Total Precast Concrete Structures
This program is registered with CPCI for continuing professional education.

- CPCI’s continuing-education program emphasizes on learning for architects, engineers and other construction professionals. It helps those in the construction industry to keep current, master new knowledge and skills, plan for the future, and responsibly meet the role society entrusts to a professional. In doing so, it has the potential to be one of the primary forces in the improvement and revitalization of the construction industry.

- CPCI provides and numbers of seminars and presentations administered by CPCI representatives and CPCI members. Please contact CPCI for more information at (877 )937 2724 or email info@cpci.ca
Total Precast Structures

- The terminology “Total Precast Structures” encompasses projects where both the substantial core and the shell of the structure are constructed using precast components.

- Total Precast systems can be used on many types of commercial applications beyond parking garages, including but not limited to: office buildings, schools, multi-family housing, bridges and marine structures.

- This design medium incorporates precast materially into a substantial portion of the entire architectural/structural core/shell system.

- ...with that said, how many in the room have participated in this type of design and construction?
Buildings can be framed using precast concrete in a number of different configurations depending on:
- the overall geometry
- floor spans
- interior and exterior layout
- cladding arrangements.
Precast Concrete Framing Members

- Floor and roof slabs
  - Double Tee slabs
    - Long clear spans
    - Working platform
    - Fire rated

<table>
<thead>
<tr>
<th>Superimposed Loads</th>
<th>75 psf</th>
<th>100 psf</th>
<th>125 psf</th>
</tr>
</thead>
<tbody>
<tr>
<td>18” DT x 10’-0”*</td>
<td>42 ft</td>
<td>38 ft</td>
<td>33 ft</td>
</tr>
<tr>
<td>24” DT x 10’-0”*</td>
<td>45 ft</td>
<td>40 ft</td>
<td>35 ft</td>
</tr>
</tbody>
</table>

*Consult your local precast manufacturer for the sizes/capacities in your area.
Precast Concrete Framing Members

- Floor and roof slabs
  - Hollow core slabs
    - Long spans
    - Maximum headroom
    - Finished ceiling
    - Fire rated

<table>
<thead>
<tr>
<th>Superimposed Loads</th>
<th>75 psf</th>
<th>100 psf</th>
<th>125 psf</th>
</tr>
</thead>
<tbody>
<tr>
<td>8” HC x 4’-0”**</td>
<td>35 ft</td>
<td>32 ft</td>
<td>30 ft</td>
</tr>
<tr>
<td>12” HC x 4’-0”**</td>
<td>45 ft</td>
<td>42 ft</td>
<td>40 ft</td>
</tr>
</tbody>
</table>

*Consult your local precast manufacturer for the sizes/capacities in your area.
Precast Concrete Framing Members

- Beams
- Columns
  - columns can have architectural finishes
Precast Concrete Framing Members

- Panels
  - Shear and bearing walls
Precast Concrete Framing Members

- Connections
  - Shear and bearing walls
  - Columns
  - Emulation splice details
Architectural Precast Concrete
Load Bearing Wall Panels

- Horizontal Panels
  - Punched window openings
Architectural Precast Concrete
Load Bearing Wall Panels

- Vertical Panels
  - Punched window openings
Architectural Precast Concrete
Load Bearing Wall Panels

- Spandrel Panels
  - Continuous window openings
Architectural Precast Concrete
Load Bearing Wall Panels

- Panel Finishes
  - Sandblast
  - Acid Etch
Architectural Precast Concrete
Load Bearing Wall Panels

- Panel Finishes
  - Brick Faced
Architectural Precast Concrete
Load Bearing Wall Panels

- Panel Finishes
  - Cast Stone Faced
Keys to Fabrication Economy:

- Repetition
- Piece Size
## How Panel Size Affects Installation Cost ($/SF)

<table>
<thead>
<tr>
<th>Panel Size</th>
<th>Erection Cost Per Piece</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$300</td>
</tr>
<tr>
<td>50 SF</td>
<td>$6.00</td>
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<tr>
<td>100 SF</td>
<td>$3.00</td>
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<tr>
<td>150 SF</td>
<td>$2.00</td>
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<tr>
<td>200 SF</td>
<td>$1.50</td>
</tr>
<tr>
<td>250 SF</td>
<td>$1.20</td>
</tr>
<tr>
<td>300 SF</td>
<td>$1.00</td>
</tr>
</tbody>
</table>

**Conclusion:** MAKE BIG PANELS!!
Case Study
Block 89 - Kansas City
Basic framing plan for the office tower
Case Study
Arapahoe County Offices
Colorado
Erection started 2 months after the issue of Contract Documents
- Value Engineering option omitted brick columns in favor of architectural concrete
- This simplified and expedited the precast production
The architect created a leaf patterns on the entry panels...

This was paid for with savings obtained by standardizing other precast components
Basic framing plan for the Arapahoe County Office Tower
Case Study
Colorado High School
Case Study

MAPA - New England

The parking garage was located under and beside the office structure.
Yes, Green Concrete is OK!
This entire project was built over a precast basement parking garage
A vaulted skylight feature was built into the precast framing

The exposed structure in the lobby area turns architectural
Case Study
Opus I & II, Denver, Colorado

- National developer using precast for spec. office space
- Unique design team organization with mechanical, electrical and plumbing coordination up front
Basic framing plan for the rectangular tower
Framing plan for the L-shaped tower repeats precast elements.
Case Study
Lucent
Case Study
Lucent

- 589,055 SF
- 3078 precast pieces
- Erection duration 153 days
- 20.1 pcs/day
Case Study
CH2M Hill Office - Colorado

- 2590 precast pieces
- 358,423 sf
Case Study
Starz Office Bldg

- Contractor wanted speed and cost efficiency
- Erection Duration 109 days
- Average erection 22.5 pcs/day
The architect wanted natural stone blocks..

Precast stone look was created using urethane molds.

Thin “soap” pieces were doweled in after to hide the real panel joints.
Precast Construction Positive Factors

- Increased construction speed
- Plant cast quality
- Unlimited architectural applications
- Single source supplier for skin/shell
- Structural/Architectural system integration
- Is the cost comparison “apples to apples”? 
- Are life cycle cost savings enumerated? 
- Precaster must be willing to assist Design Team 
- Did we mention SPEED……..??
Cost Issues

- Efficiency of DT layout is a BIG Cost Factor
  - basic column grid is critical
- Perimeter column spacing must match the framing layout
- Repetition of architectural façades
- Contain any brick facing within the panels
Shop Drawing Process

- Start early and track with the Design Team
- Watch out for “Scope Creep”
- Weekly meetings
- Confirm circular coordination, not central control through the contractor
- Establish submittals for confirmation of coordination, NOT approval.
Scheduling Issues

- Has a project schedule been developed with the proposed scope of work?
- Has there been adequate input from the precaster?
- Does the design schedule, contract documents and permits align with construction/production?
- Is Notice To Proceed at the appropriate date, or too late?
- Precast construction is not normal to traditional methods – SD-DD-CD-CA

*SD (sketch design) – DD (detailed design) – CD (contract documents) – CA (contract administration)*
These comments are by David Barber

Barber Architects, Denver, CO was founded in 1979

Over 8 million sf of Interior Design and Architecture

Designed projects totaling over $950 million

80% of the firm’s work is with repeat clients

2002 Colorado Architectural Firm of the Year - A&E Magazine

2002 Top Office Facilities Architect - Denver Business Journal

Experience includes corporate, hospitality, resort specialty projects, governmental, educational, and residential structures.

Designed over 4 million sf of Total Precast Structures
MENTORING

- Architects know a little about a lot
- Establish relationships with precasters early
- Precasters must be willing to teach
- Investment in the future
- Tolerance for risk?
- All architects are different
BASIC BUILDING BLOCKS

Maximum Panel Dimensions
- Affected by local conditions
- Limited by regulatory agencies
- 12’ tall x 30’ long panels are preferred
- 16’ maximum panel height
- 45’ maximum panel length
BASIC BUILDING BLOCKS

Maximum Panel Weight
- Common payload of 40,000 lbs
- Handling capacity of 50,000 lbs
- Maximum weight up to 58,000 lbs
- Location affects maximum weight
BASIC BUILDING BLOCKS

- Minimum Panel Thicknesses
  - 6 inch minimum bearing at pocket
  - 2 inch minimum coverage at pocket
  - Thinner portions of panel are possible
Tolerances

- Panel joints and location
- Window frame location
BASIC BUILDING BLOCKS
Cost Effective Repetition
BASIC BUILDING BLOCKS

Multiple Finishes
BASIC BUILDING BLOCKS

Full Size Mockups
STRUCTURAL DEPTH

- Floor to Floor Height
- Floor to Exterior Wall Ratio
- Mechanical Clearances
STRUCTURAL DEPTH

- Floor to Exterior Wall Ratio
STRUCTURAL DEPTH

- Mechanical Clearances
FLOOR PLATE DESIGN

- Core Design for Double Span vs. Triple Span Plates
FLOOR PLATE DESIGN

- Planning Modules
FLOOR PLATE DESIGN

- Notches and Setbacks
GREEN DESIGN

- CaGBC/US Green Building Councils
- LEED Certification
- Resource Use
- Ecological Loading
- Health Effects
GREEN DESIGN

Resource Use

- Durability
- Efficiency

Ecological Loading

- Thermal Mass
- Local Production
- Includes Recycled Materials
- Building Reuse

Health Effects

- Indoor Air Quality
- Light Reflectance
TOTAL PRECAST STRUCTURES

- Architects Know a Little About a Lot
- Know Less and Less
- Know Nothing About Everything
What if you could manufacture a building in a factory and install it straight from the truck with a minimum of inconvenience to the public who must share the roads and property adjacent to the jobsite?
Summary

What if you could install the building components in any weather without worrying about the time of year that construction will take place? Total precast structures can cut months off a project schedule.
What if you could have the precaster create your design in house using a top-down 3D-CAD system that will assist coordination with the other trades, catch errors and speed up the production of shop drawings for the precast plant?
Summary

What if you could use prestressed beams, floor and roof slabs to provide larger clear spans and more column-free space? You can design in increased load capacity for future reuse of the building at minimum cost.
What if you could use precast concrete factory components that have superior fire, vibration and sound ratings?
What if you could provide a superior building envelope using insulated precast walls that will perform and save energy costs over the life of the building? The thermal mass of concrete will help to reduce heating and cooling equipment and costs.
Summary

What if you could provide a building that uses less energy to operate and is recyclable at the end of its useful life? The design life for a precast frame and exterior walls are at least 50 to 100 years.
Summary

What if you could provide a durable building that will look good and require minimal upkeep and maintenance over a long and useful life?
Summary

What if you could have almost unlimited exterior facades (profile, colour and texture) that will look good and maintain the value of the owner’s investment over the long term?
Summary

All of these benefits are available today.

Consult with CPCI members about your next project.
Questions?

This concludes CPCI Continuing Education Systems Program. Thank you for your time!

For more information on CPCI:
www.cpci.ca
www.sustainableprecast.ca
www.precastcertification.ca