# WATTBLOCK

# HVAC Review

[redacted]

[redacted]

**Updated: 6th July 2016**


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# HVAC Review

[redacted]

[redacted] is a residential strata block consisting of 85 units split across 2 buildings of 6 and 7 floors respectively. There are 2 levels of underground parking, 2 electric gates, 4 entrance foyers, 4 lifts, and 4 fire escapes. Total electricity billing for common areas is approximately $14,000 p.a. Wattblock has previously estimated that approximately one fifth of this spend would be for common area Heating, Ventilation and Air Conditioning (HVAC).

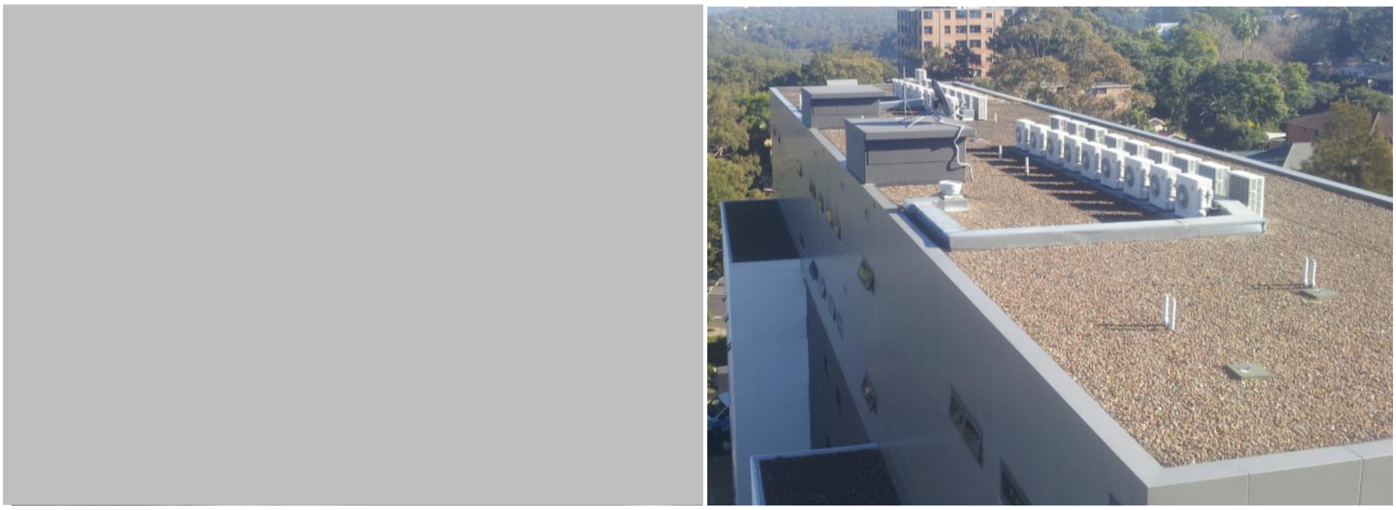


*Fig. 1 [redacted] street front view of Building A, Rooftop view of Building A*

This review indicates that there are 12 common area ventilation fans across car parking, foyers, comms rooms, hydraulic services room, fire room, switch rooms, and garbage ventilation. [redacted] does not have common area air conditioning or centralised heating or cooling for apartments. There are air conditioning units on the roof which are connected directly to individual apartments and not powered off common power. Figure 2 on the following page sets out the general location of ventilation features of the building.

<u>Site Visit Details</u>

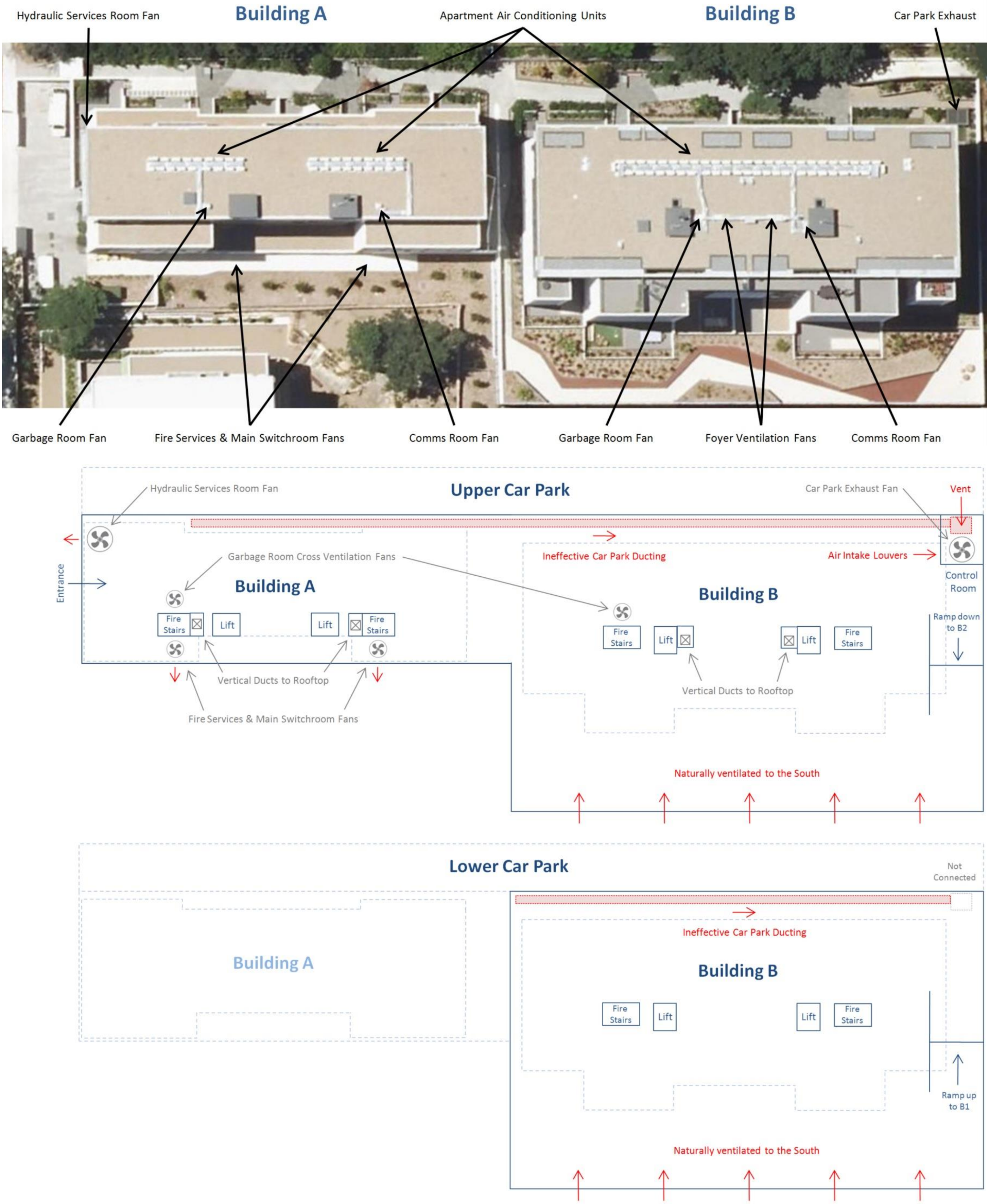
**Date:** 16th June 2016

**Time:** 8:30am – 10:30am

**Participants:** [redacted]

**Strata Agent:** [redacted]

*Fig. 2 Building Plan Views – Ventilation Features*



**Ventilation Control Room**

All common area ventilation fans are controlled via a dashboard which is shown in figure 3 below. This ventilation control dashboard in co-located in the main car park ventilation room, which is positioned in the north east corner of the upper car park area beneath Building B. This is labeled as ‘Control Room’ in figure 2.

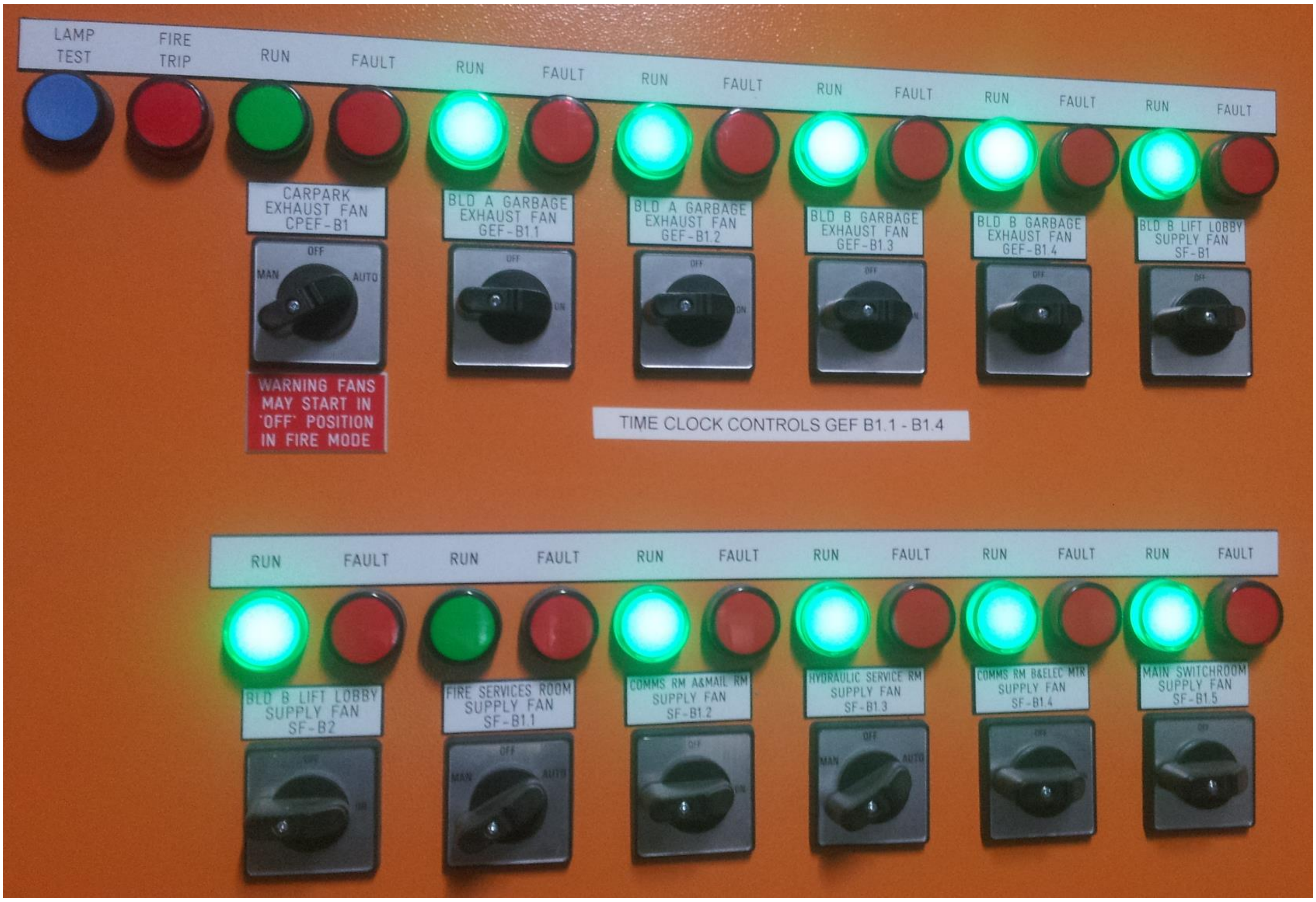



*Fig. 3 Fan Control System located in Car park Exhaust Room*

During the on site visit all systems were examined and deemed to be in working condition. Several tests were conducted on the car park exhaust fan and this was found to be operating normally. No faults were discovered. As a general observation this control panel allows all systems to be manually turned off and on to facilitate testing ventilation airflows and noise levels at any time. Such tests should be conducted in the presence of the building manager and all dials should be returned to their default positions as shown in figure 3.

The following pages review the various ventilation systems that are represented on this dashboard control system. For ease of reference the labeled code numbers on the control panel are indicated in each section of the report.

**Car Park Exhaust Fan (CPEF-B1)**

[redacted] has two levels of underground car parking. The first level extends underneath the length of both Building A and Building B. A security entrance at street level on the west end of Building A provides access from [redacted] Road. The lower car park level sits beneath Building B with the access ramp between the two levels being at the far east end of the car park. It is notable that the south end of the car park is open and this provides highly efficient natural ventilation of fumes from the car park.

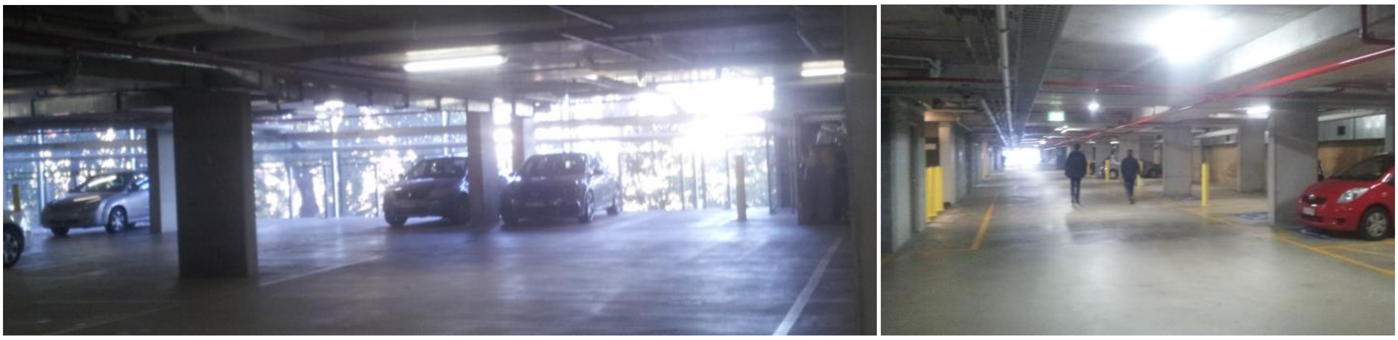


*Fig. 4 From left to right, Natural car park ventilation open to the south, Length of upper car park level to entrance*

In the far north east corner of the upper car park there is a car park ventilation room. While the access door is normally closed, the ventilation room effectively works by sucking air into the room from the surrounding car park and venting it out of the building. This vent is located in the north east corner of the property as indicated on the map in figure 2 and in figure 5 below. There is a large louvered wall panel in the external wall of the ventilation room which acts as the primary air intake to the room as shown in figure 5.


*Fig. 5 From left to right, Car park ventilation room with louvered wall panel intake, External vent located in garden*

The car park ventilation system consists of a large ~5.5kW Fantech exhaust fan, a variable speed drive, carbon monoxide (CO) sensors and ductwork. The fan is set to the ‘Auto’ position on the fan control dashboard and this setting means that the fan is controlled by the carbon monoxide (CO) sensors which are distributed throughout the car park. This fan will also operate during fire mode even if set to the 'Off' position.

While this is a very high powered fan it is driven by a Variable Speed Drive (VSD) which increases in speed gradually in response to the CO sensors. Because the car park is naturally ventilated the fans should not be triggered very often. When they are triggered the fan would usually only operate at a low level before running down again. The building manager estimated that this fan operates for a total of approximately 1 hour per week, which confirms expectations of low operating hours.

*Fig. 6 From left to right, ~5.5kW Fantech exhaust fan, Carpark ductwork connects in behind the fan*

During the onsite visit the fan was tested to observe airflow dynamics and efficiency. When switched to the 'On' position the fan gradually starts to build up speed and pull air through the main intake. The fan sits in-line within the large barrel shape in Figure 6 with the intake being at the left side of the picture. The intake is 1-2 meters in diameter commensurate with the power of the fan. However, it is positioned with only centimeters of clearance from a wall which dramatically reduces efficiency of air flow intake.

Outside the car park ventilation room there is a network of ducting on both the upper and lower car park areas. The ducting runs along the north wall with vertical channels pulling air from ground level into the ducts. However, the ducting on both levels were not operating effectively. According to the Fantech technician the lower level ductwork was not actually connected to the car park ventilation room at all. Figure 7 shows the lower level ductwork ends in a ventilation box that does not appear to connect up into the car park ventilation room.

The upper level ductwork was confirmed to connect through to the car park ventilation room, but was sitting behind the fan, rather than in-line in front of the fan. While the system is still operating to suck air through the upper level ductwork by way of venturi airflow dynamics, the volume was extremely low. The airflow pressure was insufficient to hold a sheet of paper against the intake grills along the ducting. However, despite the ineffective ducting, there is a large louvered vent on the outside wall of the car park ventilation room that serves as the main air intake. This was generating enough air pressure to hold a thick notepad against the grill.

*Fig. 7 From left to right, Ductwork running along north wall, Lower level ductwork beneath ventilation room*

Overall the system was deemed to be an inefficient design. While the system configuration is not efficient in terms of airflow dynamics, the operating costs are estimated to be very low. The presence of natural ventilation, carbon monoxide (CO) sensor controls and the variable speed drive is expected to translate to very low operating hours. At full speed the exhaust fan will be consuming a large amount of energy. However, the variable speed drive allows the exhaust fan to operate at lower speeds depending on the level of carbon monoxide.

The car park ventilation fan itself generates a considerable level of noise when operating at full power. Inside the ventilation room itself the noise level was such that it became necessary to speak with raised voices. Immediately outside the car park ventilation room with the door closed the volume dropped off dramatically but was still quite loud. However, as you moved further away the fan was less audible and could not be heard at all at the far entrance of the car park. Furthermore the fan could not easily be heard immediately outside the external vent in the far north east corner of the garden. There was some noise created by the airflow rustling the leaves immediately outside the vent. It is also observed that due to the variable speed drive the noise generated by the fan increases gradually over a period of several minutes. There is no abrupt stopping and starting with this system.

While the system is expected to be very low cost, the inefficient airflow dynamics could be improved with some minor energy savings and noise reduction benefits (eg 5 decibel reduction). Within the space constraints of the ventilation room the existing axial fan could be replaced with a smaller, more efficient centrifugal fan configured to suck air in-line through the car park ducting on both levels. This is likely to be a very expensive project noting that the existing fan has been built into the room and is larger than the access door.

An alternative solution to consider is Fantech's JetVent system. This is ideal for car parking spaces with good natural ventilation such as JetVents are small low powered fans that run off CO sensors and can be positioned at points around the car park to push air out through to open areas. Such a system would enable the decommissioning of the existing ~5.5kW fan and all the ineffective ductwork. This would also free up the existing car park ventilation room for other purposes.

The advice from the Fantech technician that the lower level car park ductwork is not connected to the ventilation room may raise some concerns. The implication is that there is effectively no direct ventilation of the lower level and therefore higher risk of carbon monoxide poisoning. However, the overall car parking space is controlled by distributed CO detectors and these are rarely being triggered.

With a more efficient design you might reduce the operating power and operating hours with resulting lower power bills and noise reduction as well as rectification of lower level car park ventilation efficacy.

**Hydraulic Service Room Supply Fan (SF – B1-3)**

The Hydraulic Service Room supply fan is set to the 'Auto' position.  This is estimated to be a ~0.6kW fan which represents mid range power consumption.  The building manager advised that this fan actually operates 24 hours a day and is necessary to extract hot air out of the room.  The Hydraulic Service Room contains common hot water boilers that operate constantly throughout the day.  These boilers service the hot water usage of the apartments.  Even though hot water usage is expected to peak during the morning and evening hours, the boilers maintain a large body of water at a high temperature for ready usage.


*Fig. 8  From left to right, intake vent on access door, in-line fan, and vent on external wall near car park entrance*

This fan generates a noticeable level of noise immediately outside the room near the entrance to the car park.  However, the noise level is expected to be constant and not stopping and starting as would be the case with sensor or timer controls. For the avoidance of doubt, the operation and noise levels of the fans can be readily tested by alternately switching the setting between the 'Off' and the 'Man' (manual) or on position.  The setting should be returned to the 'Auto' position at the conclusion of any testing.

It may be possible to implement a Variable Speed Control system which operates in response to temperature based sensors.  However, this is likely to be an expensive project and should not be considered without a broader review of hot water efficiency.  In all probability an expensive sensor system may well end up running 24 hours a day anyway because of the heat levels in the room.  On the other hand a water efficiency review may reveal that the water heating systems are not efficient and can be improved by better insulation which may implicate changes to ventilation requirements.

**Garbage Exhaust Fans (GEF – B1-1) (GEF – B1-2) (GEF – B1-3) (GEF – B1-4)**

There are two garbage exhausts fans in operation in Building A (GEF – B1-1 and GEF – B1-2). There are a further two garbage exhausts fans in operation in Building B (GEF – B1-3 and GEF – B1-4).

There are several garbage rooms located in the upper car park level in each of both Building A and Building B. It was observed in both buildings that these rooms were joined together by flat ductwork and a ~0.36kW Fantech in-line fan that moved air from one room to the next. These fans are located in the upper car park, the first being near the entrance beneath Building A, and the second being deeper into the car park beneath Building B.

*Fig. 9 From left to right, Flat ductwork from one garbage room, with in-line fan, pushes air to next garbage room*

The second set of fans were determined to sit at the top of two separate garbage chutes that run vertically up to the roof of Building A and Building B. These fans are a low powered Fantech 0.15kW rooftop fans.


*Fig. 10 From left to right, Vertical garbage shoot access on levels, with rooftop fan at the top, Control switch close up*

All four fans are set to the 'On' position which is controlled by a time clock controller. The time clock controller is manually set to turn on and off according to the settings. At the time of the site visit the settings were configured to turn on at 7am and off at 8pm. This system was deemed to be energy efficient with appropriately sized low power fans and an effective ductwork configuration.

Further energy savings could be achieved by reducing the hours of operation on the timer settings. Another Wattblock customer was able to reduce hours of garbage ventilation to three hours in the middle of the day. They also reduced garbage room smells by employing a bin cleaning service. Oz Bin Cleaning offers monthly cleaning for as little as $65 per visit. This is overall a more hygienic longer term solution for healthy garbage rooms.

While the noise levels were noticeable immediately outside the garbage rooms near the in-line fans, the timer system hours of operation were set to operate during the daytime to avoid disturbing residents at night. It is noted that the timer settings can be adjusted to test noise levels at different times of the day if there were any concerns. One of the garbage rooms was located near the car park entrance of the west side of Building A with in-line fan shown in figure 9. The fans located on the roof are unlikely to be causing any noise issues.

If the in-line fans in the car park where considered to be causing a noise disturbance, it might be possible to turn them off and rely solely on the rooftop fans. As noted, in each building the in-line fan serves to push air from one garbage room to the next, from which the rooftop fan pulls the air up and out of the building. By turning off the in-line fan the rooftop fan would still suck air up from all the first garbage room which in turn would suck air through the ducting from the other garbage rooms. However, to be effective the operating hours of the rooftop fan might need to be increased or the fan replaced with a higher powered fan.

**Fire Services Room Supply Fan (SF – B1-1)**

The Fire Services Room Supply Fan is set to the ‘Auto’ position. This is set to operate only when fire mode is triggered. The operation of the fire services supply fan was not tested during the site visit but is understood to be in working order and compliant with fire safety regulations. It is noted that this fan can be manually set to the ‘Man’ (manual) or on position at any time to confirm the fan is operating normally and observe noise. Ensure the setting is returned to the ‘Auto’ position after any testing.

Because this fan would normally only operate in the event that fire mode is activated it will not be drawing power or have any impact on noise levels. Energy efficiency projects will not have a reasonable payback period.

**Main Switchroom Supply Fan (SF – B1-5)**

This fan provides ventilation to the Main Switchroom. This fan is set to the 'On' position and runs 24 hours a day. This is an external facing vent and considered unlikely to be contributing to noise issues. However, the system can alternately be set to the 'On' and 'Off' position to test impact on noise levels. This is a low powered fan similar in size to the comms room ventilation fans, with low energy consumption. Some power savings could be achieved by introducing a timer system and setting it up to operate over fewer hours each day. Although not likely to be material the costs to implement such a project should deliver savings with a 3-5 year payback.

**Communications Room A & Mail Room Supply Fan (SF – B1-2)**

This fan provides ventilation to both the Mail Room and the Communications Room in Building A. The fan is set to the 'On' position and runs 24 hours a day. This is a low powered Fantech 0.15kW rooftop fan which pulls air up from the lower Communications Room A & Mail Room to the roof. For further analysis see the following section.

**Communications Room B & Electricity Meter Room Supply Fan (SF – B 1-4)**

This fan provides ventilation to both the Electricity Meter Room and the Communications Room in Building B. The fan is set to the 'On' position and runs 24 hours a day. This is a low powered Fantech 0.15kW rooftop fan which pulls air up from the lower Communications Room A & Mail Room to the roof.


*Fig. 11 From left to right, Comms topper fan Building A, Comms topper fan Building B, Rating label close up*

Due to the location of the these fans on the roofs of Building A and Building B and the low power ratings, these fans are unlikely to have any noise impacts on residents. A timer system could be introduced to operate over fewer hours each day. Although not likely to be material the costs to implement such a project should deliver savings with a 3-5 year payback.

**Building B Lift Lobby Supply Fans (SF – B1) (SF – B2)**

Building B has additional ventilation for the lobby area supplied by two fans located on the roof of Building B. Both fans are set to the 'On' position and run 24 hours a day. These are low powered Fantech 0.36 kW in-line fans positioned inside ducting on the roof between the two lift rooms. This ducting is raised off the surface of the roof providing clearance for cable channels that service the apartment air conditioning systems. The foyer ventilation system is not connected to any air conditioning itself.

The foyer ventilation ducting sucks air from the roof and pushes it down through two vertical ducts running down to the ground floor. There is one fan for each vertical shaft. On the roof the ducting connects the two channels together and the air intake is located midway between the two fans on the horizontal section of ducting. Figure 12 shows the horizontal section of ducting and the location of the two fans can be seen where the ducting is supported by concrete foundations at either end.


*Fig. 12 From left to right, Foyer ducting on roof connects vertical shafts, Fan control switch, Rating label close up*

Due to the location of the these fans on the roofs of Building B and the low power ratings, these fans are unlikely to have any noise impacts on residents. A timer system could be introduced to operate over fewer hours each day. Although not likely to be material the costs to implement such a project should deliver savings with a 3-5 year payback. There are also passive ventilation systems that do not consume any power and rely on wind to drive airflow through the building (See Product Information section). Consideration should also be given to amenity impacts to residents in Building B should a passive ventilation system or timer system be introduced to reduce the hours in which the Foyer ventilation is operating.

**Apartment Ventilation**

Ventilation of bathrooms, laundries and kitchens is through vents in side walls.  Some apartments have additional vents on the roof which may be for kitchen rangehoods if not bathrooms and laundries.  Top floor apartments in Building B have mechanical louvers on the roof above balcony space.  All these systems are covered by individual energy billing to apartments.

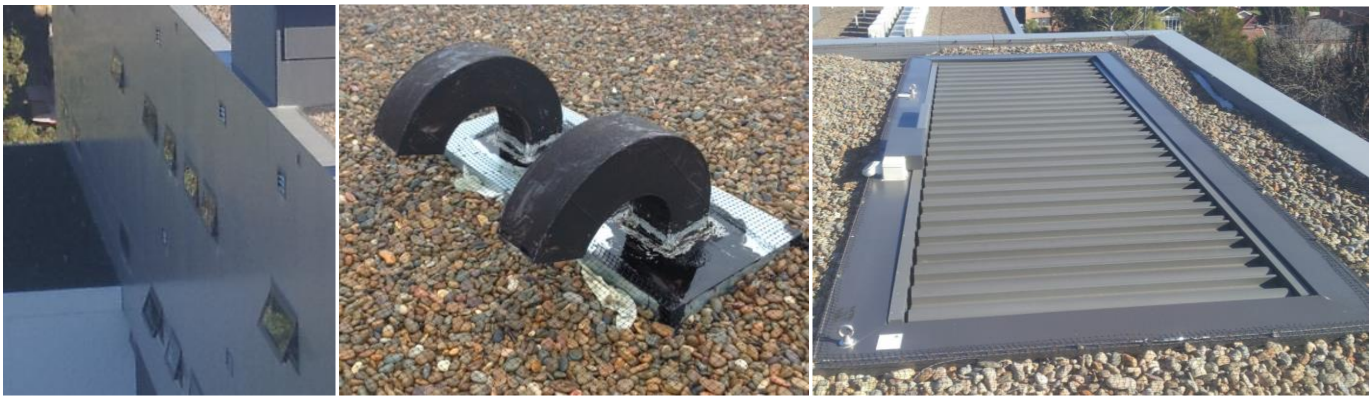


*Fig. 13  From left to right, apartment vents on external walls, rooftop vents, and rooftop louvers*

Testing noise level impacts of individual apartment ventilation systems is beyond the scope of this assessment.  Individual unit owners are encouraged to investigate their own apartment ventilation systems if they suspect that noise levels are an issue.  Some apartment buildings have common ventilation for apartments facilitated by vertical shafts pulling air through apartment bathrooms, laundries and kitchens up to higher powered rooftop fans.  This has been known to create noise issues in apartments, particularly those in the upper levels closer to the fans.  However, this apartment complex appears to have individual ventilation directly through external walls and most likely using low powered fans.

**Apartment Air Conditioning**

There are 36 air conditioning units on the roof of Building A and a further 50 air conditioning units on the roof of Building B.  Most air conditioner units are 2012 model Mitsubishi Electric systems rated 3.79kW for cooling and 3.9kW for heating.  There are a few larger units on Building B.

The units are collected together in rows along the middle of the roofs with ducting used to protect cables and pipes from the weather elements.  This ductwork is not used to facilitate common airflow.  Individual pipes run inside the ductwork to service the apartments and the units are connected to apartment energy billing.

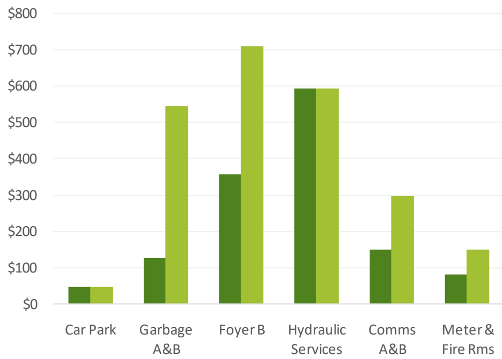
*Fig. 14  From left to right, air conditioners in rows on the roof, larger units, and ductwork usage for cables and pipes*

Each unit is rated at 66dBA which may result in considerable noise levels when all systems are operating.  However, due to the location of the units on the middle of the roofs it is expected the noise will not carry to the apartments. Apartments most likely effected would be the upper levels.

**Financial Summary**

Based on this ventilation assessment Wattblock estimates that common area ventilation is costing approximately $2,340 each year in electricity usage costs. This is estimated to be distributed between the common area systems as shown in the financial summary table below. This breakdown is based on information about the operating times and power ratings as noted in the prior sections of the report for each area. Maintenance costs are not included.

| Ventilation | Annual Cost | Optimised | Est. Savings |
|---|---|---|---|
| Car Park Exhaust | $45 | $45 | $0 |
| Garbage Exhaust A&B | $546 | $126 | $420 |
| Foyer B Exhaust | $711 | $356 | $356 |
| Hydraulic Services Exhaust | $593 | $593 | $0 |
| Comms A&B Exhaust | $296 | $148 | $148 |
| Meter & Fire Services Exhaust | $148 | $80 | $68 |
| **Total** | **$2,340** | **$1,348** | **$992** |




Based on a technical review of each area a total annual energy savings opportunity of $992 for common area ventilation systems is estimated. Energy usage rate of 11.3c per kWh is based on billing data.

Not all savings are readily achievable within reasonable payback constraints. The following section provides more information on possible technologies that may be relevant.

**Product Information**

<u>Variable Speed Drives</u>

Variable Speed Drives (also known as Frequency Inverters) can be used to control conventional motors in fans, pumps, and other machinery provided they have adequate cooling. Where speeds may be selected from several different pre-set ranges, usually the drive is said to be an Adjustable Speed Drive (ASD). If the output speed can be changed without steps over a range, the drive is usually referred to as a Variable Speed Drive (VSD).

In application to exhaust fans VSDs allow the fans to start slowly and gradually reach full speed instead of a sudden jump to maximum output. This has various benefits including energy savings, maintenance savings, and noise reduction. Noise levels will be lower when the fan is not operating at full output, but it also avoids the usual transition sounds when fans turn off and on. Maintenance savings come about through reduced wear and tear on the exhaust fan which extends its lifespan.


*Fig. 16 From left to right, Energy savings from VSD demand control vs two speed fans, Examples of Fantech VSDs*

The control of conventional motors is more effectively done using frequency inverters which vary the motor speed by varying the frequency of the electrical supply. Recent developments in power electronics have resulted in drive efficiencies as high as 98% being achieved with additional benefits of reduced noise levels, reduced harmonic distortion to supply, increased ratings and improved reliability.

[redacted] already has a VSD system controlling the car park ventilation fan in response to carbon monoxide sensors. While the overall airflow dynamics of the system are poor, the technology has already been adopted and the above benefits have been realised.

References:

Fantech Website - http://www.fantech.com.au/AncilRange.aspx?RangeID=41
Spitzer, David W. (1990). Variable Speed Drives. Instrument Society of America. ISBN 1-55617-242-7.

<u>JetVent Impulse Ventilation</u>

Fantech distributes a range of 'JetVent' Impulse Ventilation fans in Australia, New Zealand and South East Asia. This is a viable alternative for [redacted] car park ventilation taking better advantage of the open characteristics.

*Fig. 15 From left to right, JetVent Centrifugal Fan Design, Site installation, JetVent Axial Fan Design*

One of the most significant developments in car park ventilation design in recent years has been the introduction of Impulse Ventilation. Originating in Europe this technology has been widely used around the world for both car park ventilation and smoke management control systems.

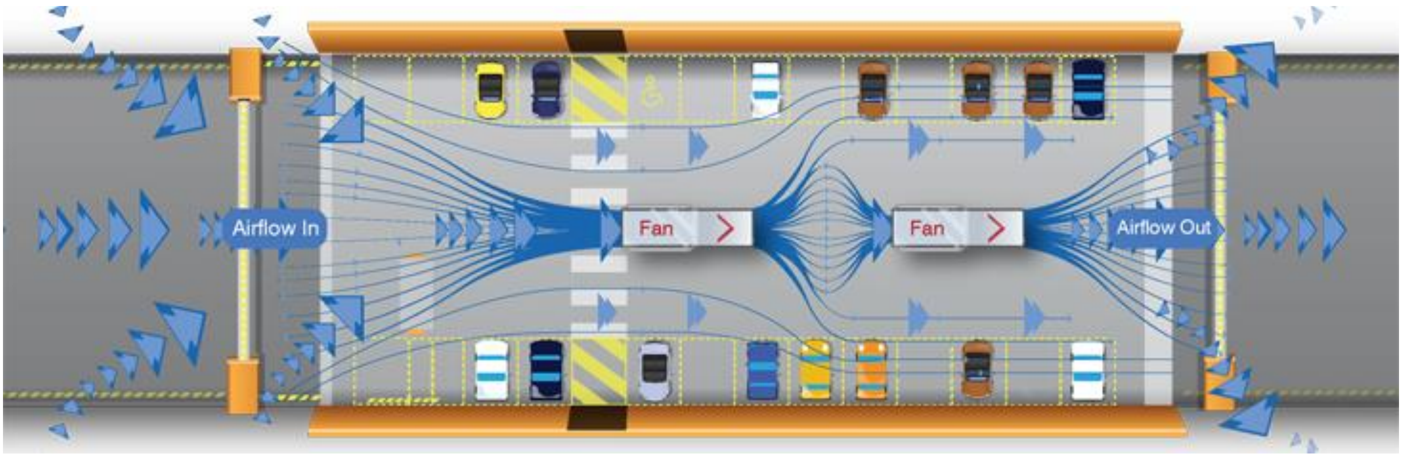



*Fig. 16 Open car park using 2x JetVent fans entrains surrounding airflow through natural ventilation*

An Impulse Ventilation System is based on distributing a number of small fans throughout a car park that either replace traditional distribution ductwork in closed car parks or increase cross-flow ventilation in open car parks. The fans produce a stream of air, in turn moving a larger quantity of air surrounding the fan through a process known as entrainment. This innovative alternative to traditional systems provides a number of significant benefits.

- Largely eliminates the need for air distribution ductwork within the car park.
- Exhaust systems have less resistance and therefore require smaller fans that consume less power.
- Reduces or eliminates plant rooms and ventilation risers yielding additional space for parking or other uses.
- Increases the energy efficiency of the system over and above the best ducted car park ventilation systems.
- Individual units are small in profile and easy to install with flexible placement.

The ventilation of car parks is essential for removing vehicle exhaust fumes containing harmful pollutants. Some of these pollutants include Carbon Monoxide (CO), Nitrous Oxides (NOX), Sulphur Dioxide (SO2) and heavy metal compounds. In addition to removing pollutants, the ventilation systems may also provide assistance to fire fighters by either limiting the spread of smoke in the event of a fire or clearing smoke after the fire is extinguished.

For further reading download the JetVent design guide (PDF 44 pages).

References:
JetVent, The Car Park Ventilation Solution, A Practical Guide for Selection & Application, 2015, Edition 3.1
http://www.fantech.com.au/images/Brochures/JetVent%20Guide.pdf

Sensors & Timers

Switchboard Mechanical Timers can be installed to automatically control power supply to fans and other electrical systems according to the hours of the day.  These devices are normally installed within the common area switch room and feature a manual dial that can be used to set the 'on' and 'off' times.  This is the type of system that is installed to control the garbage ventilation at [redacted] While the device is currently set to operate the fans between 7am and 8pm, these settings can usually be manually adjusted to operate at multiple times across the day.

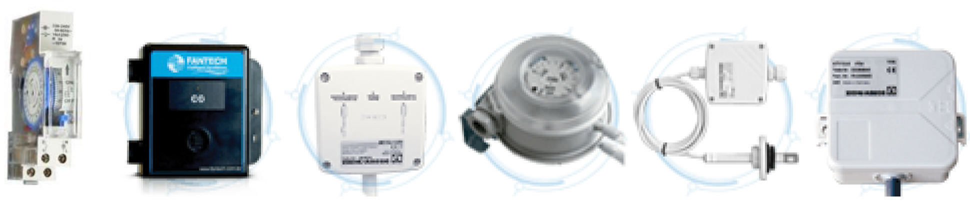


*Fig. 17 Switchboard Timer, Sensors for Pollutants, Humidity, Pressure, Airflow Velocity, Temperature*

[redacted] also employs carbon monoxide sensors to control the car park ventilation fan.  Sensors operate by controlling power supply to the fans based on sensor settings, such as CO levels. Pollutant sensors are commonly available in carbon monoxide (CO) and nitrogen dioxide (NO2) versions. These are ideal in enclosed or semi-enclosed spaces that contain harmful vehicle exhaust pollutants such as car parks and loading bays.

There is a range of other sensors that can be used to control fans and other electrical systems. Humidity sensors can provide accurate measurement of both relative humidity and temperature in air conditioned for example. Pressure sensors can monitor differential pressure and negative pressure for such applications as pressure control for central extraction and variable air volume systems. Airflow velocity sensors can be positioned within ducts to measure airflows in any direction. Temperature sensors can measure ambient air temperatures.

References:
Energy Efficient Ventilation Solutions, Integrating EC Motor Technology, Fantech (PDF 40 pages)
http://www.fantech.com.au/images/Brochures/ECO%20TECH%20range.pdf
Control System Strategies - http://www.fantech.com.au/FanRange.aspx?AppID=P2&RangeID=2020

Passive Ventilation Systems

Green buildings like the Red Center at the University of NSW utilise passive ventilation principles. Natural ventilation is controlled using thermal shafts, flues and stairwells to generate increased stack effect pressure. Automatic dampers and adjustable louvers are used to control the ventilation rate in each area of the building relative to the particular thermal requirements. The thermal flues are located on the north face of the building so the natural solar heating assists the drawing of air from the low level vents. The natural ventilation system is not intended to replace air conditioning. It is, however, intended to provide significantly enhanced environmental conditions.


*Fig. 18 Passive Ventilation Principles, Small Thermal Flue, Large Thermal Flues at UNSW Red Center*

References:
AAPPA News, New Green Building at UNSW, Roger Parks, Director Facilities Department
http://www.tefma.com/uploads/content/134-news98_12.pdf

**Wattblock Conclusions**

<u>Energy Efficiency</u>

The common area ventilation systems at are generally efficient with the use of variable speed drives, timers and sensors appropriately used to minimise energy use in most areas. Further efficiency gains with a relatively quick payback can be achieved by introducing timers for ventilation of Communication Rooms A and B, Mail Room, Main Switch Room, Electrical Metering Rooms, and Building B Foyers and by reducing the hours of Garbage Room ventilation.

Several solutions for improving energy efficiency of the car park ventilation and hydraulic services room ventilation were also discussed. These solutions are more complex and will likely be more costly projects with a longer payback. Wattblock suggests the JetVent system may be suitable for more effective car park ventilation. However, the car park exhaust system only accounts for 4% of the total energy use. As a result, a relatively small amount of energy will be saved with further upgrades.

<u>Noise Levels</u>

Most common area ventilation fans are located on the roof where they are unlikely to disturb residents. There are a number of fans located on the upper car park that could potentially disturb residents. Firstly the car park ventilation while very loud when operating at full power is only noisy in the vicinity of the ventilation room in the far north east corner of the car park. Residents in the lower level of Building B might be disturbed by the rustling of leaves in the north east corner of the garden. However, as noted the car park ventilation is controlled by CO sensors and it is understood this rarely comes on and is unlikely to reach full power due to the variable speed drive.

Other fans that might potentially disturb residents are the garbage fans in the upper car park and the hydraulic services room fan located near the entrance to the car park. These fans are also considered unlikely to be causing any amenity issues with respect to noise levels. See the individual sections of the report for further discussion and suggestions. Wattblock was not able to examine individual apartment ventilation systems within the scope of this report. These may also cause noise disturbances and residents are advised to investigate if there are concerns.

<u>Recommendations</u>

Wattblock recommends further investigating fast payback energy efficiency projects and the use of JetVent to improve airflow dynamics. Wholesale energy costs and network costs in NSW are set to increase significantly this financial year, so it is a good time for implementing energy efficiency projects. Wattblock is happy to assist in obtaining quotes for implementing any projects that are of interest.

Wattblock also recommends further investigation of common hot water systems in your buildings. This would assist in making a more informed assessment with regard to the hydraulic services room ventilation as well.

**Who is Wattblock?**

Wattblock was co-founded by Brent Clark and Ross McIntyre in 2014. They are joined by Scott Witheridge environmental engineer, Jacky Zhong solar engineer plus a team of solar and low energy buildings specialists. Visit wattblock.com

**What is Wattblock's mission?**

The energy wasted in Australia's strata buildings has a bigger impact on carbon emissions than the cars driving on the roads. Wattblock aims to **crowdsource** the achievement of Australia's national carbon emission reduction target.

**How many strata buildings has Wattblock assisted?**

Wattblock has assisted approximately 600 strata buildings across Australia to mobilize on energy saving initiatives. Wattblock has also directly project managed the upgrade of 13 buildings in Sydney. To date it has identified over $25m of annual energy waste across townhouses to high-rise residential skyscrapers.

**Who is partnering with Wattblock?**

City of Sydney municipal government, Microsoft CityNext, Telstra's muru-D, and the University of NSW

**Who is covering Wattblock in the media?**

SBS, North Shore Times, Foxtel, BRW, The Australian, Business Insider, Computerworld, StartupSmart, StartupDaily, LookupStrata, Technode, Fifth Estate.

**Wattblock Awards**

Best Social Change Entrepreneur 2015, Start-up Smart, Energy Winner at 1776 Challenge Cup Sydney, University of NSW China Trade Mission, CeBIT Community Support Finalist.

**Are Wattblock's electrician's licensed?**

All electricians engaged by Wattblock have been licensed in the states in which they operate.

**Who is backing Wattblock?**

Wattblock has received investment from muru-D as part of Telstra's startup accelerator program, Eastern Hill Investments, an Asian-based environmental engineer, a UK-based energy company consultant, a U.S.-based hi-tech investor, a NZ sustainability funds manager, a Sydney-based environmental impact investor, a Sydney-based clean tech consultant and a Sydney-based clean technology finance consultant.

**Where is Wattblock located?**

Wattblock is based at Michael Crouch Innovation Centre at UNSW in Sydney and at River City Labs in Brisbane.