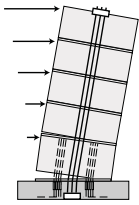


# HYBRID PRECAST WALL SYSTEMS

## FOR SEISMIC REGIONS



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February 18, 2008

### INDUSTRY MEETING RESOLUTIONS

Meeting Date: January 29, 2008

Meeting Venue: University of Notre Dame, Notre Dame, Indiana

In Attendance: Walt Korkosz, Gino Kurama, Brian Smith

The following resolutions were made during the meeting:

#### **FULL SCALE PROTOTYPE**

##### *Lateral and Axial Loading*

- Based on a study of typical pre-cast concrete structures, it was determined that a full-scale, design base overturning moment of about 15,000-kip-feet and a full-scale, design gravity axial force of about 80-kips per floor will be used.

##### *Prototype Wall Dimensions*

- The prototype structure will be a four-story wall with the first story height equal to 12-feet, upper story heights equal to 11-feet, and wall length equal to 20-feet.
- The wall panel thickness will be equal to 12-inches.
- The first panel-to-panel joint will be located 12-feet from the top of the foundation, which corresponds to the top of the first story level.

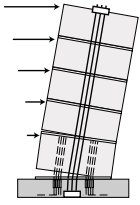
##### *Reinforcement Design and Layout*

- The wall will be designed such that 50% of its base moment strength will be provided by mild steel reinforcement; the remainder will be provided by unbonded post-tensioning (PT) steel and the gravity axial force.
- The PT steel will be placed in two bundles of equal cross-sectional area. The centerline of each bundle will be located 6-inches from the centerline of the wall panel. In other words, the center-to-center spacing of the two PT bundles will be 12-inches.
- The mild steel reinforcing bars will be placed symmetrically in two groups, with one group of bars located on each side of the wall centerline and further away from the wall centerline than the PT bundle.

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### FULL SCALE PROTOTYPE (cont.)

#### *Material Properties*

- The unconfined concrete strength will be 6-ksi.
- The fiber-reinforced grout strength at the horizontal joints will be 5-ksi.
- The mild steel yield strength will be 60-ksi.
- The ultimate strength of the PT strands will be 270-ksi.

#### *Cost Comparison*

- Once the prototype structure is designed, a cost comparison of the hybrid wall system and a similar monolithic cast-in-place concrete system will be conducted.

### BASIC TEST SPECIMEN

#### *Basic Test Specimen Dimensions*

- The basic test specimen will be a 0.4-scale model of the full-scale prototype wall described above.
- The wall panel thickness of the basic test specimen will be 6-inches, which corresponds to a 0.5-scale factor. The wall thickness cannot be scaled down exactly due to practical limitations.

#### *Construction Details*

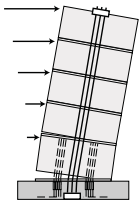
- Based on preliminary design calculations, a tentative schematic drawing of the elevation and cross-section near the base of the basic test specimen are shown on the next page.
- Splice sleeve couplers will be used to provide continuity between the mild steel bars in each wall panel and in the foundation. As shown on the next page, reinforcing bars from each wall panel will be inserted and grouted into splice sleeves embedded into the adjacent (lower) panel or foundation.
- Unbonding of the mild steel bars at the wall base will be achieved by wrapping a pre-determined length of the bars at the bottom of the base panel.
- The grout thickness for the scaled test specimens will be 0.75-inches.
- Clear concrete cover for the test specimens will be 0.5-inches.

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## PARAMETRIC TEST SPECIMENS

### Test Parameters

- A total of six tests will be conducted.
- In addition to the basic test specimen listed above, four parametric test specimens will be determined by varying the following properties of the basic test specimen: wall length (aspect ratio), mild steel contribution to the base moment strength divided by the total base moment strength ( $M_{ms}/M_{wall}$ ), concrete confinement details at the wall base (special vs. intermediate), and wall panel openings.
- One additional parametric specimen will be an emulative precast concrete wall with only mild steel reinforcement which will serve as a comparison specimen.
- The matrix of the proposed wall test specimens is shown below. The basic test specimen (test number 2) is highlighted.

Test Number	Full-Scale Wall Length	$M_{ms} / M_{wall}$	Confinement Details	Wall Openings
1	20-feet	Emulative	Special	Yes
2	20-feet	0.50	Special	No
3	20-feet	0.25	Intermediate	No
4	20-feet	0.50	Special	Yes
5	12-feet	0.50	Special	No
6	12-feet	0.25	Intermediate	No

- The longer test specimens (full-scale wall length equal to 20-feet) will consist of two wall panels - one panel representing the first (base) story and the other panel representing all of the upper stories.
- The shorter test specimens (full-scale wall length equal to 12-feet) will consist of a single wall panel modeling the entire four-story structure.

### Wall Openings

- At full-scale, the typical wall panel opening size will be at least 3-feet wide by 4-feet tall. The openings will be placed 3.5-feet above the top of the foundation.
- Wall openings will be located only in the base panel (first story).
- Wall openings will not be used in the 12-foot wall panels.

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