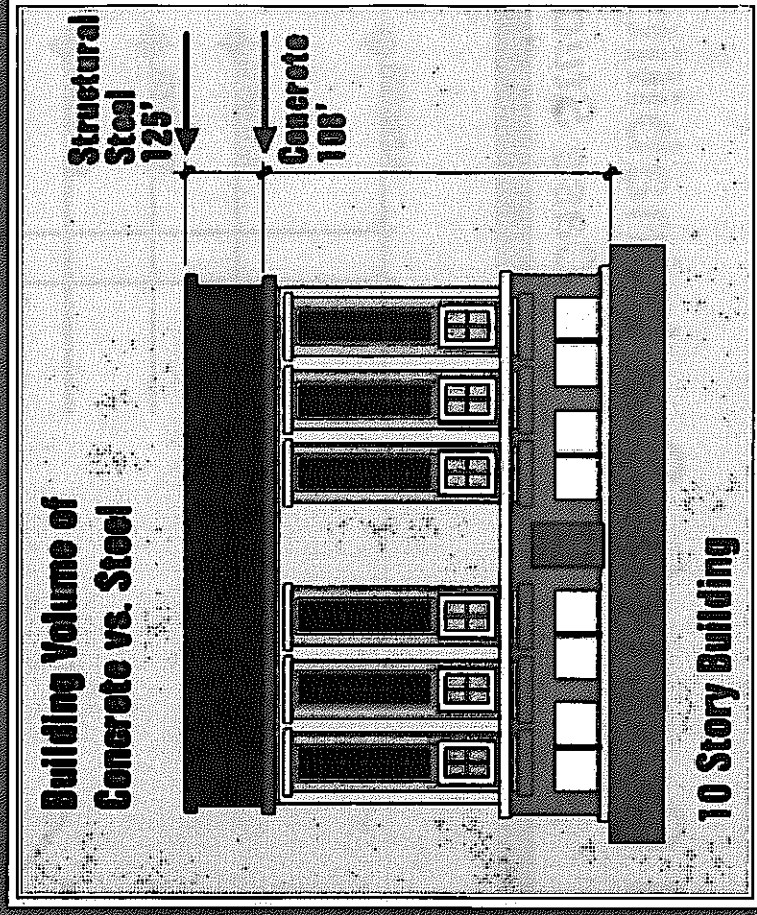


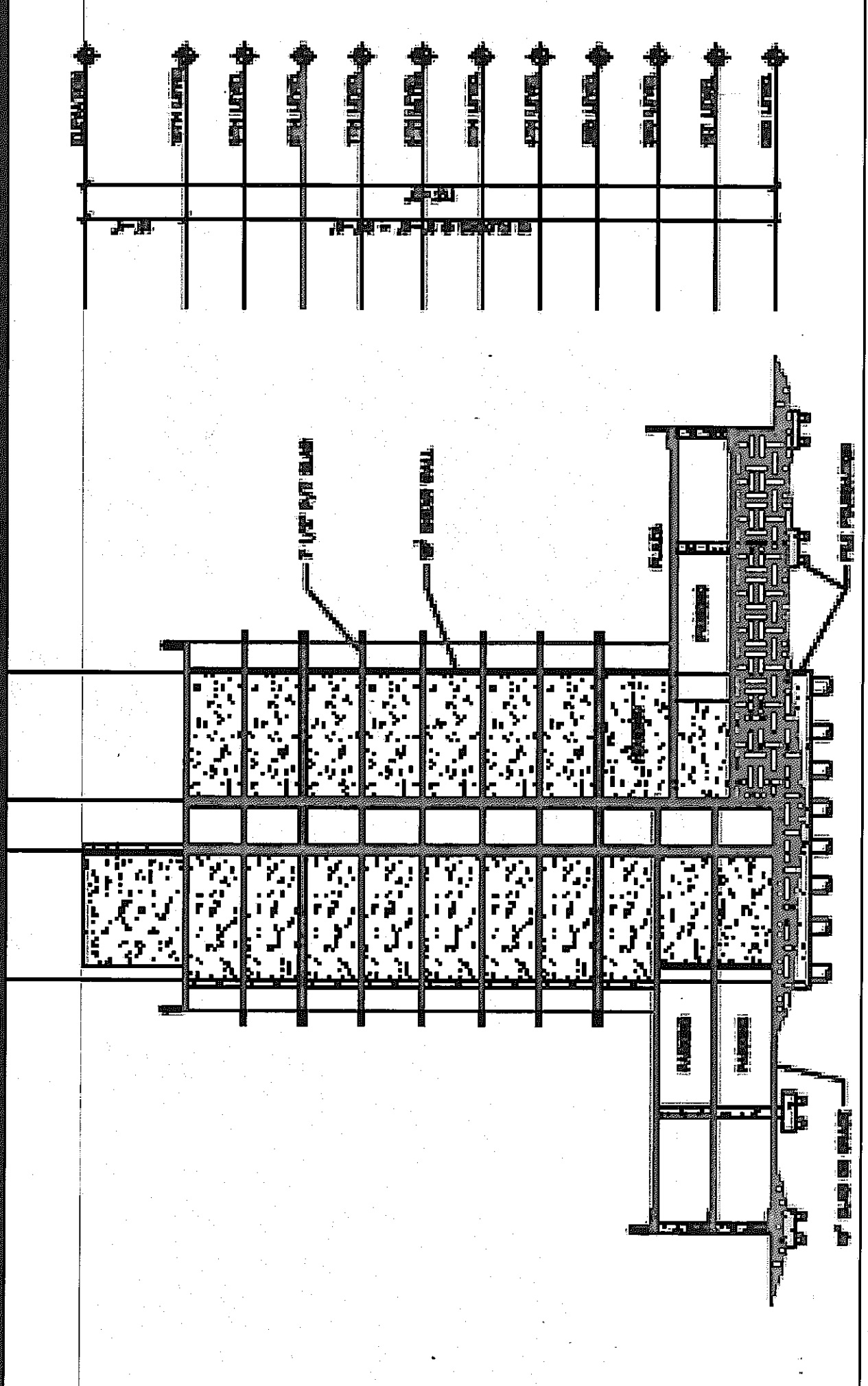
# Post Tensioning Advantages

## *Sustainability/Environmental Impact*

- Less embodied energy
- Reduced energy usage
- Material Savings
  - ❖ Concrete
  - ❖ Cladding
  - ❖ Mechanical
  - ❖ Electrical
  - ❖ Elevator
- Faster construction
- Life Cycle Cost



# Post-Tensioned Concrete Sustainability A Case Study



# PT vs. R/C Residential Tower

## Comparison of Material Requirements

| Conventionally Reinforced Slabs |           |        |       | Mild Steel |         | Post-tensioning     |             | Concrete           |
|---------------------------------|-----------|--------|-------|------------|---------|---------------------|-------------|--------------------|
| Element                         | Area      | T      | W     | L          | Unit    | Total               | Unit        | Total              |
| Slab on Grade                   | 22,360 sf | 10 in  | -     | -          | 4 psf   | 89,440 lb           | -           | 759 cy             |
| Columns                         | -         | 24 in  | 24 in | 2,166 ft   | 85 plf  | 184,110 lb          | -           | 321 cy             |
| Shear Walls                     | 31,707 sf | 18 in  | -     | -          | 18 psf  | 570,726 lb          | -           | 1762 cy            |
| Parking Slab                    | 22,360 sf | 9.5 in | -     | -          | 4.5 psf | 100,620 lb          | -           | 656 cy             |
| Plaza Slab                      | 22,360 sf | 14 in  | -     | -          | 7.5 psf | 167,700 lb          | -           | 966 cy             |
| Residential Slabs               | 74,004 sf | 9.5 in | -     | -          | 4.5 psf | 333,018 lb          | -           | 2170 cy            |
|                                 |           |        |       |            |         | <b>1,445,614 lb</b> | <b>0 lb</b> | <b>6633 cy</b>     |
| Cost*                           |           |        |       |            |         | <b>\$1,301,053</b>  | <b>\$0</b>  | <b>\$1,160,775</b> |
| Total**                         |           |        |       |            |         | <b>\$2,461,828</b>  |             |                    |

| Post-tensioned Slabs                                              |           |        |       | Mild Steel |          | Post-tensioning     |                  | Concrete           |
|-------------------------------------------------------------------|-----------|--------|-------|------------|----------|---------------------|------------------|--------------------|
| Element                                                           | Area      | T      | W     | L          | Unit     | Total               | Unit             | Total              |
| Slab on Grade                                                     | 22,360 sf | 10 in  | -     | -          | 4 psf    | 89,440 lb           | -                | 759 cy             |
| Columns                                                           | -         | 20 in  | 20 in | 2,166 ft   | 65 plf   | 140,790 lb          | -                | 223 cy             |
| Shear Walls                                                       | 31,707 sf | 18 in  | -     | -          | 15 psf   | 475,605 lb          | -                | 1762 cy            |
| Parking Slab                                                      | 22,360 sf | 7.5 in | -     | -          | 2.75 psf | 61,490 lb           | 0.75 psf         | 518 cy             |
| Plaza Slab                                                        | 22,360 sf | 11 in  | -     | -          | 4 psf    | 89,440 lb           | 1.1 psf          | 759 cy             |
| Residential Slabs                                                 | 74,004 sf | 7.5 in | -     | -          | 2.75 psf | 203,511 lb          | 0.75 psf         | 1713 cy            |
|                                                                   |           |        |       |            |          | <b>1,060,276 lb</b> | <b>96,869 lb</b> | <b>5733 cy</b>     |
| * Rebar = \$0.90/lb ; P/T = \$2.30 /lb ; Conc. = \$175/cy         |           |        |       |            |          |                     |                  |                    |
| ** Does not reflect savings in materials and cost from foundation |           |        |       |            |          | <b>\$954,248</b>    | <b>\$222,799</b> | <b>\$1,003,275</b> |
| Post-tensioned building uses 16% less concrete                    |           |        |       |            |          | <b>\$2,180,322</b>  |                  |                    |

# Case Study: The Numbers

- **16% less concrete materials**
  - ❖ Reduction in CO<sub>2</sub> due to less cement
  - ❖ Less material to transport
  - ❖ Less energy to produce aggregate
  - ❖ Reduced building weight
- **20% less reinforcing (P/T + R/B) materials**
  - ❖ Less energy consumed in steel production
  - ❖ Smaller workforce to install
- **2% less vertical height**
  - ❖ Reduced volume for HVAC
  - ❖ Reduction in façade material/vertical systems (e.g. elevators, plumbing, stairs etc)
  - ❖ Less energy for lifting vertical systems
- **Faster construction**
- **Concrete frame is 13% less expensive**

- Seven additional LEED points are available for “Innovations in Design”
- The points can be achieved by:
  - ❖ Reduction of concrete material 1 pt
  - ❖ Reduction of reinforcing materials 1 pt
  - ❖ A less expensive structural frame 1 pt
  - ❖ Reduced building weight 1 pt
  - ❖ Lower building height, less shadow 1 pt
  - ❖ Faster construction 1 pt
  - ❖ Building footprint could be smaller 1 pt