ILLINOIS SECTION
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ILLINOIS GEO-INSTITUTE
OCTOBER 2024 DINNER MEETING

Micropile Underpinning of Davis-Besse Nuclear Power Station Cooling Tower

PLACE:	Pazzo's • 311 S Wacker Dr., Chicago, IL 60606 • (312) 913-1600 (Parking is located south of the 311 building - $13.00 after 5:00PM)		
DATE & TIME:	**October 15, 2024** Cocktails 5:15 pm, Dinner 6:15 pm, Presentation to follow		
SPEAKERS:	Terry Holman, Geosyntec Consultants Nathan Holmer, Geosyntec Consultants		
COST:	$65 General (Contractor, Consultant with reservation) $55 Education/Government Employees (with reservation) $20 Students (with reservation) (if paying with check, make checks payable to ASCE IL Geo-Institute)		
ONLINE REGISTRATION:	Professionals Educator/Government Employees Students (1.0 PDH will be provided to all attendees)		
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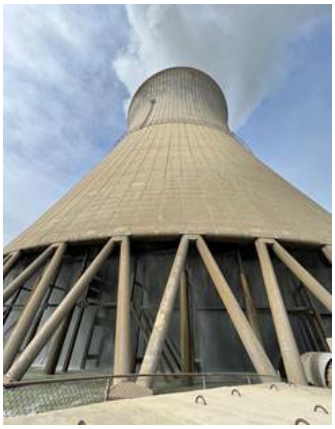
Abstract

The Davis-Besse Nuclear Power Station came on-line July 31, 1978, outside of Toledo, Ohio. The plant's cooling tower stands 493 feet tall is supported by a 13-foot-wide reinforced concrete ring beam foundation with centerline radius of 208 ft. The tower shell is supported by a series of 88 inclined columns that connect to the ring beam foundation.



The foundation has slowly been settling since about 1978-1980 because of dissolution of anhydrite and gypsum-based granular material that was used as structural fill. The greatest settlement has occurred beneath the outflow channel that conveys the cooled water away from the tower. The differential settlement has caused the tower shell to deform creating cracking risk due to elevated stresses in this critical thin shell element. The ring beam foundation required an underpinning or stabilizing system to arrest any future settlement and limit additional distress to the system.

Keller North America was selected by the Owner to provide a design-build solution and engaged Geosyntec Consultants to develop and design the geotechnical and structural solution. After consideration of multiple specialty geotechnical solution concepts for stabilizing the structure, a system of axially loaded micropiles and reinforced concrete grade beams was selected, to be situated on the inner and outer radii of the foundation and extending over about 390 ft of the centerline circumference. Key to the performance and efficiency of the system was the development of an enhanced shear interface design between the new grade beam elements and a roughened existing ring beam surface to optimize the steel reinforcement dowels.

Grade beam geometry and micropile spacing made it feasible to evaluate the continuous and discrete beam zones as deep beams, which led to use of adapted strut-and-tie models to develop the shear and longitudinal reinforcement. The resulting general maximum unfactored micropile loads were 455 kips, with localized pile loads within discrete beam sections approaching 510 kips. Efficient geotechnical and structural design for the rock-socketed micropile was conducted using allowable stress design concepts, and performance was verified through two full scale instrumented load tests.

The greatest challenge in the design of this underpinning system came from the construction schedule which demanded completion of the most complex parts of the work during a 14-day plant shutdown window, necessitating round the clock work between the construction entities.

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About the Speakers

Terry Holman, Ph.D., P.E., is a Senior Principal Engineer with Geosyntec Consultants and leads Geosyntec's national Geostructural and Construction Engineering group. He possesses 30 years of professional experience focused on the areas of: geotechnical and structural engineering; design; construction management; specialty geotechnical construction; and heavy-civil construction. Terry's technical expertise, developed through his career as a geotechnical engineer, specialty contractor, and construction manager, extends across the entire spectrum of construction and design, with an emphasis on constructability, cost and schedule, and safety for contractors.

Terry's industry leadership includes serving as an elected member of The Moles (one of the most prestigious recognitions given to underground, marine, and heavy foundation construction professionals in the United States), a member of the ADSC, DFI, PDCA, ASCE, and the Geo-Institute. He previously served as the Co-Chair of the joint ADSC-DFI-PDCA Working Platforms Group. Terry was previously an Adjunct Professor in the Department of Civil and Environmental Engineering at Northwestern University in Evanston, Illinois.

Nathan Holmer, P.E., S.E. is a Senior Engineer and Structural Engineering practice leader in Geosyntec Consultants' national Geostructural and Construction Engineering group. He has developed expertise in structural design and evaluation of concrete and steel structures through 14 years of practice as a professional. Throughout his career, he has utilized his advanced knowledge and understanding of structural analysis and mechanics to facilitate the design and inspection of linear infrastructure projects (bridges, retaining walls, and tunnels) as well as comprehensive forensic evaluations of building structures. Nathan was deeply involved with the investigation of the 2019 collapse of the Hard Rock Hotel under construction in New Orleans.

Most recently, Nathan has focused on bringing his comprehensive structural and construction engineering skillset to a series of contractors across the United States. His broad base understanding of civil and structural engineering allows for the seamless adaptation to many of structural or construction challenges encountered by Geosyntec's vastly diverse client group.