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Good health Hospitals are rapidly evolving



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Day procedures step-down beds. The image on the roof is a trompe l'oeil (trick of the eye), or as the architects prefer, a feature visual therapy panel.

An enhanced model of care

An Australian-based healthcare design practice has played a pivotal role in delivering Canada's first public-private partnership (P3) hospital, the 300-bed Abbotsford Regional Hospital and Cancer Centre.

Combining efficient and productive care-giving with energy efficiency is the challenge confronting all healthcare designers.

Though Australia is only now seeing the first of our next-generation hospital facilities nearing completion, Canada's first acute-care hospital to achieve Gold LEED (Leadership in Energy and Environmental Design) has been operating for more than two years. Gold

LEED is the North American equivalent of a 5 Star Green Star rating.

The C\$350 million (\$370 million), 300-bed Abbotsford Regional Hospital and Cancer Centre provides enhanced and specialised health services to more than 150,000 people in the greater Abbotsford area, and up to 330,000 people in the Fraser Valley region, located 100km north of Vancouver.

Replacing a facility just a third its size, the new building of over 60,000 sq m includes an integrated cancer centre and university-affiliated research and education centre. The "greenfield" location on which the centre is built challenged designers due to its sloping, undulating terrain and the need to incorporate natural woodland within the site.

Designed by Australian-based healthcare architects Silver Thomas Hanley (STH),



The main entry to the hospital, which has earned the equivalent of a 5 Star Green Star rating.

in a joint venture with Musson Cattell Mackey Partnership in Vancouver, the design sees the facility divided into six pods, each performing a different role, yet remaining closely organised around a central 24m high atrium.

It's an approach that reflects STH's philosophy for this type of building.

"Hospitals and healthcare facilities are cities within cities," says STH director Aija Thomas. "They have both a diversity and complexity of services, staff, patients and visitors."

The hospital's atrium is a visually stunning space, resembling the foyer of a recital hall or library rather than that of a hospital, and due to the building's design, remains a strong wayfinding element from almost any interior location, as well as assisting to flood the interior of the hospital with daylight.

Operationally, there are also benefits derived from the clearly defined zoned accommodation for acute care, day procedures, cancer care, ambulatory care, mental health and support services, with their integration designed around logical patterns of movement, promoting staff efficiencies by minimising travel between frequently used spaces.

The calm, healing atmosphere achieved is a reflection of evidence-based design, which advocates rooms containing at most two beds. Research suggests this provides increased control for patients over their environment, and considerably more privacy than traditional four-bed wards.

This design approach also minimises physical exertion for staff, and takes into consideration the latest infection-control strategies. Large windows capture both daylight and pleasant views of the surrounding greenery for the benefit of patients – and other users of the space.

"Vibrant colours are also a feature of the interior design, as are clever facades on walls and ceilings depicting natural scenes where they could otherwise not be achieved by windows. These contribute to achieving a lively, uplifting and engaging interior"

"Our architecture and design provides a solution that seeks to enhance the experience for all users of our clients' facilities," says Thomas. "Patients, staff and visitors are recognised as both short – and long-term occupants of the healthcare environment, and we respond to their different requirements."

The atmosphere at the Abbotsford Regional Hospital and Cancer Centre is enhanced by the numerous respite areas of courtyards and gardens, which promote an "outward looking internal environment".

Vibrant colours are also a feature of the interior design, as are clever facades on walls and ceilings depicting natural scenes where they could otherwise not be achieved by windows. These contribute to achieving a lively, uplifting and engaging interior.

DESIGNING FOR TOMORROW

The size of the building, new models of care and the unusual procurement model as a public-private partnership project (P3) created many challenges in the briefing phases, not least of which was ensuring stakeholders and users understood their own requirements.

Each program and health area was reviewed and developed to ensure clinical best practices would meet the long-term needs of the region, and to incorporate recent innovations in healthcare. One example is the infection-control strategy, which was revised in light of a SARS outbreak. This resulted in a significant number of rooms being designed as negative-pressure isolation rooms, which are essential to effective management of disease control.

In an effort to improve the brief, the design team took the opportunity to work more closely with the client to question assumptions. This required closer dialogue between designer and client, with normal or standard procedures disregarded if deemed inefficient or inappropriate. The result? An enhanced model of care that has



A single-bed patient room. Evidence-based design advocates hospital rooms containing at most two beds.

proved to be more therapeutic for patients and more effective for staff.

Consideration of the 50-year service life of the facility meant significant future proofing was incorporated into the design.

Adaptability and flexibility for expansion was deemed paramount, evidenced by the building's compact footprint (50 per cent of the site is undeveloped) and centrally located to allow the six pods to grow outwardly while the design maintains its central link to the inner atrium.

Mechanical services can also expand due to spare riser space capacity, uniform structural grids, and generous floor-to-floor heights providing flexibility in layout. Demountable facades provide for further expansion and allow access for large equipment installations.

ACHIEVING ENERGY EFFICIENCY

Energy efficiency and carbon footprint were addressed from the earliest stages of the design. Although initially expected to achieve a LEED Silver certification (the equivalent of 4 Star Green Star), the building earned LEED Gold accreditation this time last year.

The building's solar orientation, air conditioning plant design and building envelope thermal efficiency through the use of low e-glazing all contribute to it using 38 per cent less energy, with reduced ongoing energy costs of C\$480,000 annually, compared to compliant designs.

“In order to achieve the building's energy targets, it was necessary to rethink typical hospital design practice and come up with cost-effective solutions that were acceptable to all the contractors”

This was achieved through energy modelling and a collaborative design approach between end users, design and cost consultants, with model simulation measuring 13 systems, 238 zones, 488 spaces, 524 shell elements and 9,000 individual fixtures.

Literally hundreds of possible energy saving strategies were analysed, using sophisticated simulation software.

In order to achieve the building's energy targets, it was necessary to rethink typical hospital design practice and come up with cost-effective solutions that were acceptable to all the contractors.

ENERGY-EFFICIENT MECHANICAL SERVICES

High-efficiency gas-fired hot water boilers are used for building heating; two 4,900kW and one 2,000kW 85 per cent efficient hot water boilers are located in the hospital's central power plant.

A flue gas-heat recovery system, using heat exchangers located in the combined boiler breeching, recover up to 700kW of energy that would normally be wasted. The recovered energy is used for heating the building and domestic hot water.

A high-efficiency chilled water generation system is used for air conditioning portions of the building; two 900-tonne chillers are piped in counter-flow configuration with a chilled water temperature reset control to optimise energy efficiency.

The chillers consume a maximum 0.5kW/tonne of cooling. A condenser water heat-recovery system recovers up to 980 kW of energy that would normally be wasted.

COVER FEATURE



The linear accelerator in the cancer centre, featuring a visual therapy panel on the roof.

The recovered energy is used for pre-heating the hospital's domestic hot water.

An exhaust-air heat-recovery system recovers energy from all significant exhaust air systems. The recovered energy is used to reduce the energy impact of the large 100 per cent outside-air systems serving the operating rooms, laboratory and intensive care areas.

Variable speed control is used on all significant fans and circulating pumps. For example, the chilled-water circulating pumps and the secondary heating water pumps have variable flow control to reduce energy consumption at non-peak operating times.

“Hospitals and healthcare facilities are cities within cities. They have both a diversity and complexity of services, staff, patients and visitors”

Bypass control on all heat recovery and cooling coils reduces standby energy losses. For example, automatic bypass dampers open when the heat recovery coil is not recovering energy.

Demand ventilation control is used; CO₂ and occupancy sensors control the amount of ventilation air supplied into non-critical areas of the hospital.

Low-flow plumbing fixtures reduce the energy required to heat the domestic hot water.

Energy-efficient lighting systems have a power density of 8.9W/sq m; a typical Canadian hospital has a lighting power density of 15.3W/sq m.

The high performance-building envelope has low-e glazing, with selective shading coefficients for control of building heating and cooling loads.

Air quality was recognised for its impact on the healing process as well as on staff productivity, with VOC levels reduced, and user control of zoned internal environments introduced. Post-occupancy evaluations conducted during the hospital's first year of operation are evidence that this design is successfully providing an environment that is both therapeutic to patients, as well as attracting a high calibre of staff.

“Healthy environments help speed up the healing process for our patients,” says Dr Nigel Murray, president and CEO of Fraser Health, a public sector partner for the project.

“Natural light and views to green spaces in patient rooms and many other facility features are beneficial for patients, as well as our staff, physicians, and volunteers.” ■

PROJECT AT A GLANCE

The professionals

Architects:
**Silver Thomas Hanley/Musson
Cattell Mackey**

Construction:
PCL Constructors Westcoast

Energy simulation:
EnerSys Analytics

Independent commissioning agent: **Airmec Systems**

Mechanical engineering:
Stantec Consulting