LIFE SCIENCES BUILDING, YORK UNIVERSITY

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Category: A. Buildings

PROJECT HIGHLIGHTS

If best practice in structural engineering is represented by projects that are ideally suited to the needs of the client while increasing efficiency and reducing cost, the York University Life Sciences Building is a great example of such a project.

Built on the site of a former apple orchard, this 160,000 square foot, four-storey, state-of-the-art university building includes lecture halls, seminar rooms, and highly secured research labs for the study of biology. With a capital budget in the order of $70million, it was designed by NXL Architects, in association with SSG Architecture Inc. Structural systems employed reinforced concrete to meet the project's demands for a robust, economical and sustainable material. The building features reinforced concrete flat slab for the floor plates and a series of reinforced concrete cores to resist lateral loads. As of 2011, the Life Sciences Building was the first structure in Toronto to use Bubble Deck technology, and it was the first Bubble Deck project completed in Ontario. This project is innovative in terms of its use of this material, both in the way that Bubble Deck responds to the requirements of the program and adds value and economy to the project.

The finished building houses two significant York University research hubs, the Biomedical Imaging Facility and the Bioanalytical Facility, which contain equipment for advanced biomedical imaging, electrophysiology, cellular imaging and bioanalysis. The creation of these laboratories, and of the entire Life Sciences building, was supported by multiple levels of government funding, in a collective initiative to support Ontario's research capabilities and contributions to science as well as the university's ability to recruit top-tier researchers.

The gross area of the project is 20,000 m^2, and the floor plate is approximately 4,000 m^2. The typical grid is 9.6 m with a 12.0 m span over the lecture hall bays. As a laboratory building, it required intensive mechanical services, and one of the project's primary concerns became the coordination of mechanical and electrical services. (Crossey Engineering Ltd. provided mechanical/electrical engineering on the project.)

Ian Mountfort, a principal at Blackwell Bowick Partnership Limited, was the lead engineer on this project. We believe that this project showcases our firm's ability to provide an efficient structure using innovative technology that meets all program requirements, within a tight timeline. It also demonstrates our capacity to deliver on a large project with extensive, complex program requirements. For many reasons, we believe this project is an excellent candidate for an award from the Canadian Consulting Engineers.

PROJECT DESCRIPTION

INNOVATION AND COMPLEXITY

As the first building to be constructed in the province using Bubble Deck, this project meets the criteria of being both innovative and complex in terms of the engineering involved.

When we began the project, our schematic design identified reinforced concrete as the best option in terms of its ability to provide a robust and economical structure. Concrete was also adopted for aesthetic reasons, with the architect choosing to express architectural concrete columns and slab soffits around the day-lit perimeter of the building.

The initial design worked with a reinforced concrete flat slab for the floor plates, and a series of reinforced concrete cores to resist lateral loads. While this system worked well for the 9,600-square-foot bay, the long span condition required a system of dropped beams, affecting floor to floor height as well as coordination of mechanical services. The use of drop beams is the normal solution in this circumstance, but in this case, it was sub-optimal, so we looked for further solutions.

It was then that we considered a flat plate Bubble Deck slab as an alternative. The Bubble Deck system works by embedding an array of plastic spheres to act as void forms within a 70mm-deep precast concrete soffit. These precast elements are delivered in 3-meter by 9-meter plates and are assembled on site, supported on a temporary system of re-shores. Working bottom steel is embedded within the precast elements with lap bars between panels. Top steel is placed in the field, and the slab is poured and finished in the conventional manner. The resulting slab is a fully continuous, lightweight, two-way reinforced concrete flat plate.

Because of our choice to use Bubble Deck, the project was confronted with a number of challenges due to it employing an innovative new technology. The success of the project is due to the collaboration of consultants, contractors and building officials.

We worked closely with regulatory bodies when incorporating new technology or systems. Blackwell Bowick worked with the plans examiner in advance of permit to anticipate and satisfy their concerns around code compliance. We were glad that the lead consultants started this process early and remained proactive when it came to regulation.

Through the coordinated efforts of the project team, and the excellent performance of the concrete trades, the erection of this innovative structure kept pace with the rigorous demands of the construction schedule, and resulted in a high-performing structure.

EXCEEDING CLIENT NEEDS

Our prime objective is to solve the tough problems of architects and adding value to projects for owners. We advocated for the adoption of the Bubble Deck system in consideration of the following advantages:

1. A reduction in slab mass by approximately 30% relative to the conventional system. This resulted in a significant reduction in both seismic forces and foundation requirements.
2. A significant optimization in the use of concrete material. The void-form system displaces mass from the interior of the slab where it contributes little strength and stiffness in bending.
3. Elimination of drop panels and drop beams, simplifying the distribution of services and maximizing floor-to-floor height.
4. Since precast elements are fabricated in well-controlled conditions off-site, the result is concrete soffits of architectural quality that can be exposed in key locations.

ENVIRONMENTAL IMPACT

Elements of the program of this building add to its environmental credentials. From the architects' website: "The building encompasses modern flexible, modular labs designed to a CL-2 level, and sustainable design features targeted for LEED Silver rating. Additional features include the randomized exterior envelope capitalizing on exterior views, efficient mechanical heat recovery systems and mitigating noise silencers that will reduce the overall footprint of the building."

The materials chosen for this project also contributed to lessening its environmental impact. By optimizing the use of concrete in the project, our choice to use Bubble Deck resulted in a reduction in embedded energy and a more environmentally sustainable use of material, therefore reducing the environmental burden of this project.

This project has been LEED Silver accredited.

SOCIAL AND ECONOMIC BENEFITS

Our decisions in this project have obvious design and environmental merits, but in addition, they also served to reduce costs, and were considered "value for money" improvements. The new framing system to reduce the mass of concrete in slabs resulted in lower costs, and the prefabricated components of the structural system helped to advance the project schedule, allowing more time for fit-out of the complex interior program.

Finally, the use of Bubble Deck allowed the team to optimize the project schedule, which allowed us to achieve the project within an 18-month timeframe—before the start of the 2011 academic year.