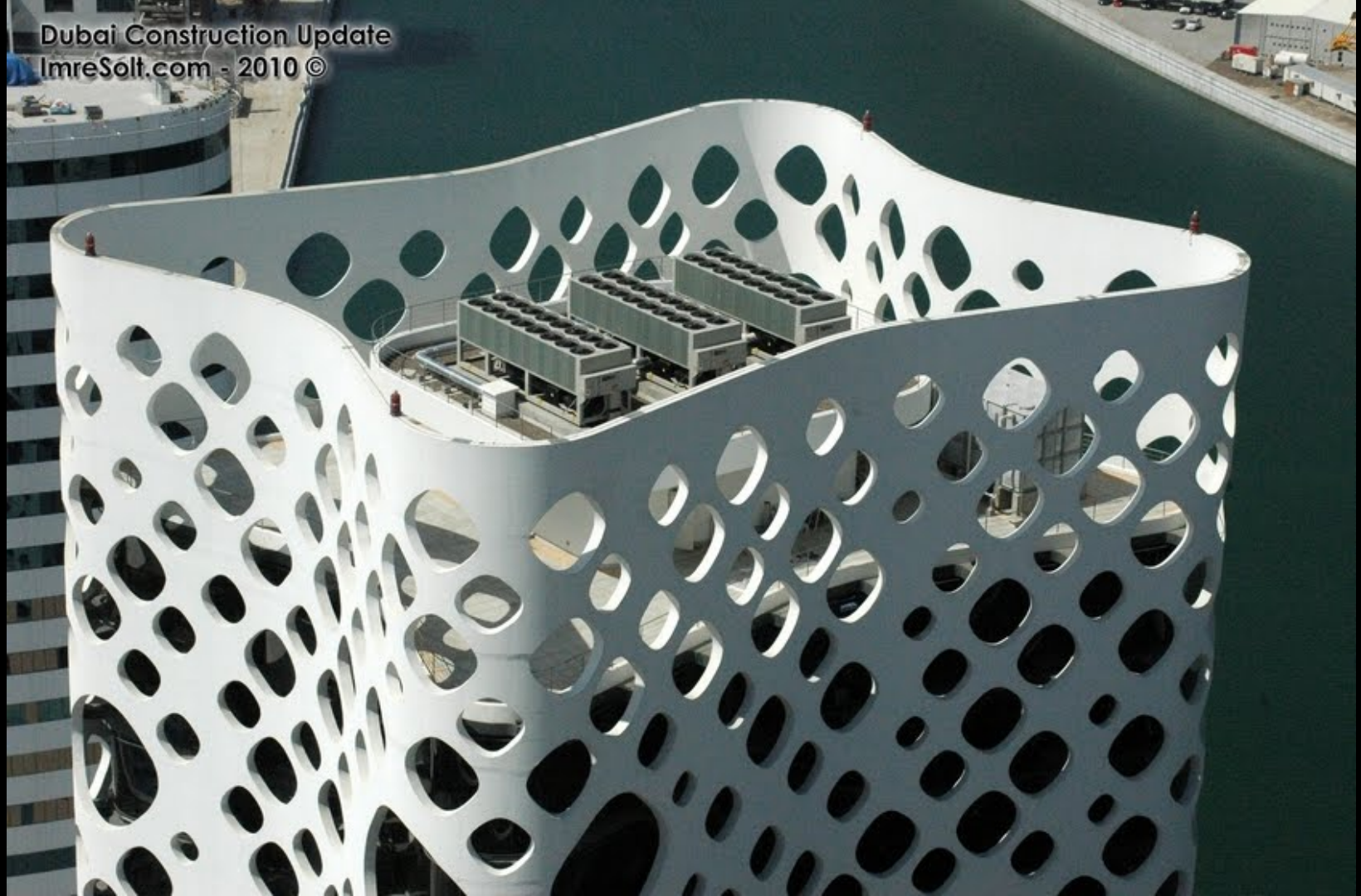
O-14 Tower,
Dubai

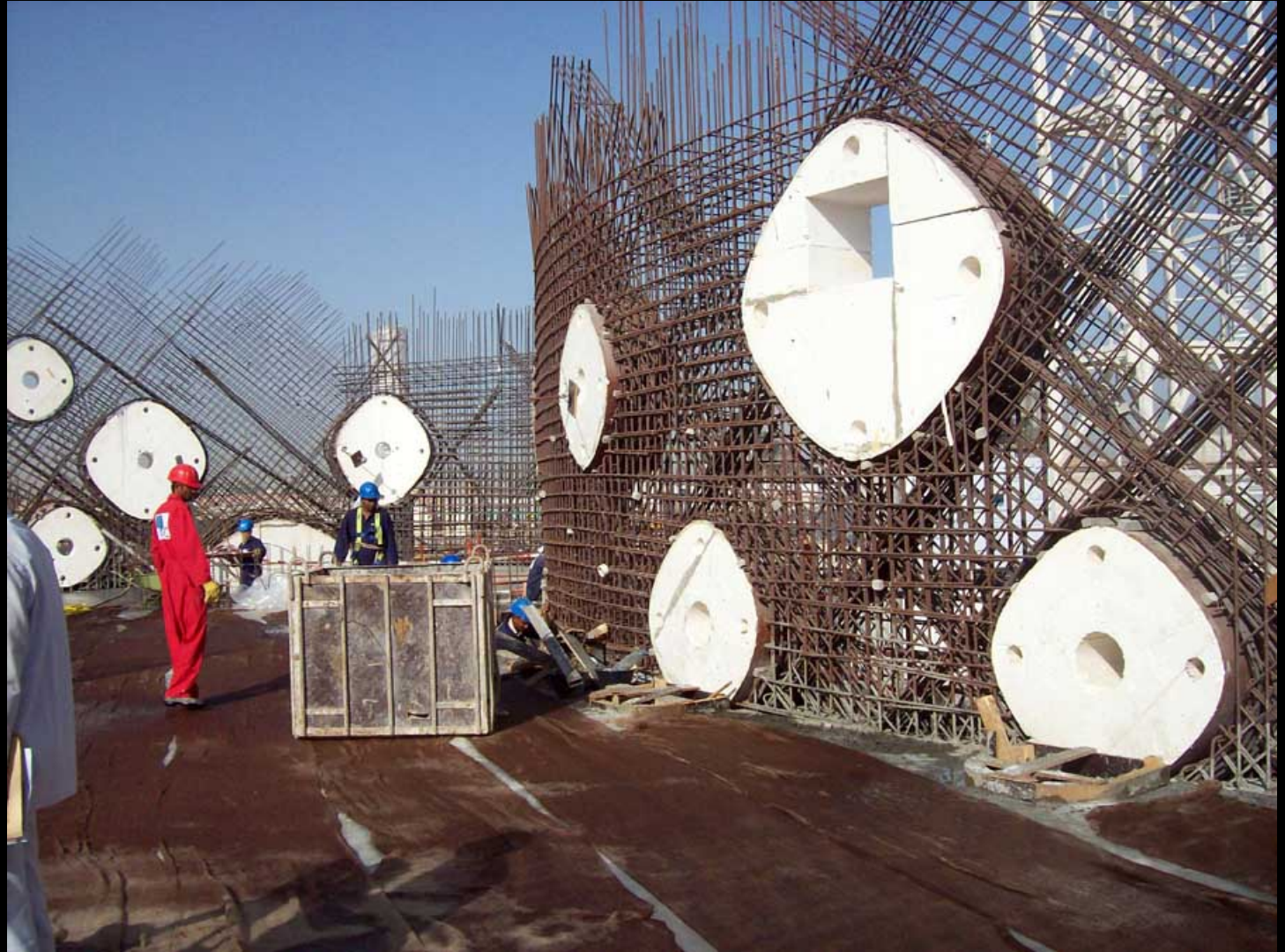


TOWER ISOMETRIC



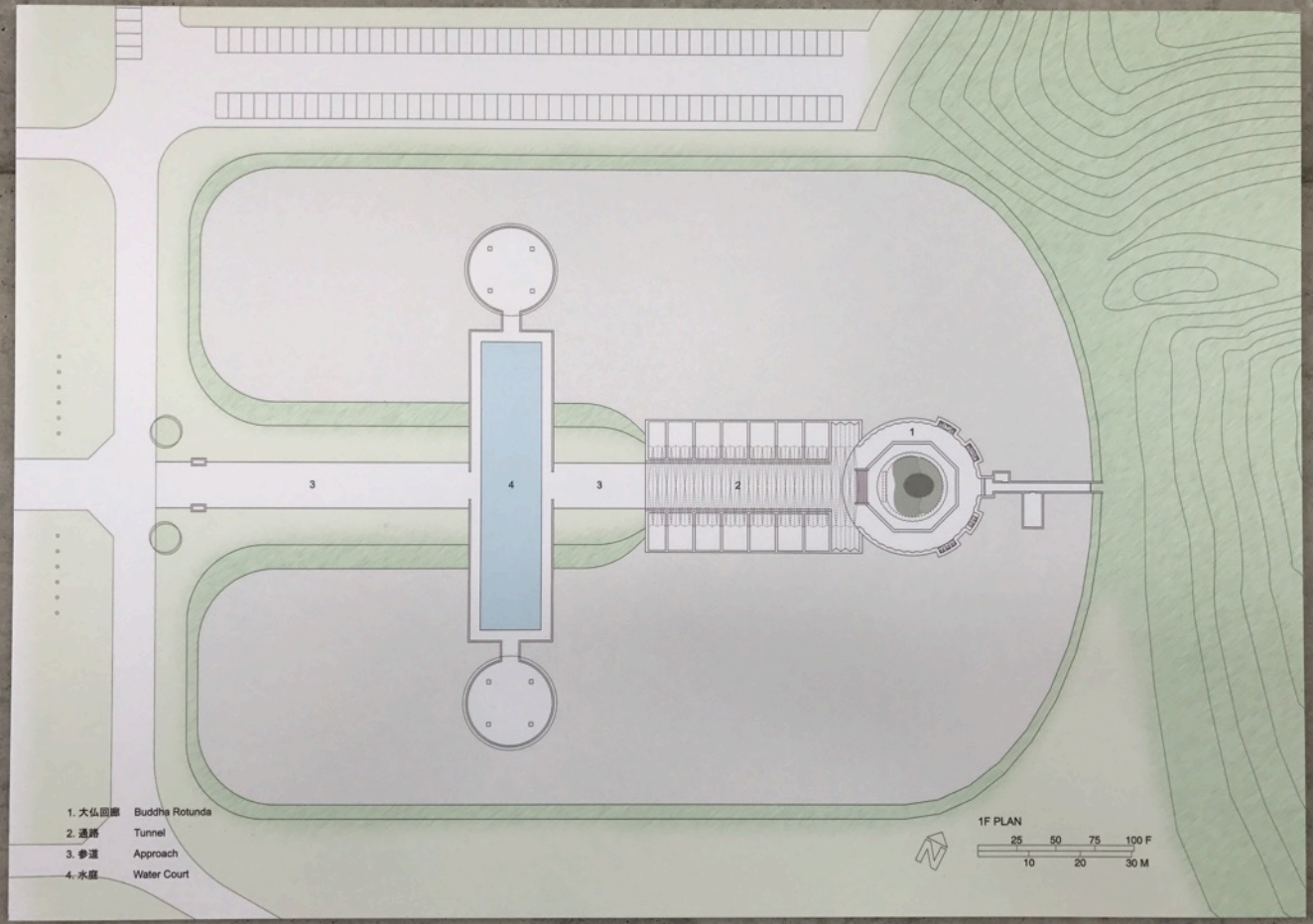
PODIUM ISOMETRIC


Dubai Construction Update
ImreSolt.com - 2010 ©



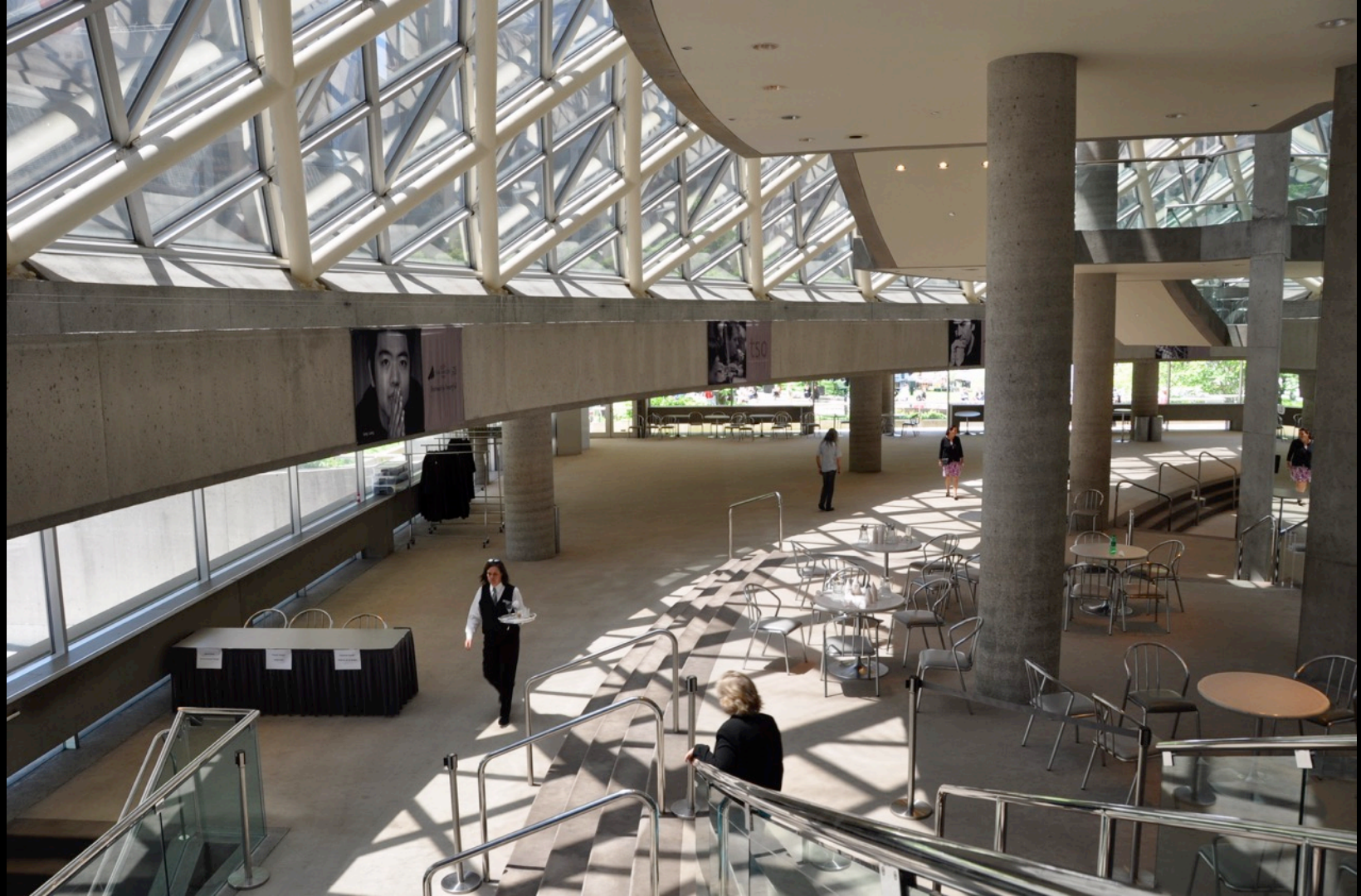

Makomanai Takino Cemetary
Sapporo, Japan
Tadao Ando
2017

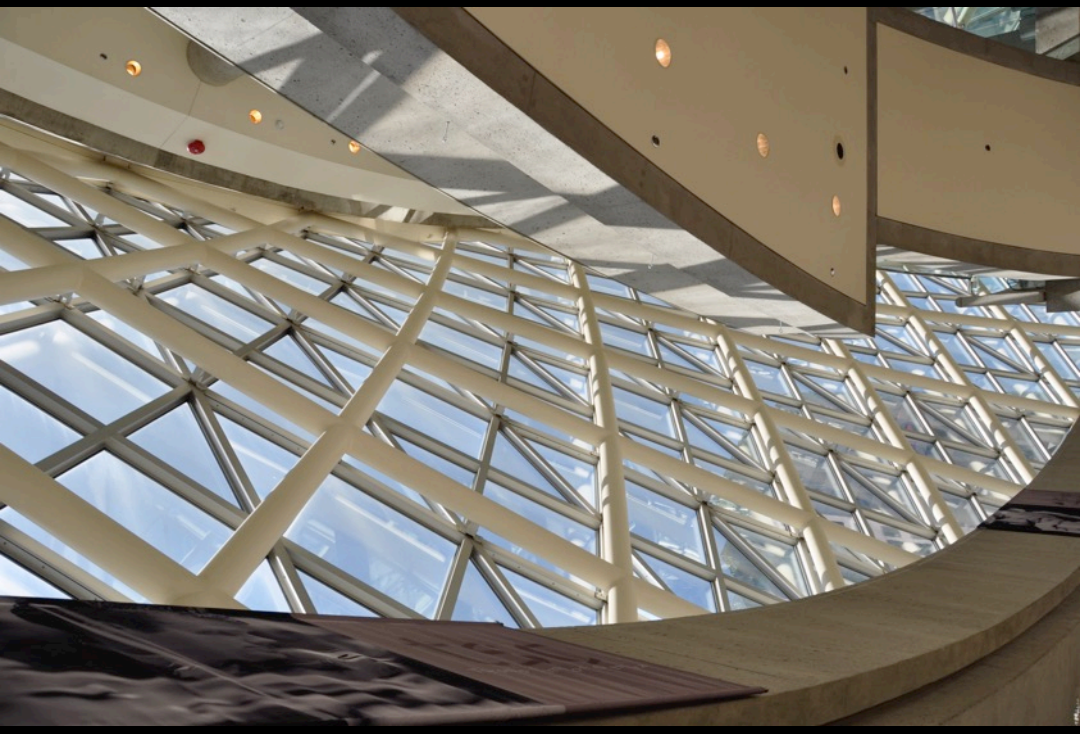

足元
注意

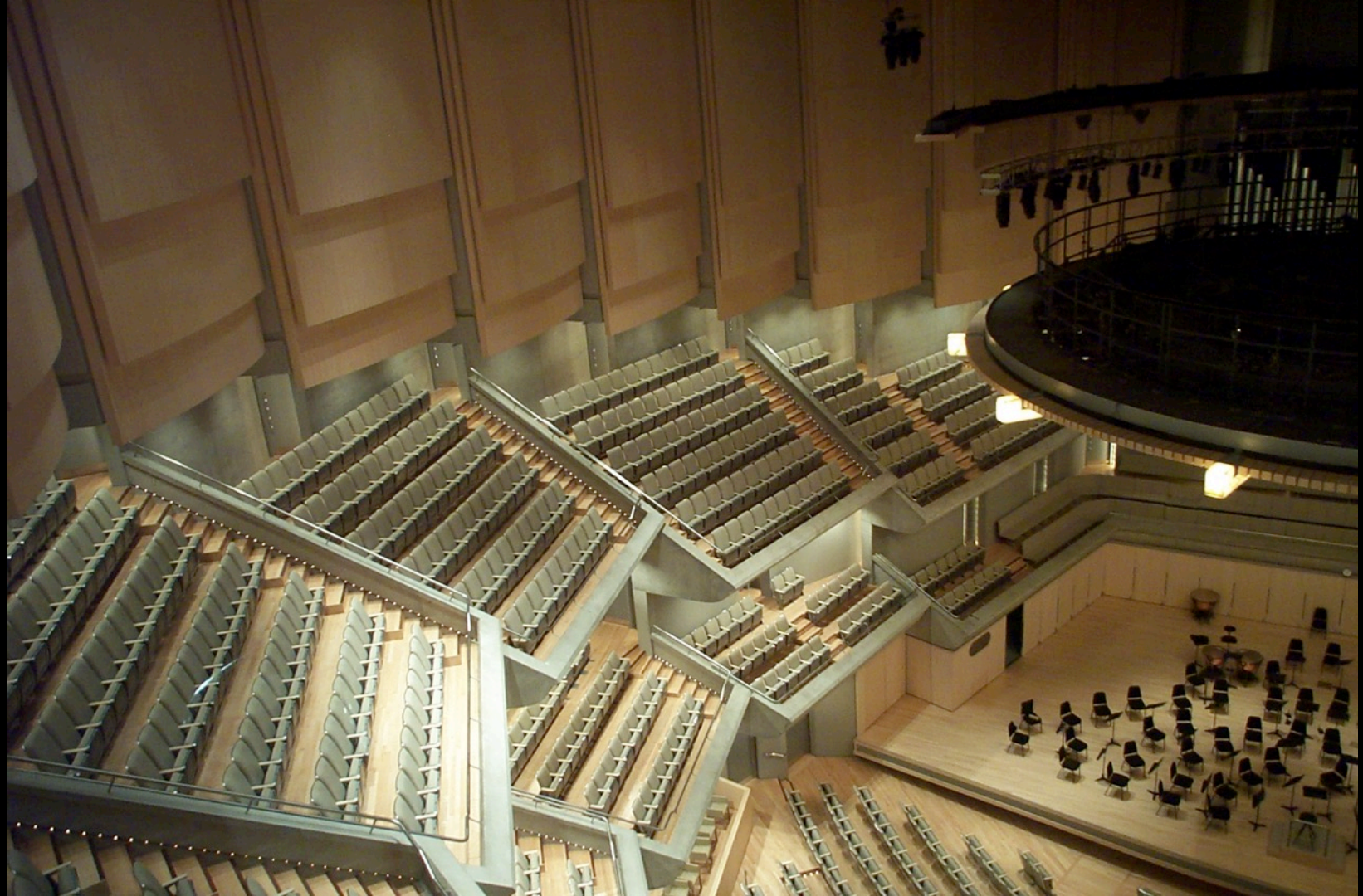

1
2
3
4
3
1. 大仏回廊 Buddha Rotunda
2. 通路 Tunnel
3. 参道 Approach
4. 水庭 Water Court
1F PLAN
25 50 75 100 F
10 20 30 M

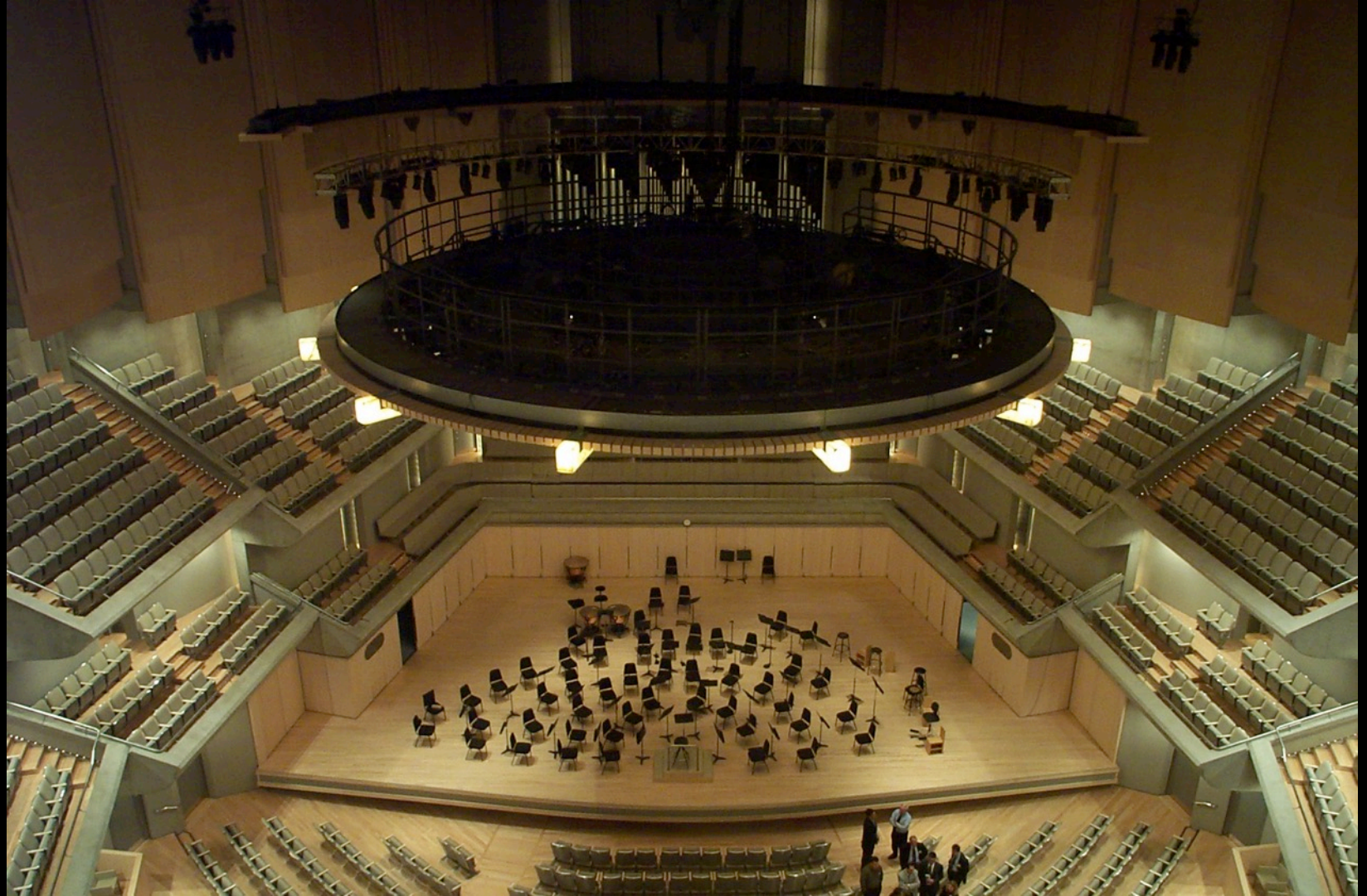

SB12A
HORAI SANGYO
No.12-138

Roy Thomson Hall, Toronto
Arthur Erickson









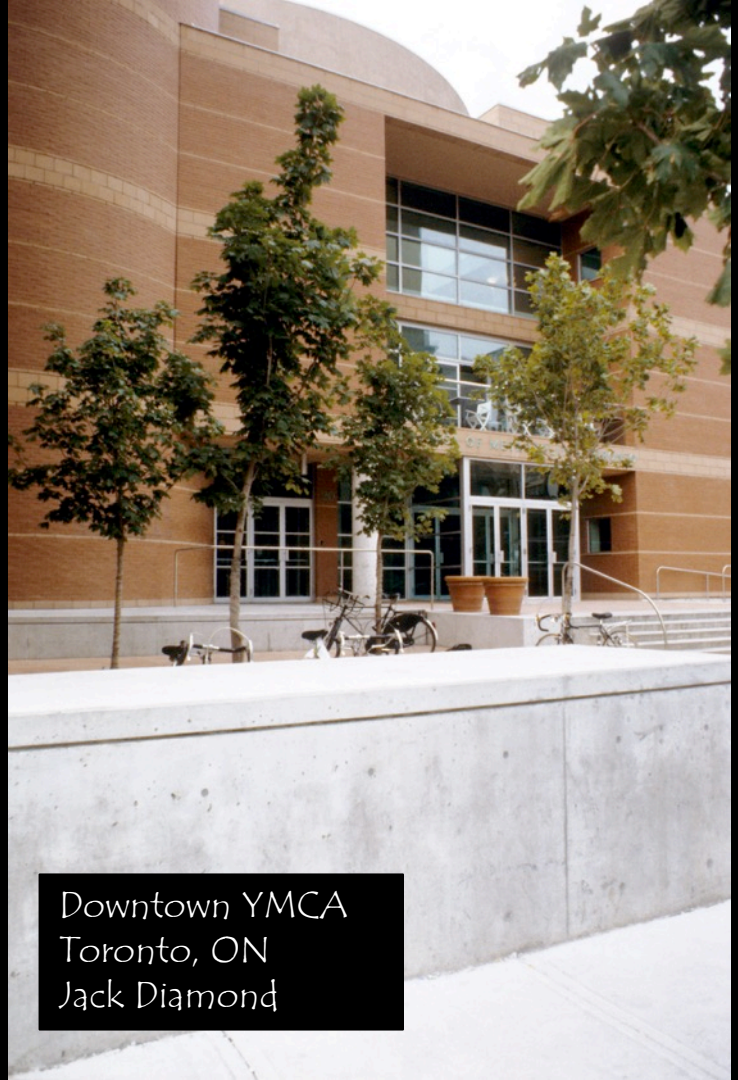
University of Lethbridge, Alberta
Arthur Erickson


CAFE

Hyatt Regency Hotel,
San Francisco

Robson Square, Vancouver

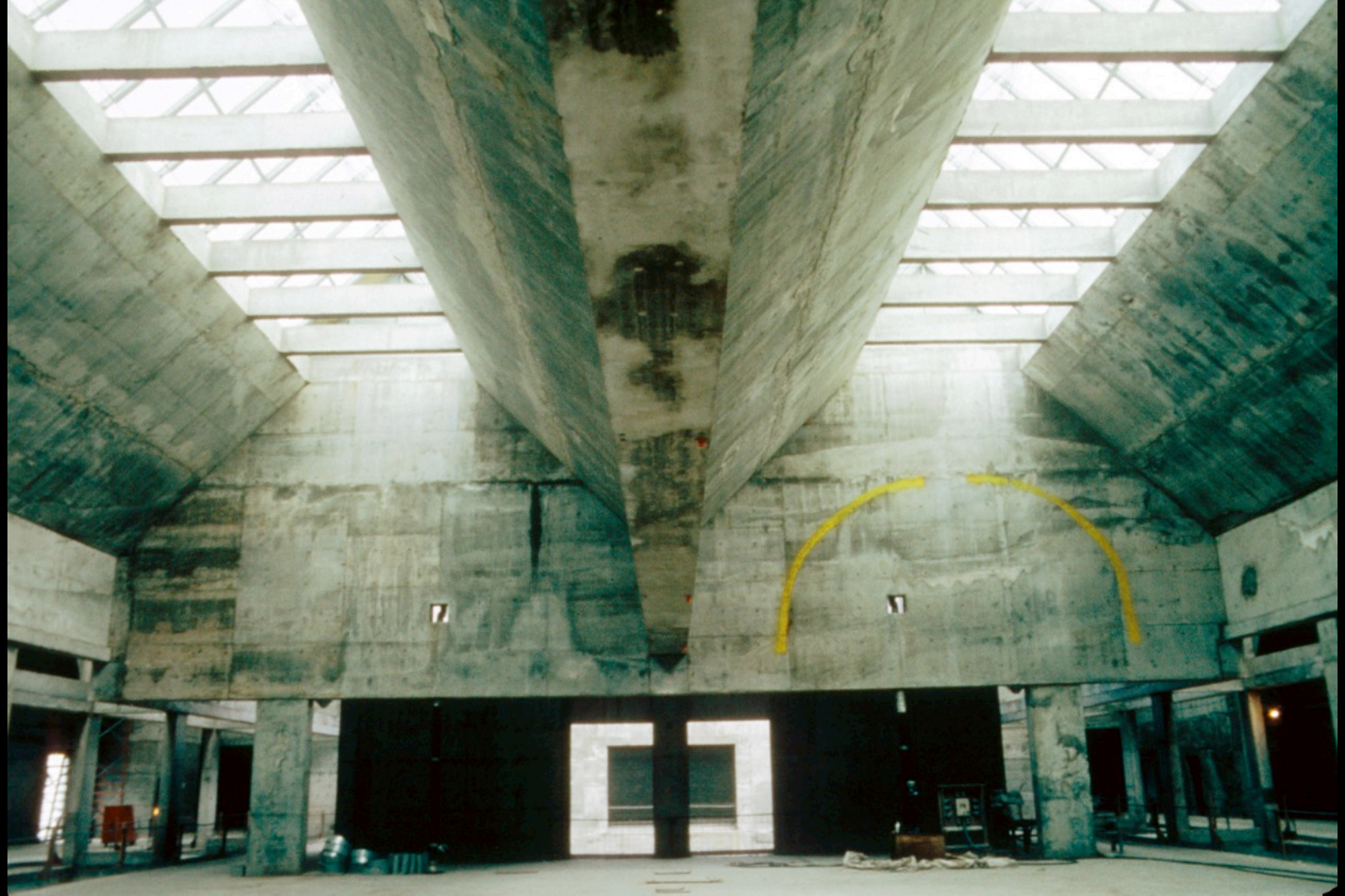
Law Courts, Vancouver
Arthur Erickson

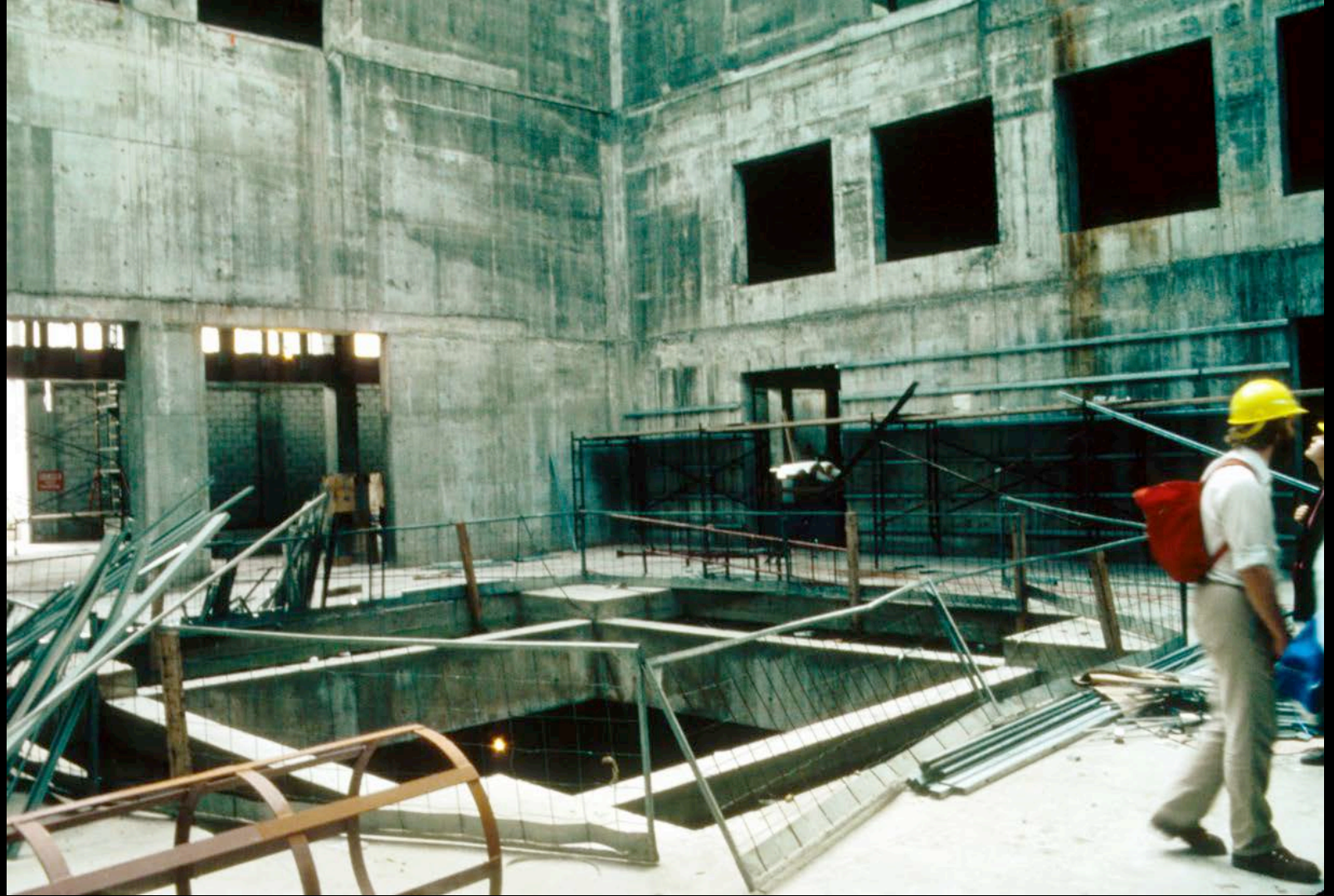


Downtown YMCA
Toronto, ON
Jack Diamond


RAM

National Gallery
Ottawa, ON
Moshe Safdie






Brunswick Ave. Toronto


CW-87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Office Building
Washington, D.C.


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CROSS HERE
CONSTRUCTI
SITE
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ENTER
ICE

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Ryerson Student Centre, Toronto
Snohetta


RYERSON UNIVERSITY STUDENT LEARNING CENTRE


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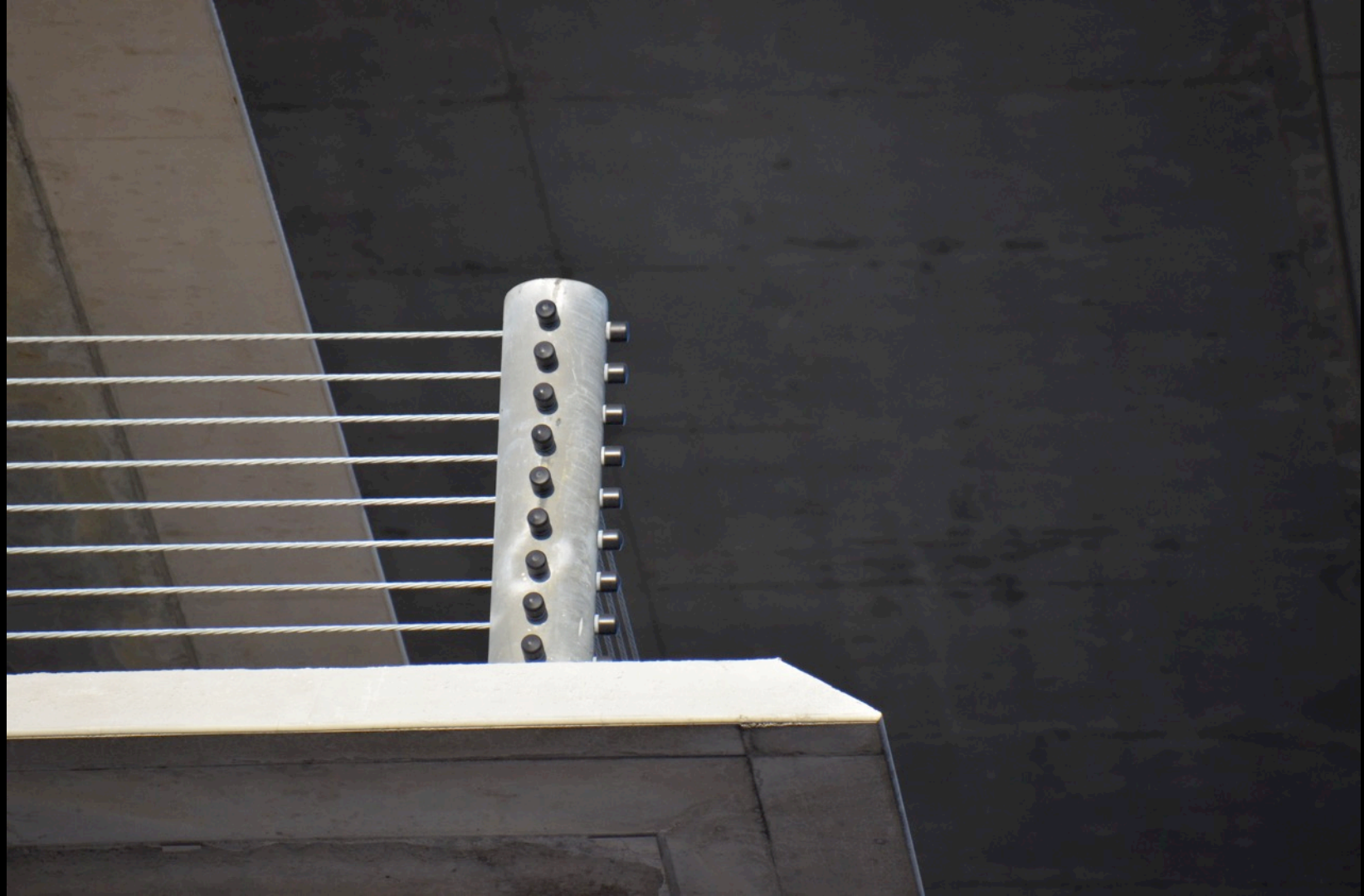
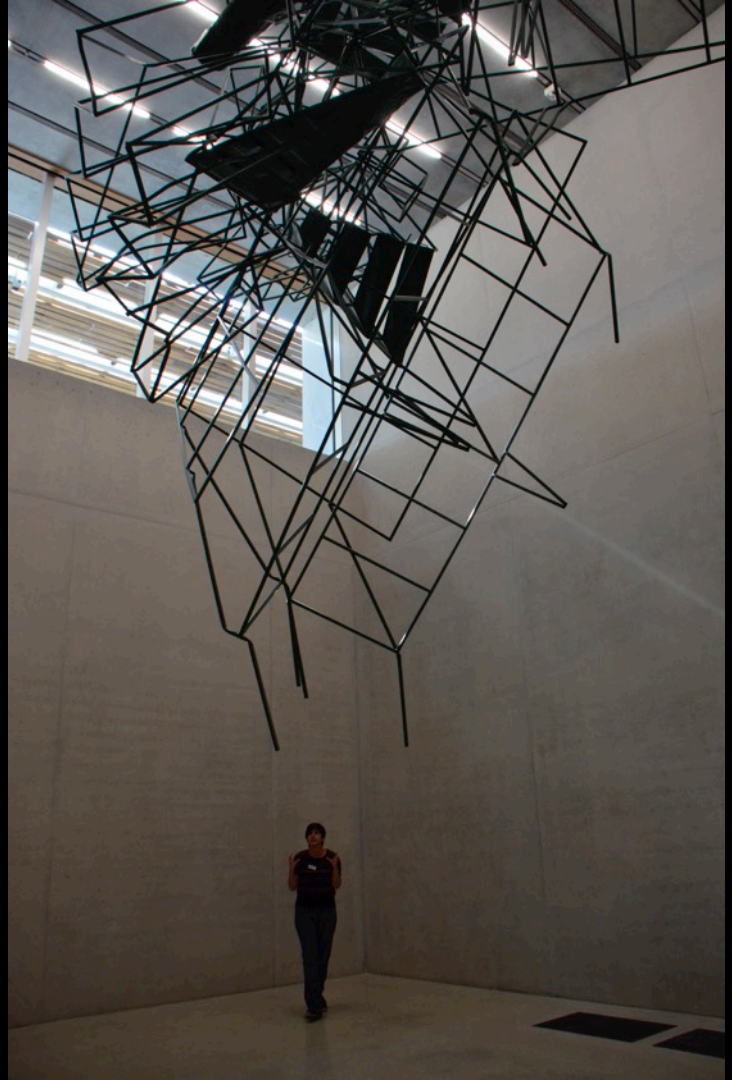
1111 Franklin Road, Miami
Herzog and deMeuron




XIT

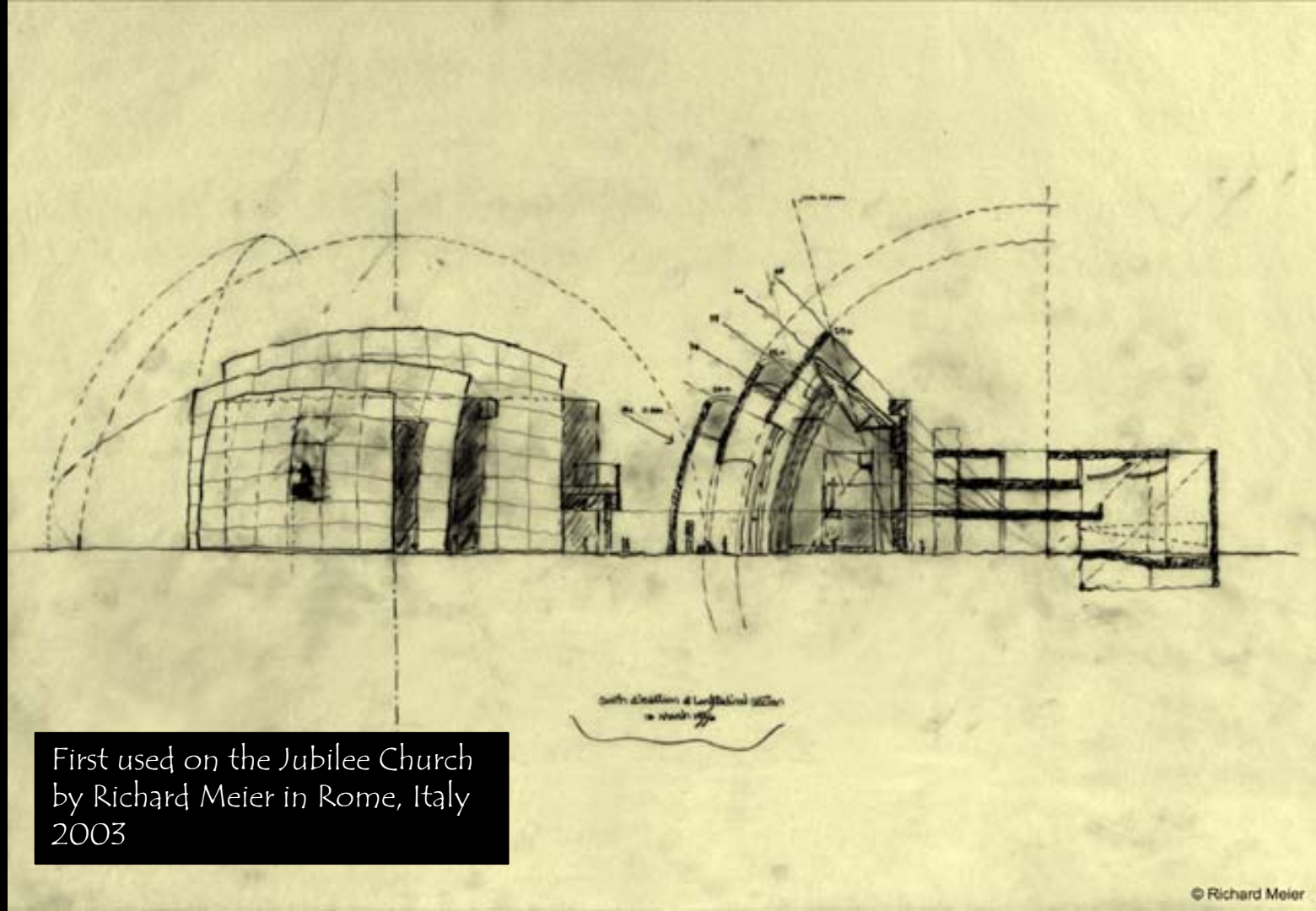

Miami Art Gallery
Herzog and deMeuron



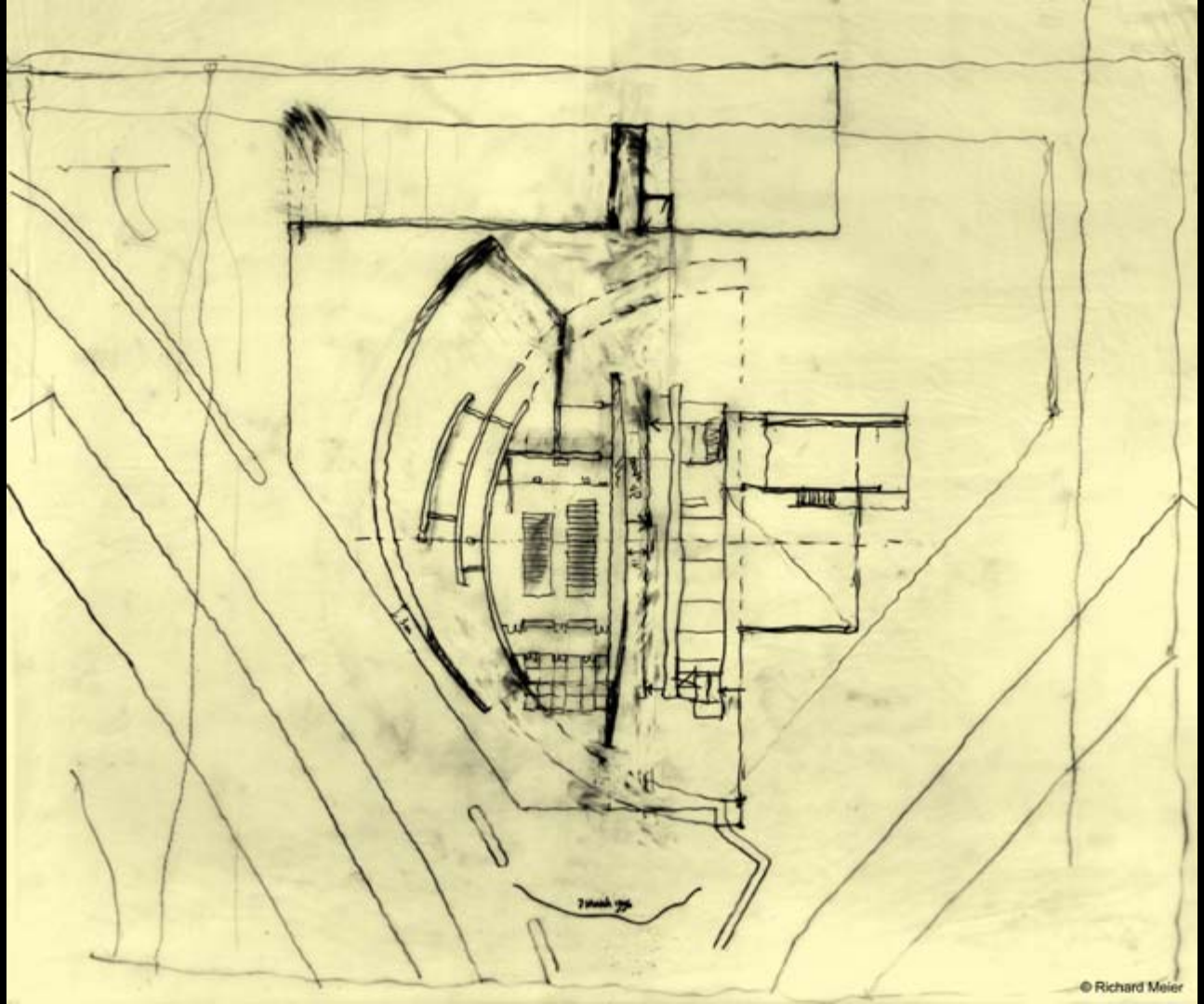
10 Hudson Yards
New York City, USA
KPF Architects
2015
267.7m

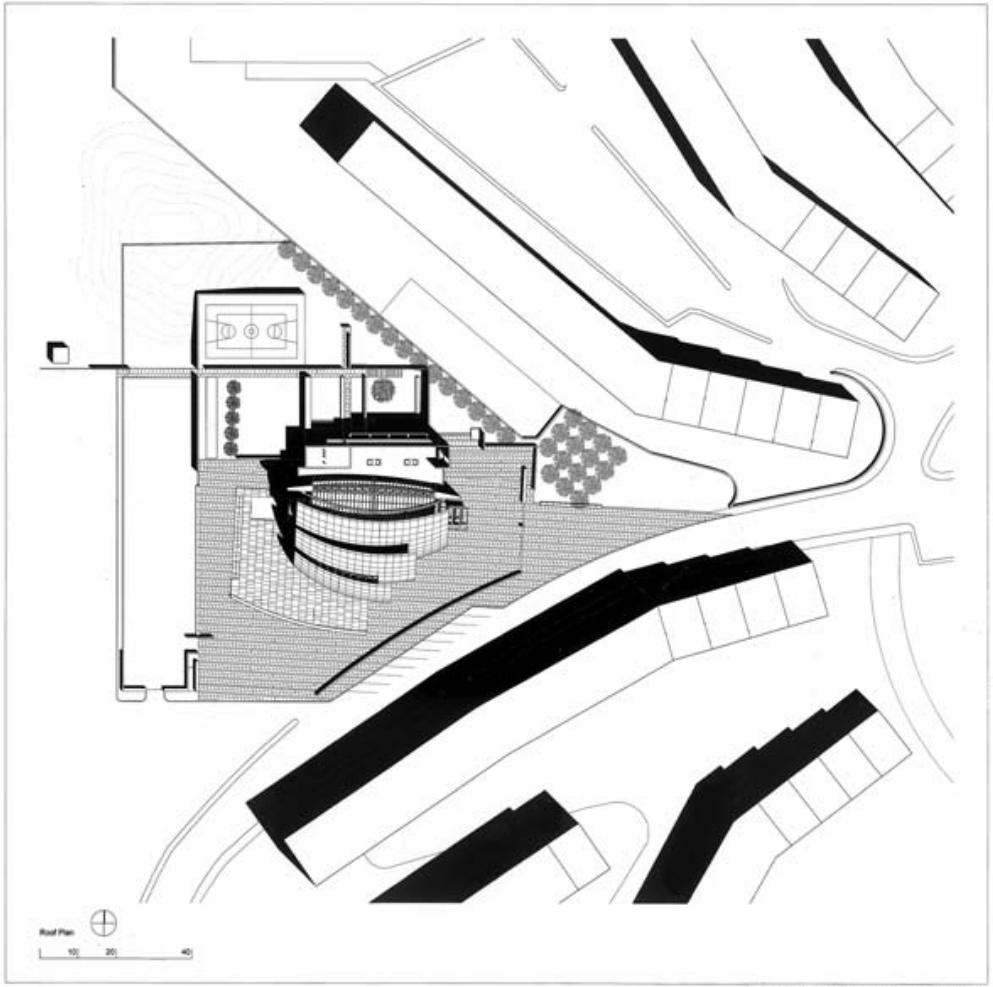
Self cleaning concrete is called photocatalytic concrete
Invented in Italy
Depends on titanium oxide additive to "eat" pollution

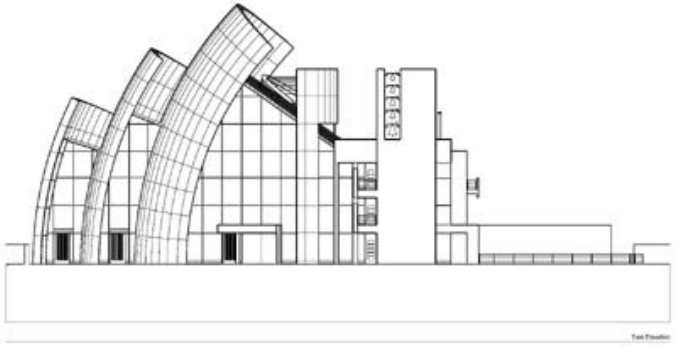
It was touted as a technological miracle to keep concrete from getting stained by pollution, but not working as well as expected.

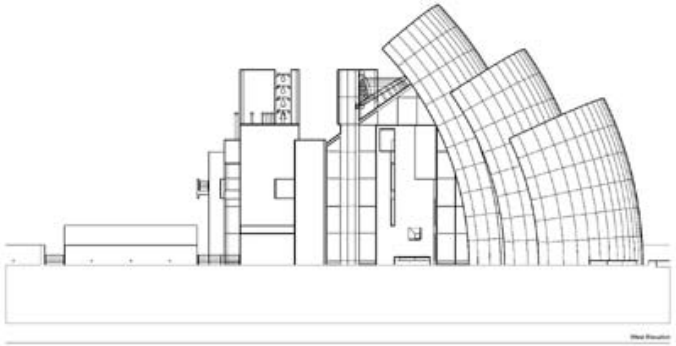


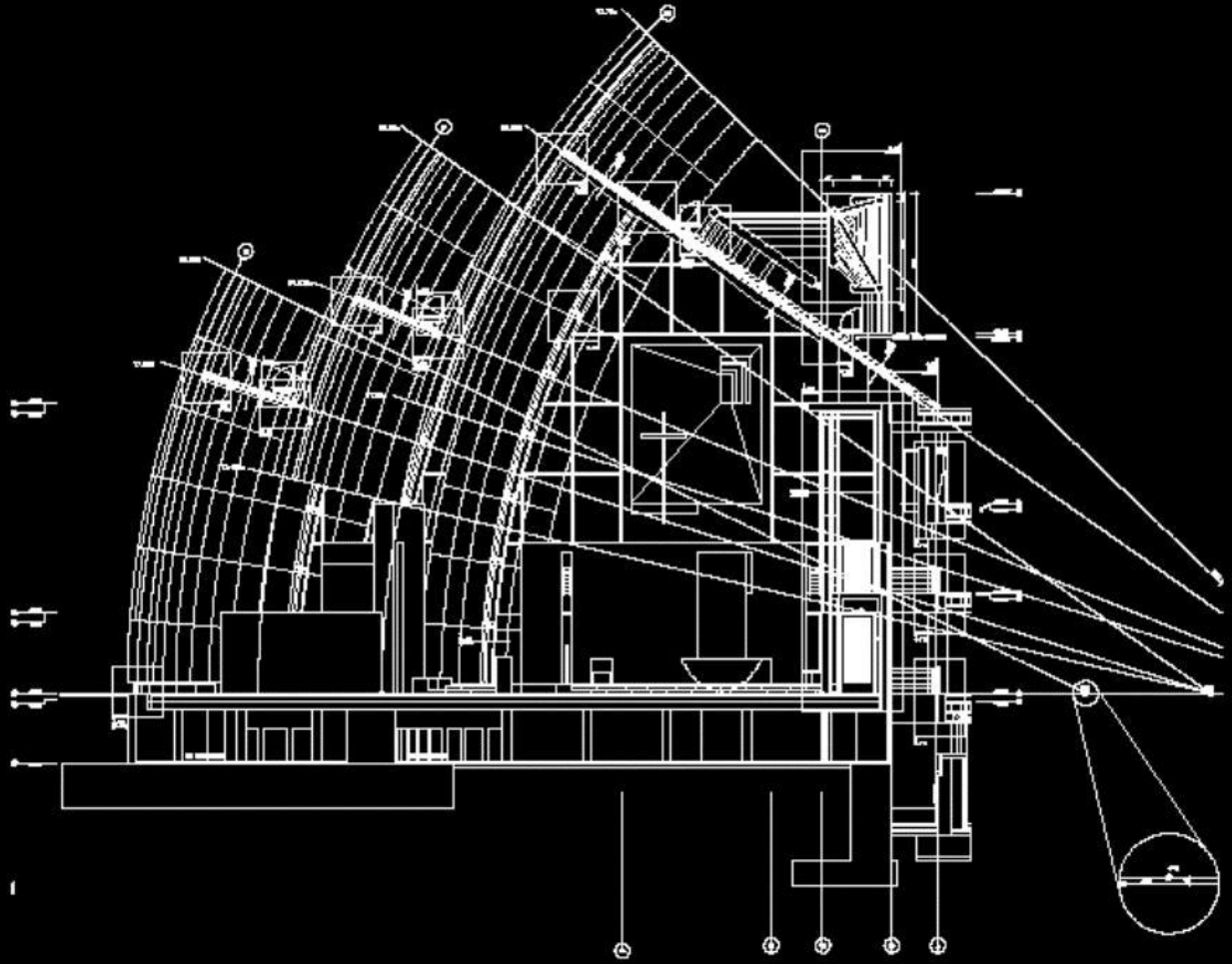
First used on the Jubilee Church by Richard Meier in Rome, Italy 2003

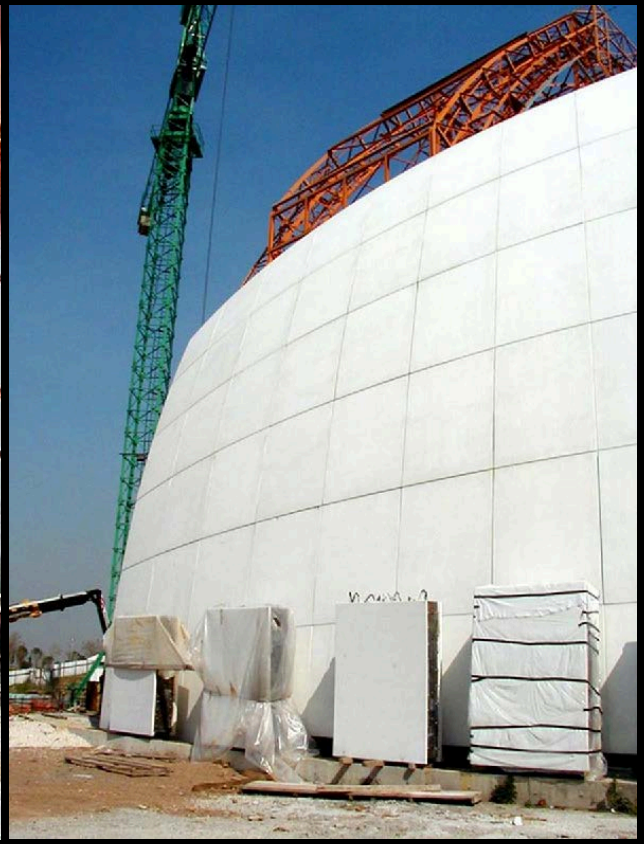

© Richard Meier









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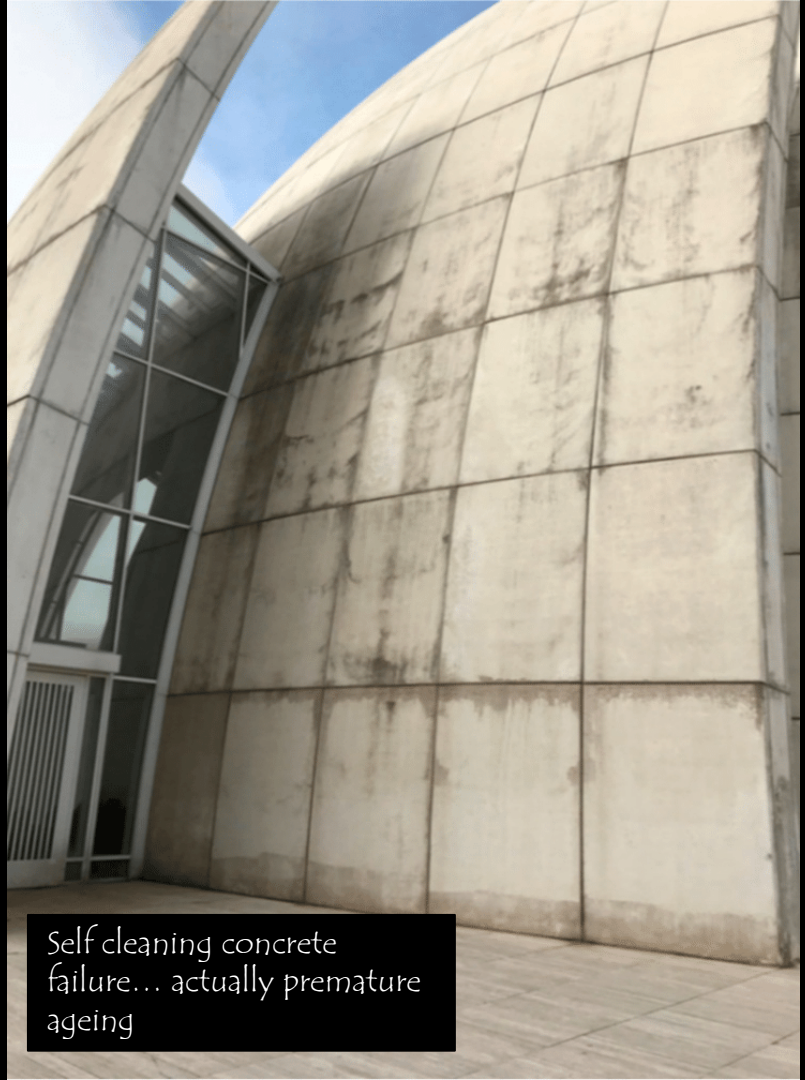
https://www.researchgate.net/figure/View-of-the-damages-on-the-surface-of-the-self-cleaning-concrete-shells-of-Jubilee-Church_fig29_337427859



Self cleaning concrete failure… actually premature ageing