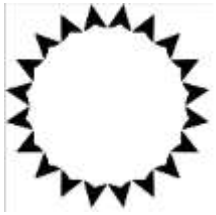
PEF2602
Estruturas na Arquitetura I I – Sistemas Reticulados



Pórticos

(Aula 11 – 05/11/2018)

Professores
Ruy Marcelo Pauletti, Leila Meneghetti Valverdes, Luís Antônio Bittencourt Jr.

Os 'skylines' das grandes cidades evidenciam os pórticos (especialmente os edifícios multipavimentos) como o sistema estrutural fortemente predominante.

Os demais sistemas estruturais têm aplicações notáveis, mas relativamente restritas.

Hong Kong, China: Metro/Urban Population: 7.0 million

Adaptado de "The Top 15 Skylines in the World v3.0" (www.diserio.com)

Chicago, USA: Metro/Urban Population: 9.0 million

New York City, USA : Metro/Urban Population: 18.0 million

Shanghai, China: Metro/Urban Population: 14.0 million

Singapore: Metro/Urban Population: 4.3 million

Tokyo, Japan: Metro/Urban Population: 34.0 million

Toronto, Canada: Metro/Urban Population: 5.5 million

Kuala Lumpur, Malaysia: Metro/Urban Population: 1.5 million

Shenzhen, China: Metro/Urban Population: 6 millions

Seattle, USA: Metro/Urban Population: 3.7 millions

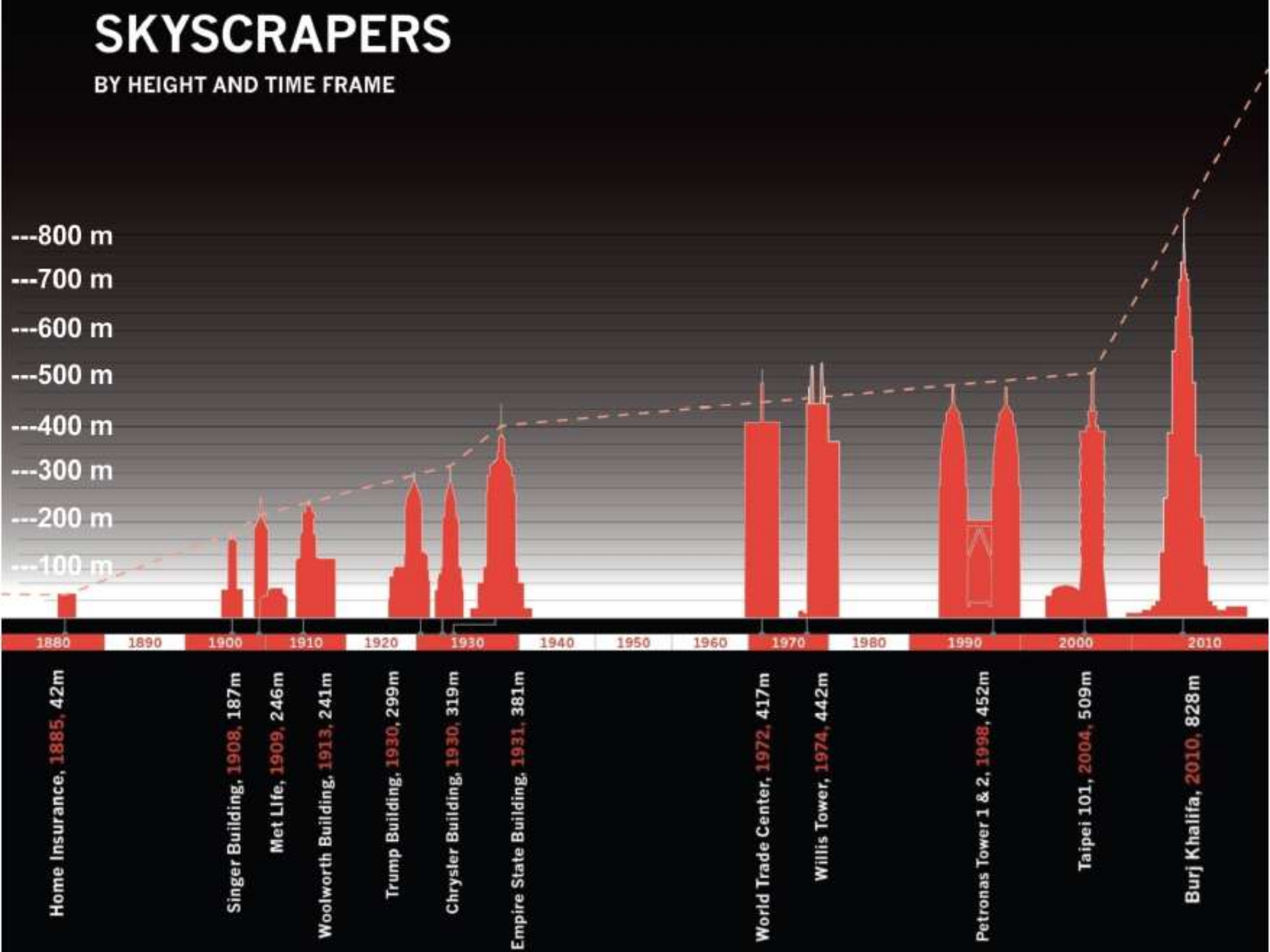
Dubai, United Emirates: /Urban Population: 1.6 million

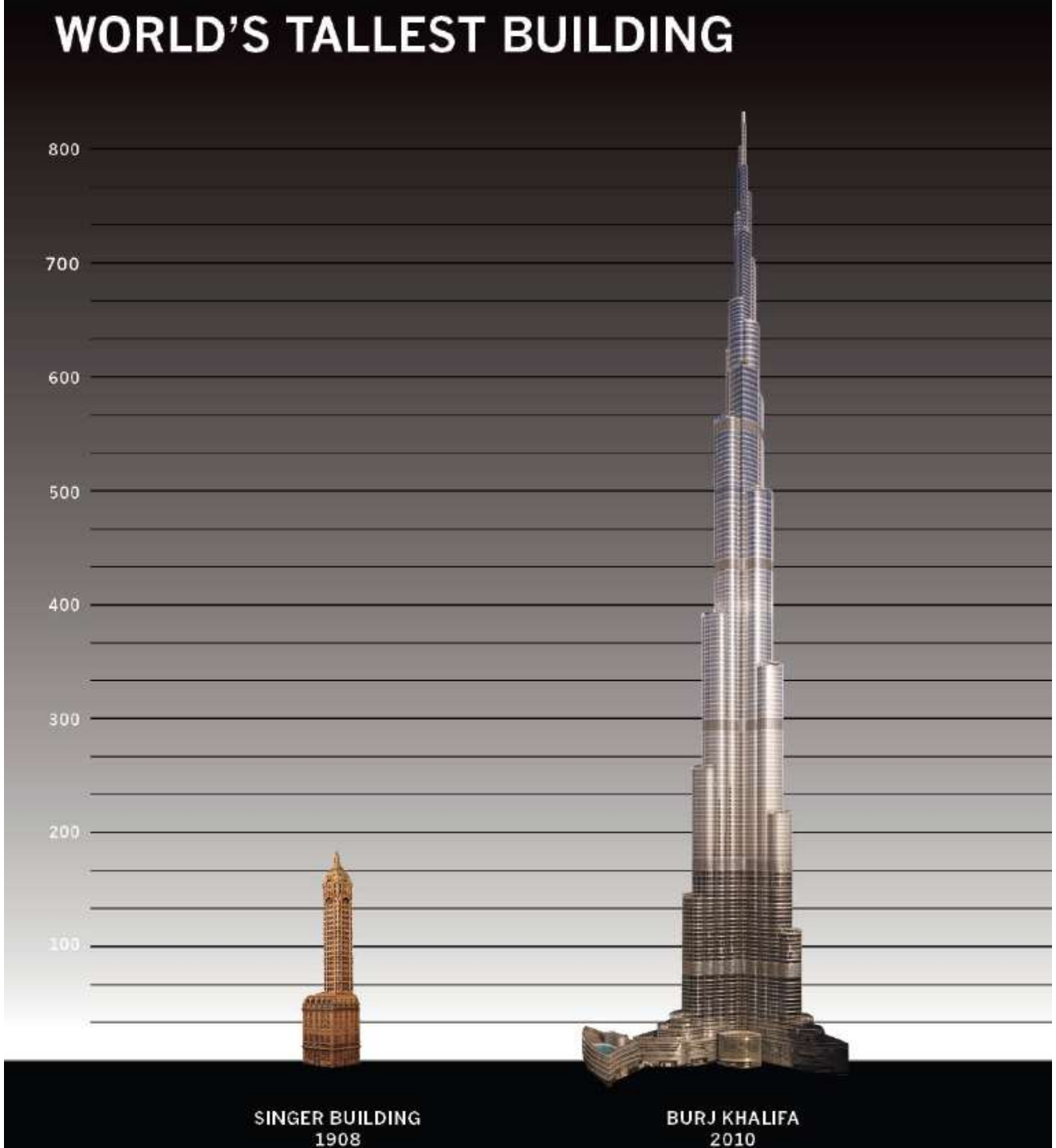
Seoul, South Korea: Metro/Urban Population: 22 million

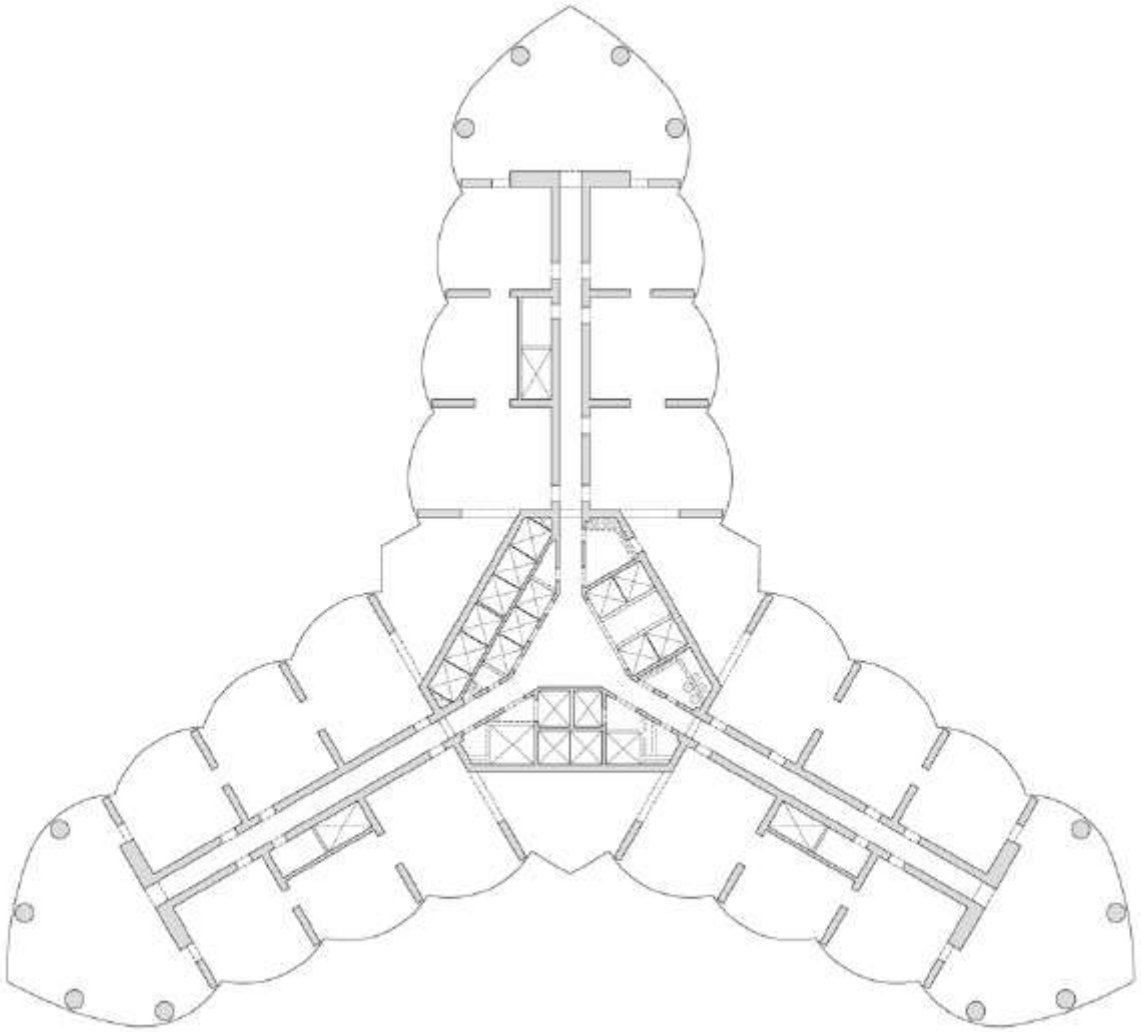
Sidney, Australia: Metro/Urban Population: 4.2 million

SKYSCRAPERS

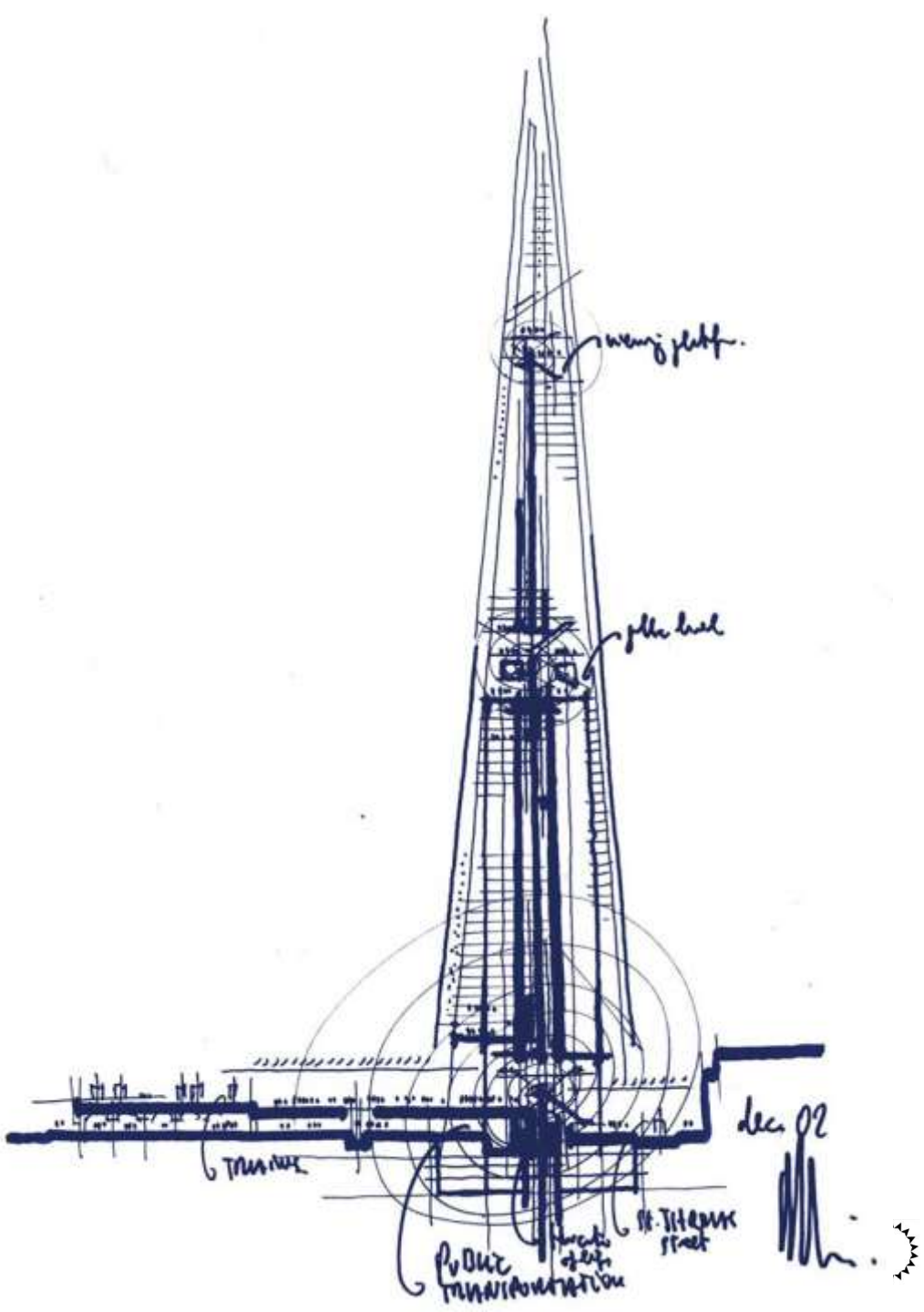
BY HEIGHT AND TIME FRAME




WORLD'S TALLEST BUILDING
800
700
600
500
400
300
200
100
SINGER BUILDING
1908
BURJ KHALIFA
2010



The Shard – London - 2012
Renzo Piano - height: 306m / 72 public floors / 87 total

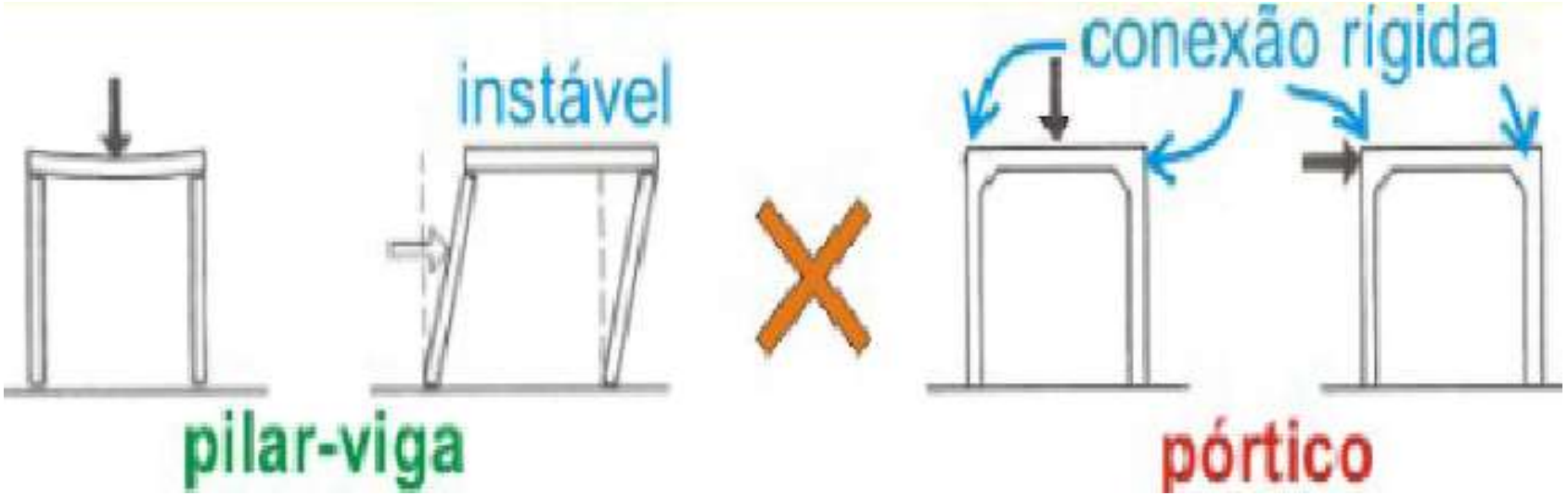


Estru

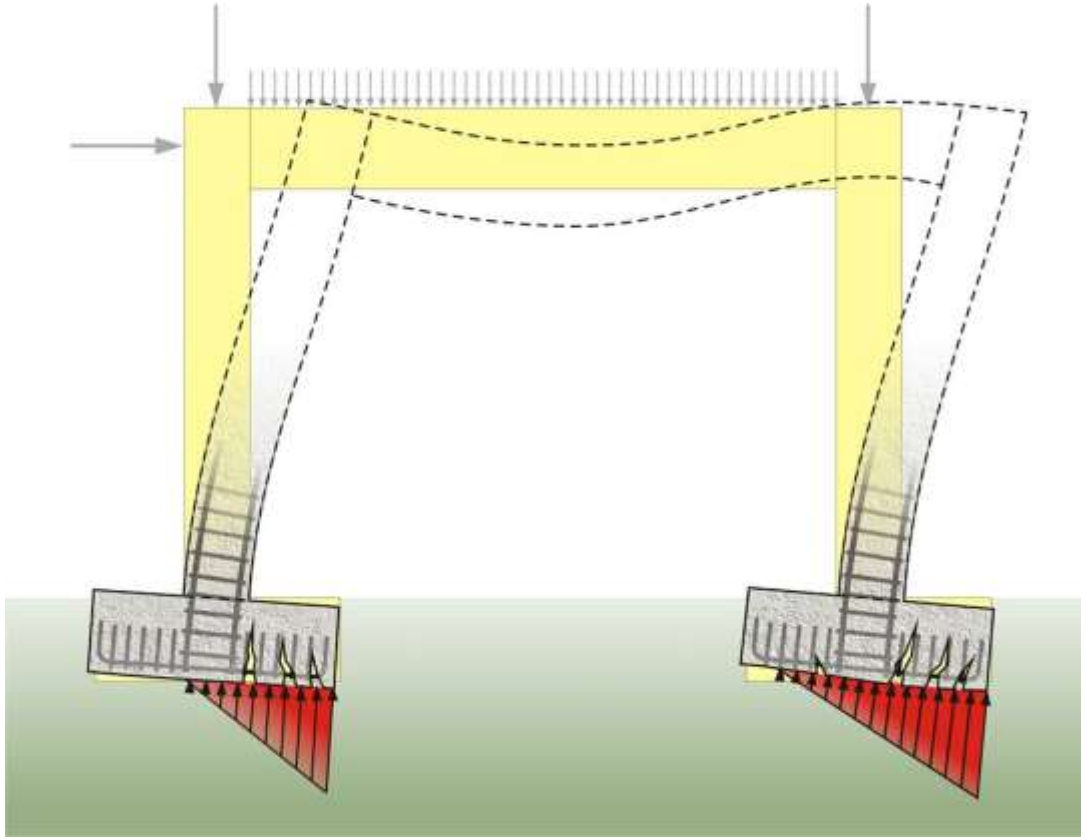
Pórticos

Sistemas reticulados compostos por elementos lineares resistentes à força normal, à flexão e à torção, e conectados por suas extremidades de forma a não permitir rotações relativas ('conexões rígidas').

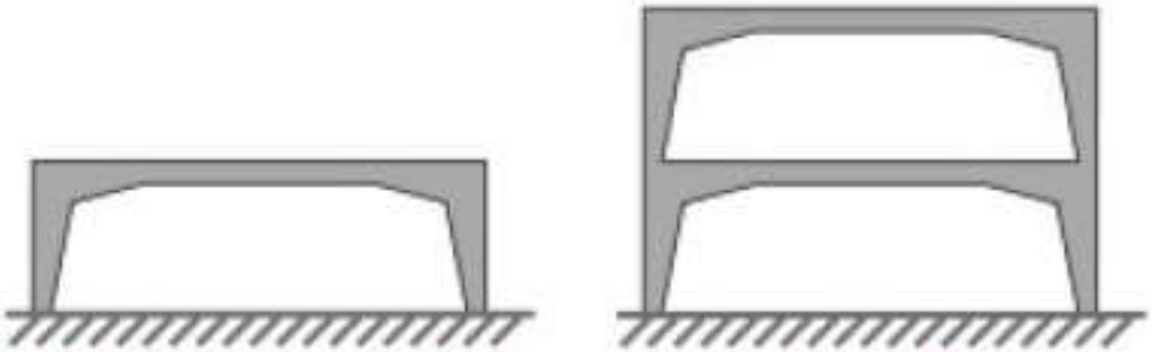
Os membros de um pórtico são em geral capazes de resistir a esforços normais, cortante e de flexão, e são comumente empregados em padrões repetitivos, resultando em estruturas hiperestáticas.



Pórticos

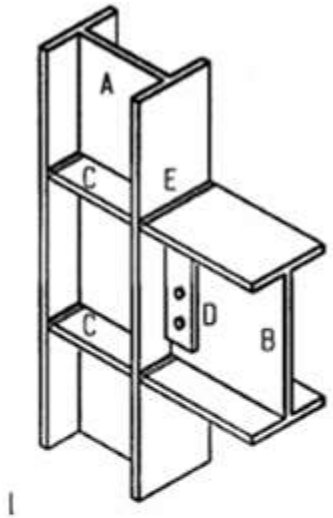


Pórticos Metálicos



Pórticos em Concreto Armado

Nós de Pórticos



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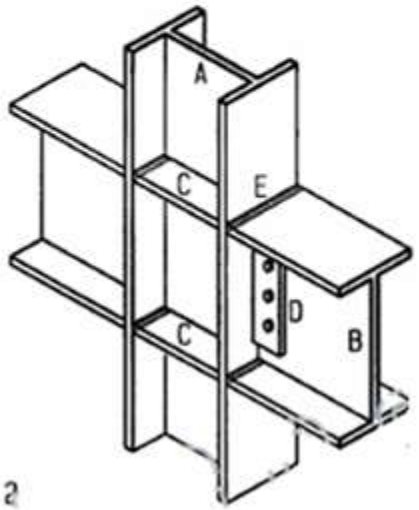

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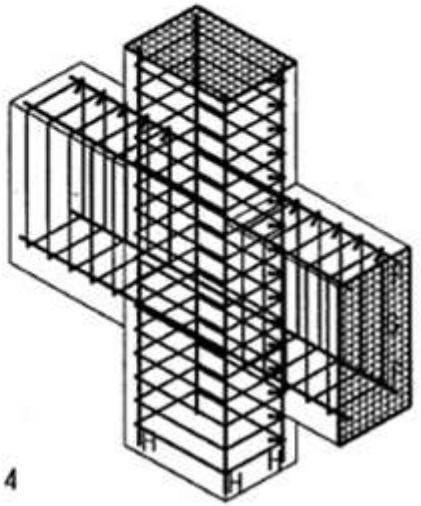
3

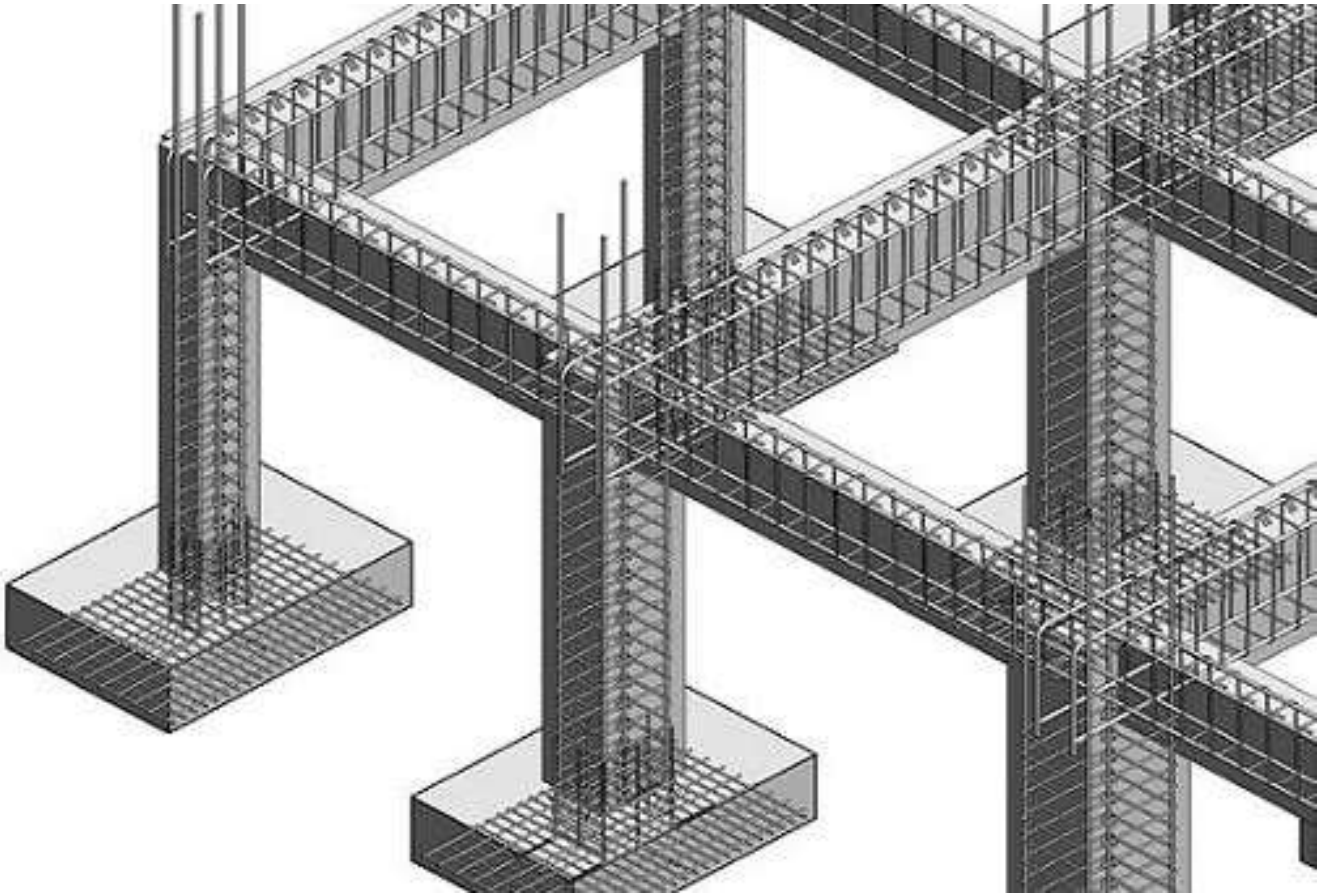


4

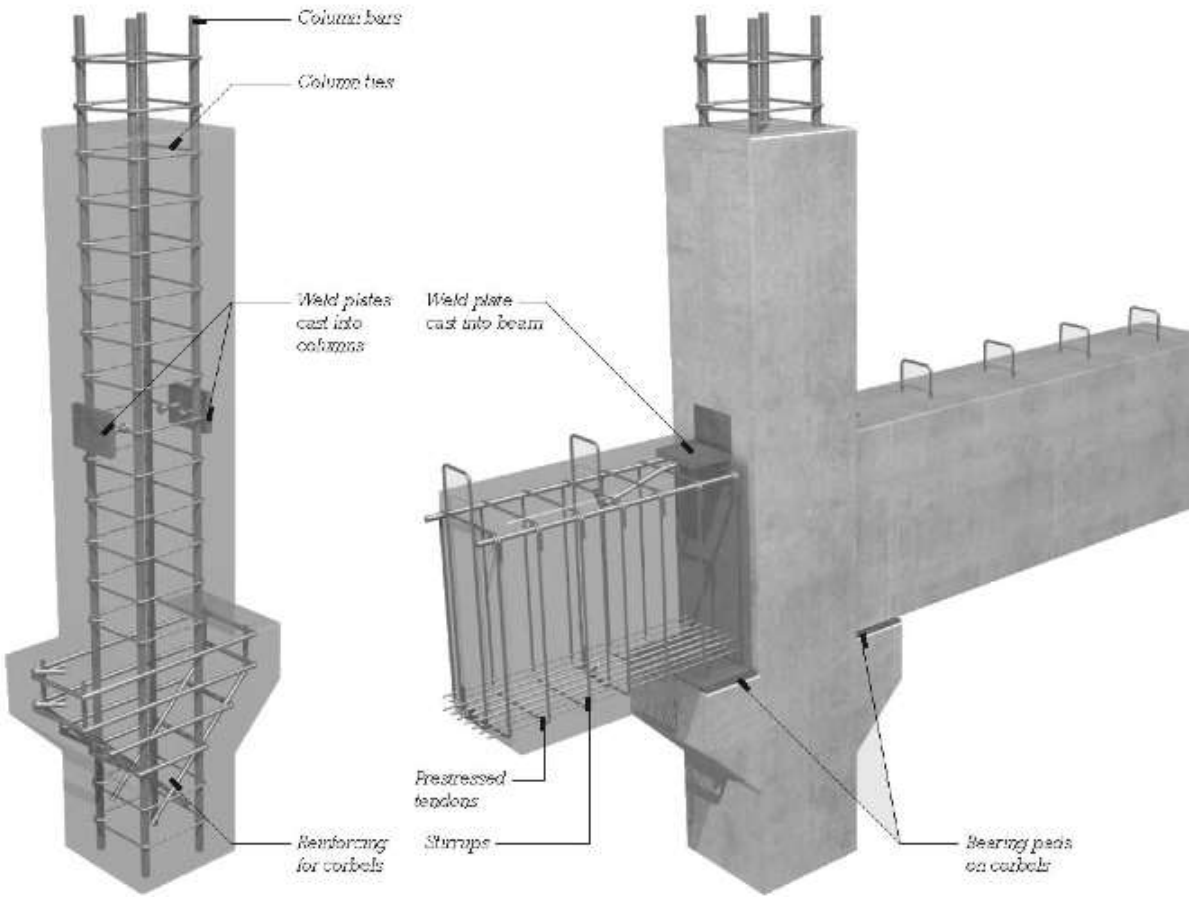
Estruturas Metálicas

Concreto Armado

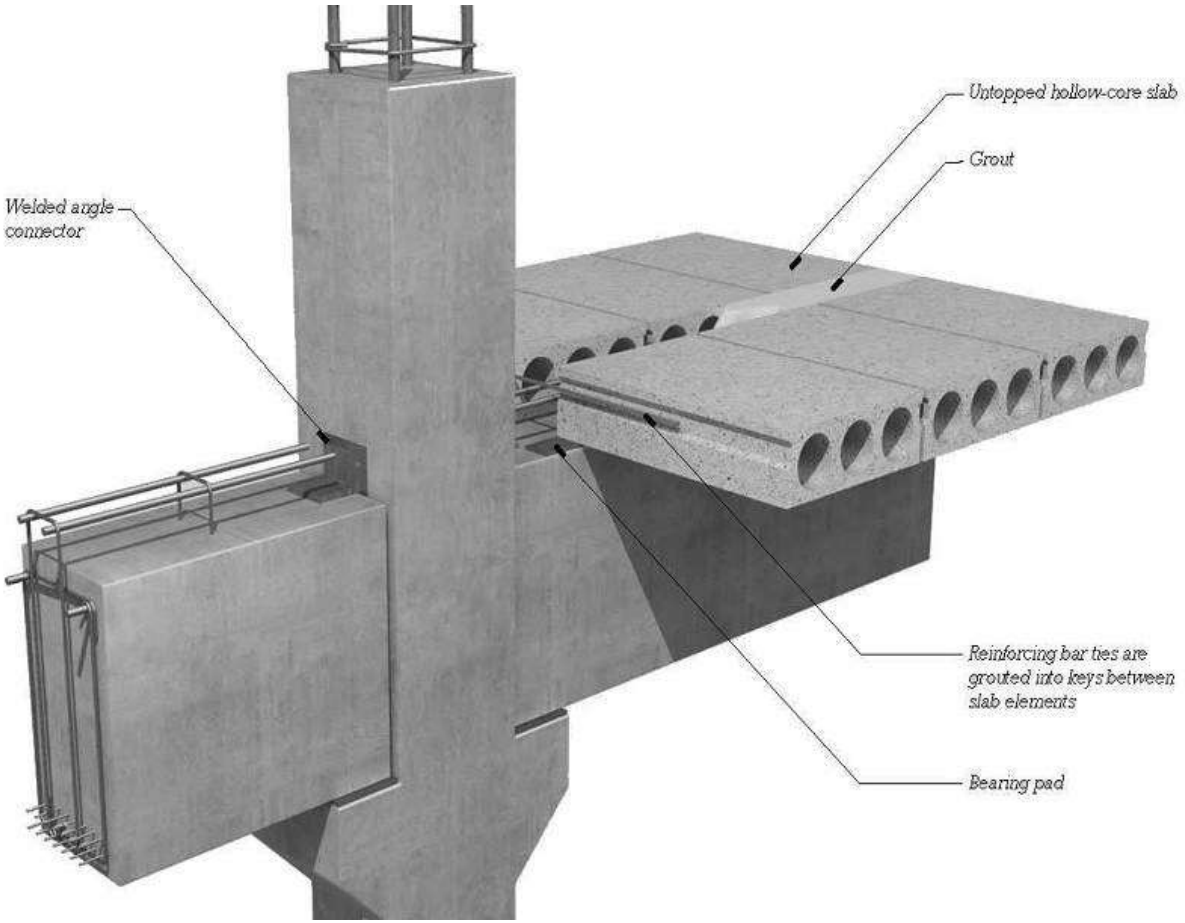
Pórticos de concreto armado



Pórticos de concreto armado pré-moldado

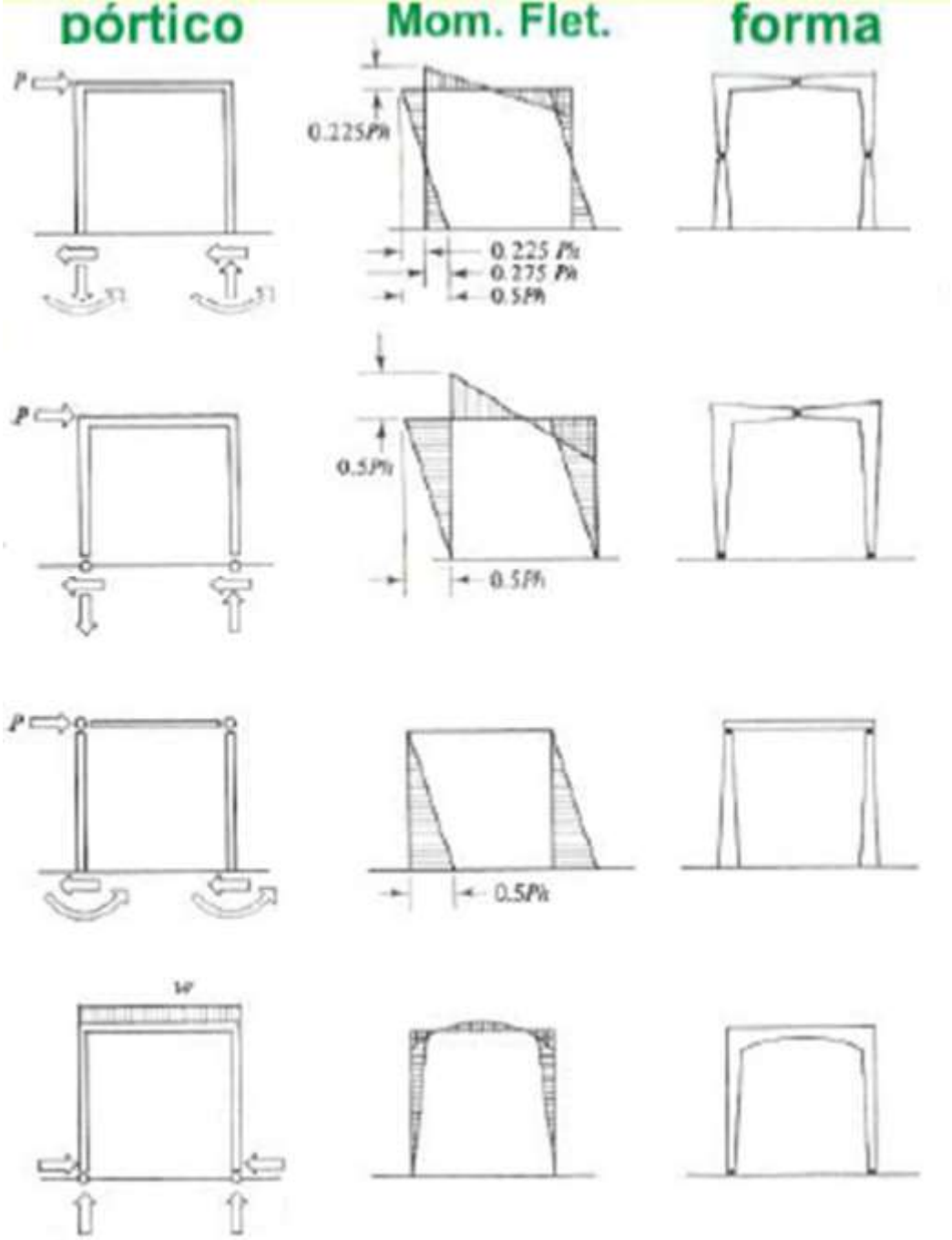


Pórticos de concreto armado pré-moldado



A distribuição dos esforços em um pórtico depende fortemente da vinculação da estrutura!

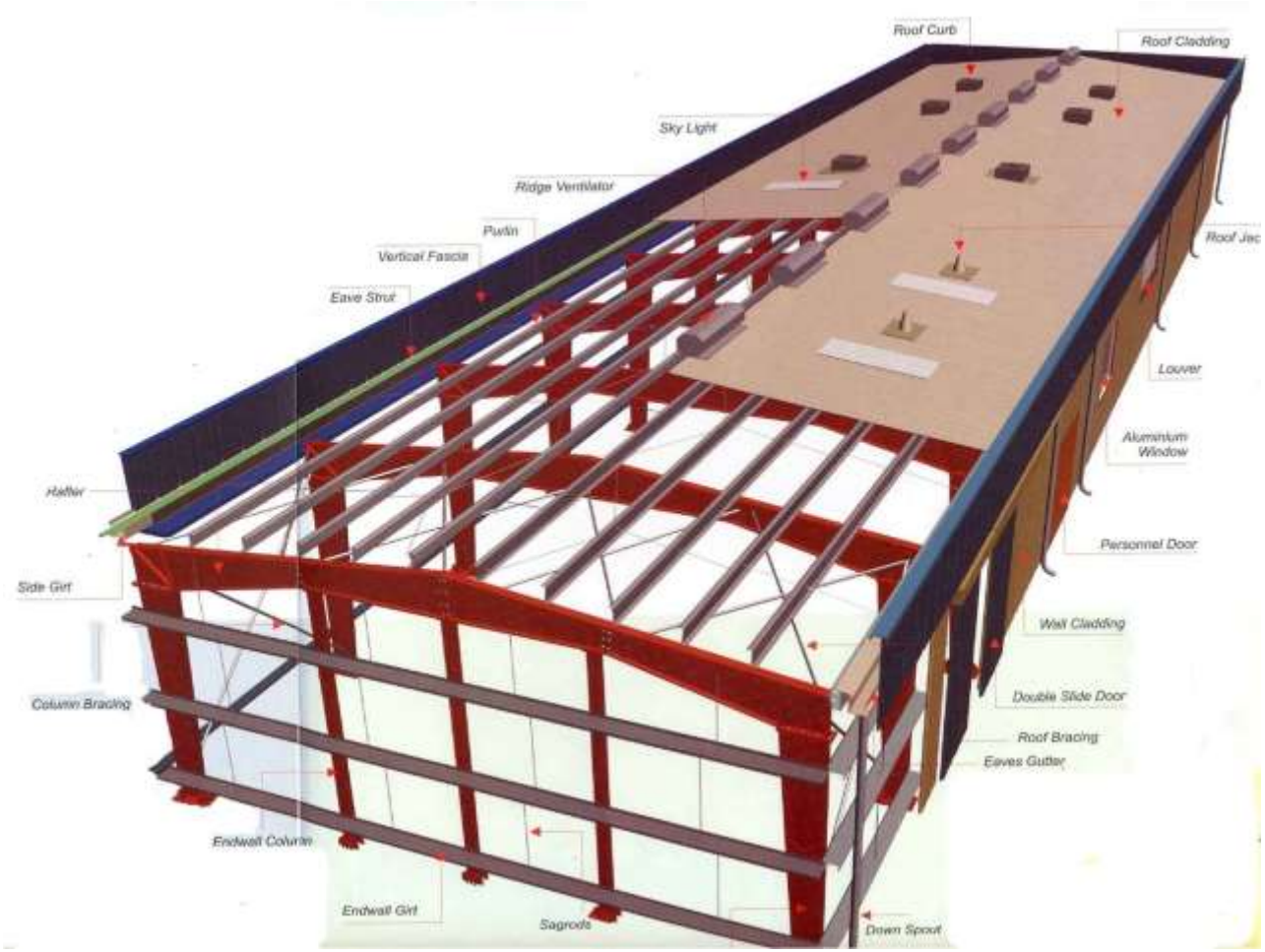
Juntas podem ser inseridas, tomando partido dos pontos de momento fletor nulo!



Nota: nesta figura, os momentos fletores estão desenhados conforme a convenção americana (do lado comprimido).
Ref. Shodek, Structures, 1992.

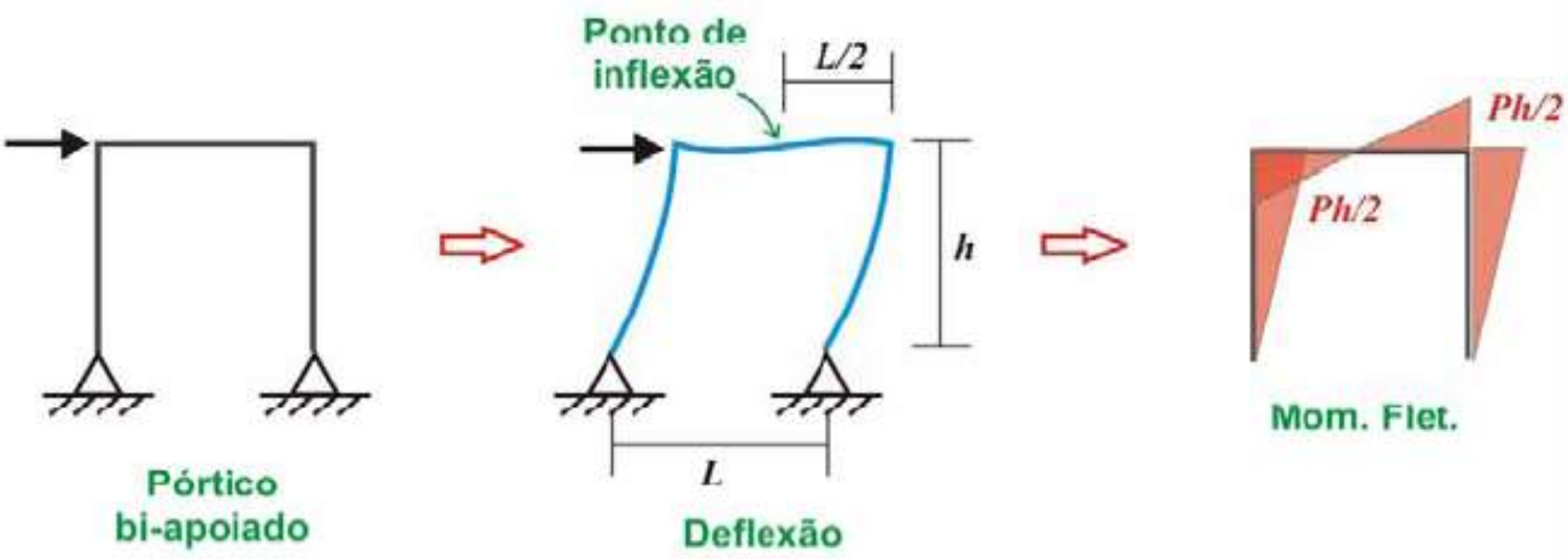

pórtico
Momentos Fletores
forma
tri-articulado
bi-articulado
balanços

Pavilhão industrial típico
– sucessão de pórticos planos contraventados



Estudo qualitativo de pórticos planos simples

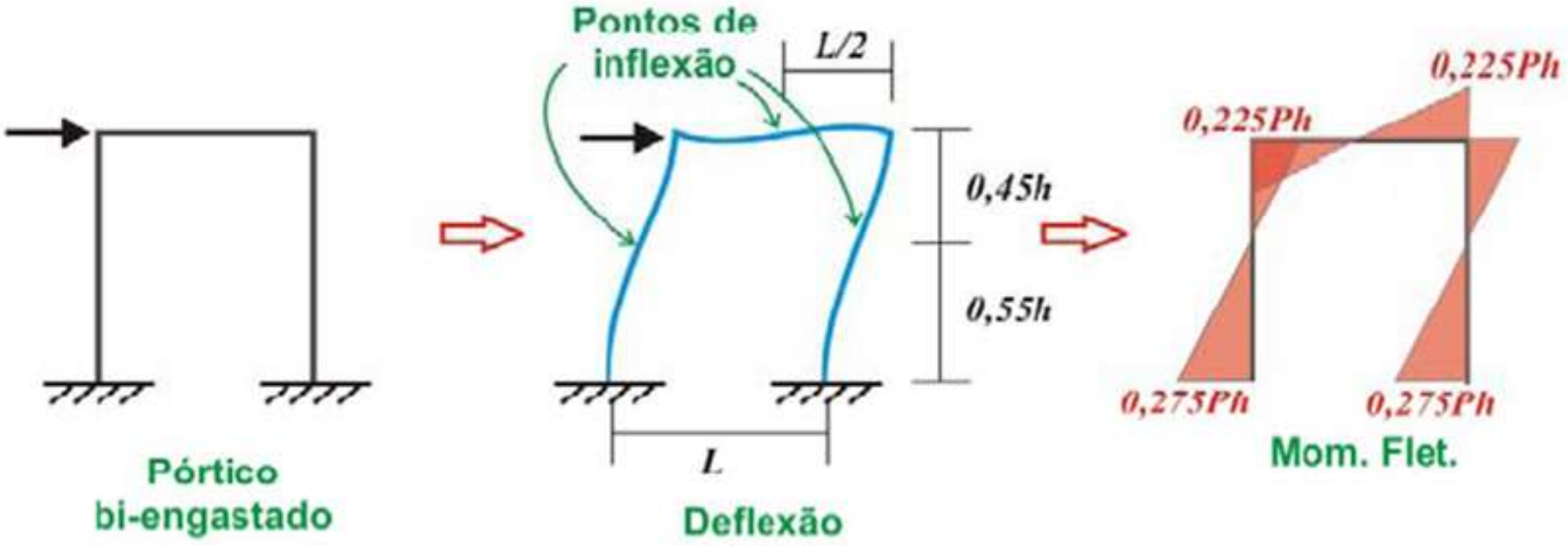
Pórtico biarticulado sujeito a carga lateral



Nota: a posição assumida para o ponto de articulação decorre da anti-simetria do problema

Estudo qualitativo de pórticos planos simples

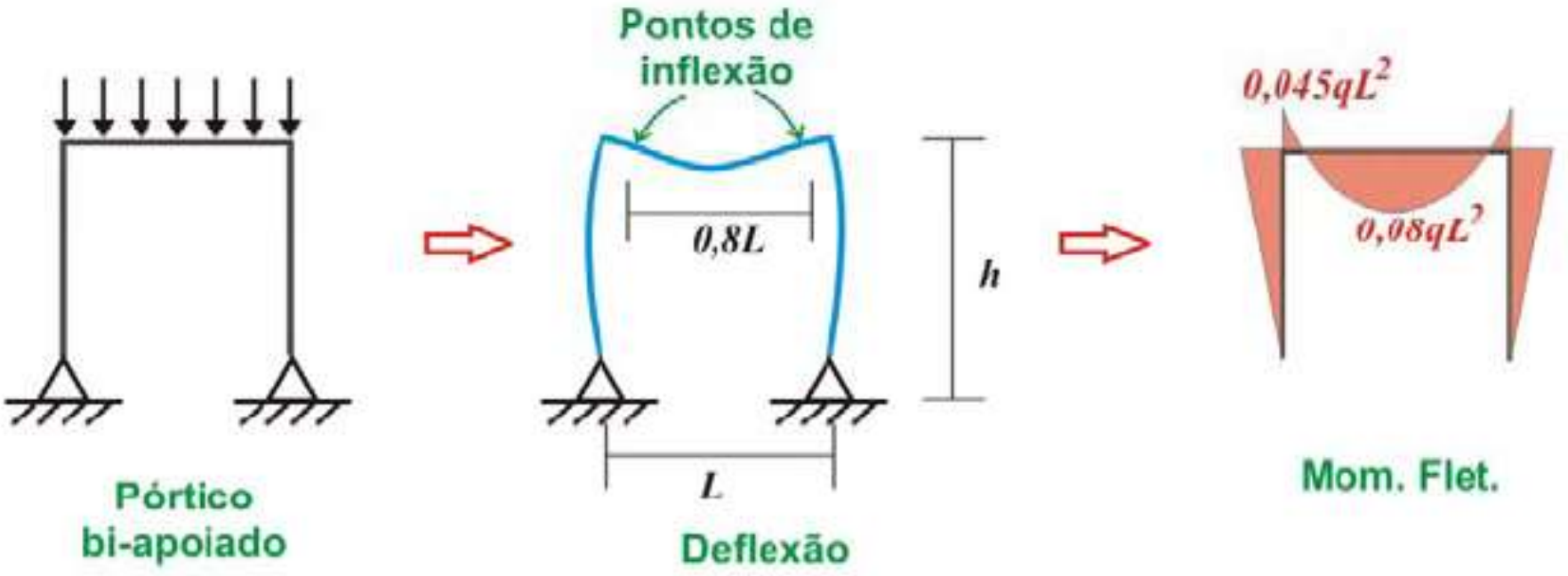
Pórtico biengastado sujeito a carga lateral



Nota: a posição assumida para os pontos de articulação decorrem de se considerar barras com a mesma rigidez à flexão

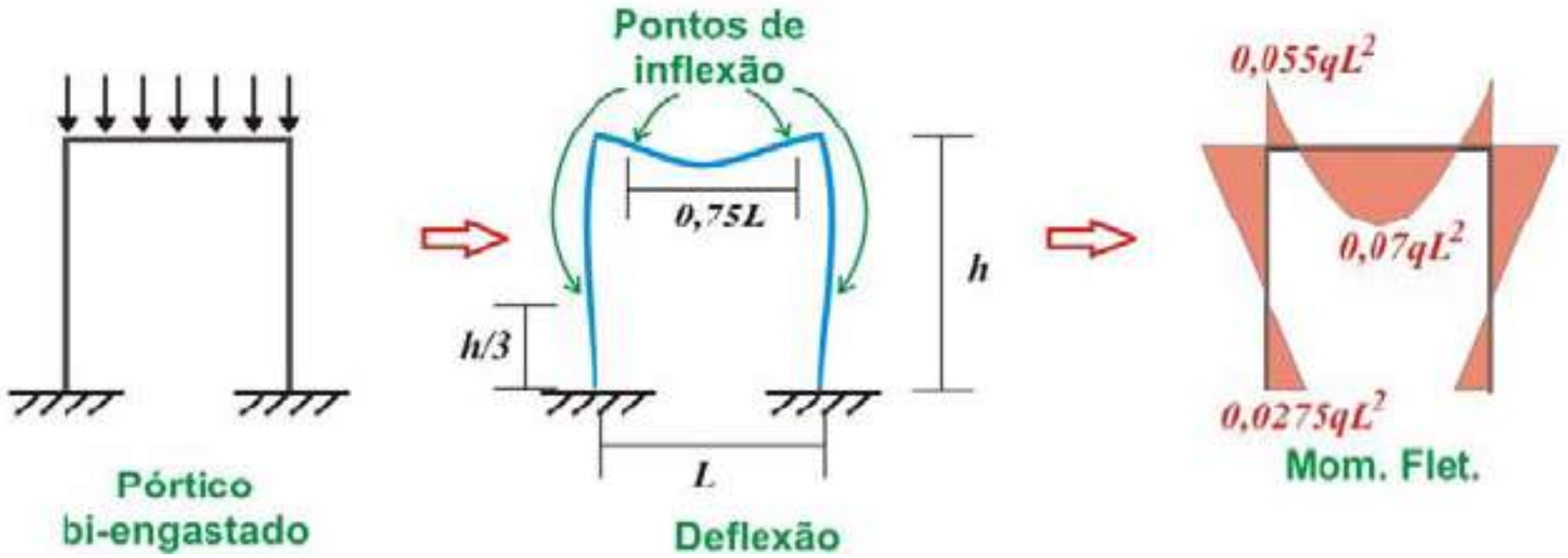
Estudo qualitativo de pórticos planos simples

Pórtico biarticulado sujeito a carga vertical



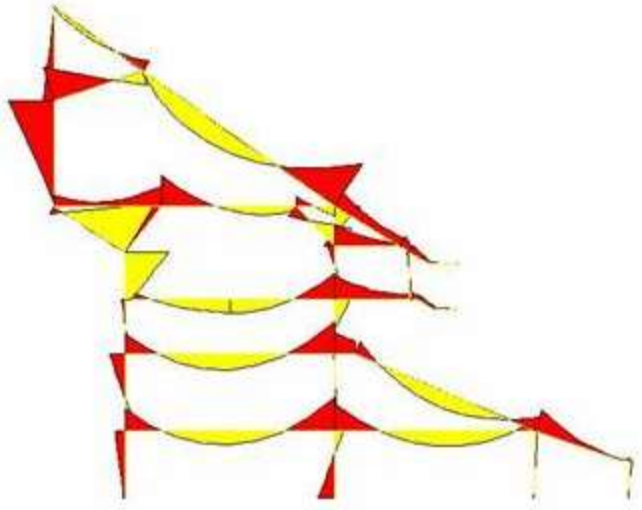
Estudo qualitativo de pórticos planos simples

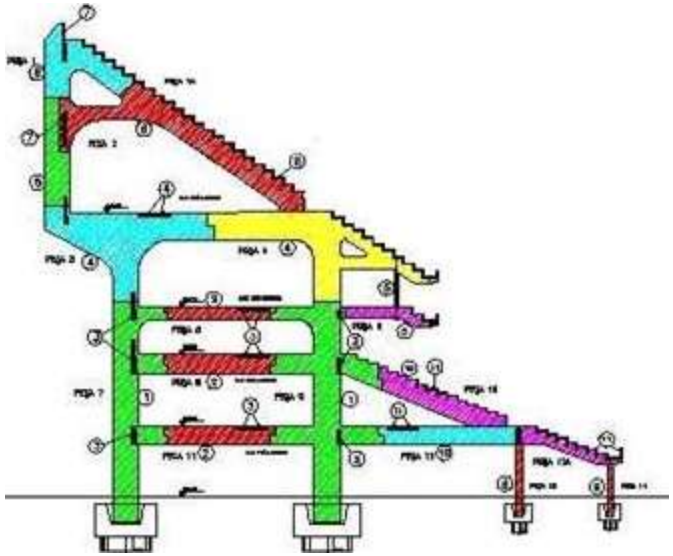
Pórtico biengastado sujeito à carga vertical



Pórtico de concreto pré-moldado

(Estádio Olímpico João Havelange – ou Engenhão, ou Estádio Nilton Santos, 2007).

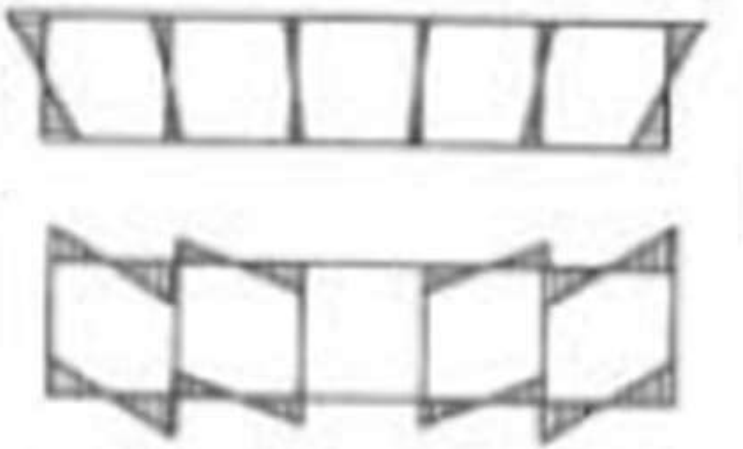




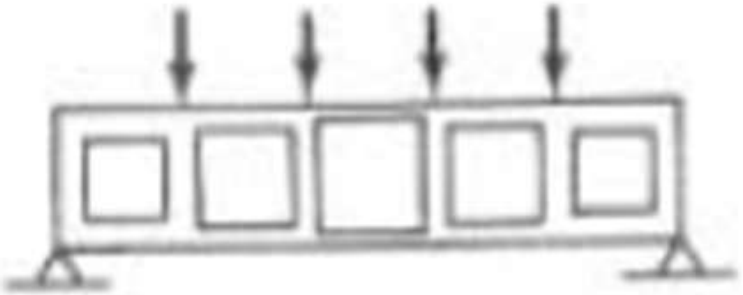
Vigas Vierendeel.

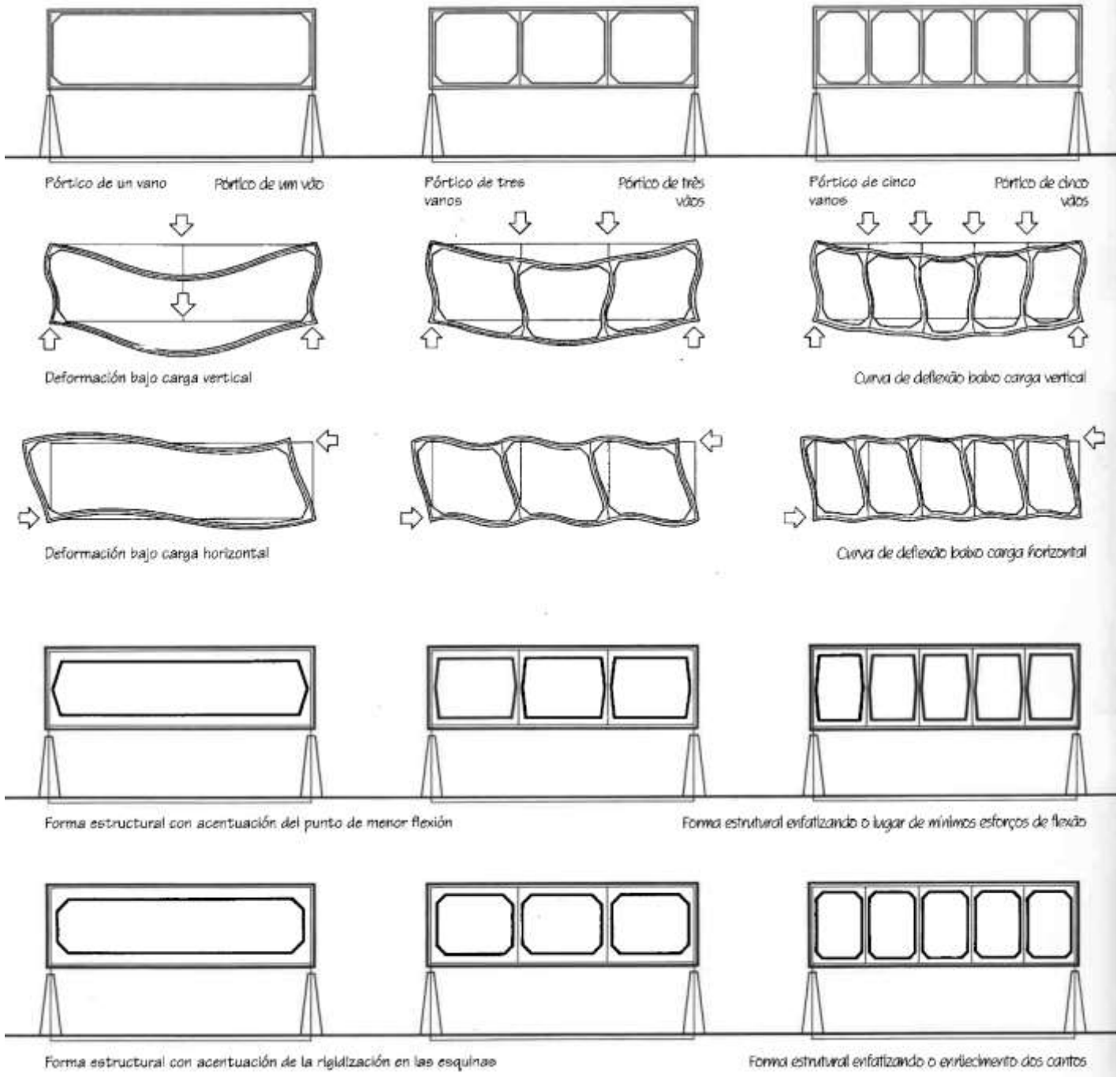
Forças normais

Momentos fletores

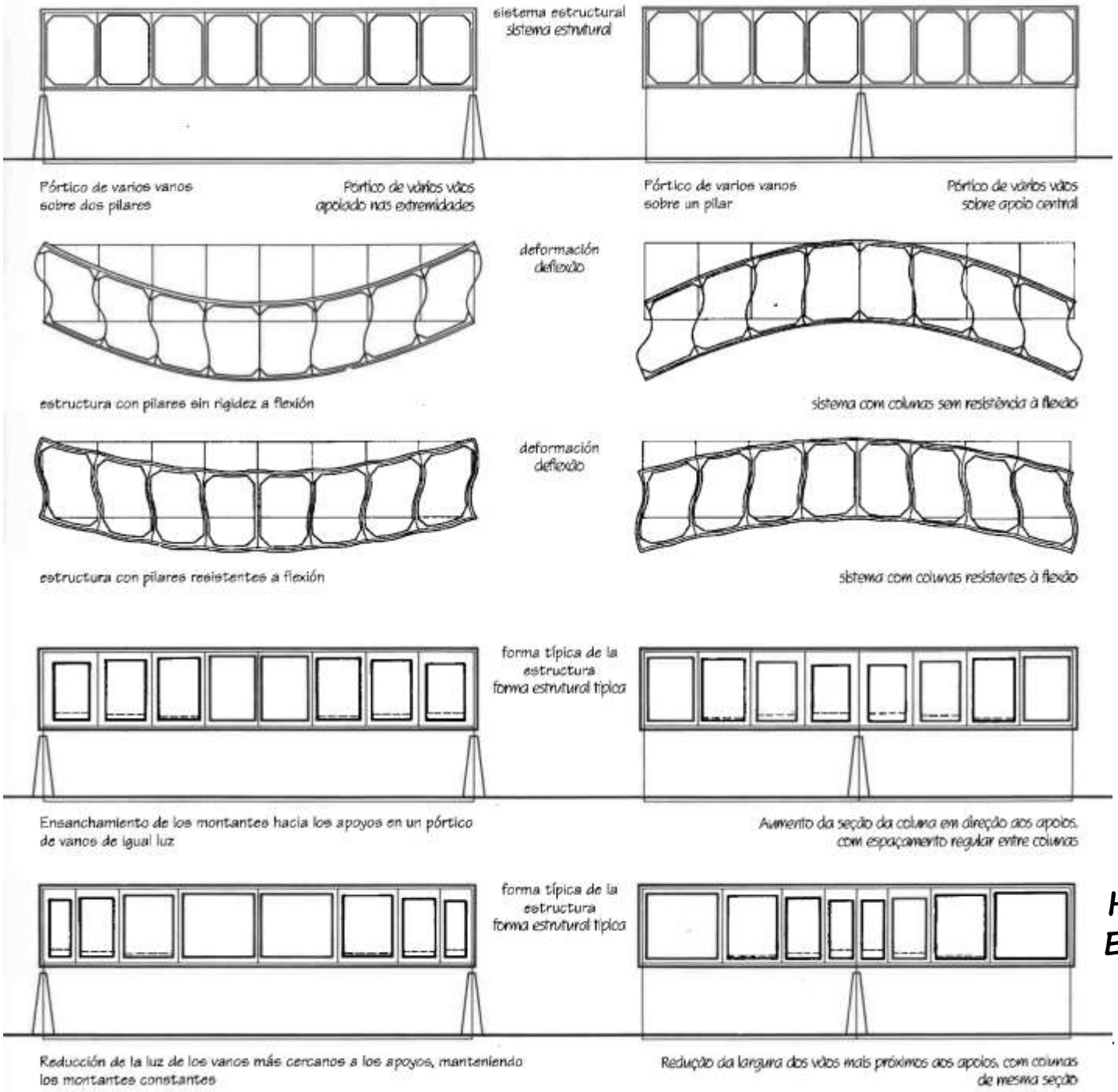


Forma





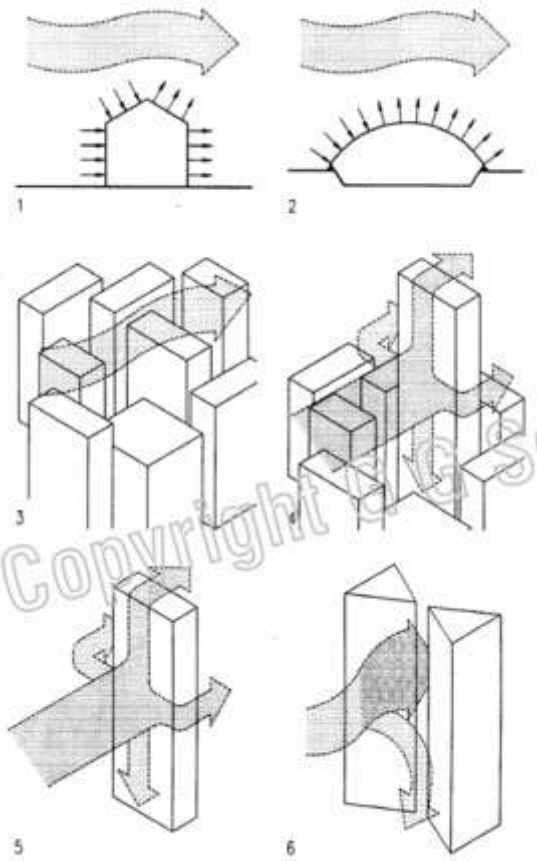
H. Engel, Sistemas Estruturais, 1997.



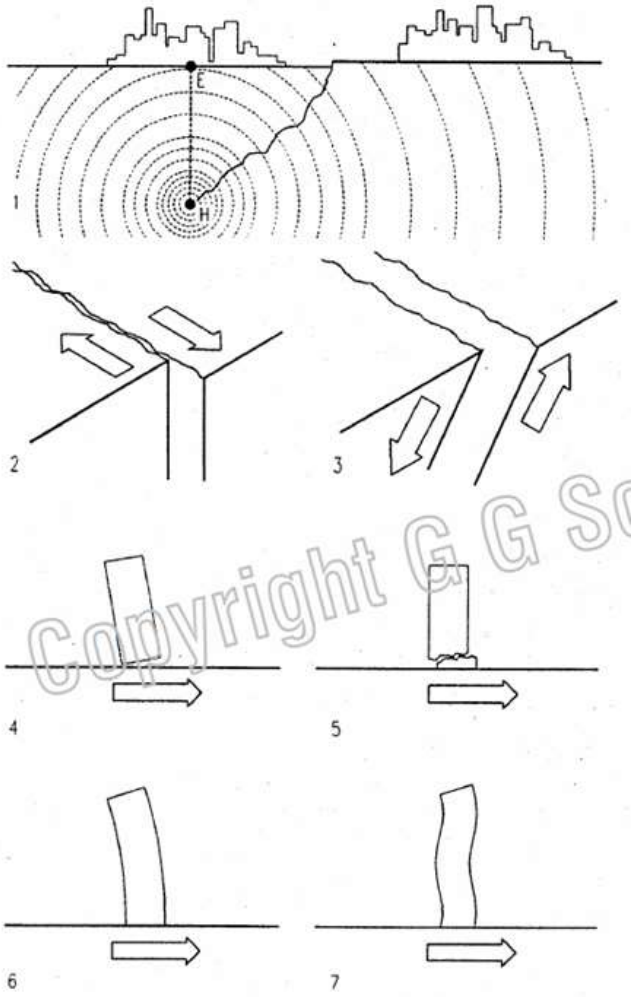
H. Engel, Sistemas Estruturais, 1997.

Cargas Laterais

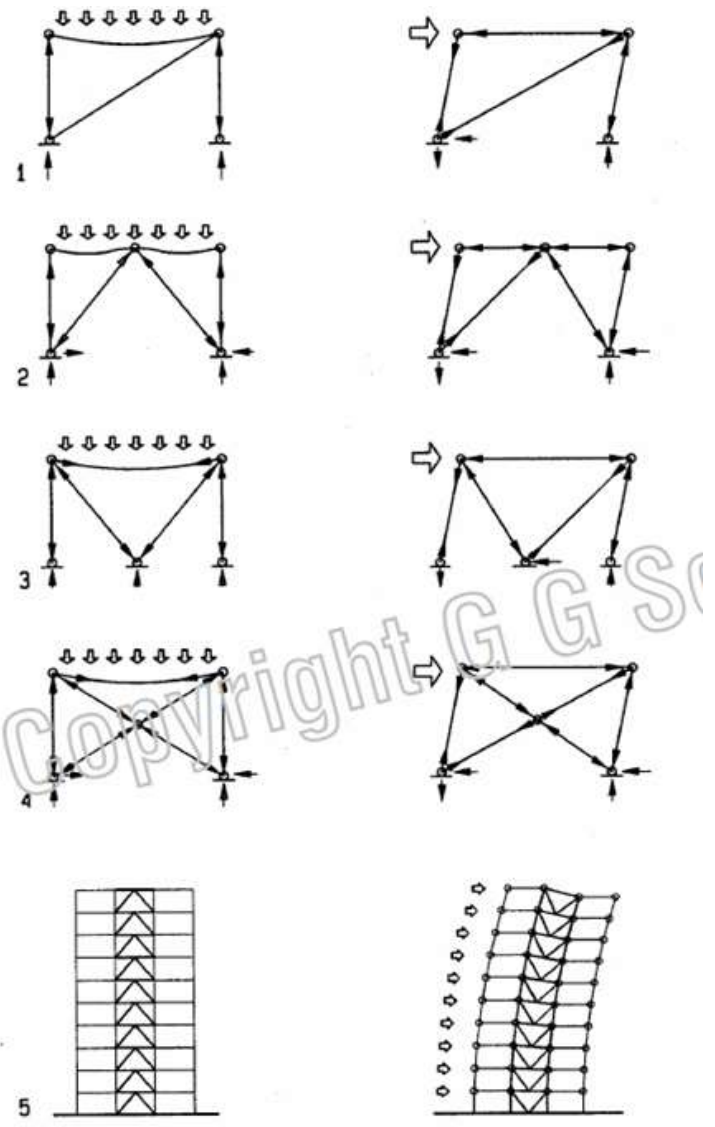
Ventos

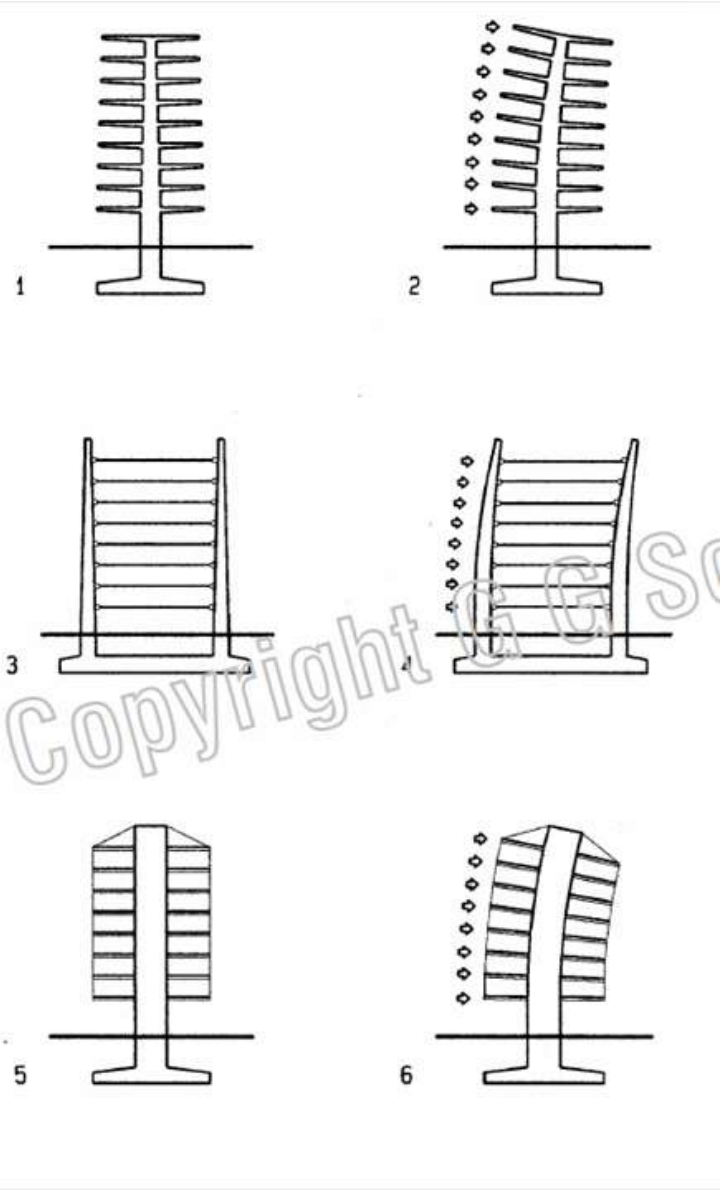


Terremotos

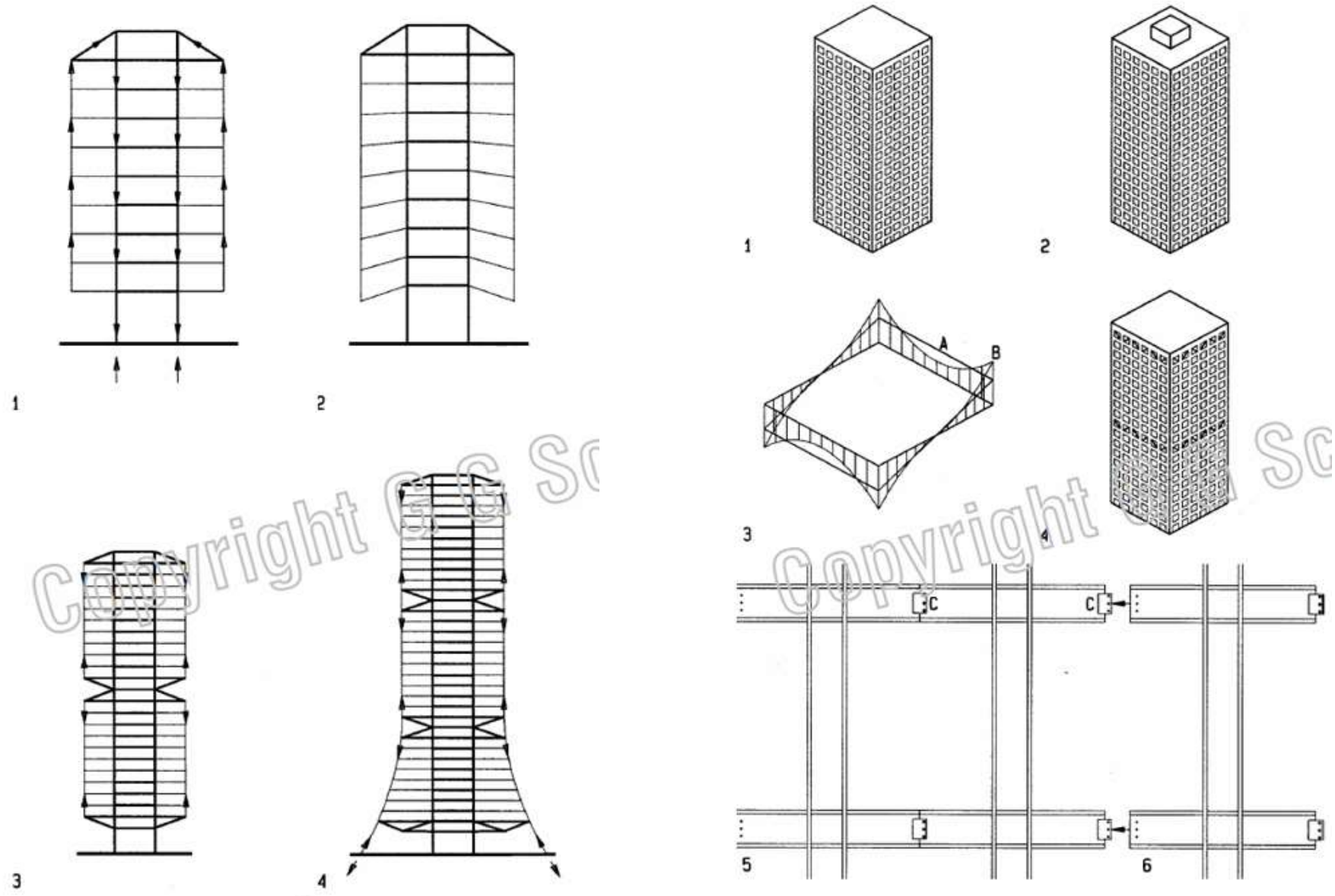


Figuras extraídas de 'Architectural Structures', G.G. Schierle, 1990-2006





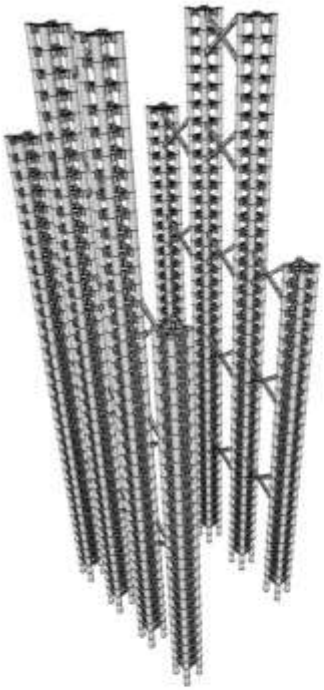
Figuras extraídas de 'Architectural Structures', G.G. Schierle, 1990-2006



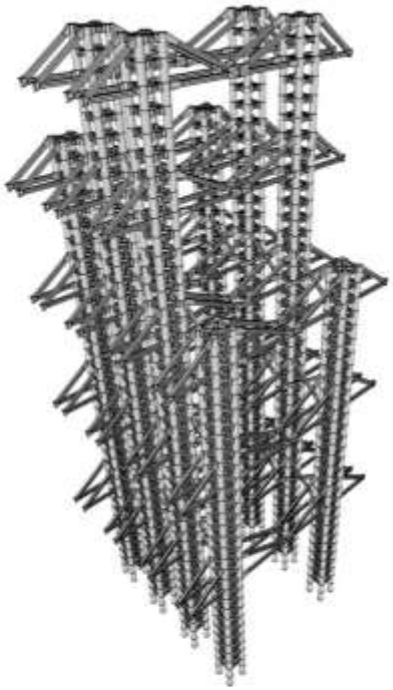
Figuras extraídas de 'Architectural Structures', G.G. Schierle, 1990-2006

Hong Kong and shanghai Bank Headquarters, Hong Kong, Foster + Partners, 1986

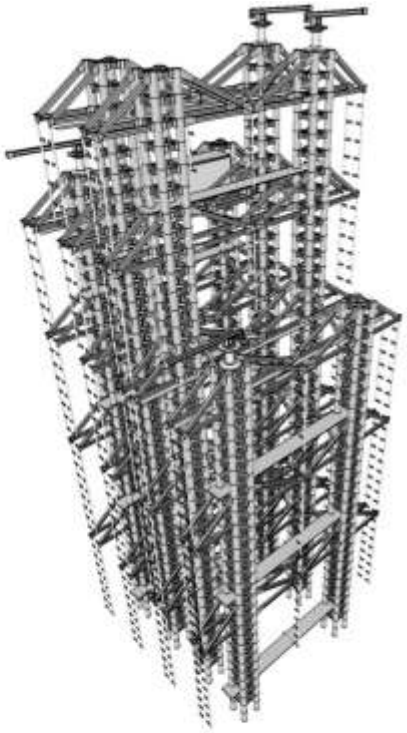
Hong Kong and Shanghai Bank Headquarters, Hong Kong, Foster + Partners, 1986



Mast



Truss



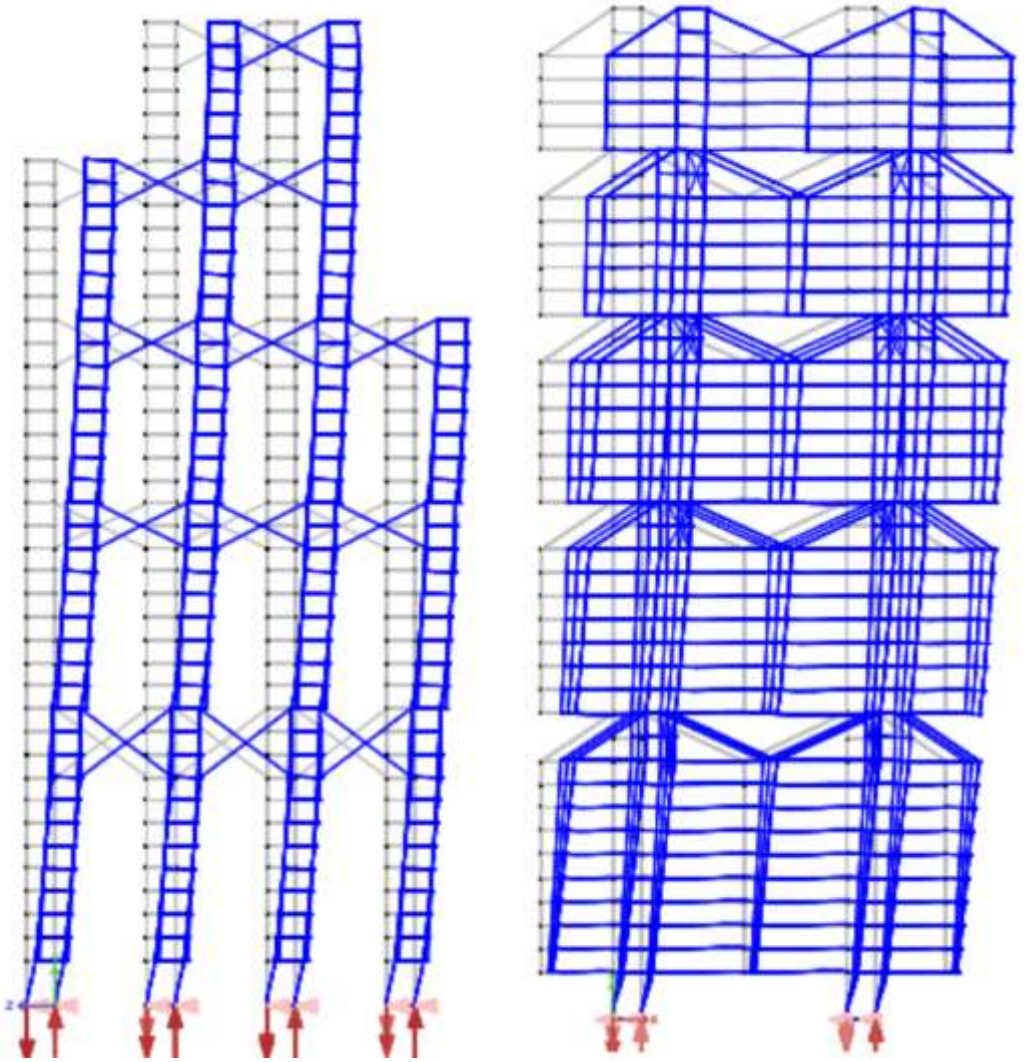
Cantilever

Ref.: 'HSBC – Hong Kong and Shanghai Banking Corporation', Yiming Guan, Yang Cao, Fu Chen,

Deflection Diagram

a. Front wind

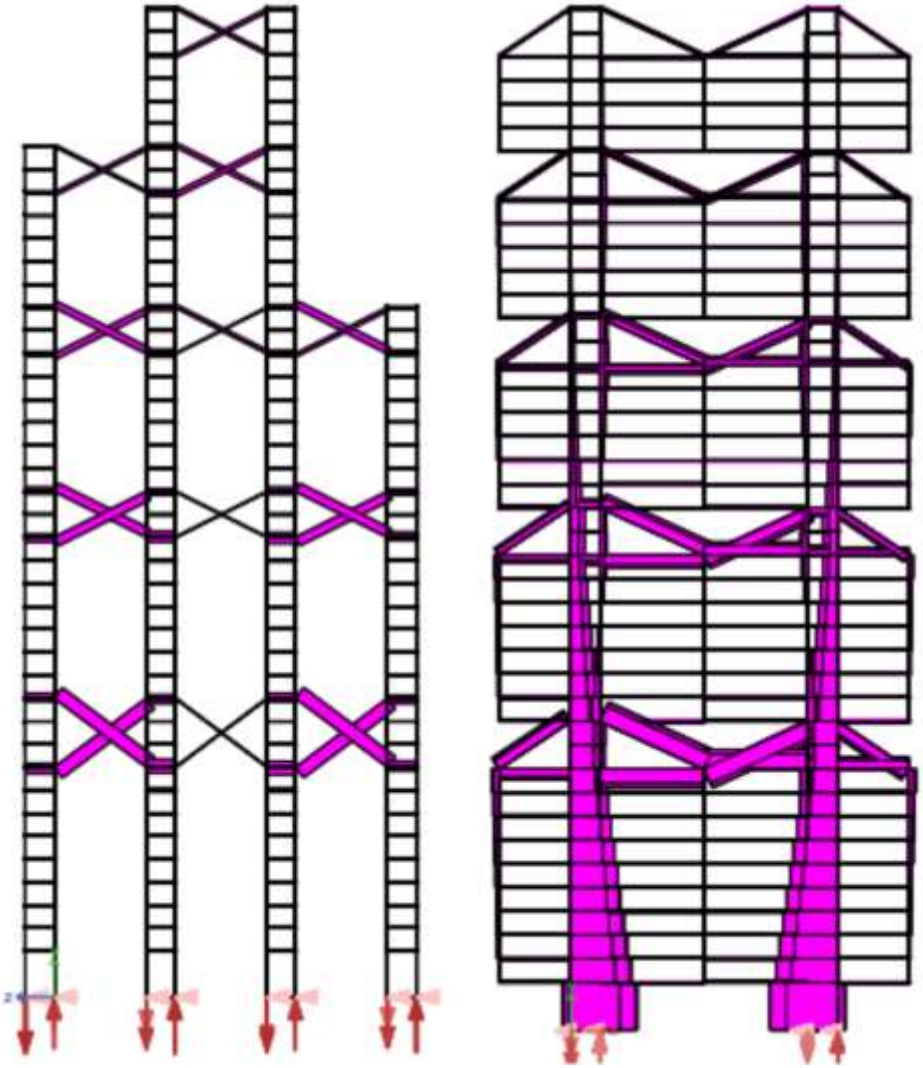
b. Side wind



Axial Force Diagram

a. Front wind

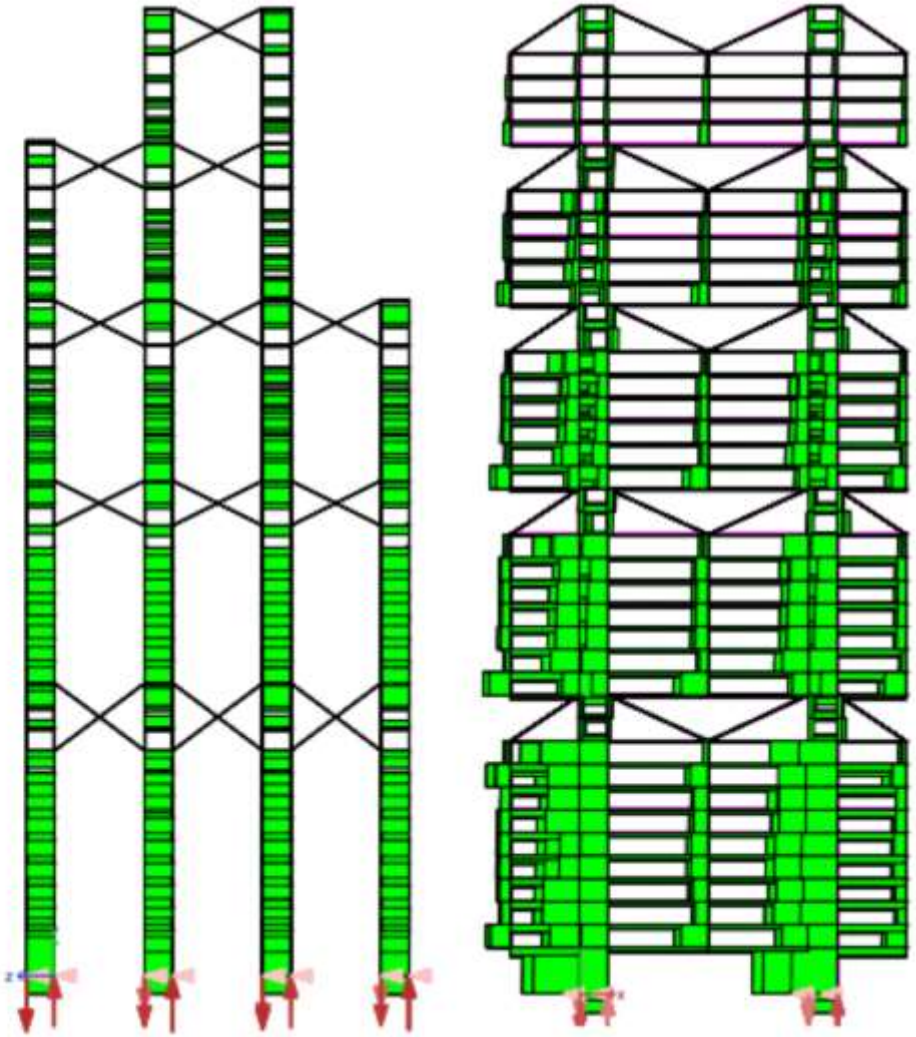
b. Side wind



Shear Diagram

a. Front wind

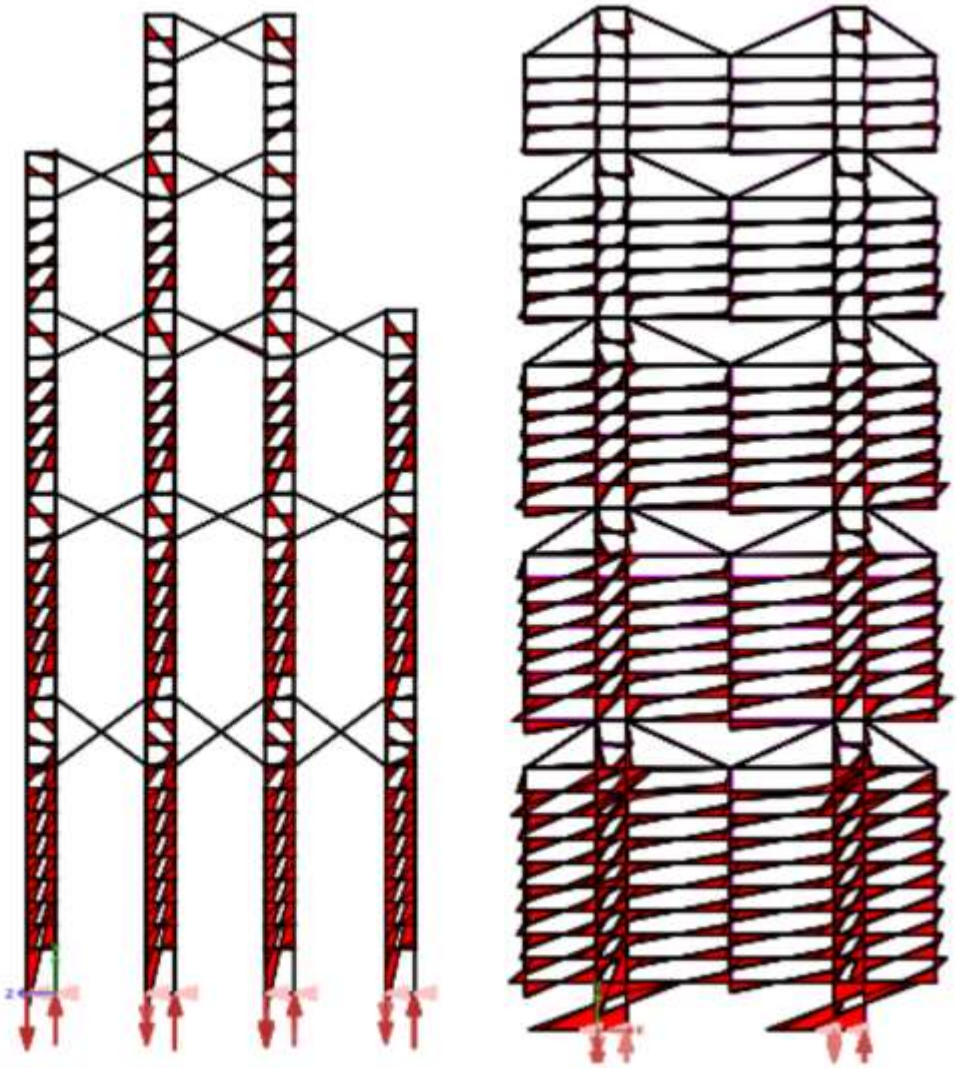
b. Side wind



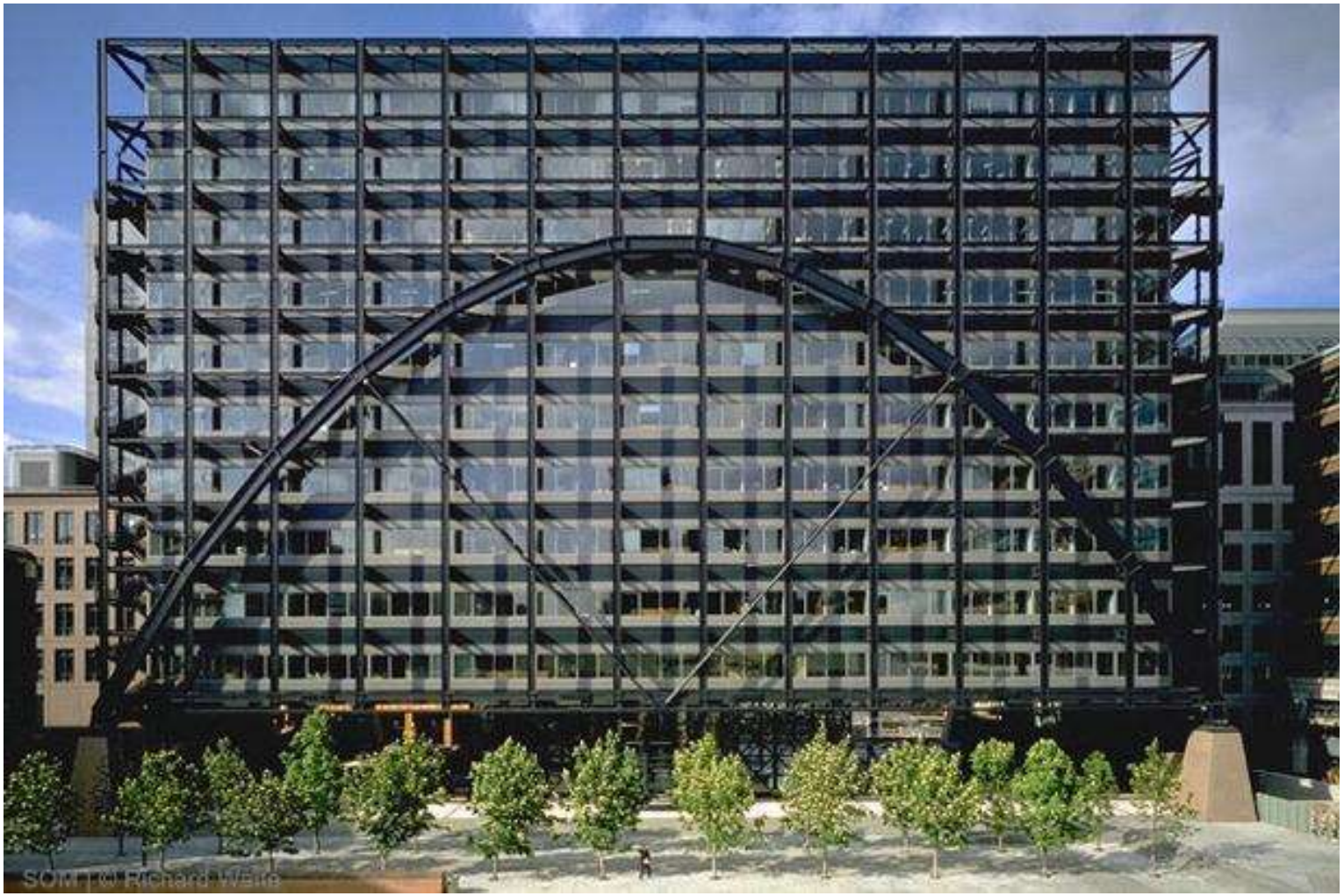
Moment Diagram

a. Front wind

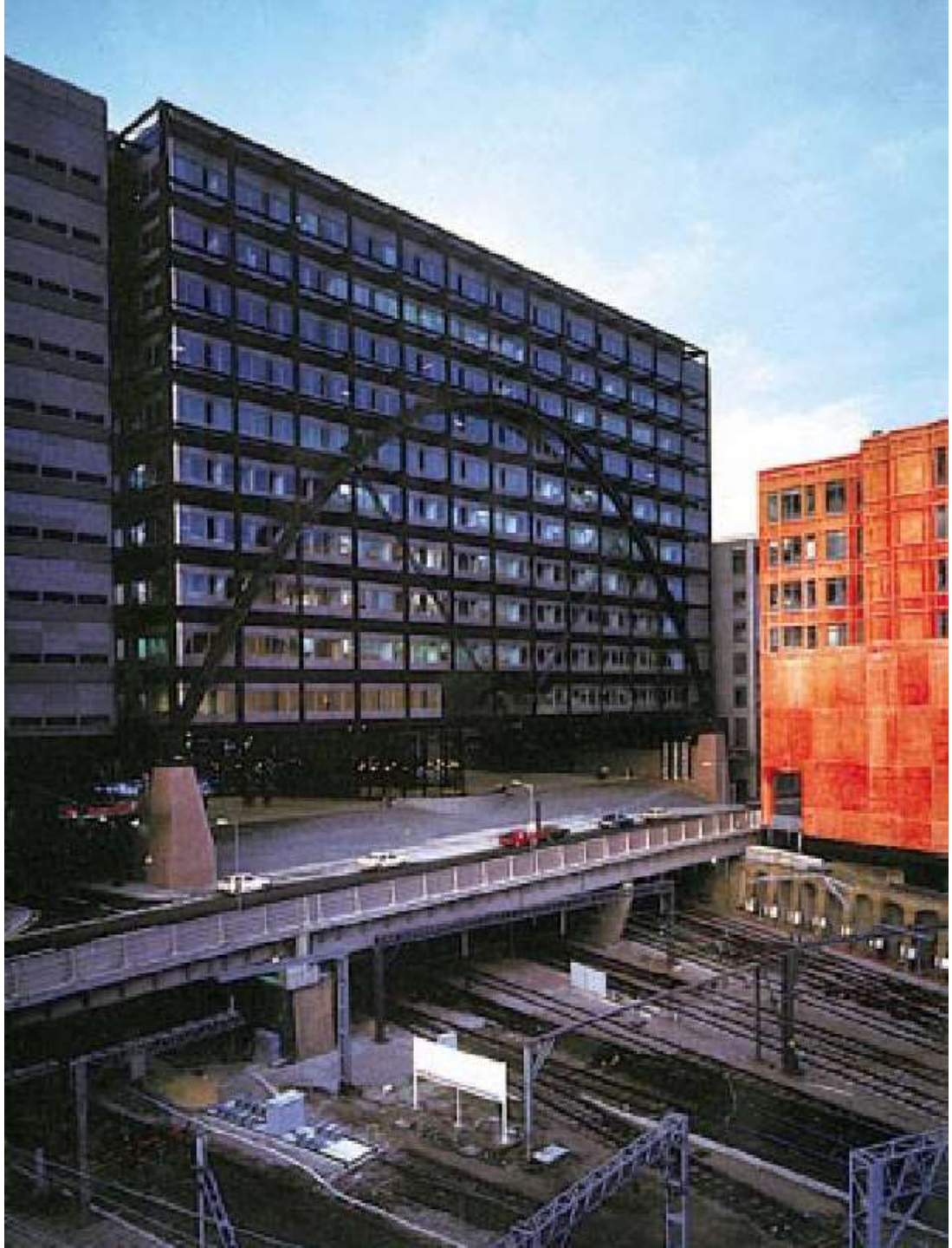
b. Side wind

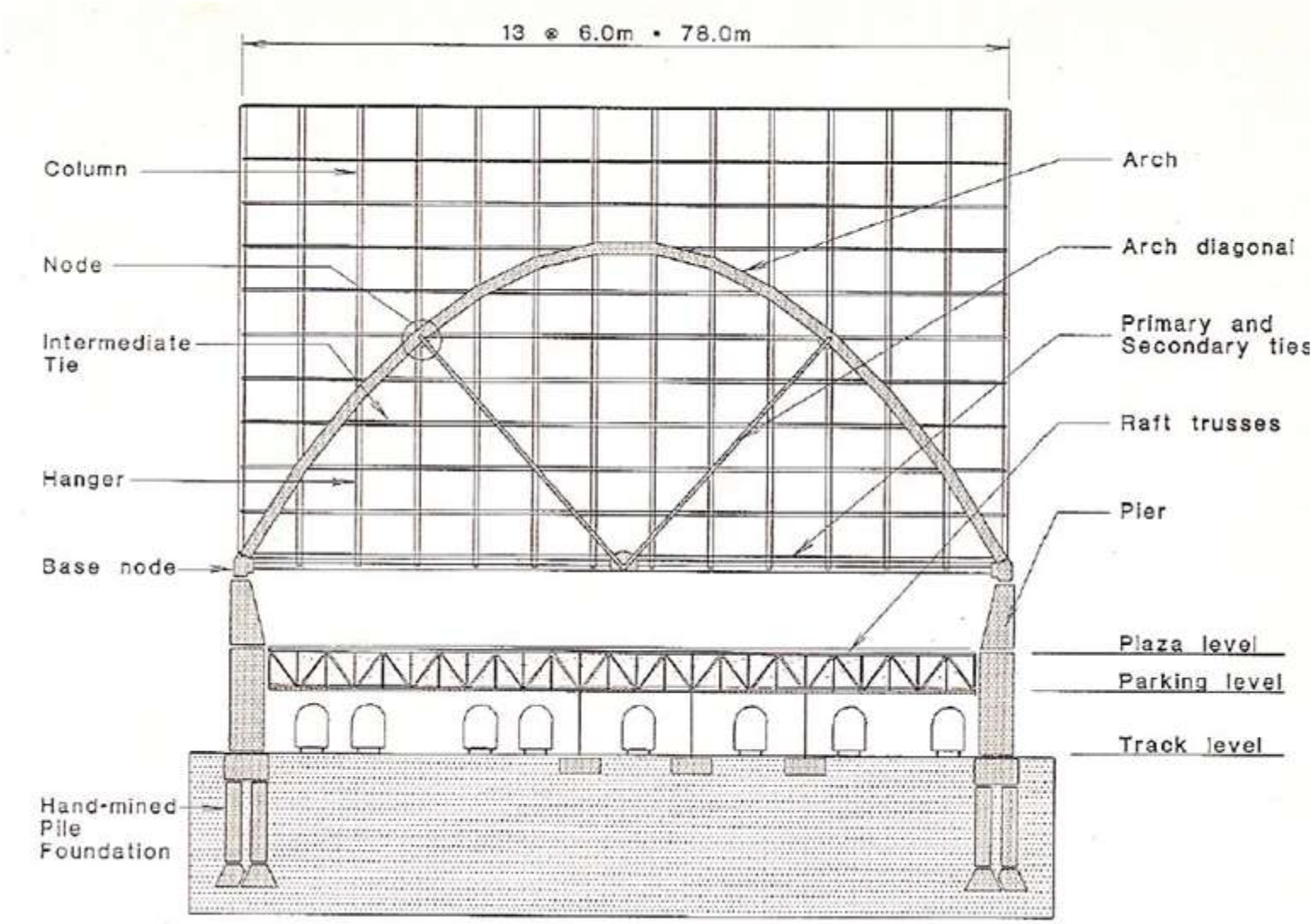


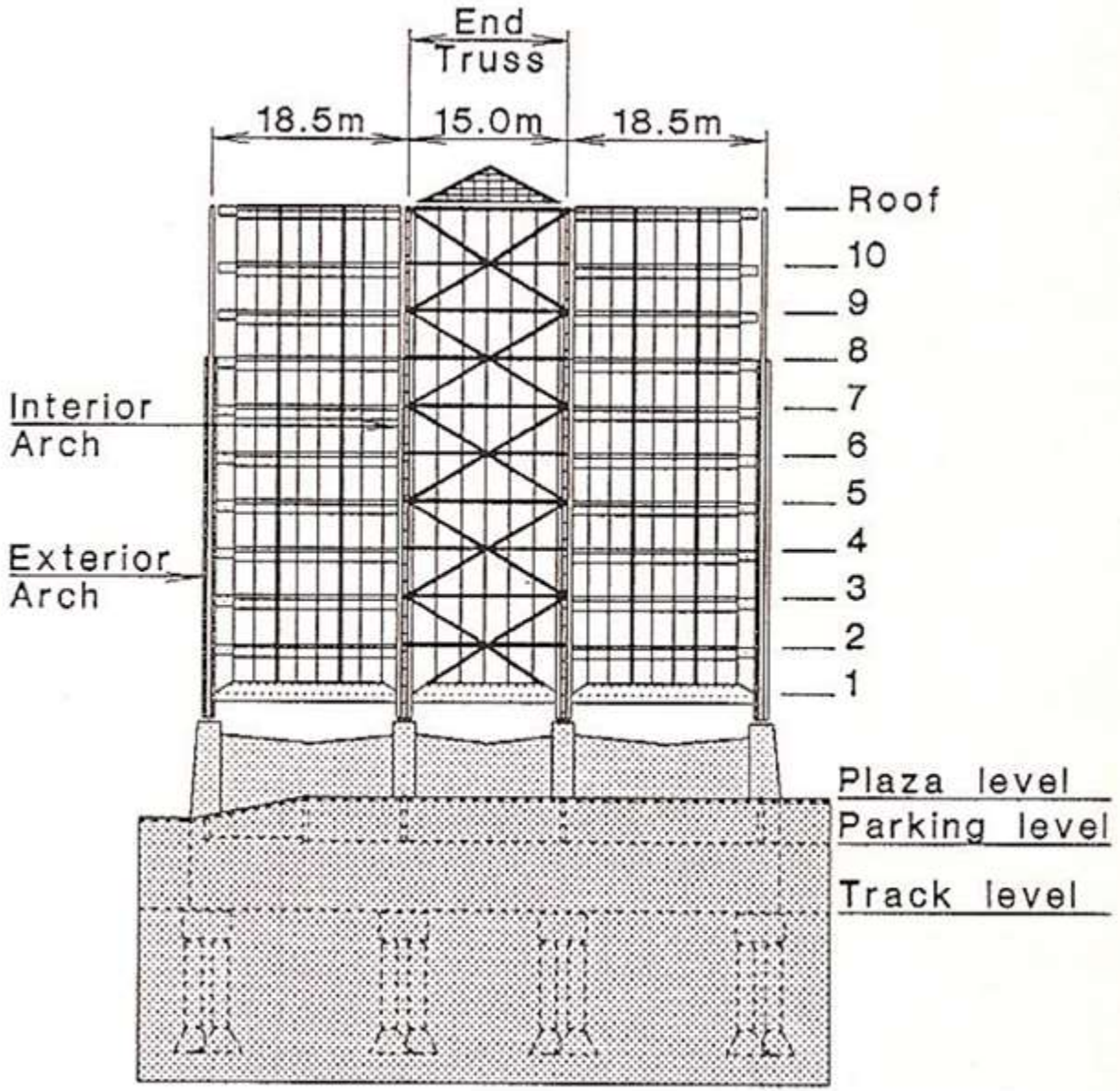
Broadgate Exchange House, S.O.M.
Liverpool, London,, 1990

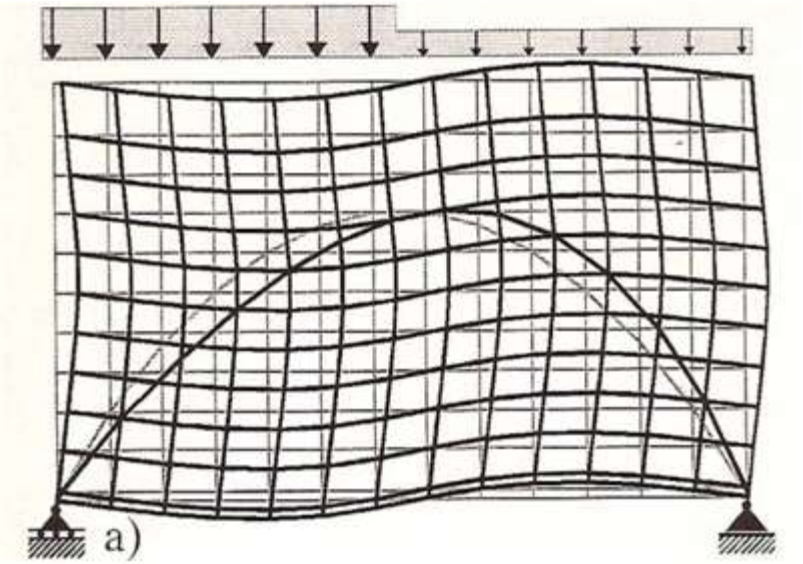


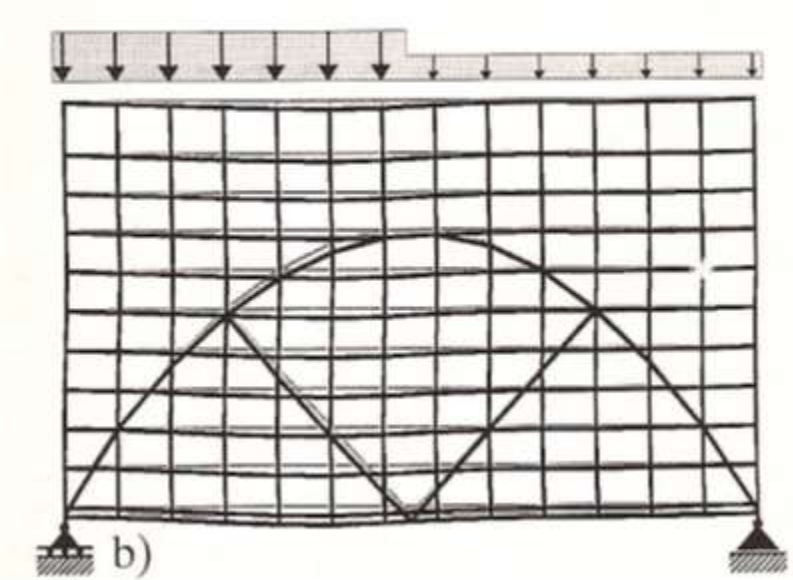

EXCHANGE
HOUSE

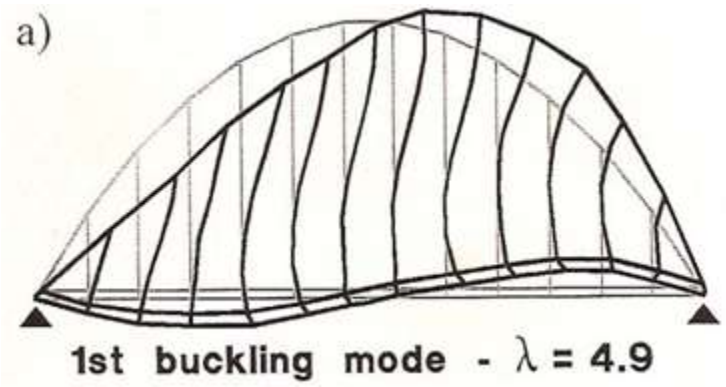


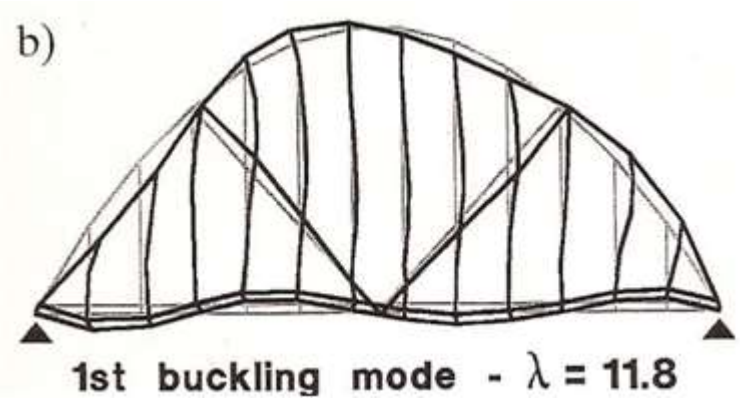

13 @ 6.0m = 78.0m
Column
Node
Intermediate Tie
Hanger
Base node
Hand-mined Pile Foundation
Arch
Arch diagonal
Primary and Secondary ties
Raft trusses
Pier
Plaza level
Parking level
Track level


End
Truss
18.5m
15.0m
18.5m
Roof
10
9
8
7
6
5
4
3
2
1
Interior
Arch
Exterior
Arch
Plaza level
Parking level
Track level


a)


b)


a)
1st buckling mode - λ = 4.9


b)
1st buckling mode - λ = 11.8