

Y A W K E Y C E N T E R f o r C A N C E R C A R E

Dana-Farber Cancer Institute

Internationally known for its clinical excellence and cancer research, Dana-Farber Cancer Institute (DFCI) is consistently recognized as one of the leading cancer research institutes in the country. Between 2001 and 2008 alone, annual outpatient visits and infusions at DFCI increased from approximately 140,000 to more than 264,000 along with clinical trials increasing by nearly 80%. DFCI sought to provide ample, state-of-the-art facilities for leading-edge treatment of cancer and related diseases for the expanded patient population, and to create an enhanced healing environment with a strong patient and family centered focus, improved patient safety, and support for safe staff practices.

Utilizing the last buildable site on the DFCI Longwood Campus in Boston, Massachusetts, the new Yawkey Center for Cancer Care (YCCC) is a 500,000 square foot building (198 ft x 186 ft plan) with seven stories of below-grade parking and fifteen above-grade stories. To help unite the DFCI campus, and to alleviate pedestrian and vehicular traffic, the design incorporates both below and above-grade connections to the adjacent Smith Building and the Dana Building across the street. The facility represents the Institute's forward-looking vision and according to Dr. Edward Benz, president of DFCI, *"The new YCCC is Dana-Farber's response to the need for the best 21st century cancer care and for new modes of clinical research designed to bring better treatments to patients more quickly and safely."*

Working with the renowned ZGF Architects and Walsh Brothers construction team, Simon Design Engineering (SDE) provided site engineering master planning and served as Structural Engineer of Record for the superstructure and foundations. SDE brought over 20 years of experience on the DFCI campus, including the structural and isolation design of the abutting Smith Building. Intensive collaboration was demonstrated by the design and construction team, which ultimately resulted in the project being completed two months ahead of schedule and on budget.

The logistical challenges of this project were extraordinary. With no lay-down area, the roof of the mechanical room was designed to provide a construction staging platform, tower crane support, and earth retention to avert the use of tiebacks at the upper levels. Proximity to the Medical Area Total Energy Plant (MATEP), which provides electricity, steam and chilled water to the Longwood area, also presented a host of issues. The low-frequency vibrations produced by its generators, if left unmitigated, would have a severe impact on DFCI's sensitive operations. The solution, isolate the building from the surrounding soil with a three-foot thick reinforced concrete slurry wall that served as an excavation support system, groundwater cutoff, and a permanent isolation wall. With no physical connection to the slurry walls that surround the structure, the YCCC is literally a free-standing 22-story building that begins seven stories below grade and is supported on isolated piers founded on bedrock.

The slurry wall system is similar to the abutting 15 year old Smith Building, but significantly more complicated; DFCI utilized the same design team as the Smith Building, including GEI Consultants, Inc. for geotechnical services. The construction of the underground garage required the excavation and removal of 20,000 tons of soil to a depth of 80 feet beneath Brookline Avenue and 50 feet below the MATEP.

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Supporting the slurry walls are 286 permanent tie back anchors, composed of 140 foot-long bundles of steel cables (total of 75 miles of cable, weighing 148 tons). To ensure that there was no uncontrolled soil loss during the tieback installation, a specially designed rig was used to carefully manage the drilling process that occurred up to 60 feet below the groundwater table. Computer generated 3D survey technology was utilized to monitor the settlement of the MATEP during construction to insure its critical equipment incurred no impact.

Due to potential construction related vibrations and noise, the team utilized an innovative hydro-mill drill rig to cut through the rock at the bottom of the slurry walls, without impacting the sensitive operations of neighboring facilities. The hydro-mill technology cut the bedrock at a rate 10-15 times faster than traditional methods, saving three weeks on the schedule and preventing shutdowns due to excessive vibrations.

The superstructure foundations are offset ten feet from the slurry wall to preclude the need to expose the toe of the wall and reduce overall risk of vibration transmission. In some locations, it was essential that columns slope inward ten feet from the ground floor to the lower level, while avoiding large transfer girders at grade. For the deep foundations, SDE developed a vital “caisson-in-a-can” solution that provided a watertight seal, which allowed for the piers to be inspected and surrounded with a layer of isolation foam to reduce the transmission of ground vibrations.

Protection of the public’s health during construction was a key initiative for the team. DFCI included an emissions control element into the construction management plan. Detailed specifications regarding standards for the idling of equipment and the reduction of hydrocarbons were imposed on all subcontractors. The result, the YCCC project became the model for *Greater Boston Breathes Better* and the team earned a Merit Award of Excellence from the Environmental Protection Agency (EPA) recognizing the incorporation of clean diesel strategies into the construction management plan. Volatile organic compound (VOC) pollutants were reduced by 42%, carbon monoxide by 31%, and particle matter by 20%. Nearly 100% of the site’s waste was recycled.

The project is expected to receive a LEED Silver rating and is a pilot project in the Green Guide for Healthcare Initiative. A primary goal of this project was to achieve a park-like setting; green roof gardens with plantings have been incorporated on the roofs of the 4th, 11th, 12th, and 14th floors and a healing garden is provided as a place of calm for patients, families, and caregivers. Indoor air quality management plans to mitigate potential air quality hazards were also implemented and low-emitting adhesives/sealants, paints/coatings and carpet systems were used to reduce indoor air contaminants.

SDE provides DFCI: Owner’s Agent, Conceptual Project Design, Project Programming, Value Engineering, Management, Parking Consulting, SER, Project Coordination, Material Evaluation, Quality Assurance, Project Closeout.