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Structural Concrete Design - The Legacy of Dr. W. Gene Corley

ACI Fall 2013 Convention
October 20 - 24, Phoenix, AZ

ACI WEB SESSIONS





Randall W. Poston, Ph.D., P.E., S.E. is a Principal of WDP & Associates, Inc., Austin, Texas, and received his engineering degrees from the University of Texas at Austin. He is the current Chair of ACI Committee 318, Structural Concrete Building Code. He is a former member of the ACI Board of Direction and the Technical Activities Committee (TAC) and Past Chair of the TAC Repair and Rehabilitation Committee. He is also a member of ACI Committees 222, Corrosion of Metals in Concrete; 224, Cracking (of which he is Past Chair); and 562, Evaluation, Repair, and Rehabilitation of Concrete Buildings.

ACI WEB SESSIONS

Dr. W. Gene Corley – Contributions to the ACI 318 Structural Concrete Building Code


Randall W. Poston
Chair – ACI Committee 318



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Overview of Presentation


- Corley and Committee 318
- Contributions to 318 Code provisions
- Chairmanship years
- 318-14 Code Reorganization contributions
- Corley legacy



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Corley and Committee 318

- Began serving in 1973
- Served as Chair from 1989 to 1995
- Served as member for 40 years



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Contributions to 318 Code



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First Code - 1977

ACI Standard
BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE (ACI 318-77)
 REPORTED BY ACI COMMITTEE 318

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 J. D. STYKES, JR.
 GEORGE WINTER
 LORING A. WYLLIE, JR.

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Chapter 8: Analysis and Design—General Requirements

8.14. Vanderbilt, M. D., and **Corley, W. G.**, "Frame Analysis of Concrete Building," *Concrete International*, V. 5, No. 12, Dec. 1983, pp. 33-43.

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Chapter 11: Shear and Torsion

11.4. Barney, G. B.; **Corley, W. G.**; Hanson, J. M.; and Parmelee, R. A., "Behavior and Design of Prestressed Concrete Beams with Large Web Openings," *Journal of the Prestressed Concrete Institute*, V. 22, No. 6, Nov.-Dec. 1977, pp. 32-61.

11.57. Cardenas, A. E.; Hanson, J. M.; **Corley, W. G.**; and Hognestad, E., "Design Provisions for Shear Walls," *ACI JOURNAL, Proceedings* V. 70, No. 3, Mar. 1973, pp. 221-230.

11.58. Barda, F.; Hanson, J. M.; and **Corley, W. G.**, "Shear Strength of Low-Rise Walls with Boundary Elements," *Reinforced Concrete Structures in Seismic Zones*, SP-53, American Concrete Institute, Farmington Hills, MI, 1977, pp. 149-202.

11.70. **Corley, W. G.** and Hawkins, N. M., "Shearhead Reinforcement for Slabs," *ACI JOURNAL, Proceedings* V. 65, No. 10, Oct. 1968, pp. 811-824.

11.73. Hawkins, N. M., and **Corley, W. G.**, "Moment Transfer to Columns in Slabs with Shearhead Reinforcement," *Shear in Reinforced Concrete*, SP-42, American Concrete Institute, Farmington Hills, MI, 1974, pp. 847-879.

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Chapter 13: Two-Way Slab Systems

13.10. Carpenter, J. E.; Kaar, P. H.; and **Corley, W. G.**, "Design of Ductile Flat-Plate Structures to Resist Earthquakes," *Proceedings, Fifth World Conference on Earthquake Engineering*, Rome, June 1973, International Association for Earthquake Engineering, V. 2, pp. 2016-2019.

13.12. Vanderbilt, M. D., and **Corley, W. G.**, "Frame Analysis of Concrete Buildings," *Concrete International: Design and Construction*, V. 5, No. 12, Dec. 1983, pp. 33-43.

13.18. **Corley, W. G.**; Sozen, M. A.; and Siess, C. P., "Equivalent-Frame Analysis for Reinforced Concrete Slabs," *Structural Research Series* No. 218, Civil Engineering Studies, University of Illinois, June 1961, 166 pp.

13.20. **Corley, W. G.** and Jirsa, J. O., "Equivalent Frame Analysis for Slab Design," *ACI JOURNAL, Proceedings* V. 67, No. 11, Nov. 1970, pp. 875-884.

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Chapter 21: Earthquake-Resistant Structures

21.46. Barda, F.; Hanson, J. M.; and **Corley, W. G.**, "Shear Strength of Low-Rise Walls with Boundary Elements," *Reinforced Concrete Structures in Seismic Zones*, SP-53, American Concrete Institute, Farmington Hills, MI, 1977, pp. 149-202.

21.53. Barney, G. B.; Shiu, K. N.; Rabbat, B. G.; Fiorato, A. E.; Russell, H. G.; and **Corley, W. G.**, *Behavior of Coupling Beams under Load Reversals* (RD068.01B), Portland Cement Association, Skokie, IL, 1980.

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Corley Chairmanship

BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE (ACI 318M-89) (REVISED 1992) AND COMMENTARY—ACI 318RM-89 (REVISED 1992)

REPORTED BY ACI COMMITTEE 318

ACI Committee 318
 Standard Building Code

W. G. Corley Chairman		Basile G. Rabbat Secretary			
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Clifford L. Freyermuth	Edward S. Hoffman				

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Chair - 1989 to 1995



Chair 1989 to 2005

- Document title is changed to "Building Code Requirements for Structural Concrete" to reflect expanded content
- Helical ties, silica fume, shrinkage-compensating concrete, and concrete slabs cast on steel form deck are explicitly recognized
- A procedure for removal of shores and installation of reshores, backed up by calculations, is mandated for contractors



Chair 1989 to 2005

- Minimum flexural reinforcement requirements tied to concrete strength
- Slender column design provisions are expanded, additional methods for approximate analysis are introduced, and stiffness values are defined
- Design provisions for torsion are revised and apply equally to reinforced and prestressed concrete (thin-wall, space truss analogy)



Chair - 1989 to 2005

- Development length calculation for deformed bars in tension is simplified
- Chapter 13, Two-way slab systems, is reformatted and incorporates modified provisions for slab-to-column moment transfer
- Chapter 16, Precast Concrete, is greatly expanded and incorporates detailed requirements for structural integrity



Chair - 1989 to 2005

- A new Chapter 22, Structural Plain Concrete, is added
- A new Appendix B, Unified Provisions for Reinforced and Prestressed Concrete Flexural and Compression Members, is introduced
- A new Appendix C, Alternative Load and Strength Reduction Factors, is provided for the design of "mixed construction." (same load factors & factored load combinations for steel frames, masonry, or timber, on concrete footings.)



Chair - 1989 to 2005

- After a trial period of six years, Appendices B & C were moved in the body of the '02 code and are now the standard procedure for Unified Design (tension-controlled, compression-controlled, and transition sections.) It displaced the "sacred" 0.75 rho balanced.



Chair – 1989 to 2005

Gene was always a proponent for use of High Strength Concrete. Based on research conducted at PCA in the '70s, he maintained that the rectangular stress block factors need not be changed for high strength concrete. Based on research conducted in the early 80's, the limit on $\sqrt{f'_c}$ was set starting in the '89 code at 100 psi



Support for Reorganization



ACI 318-14 Reorganization

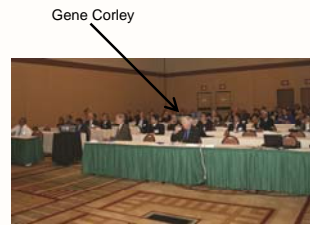


- In 2003, committee 318 began discussion on code organization
- In 2006, ACI surveyed users about experience using 318



ACI 318-14 Reorganization

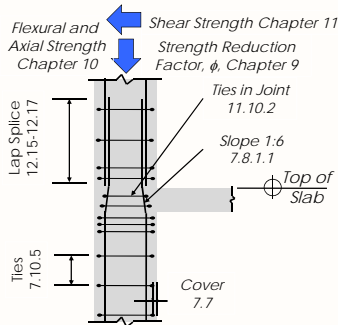
- In 2006, J. Wight forms TG – 7
 - W.G. Corley was a member
- In 2006, focus groups were held with practicing engineers
- In 2007, a workshop concluded the reorganization effort should continue
- In 2007, an outline was developed by ACI 318 Steering Committee
- In spring 2008, committee began to reorganize the Code



Why Reorganize 318?

How Do I Know If I Have Fully Satisfied the Code?

- Related Code provisions in several chapters
- Code assumes user knows which provisions apply in each use
- More than 2,500 provisions tax this assumption



ACI 318-11: Related Provisions

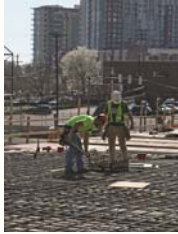

Five chapters for one design / detail

Many Chapters and Sections Required for One Design / Detail

ACI 318-14 Reorganization


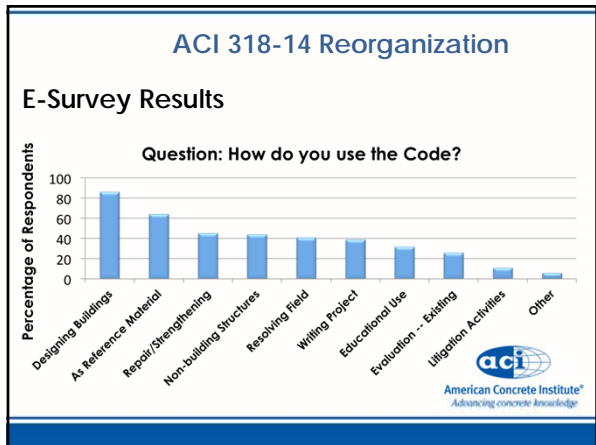
General Goal:

- To improve overall logic of information location and for greater ease-of-use.

ACI 318-14 Reorganization


- ACI 318 organization based on behavior of cast-in-place reinforced concrete
- Structural provisions assumed a working stress limit through 1956
- "Ultimate Strength" approach firmly established in 1971 edition.

ACI 318-14 Reorganization Process

Survey feedback:


- Engineers want all related information for a member's design and detailing easily located
- Engineers want the Code to be more closely related to how they design members



ACI 318-14 Reorganization

Specific Goals:

- Users know when design is complete
- Provide explicit detailing requirements for each member
- Improve consistency of language and style
- Allow for future technology/new topics



ACI 318-14 Reorganization

- As balloting occurred, some gaps were identified:
 - Structural system performance
 - Diaphragm design and detailing
 - Foundation systems




Corley Legacy

- Code to protect public safety
- Two – way slab system design and analysis
 - Equivalent frame analysis
 - Moment transfer and punching shear
- Shear wall behavior and design
- Very supportive of reorganization
- Empathy for structural designers



Corley Legacy

Dr. Corley would not let current committee eliminate shearheads from the code!

