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CANADA MORTGAGE AND HOUSING CORPORATION

Better Buildings

Issue 2

OPERATING • MANAGING • REPAIR • RETROFIT • RENOVATION

Parkade Ventilation Retrofit

An existing four-level underground parkade at an apartment building in Victoria, B.C. needed a new ventilation system. The "naturally ventilated" top level did not meet B.C. Building Code requirements for an "open-air storey". Two, 25-year old, continuous-operation fan systems ventilated the bottom three levels. Residents complained for years about the noise caused by one fan, which was mounted on the exterior wall of the building. The other fan, in a small room in the parkade, was difficult to access for maintenance, had restricted air flow, and wasted storage space.

The project's objectives were:

- increase parkade ventilation
- reduce fan noise, maintenance and energy costs
- bring the top parking level up to B.C. Building Code standards
- increase storage area.

To do this, the owners built a new mechanical room for the west fan and installed two new exhaust systems. The exhaust systems included carbon monoxide and combustible gas sensors. The mechanical ventilation systems were expanded to serve the top level.

The new mechanical room was built when the gas detection systems were in place. It took two days to complete the work. The construction work did not disrupt parking for the residents.

The total project cost was $117,461 (plus GST). The design-build team of a local ventilation company, mechanical contractors and engineers had a contract based on solutions proposed in writing to the owner. The project started in June 1998, and took about six weeks to complete, which is standard for this type of work.

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Because the project added a new mechanical room, the City of Victoria required a Development Permit that included a detailed submission. It took several weeks to go through the Development Permit process. The owner's operating capital paid for the project.

The project's success is the result of a mix of common sense, appropriate technology, and basic engineering.

Technical and Engineering Considerations

The original design considered the top level an "open-air storey" that did not require mechanical ventilation. The current B.C. Building Code states that an open-air storey must have 25 per cent of the perimeter wall area open to the outside, and provide cross-ventilation.

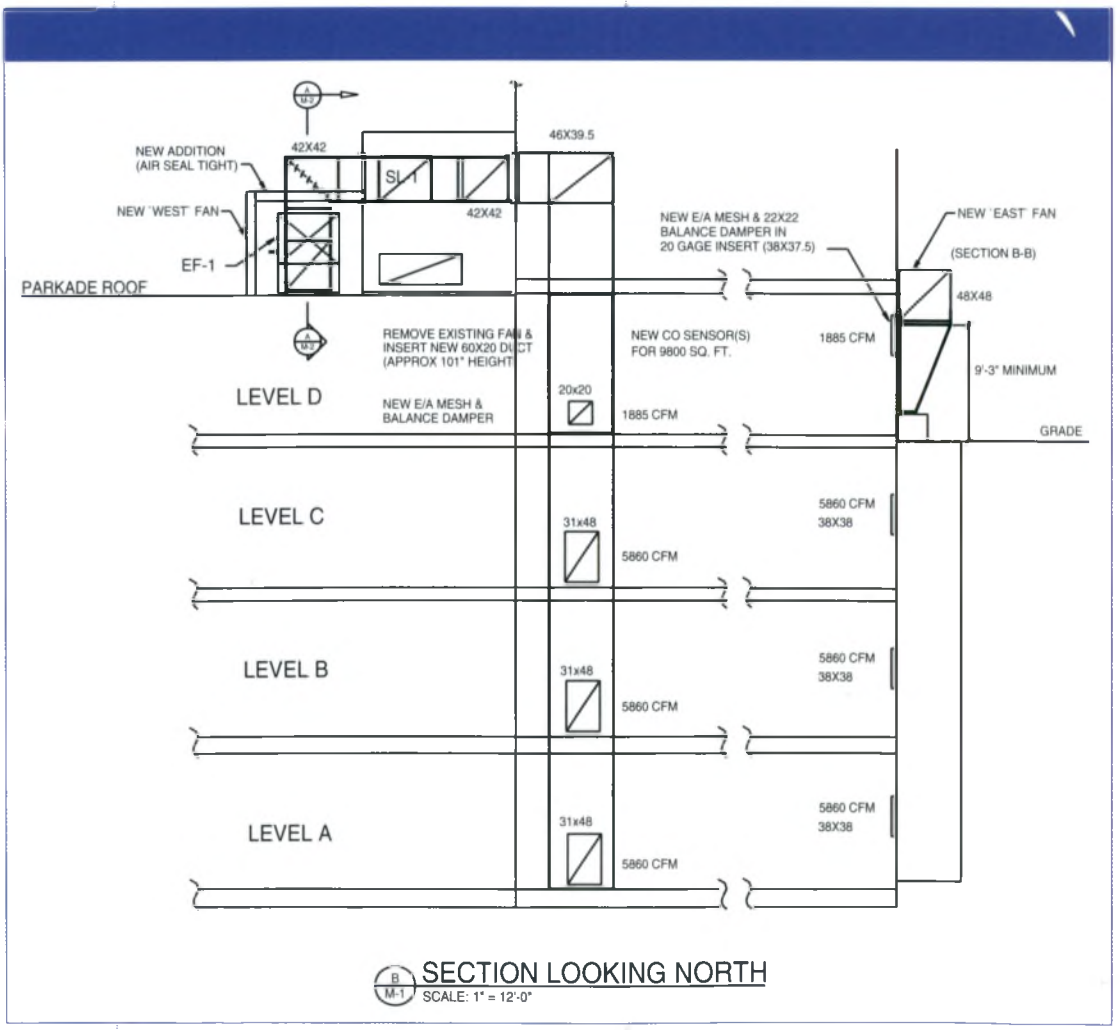
East (supply) and west (exhaust) continuous-operation fan systems ventilated the lower levels of the parkade. The tube-axial fans moved about 9,450 L/s (20,000 cfm.) through the parkade. They were not large enough to ventilate the parkade to the current B.C. Building Code requirement of 0.77 cfm/ft^2 (0.77 cfm/ft^2 = 3.9 L/s/m^2). They were also installed without sufficient attention to flow restrictions.

The 7.5-horsepower, unsilenced fan was mounted on the east, outside wall close to apartment windows. The fan's location made already high maintenance costs even higher. The west fan, in a small room inside the parkade, was also difficult to reach for maintenance. Because the fans ran all the time, the energy consumption cost was about $6,500 a year.

The Solutions

Improved ventilation: The undersized supply and exhaust fans were replaced with two new exhaust fans capable of exhausting the entire parkade to 3.9 L/s per square metre of floor area.(.77cfm/ft^2). The new east fan is a 10-horsepower, 36-inch tube-axial fan. The new west fan is a 10-horsepower centrifugal fan. Each system can exhaust 9,185 L/s (19,475 cfm), almost twice the capacity of the old fans.

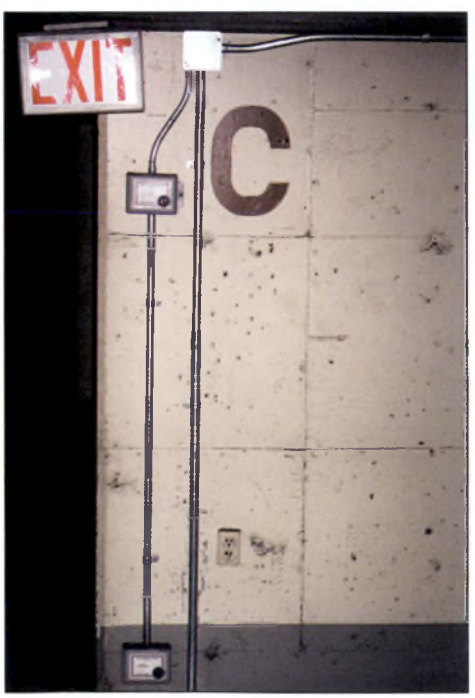
Compliance with B.C. Building Code: The ducts from the old east fan system go through the top level of the parkade. By installing an exhaust louver at the old duct and



sizing the new fans to accommodate the increased air flow capacity requirements, the top level is now mechanically ventilated. The entire parkade now meets B.C. Building Code ventilation requirements.

Reduction in noise levels: Dissipative silencers were applied to the intakes and outlets of both new fans. The insertion losses (dB) associated with the silencers resulted in approximately 65 dBA at the outlet. Vibration isolators and flexible duct connectors reduce motor vibration and provide sound insulation.

Reduction in energy costs: There are 20 CO sensors installed at a five feet height (the "breathing zone") throughout the garage. Another 20 combustible gas sensors, to detect gases such as propane, methane, and gasoline fumes were installed throughout the garage within six inches of the floor. The sensors connect to a control system that turns on the fans if CO concentrations rise to 50 ppm (parts per million). An alarm goes off if CO rises to 100 ppm. If propane reaches



10 per cent of the lower explosion level (LEL) concentration, the fans turn on after two minutes. An alarm goes off if propane reaches 20 per cent LEL.

The fans run for at least 10 minutes after the sensors start them. If the sensors show safe gas levels after 10 minutes, the sensors shut the fans off. If gas levels are not safe, the fans keep running until levels are safe. With properly set-up sensors, the fans will run between one and two hours a day, cutting electricity costs by $6,000 a year.

Increased storage area: Since a new mechanical room was constructed for the west fan, the old mechanical room was converted to a storage room.

Reduction in maintenance costs: The new fans do not have to run all the time. They have carbon monoxide (CO) and combustible gas sensors and controls (see energy costs, below). When the sensors detect gas levels above a set point, the fans turn on. The new mechanical room contains proper clearance for maintenance around the unit. Proper intake and discharge duct configurations for the east fan allow for balanced blade loading. The west fan duct configuration was also improved. The new centrifugal fan has a much lower impeller speed than the old axial fan. These features reduce maintenance, wear and tear.

Scheduling

The CO and combustible gas sensors were installed first to minimize difficulties from a lack of ventilation during the change to new fans. The sensors would set off an alarm if gas levels were dangerous. The original west fan operated during the east fan switch-over. The original east fan was taken apart and the new one installed within two days.

The new west mechanical room was built, air distribution systems installed, and the louver in the top floor duct installed before the fan switch-over. The new west system was integrated with the original system so that at switch-over, the only work was removing the old fan, installing straight duct in its place, and making the duct connection from the old discharge louver to the new fan intake duct. The new east fan ran during this work.

The Cost

The total project costs, which were paid from the owner's operating capital, were $117,461 plus GST, broken down as follows:

CO Monitoring System	$ 27,300
New Fan Room	$ 13,475
Ventilation Systems	$ 69,076
Design and project management	$ 6,610
Development Permit	$ 1,000
Total:	$117,461

The Results

The success of this ventilation retrofit project is due to a mix of common sense, appropriate technology, and basic engineering. The property manager reports better ventilation, reduced noise and lower energy and maintenance costs. The payback from energy cost reduction alone is estimated at 4.5 years. There are no tenant complaints about noise and vibration—which the property manager feels will cut turn-over. In meeting the requirements of the B.C. Building Code, the new ventilation systems have lowered costs and added to the value of the building.

Contacts

Owner:
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N-Viro Air Ltd. (Gerry Lentz)

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Manager:
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For more information about building envelope solutions and best practices, visit the Canada Mortgage and Housing (CMHC) web site at www.cmhc-schl.gc.ca and visit the Highrise and Multiples site at www.cmhc-schl.gc.ca/research/highrise/

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