



LED streetlight trial



Category P LED Luminaire Trial

Document and Amendment History

Version Number	Publish Date	Approved By	Summary of Changes
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INTRODUCTION AND TENDER PROCESS

Introduction

Ausgrid owns and maintains approximately 250,000 streetlights on behalf of 41 local councils. Ausgrid's goal is to provide the most energy efficient cost effective solutions to councils whilst minimising Ausgrid's operational costs. LED streetlights are evolving over the world as a technology that can meet these criteria.

It has taken some time for LED streetlighting manufacturers to consider producing streetlights specifically for the Australian and New Zealand markets. There are some significant differences between the Asian, European and American markets which prevent an "off the shelf" solution being chosen from one of these markets to use in Australia. This creates a commercial challenge for the manufacturers because on a global scale the Australian market is small. This then translates to a trade off situation for Ausgrid between capital and operational costs of the new technology verse the current. It appears now however that we do have the attention of LED streetlight manufacturers and there are now a number of products appearing that can compete with existing technology both technically and at a commercial level.

The next step now that Ausgrid is confident that there are products available in a competitive market is to trial a sample of these products. The purpose of this trial is to determine the following:

- Suitability of the construction of the LED luminaires for use on the Ausgrid network. In particular category P4 and P5 roads.
- Visual impact and minimisation of glare.
- Council and resident reactions to the new type of lighting.
- Understand what problems may be encountered with the introduction of LED streetlights

Tender Process

Ausgrid underwent an open tender process to choose the suppliers of the LED streetlights on trial. 30 responses were received and 3 were chosen. Ausgrid used criteria such as cost, technical conformance to the specification, quality, and supply chain to evaluate responses. Cost and technical characteristics of the responses varied significantly and suppliers varied from large multinationals to small Australian firms who had little experience in public lighting.

Ultimately what set the suppliers apart was the ability to comply to category P4 and P5 lighting levels required by AS1158.3 at the spacing that Ausgrid require. Very few suppliers were able to meet this requirement.

TECHNICAL DETAILS OF CHOSEN PRODUCTS

Supplier 1

- Sylvania Street LED
- 25W LED module - 18 x 1.4W High Power LEDs
- Total system power consumption 29W
- Precision modelled IP65 LED lens
- Integrated heat sink
- IP67 LED driver
- “Plug & Play” Electronic control gear and LED module.
- Colour Temperature: 5000K
- Colour Rendering Index: ≥ 70



Supplier 2

- LED Roadway Lighting SAT-24S
- Power consumption: 28W @ 350mA switchable to 22W @ 280mA
- IP 66 Ingress Protection for both light engine chamber and power supply chamber
- Two independent LED light engines are to be angled at 30° to a horizontal roadway in order to maximize targeted lumen output
- Heat sink fins to be integral with the single-piece cast body
- Colour Temperature 5000K (± 500),
- Colour Rendering Index: > 65



Supplier 3

- OrangeTeK Terraled 48
- Power Consumption 50W.
- High Quality 110 Lumen/Watt Nichia LEDs.
- Each LED module is fitted with identical optical lenses to provide optimal efficiency and desired light distribution
- The driver unit is individually sealed to a protection of IP66.
- Colour temperature: 4800K.
- Colour Rendering Index: ≥ 70



TRIAL SITES AND ENERGY USE

Trial Sites

Ausgrid invited all councils to submit a site they thought would be suitable for the trial. We received 15 responses by the cut off date and all these sites were evaluated using the following criteria:

- A street / block with little or no trees.
- The road reserve should be of standard width (20 metres).
- The street should be straight and flat.
- The street should be in a quiet residential area (light residential traffic).

Of the sites evaluated 8 were chosen to perform the trial. The sites are:

Cronulla – 1-24 Coast Ave and 1-21 Arthur Ave

North Bondi – 126-168 Ramsgate Ave

Georges Hall – Oak Drive between 7 Ash St and Whitemore)

Wiley Park – Shadforth St (between Lakemba St and Punchbowl Rd)

Balgowlah Heights – Bareena Dr (from Woodland St to Dobroyd Scenic Dr)

Mosman – Medusa St

Norville – 34-90 Irene Parade

North Ryde – 1-48 Betty Hendry Parade

Energy Use

Replaced lights were a mixture of mercury vapour and fluorescent globes. A total of 62 lights were replaced across the different locations in the trial.

Location	Total energy use of old streetlights (Watts)	Total LED energy use (Watts)	Energy saving
North Bondi Ramsgate Ave	391.6	168	57.1%
Cronulla Coast Ave & Arthur Ave	812.8	451.8	44.41%
Mosman Medusa Street	529	174	67.11%
Balgowlah Heights Bareena Dr	1053.8	552.2	47.6%
North Ryde Betty Hendry Pde	562.8	290	48.47%
Wiley Park Shadforth Street	342.2	168	50.91%
Georges Hall Oak Drive	392.8	224	42.97%
Norville Irene Parade	574.8	174	69.73%

BEFORE AND AFTER RESIDENT SURVEYS

Over 1000 letters were sent to notify residents that their street had been chosen for the LED trial. Accompanying this letter was a survey for residents to complete based on the existing street lighting (shown below). The survey was a way to get the residents to take notice of their existing street lighting so that they would be better able to make a comparison of the LED street lights.



LED Lighting Trial Opinion Survey - November 2011

Before we start our LED lighting trial, please let us know what you think about the existing lighting in your street:

Street name: _____

<i>Please tick one box from each row</i>	Agree	Slightly agree	Neither agree or disagree	Slightly disagree	Disagree
1. Street lighting in my street is adequate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. The daytime appearance of street lights in my street is acceptable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Existing street lights in my street are too bright and/or glary	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Existing street lights in my street are too dim and need upgrading	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. As a pedestrian, existing street lights in my street make me feel safer after dark	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Existing street lights in my street assist my driving and help me see pedestrians and cyclists better	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. My age group is:	< 40 <input type="checkbox"/>	40- 49 <input type="checkbox"/>	50-59 <input type="checkbox"/>	60-69 <input type="checkbox"/>	70+ <input type="checkbox"/>

Further comments/suggestions

Please feel free to provide your contact details below if you are happy for us to contact you in the future.

Name : _____

Address: _____

Phone: _____

Please return your survey in the stamped envelope provided

After the LED street lights had been installed for a month we sent out another survey seeking resident's feedback. The results from both of these surveys have been compiled and are tabled on the following pages.

LED Lighting Trial Opinion Survey - February 2012



Now that the trial has started, please let us know what you think of the new lighting in your street:

Suburb: **BALGOWLAH HEIGHTS**

<i>Please tick one box from each row</i>	Agree	Slightly agree	Neither agree or disagree	Slightly disagree	Disagree
1. The new street lighting in my street is adequate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I prefer the new street lights as compared to the old street lights	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. The daytime appearance of the new street lights in my street is acceptable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. New street lights in my street are too bright and/or glary	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. New street lights in my street are too dim and more light is needed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. As a pedestrian, the new street lights in my street make me feel safer after dark than the old lights	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. New street lights in my street assist my driving and help me see pedestrians and cyclists better	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. My age group is:	<input type="checkbox"/> < 40	<input type="checkbox"/> 40- 49	<input type="checkbox"/> 50-59	<input type="checkbox"/> 60-69	<input type="checkbox"/> 70+

Further comments/suggestions

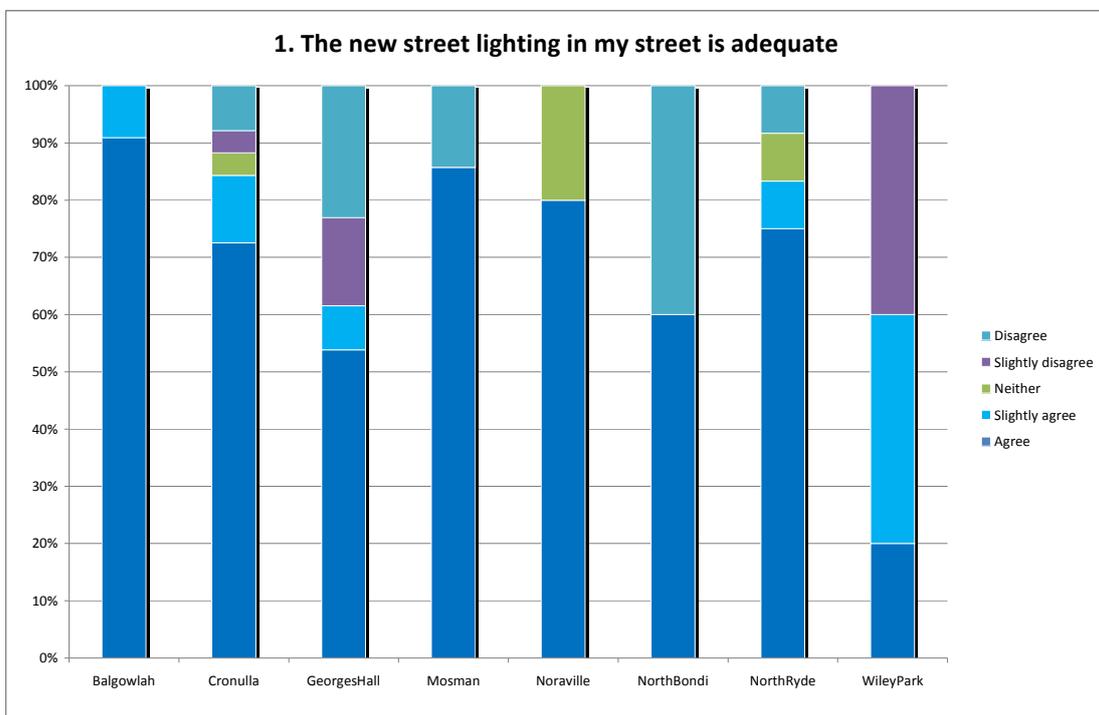
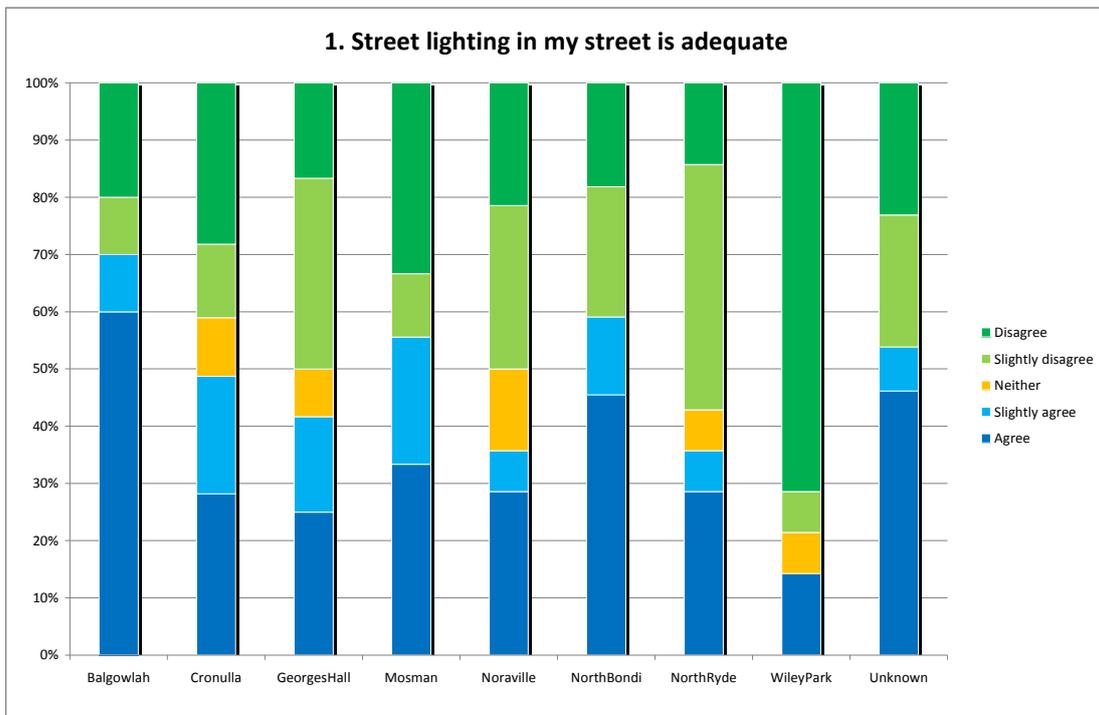
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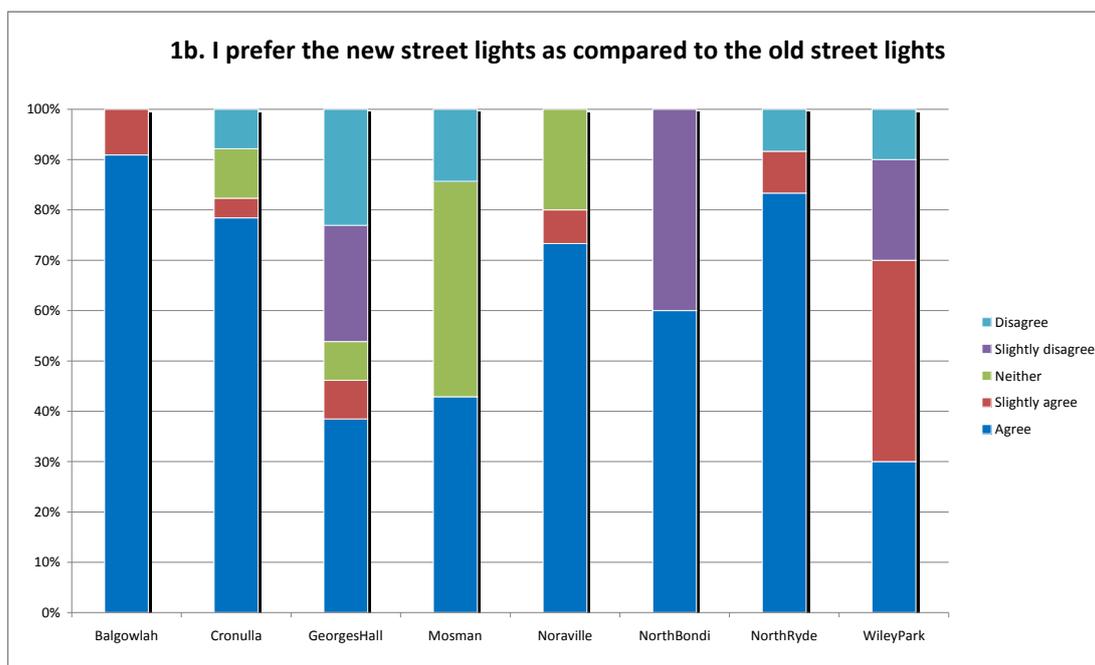
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Address: _____

Phone: _____

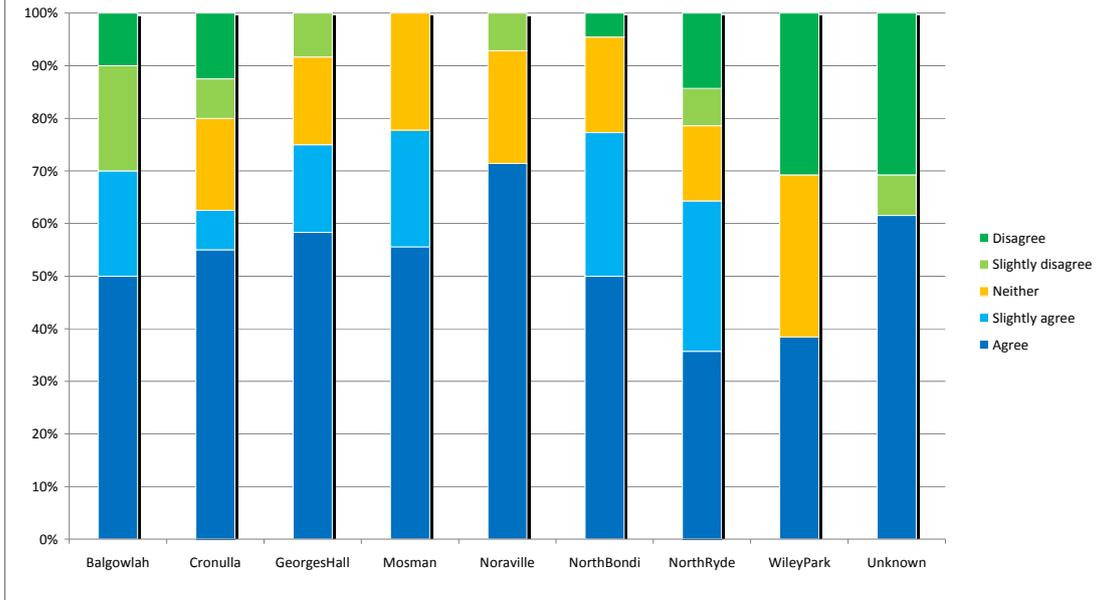
Please return your survey in the stamped envelope provided by 30th March 2012



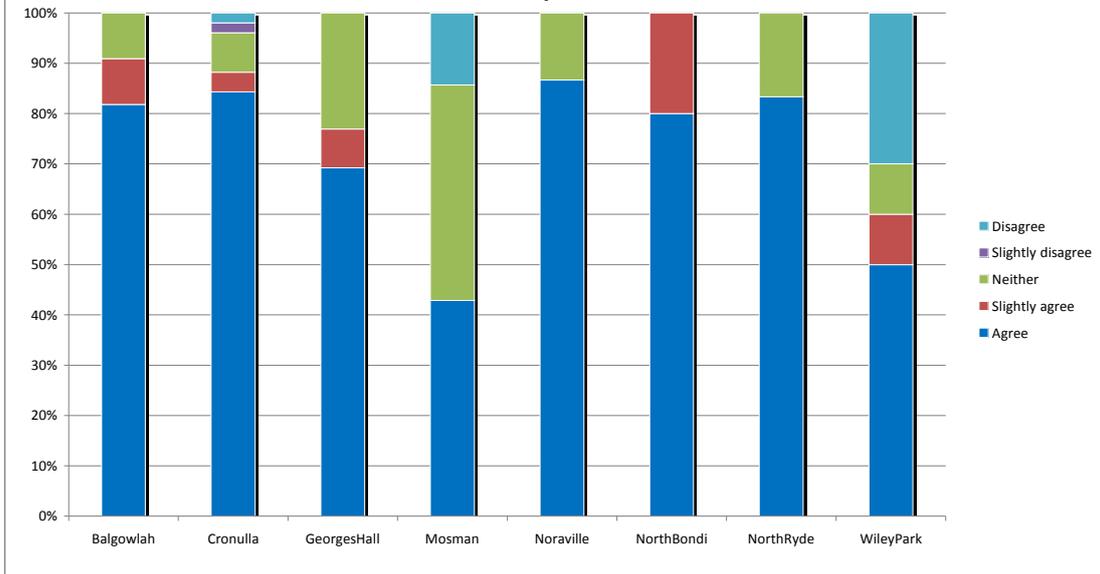


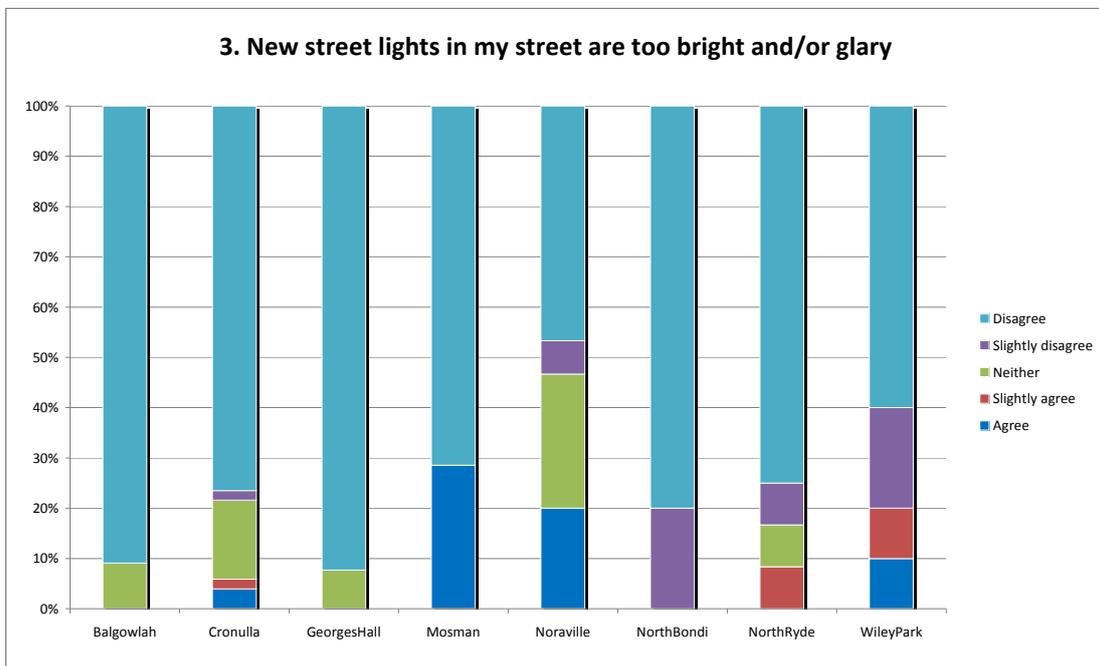
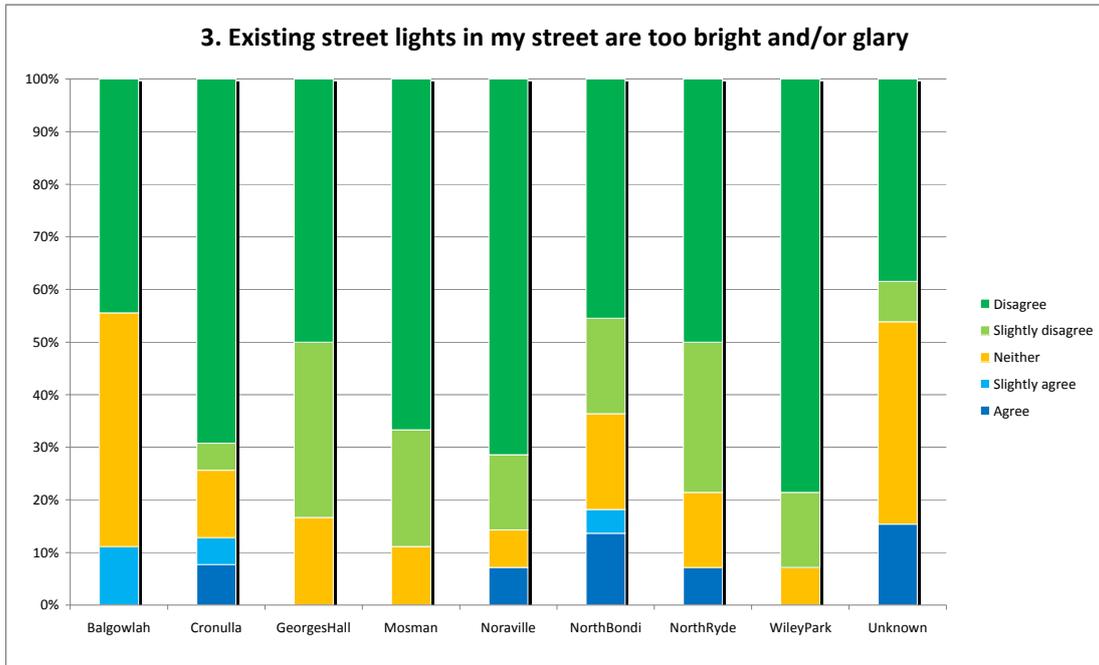
These results show that the majority of the residents prefer the new streetlights to the old. What they also show is that the residents prefer more light. The luminaires trialled at Balgowlah and Cronulla have a significantly higher wattage (50W) than the other trial luminaires which in turn would output more light. As can be seen in the results these two sites have the highest amount of “Agree” in the “*I prefer the new street light as compared to the old street lights*” category. Counter to that the locations that have 22W luminaires installed have the least amount of “Agree’s” in this category. In response to this we have increased the output of the luminaries to 28W to determine if there is any discernable improvement in lighting levels. It should be noted that all of these locations met Australian Standards for category P5 and P4 lighting levels.

2. The daytime appearance of street lights in my street is acceptable



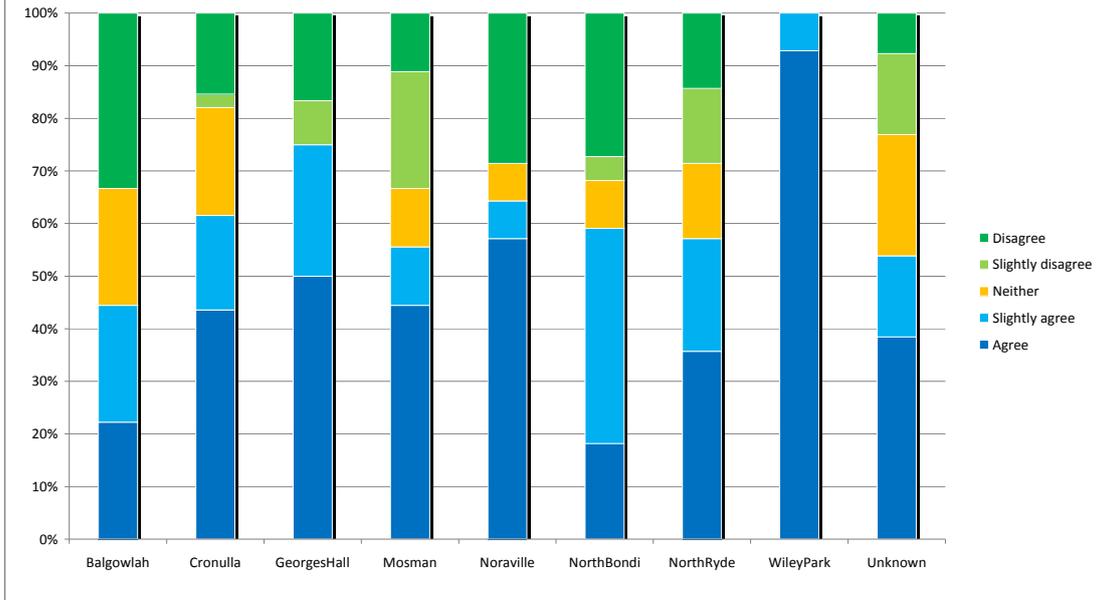
2. The daytime appearance of the new street lights in my street is acceptable



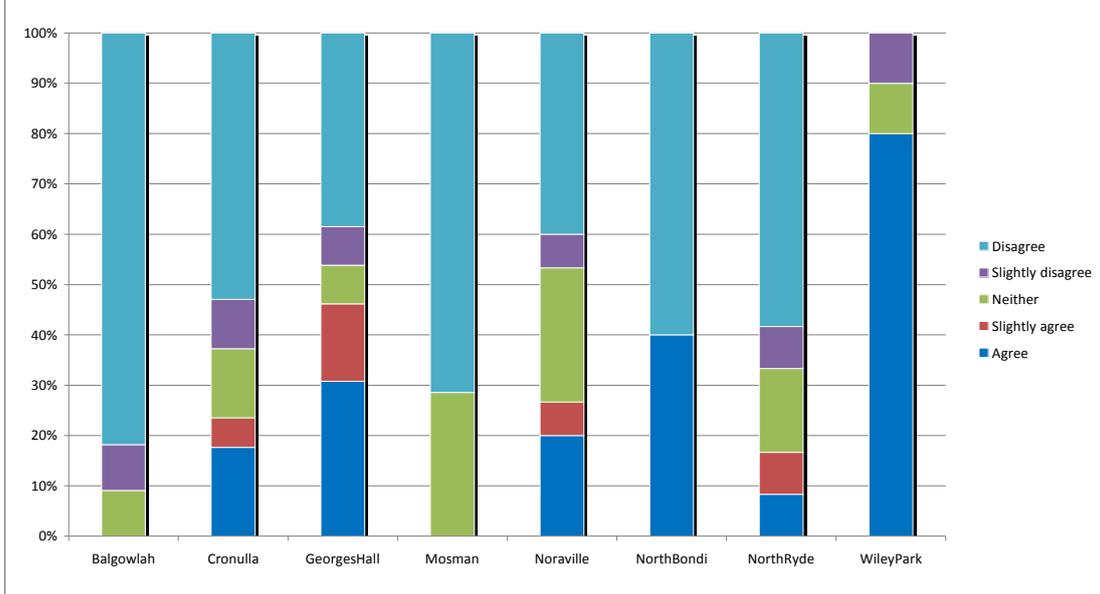


Glare is an issue with all streetlights. However LED streetlights have generated much more discussion in this area due to directional nature of LED's streetlights. As such we included a question in the surveys regarding glare. The results show that the residents do not find the LED streetlights any glarier than the previous streetlights and in fact quite the opposite.

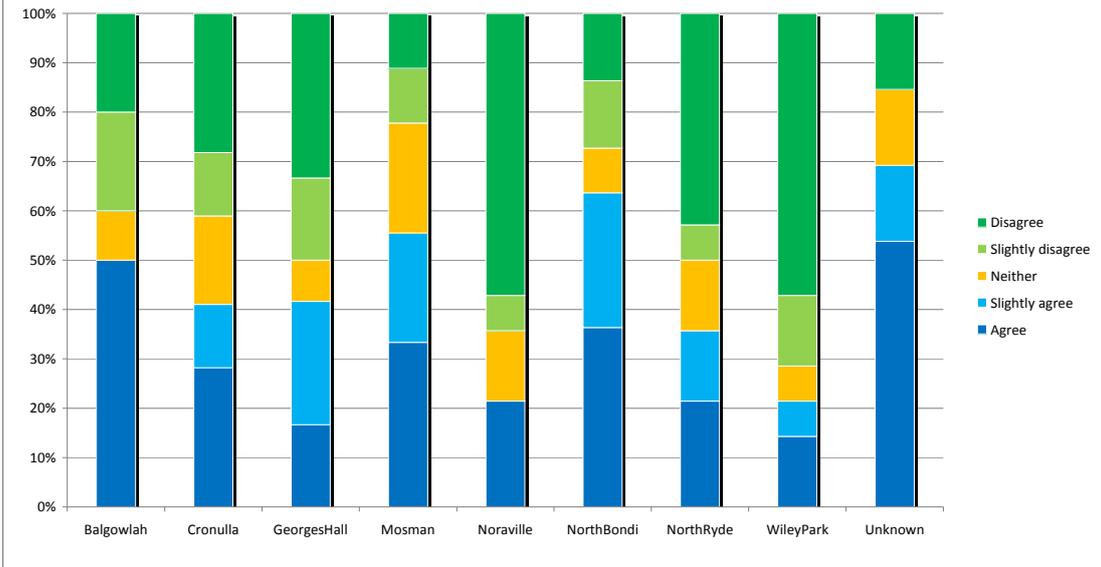
4. Existing street lights in my street are too dim and need upgrading



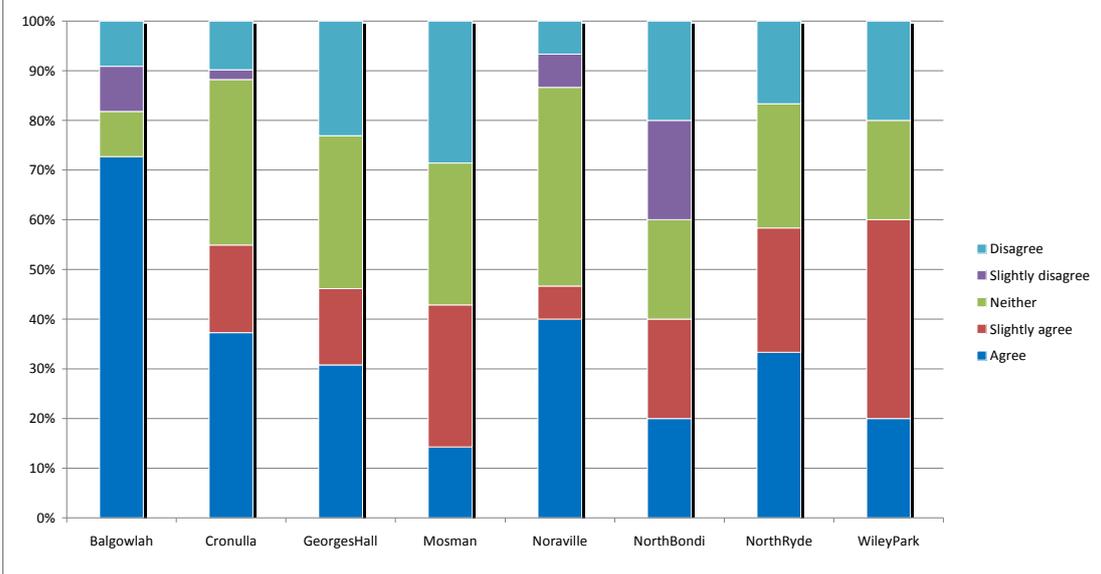
4. New street lights in my street are too dim and more light is needed



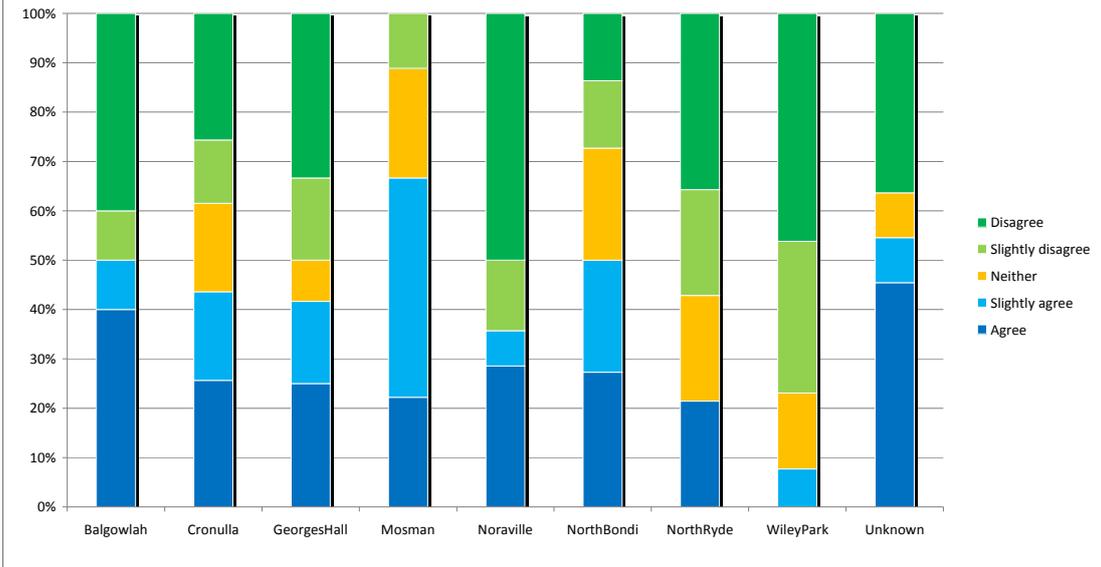
5. As a pedestrian, existing street lights in my street make me feel safer after dark



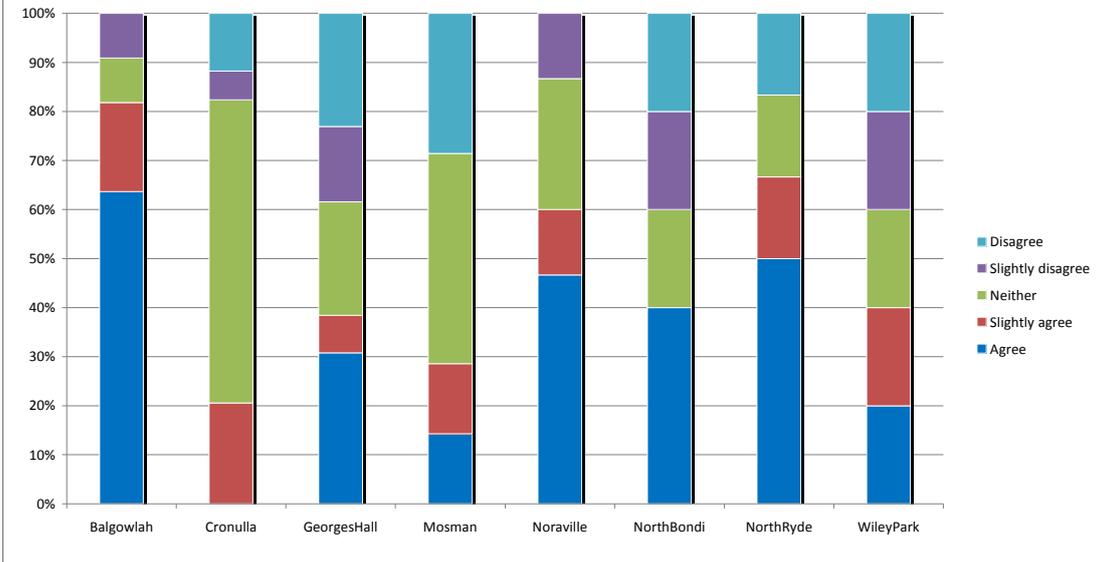
5. As a pedestrian, the new street lights in my street make me feel safer after dark than the old lights

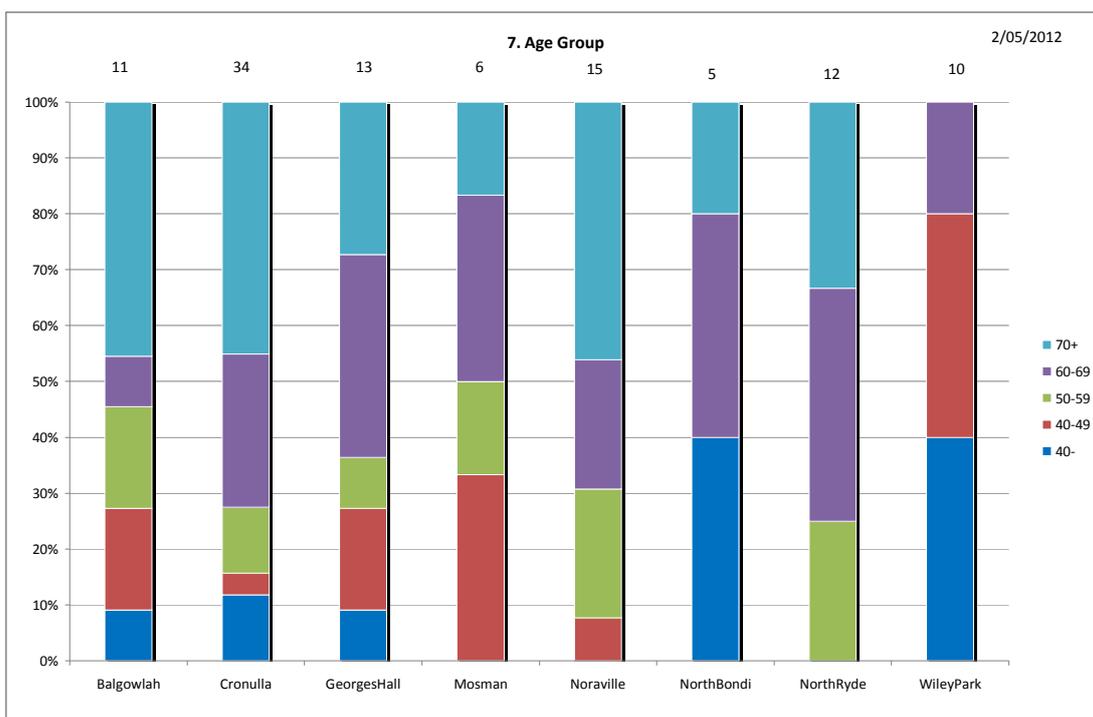
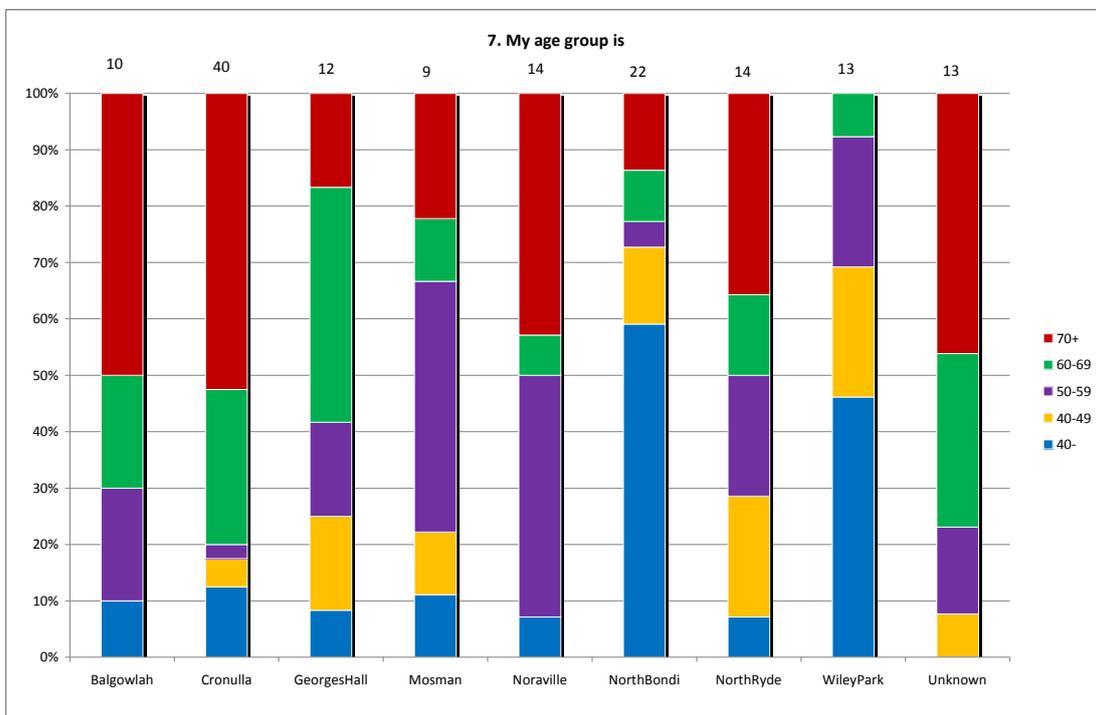


6. Existing street lights in my street assist my driving and help me see pedestrians and cyclists better



6. New street lights in my street assist my driving and help me see pedestrians and cyclists better





The figure at the top of each bar is the total number of surveys received in each age group.

Overall there has been a positive response from residents to the LED trial.

PHOTOMETRY RESULTS AND ISSUES ENCOUNTERED

Light levels were measured at the trial sites before and after the installation of the LED streetlights. The average illuminance measured in Lux is shown on the next page. The average illuminance required by the Australian standard is 0.5 lux for category P5 and 0.85 lux for category P4. The only P4 category site on trial is North Bondi all others are P5. As can be seen by the results all locations exceed the average illuminance level required by Australian Standards. This however is not the only condition required to meet Australian Standards, minimum light levels must exceed 0.07 lux for P5 and 0.14 for P4. As these levels are quite low and difficult to accurately measure, these conditions are verified by calculations rather than by field measurements. However, Ausgrid will not be looking for a bare minimum pass on these conditions but rather a streetlight that is perceived as doing the job as it is intended, i.e. to sufficiently light footpaths and roads.

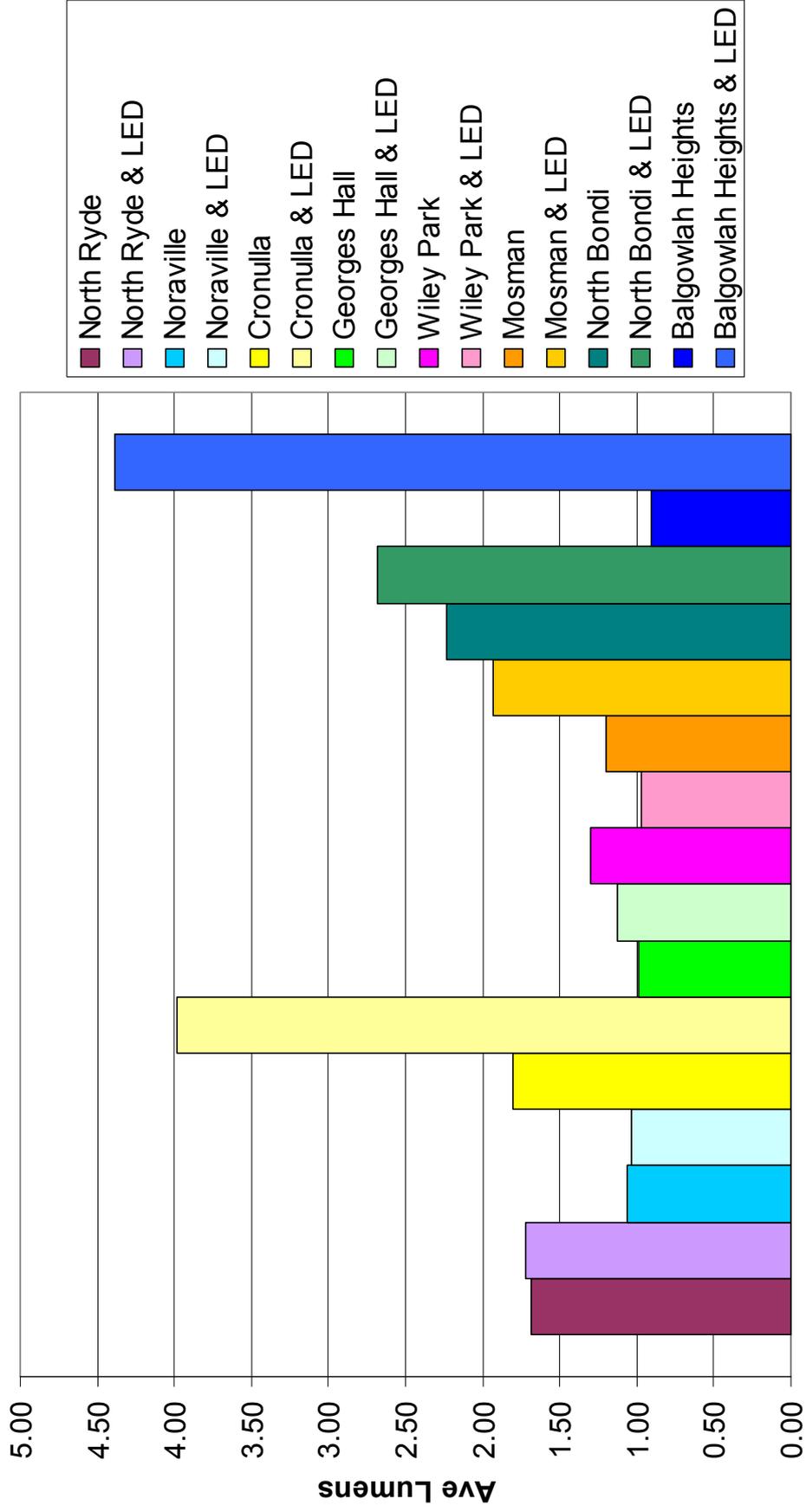
It should be noted that pole spacing has a significant impact on the average Lux levels. The table below shows the average spacing between poles at the various sites. Average lux levels will increase the closer the poles are spaced and vica verca.

Site	Category	Ave Spacing (m)
North Ryde	P5	47.4
Georges Hall	P5	57.4
Noraville	P5	78.6
Wiley Park	P5	74.0
Balgowlah Heights	P5	48.9
Mosman	P5	56.4
Cronulla	P5	52.4
North Bondi	P4	29.8

The two sites that stand out in these results are the sites that we have installed higher wattage luminaires (Cronulla and Balgowlah) and that have the best overall results in the resident surveys. Wiley Park and Georges Hall have the lowest wattage luminaires installed and this is also evident by the resident responses.

There have been very few issues or problems with the trial to date. One issue encountered was of mechanical nature in that a seal was allowing water into the streetlight. The manufacturer quickly rectified this and as a precaution replaced seals on all of their units. We also had an intermittent failure of one unit, however we could not replicate this failure in the lab. One unit started to strobe after about 30 seconds from turn on. The manufacturer replaced the unit.

Before & After LED Trial



BEFORE AND AFTER PHOTOS

Before – 42W Compact Fluorescent - Betty Hendry Parade, North Ryde



After – 29W LED - Betty Hendry Parade, North Ryde



Before – Twin 20 fluorescent luminaire - Oak Drive, Georges Hall



After – 22W LED- Oak Drive, Georges Hall



This last photo is the site where we have increased the wattage from 22W to 28W. This photo is 22W.

CONCLUSION

This trial has generated a great deal of discussion around the adoption of LED streetlights. The trial luminaires in the short time they have been operating certainly appear to be comparable if not better in terms of light output to the current 42W Compact Fluorescents, 80W MBF and Twin 20 fluorescents luminaires. However, Ausgrid is mindful of some outstanding issues regarding the adoption of LEDs.

First and foremost is the lack of an Australian Standard that acknowledges LED's as a source for street lighting for use in Australia, however Ausgrid is now working with The Australian Standards Committee to revise AS1158 to include LED luminaires. A draft Standard has now been released for comment.

One of the main focuses of this trial was to assess the suitability of LED luminaires for use on Ausgrid's network. Because the use of this technology is relatively new to the Australian environment, there is a lack of a recognised metric or method that all manufacturers use in order to extrapolate lumen maintenance and failure rates over the expected life spans of 20 years. Standardised data about failure rates over 20 years for other parts of a street lighting system, like the Photoelectric cells, is also not available.

In terms of maintenance data, Ausgrid's current category P streetlights are wiped during the bulk lamp replacement cycle as build up of dust, dirt and other pollution on the visor can significantly reduce the light output. LED luminaires are being promoted as having little or no maintenance requirements, however they also have lenses or visors that would need to be cleaned at some point. The questions remain about how often, by what method and what the impact on maintenance costs or predicted savings may be.

Maintenance and life span data is used by electricity networks, like Ausgrid, and the Australian Energy Regulator to set and approve maintenance programs and customer charges over the life of the luminaire. Errors or

incorrect estimates in these early stages could have significant financial impacts in the future.

Based on this trial, Ausgrid will meet with local councils to gain their support for a roll out of LEDs on P4 and P5 roads, when existing streetlights can not be fixed. In addition, a small number of new installations each year will involve LED technology. Ausgrid will also work with the Australian Energy Regulator to achieve the best outcomes for its customers. There is widespread adoption of this technology in other parts of the world and there has been a great deal of research into the reliability of the drivers and lumen maintenance. This trial shows there are good signs for the use of LEDs as a good source of light for street lighting on Ausgrid's network.