



**ASOCIACIÓN LATINOAMERICANA DE CONTROL DE CALIDAD
PATOLOGÍA Y RECUPERACIÓN DE LA CONSTRUCCIÓN
BOLIVIA**

**Coloquio
Internacional
de Patología Estructural**


Viernes 30 de Julio
 Hrs. 15:00 GMT-4 La Paz - Bolivia







Paulo Helene
 Diretor PhD Engenharia
 Diretor Presidente do IBRACON
 Ex Presidente ALCONPAT Internacional
 Prof. Titular Universidad de São Paulo
 Member fib(CEB-FIP) Model Code for Service Life Design
 Conselheiro da CNTU e SEESP



"do Laboratório de Pesquisas em Construção de Obras"

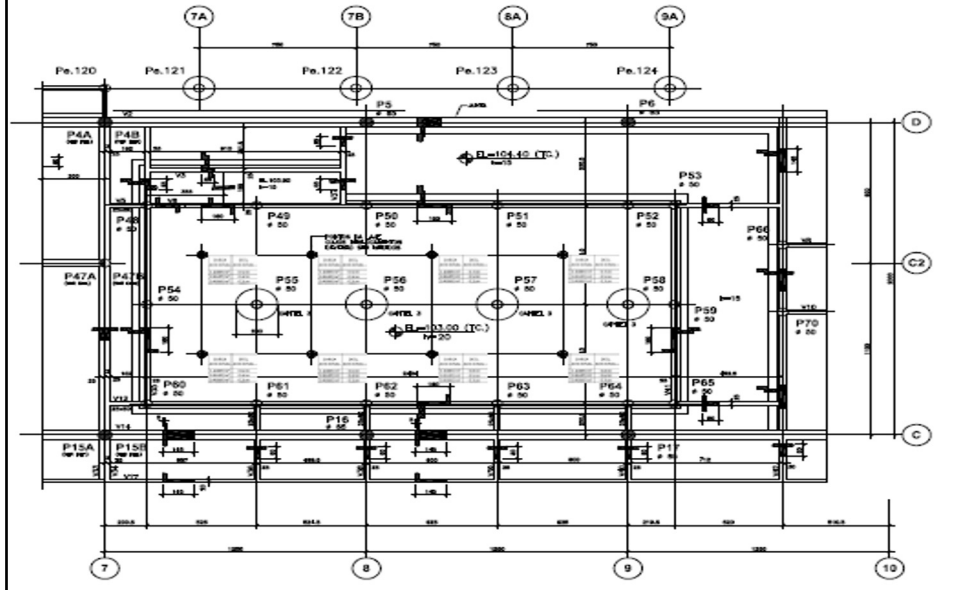
1



2

Pileta Centro Esportivo

Prueba de Carga realizada en junio de 2017



3

Problema

La revisión del diseño estructural, ATP (análise técnica de projeto) apuntó que hay problemas de cálculo en la losa de fondo. Projectista no concordó y decidimos una prueba de carga realizada en junio de 2017.



4



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10

Paulo Helene

MANUAL

PARA REPARO,

REFORÇO E

PROTEÇÃO DE

ESTRUTURAS

DE CONCRETO

Projeto de Divulgação Tecnológica

PINI

FOSROC

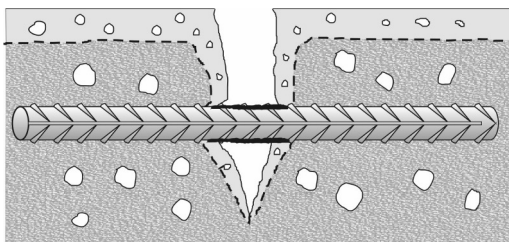
Punção

Manifestação Típica



11

Fissuração y Carbonatación y Cloruro



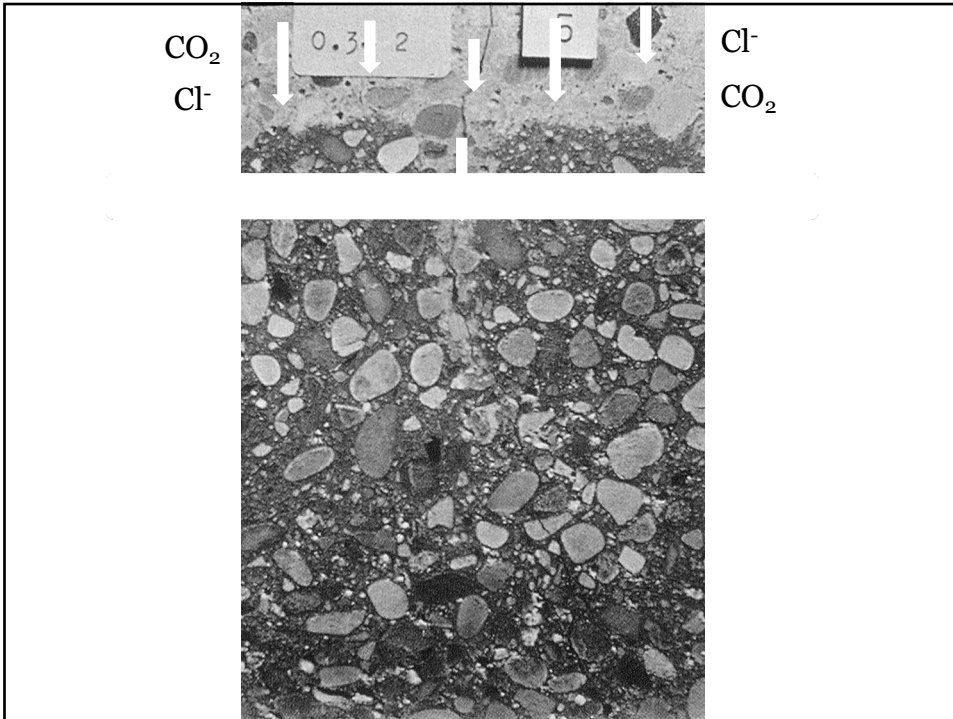
espesura carbonatada

w_k piezas a flexion $\gamma_F = 1$

0,1 , 0,2 , 0,3 y 0,40 mm

→ vida útil ≥ 50 años!

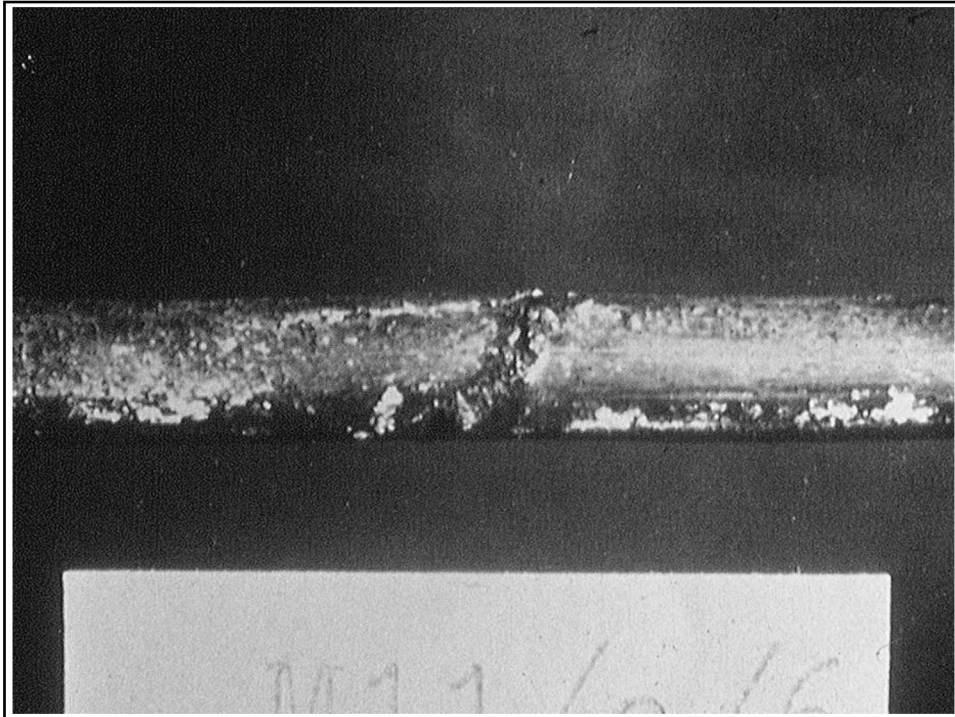
12



13



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19

MENU G1 ESPÍRITO SANTO tvgozeto

19/07/2016 09h49 - Atualizado em 19/07/2016 19h32

Área de lazer em condomínio de luxo desaba e porteiro é achado morto

Drone mostra o estrago no Grand Parc, na Enseada do Suá, em Vitória. Suspeita é de vazamento de gás, segundo Corpo de Bombeiros.

Viviane Machado e Victoria Varejão
Do G1 ES

FACEBOOK TWITTER G+ PINTEREST



As torres do condomínio de luxo Grand Parc Residencial Resort, na Enseada do Suá, em Vitória, foram esvaziadas após toda a **área de lazer desabar, na manhã desta terça-feira (19)**. Quatro pessoas ficaram feridas e **um porteiro ficou desaparecido até as 17h. Ele foi encontrado morto**. O desabamento aconteceu por volta de 3h.

globo.com/espírito-santo/noticia/2016/07/torres-de-condominio-de-luxo-no-es-sao-evacuadas-apos-desabam-en-to.html

20

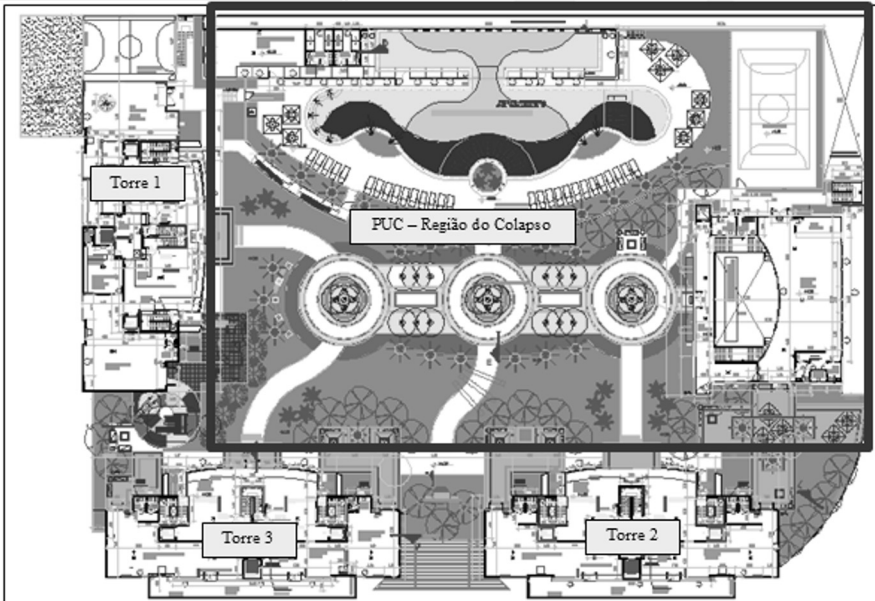


21



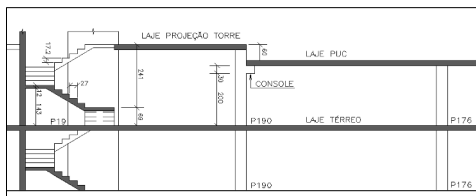
22

- Data: 19/07/2016 (03 h;
- 6 años de edad



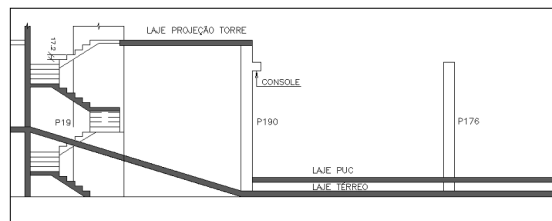
23

COLAPSO ESTRUTURAL



Situação antes do colapso

Situação após colapso



24



25



26



27



28



29



30



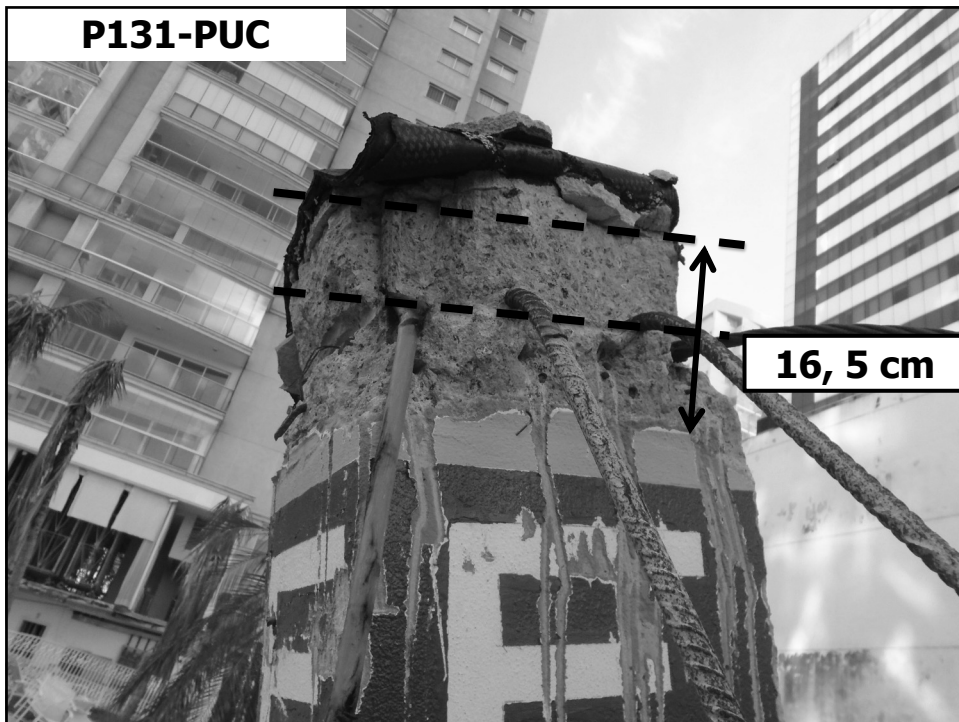
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P118-PUC

35



P133-PUC

36



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38



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40



41

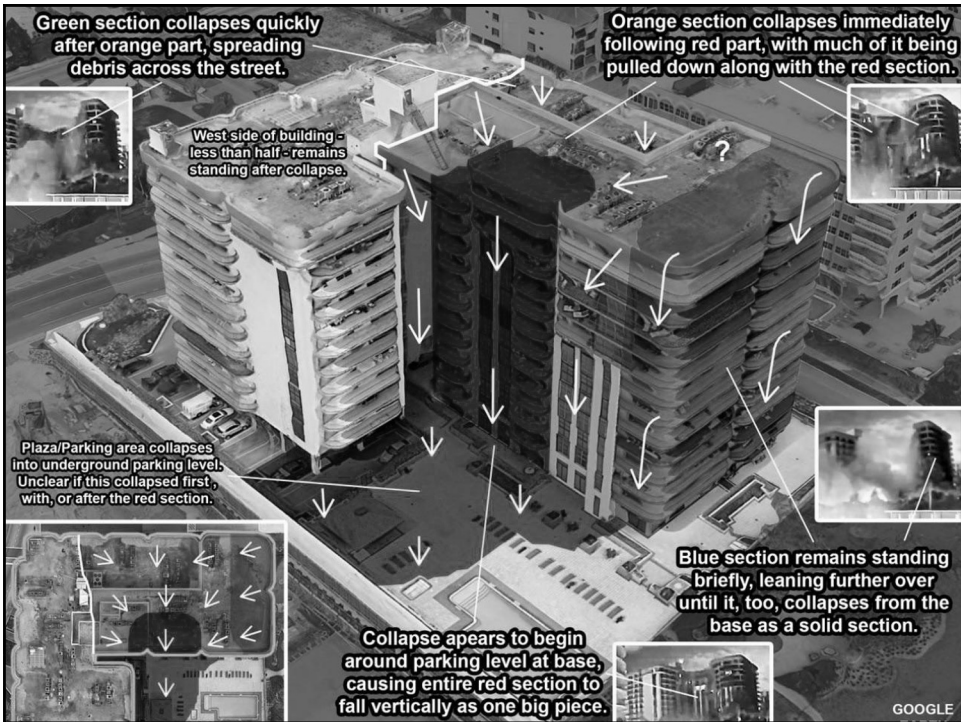


42



Boa prática a ser adotada em estruturas de concreto com cordoalhas protendidas engraxadas (pintura na face inferior da laje)

43



Green section collapses quickly after orange part, spreading debris across the street.

Orange section collapses immediately following red part, with much of it being pulled down along with the red section.

West side of building - less than half - remains standing after collapse.

Plaza/Parking area collapses into underground parking level. Unclear if this collapsed first, with, or after the red section.

Blue section remains standing briefly, leaning further over until it, too, collapses from the base as a solid section.

Collapse appears to begin around parking level at base, causing entire red section to fall vertically as one big piece.

GOOGLE

44



45



46




47




48

7/1/2021 40 Year Building Recertification Miami | Florida Inspections Unlimited

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<https://www.homeinspectionsmiami.com/>



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40 Year Building Recertification Miami

If you own old property in Miami chances are you've heard about 40 year building recertification. The ordinance was enforced in 1975 and then it was replaced in 2001 by the Florida Building Code. The recertification decree applies to buildings within counties in Florida with the exception of small structures, duplexes, and single family homes. Forms are issued by the county and normally sent to individuals along with notice for inspection.

How does it work?

40 year recertification requires that buildings in Florida be re-certified for electrical and structural safety every 40 years. Upon expiration of 40 years, the county or city building authority will send out a "Notice

REQUEST A QUOTE

49



October 8, 2018

Champlain Towers South
8777 Collins Avenue
Surfside, FL 33154

Attention: Ms. Maggie Manrara
Treasurer

**Re: Champlain Towers South Condominium
Structural Field Survey Report
MC Job# 18217**

Dear Ms. Manrara:

Morabito Consultants, Inc. (MC) is pleased to submit this structural engineering report of the Field Survey completed at the existing Champlain Towers South Condominium Complex (CTS) in Surfside, FL. The scope of this project includes a review of the existing 12 story plus penthouse 136-unit residential building, below-grade parking garage and at-grade exterior entrance drive, pool and recreation area. MC reviewed a representative sample of ~68 condominium units (half of the total units found in the building) along with the roof, exterior facade (observed from the balconies surveyed), parking garage,

50

O RELATÓRIO DA INSPEÇÃO DA FIRMA "MORABITO CONSULTANTS" DE 2018

DÁ ALGUMAS CLARAS INFORMAÇÕES SOBRE ESSE ITEM

VER NO LINK

https://www.townofsuffsidefl.gov/docs/default-source/default-document-library/town-clerk-documents/champlain-towers-south-public-records/8777-collins-ave---structural-field-survey-report.pdf?sfvrsn=882a1194_2

" The Pool Deck and Entrance Drive areas were reviewed

...

Many of the existing pavers on the pool deck are cracked

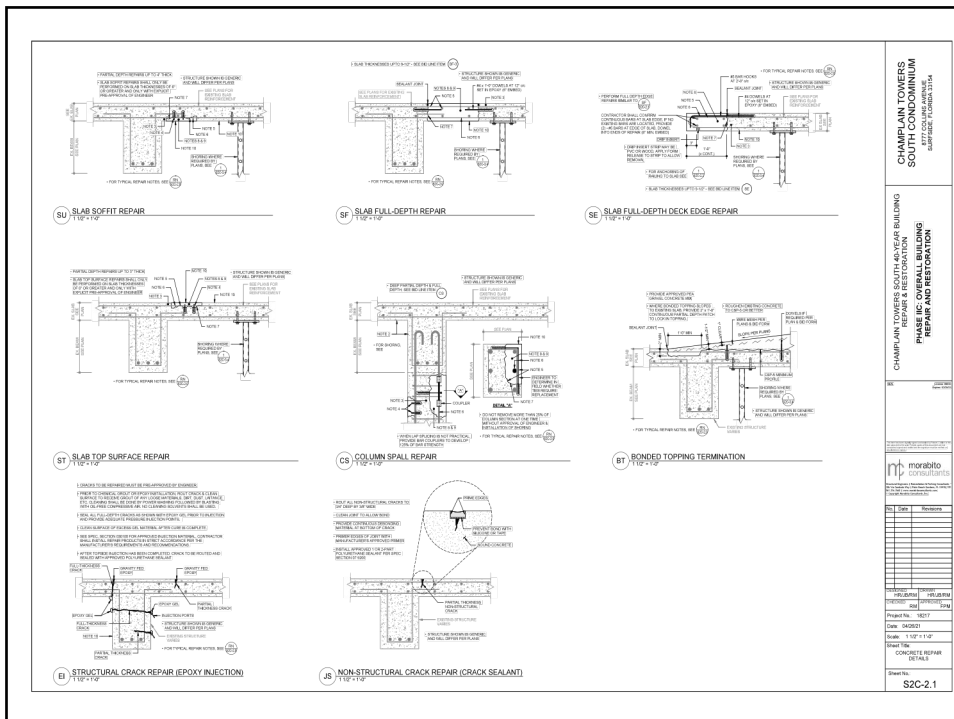
...

The joint sealant was observed to be beyond its useful life and are in need to complete replacement

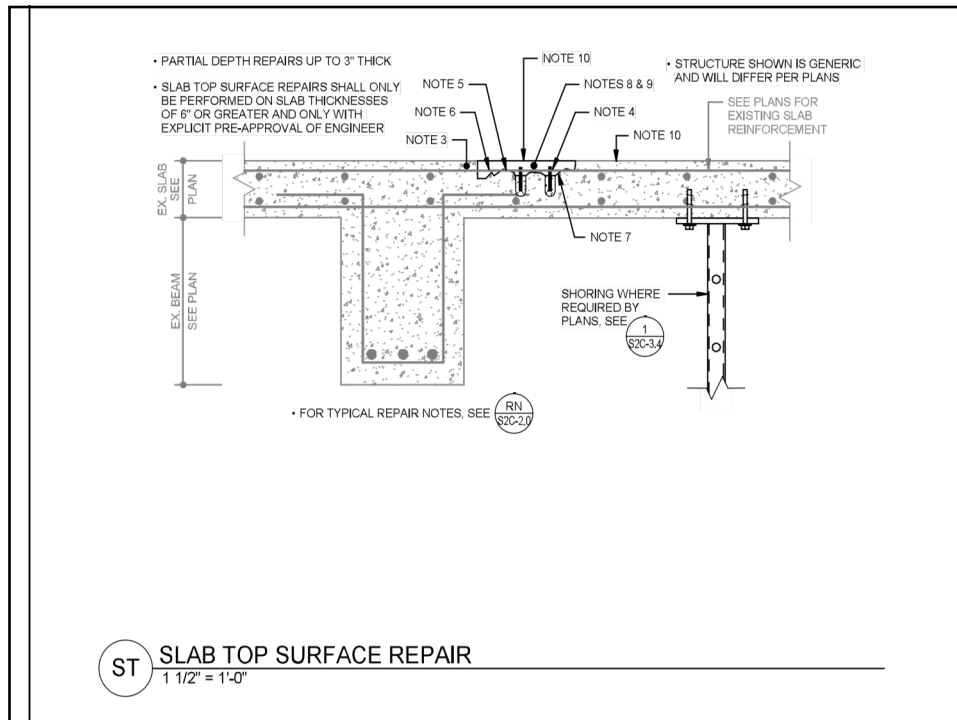
...

The failed waterproofing is causing major structural damage to the concrete structural slab below these areas "

51



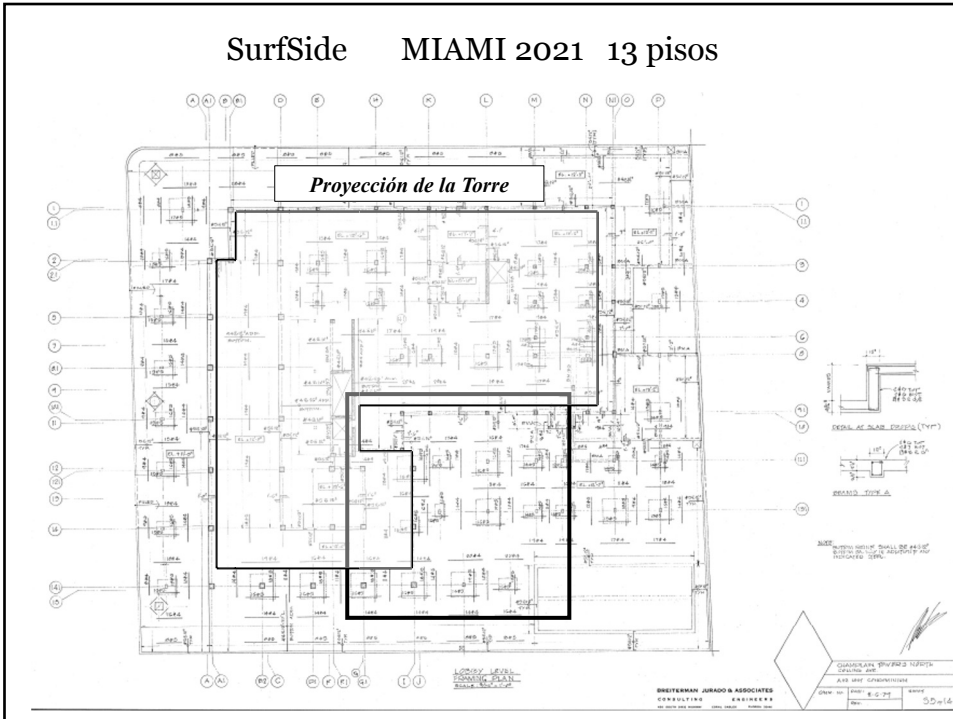
52



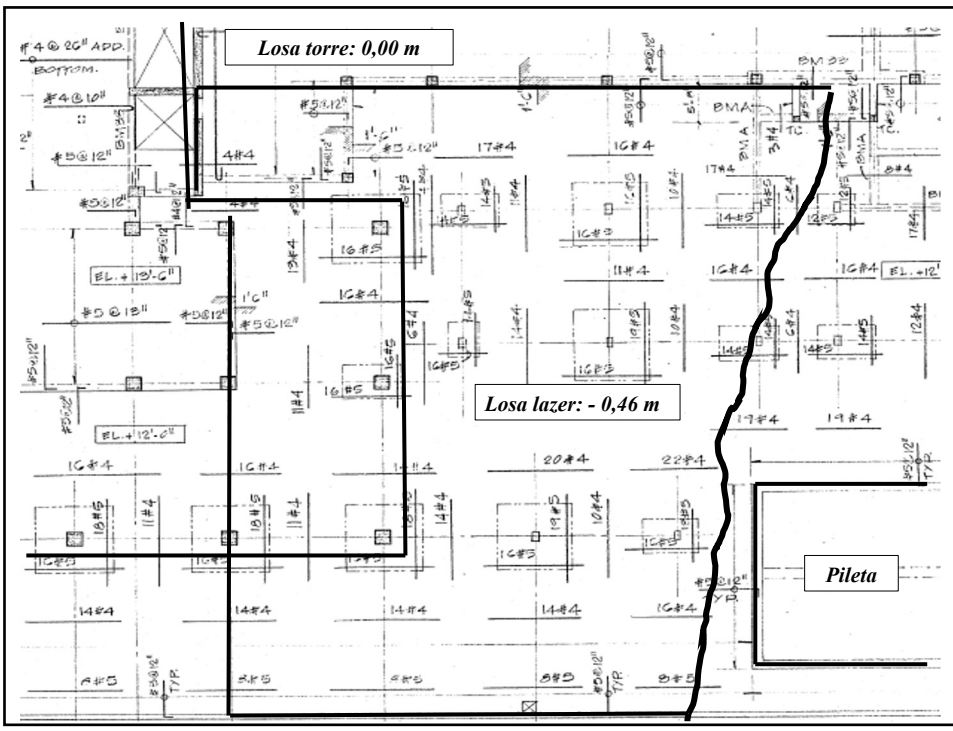
53

- ❖ Pacometría - posición de los refuerzos
- ❖ Esclerometria - dureza superficial
- ❖ Ultrasonido - nidos de hormigonado
- ❖ Testigos - f_c concretos
- ❖ Espesor de la cubierta
- ❖ Espesor de carbonatación
- ❖ Presencia o perfil de cloruros
- ❖ Diseño de grietas
- ❖ Identificación de áreas problemáticas

54



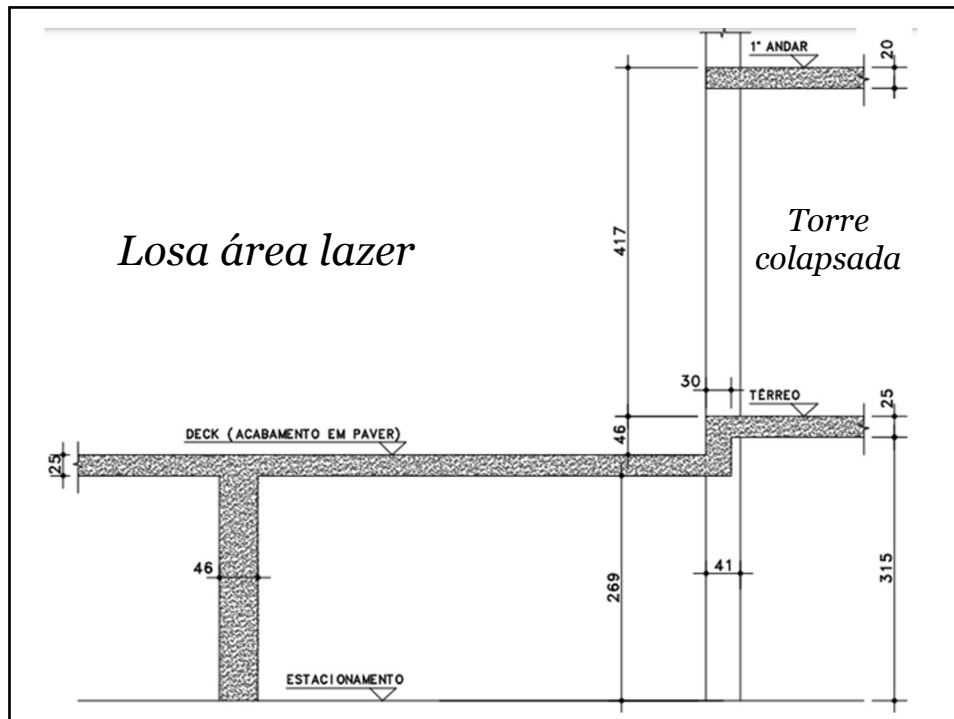
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56

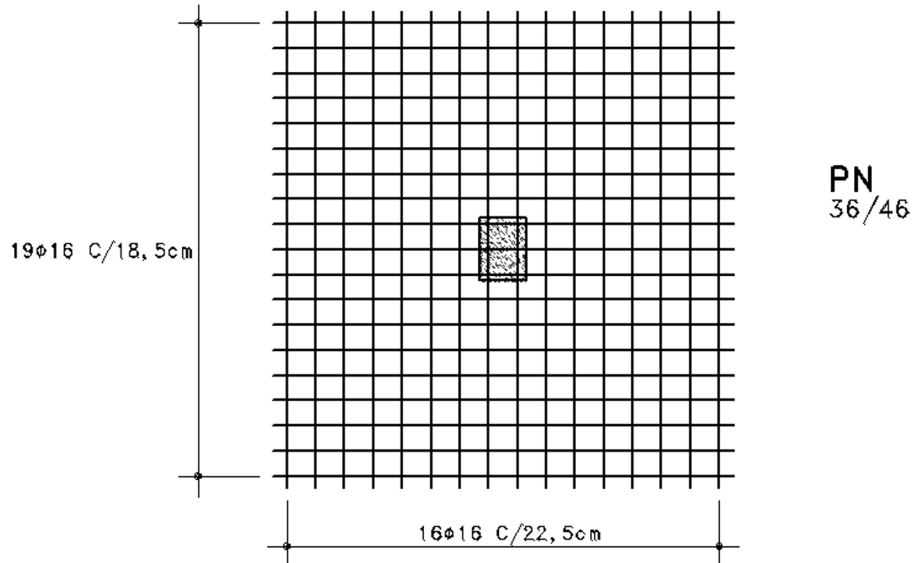
- ✓ Columnas de hormigón desde aparcamiento hasta tercer piso: 6,000psi (41.4 MPa)
- ✓ Losas de hormigón hasta 8 pisos: 4,000psi (27.6 MPa)
- ✓ Refuerzo de la columna 61x61cm : 12Ø32 → $A_s = 98.28\text{cm}^2$
→ $\rho = 2.64\%$
- ✓ Refuerzo de la columna 41x41 cm : 8Ø36 → $A_s = 80.48\text{cm}^2$
→ $\rho = 4.79\%$
- ✓ Refuerzo de la columna 36x46 cm: 10Ø32 → $A_s = 81.9\text{cm}^2$
→ $\rho = 4.95\%$
- ✓ Losas de espesor: 25cm (Lazer), 20cm (torre)
- ✓ Losas, refuerzo inferiores: Ø12.7 C/30cm → $\rho = 0.17\%$ (Planta baja), 0.19% (Torre)
- ✓ No se encuentra en el diseño ningún detalle de armadura de punzonamiento

57



58

Refuerzo SUPERIOR columnas 36x46 cm
Losa área lazer, plana, sin capitel



59

apartado 20.12

“Punzonamiento”

pág. 418 a 422

Hormigón Armado

14^o Edición

Basada en la EHE

Publicada em 2000

Pedro Jiménez Montoya

Álvaro García Meseguer

Francisco Morán Cabre



60

Losa Lazer Pileta → Punzionamiento

$e_{\text{nominal}} = 25 \text{ cm} \rightarrow \text{canto} \rightarrow d = 22 \text{ cm}$

Carga peso próprio = 625 kgf/m²

Carga Permanente = 450 kgf/m² Total : 1300 kgf/m²

Carga Acidental = 225 kgf/m²

Columnas 36 cm x 46 cm a cada 6,5 m por 7,0 m

Superficie crítica → 2,5 m² → carga en la columna = 55000 kgf

$f_{ck} = 27,6 \text{ MPa (N/mm}^2\text{)}$

Cuantía = 0,01 coeficiente $\beta = 1,15$

Normal solicitante → $F_{sd} = 550 * \gamma_F$ (kN)

Perímetro crítico → $\mu_1 = 440 \text{ cm}$

61

Losa Lazer Pileta → Punzionamiento

$$\tau_{rd} = 0,12 * \left(1 + \sqrt{\frac{200}{d}}\right) * \sqrt[3]{(100 * \rho_l * f_{ck})}$$

$$\tau_{sd} = \frac{\beta * F_{sd}}{\mu_1 * d}$$

62

Losa Lazer Pileta → Punzionamiento

$$\tau_{sd} = \tau_{rd}$$

$$\tau_{rd} = 0,70 \text{ N/mm}^2 \text{ (MPa)}$$

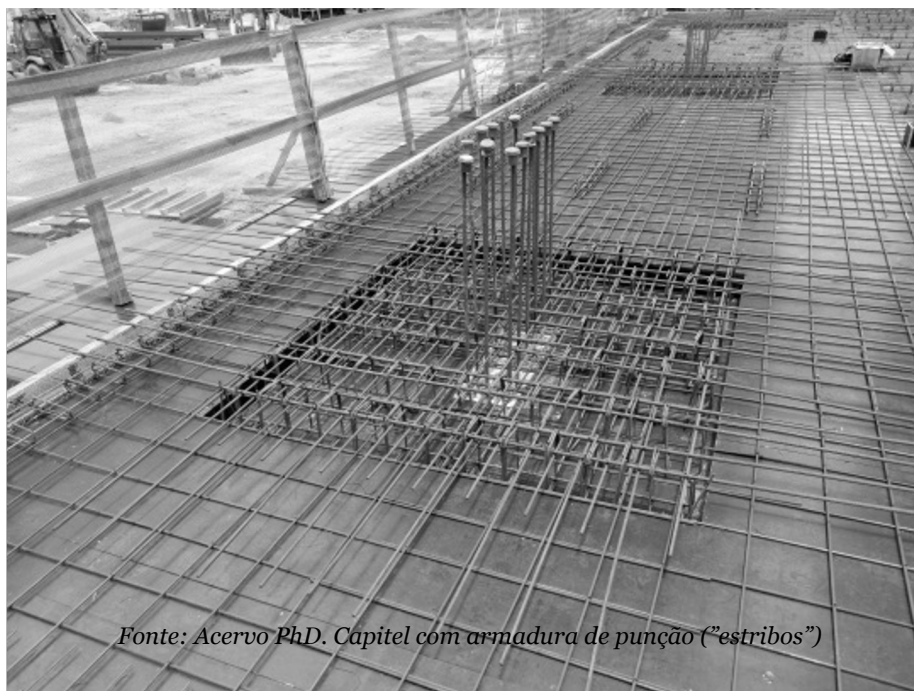
$$\tau_{sd} = 0,65 * \gamma_F$$

(1,4 ?!)

$$\gamma_F = 1,08$$

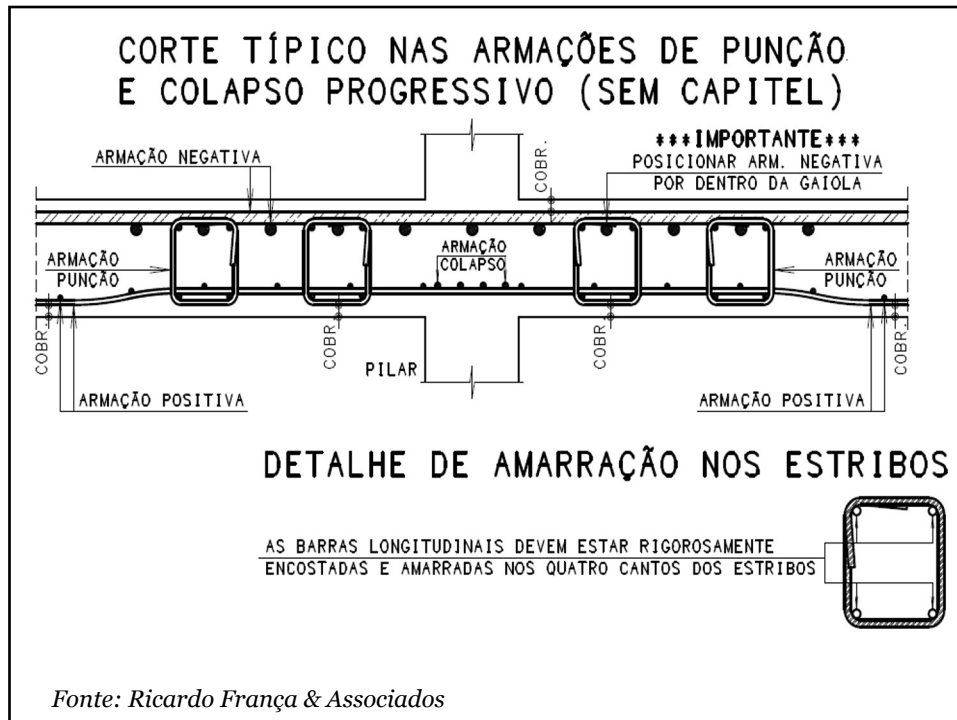
(1,5 ?!)

63

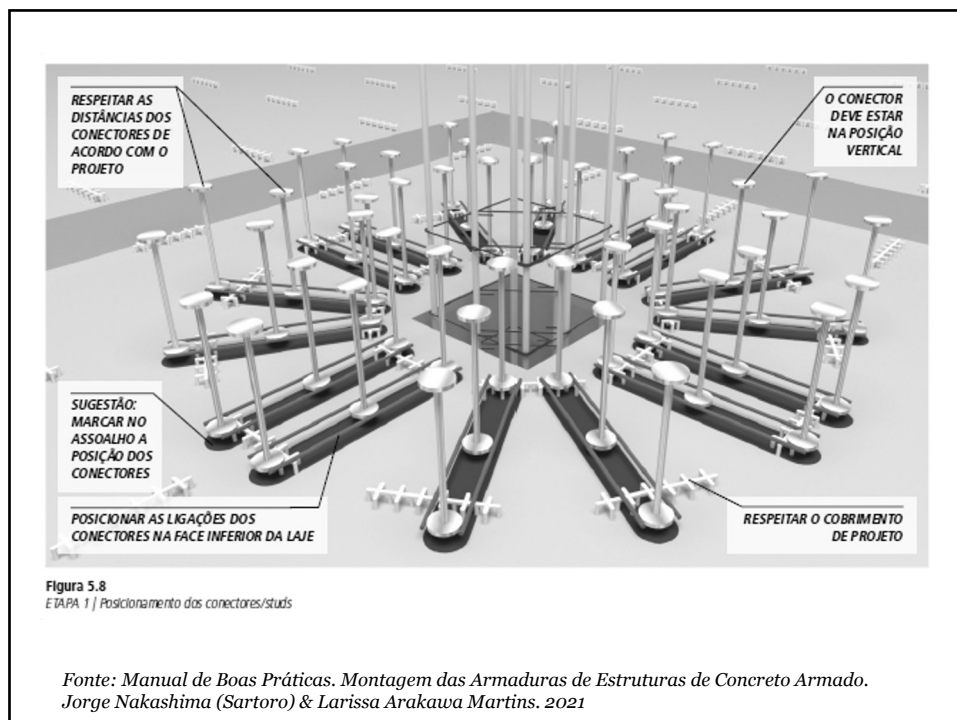


Fonte: Acervo PhD. Capitel com armadura de punção ("estribos")

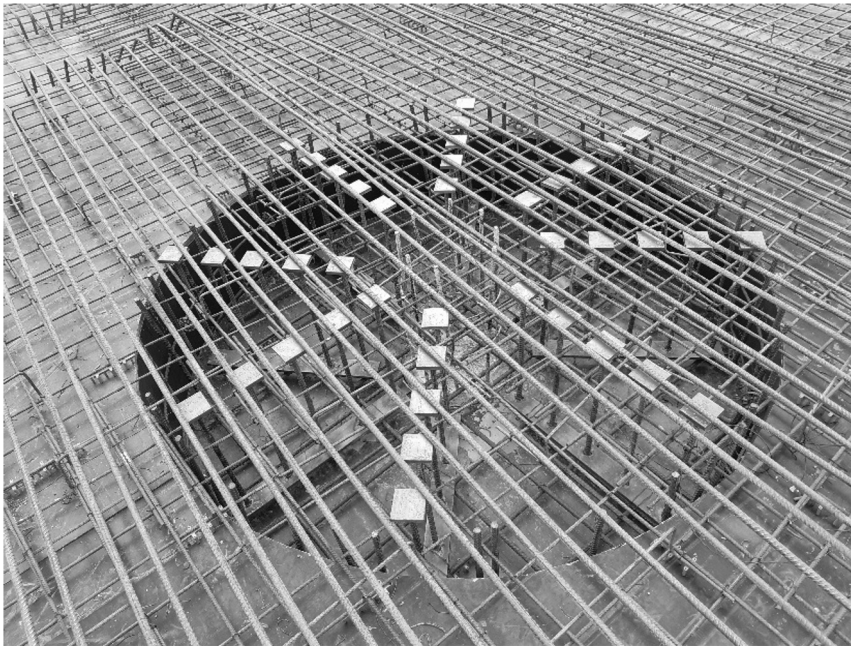
64



65



66



Fonte: Acervo PhD. Capitel com armadura de punção (“studs”).

67

Lecciones

- ❖ Nuestras condolencias y solidaridad con las familias afectadas
- ❖ ATP (revisión del diseño estructural por pares)
- ❖ ATO (control tecnológico de estructuras por pares)
- ❖ ATU (inspección periódica)
- ❖ Mantenimiento (obras)
- ❖ ¡Cuidado con el agua! Nunca menospreciar corrosión!
- ❖ Los edificios no son eternos
- ❖ Elegir profesionales bien preparados (Certificación)
- ❖ El último ingeniero universal fue Leonardo da Vinci

68



69