

SECRET

INSIDE PERSPECTIVE

AGENT



THE SECRET AGENT REPORT

SPECIAL EDITION
VOLUME 23 - SEPTEMBER 2014

THE EAST WEST LINK



THE EAST WEST LINK

SPECIAL EDITION

3	1. INTRODUCTION
3	2. CONSTRUCTION ACTIVITIES AND PROPERTY ACQUISITION
3	2A) Precinct 1
4	2B) Precinct 2
5	2C) Precinct 3
6	3. ASSOCIATED ENVIRONMENTAL CONCERNS
6	3A) Air Pollution and Health Concerns
6	→ Main Air Pollutants
6	→ Health Implications
8	→ East-West Link Air Quality Assessment
8	3B) Noise and Vibration
8	→ Precinct 1
8	→ Precinct 2
8	→ Precinct 3
8	3C) Case Studies
8	→ Clifton Hill Primary School
10	→ Melbourne General Cemetery
10	→ Melbourne Zoo
11	→ Elderly Chinese Home Inc
11	4. PRICE ESTIMATION FOR PROPERTIES
11	4A) Methodology
12	4B) Ventilation Stacks
12	→ Burnley Tunnel
13	→ Clifton Hill
13	→ Parkville
13	→ Individual Property Pricing in relation to venting stacks
14	4C) Tunnels
14	→ Burnley Tunnel
15	→ The East-West Link Tunnel
17	5. LONG TERM IMPACTS
18	6. REFERENCES

“WITHOUT DEVIATION FROM THE NORM, PROGRESS IS NOT POSSIBLE.”

- FRANK ZAPPA

COVER IMAGE

Our cover image this month has been created by freelance illustrator Jasmin Neophytou. Frank would have been proud of Jasmin. Her works deviate from the norm by way of her playful use of colour, shape and proportion. Her cover brings a lightness to the serious topic of the East West Link project.

19 INNER MELBOURNE TURNOVER

Table 9

Inner Melbourne Turnover

20 Inner Melbourne Apartments - Price Comparisons



Table 10

Apartments - Price Comparisons

Figure 22

Apartments - Quarterly Median Change (%)

22 Inner Melbourne Townhouses - Price Comparisons



Table 11

Townhouses - Price Comparisons

Figure 23

Townhouses - Quarterly Median Change (%)

24 Inner Melbourne Houses - Price Comparisons



Table 12

Houses - Price Comparisons

Figure 24

Houses - Quarterly Median Change (%)

26 Acknowledgements

The data upon which this report is based was sourced from: The Australian Bureau of Statistics (www.abs.gov.au/census), The Department of Human Resources, Google Maps (maps.google.com.au), propertydata.com.au, Land Victoria (www.land.vic.gov.au), realestateveiw.com.au, Domain (domain.com.au), realestate.com.au, Fairfax, Residex, various individual real estate agents operating in inner Melbourne, and other specialised sources as noted in the following content.

© 2014 Secret Agent HQ Pty Ltd. All rights reserved. No reproduction, distribution or transmission is permitted without the prior written permission of Secret Agent HQ Pty Ltd.

THE EAST WEST LINK

JODIE WALKER, XI WANG AND STEEN BAKER-HOLLAND

On the 20th of August 1860, Burke and Wills led a 19 man expedition to cross the continent of Australia, beginning the journey from Melbourne. 23 horses, 6 wagons and 26 camels were the unsophisticated transport methods helping the 19 men navigate the Australian landscape that was previously uncharted by European descendants. 15,000 Melburnians gathered at Royal Park to cheer off the great explorers. Now 154 years later, the exact spot that Burke and Wills set off from has become the subject of controversy for many Melburnians. Directly below the starting point of the expedition will sit the proposed East West Link tunnel. This new infrastructure is set to revolutionise transport in Melbourne. From camels to concrete tunnels, we explore the latest milestone soon to be added to Melbourne's fabric.

In this special report Secret Agent takes a look at the most recent road infrastructure project in Melbourne: The East West Link. The impacts on the citizens of Melbourne and implications on the property market will be analysed and discussed in detail.

The East West Link aims to provide an efficient road connection between the eastern and western suburbs of Melbourne. The project will involve extensive road widening, road upgrades, junction improvements and most notably the construction of a 4.4km tunnel connecting the Eastern freeway to Citylink. These improvements aim to relieve pressure on Melbourne's roads and provide for the rapid population growth predicted for Melbourne.

Long term benefits include potential easing of congestion, improved travel times for Victorian's, and greater transport links for many Melbourne businesses.

On the other hand, in order for construction to commence, both residential and commercial properties, will need to be acquired, causing home displacement and job lay-offs. The health risks associated with air pollution from the tunnel and its ventilation systems are also a major concern, especially with the poor results from ongoing scientific analysis of particulate matter emissions.

The Burnley Tunnel is a completed major road tunnel project in Melbourne which can be used for comparative analysis due to its similarities with the East West Link. The East West Link project has been divided into 6 precincts. This report will focus on precincts 1-3 which encompass the road tunnel. Precincts 4-6 involve extensive road improvements around the Citylink area which will have less significant impact on existing property.

2. CONSTRUCTION ACTIVITIES AND PROPERTY ACQUISITION 2A) Precinct 1

The East West Link infrastructure project conceptually begins with widening of the Eastern Freeway (Figure 1, Page 4) to accommodate an increase in traffic volumes. This becomes increasingly complex as the road reaches the Hoddle Street intersection, where elevated road structures and other linkages are required. As these improvements branch out, disruption will be imposed on the surrounding residential area with home acquisitions being required.

Just west of the Hoddle Street intersection an open cut into the ground is required leading up to the eastern portal of the proposed tunnel. From there a cut and cover construction process is required for approximately 300m until the road tunnel can be bored completely underground.

At the Gold Street and Alexandra Parade intersection where the tunnel begins, a ventilation structure will be erected requiring the acquisition of Provans Timber and Hardware. This may cause increased air pollution. Health issues associated with particulate matter and toxic gases being concentrated in this region may eventuate. This will have an influence on homebuyers as people may be less willing to live adjacent to such a structure. Within 100m of this ventilation structure is Clifton Hill Primary School which sees the vent as a significant threat to the safety of its children and staff. To maintain traffic flow during the tunnel construction, the Alexandra Parade side track will be constructed north of the existing Alexandra Parade between Smith Street and Copper Lane, requiring the acquisition of many properties.

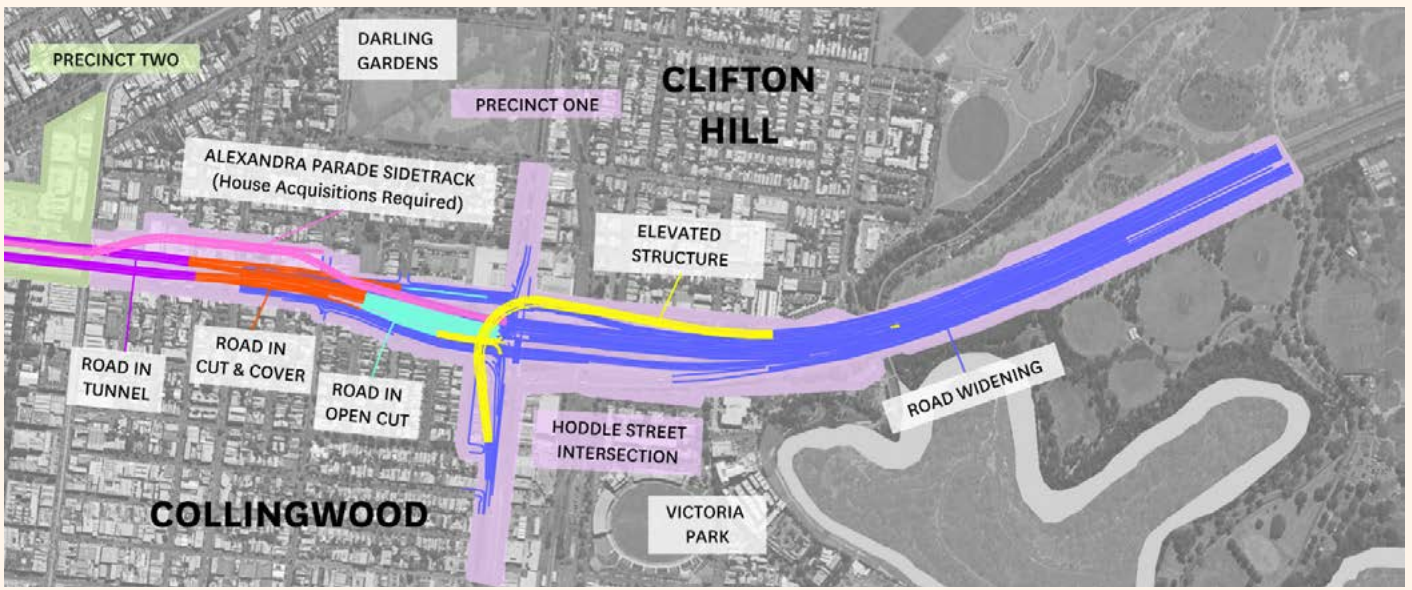
The Linking Melbourne Authority (LMA) has identified the following properties to be acquired for the purpose of construction. (Table 1) (Linking Melbourne Authority, 2014)

Located at the intersection of Gold Street and Alexandra Parade, Provans Timber & Hardware is a family owned business that has been running since 1903. The proposal for the East West Link has the eastern ventilation structure located at this site.

Table 1: Property Acquisitions in Precinct 1

	Residential Properties	Commercial Properties
Hotham Street	3	Nil
Bendigo Street	14	Nil
Alexandra Parade North	18	18

Figure 1: Precinct 1 Map



In an interview with Provan’s Assistant Manager, Jarrod Rosenberg, he said that they had been given no official statement but “we need to move out by the second half of next year (2015).” Jarrod mentioned that Provan’s has built a strong business presence over the past 110 years in its current location, which works perfectly as it has easy road access and is highly visible to commuters and motorists coming down Alexandra Parade. Now they will have to forgo this and look for another suitable site, which is an extremely difficult task. He added that “The proposed acquisition has potentially imposed stress on my employees as well, as they will lose their jobs if we cannot find a site.”

Apart from the 18 businesses that have to relocate, 35 households in Precinct 1 have also been advised that they will have to move on. A resident of 11 years at a property to be acquired on Bendigo Street says “...obviously we don’t want it to happen. This is our home.” Another 70-year old resident said that it hit him hard that he had to leave the neighbourhood. He said that it would be exceedingly difficult for him to find an affordable alternative in that area.

2B) Precinct 2

Precinct 2 is wholly comprised of a twin 4.4km tunnel. As these tunnels are 20-30 metres underground there is to be no surface construction activities and therefore properties will be mostly unaffected. It is expected that an air intake structure will be required somewhere in this area which would cause disruption on the surface. Vibration and noise may be transmitted to the surface during the construction process. Figure 3 shows the tunnels travelling under the north side of Alexandra Parade and then under the Melbourne General Cemetery and Royal Parade.



Figure 2: Provan’s Timber & Hardware

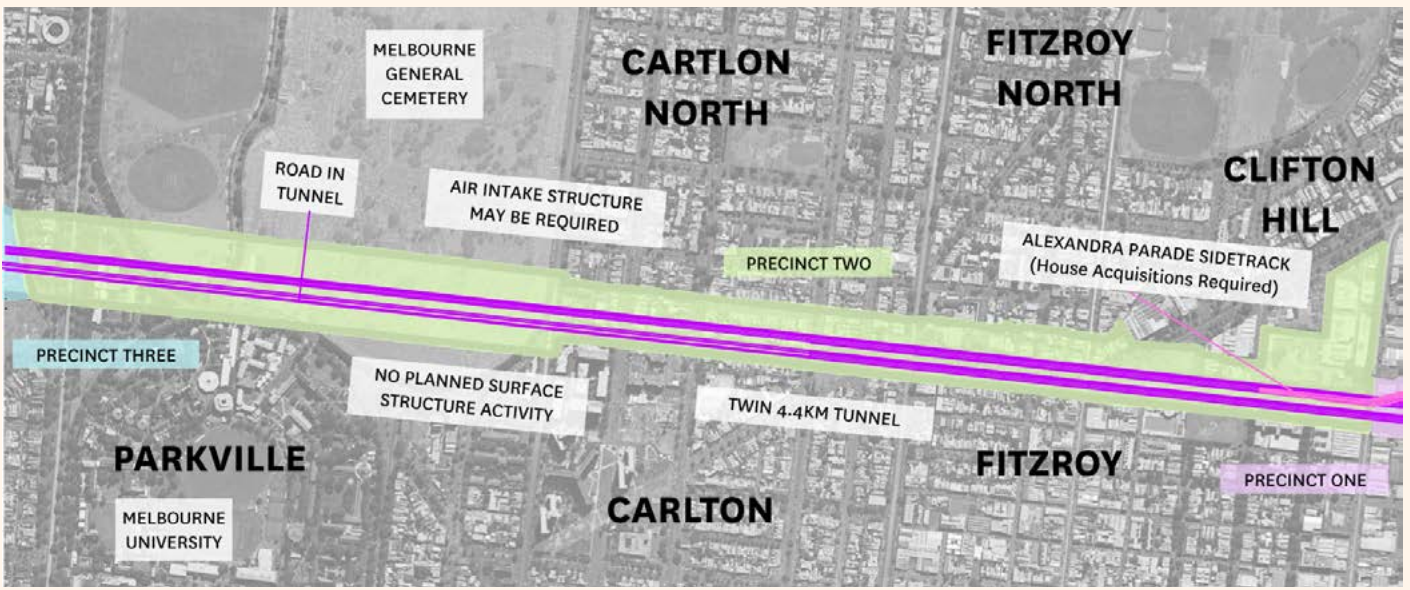
The proposed tunnels will run under 258 properties requiring acquisition of the ground underneath. Property values could be negatively affected due to psychological factors associated with living above a tunnel.

No properties on the surface would be acquired for the entire section of Precinct 2. The tunnels would run beneath 258 private properties, requiring stratum acquisition underground (Table 2). (Linking Melbourne Authority, 2014)

Table 2: Property Acquisitions in Precinct 2

Street Name	Residential Properties	Commercial Properties
Alexandra Parade (acquisition of land beneath the surface only)	198	19
In addition, there are 41 other properties to be acquired.		

Figure 3: Precinct 2 Map

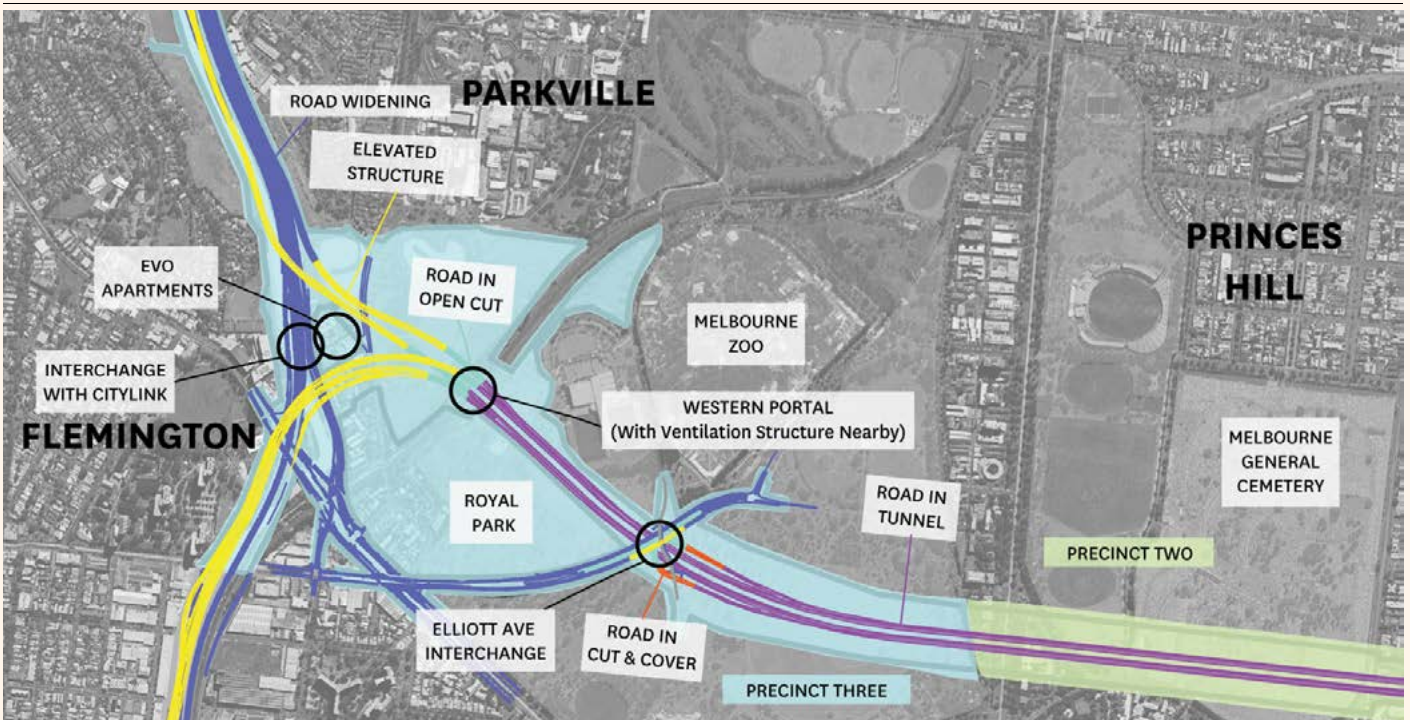


If residents took up ownership prior to 1891, the ownership of the land covers ground level right to the planet's core. The LMA would have to acquire the subterranean land and compensation could be sought by these owners with historic titles. For those whose ownership commenced after 1891, ownership includes the rights to the land underneath the houses to a depth of approximately 15 metres. The tunnel appears to be designed so that the acquisition of underground land with newer titles could be avoided. (Hewitt, 2014)

2C) Precinct 3

The twin tunnels continue through Royal Park until an interchange at Elliot Avenue (Figure 4). The tunnel exits will require an extensive excavation and construction process and will be obtrusive to Royal Park and the surroundings. To facilitate the induced traffic demand, Elliot Avenue will be widened.

Figure 4: Precinct 3 Map



The tunnels emerge further up just past the Upfield railway line and connect with Citylink. This connection requires elevated road structures that pass through Ross Straw Field and other areas of Royal Park.

These road connections cross over residential areas around Manningham Street and effectively “sandwich” the recently constructed Evo apartment complex. This could devalue this particular region of Parkville due to increased noise and air pollution as well as the visual presence of the elevated road structures. In this area 55 residential properties will be compulsorily acquired.

The second ventilation structure will be located near the tunnel exit in Royal Park. There are many significant buildings located in the vicinity of the vent including Evo apartments, Melbourne Zoo, the Royal Children’s Hospital and a Chinese aged care home on Manningham Street. As well as the aesthetic disturbance to the parkland, residents in the area and the population of the aforementioned buildings may be subject to health risks from the particulate matter released from the vent.

Since the proposal, the government has purchased Evo apartments as a form of compensation due to the negative impacts the new road infrastructure will have on the complex.

Table 3: Property Acquisitions in Precinct 3

Street Name	Residential Properties	Commercial Properties
Manningham Street	55	0
Racecourse Road	0	1

3. ASSOCIATED ENVIRONMENTAL CONCERNS

3A) Air Pollution and Health Concerns

As the East West Link is located in a highly urbanised and populated area, the structure, construction and continuing operation of the project have significant impacts on the air quality of the neighbourhood.

→ Main Air Pollutants

PARTICULATE MATTER (PM)

PM stands for a myriad of substances in the atmosphere composed of potentially thousands of chemical compounds suspended in the air in a solid, liquid, or multiphase state. PM mainly generates from traffic and it is a major pollutant in road tunnels.

In a road tunnel, PM is mainly composed of a suspension of dust and tailpipe emissions, which are dominated by black carbon and organic compounds. Trucks tend to emit more PM than smaller vehicles. The Environment Protection Authority (EPA) is concerned with two types of PM which have been

grouped according to their size. The first type is between 2.5 and 10 micrometres in diameter (PM₁₀) and includes inhalable coarse particles such as those found near roadways and dusty industries. The second type are fine particles which are less than 2.5 micrometres in diameter (PM_{2.5}) and typically found in smoke and haze. These can be formed when gases released from automobiles, power plants and ventilation stacks react with oxygen in the air.

Exposure to PM can be risky if it contains toxic or carcinogenic substances, for example soot and Polycyclic Aromatic Hydrocarbons. (National Health and Medical Research Council, 2008) The health concerns of PM are discussed in more detail later in this section.

CARBON MONOXIDE (CO)

The major source of CO in urban area is traffic exhaust, coming from petrol-powered cars as a by-product of incomplete combustion.

CO endangers human health by binding with the Hemoglobin in our blood to form Carboxyhemoglobin (COHb). This reduces the oxygen-carrying capacity of blood and impairs the release of oxygen to the tissues. High COHb levels increases the risks of abnormal heart function and short-term reversible neurological effects. Thanks to technological advancements in engine design, CO is only a significant ambient pollutant close to busy traffic (within 100 metres) and within a tunnel. For distances further than this range and outside the tunnel, the danger of excessive exposure is greatly reduced. (National Health and Medical Research Council, 2008)

NITRIC OXIDE (NO) AND NITROGEN DIOXIDE (NO₂)

NO and NO₂ originate from a combination of Nitrogen and Oxygen in high temperature environments from internal combustion engines. NO₂ is generally higher closer to tunnel exits. There are several adverse health effects that can result from exposure to high NO₂ levels. These include increased respiratory symptoms in children, onset of respiratory symptoms among infants and increased bronchitis symptoms for children with asthma. For people with asthma, their lung functions could be directly affected, and they could have increased bronchial responsiveness. (National Health and Medical Research Council, 2008)

→ Health Implications

Ambient pollutants from traffic raise health concerns for tunnel users and people residing nearby, but the impacts are dependent on the distance from the tunnel portals. The National Health and Medical Council (2008) divides the distances into three geographical zones as listed on the following page.

ZONE 1. WITHIN 100-200 METRES FROM THE TUNNEL PORTALS/VENTILATION STRUCTURE

The ambient pollutant concentration reaches the highest level at the exit portal, and then decreases rapidly as the distance increases. In fact, the concentration level falls to a similar level as background concentrations within 100 metres from the tunnel exit.

ZONE 2. FROM 200 METRES TO 1000 METRES FROM THE TUNNEL PORTALS/VENTILATION STRUCTURE

Beyond 200 metres, the increase in ambient pollutant concentration is negligible. Therefore, although the number of residents that are potentially affected is larger in this range, the actual impact is not significant.

ZONE 3. AREAS BEYOND 1000 METRES FROM THE TUNNEL PORTALS/VENTILATION STRUCTURE

The wider areas might be affected by the redistribution of traffic flows. Other roads may be less congested when the tunnel is operating, and therefore bring less pollution to areas surrounding those roads.

The impacts of the tunnel's opening is a key focus of this report. Ambient pollutants are released at the tunnel portals and ventilation stacks at a much higher concentration compared to an open road scenario. Once the tunnel portal and ventilation structure come to operate, the local air quality at the vicinity of the portal is expected to be worse than an area with no presence of a vent.

This does not necessarily mean that the local residents will suffer from deteriorating air quality in the vicinity of tunnel portals after they are built. This is especially the case as Alexandra Parade has been served as a major path from east to west, and that there has been considerable congestion and queuing traffic during peak hours for many years. Empirically, there are mixed results from different case studies on the effects of major tunnel projects in various countries.

Two reviews and continuous monitoring data on the Burnley and Domain tunnel stacks in Melbourne show that the emissions have minimal effect on the long-term measures of air quality. In contrast, another study investigating the Sodra Lanken Tunnel in Stockholm revealed that the air quality worsens near the tunnel portals, however, on the ground level of a wider area and in the city centre, the air quality improved, potentially due to slight redistribution of the local traffic. (National Health and Medical Research Council, 2008) The effects on children are of special interest, as the developing body and brain are more vulnerable. Air pollution has long been thought to exacerbate minor acute diseases in the younger population. Recent research suggests that air pollution, especially that related with traffic discharge is associated with infant mortality and the development of asthma and atopy in children. Particulate Matter and Ozone (O₃) are thought to be the dominant contributors

to the deterioration of asthma conditions and resultant hospitalisation. In addition, it has been demonstrated that there is a relationship between air pollution, impaired lung function and development in children and adolescents. It is suggested that children should avoid exposure to busy roads where possible. There can be adverse consequences in lung function and general health, if lung development is impaired at a young age.

A particular concern of Secret Agent in regards to the East West Link is the health implications associated with Particulate Matter (PM) arising from the ventilation stacks. PM₁₀ and PM_{2.5} are small enough to reach the lower respiratory tract and even enter the blood stream. Numerous epidemiological studies conducted over the past 30 years have found strong relationships between the exposure of PM and short term effects such as increased hospital admissions and premature death. Exposure-response relationships also exist for cumulative health effects which are seen over a longer time frame. These include lung cancer, cardiovascular disease and cardiopulmonary disease. (Valavanidis et al, 2008) The coagulation properties and concentrations of PM are dependent upon weather. Studies conducted in warm weather show that PM concentration reduces to background level at about 300 – 400 metres from the major highways. In cold weather with still atmosphere, coagulation is greater. (National Health and Medical Research Council, 2008)

PEOPLE WHO SPEND SIGNIFICANT TIME IN THESE AREAS ARE LIKELY TO BE EXPOSED TO FAR MORE PM THAN WHAT WOULD NORMALLY EXPECTED.

Reported health problems associated specifically with PM include changes in heart rhythms, heart attacks, respiratory problems and death resulting from severe respiratory or cardiac malfunction. A study conducted in the Netherlands found that cause specific mortality rates increase when the airborne concentrations of PM increases. (Brunekreef et al, 2009) In addition, increased work and school absences are observed in environments with higher PM concentrations. There is a correlation between changes in daily particulate matter concentrations and number of people hospitalised as well as mortality rates from cardiovascular and pulmonary diseases. An assessment of ambient air pollutants on daily mortality in 20 of the largest cities in the United States was carried out between 1987 to 1994. This assessment found that PM was a major contributor to increased mortality, more so than other pollutants such as CO and NO. From the results they estimated that for every 10 cubic microgram increase in PM₁₀ there is an increase in daily mortality rate between 0.5% and 1.6%. (Samet et al, 2000)

The most comparable study on the potential health effects of the East West Link is the evaluation of the effects associated with the ventilation stack for the Lane Cove Tunnel in Sydney. This is a 3.6km road tunnel connecting two freeways in Sydney. It also has two ventilation stacks at each end of the tunnel. Operations commenced in 2007. The evaluation performed by Cowie et al (2012) assessed the respiratory symptoms in residents living in one of four exposure zones the year before the tunnel opened and in each of the two years afterwards. They found that residents living around the tunnel ventilation stack reported more upper and lower respiratory symptoms and had lower lung volumes after the tunnel opened. An interesting finding was the fact that residents who were in the zone where traffic was reduced by half showed no improvements in respiratory health.

People respond to excessive PM differently, some people being more susceptible than others. Various studies suggest that people with existing illness (for example, cardiovascular disease, asthma, or diabetes) and nutritional deficiencies suffer more from high PM concentrations. Race, gender and age seem to be relevant factors too. The elderly and very young are more susceptible to PM. (Davidson et al., 2005) A study by Gauderman et al (2004) found adverse effects on lung development in children living near tunnels and ventilation stacks in California. Over 3000 children living in 12 different communities were followed up for 8 years. Those that lived within 500 meters of a freeway had detrimental results with significantly decreased attainment of forced expiratory volumes as they reached adulthood.

This raises a significant issue when assessing the impact of East West Link, as Clifton Hill Primary School is located less than 100 metres away from the proposed location for the ventilation stack for the eastern portal, and that students generally spend seven hours on average at school each day.

→ East West Link Air Quality Assessment

The LMA has assessed the proposal's potential impact on local air quality. The results are documented in the Comprehensive Impact Statement Chapter 11 – Air Quality.

It should be mentioned that up to the publishing date of this report, the exact location and design of the proposal has not been finalised. It is highly likely that the vent structure of the eastern portal will be located near Alexander Parade, amongst many residential and commercial buildings generating building wake effects. Building wakes describe the effect on plume dispersion caused by the presence of buildings near a stack, usually resulting in increased ground level concentrations of pollutants. (DOEC, 2001) In comparison, the western portal would be located close to Royal Park where there is no such concern for building wakes due to fewer buildings. Following a sensitivity analysis of building wakes, it has been suggested that the vents in the western portal shall have a height of 20 metres whereas the eastern vent

will have a height of 30 metres to comply with the acceptable concentrations at ground level. Roadside air pollution has been assessed by modelling NO₂, and the results are then translated to the compliance situation of other pollutants such as CO and PM₁₀. In summary, greater NO₂ levels are expected to be observed in vicinity of the on-ramp and some locations along Hoddle Street and Alexandra Parade. The concentration of NO₂ falls significantly at distances greater than 50 metres from the peripheral roads. There is some reservation on how representative NO₂ can be in indicating the concentrations of all other ambient pollutants. As covered in the next section "Case Studies" on Clifton Hill Primary School, the concentration of CO and PM can be quite significant whilst at the same time the concentration of NO₂ can be relatively mild.

3B) Noise and Vibration

Noises are generated from demolition, excavation, piling and construction activities, trucks accessing the construction site, and tunnelling works. Noise is considered to be irritating and distracting, and it is closely associated with cardiovascular diseases. (Shu et al., 2014) Construction activities can cause vibration, such as the operation of a tunnel boring machine, blasting, and so on. Vibration could potentially disturb people from their sleep and daily activities, however vibration felt by humans does not reach a level that will damage houses.

→ Precinct 1

As several properties will be demolished and temporary carriageway built, Precinct 1 will be temporarily exposed to high levels of traffic noise.

The use of hydraulic hammers will produce perceptible levels of vibration, which will not damage properties. If drilling and blasting are deemed necessary, vibration will need to be properly managed. Once operation commences, noise levels are not evenly shared in precinct 1. Some locations will experience higher levels of noise, whereas other locations will experience a reduction in traffic noise.

→ Precinct 2

Depending on the techniques involved in tunnelling, noise and vibration levels vary. Once operation commences, noise levels above ground will be reduced significantly as the surface traffic reduces.

→ Precinct 3

Vibration in this area arising from construction will be minimal. Melbourne Zoo could be a very sensitive area as discussed in the case studies below. Similar to Precinct 1, once the East West Link construction begins, the noise levels

for some locations may be increased, and this will need to be properly managed by the Tender.

3C) Case Studies

→ Clifton Hill Primary School

Clifton Hill Primary School is a co-educational state primary school for students from Prep to grade 6. It is located at 180 Gold Street in Clifton Hill, approximately 130 metres from Alexandra Parade. Assistant Principal Karen Dileo was interviewed by Secret Agent for the purpose of this report. She explained the school's understanding of the East West Link and its associated impacts on the school community. The school was involved in three consultations with the LMA to address its concerns and preferences. In addition, the school has run a survey amongst its parent community regarding the proposal.

THE MAJOR CONCERNS OF THE SCHOOL ARE THE AIR QUALITY AND THE POTENTIAL DISRUPTIONS CAUSED BY CONSTRUCTION ACTIVITIES, WHICH ARE SET TO START IN OCTOBER 2014.

In terms of air quality, the school had preferred the ventilation stack to be moved 300-400 metres eastward. This has significant cost implications for the project budget. An air quality monitor has been installed in the school, with the intention to measure the impacts of the project on the concentration levels of ambient pollutants.

The air quality monitor runs daily reports on major air pollutants, including CO, NO₂, PM_{2.5} and PM₁₀. Two random days were sampled with the results shown in Figure 8. The data for August 16th is relatively poor when directly compared to the data for August 13th. This shows that even prior to the proposal, the pollutant concentration levels are high, posing potential threats to students as they come to school between 8:30am-9:00am, have recess at 1:00pm-2:00pm, and attend after school care from 4:00 pm-6:00pm. Exposure to pollution over seven years of schooling is a substantial period of time.

Two outcomes await the school; the change in air quality during the five year construction period and the change in air quality post construction when the vent is in operation. If there is significant increase in the concentration of ambient pollution during and after the construction of the tunnel portal and ventilation structure, it might trigger decline in student enrolment, and students moving out of the school, as indicated by 30% of respondents of the survey ran by the school.



Figure 5: Clifton Hill Primary School Location Map



Figure 6: Clifton Hill Primary School - Air Quality Checking Station



Figure 7: Clifton Hill Primary School

Figure 8: Clifton Hill Monitoring Station Daily Air Quality Index

	13 AUGUST 2014					16 AUGUST 2014				
	PM10 Pollutant Index	CO Pollutant Index	NO2 Pollutant Index	PM 2.5 Pollutant Index	Dominant Pollutant	PM10 Pollutant Index	CO Pollutant Index	NO2 Pollutant Index	PM 2.5 Pollutant Index	Dominant Pollutant
1 AM	Very Good	Good	Good	Very Good	NO2	Fair	Fair	Fair	Fair	CO
2 AM	Very Good	Good	Good	Very Good	CO	Fair	Poor	Good	Fair	CO
3 AM	Very Good	Good	Good	Very Good	NO2	Fair	Poor	Good	Fair	CO
4 AM	Very Good	Good	Good	Very Good	NO2	Fair	Poor	Good	Fair	CO
5 AM	Very Good	Good	Good	Very Good	NO2	Fair	Poor	Good	Fair	CO
6 AM	Very Good	Very Good	Good	Very Good	NO2	Fair	Poor	Good	Fair	CO
7 AM	Very Good	Very Good	Good	Very Good	NO2	Fair	Fair	Good	Fair	CO
8 AM	Very Good	Very Good	Fair	Very Good	NO2	Fair	Fair	Good	Fair	PM2.5
9 AM	Very Good	Good	Fair	Very Good	NO2	Fair	Fair	Good	Fair	PM2.5
10 AM	Very Good	Good	Fair	Very Good	NO2	Fair	Fair	Good	Fair	PM2.5
11 AM	Very Good	Good	Good	Very Good	CO	Fair	Good	Good	Fair	PM2.5
12 PM	Very Good	Good	Very Good	Very Good	CO	Fair	Good	Good	Fair	PM2.5
1 PM	Very Good	Good	Very Good	Very Good	CO	Fair	Good	Good	Fair	PM2.5
2 PM	Very Good	Good	Very Good	Very Good	CO	Fair	Good	Good	Poor	PM2.5
3 PM	Very Good	Good	Very Good	Very Good	CO	Fair	Good	Good	Poor	PM2.5
4 PM	Very Good	Good	Very Good	Very Good	CO	Fair	Good	Good	Poor	PM2.5
5 PM	Very Good	Very Good	Very Good	Very Good	NO2	Fair	Good	Good	Poor	PM2.5
6 PM	Very Good	Very Good	Good	Very Good	NO2	Fair	Good	Good	Poor	PM2.5
7 PM	Very Good	Very Good	Good	Very Good	NO2	Fair	Good	Good	Poor	PM2.5
8 PM	Very Good	Very Good	Good	Very Good	NO2	Fair	Good	Good	Poor	PM2.5
9 PM	Very Good	Good	Good	Very Good	NO2	Fair	Good	Good	Poor	PM2.5
10 PM	Very Good	Good	Good	Very Good	NO2	Fair	Good	Good	Poor	PM2.5
11 PM	Very Good	Good	Good	Very Good	CO	Fair	Good	Good	Poor	PM2.5
12 AM	Very Good	Good	Very Good	Very Good	CO	Fair	Good	Good	Poor	PM2.5

In summary it can be concluded that in terms of air quality around the school:

- It is subject to the specific conditions on certain days, including humidity, wind orientation and speed, temperature, and traffic conditions;
- Is generally poorer from 2am to 10am;
- Potentially seasonal. For example, cold weather usually leads to heavier pollution.

→ **Melbourne General Cemetery**

The East West Link is expected to run beneath a section of Melbourne General Cemetery, located at College Crescent. Similar with its counterpart, Northern Link tunnel project, in Brisbane, the concerns include the possible impacts to heritage-listed graves, grave stones, headstones and monuments. Construction equipment such as boring machines may generate noticeable vibrations, hence damage the above items, especially if they are already unstable,

deteriorated and degraded. (Moore, 2010)

The East West Link has stated in its Performance Requirement that the selected contractor will need to “Undertake condition assessments of heritage buildings or structures prior to commencement of construction including the Melbourne General Cemetery for all existing gravestones, crypts, memorials and monuments within the project boundary.” Melbourne General Cemetery will be involved in ongoing consultation with the contractor and LMA on any emerging issues. It is yet uncertain to determine the impacts at this stage.

→ **Melbourne Zoo**

Melbourne Zoo is known for its large variety of species. It welcomes 1.3 million visitors every year. It is located about 150 metres from the proposed construction site. The LMA claims that the construction work will be carefully managed, and that vibration from tunnelling machinery would dissipate

before it imposes any impacts on the Zoo. (Linking Melbourne Authority, 2013) Some animals are highly sensitive to changes in their external environment. Melbourne Zoo has expressed their concern over loud noises, shocks, and vibrations which could be felt after being amplified by water. Animals such as elephants, giraffes, seals, pygmy hippos and crocodiles, are likely to be disturbed and startled, which imposes risks to the animals and the employees. They also fear that the construction of such a project will reduce the number of visitors.

Melbourne Zoo is now considering an early-warning system which notifies the employees to leave before loud noises, so that they don't risk being attacked by distressed animals. (Cook & Tomazin, 2014) A contingency plan will be established, but only after a contractor for the project is signed later this year.

→ Elderly Chinese Home Inc.

The Elderly Chinese Home (Figure 10) is located at 129 Manningham Street in Parkville. It provides aged care to senior residents with a Chinese background.

Proposed to commence in mid-2015, East West Link will build five-storey ramps around its western portal. This means that the East West Link will be less than 30 metres from the home, and its lounge and sunroom will be overshadowed by an off-ramp, which will reach a five-storey height. Currently the Home is considering relocation, which will cost about \$20 million.

Secret Agent interviewed the chairman of the home, Mr. Albert Lee, for the purpose of this report. Mr. Lee is currently speaking with government representatives in what he says is a respectful discussion about the way forward. The Home has just officially opened a new 2 storey wing in February 2014, and the East West Link will overshadow part of the structure. Since the home was opened in 1986, it has undergone 4 extensions to go from its original capacity of 11 rooms, to the ability to house 47 residents (with a long waiting list). While he understands the need for progress and solving a large traffic problem, Mr. Lee is keeping in mind the legacy, and the possible disruption to the residents. "We are mindful of factors during construction and after the completion of the project, and have lots to consider regarding the decision to stay and adapt, or to relocate. We are responsible for our residents and their families and also our staff." The home is already quite close to the existing freeway but has still manages to create a warm environment for its residents.

4. PRICE ESTIMATION FOR PROPERTIES

4A) Methodology

Secret Agent adopted two methods in pricing average sales and individual houses. Firstly, price changes in the surrounding areas for Burnley Tunnel from 1993 to 2000



Figure 9: Melbourne Zoo



Figure 10: The Elderly Chinese Home, Parkville

were analysed. It is expected that this past project has significant indications on how property prices will change as a consequence of the construction and presence of a tunnel and ventilation stack for the East West Link. The pattern is analysed and applied to the East West Link to predict the average sales prices from 2014-2024.

Secondly, it is recognised that individual house prices are not only affected by the surrounding environment, but also by the amount of accommodation (number of bedrooms and bathrooms). Hedonic Regression was used to account for a number of variables effecting property prices. Property Data Online was used to collect the sale price, date, and number of rooms of the sample properties, then property prices were

regressed with year of sale, number of rooms and distance of the property to the tunnel or ventilation stack. This allowed for observation of the main determinants of individual house prices.

Note that this research has adopted prices calculated as average, instead of median. Average prices can reflect the overall price patterns of the areas of interest. Averages can sometimes be distorted by abnormal sales in a particular year. In this case, analysis on median prices (not reported) show similar patterns with average prices.

The analysis has been performed in two parts. The first part looks at the areas surrounding ventilation stacks while the second part examines the prices for streets up to 550 meters from the proposed location for the East West Link tunnel.

4B) Ventilation Stacks

Ventilation stacks are essential in managing the emissions of road tunnel projects. Expelling emissions through tunnel portals (entrances/exits) results in highly concentrated emissions being distributed at ground level. Utilizing tall ventilation structures allows for minimal impact on the immediate vicinity. A study on the M5 tunnel in Sydney found that emissions through a 35 metre stack were 50 times less than that through the portal at ground level. (NSW Department of Health, 2006) There are two ventilation stacks proposed for the East West Link tunnel. One is located in Clifton Hill at the eastern portal while the other is in Parkville at the western portal.

There is widespread debate on how serious the health impacts of these tunnel emissions through stacks or portals can be. Appropriate management of the method of expulsion can significantly reduce the level of these impacts. The M5 tunnel in Sydney has both portals located in residential areas and therefore ventilation stacks were necessary. In a response to community backlash a ventilation tunnel was constructed which transports emissions to a ventilation stack 1km north of the tunnel in an industrial zone, away from residential areas.

→ Burnley Tunnel

The Burnley Tunnel in Melbourne connects traffic from the Monash Freeway in the east to the Westgate Freeway in the west. This tunnel was constructed between 1996 and 2000. This is an example of a tunnel with similar ventilation methods to that of the proposed East West Link tunnel as it has a ventilation stack at each portal. Analysis has been done on how the construction of this tunnel affected house values in the vicinity of the ventilation stack in Burnley. It would be assumed that the presence of such a structure would deter people from living in the area due to fears of health risks triggered by the presence of an operating ventilation stack. The National Health and Medical Research Council has found

that ventilation stacks can potentially impact the health of people living or working within a one kilometre radius of the structure. People closer are of course at greater risk and emissions from portals impact the health of people within 100-200 metres. (National Health and Medical Research Council, 2008) Despite these scientific findings the physical presence of the structure is what will ultimately discourage people from living in the area. People more than 500 metres away would generally have an “out of sight, out of mind” view.

Analysis over part of the lifetime of this project has been completed by comparing average house prices within a 500 metre radius of the ventilation stack and average house prices within 500 metres to 1000 metres of the stack.

Figure 11: Burnley Tunnel Ventilation Stack Map

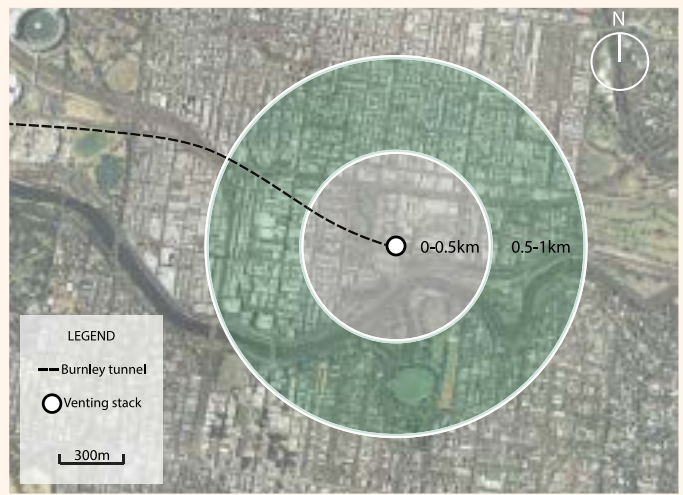


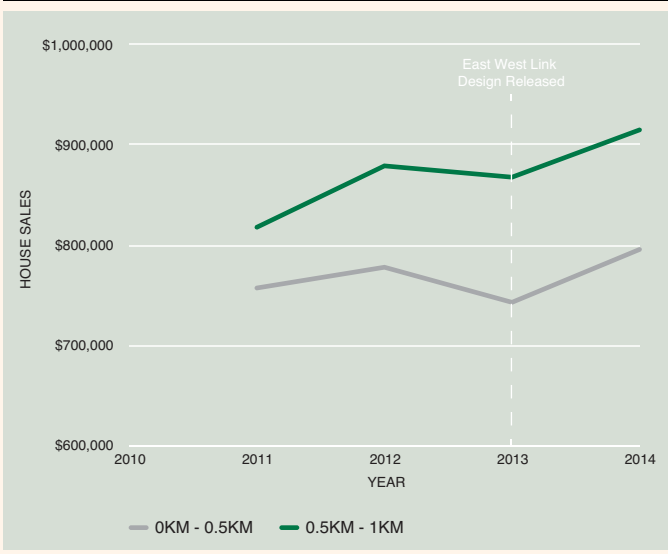
Figure 12: House Sale Adjacent to Burnley Tunnel Ventilation Stack



The results in Figure 12 show that:

- From 1993 to 2005, the average sales prices of both regions have been increasing, despite some fluctuations;

Figure 13: House Sales Adjacent to Proposed Clifton Hill Ventilation Stack



- Average sales prices for properties located within 0.5km from the ventilation stack are consistently lower than those located from 0.5 to 1km, reflecting that environmental concerns could be an important determinant of properties around a ventilation structure; and
- The price increase during the construction period (1996-2000) tended to slow down for properties located within a 500 metre radius from the vent, relative to those further away. Figure 12 shows that before 1996, the prices in the two regions were similar and changed in a parallel fashion. As construction of the project begins in 1996, the houses within the 500 metre radius begin to drop in price which is displayed clearly with the divergence of the two lines. This discrepancy peaks around the middle of construction which can be attributed not only the ventilation stack, but also the noise and air pollution in the area due to the overall construction process. After the tunnel is completed in the year 2000 the prices in the two regions begin to converge.
- It seems that during the construction period, the market started to adjust to the new condition, where people who were more sensitive to noise and threats of ambient pollutants moved out and those who were not so sensitive to the above factors took over these properties. By the completion of the project, property prices had achieved equilibrium and the markets for the two regions converge.

→ Clifton Hill

The same analysis performed on the Burnley Tunnel vent was completed on the proposed location of the East West Link eastern vent. The proposal for the East West Link project was released in 2013 so at around this point it could be expected

Figure 14: Clifton Hill Ventilation Stack Map

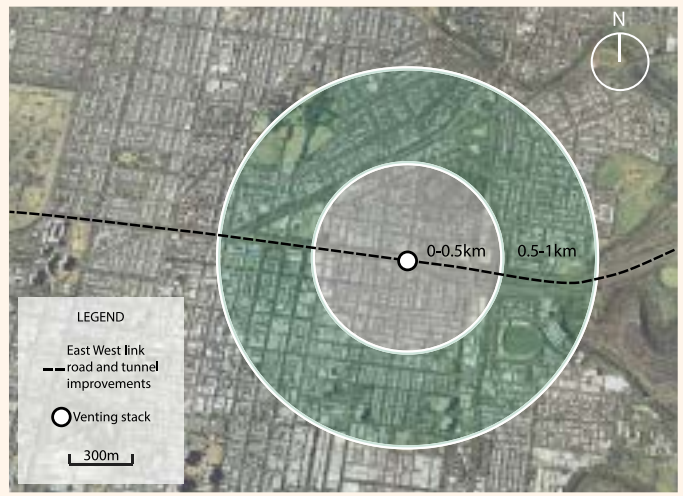


Figure 15: House Sales Adjacent to Parkville Ventilation Stack

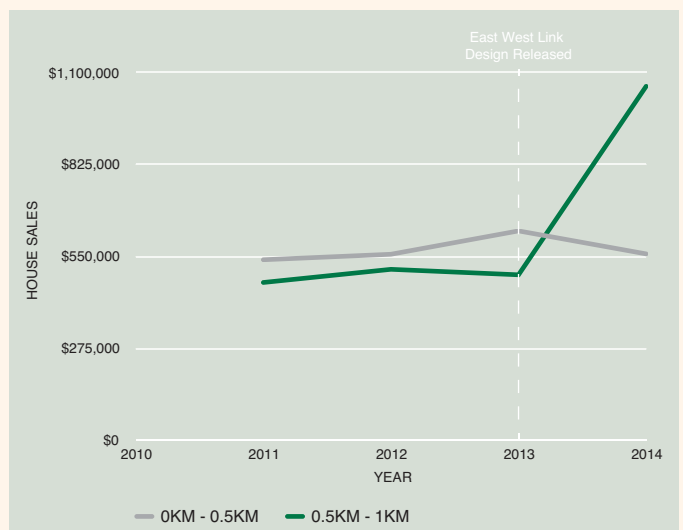
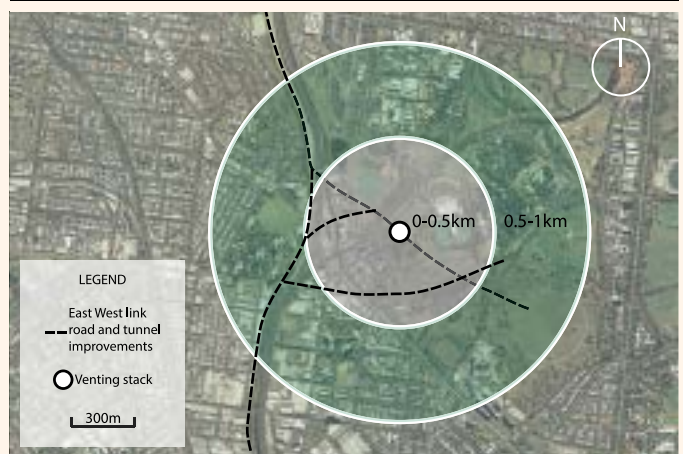


Figure 16: Parkville Ventilation Stack Map



that house prices within 500 metres would suffer. The results are shown in Figure 13. From 2011 to 2014 the average house prices in both region fluctuate in the same manner and have the same trends. Most likely, it is too early in the projects development for any noticeable impact on house prices to be apparent. It is also possible that without the physical presence of the ventilation structure it is not having much of an effect yet.

→ Parkville

Analysis of the western ventilation structure shows a divergence in price between the two regions which could be attributed to the East West Link project. Figure 15 shows that after 2013, house prices in the 500 metre to 1000 metre region clearly drop which could be credited to all the proposed infrastructure improvements in the area. The house prices in the closer bracket increase sharply which is an unexpected result. This is most likely due to the small sample size (there are few residential properties within 500 metres of the vent) and the sale of a \$1.4 million property in 2014. This small sample size along with the small timeframe provides less conclusive results for the effects of the western vent.

→ Individual Property Pricing Model in relation to venting stacks

After a regression analysis on properties in vicinity to Burnley Vent, it is shown that although both room number and distance to the vent are important factors in pricing properties, the number of rooms in a property plays a much more significant role than distance to the vent.

Statistically, the results show that:

- If all other conditions are held constant, having one more room (either bedroom or bathroom) tends to increase the total property price by \$102,273 for properties with at least four rooms in total;
- If all other conditions are held constant, prices increase for about \$61 for every metre increase in distance from the vent, which is marginal when compared with the effect of room structure;
- For the same property, an additional year increases the property value by \$39,000. Taking out annual inflation of about 3%, the increase is marginal.

This means that if there are three properties with the same number of rooms in a given year, and they are located at 0km, 0.5km and 1km from the venting stack respectively, their prices will differ. The property immediately next to a stack will be valued \$30,500 lower than its counterpart located 0.5km away, and \$61,000 lower than 1km away, from the venting stack.

International studies have found that properties in the nearby vicinity of ventilation stacks are less desirable to live in. During and following the construction of three road tunnels in Oslo, surveys were repeated amongst residents in affected neighbourhoods over a 6 year period. The results of these found that generally residents were satisfied with the changes. The residents who lived close to the tunnel entrances reported annoyance due to noise, traffic and air pollution. (TØI, 2004)

4C) Tunnels

The presence of a tunnel under a major road does not impose real environmental threats. Depending on the method during the construction period, residents nearby may be disturbed by noise and vibration. People may be influenced by the perception that a tunnel is running beneath their properties and become less willing to stay or purchase these properties. This perception compounds with the traffic emissions from the major road above the tunnel. Therefore, it is likely that house prices will increase as the distance from the major road and tunnel increases.

It is important to consider that a tunnel running beneath major roads could reduce the traffic flow on these roads, and in effect make the surrounding properties more attractive. It is uncertain how exactly these two opposite effects offset each other.

→ Burnley Tunnel

Three streets were selected in parallel with part of Burnley Tunnel (Table 4 and Figure 17) which runs beneath Swan Street. The length of this particular road section is approximately 300 metres in total. Though relatively short, it mirrors the East West Link tunnel, which runs underneath Alexandra Parade. Although the Belgrave/Lilydale line runs past this particular section of the Burnley Tunnel, this should not have an impact on the extent to which the construction of the tunnel affects property price. The presence of the railway will be treated as a constant in this analysis.

Table 4: Streets Sampled near Burnley Tunnel

Street Name	Distance Relative to Swan Street	Distance to Swan Street
Tanner Street	North	210m
Richmond Terrace	North	350m
Kelso Street	South	350m

Figure 17: Three Sampled Streets near Burnley Tunnel

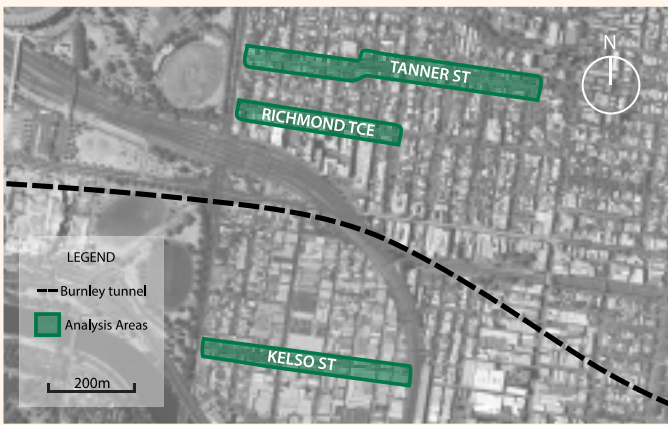
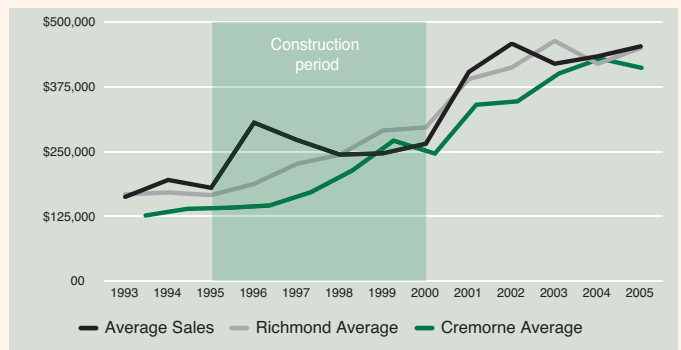


Figure 18: Average Sale Prices in Selected Streets - Burnley Tunnel



Figure 19: Average sales price – comparison with Richmond and Cremorne



The main observation from Figure 18 is despite the overall upward trend in property prices across the years, during the construction period from 1996-2000, there is a decline in the average sale price for properties located on these three streets.

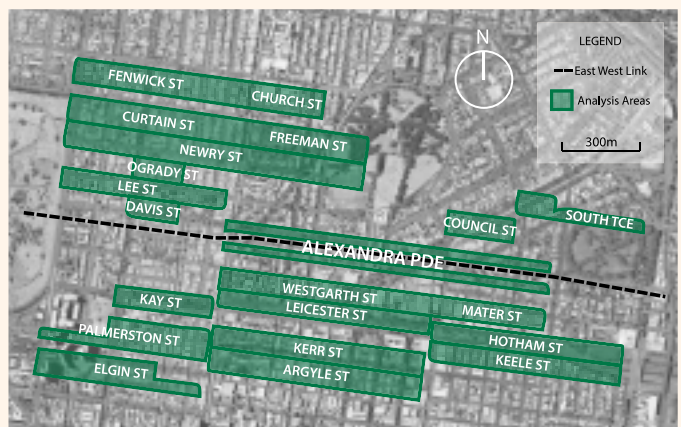
In order to attribute this decline to the construction of the tunnel, it is necessary to rule out the possibility that the surrounding property market experienced similar fluctuations. The comparison of property prices in these three streets against property prices in two nearby suburbs, Richmond and Cremorne, is shown in Figure 19.

It can be observed that compared to the average sale price of properties in Richmond and Cremorne, properties on the three sample streets have similar or higher prices, potentially due to better accessibility. In addition, the price changes are positively correlated. During the construction period, the price changes between the sample streets and two suburbs started diverging. This divergence lasts until the completion of the project.

It can be concluded that the construction of tunnels does negatively impact property prices in surrounding areas. This negative impact tends to fade towards the end of the construction.

→ The East West Link Tunnel

Figure 20: Sampled Streets near East West Link Tunnel



Properties on 22 streets in parallel with Alexandra Parade were sampled for their 2013-2014 prices as the basis for price projection. (Table 5 and Figure 20)

Applying the price change patterns of Burnley Tunnel from 1996 to 2005 to the East West Link tunnel, enabled price projections to be made for the construction period 2014-2019, and a five year post construction period from 2020-2024. The results are shown in Table 6 and Figure 21.

THE EAST WEST LINK WILL NEGATIVELY INFLUENCE PROPERTY PRICES AROUND THE TUNNEL, AND THE DECLINE WILL TAKE ABOUT FIVE YEARS TO RECOVER. THE WORST EFFECTS WILL BE ONE TO TWO YEARS INTO THE CONSTRUCTION PERIOD.

The price projections modelled from the Burnley Tunnel have limitations and are a projection only. They do not account for:

- More awareness of environmental impacts. Apart from the price decline during the construction period, the price for the regions started falling since mid-2013, approximately the same time when the design for the East West Link was released. This differs from Burnley Tunnel scenario, which indicates that people are more aware of the potential environmental threats from tunnel constructions and the property market adjusted much earlier than previously. This implies that the decline that is expected in the next five years may be more dramatic for the East West Link, and that the recovery towards the end of the construction may take longer than projected in this report.
- Wider property market change. In particular, there seems to be an abnormal change in price peak in mid 2021 (about 52%), simulated from the mid 2001 Burnley Tunnel figure. This is most likely due to wider property market changes in early 2000, as the change in average prices for Richmond and Cremorne show a similar peak. Therefore, the projection should be read in light of the wider property market fluctuations in the next five to ten years.

Table 5: Streets Sampled near East West Link Tunnel

Street Name	Direction Relative to Alexandra Parade	Distance to Alexandra Parade
Alexandra Parade	N/A	0
Davis Street	North	70
Council Street	North	150
Lee Street	North	150
Ogrady Street	North	230
Page Street	North	250
South Terrace	North	250
Newry Street	North	300
Curtain Street	North	400
Freeman Street	North	550
Church Street	North	550
Fenwick Street	North	550
Mater Street	South	150
Westgarth Street	South	150
Leicester Street	South	220
Hotham Street	South	235
Kay Street	South	250
Keele Street	South	300
Kerr Street	South	350
Palmerston Street	South	400
Argyle Street	South	450
Elgin Street	South	550

Table 6: Actual and Projected Average Prices- Properties within 550 metres of East West Link Tunnel

Year	Average Price	Actual or Projected
2011	881,093	Actual
2012	910,414	Actual
2013	912,120	Actual
2014	813,224	Actual to Aug 2014
2015	724,090	Projected
2016	648,918	Projected
2017	655,469	Projected
2018	704,696	Projected
2010	761,072	Projected
2021	1,156,829	Projected
2022	1,313,676	Projected
2023	1,202,233	Projected
2024	1,243,275	Projected

5) LONG TERM IMPACTS

A potential benefit of the East West Link will be reductions in traffic volumes. This will decrease travels times, relieve stress on commuters and lower air pollution helping to mitigate health risks. Table 7 shows the predicted traffic volumes in 2031 which show widespread reductions. (Linking Melbourne Authority, 2014)

Table 7: Predicted Traffic Volumes in 2031

Road	Reductions of up to
Alexandra Parade	-30%
Johnston Street	-30%
Macarthur Road	-30%
Boundary Road	-15%
Queens Parade	-10%
Brunswick Street	-10%
Bell Street	-10%
Flemington Road	-10%
Chandler Highway	-5%

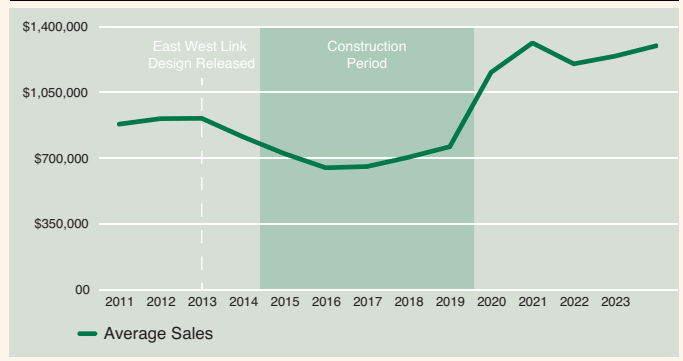
There is debate on the accuracy and completeness of the traffic modelling, which is documented in the Complete Impact Statement (CIS). A common topic of discussion for transport engineers is the lack of consideration given to induced traffic. The phenomenon of induced demand traffic is defined as the increase in road travel demand as a result of reduced travel times. In the context of the East West Link this refers to an overall increase in the number of road users due to the construction of the linking tunnel.

In one report, Dr Michelle E Zeibots says in reference to Melbourne’s transport network that “Prevailing conditions make the network vulnerable to high levels of induced traffic growth if the East West Link is introduced at a time when the public transport network is clearly under pressure.” She goes onto say that “I do not believe the issue of induced traffic growth has been adequately addressed in the CIS.” (Zeibots, 2014) In another report, Transport Engineer Peter Thompson says when referring to the CIS and the matter of induced traffic that “...it remains unclear if or how it has been dealt with.” (Pitt & Sherry, 2014)

These two experts suggest that the traffic modelling results documented in the CIS do not address all issues and are inaccurate. If this is the case traffic volume reductions may not reach the levels that are proposed resulting in less impressive benefits. With Melbourne’s current rapid population growth, perhaps other projects that would substantially increase network performance are being overlooked.

Once operation commences, the East West Link will be

Figure 21: The East West Link Pricing Projection



highly influential in shaping Melbourne in a variety of ways. Over the next five years, the construction of the proposal will bring enormous employment opportunities. This is not achieved without consequences, with several businesses having to relocate and potentially lose employees. Over a longer term, having an alternative connection between Melbourne city and the Eastern suburbs can reduce the over reliance on Alexandra Parade. In particular, motorists with destinations at the two ends of the tunnel can reduce their travel time, which in turn will reduce the traffic congestion from Alexandra Parade to City Link, and provide improvement potential for public transport in the area.

The implications for the wider Melbourne region are huge. Better connectivity and transport flexibility will enable Melbourne residents to choose properties in both eastern and western outer suburbs. This will drive up the demand for the property market and infrastructure. Secondly, higher population density and activities in suburbs will stimulate commercial activities in those areas, help improve the spatial configuration in Melbourne, and build a more balanced and prosperous city.

In addition, the East West Link will improve the connectivity for road freight to and from the Port of Melbourne and northern suburbs, and offer better access to Melbourne Airport. This will benefit the business community that have employees travel cross-city and to and from other cities, and firms located in Melbourne and regional Victoria that need to transport goods to and from interstate. Over the long term, Melbourne could construct a better Economic stance and stronger presence in the Asia-Pacific region.

It might take some time for these benefits to be realised. In particular, the extent that people will use the tunnel is not only subject to where they depart and where their destinations are, but also to the perception of road users. It is likely that people are uncomfortable with using an extensive tunnel across the city, with the fear of health impairment and underground congestion. In addition, this report has no intention to assess the cost effectiveness of such a project, but only to shed light on the potential impacts of this project according to its current design, which is also subject to

change once the tender process is concluded.

Overall the East West Link will have wide ranging and significant effects on not only the immediate areas surrounding the project but also greater Metropolitan Melbourne.

In terms of the property market, Secret Agent believes the effects will be temporary. Based on the pricing situation for the Burnley Tunnel, the East West Link is predicted to have its greatest effect on property prices in the first two years of construction. Property prices in the vicinity of the tunnel would decrease at a rate of about 10% for the two to three years then rise slowly again nearing the completion of the project. Once the tunnel is complete, prices will return to normal levels. Whilst it was not looked at in depth in this study, it would be expected that the East West Link will benefit house prices in the Eastern and Western suburbs since these areas will be better connected and more accessible thereby increasing demand and prices.

A longer term impact, one that is speculative but backed by increasing amounts of scientific evidence, is the potential for great harm in relation to the particulate matter released and concentrated around the venting stacks. Children, the elderly and those with pre-existing health issues are of particular concern as they are more susceptible to ill effects.

Pricing indications of properties surrounding the vents supports the health concerns to some extent. The Burnley Tunnel analysis shows that during and after construction the price for properties within 500 metres of the venting stack is consistently lower than properties located between 500 metres and 1000 metres. At the start of the construction period the price increases for houses within 500 metres (10% per year), is slower than the price increases for houses between 500 metres and 1000 metres (19% per year). The proposed vent locations for the East West Link have had an early effect on property prices even before the proposal comes to life. It can be expected that during construction the same trends as the Burnley Tunnel will be seen. That is, for every metre increase in the distance from the ventilation stack, property prices increase. In the case of the East West Link, it will be interesting to see how a more health conscious community view property in this area throughout the duration of the project and once completed.

6) REFERENCES AND FURTHER READING

Brunekreef, B., Beelen, R., Hoek, G., Schouten, L., Bausch-Goldbohm, S., Fischer, P., Armstrong, B., Hughes, E., Jerrett, M., and Van den Brandt, P., 2009. Effects of long term exposure to traffic related air pollution on respiratory and cardiovascular mortality in the Netherlands: the NLCS-AIR study, *Res Rep Health Eff Inst*, (139):5-71.

Cook, H. & Tomazin, F., 2014. Melbourne Zoo fears animal panic during tunnel drilling blasts, accessed on 1st August, <<http://www.theage.com.au/victoria/melbourne-zoo-fears-animal-panic-during-tunnel-drilling-blasts-20140125-31fr.html>>

Cowie, T., Rose, N., Ezz, W., Xuan, W., Cortes-Waterman, A., Belousova, E., Toelle, B., Sheppard, V., and Marks, G., 2012. Respiratory Health before and after the opening of a road traffic tunnel: A Planned Evaluation, accessed on 28th August 2014, <<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0048921#s2>>

Davidson, C. I., Phalen, R. F. & Solomon, P. A., 2005. Airborne Particulate Matter and Human Health: A Review. *Aerosol Science and Technology*, Volume 39, p. 737.

Department of Environment and Conservation (NSW), 2001. Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, s.l.: s.n.

Gauderman, W., Vora, H., McConnell, R., Berhane, K., Gilliland, F., Thomas, D., Lurmann, F., Avol, E., Kunzli, N., Jerrett, M., and Peters, J., 2007. Effect of exposure to traffic on lung development from 10 to 18 years of age: a cohort study, *Lancet*, Feb 17;369(9561):571-7.

Hewitt, S., 2014. East West Link battle goes underground, accessed on 1st August 2014, <<http://www.theage.com.au/victoria/east-west-link-battle-goes-underground-20140806-1017er.html>>

Linking Melbourne Authority, 2013. The East West Link and Melbourne Zoo, s.l.: s.n.

Linking Melbourne Authority, 2014. Comprehensive Impact Statement, s.l.: s.n.

Moore, T., 2010. Tunnel runs deep, concerns run deeper, accessed on 1st August 2014, <<http://www.brisbanetimes.com.au/queensland/tunnel-runs-deep-concerns-run-deeper-20100429-twb3.html>>

National Health and Medical Research Council, 2008. Air Quality in and Around Traffic Tunnels, s.l.: s.n.

NSW Department of Health, 2006. Investigation into the possible health impact of the M5 East Motorway Stack on the Turrella Community, s.l.: NSW Department of Health.

Pitt & Sherry, 2014. Proposed East West Link Evidence to the Assessment Committee - Traffic & Transport, s.l.: s.n.

Samet, JM., Dominici, F., Curriero, F., Coursac, I., and Zeger, S., 2000. Fine particulate air pollution and mortality in 20 US Cities, 1987-1994, *NEJM*, 343(24):1742-49.

Shu, S., Yang, P. & Zhu, Y., 2014. Correlation of noise levels and particulate matter concentrations near two major freeways in Los Angeles, California. *Environmental Pollution*, Volume 193, p. 130.

TØI (Transportøkonomisk institutt), 2004. Veger til bedre bymiljø. Miljøundersøkelser, Oslo Øst 1987-2002. Report 743/2004.

Valavanidis, A., Fiotakis, K., and Vlachogianni, T., 2008. Airborne particulate matter and human health: toxicological assessment and importance of size and composition of particles for oxidative damage and carcinogenic mechanisms. *J Environ Sci Health C Environ Carcinog Ecotoxicol Rev*. 26(4):339-62.

Zeibots, M. E., 2014. Expert Witness Report - Induced travel demand and traffic forecasts for the proposed East West Link Tollway: implications for traffic network performance, s.l.: s.n.

INNER MELBOURNE TURNOVER

Table 9: Inner Melbourne Quarterly Turnover

		PREVIOUS QUARTER (MAR, APR & MAY 2014)				CURRENT QUARTER (JUN, JUL & AUG 2014)					
		Apartments		Houses and Townhouses		Apartments			Houses and Townhouses		
		Turnover	Turnover By Area	Turnover	Turnover By Area	Turnover	Turnover By Area	Number of Listings 1/9/2014	Turnover	Turnover By Area	Number of Listings 1/9/2014
CENTRAL	Docklands	3.98%		0.00%		2.88%		280	0.00%		0
	Melbourne	2.53%	2.47%	0.00%	0.00%	1.35%	1.64%	754	0.00%	0.00%	0
	Southbank	1.59%		0.00%		1.79%		351	0.00%		0
INNER NORTH	Brunswick	2.19%		1.36%		1.18%		82	0.93%		49
	Brunswick East	1.98%		1.44%		2.08%		40	1.16%		23
	Carlton	0.93%		0.53%		0.84%		199	0.53%		10
	Carlton North	0.95%		0.91%		0.38%		5	0.67%		13
	Clifton Hill	2.61%		1.80%		1.40%		2	0.82%		18
	Collingwood	1.68%	1.39%	0.83%	1.38%	1.76%	1.15%	30	0.77%	0.8%	8
	Fitzroy	1.37%		1.78%		1.00%		34	0.89%		11
	Fitzroy North	0.91%		1.60%		1.16%		24	0.53%		22
	North Melbourne	1.18%		1.20%		0.99%		72	0.52%		20
	Northcote	1.14%		1.44%		1.35%		42	0.91%		42
	Parkville	1.75%		2.30%		1.87%		19	0.57%		5
Princes Hill	0.00%		1.29%		0.00%		0	0.16%		0	
INNER EAST	Abbotsford	3.47%		2.23%		2.95%		65	1.43%		10
	Burnley	0.68%		1.96%		0.68%		0	1.47%		0
	Cremorne	1.10%		0.79%		0.55%		1	0.39%		0
	East Melbourne	2.07%	2.12%	3.20%	2.00%	1.38%	1.45%	19	1.07%	1.12%	7
	Hawthorn	2.01%		1.58%		1.34%		159	0.85%		43
	Prahran	2.31%		2.46%		1.90%		106	0.97%		41
	Richmond	2.13%		1.94%		1.42%		102	1.44%		48
	South Yarra	2.08%		2.19%		1.28%		229	0.95%		32
INNER SOUTH	Albert Park	1.18%		1.22%		0.79%		8	0.65%		9
	Middle Park	1.46%	1.42%	1.62%	1.23%	0.84%	0.9%	6	0.77%	0.57%	10
	Port Melbourne	1.00%		0.69%		0.85%		59	0.30%		15
	South Melbourne	2.12%		1.93%		1.03%		94	0.74%		12
INNER WEST	Flemington	0.89%		1.51%		0.54%		10	0.86%		8
	Kensington	1.19%	1.43%	1.26%	1.41%	1.43%	0.91%	30	0.75%	0.8%	16
	Travancore	1.66%		0.74%		0.62%		43	0.00%		3
	West Melbourne	2.71%		2.40%		1.06%		39	1.40%		10

(Total Sales for the period against total housing supply) Table compiled from data collected from March to August 2014. Total private dwellings information from the 2011 Census Report from the Australian Bureau of Statistics.

INNER MELBOURNE APARTMENTS PRICE COMPARISONS BY ROLLING QUARTERS



Table 10: Inner Melbourne Apartments - Price Comparisons

	PREVIOUS QUARTER (MAR, APR & MAY 2014)				CURRENT QUARTER (JUN, JUL & AUG 2014)					
	Average Price	Median Price	Lowest Sale	Highest Sale	Average Price	% CHANGE	Median Price	% CHANGE	Lowest Sale	Highest Sale
Docklands	784,481	635,000	373,000	3,750,000	538,591 ↓	-31.34%	548,000 ↓	-13.70%	206,000	710,000
Melbourne	599,360	480,000	145,000	3,150,000	436,000 ↓	-27.26%	430,000 ↓	-10.42%	262,000	690,000
Southbank	636,656	565,000	378,000	1,600,000	643,938 ↑	1.14%	599,000 ↑	6.02%	290,000	1,450,000
Brunswick	461,849	465,000	229,500	930,000	456,552 ↓	-1.15%	445,000 ↓	-4.30%	225,000	775,000
Brunswick East	458,667	495,000	245,000	690,000	476,719 ↑	3.94%	483,500 ↓	-2.32%	362,500	643,000
Carlton	366,300	379,000	130,000	680,000	326,318 ↓	-10.91%	210,000 ↓	-44.59%	133,000	715,000
Carlton North	*728,400	*560,000	320,000	1,724,000	*730,500 ↑	0.29%	*730,500 ↑	30.45%	730,500	730,500
Clifton Hill	543,000	544,000	353,000	650,000	532,071 ↓	-2.01%	523,000 ↓	-3.86%	297,500	670,000
Collingwood	556,533	505,000	155,000	1,015,000	727,750 ↑	30.76%	648,000 ↑	28.32%	348,000	1,237,000
Fitzroy	696,792	678,500	285,000	1,105,000	732,618 ↑	5.14%	655,000 ↓	-3.46%	338,000	1,410,000
Fitzroy North	504,725	505,000	331,000	850,000	538,591 ↑	6.71%	548,000 ↑	8.51%	206,000	710,000
North Melbourne	488,846	500,250	135,000	1,050,000	460,025 ↓	-5.90%	457,500 ↓	-8.55%	148,000	667,500
Northcote	450,441	490,000	318,000	605,000	436,000 ↓	-3.21%	430,000 ↓	-12.24%	262,000	690,000
Parkville	687,600	585,000	278,000	1,020,000	708,962 ↑	3.11%	596,000 ↑	1.88%	355,000	2,620,000
Princes Hill	-	-	-	-	-	-	-	-	-	-
Abbotsford	488,105	420,000	339,000	835,000	568,593 ↑	16.49%	520,000 ↑	23.81%	395,000	980,300
Burnley	*302,000	*302,000	302,000	302,000	*315,000 ↑	4.30%	*315,000 ↑	4.30%	315,000	315,000
Cremorne	551,500	551,500	428,000	675,000	-	-	-	-	-	-
East Melbourne	679,344	617,250	92,000	2,000,000	608,375 ↓	-10.45%	582,500 ↓	-5.63%	92,000	1,090,000
Hawthorn	552,431	517,250	100,000	1,380,000	480,432 ↓	-13.03%	457,000 ↓	-11.65%	115,000	1,208,000
Prahran	574,683	540,000	368,000	1,170,000	563,580 ↓	-1.93%	570,000 ↑	5.56%	332,500	1,030,000
Richmond	523,058	466,500	282,500	1,190,000	511,434 ↓	-2.22%	452,000 ↓	-3.11%	197,000	1,200,000
South Yarra	616,683	525,000	290,000	3,400,000	590,749 ↓	-4.21%	570,000 ↑	8.57%	225,000	1,350,000
Albert Park	*1,699,200	*2,375,000	510,000	2,470,000	*270,000 ↓	-84.11%	*270,000 ↓	-88.63%	270,000	270,000
Middle Park	*791,400	*760,000	630,000	1,100,000	*470,750 ↓	-40.52%	*478,000 ↓	-37.11%	456,250	478,000
Port Melbourne	744,398	649,500	370,000	2,075,000	879,299 ↑	18.12%	750,000 ↑	15.47%	345,000	2,055,000
South Melbourne	658,439	593,500	337,500	1,950,000	724,395 ↑	10.02%	620,000 ↑	4.47%	370,000	1,660,000
Flemington	407,458	365,750	273,000	675,000	-	-	-	-	-	-
Kensington	455,050	459,500	360,000	600,000	399,929 ↓	-12.11%	400,000 ↓	-12.95%	307,500	490,500
Travancore	*373,167	*372,000	307,500	440,000	*460,000 ↑	23.27%	*460,000 ↑	23.66%	460,000	460,000
West Melbourne	508,688	535,000	250,000	750,000	580,944 ↑	14.20%	560,000 ↑	4.67%	420,000	705,000

Table compiled from data collected from March to August 2014. A dash indicates no recorded sales for the quarter, inability to show a quarterly change or no quarterly change. Directional arrows indicate change in comparison to the previous rolling quarter. * indicates an average or median value calculated using 5 sales or less.

INNER MELBOURNE APARTMENTS QUARTERLY MEDIAN PRICES MAPPED



Figure 22: Inner Melbourne Apartments - Quarterly Median Change (%)

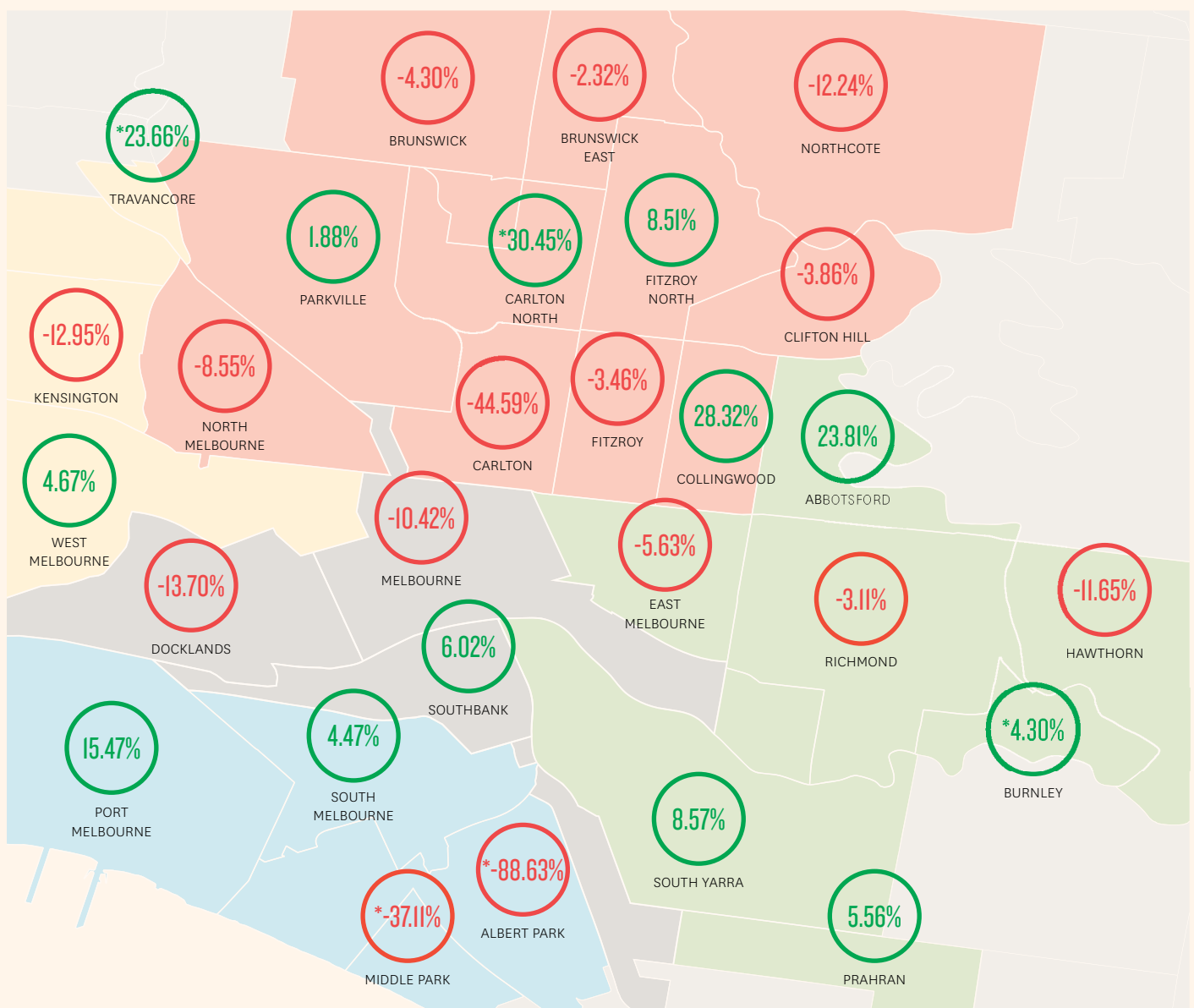


Table compiled from data collected from March to August 2014. Cremorne, Flemington and Princes Hill were omitted due to insufficient data.
* indicates an average or median value calculated using 5 sales or less.

INNER MELBOURNE TOWNHOUSES PRICE COMPARISONS BY ROLLING QUARTERS



Table 11: Inner Melbourne Townhouses - Price Comparisons

	PREVIOUS QUARTER (MAR, APR & MAY 2014)				CURRENT QUARTER (JUN, JUL & AUG 2014)					
	Average Price	Median Price	Lowest Sale	Highest Sale	Average Price	% CHANGE	Median Price	% CHANGE	Lowest Sale	Highest Sale
Brunswick	694,263	665,000	560,000	900,000	721,167 ↑	3.88%	708,000 ↑	6.47%	600,000	880,000
Brunswick East	682,350	640,000	552,000	820,000	747,955 ↑	9.61%	745,000 ↑	16.41%	546,500	1,027,000
Carlton	*866,000	*866,000	840,000	892,000	*555,000 ↓	-35.91%	*555,000 ↓	-35.91%	555,000	555,000
Carlton North	*1,000,000	*1,000,000	1,000,000	1,000,000	*1,039,000 ↑	3.90%	*1,039,000 ↑	3.90%	853,000	1,225,000
Clifton Hill	*831,800	*760,000	702,500	1,100,000	*690,250 ↓	-17.02%	*692,500 ↓	-8.88%	626,000	750,000
Collingwood	-	-	-	-	*657,000 -	-	*657,000 -	-	657,000	657,000
Fitzroy	*906,667	*860,000	725,000	1,135,000	*740,000 ↓	-18.38%	*750,000 ↓	-12.79%	650,000	820,000
Fitzroy North	831,125	882,500	625,250	1,160,000	*1,670,000 ↑	100.93%	*1,670,000 ↑	89.24%	1,670,000	1,670,000
North Melbourne	639,667	672,500	459,000	759,000	787,938 ↑	23.18%	745,000 ↑	10.78%	638,000	1,225,000
Northcote	819,333	827,500	590,000	1,175,000	767,643 ↓	-6.31%	740,000 ↓	-10.57%	627,500	879,000
Parkville	*655,000	*655,000	655,000	655,000	*900,000 ↑	37.40%	*900,000 ↑	37.40%	900,000	900,000
Princes Hill	-	-	-	-	-	-	-	-	-	-
Abbotsford	*777,000	*766,500	525,000	1,050,000	*731,667 ↓	-5.83%	*600,000 ↓	-21.72%	600,000	995,000
Burnley	*1,750,000	*1,750,000	1,750,000	1,750,000	*1,950,000 ↑	11.43%	*1,950,000 ↑	11.43%	1,950,000	1,950,000
Cremorne	-	-	-	-	-	-	-	-	-	-
East Melbourne	*1,028,333	*760,000	760,000	1,565,000	*1,440,000 ↑	40.03%	*1,440,000 ↑	89.47%	1,440,000	1,440,000
Hawthorn	1,244,125	990,500	745,000	2,170,000	*943,000 ↓	-24.20%	*943,000 ↓	-4.80%	910,000	976,000
Prahran	*1,056,100	*1,050,000	963,000	1,150,000	-	-	-	-	-	-
Richmond	939,022	860,000	691,000	1,850,000	1,057,655 ↑	12.63%	908,500 ↑	5.64%	652,000	2,530,000
South Yarra	1,058,250	1,077,500	761,000	1,340,000	*1,029,600 ↓	-2.71%	*1,006,000 ↓	-6.64%	705,000	1,605,000
Albert Park	*2,303,333	*2,310,000	1,995,000	2,605,000	*1,255,000 ↓	-45.51%	*1,150,000 ↓	-50.22%	765,000	1,850,000
Middle Park	*1,570,000	*1,570,000	1,570,000	1,570,000	-	-	-	-	-	-
Port Melbourne	1,088,389	1,040,000	775,000	1,460,000	1,507,667 ↑	38.52%	1,485,000 ↑	42.79%	906,000	2,020,000
South Melbourne	-	-	-	-	*1,625,000 -	-	*1,625,000 -	-	1,625,000	1,625,000
Flemington	*601,500	*601,500	601,500	601,500	-	-	-	-	-	-
Kensington	652,800	653,000	380,000	807,000	672,438 ↑	3.01%	662,500 ↑	1.45%	485,000	925,000
Travancore	-	-	-	-	-	-	-	-	-	-
West Melbourne	*855,500	*855,500	810,000	901,000	-	-	-	-	-	-

Table compiled from data collected from March to August 2014. A dash indicates no recorded sales for the quarter, inability to show a quarterly change or no quarterly change. Directional arrows indicate change in comparison to the previous rolling quarter. * indicates an average or median value calculated using 5 sales or less.

INNER MELBOURNE TOWNHOUSES QUARTERLY MEDIAN PRICES MAPPED



Figure 23: Inner Melbourne Townhouses - Quarterly Median Change (%)

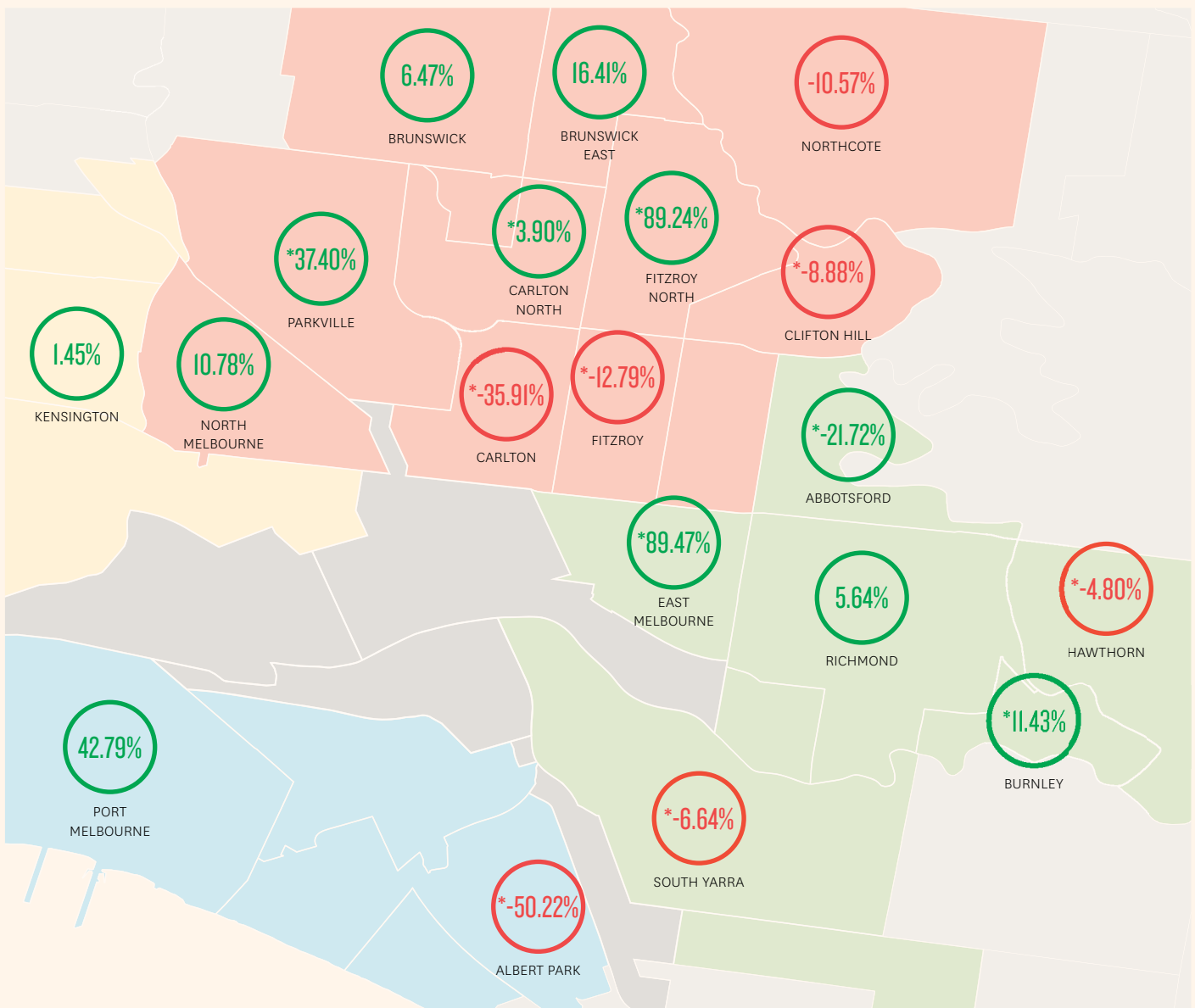


Table compiled from data collected from March to August 2014. Collingwood, Cremorne, Flemington, Middle Park, Parkville, Prahran, Princes Hill, South Melbourne, Travancore and West Melbourne were omitted due to insufficient data. * indicates an average or median value calculated using 5 sales or less.

INNER MELBOURNE HOUSES PRICE COMPARISONS BY ROLLING QUARTERS



Table 12: Inner Melbourne Houses - Price Comparisons

	PREVIOUS QUARTER (MAR, APR & MAY 2014)				CURRENT QUARTER (JUN, JUL & AUG 2014)					
	Average Price	Median Price	Lowest Sale	Highest Sale	Average Price	% CHANGE	Median Price	% CHANGE	Lowest Sale	Highest Sale
Brunswick	461,849	465,000	229,500	930,000	886,314 ↑	91.91%	835,000 ↑	79.57%	650,000	1,405,000
Brunswick East	984,373	841,000	650,000	1,575,000	873,647 ↓	-11.25%	875,000 ↑	4.04%	545,000	1,202,000
Carlton	*1,131,250	*1,192,500	740,000	1,400,000	1,166,167 ↑	3.09%	1,125,000 ↓	-5.66%	763,000	1,736,000
Carlton North	1,192,588	1,060,000	715,000	2,550,000	1,041,500 ↓	-12.67%	963,500 ↓	-9.10%	791,000	1,520,000
Clifton Hill	1,098,565	1,008,000	680,000	1,685,000	1,043,091 ↓	-5.05%	1,000,000 ↓	-0.79%	740,000	1,455,000
Collingwood	793,462	738,000	700,000	1,140,000	838,556 ↑	5.68%	804,000 ↑	8.94%	653,000	1,016,000
Fitzroy	1,191,545	1,097,500	755,000	1,775,000	1,435,375 ↑	20.46%	1,307,500 ↑	19.13%	1,195,000	1,800,000
Fitzroy North	1,306,614	1,045,000	740,000	3,724,000	1,213,235 ↓	-7.15%	1,167,000 ↑	11.67%	792,500	2,500,000
North Melbourne	952,214	851,000	560,000	2,200,000	-	-	-	-	-	-
Northcote	1,023,500	911,000	590,000	2,100,500	1,093,114 ↑	6.80%	960,000 ↑	5.38%	620,000	2,520,000
Parkville	1,441,727	1,410,000	935,000	2,100,000	*1,470,833 ↑	2.02%	*1,325,000 ↓	-6.03%	1,150,000	1,937,500
Princes Hill	1,137,125	1,116,000	875,000	1,460,000	*1,465,000 ↑	28.83%	*1,465,000 ↑	31.27%	1,465,000	1,465,000
Abbotsford	968,354	889,250	600,000	3,002,000	922,133 ↓	-4.77%	805,000 ↓	-9.47%	730,000	1,470,000
Burnley	*1,068,333	*1,100,000	820,000	1,285,000	*1,327,500 ↑	24.26%	*1,327,500 ↑	20.68%	855,000	1,800,000
Cremorne	*932,500	*832,500	750,000	1,315,000	*897,000 ↓	-3.81%	*897,000 ↑	7.75%	707,000	1,087,000
East Melbourne	2,623,409	2,650,000	432,500	5,275,000	*2,725,250 ↑	3.88%	*2,150,000 ↓	-18.87%	1,501,000	5,100,000
Hawthorn	2,022,955	1,655,000	576,000	4,350,000	1,445,173 ↓	-28.56%	1,217,500 ↓	-26.44%	315,000	4,360,000
Prahran	1,345,975	1,097,500	725,000	4,060,000	1,084,071 ↓	-19.46%	963,750 ↓	-12.19%	605,000	1,980,000
Richmond	1,042,681	903,500	650,000	4,480,000	1,102,296 ↑	5.72%	920,000 ↑	1.83%	660,500	4,070,000
South Yarra	2,028,799	1,450,000	735,000	5,700,000	1,609,105 ↓	-20.69%	1,400,000 ↓	-3.45%	772,000	3,800,000
Albert Park	1,745,953	1,555,000	860,000	4,300,000	1,652,357 ↓	-5.36%	1,301,500 ↓	-16.30%	790,000	3,800,000
Middle Park	1,643,909	1,456,000	1,270,000	2,560,000	1,958,750 ↑	19.15%	1,680,000 ↑	15.38%	840,000	3,950,000
Port Melbourne	1,201,188	1,075,000	690,000	2,650,000	1,111,661 ↓	-7.45%	1,012,500 ↓	-5.81%	700,000	1,800,000
South Melbourne	1,413,055	1,335,000	700,000	2,880,000	1,418,667 ↑	0.40%	1,272,500 ↓	-4.68%	611,000	3,250,000
Flemington	754,250	718,500	595,000	990,000	864,400 ↑	14.60%	735,000 ↑	2.30%	560,000	1,310,000
Kensington	851,118	790,000	591,250	1,430,000	844,909 ↓	-0.73%	708,000 ↓	-10.38%	572,000	2,000,000
Travancore	*877,500	*877,500	585,000	1,170,000	-	-	-	-	-	-
West Melbourne	1,170,333	1,117,500	662,000	1,870,000	*1,012,500 ↓	-13.49%	*1,012,500 ↓	-9.40%	812,000	1,155,000

Table compiled from data collected from March to August 2014. A dash indicates no recorded sales for the quarter, inability to show a quarterly change or no quarterly change. Directional arrows indicate change in comparison to the previous rolling quarter. * indicates an average or median value calculated using 5 sales or less.

INNER MELBOURNE HOUSES QUARTERLY MEDIAN PRICES MAPPED



Figure 24: Inner Melbourne Houses - Quarterly Median Change (%)

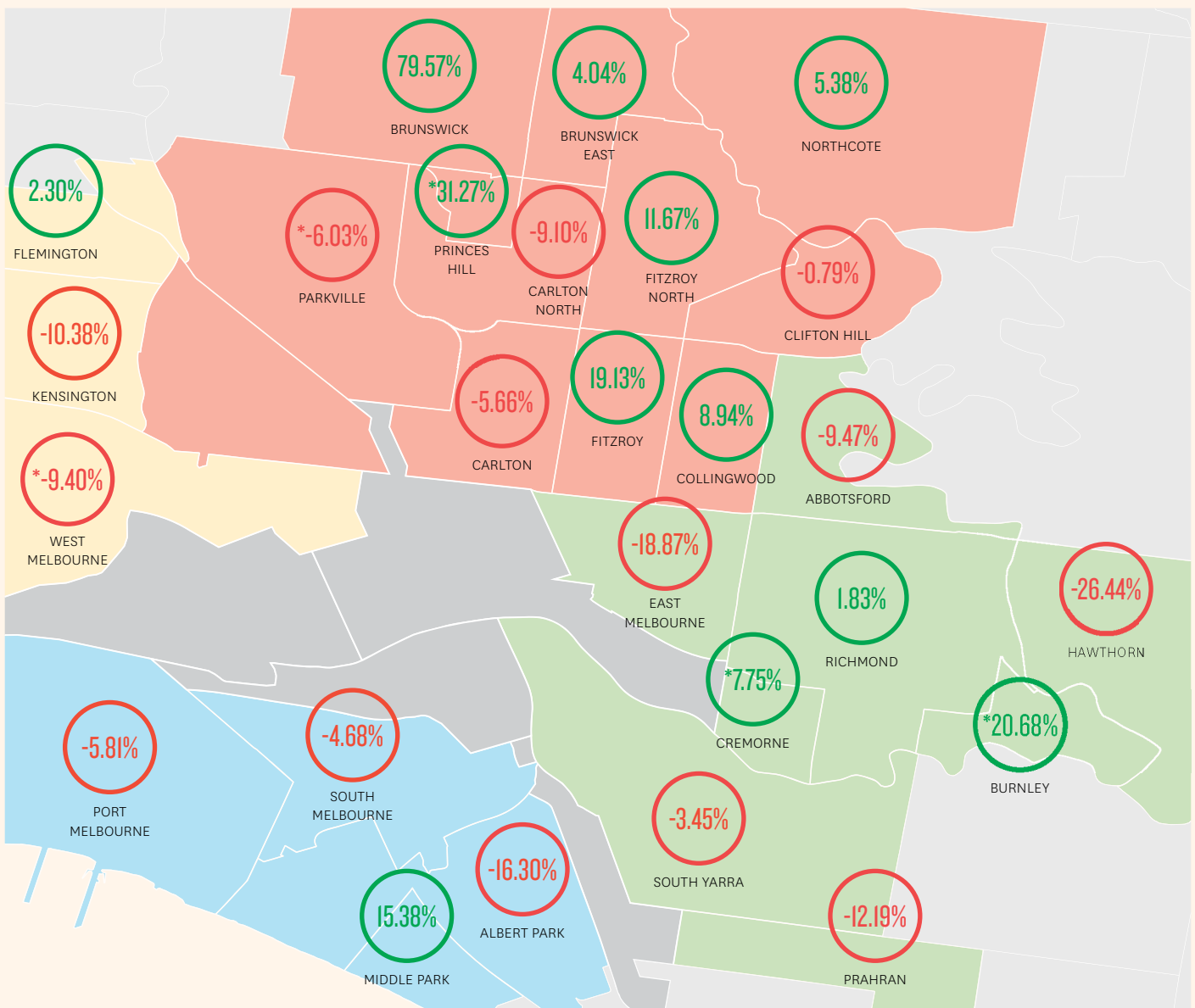


Table compiled from data collected from March to August 2014. Travancore and West Melbourne were omitted due to insufficient data. * indicates an average or median value calculated using 5 sales or less.

SECRET

INSIDE PERSPECTIVE

AGENT



THE SECRET AGENT REPORT
secretagent.com.au/thinking

For more information, contact Secret Agent.
info@secretagent.com.au

(+61) 3 9349 4333

Acknowledgements:
Steen Baker-Holland
Lauren Bezzina
Cosmo McIntyre
Jasmin Neophytou
Paul Osborne
Richard Rossmann
Jodie Walker
Xi Wang



[WWW.INSTAGRAM.COM/CURATION1](https://www.instagram.com/curation1)