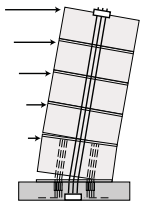
HYBRID PRECAST WALL SYSTEMS
FOR SEISMIC REGIONS



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May 18, 2010

Industry Meeting Resolutions

Meeting Date: April 20, 2010
Meeting Venue: Tele-Conference
In Attendance: W. Korkosz, K. Baur, D. Dieter, J. Albrigo, M. Ugalde, Y. Kurama, B. Smith

The following resolutions were made during the meeting:

Results from Specimen #2

- The performance of Specimen #2 was reviewed with specific focus given to the energy dissipating (E.D.) bars, which appeared to pull out from the Type-2 mechanical splice connectors placed inside the foundation.
- It was noted that the wall loading procedure required by ACI ITG-5.1 resulted in a strain history for the E.D. bars that is much more demanding than the strain history required by ICC AC-133 for the certification testing of Type 2 mechanical splices, both in terms of the total number of cycles and the maximum bar strains.
- E.D. Bar pull out was not observed in Specimen #1, which was designed as an identical wall to Specimen #2. The same Type 2 splices were used in both specimens, with similar anchor grout strengths (8.6-ksi on test day). A possible reason for pull out in Specimen #2 (but not in Specimen #1) is the higher concrete strength of the lower wall panel in Specimen #2 (6.5-ksi versus 4.7-ksi on test day), which may have decreased the neutral axis depth at the base joint and increased the corresponding E.D. bar strains at the same drift level. Furthermore, during the assembly of the wall, the E.D. bars in Specimen #2 were more "off-center" with respect to the anchor opening than the bars in Specimen #1.
- Concrete cores will not be taken through the E.D. bars in the base panel of Specimen #2. Cores were taken through the base panel of Specimen #1 to investigate the "additional" debonded length of the energy dissipating steel. This was deemed not necessary for Specimen #2 since bar pull out occurred inside the foundation. Concrete cores of the foundation may be taken at a later date (after reusing the foundation with Specimen #3) in order to evaluate the extent of the bar pull out.

This project is funded by the Charles Pankow Foundation and the Precast/Prestressed Concrete Institute. Any opinions, findings, conclusions, and/or recommendations expressed in this material are those of the researchers and do not necessarily represent the views of the sponsors.

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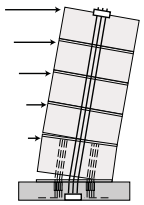

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Action Plan for Specimen #3

- Since Specimen #3 has already been cast with the same Type 2 E.D. bar splice connectors inside the foundation, several options that may help delay or prevent bar pull out were discussed.
- It was decided that a steel plate, nut or other type of custom-made end-anchor welded onto the end of the E.D. bars prior to placement within the anchors would not be reflective of what would typically be used in practice. Additionally, this type of connection detail would decrease the construction tolerances when placing the E.D. bars inside the anchors.
- Ultimately, the use of a higher-strength grout mix inside the splice anchors was deemed most practical. The splice anchor grout strength achieved for Specimens #1 and #2 (8.6-ksi on test day) was only slightly higher than the minimum manufacturer's required compressive strength of 8.5-ksi. To ensure higher compressive strength, trial batches of grout will be cast and tested prior to the assembly of Specimen #3. The different grout mixes will use different amounts of water in the mix. In addition, a higher-strength non-metallic grout will also be tested.
- The results of the grout compressive strength tests will be discussed during a future advisory panel meeting prior to the assembly of Specimen #3.

Future Uncast Specimen

- Specimens #4-#6 have not been cast yet. Based on the test results from Specimen #3, a decision will be made regarding the E.D. bar construction details at the base-panel-to-foundation joint. Potential future details include the use of oversized splice anchors to increase bar embedment length and construction tolerances, mechanical end-anchors, or fully-developed bars grouted within corrugated metal ducts.
- Casting of the remaining specimens will take place in two installments to allow for additional unforeseen modifications between casting dates. The casting schedule will be (a) Specimen #4 followed by (b) Specimens #5 and #6.
- The design maximum strain limit for the E.D. bars will be re-evaluated after the testing of Specimen #3 but prior to the design of Specimen #4. For Specimens #1, #2, and #3, the designed maximum E.D. bar strain was approximately 57% of the bar strain at peak stress under monotonic tensile loading. For comparison, the designed maximum E.D. bar strain for the hybrid walls used in the UCSD DSDM project was approximately 50% of the bar strain at peak stress under monotonic loading.

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