



# SURREY MEMORIAL HOSPITAL CRITICAL CARE TOWER

CANADIAN CONSULTING ENGINEERING AWARDS 2014 | CATEGORY - BUILDINGS



Photos Courtesy of: Ed White



THE SURREY MEMORIAL HOSPITAL REQUIRED EXPANSION AND REDEVELOPMENT TO MEET THE NEEDS OF A QUICKLY GROWING POPULATION. AS BRITISH COLUMBIA'S LARGEST HEALTHCARE PROJECT, THE 57,394M<sup>2</sup>, EIGHT-STOREY CRITICAL CARE TOWER EXPANSION TO THE SURREY MEMORIAL HOSPITAL WILL OFFER SIGNIFICANT IMPROVEMENTS TO PATIENT CARE IN SURREY, WHILE PROVIDING A WORLD-CLASS FACILITY THAT IS ADAPTABLE TO FUTURE NEEDS AND EXPANSION.

MMM GROUP LIMITED DESIGNED A HIGH-EFFICIENCY MECHANICAL AND ELECTRICAL SYSTEM UTILIZING A SUSTAINABLE APPROACH TO ATTAIN LEED GOLD.

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# INNOVATION

The electrical and mechanical systems for this facility are very complex and incorporate the benefits of being energy efficient and sustainable. The philosophy used in all aspects of the hospital design has been to create an environment that enhances patient safety and care. Various systems in the building have incorporated redundancy with a high degree of flexibility in order to remain operational at all times, including during and after adverse situations such as an earthquake.

THE NEW MECHANICAL DESIGN INCORPORATES A VARIETY OF INNOVATIONS. THE HVAC SYSTEM HAS BEEN DESIGNED TO PREVENT THE SPREAD OF AIR BORNE DISEASES BY NOT PERMITTING THE SUPPLY AIR TO BE RECIRCULATED BACK TO THE MAIN AIR HANDLING UNITS.

Typically each of the patient floors has been divided into four patient pods and staff have the ability to locally change the environment of each pod to 'infection control' mode. Signals are transmitted to the mechanical systems that modulate local air pressures to contain the infection locally and prevent its spread in the hospital.

Another design innovation was ensuring the isolation rooms would continue to maintain relative negative pressure during a fire alarm condition when the control of smoke migration was required. With a typical floor having had

an average of five fire zones, the innovative solution realized was for each of the zones to be ducted independently from the adjacent zone and each isolation room provided with a supply and return air valve. This enables Facility Maintenance and Operations to control the migration of smoke within a fire zone by positively pressurizing the surrounding zones and isolating the fire zone that set off the alarm. The project has been constructed with a helipad on the roof; the traditional concept of temporarily shutting down the air systems during a helicopter approach was not acceptable. Therefore, the air handling systems have been designed with redundant modules and comprehensive air monitoring and control systems that will mitigate the probability of having the helicopter fumes drawn into the building. The project was constructed using innovative, sophisticated and integrated electronic communications and security systems to provide a welcoming, safe, and secure environment for patients, visitors, and staff. Some of the technologies implemented include security management solutions, asset management, access control, video surveillance, and wireless communications. Through integration of these systems, real-time actionable information can be provided enabling quicker responses to clinical and security concerns that could otherwise quickly become unmanageable.





Photo: Ed White

# COMPLEXITY

The facility incorporated ductwork, piping, and mechanical equipment sized for future expansion and provision of redundant equipment, which takes up more floor and ceiling space than a traditional hospital design, already squeezed by building height restrictions. Further complexity is introduced by the need for redundancy, infection control, and post disaster provisions.

As described in the “Innovation” section, the project was constructed with a helipad on the roof; an alternative method of controlling the air systems during a helicopter approach was designed.

A high number of patient rooms required the ability to support invasive procedures and be provided with individual dialysis boxes.

The modern communications technologies employed in the tower enable the real time transmission and delivery of data that provides a clear picture of the patient’s health and how it is changing. The complications associated with the implementation of this system were due to the scale in functions and level of integration.

A new utility service corridor was constructed between the existing south tower and the new tower in order to extend the normal and



essential power systems and communication network infrastructure. The main electrical room houses three interconnected high voltage substations, supporting the building's electrical power connections; and two fire-rated electrical shafts to support the electrical equipment located within stacked electrical rooms on every floor. The essential and normal power distribution has been arranged such that failure of one riser feeder will not impact the operation of equipment and systems in the building.



Photo: Ed White



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# SOCIAL AND/OR ECONOMIC BENEFITS

**SURREY MEMORIAL HOSPITAL'S (SMH) CRITICAL CARE TOWER (CCT) ACCOMMODATES 48 PRIVATE ROOMS IN A NEONATAL CENTRE OF EXCELLENCE WITH AN ADJACENT PEDIATRIC PHARMACY, 25 INTENSIVE CARE BEDS, 20 BEDS FOR SERIOUSLY ILL PATIENTS IN THE HIGH ACUITY UNIT WITH SIX MORE BEDS ON THE SAME FLOOR, TWO MEDICAL FLOORS EACH WITH 36 BEDS, AN EXPANDED LABORATORY, A ROOFTOP HELIPAD, MORE THAN 440 NEW PARKING STALLS, AND ADDITIONAL SPACE FOR SMH'S CLINICAL ACADEMIC CAMPUS.**

With the societal expectation of advanced technology, the new CCT has incorporated modern electrical and communications systems and technologies intended to assist staff and improve the experience for patients. Concepts include the integration of the nurse call system with wireless communication capabilities for expanded coverage and quicker response times; and the combination of the patient admissions / discharge and nurse call systems to improve the transfer of patient information between clinical and administrative healthcare professionals. Natural daylighting is provided in all patient rooms, promoting a healing environment, reducing patient recovery times.

Economic benefits of the CCT include the creation of more than 3,250 construction related jobs. Coordination between consultant and contractor during design and construction allowed the building to be constructed within the tight schedule and on budget. In order to achieve overall lowest cost, labour costs were taken into account when selecting the mechanical and electrical equipment. The project utilized REVIT modelling to produce a coordinated design and minimize conflicts. The project was delivered using staged permits and design packages to facilitate fast-track construction program.



# ENVIRONMENTAL BENEFITS

**THE COLLABORATIVE TEAM DESIGNED A HIGH-EFFICIENCY MECHANICAL AND ELECTRICAL SYSTEM AND UTILIZED STATE-OF-THE-ART ENERGY EFFICIENT TECHNOLOGIES.**

Based on LEED, the design energy cost of the hospital was reduced by at least 55% when compared to the energy cost of a reference building designed to the Model National Energy Code for Buildings. The Critical Care Tower features state-of-the-art energy efficient electrical technologies such as LED lighting, efficient T5 and T8 lamps, low-mercury lamps, fluorescent dimming systems, ultra-low wattage exit signs, and occupancy sensors integrated with networked light controls. Outdoor light standards that reduce lighting pollution were selected.

Mechanical engineering highlights included the provision of a highly energy efficient system with the smallest footprint while meeting the Client's strict requirement to provide patients with the best healthcare environment to enhance the healing process. Utilizing air to water heat pumps complete with a heat recovery feature allowed the Coefficient of Performance to be double by simultaneously producing cooled water and low grade heat from the same unit. Cooling towers were not required, minimizing the risk of the Legionella bacteria. Post disaster, the heat pump would not require make-up water; this allows the building air conditioning to operate post disaster and reserves the domestic water reservoir for the patients.





Photo: Ed White

## MEETING CLIENT'S NEEDS

The goals of the Health Authority were to create a facility that was more responsive to patient, staff and the public's needs, striving to embrace technological advances using sophisticated equipment, reducing inefficiencies associated with the delivery of healthcare services and reducing the facility's operating costs. The intent was to create a facility that incorporated evidence-based design to achieve safe and therapeutic environments for patient care and promote efficient staff performance.

The project objectives included creating an over-arching design approach for environmental, economic, and social sustainability, while being adaptable to the facility's future needs and expansion.

The 57,394 m<sup>2</sup>, eight-storey Critical Care Tower expansion met these goals by achieving significant improvements to patient care in Surrey and provides Canada's fastest growing and diverse community with a world-class facility. Electrical and mechanical equipment and infrastructure has been designed to meet present and future requirements with minimal disruption to the facility. Easy maintenance is a key component; reducing noise, dust, and possible infection control issues. The facility is on track for LEED Gold certification. The consultant and construction team collaboratively worked with the health authority to achieve a highly sustainable facility, both during construction and for ongoing operations.