



John Pillar
Hampton Inn &
Suites
National Harbor, Md
Advisor: Dr. Memari

Distinguished Speaker Series, Spring 2007

Presentation Outline

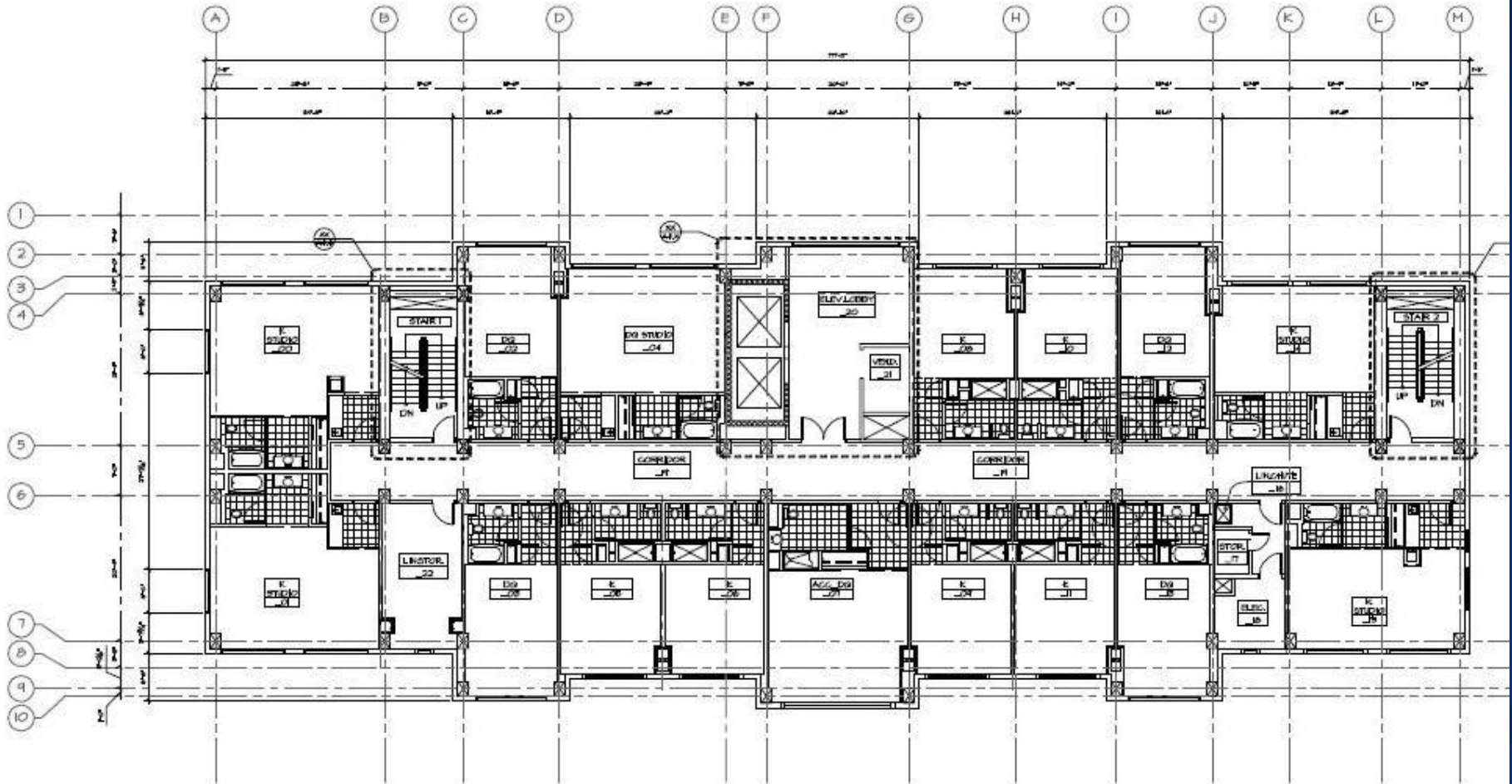
- Existing Conditions
- Proposal
- Structural Depth – PT Slab Investigation
- Construction Breadth – Cost and Construction Impact

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Typical Floor



3RD THROUGH
11TH FLOOR PLAN
SCALE: 1/8" = 1'-0"

Existing Conditions

- 10-1/2" Concrete flat plate with 2-1/2" drop panels
- 12"x24" columns
- Spread footing foundations
- Concrete shear wall lateral force resisting system
- 11 stories above grade
- 10'-3" typical floor to floor height
- Designed under IBC 2003

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New Proposal

- Replace original 10-1/2" normally reinforced slab with thinner post-tensioned slab
 - lower seismic base shear
 - more economical system
- Examine behavior:
 - new lateral response
 - punching shear conditions, slab deflection
 - Footings, lateral force resisting system
- Analyze new cost and schedule associated with flooring system switch

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PT slab is more economical

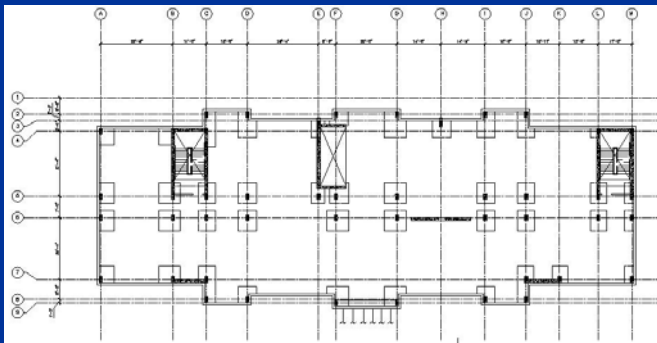
- Slimmer slab profile (8" vs. 10.5")
- Punching shear predicted to be ok
- Banded tendons spanning East-West
- Uniform tendons spanning North-South
- Loading:

40 psf (live)

100 psf (dead)

28 psf (partitions, m/e/p)

168 psf



Column Adjustments



STV Incorporated
Architects and Engineers
7125 Ambleside Road Suite 200
Bethesda, Maryland 21224
410.944.9173 410.264.7044 fax

Construction Documents for
Hampton Inn and Suites
250 WATERFRONT STREET
National Harbor, Maryland



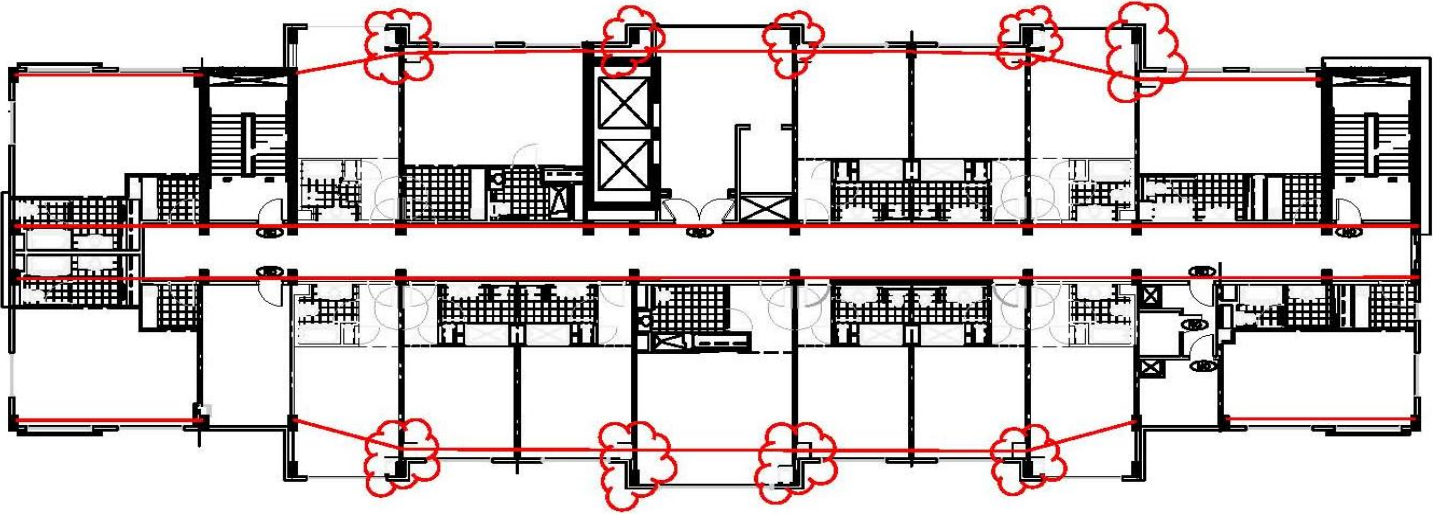
401 North Lake Street, Alexandria, VA 22304
703-549-2000 703-549-2001 fax

JOHN A. STUBBS, AIA

| No. | Revisions | Date |
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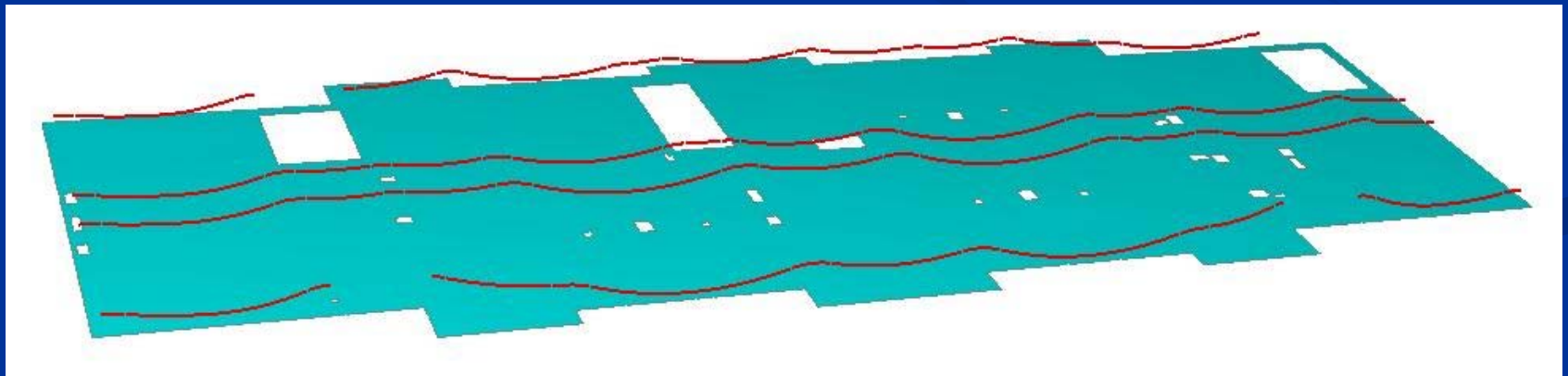
Drawing Title

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BM Issue: 05.02.06
Client Name: 02.02.06
Scale: AS SHOWN
Date: APRIL 2006
Drawn By: BJA/AMR
Designed By: BJA/AMR
Checked By:
Job Number: 30-12871
Drawing No:



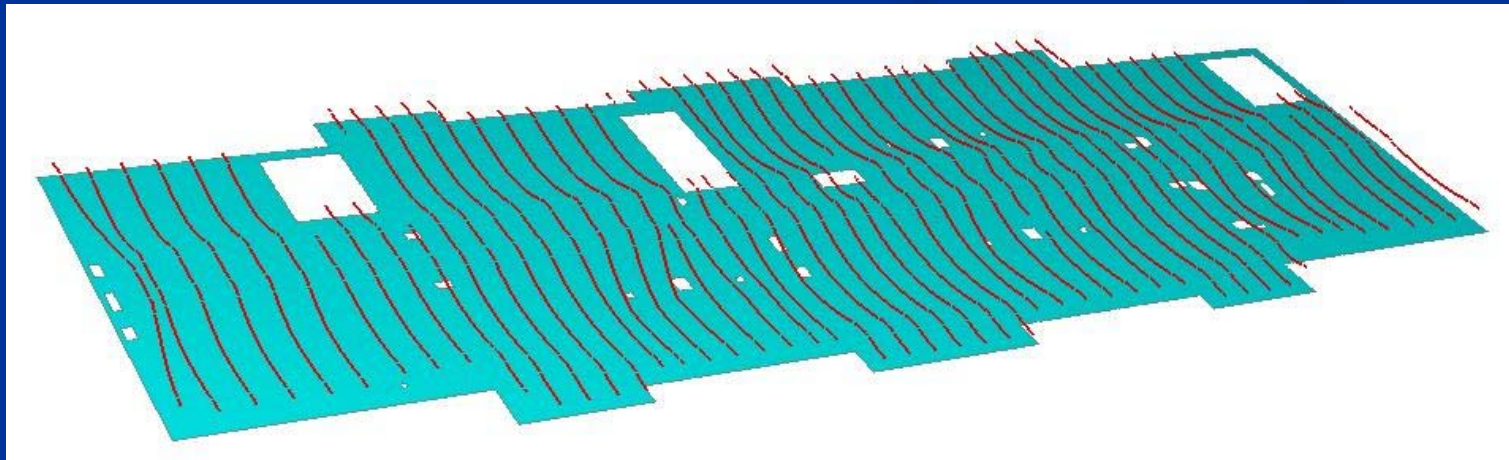
Tendon Profiles, Latitudinal

- 8" slab, cover requirements limit profile drape
- Tendons calculated to balance 90% of the dead load
- 9 strands in exterior longitudinal spans
- 12 strands in interior spans



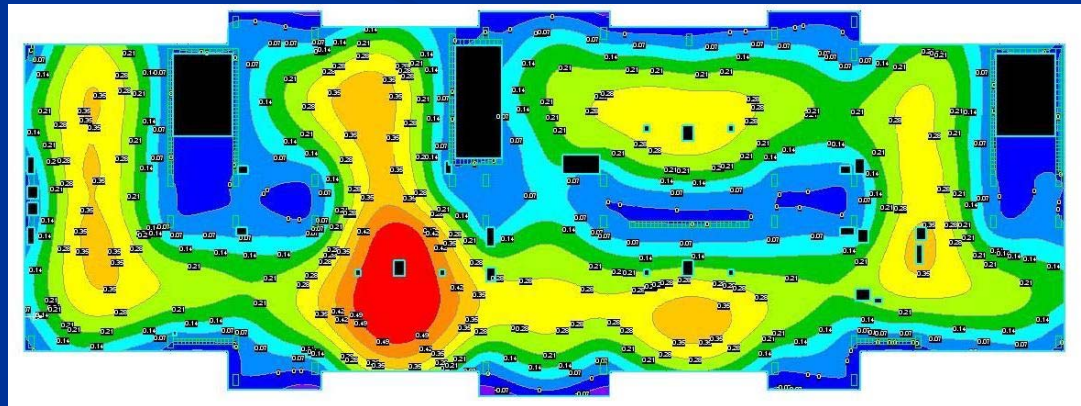
Tendon Profiles, Longitudinal

- 3 strands per tendon
- Tendons spaced at 3'-0" to 4'-0" o.c.
- End profiles terminated at center of slab
- Coordinate with slab openings/penetrations



PT investigation continued

- 12" x 24" columns adequate for punching shear in all locations
 - Punching shear was found to be ok for worst case column, $\phi V_c = 110k > V_u = 57k$
- Long term deflection is within appropriate limits
- Maximum deflection:
 - positive – 0.6"
 - negative – 0.2"



Slab Stresses at Midspan

- f_b at jacking: 146 psi Allowable: $0.6f'c_i=1800$ psi
- f_t at jacking: -292 psi Allowable: $3\sqrt{f'c_i}=164$ psi
- f_b at service: 370 psi Allowable: $0.45f'c=2250$ psi
- f_t at service: -780 psi Allowable: $6\sqrt{f'c}=424$ psi

- $f'c=5000$ psi
- $f'c_i=3000$ psi
- All conditions meet code, slab is ok

Other considerations

- Overall building weight reduced by 11%
- Seismic base shear decreased by 11% with weight savings, from 594k to 530k
 - lateral system redesign unnecessary
- 70k reduced axial load on worst case column, footings were found to be same size or very similar
 - footing redesign unnecessary
- Wind drift decreased by 0.8”
- Seismic drift decreased by 1.5”

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Cost savings of \$156,760

| | |
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| ■ Increased cost for stressing tendons & labor | +\$360,570 |
| ■ Decreased cost for rebar | -\$111,800 |
| ■ Decreased cost for slab | -\$380,000 |
| ■ Other savings | <u>-\$25,530</u> |
| | \$156,760 |

This equates to a savings of approximately \$172,100 after location and inflation are considered

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Savings equivalent: 24,586 engineering computation pads (200 page tablet)

Schedule Changes

- +6.1 extra days per floor to place & stress tendons
- -2.6 less days per floor for rebar placement
- -2.5 less days per floor for slab placement labor
=1
- 1 extra day per floor to change floor systems, 11 extra days total

Conclusion – PT system recommended

■ Pros:

- eliminate drop panels
- max slab deflection = $L/580$
- save **\$172,100**
- decreased drift from wind and seismic due to less severe P-delta effects

■ Cons:

- slab shrinks, cracks due to prestress
 - can be treated with pour stops
- schedule elongated by **11 days**
- maintenance of tendons
- increased coordination needed

Distinguished Speaker Series

- In case you missed it, encore showings will take place *tonight* at the following locations:

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| | |
|--------------------------------|----------|
| ■ Bill Pickles' Tap Room | 10:00 pm |
| ■ The All American Rathskeller | 10:30 pm |
| ■ The Phyrst | 11:00 pm |
| ■ Café 210 West | 11:30 pm |
| ■ The Saloon | 12:00 am |
| ■ Zeno's Pub | 12:30 am |
| ■ The Shandygaff | 1:00 am |
| ■ Mad Mex | 1:30 am |

Thanks!

- OTO Development
- Hope Furrer Associates, Inc.
- All AE faculty
- Online thesis mentors, all options (even CM)
- Everyone else who was involved