

A Submission to Brisbane City Council and Energex Regarding the LED Street Light Trial



Author – a concerned and motivated Brisbane resident

September 15th 2017

Executive Summary

The key points Brisbane City Council and Energex should take from this submission are:

- The move to new LED street lighting technology provides an opportunity to correct many deficiencies of Brisbane's current street lighting. However, the BCC LED Trial, as it is currently understood, appears unlikely to achieve this outcome.
- Achieving a significant reduction in Brisbane street light operating costs through the deployment of LED luminaires is a commendable goal. However, this is far too limited an objective upon which to base an LED lighting solution for Brisbane. The trial should also recognize that the residents of Brisbane streets are important stakeholders in this trial. The interests of residents, from amenity to health and environmental impact, should also be incorporated into the trial as objectives and performance evaluation factors.
- A poorly selected and insufficient range of LED luminaires are being trialed. The trial luminaires lack sufficient range of design and performance specification to properly address issues such as appropriate colour temperature, glare control, appropriate brightness, illumination pattern and control of light trespass.
- Almost all the trial luminaires are a colour temperature of 4000 K or above. However, multiple research projects into mesopic photometry and visual performance, particularly in relation to the task of driving, have found no benefit from high-Kelvin LED street lighting. Research indicates high-Kelvin lighting may be deleterious to older drivers.
- Brisbane City Council should be cognizant of the experience of many overseas cities that installed inappropriate and high-Kelvin LED luminaires. There are many examples where residents complained and local authorities then halted and modified their LED street light roll-out. The disruption and expense of poor initial luminaire selection can be considerable. BCC-Energex are encouraged to conduct a thorough investigation and trial of LED luminaires and seek a solution that not only reduces operating costs but also addresses the multiple other design issues highlighted in this submission.
- None of the BCC-Energex LED Trial luminaires evaluated in this submission are assessed as suitable for deployment across Brisbane.

1. Reasons for this Submission

This submission on the BCC-Energex LED Street Light Trial (BCC LED Trial) was initially instigated by a group of Brisbane residents that recognized the Brisbane metropolitan area as being heavily light polluted (Figure 1) and considered the move to new LED street lighting technology may provide an opportunity to significantly reduce the severity of this light pollution.

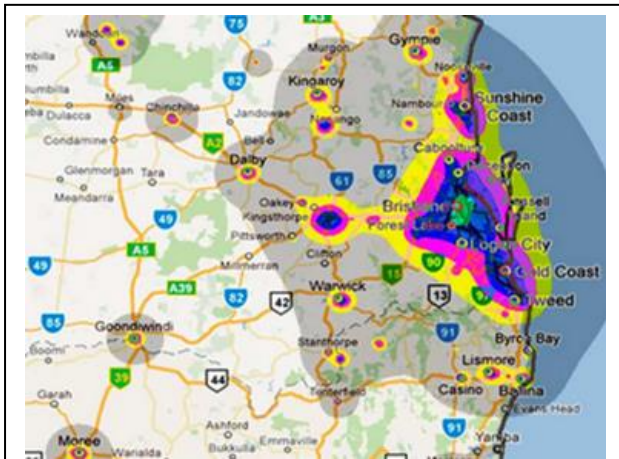


Figure 1 An indication of the light pollution halo extending from metropolitan Brisbane

<http://www.lightpollution.it/worldatlas/pages/fig9.htm>

It was also recognised that many residents, down to the individual property level, are currently badly affected by poorly designed street lighting whether that be high pressure sodium lighting (Figure 2) metal halide or compact fluorescent luminaires. Issues of light trespass and glare are common across Brisbane. However, provided the most appropriate luminaires are selected by BCC-Energex, the transition to well-chosen and properly installed LED street lighting



Figure 2 An example of severe light trespass on to private property from current high pressure sodium street lighting – Central Avenue, Mt Ommaney.

luminaires should very substantially reduce these impacts on residents.

LED street lighting was also recognised as a technology that could reduce lighting operation and maintenance costs for Brisbane rate payers and reduce greenhouse gas production. As a result, this group of residents is in principle supportive of the move to LED street lighting.

However, further research into the experience of overseas cities transitioning to LED street lighting, information provided by BCC-Energex through public consultation, and on-site assessment of the LED luminaires deployed in the 17 trial streets, raised some concerns regarding the design and performance of the BCC LED Trial and any subsequent Brisbane-wide roll-out of LED street lighting. The main concerns relate to the following issues:

- Limited information provided by BCC-Energex as to the goals of the BCC LED Trial.
- Limited information provided by BCC-Energex as to the evaluation criteria by which the performance of trial luminaires will be assessed.
- The limited range of LED luminaires, and their performance characteristics, deployed in the BCC LED Trial.
- Poor installation of LED luminaires in 16 of the 17 trial streets.
- The experience of overseas cities deploying high correlated colour temperature LED street lights and the reaction of city residents.
- Technical aspects of human mesopic vision and implications for the specification of an appropriate correlated colour temperature for Brisbane LED street lights.
- The implications of Brisbane residents' habituation to poor street lighting.

This submission will address each of these issues and provide BCC-Energex with carefully considered assessments and comments on the LED luminaires under trial.

2. Objectives of this Submission

The objective of this submission is to prompt BCC-Energex to review its current LED luminaire trial, which is considered poorly designed and implemented. BCC-Energex should expand the trial to include a wider range of LED luminaires that may better address the many failings of trial luminaires outlined in this submission. The goals of the BCC LED Trial should also be expanded to seek an LED street lighting solution that makes Brisbane and even more liveable city than it currently is

People and organisations usually adopt new technologies because they perform better and deliver greater benefits than the outgoing technology. However, from what has been observed in the BCC LED Trial, as it currently stands, there is a very real risk that inappropriate LED luminaires may be selected for Brisbane-wide roll-out. Brisbane runs the risk of becoming a less liveable city if the move to new LED lighting technology does not also bring with it solutions to problems such as:

- poor luminaire installation
- over-illumination of task areas
- over-illumination during periods of minimal requirement
- poor glare control
- excessive light trespass
- inappropriate colour temperature selection for the illumination task
- street lighting contribution to light pollution and sky-glow.

There is a vast array of LED street lighting technology installed around the world and available from innovative manufacturers. The 10 luminaires deployed in the current trial exhibit many design and operational deficiencies. This submission recommends BCC-Energex seriously review and expand the LED trial to find the best possible LED luminaires that address the problems listed above while also reducing costs for ratepayers and making Brisbane an even more liveable city for residents.

The following material provides BCC-Energex with carefully considered evaluation of the current LED trial.

3. Stated Goals of the BCC LED Trial

The only publicly available information regarding the scope and objectives of the BCC LED Trial is available on the website <https://www.brisbane.qld.gov.au/environment-waste/be-clean-green-brisbane/councils-green-commitment/led-street-lights-trial> which was, as of September 15th 2017, was last updated on September 13th 2016 at about the time of the commencement of the trial.

The only indications this website provides as to the goals of the trial are as follows:

“...will help determine which types of LED are most suitable for street lighting. Moving to LED street lights will help make our city more energy efficient by reducing street light energy consumption by up to 60 percent.” And “The trial will help determine which types of LED lights are most suitable for street lighting. Moving to LED lights will help to make our streets more energy efficient by reducing street light energy consumption and improve night time visibility for pedestrians and local residents.”

So, the goals of the trial appear to be:

- Reduce the energy consumption of street lighting.
- Improve night-time visibility for pedestrians and local residents.

This submission recommends that it would have been beneficial to the residents of Brisbane if the trial had also included objectives to evaluate LED street lighting solutions that will address the negative aspects of poor street lighting. Additional trial objectives such as the following would have been useful:

- To minimise the light pollution halo of metropolitan Brisbane and its reach across south-east Queensland.
- To minimise light trespass onto private properties.
- To minimise the extent and impact of luminaire glare on pedestrians, local residents and road users.
- To minimise the blue-rich light content of LED street lighting to the minimum necessary to meet lighting objectives and thereby minimise the potential for any human health or environmental impacts from blue-rich street lighting.

4. BCC LED Trial Performance Evaluation Criteria

The BCC LED Trial website does not provide any indication of the evaluation criteria that will be used to gauge the success, or otherwise, of the LED luminaires being trialed.

At a public consultation meeting convened on June 9th 2017 representatives of Brisbane City Council and Energex involved in the administration of the BCC LED Trial were asked to explain the evaluation criteria they would use to compile their final report and recommendations. However, no explanation of the evaluation criteria was provided.

This submission recommends the evaluation criteria and evaluation methodology for the BCC LED Trial should be made public well prior to the completion of the trial.

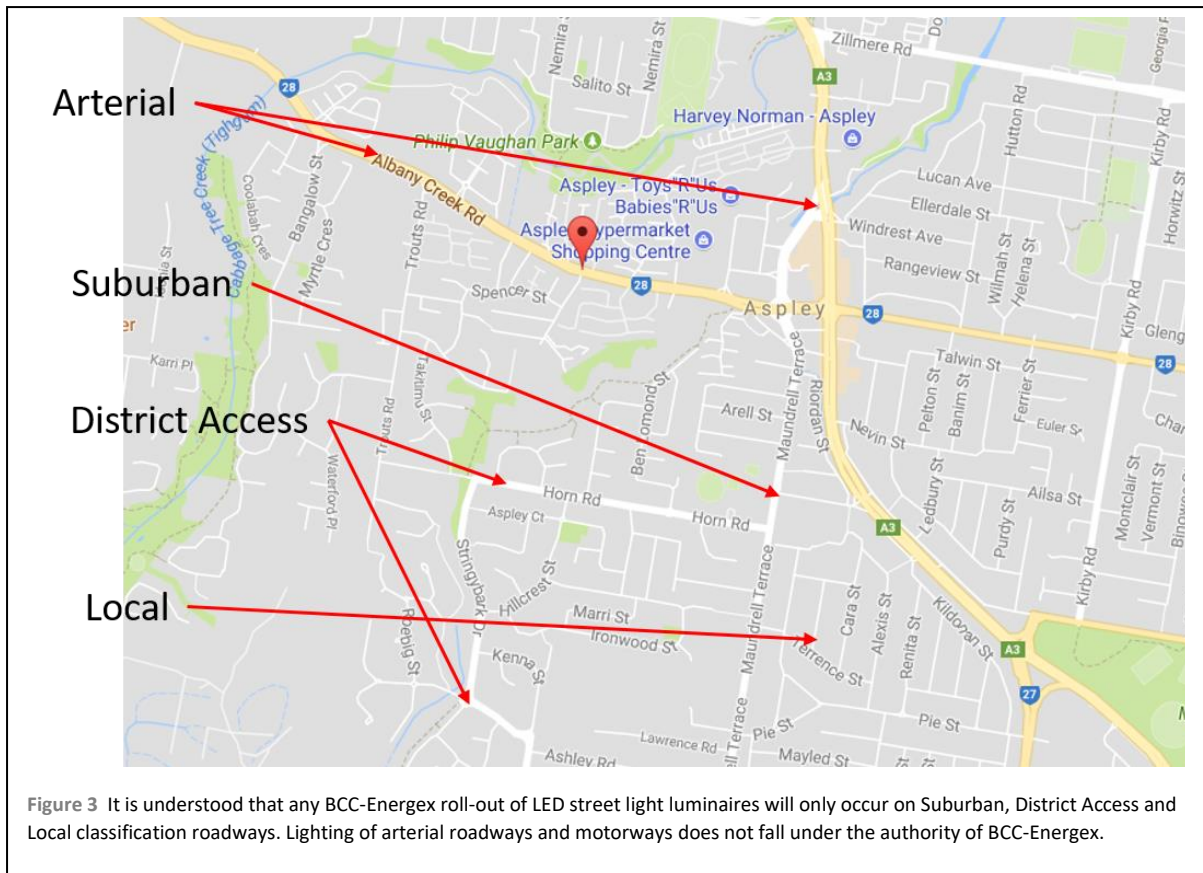
5. Assumed BCC-Energex Geographic Scope of Future LED Luminaire Roll-out

It is understood that high traffic volume motorway and arterial roads in the Brisbane metropolitan area are administered by Queensland Department of Main Roads or private motorway operators. These roadways will not be covered by any LED luminaire roll-out by BCC-Energex subsequent to this trial. It is understood that the BCC LED Trial and subsequent LED street light roll-out applies to category P roadways as defined under Australian Standard AS/NZS 1158.3.1:2005.

For clarification, Figure 3 indicates Albany Creek Road and Gympie Road are examples of arterial roadways and control of street lighting on these roads is the responsibility of the Queensland Department of Main Roads. The BCC LED Trial has no relevance to arterial classification roads.

In Figure 3, roadways identified as Suburban (for example Maundrell Terrace), District Access (for example Horn Road and Stringybark Drive) and Local (for example Cara Street and all other minor roads shown in Figure 3) will all be covered by LED street light roll-out programs by BCC-Energex subsequent to the current LED trial.

As a result, the BCC LED Trial and subsequent LED street light roll-out covers a wide diversity of roadway formats, traffic volumes and residential densities.



However, all 17 streets utilized in the BCC LED Trial are classified as Local roadways. None of the LED trial streets are classified as District Access or Suburban. It is unknown as to whether the results of the 17 Local trial streets will be extrapolated to all other higher classification roadways across Brisbane.

This submission recommends it may have been beneficial for the BCC LED Trial to have incorporated a wider range of street classifications to better test and evaluate LED luminaires best suited to the range of roadway formats and characteristics across Brisbane city.

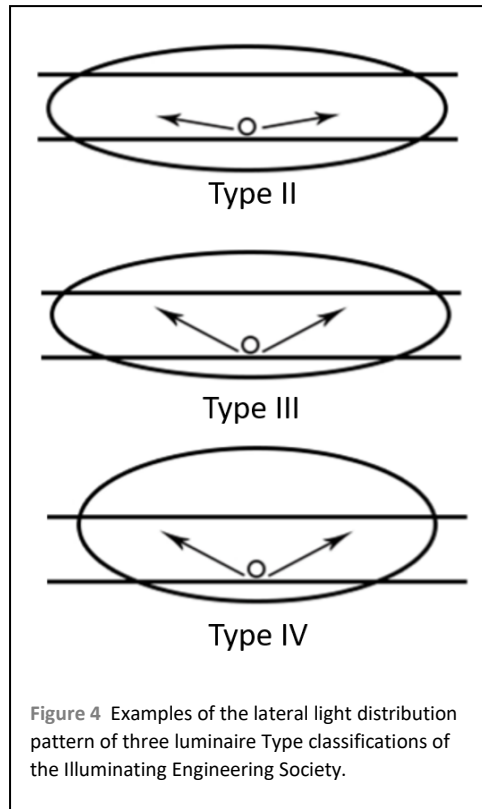
6. Range of LED Luminaires Under Trial

The characterization of LED luminaires on their technical specifications is a complex task as their performance may be measured and classified on a great many variables. The BCC LED Trial has only made public three variables by which the trial luminaires can be described – electrical wattage; LED array correlated colour temperature; and AS/NZS 1158.3.1 classification of upward light projection.

Light distribution and wasted light

Given that one of the primary goals of the BCC LED Trial is to reduce energy consumption, it is disappointing to see that six of the ten luminaires on trial are classified as Type 4 as defined in Table 2.10 of AS/NZS 1158.3.1:2005. By definition under the Australian Standard such luminaires may emit up to 8% of their light above the horizon and thus be wasted into space and contribute to unnecessary sky glow and light pollution. Also, up to 18% of all light emitted by Type 4 luminaires may be emitted above 80° to the horizontal. This means about 10% of the emitted light is projected into what is termed “the glare zone” between 80° and horizontal, plus another 8% may be wasted above the horizontal into space.

Light emitted into the glare zone can reduce the efficacy of a luminaire and counter benefits to road users or pedestrians from greater lateral light projection along a roadway. While it is understood that Type 4 luminaires are often selected to try and address the problem of inconsistent roadway illumination between widely spaced poles, this trial could have benefited from trialing a range of luminaires that seek to address this problem while also minimizing glare and upward wasted light.



The Illuminating Engineering Society (IES) defines six categories of luminaire lateral light distribution (Figure 4) – Type I to Type VS (not to be confused with the Australian Standards classification Type, mentioned above, which defines six luminaire Types, 1 to 6). BCC-Energex have not made public the IES lateral light distribution Type of the 10 trial LED luminaires.

This submission recommends BCC-Energex focus its LED Trial on full cut-off AS/NZS 1158.3.1 Type 6 luminaires that do not waste energy by projecting light above the horizontal.

This submission recommends BCC-Energex publish the IES lateral light distribution Type of the trial luminaires and ensure a range of IES Type II, III and IV LED luminaires be trialed to evaluate their ability to meet the lateral light distribution needs of Brisbane roadways.

Wattage and Light Output

Later sections of this submission assess all trial LED luminaires as being overly bright for use in many residential streets. Even though BCC-Energex state seven

of the ten trialed luminaires have a wattage rating of just 17 and 18 watts, the illumination from these luminaires is considered by this submission to be unnecessarily bright for the task. This submission recommends the range of trial luminaires be extended to include more lower wattage and lower luminous output luminaires.

Light trespass on to private property

As is outlined in later sections of this submission, the majority of the 10 LED luminaires on trial are considered to have issues with the control of forward and rear light trespass on to nearby private property. Australian Standard AS/NZS 1158.3.1:2005 Section 2.5.3.4 requires street lighting designs control and minimise light spills, or light trespass, onto abutting properties.

This submission recommends BCC-Energex seek and publish the IES BUG System data for the 10 LED luminaires under trial. The BCC LED Trial should also select additional luminaires based upon their BUG characteristics to incorporate a range of LED luminaires into the trial that are better suited to the control of light trespass in Local to Suburban category Brisbane streets.

Glare control

Section 7.3.4 of AS/NZS 1158.3.1:2005 indicates the potential for glare to negatively impact pedestrians and road users particularly where Type 4 semi cut-off luminaires are installed. The BCC LED Trial has not made public data on the light distribution pattern of the 10 trial LED luminaires. As

a result, it is not known whether any of the trial luminaires incorporate any shielding of their LED array below the horizontal. As is outlined in later sections of this submission, the majority of the 10 LED luminaires on trial are considered to be excessively glaring and may cause discomfort for pedestrians, road users and nearby residents.

Luminaire manufacturers now produce products, for example the GE Evolve™ LED Roadway with Current Gen Optics Evolve™ (Product ID: ERL1), that claim to incorporate shielding that significantly reduce luminaire glare.

This submission recommends BCC-Energex incorporate a range of LED luminaires into the trial that incorporate shielding down to the 80° and 70° levels.

Correlated Colour Temperature

While it is recognized the correlated colour temperature (CCT) of an LED luminaire is little more than a shorthand indicator of the spectral power distribution of its LED array, the CCT gives at least some indication of the likely proportion of blue light wavelengths a luminaire emits.

Of the 10 LED luminaire models deployed in the BCC LED Trial only one has a CCT of 3000K. It is assumed the spectral power distribution of these luminaires will emit the lowest proportion of blue-rich wavelengths of the 10 trial luminaire models.

While the actual need and justification for LED luminaires of 4000K or higher is explored in some detail in later sections of this submission, it is disappointing that just one model of luminaire operating at 3000K was included in the BCC LED trial.

7. Overseas City Experience with the Transition to 4000K LED Street Lighting

This submission recommends BCC-Energex investigate and take note of the experience of some overseas cities that transitioned to 4000K, and higher CCT, LED street lighting. Specific cities to research include – Gloucester, Massachusetts; Monterey, California; Davis, California; New York, New York; Lake Worth, Florida; Phoenix, Arizona; and Chicago, Illinois.

In all these cities LED street lights of 4000K CCT, or higher, were installed and then city residents lodged complaints with their local authority. The main complaints related to excessive glare, excessive brightness, light trespass and uncomfortable colour temperature. In each instance the city authorities halted their LED street light roll-out and in most instances continued the roll-out deploying luminaires rated at 3000K and in some cases 2700K. In some instances the offending luminaires were removed and replaced. These experiences caused angst for residents and local authorities and additional cost for local taxpayers.

This submission recommends BCC-Energex avoid repeating the experiences of these cities by carefully evaluating the academic research on street light colour temperature and trialing and then deploying luminaires that effectively address the issues encountered by these overseas cities.

8. Poor Installation of LED Luminaires in the 17 Trial Streets.

It is understood that LED luminaires should be installed with the horizontal orientation of the LED array in order for the task area to exhibit the illumination pattern and levels suggested by the technical specifications of the luminaire. However only a small minority of the 100 LED luminaires deployed in the BCC LED Trial are installed with an accurate horizontal orientation.

While some luminaire are close to horizontal the majority exhibit significant up-tilt, see Figure 5 for just one example. Only a minority of trial luminaires appear to have the capacity for internal angle adjustment if the bracket arm is not horizontal.

The wide variability in up-tilt angle raises concerns regarding the ability to reliably evaluate the performance of the trial luminaires. Of even greater concern is the suggestion that a Brisbane-wide roll-out of LED luminaires may simply utilize the existing bracket arms, of any orientation, and result in poorly controlled light distribution, excessive light trespass and unnecessary glare.



Figure 5 Significantly up-tilted trial LED luminaire in Malbon Street, Eight Mile Plains.

This submission recommends all LED luminaires in the BCC LED trial should be installed with the LED array horizontal. It is also suggested that all LED luminaires selected for deployment in a Brisbane-wide roll-out should incorporate an internal capability to be adjusted for horizontal installation regardless of the alignment of a bracket arm.

9. Aspects of Human Mesopic Vision and Implications for CCT of LED Street Lights

There is an abundance of research into the human vision system that shows the peak visible wavelength sensitivity of the human eye shifts from around 555nm under bright photopic conditions to around 507nm under very dark scotopic conditions. This fact underlies many LED roadway lighting designs specifying high Scotopic/Photopic Ratio light sources with high correlated colour temperature (4000K and above) in order to deliver a greater proportion of blue-rich light to a task area and thereby improve luminance as perceived by the human eye. However extensive research focused on the task of vehicle operation and roadway illumination in the United States, Europe and Japan has proven this approach is inaccurate and may also be counterproductive to some aspects of road safety.

This submission recommends, as a minimum, BCC-Energex carefully review the following research and incorporate the findings into the design of the BCC LED Trial and subsequent roll-out of LED street lighting luminaires:

- Gibbons, RB, et al. 2016, *Applicability of Mesopic Factors to the Driving Task* Lighting Research & Technology Vol. 48: 70-82
- van Bommel, W 2014, *Road Lighting: Fundamentals, Technology and Application*, Springer
- Halonen, L; et al., 2010, *Recommended System for Mesopic Photometry Based on Visual Performance* International Commission on Illumination - CIE 191

The highly abridged conclusions of these researchers essentially states:

- For an on-axis target area under commonly encountered mesopic roadway lighting conditions there is no luminance benefit to road users from deploying high Scotopic/Photopic Ratio LED or other lighting sources.

- For off-axis or peripheral vision tasks under commonly encountered mesopic roadway lighting conditions there is negligible benefit to road users from deploying high Scotopic/Photopic Ratio LED or other lighting sources.
- For road users and pedestrians aged 65 years or older, high Scotopic/Photopic Ratio lighting can contribute for diminished visual performance due to blue-light scatter within the eye and veiling glare. The dilatory capacity of the eye pupil is also diminished in this age group and reducing luminaire wattage to adjust for the assumed increased luminance from high Scotopic/Photopic Ratio lighting can result in diminished visual performance for older people.

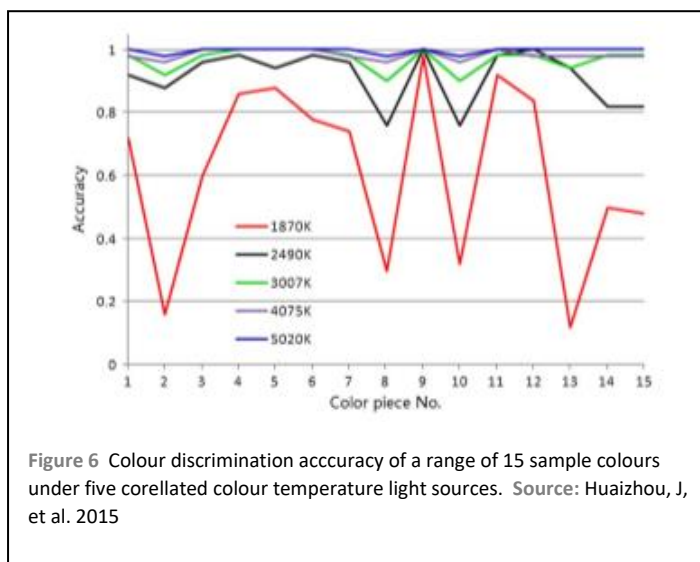
For example, the CIE research suggests that for an off-axis target under luminance of one cd/m² a 4000K LED light would provide only a negligible 2% luminance benefit over a 3000K LED luminaire. And as the target luminance and adaptation luminance of the road user increases the correction factor diminishes.

The following points highlight some of the key findings of these three, and related research reports, that underlie the key conclusions dot-pointed above.

- The task of driving primarily utilizes foveal vision.
- The foveal visual area of the human eye does not contain any rod light receptors. And since only rods, and not cone receptors, exhibit increased sensitivity to blue-wavelength light at low mesopic and scotopic conditions, increasing the blue wavelength illumination of an on-axis target will have no effect.
- The unconscious saccadic operation of the human eye means the visual field of a driver on Suburban to Local category roads will commonly extend across the roadway utilizing foveal vision.
- Any benefit from deploying high Scotopic/Photopic Ratio street lighting will only occur in off-axis or peripheral vision and most significantly around 15 degrees off-axis where the density of rods in the human eye is at its greatest.
- Extending the light distribution pattern of high Scotopic/Photopic Ratio LED lighting to significantly contribute to off-axis visual tasks of drivers would typically necessitate illuminating well beyond the carriage way and on to private property – the resulting light trespass is not the goal of street lighting.
- The lens of the human eye yellows with age and is often pronounced in people aged 65 years and older. This yellowing has the effect of increasing the internal scatter of blue wavelength light and diminishing the illumination of the retina. The ability of the human eye pupil to fully dilate is also diminished in this age group.
- High Scotopic/Photopic Ratio street lighting can negatively impact the visual performance and road safety of drivers 65 years and older.

10. Colour Rendering

AS/NZS 1158.3.1:2005 Section 2.7.2 requires that when specifying colour rendering characteristics of luminaires, street lighting designs must be based upon all factors relevant to the particular application. As outlined in Section 9, above, BCC-Energex is directed to the following research findings when assessing the colour temperature of luminaires to be specified for Category P roadways:



- Gibbons, RB, et al. 2016, *Applicability of Mesopic Factors to the Driving Task* Lighting Research & Technology Vol. 48: 70-82
- van Bommel, W 2014, *Road Lighting: Fundamentals, Technology and Application*, Springer
- Halonen, L; et al., 2010, *Recommended System for Mesopic Photometry Based on Visual Performance* International Commission on Illumination - CIE 191

Improved colour rendering is often cited as a justification for deploying high Scotopic/Photopic Ratio LED street

lighting. However, as indicated in Figure 6, a 3000K LED light source can facilitate colour discrimination almost indistinguishable from higher CCT LED sources.

This submission recommends the BCC LED Trial should incorporate LED luminaires of 2700K into the trial for at least the Local and District Access category roads and not exceed 3000K for LED luminaires trialed on Suburban classification roads.

11. Adaptive Controls

This submission recommends that since one of the primary goals of the BCC LED Trial is to reduce the energy consumption of street lighting the trial should incorporate a range of luminaire adaptive control systems, particularly on Local and District Access classification streets. SA/SNZ TS 1158.6:2015 explains a range of justifications for deployment of adaptive control systems.

12. The Issue of Habituation

A small number of Brisbane residents were interviewed during the on-site evaluation of LED luminaires in the 17 trial streets. Some residents made comments to the effect, *"I thought the new lights were really bright when they first went in but now I don't notice them"*. Habituation is a psychological learning process wherein there is a decrease in response to a stimulus after being repeatedly exposed to it. People can psychologically push an annoyance to one side.

The implication of habituation to the BCC LED Trial is that while any quantitative or qualitative research of residents' attitudes in the 17 trial streets may not find significant dissatisfaction with the trial luminaires this does not provide any proof that the luminaires deliver good street illumination when assessed against the multiple factors emphasized in this submission.

Very few Brisbane residents have the technical knowledge and vocabulary to recognize poor street lighting design and communicate its deficiencies.

The engineers designing and conducting the BCC LED trial must work on behalf of Brisbane residents and for the benefit of residents beyond just simple reduction of street lighting costs.

13. Comment on the Performance of LED Luminaires in the 17 Trial Streets

Each of the 17 trial streets were visited during the day and at night. Photographs were taken and notes recorded for multiple aspects of luminaire performance.

BCC-Energex was asked to provide information on which make and model of luminaire is being trialed in each street, however BCC declined to provide this information. As a result, luminaires may be misidentified in some streets and there may be some luminaires that have been overlooked in this assessment. In no particular order, Table 1 provides a brief overview of the assessment of each trial luminaire.

Table 1 A Brief Overview of the Assessment Findings for Trial LED Luminaires

Luminaire	Where Deployed	Positive Attributes	Negative Attributes	Overall Assessment
Lingman Power Mission 2	Lilley Road and Galleon Street	3000K CCT comfortable colour; full cut-off upward light control	Glare; over-illumination; up-tilt not adjustable; no LED array shielding; light trespass	Not suitable for Brisbane-wide roll-out
Orange Tek TerraLED Mini	Galleon Street and Third Avenue	Adjustable installation angle; Full cut-off upward light control	Excessive CCT; glare; over-illumination; no LED array shielding; light trespass	As above
Sylvania Urban - LED	Malbon, Macrossan and Howard Streets	Full cut-off upward light control	Excessive CCT; glare; over-illumination; up-tilt not adjustable; no LED array shielding; light trespass	As above
Pierlight GreenstreetLED (however this identification is uncertain)	Malbon Street		Excessive CCT; glare; over-illumination; up-tilt not adjustable; no LED array shielding; light trespass	As above
Pecan Ledway Road Lighting NXT	Cricket and Emma Streets		As above	As above
Betacom GL520	Union Street and Weekes Road		As above	As above
Sylvania Street LED	Gaynor Road and Dutton Street		As above	As above
Cooper – Streetworks XVN (however this identification is uncertain)	Brisbane and Hipwood Streets		As above	As above
Austeknis LL17025	Weenga and Playford Streets		As above	As above
Unknown	Drake Street		As above	As above

The following material provides a detailed evaluation of trial luminaires in each of the 17 streets.

1 - Lilly Road, Bardon – Comment on Trial LED Luminaires

Luminaire

It is assumed this luminaire is a - Lingman Power Mission 2.

Colour

The slight amber tint to the emitted light suggests this is a 3000K LED. Colour rendition of vehicles, vegetation and homes is good. The colour of the light is comfortable to the eye and provides a pleasing ambience to the street.

Brightness

Lilley Road is more brightly illuminated than neighboring streets. It is unknown whether Lilley Road is illuminated in excess of the minimum Australian Standard recommendation, however, it may be if neighboring streets are illuminated to the Standard. This luminaire has a measured wattage of 20.8 watts. A useful extension to the trial of this luminaire would be to deploy additional models with lower wattage of perhaps 17W and 15W to find a rating that does not over-illuminate the task area.

Glare

This appears to be a Type 6 full cut-off design luminaire. There appears to be no shielding of the LED array below what should be the horizontal. While the LED array in this luminaire is certainly much less painful to look at directly, it is still a glary light source and may well cause nuisance to residents, particularly those with bedrooms facing the street.

The lack of shielding in this luminaire implies that even if a 17W or 15W version were to be trialed it may still emit too much glare.

Luminaire Installation

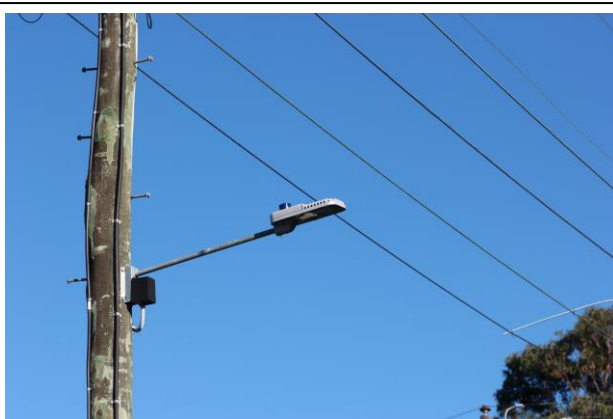
It appears none of the LED luminaires in this street have been installed with the LED array oriented to horizontal. It appears this luminaire design does not have an internal capacity for angle

adjustment and so simply conforms to the alignment of an existing bracket arm.

Light Distribution

The forward light trespass from this luminaire across the street would have been better controlled if the luminaire had been installed horizontal.

The main problem with this luminaire is its substantial light trespass projected to the rear on onto private homes. Street lighting should illuminate boundary-to-boundary and not trespass onto private property to this extent.



An example of significant up-tilted LED luminaire installation in Lilley Road, Bardon.



An example of rear light trespass onto private property – Trial LED at Lilley Road, Bardon.

Overall Assessment as a LED Luminaire for Brisbane-wide Roll-out

Overall this LED luminaire might be evaluated as one of the “least worst” of the 10 makes and models under trial. The main shortcomings of this luminaire are:

- unadjustable installation angle,
- the extent of rear light trespass, and
- the unshielded glare directly from the LED array.

This luminaire is not recommended for roll-out across Brisbane. The trial program should explore similar luminaire options with this manufacturer that better address issues with shielding, glare, proper installation and rear light trespass.

2 - Galleon Street, West, Jamboree Heights – Comment on Trial LED

Luminaires

Galleon Street has two different LED luminaires under trial along its length. The following comments refer only to the luminaire in the western end of the street from Sirocco Street to about Poseidon Crescent. This LED luminaire appears to be the same as that on trial in Lilley Road, Bardon.

Luminaire

It is assumed this luminaire is a - Lingman Power Mission 2.

Colour

The slight amber tint to the emitted light suggests this is a 3000K LED. Colour rendition of vehicles, vegetation and homes is good. The colour of the light is comfortable to the eye and provides a pleasing ambience to the street.

Brightness

Galleon Street appears to be illuminated similarly to neighboring streets. It is unknown whether this section of Galleon Street is illuminated in excess of the minimum Australian Standard recommendation.

Glare

This appears to be a Type 6 full cut-off design luminaire. There appears to be no shielding of the LED array below what should be the horizontal. While the LED array in this luminaire is certainly much less painful to look at directly, it is still a glary light source and may well cause nuisance to residents, particularly those with bedrooms facing the street.

Luminaire Installation



An example of up-tilted LED luminaire installation in the western end of Galleon Street, Jamboree Heights.

It appears none of the LED luminaires in this street have been installed with the LED array oriented to horizontal. It appears this luminaire design does not have an internal capacity for angle adjustment and so simply conforms to the alignment of an existing bracket arm.

Light Distribution

While this luminaire appears to be identical to that under trial in Lilley Road, Bardon, the forward light trespass appears to be more pronounced in this street.

Forward light trespass would have been better controlled if the luminaire had been installed horizontal.

This luminaire also exhibits significant light trespass to the rear.



An example of backward light trespass onto private property – western end of Galleon Street, Jamboree Heights.



An example of forward light trespass onto private property – western end of Galleon Street, Jamboree Heights.

Overall Assessment as a LED Luminaire for Brisbane-wide Roll-out

Overall this LED luminaire might be evaluated as one of the “least worst” of the 10 makes and models under trial. The main shortcomings of this luminaire are:

- unadjustable installation angle,
- the extent of forward and backward light trespass, and
- the unshielded glare directly from the LED array.

This luminaire is not recommended for roll-out across Brisbane. The trial program should explore similar luminaire options with this manufacturer that better address issues with shielding, glare, proper installation and backward light trespass.

3 - Galleon Street, East, Jamboree Heights – Comment on Trial LED Luminaires

Galleon Street has two different LED luminaires under trial along its length. The following comments refer only to the luminaire in the eastern end of the street from about Poseidon Crescent to Andaman Street.

Luminaire

It is assumed this luminaire is a - Orange Tek TerraLED Mini.

Colour

This is a very harsh white light and appears to be in excess of 4000K. Such harsh white light is unnecessary in a residential street such as this.

Brightness

The illumination from this luminaire appears to be brighter than the other LED luminaire being trialed on the western end of this street. For a low volume traffic and pedestrian residential street the level of illuminations appears to be significantly greater than this category of street probably requires.

Glare

This luminaire does not appear to incorporate any effective shielding below the 90° level, and this is particularly noticeable in the “glare zone” approaching 90°. The LED array is very glary for pedestrians and vehicle drivers and is likely to annoy some residents with bedroom windows facing these luminaires. Pedestrians, in particular, may find they squint their eyes and avert their vision downward when walking under this luminaire. The high colour temperature of this LED array may also contribute to the perception of glare.

Luminaire Installation



An example of up-tilted LED luminaire installation in the eastern end of Galleon Street, Jamboree Heights.

Even though this luminaire model appears to incorporate an angle adjustment mechanism the majority of the installations appear to position the LED array with an up-tilt angle. It is assumed the LED array should actually be positioned horizontal to perform to specification. This up-tilt may contribute to the glare and light trespass of this luminaire.

Light Distribution

This luminaire causes light trespass on to private properties to the rear and forwards and may cause annoyance to

residents. The full cut-off design of this luminaire is a positive feature.



Rearward light trespass.



Forward light extends across the roadway and may annoy residents on the opposite side of the street.

Overall Assessment as a LED Luminaire for Brisbane-wide Roll-out

This luminaire is not considered to be appropriate for residential street installation due to: blue-rich high colour temperature light; excessive glare; lack of LED array shielding; excessive rear and forward light trespass; and possible inability to install with the LED array horizontal.

4 - Third Avenue, Sandgate – Comment on Trial LED Luminaires

Luminaire

It is assumed this luminaire is a - Orange Tek TerraLED Mini, and the same luminaire on trial in the eastern end of Galleon Street, Jamboree Heights.

Colour

This is a very harsh white light and appears to be in excess of 4000K. Such harsh white light is unnecessary in a residential street such as this.

Brightness

For a low volume traffic and pedestrian residential street the level of illuminations appears to be significantly greater than this category of street probably requires.

Glare

As experienced with this luminaire on Galleon Road, Jamboree Heights, this luminaire does not incorporate any shielding below the 90° level and is very glary for pedestrians.

This trial luminaire is an interesting contrast with carpark luminaires on private property on this street that do incorporate shielding. Why is unshielded high intensity LED lighting being evaluated by BCC-Energex for Brisbane-wide roll-out in residential streets?

Installation



Luminaire with up-tilt estimated at greater than 10°.



Shielded carpark luminaire on private property on Third Avenue, Sandgate.

Even though this luminaire appears to incorporate an up-tilt adjustment axis none of the trial luminaires appear to be installed horizontal and some are estimated to have an up-tilt angle in excess of 10°. It is interesting to note the contrast between a luminaire deployed in a private property carpark on Third Avenue and the trial LED luminaires. The carpark luminaire incorporates internal shielding of the light source and the trial luminaire does not.

Light Distribution

The high and variable up-tilt angle of these luminaires must make it very difficult to control the distribution of light and minimization of light trespass.

This luminaire has very poor control of rear and forward trespass light.



Poor control of rear trespass light onto private property.



Forward light trespass and secondary glare zone trespass on to private property.



Excessive rear light trespass.

Overall Assessment as a LED Luminaire for Brisbane-wide Roll-out

This luminaire is not considered to be appropriate for residential street installation due to: blue-rich high colour temperature light; excessive glare; lack of LED array shielding; excessive rear and forward light trespass; and possible inability to install with the LED array horizontal.

5 - Macrossan and Howard Streets, CBD – Comment on Trial LED Luminaires

Luminaire

In both streets it is assumed the trial luminaire is a - Sylvania Urban - LED.

Colour

This is a harsh white light assumed to be 4000K. While such harsh lighting may have a role in public space lighting in the CBD, it is not suitable for residential streets.

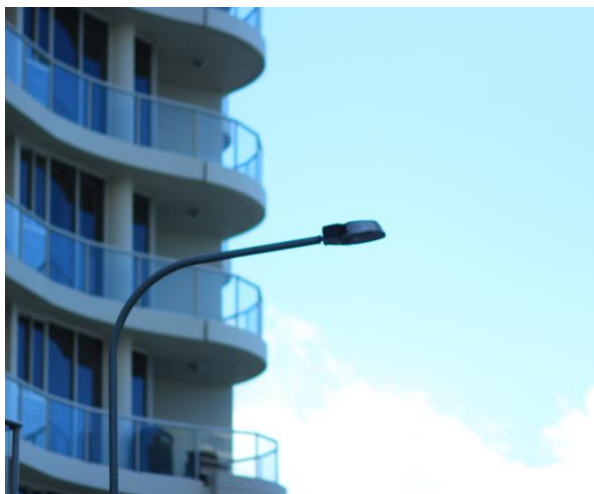
Brightness

The lighting appears very bright and more than what would be required for a residential street. However, even though pedestrians may consider these luminaires to be excessively bright they may be appropriate for public open-space lighting.

Glare

Even though this luminaire appears to have an Aeroscreen visor design it is very glary, particularly for pedestrians. There appears to be no shielding of the LED array in the 80° to 90° “glare zone”. Pedestrians may find they squint and avert their vision downwards when walking under these lights.

Luminaire Installation



All the trial luminaires in these streets appeared to incorporate an up-tilt angle of about 10°.

These luminaires do not appear to incorporate any capacity for their installation angle to be adjusted relative to the bracket arm. As a result, all trial luminaires incorporate an angle of up-tilt, estimate at 10°, which is assumed will alter their illumination performance beyond their stated specification. Given that BCC-Energex are unlikely to modify existing bracket arms in any Brisbane-wide roll-out of LED lighting this luminaire has a serious design flaw.

Light Distribution

These luminaires deliver excessive backward light trespass on to private property.



Even though these luminaires are installed with about a 10° up-tilt they still delivery excessive light trespass to the rear on to private properties.



These luminaires are very bright and excessively glary for use in residential streets.

Overall Assessment as a LED Luminaire for Brisbane-wide Roll-out

These luminaires are considered too blue-rich, too bright, too glary, too difficult to install properly and generate too much light trespass on to private property. They are not assessed as suitable for a Brisbane-wide roll-out in residential streets.

6 - Malbon Streets, East, Eight Mile Plains – Comment on Trial LED Luminaires

This appears to be the same luminaire being trialed in Macrossan and Howard streets in the CBD. It is assumed the luminaires in all three streets have identical specifications. It is a different LED luminaire to that being trialed in the western end of this street.

Luminaire

It is assumed this luminaire is a - Sylvania Urban - LED.

Colour

This is a harsh white light assumed to be 4000K. Such harsh lighting is not necessary or suitable for residential streets.

Brightness

The BCC LED Trial should publish test data for this luminaire to allow residents to know the extent of any over-illumination as per the Australian Standard for this category of street. This luminaire is considered to deliver a much higher level of illumination that is necessary in such low traffic volume and low pedestrian volume streets.

Glare

Even though these luminaires appear to have an Aeroscreen visor design they are very glary, particularly for pedestrians. There appears to be no shielding of the LED array in the 80° to 90° “glare zone”. These luminaires are an uncomfortable source of light for pedestrians. Pedestrians may find they squint and avert their vision downwards when walking under these lights. They are too bright and glary for use in residential streets.

Luminaire Installation



All of these trial luminaires in the eastern end of Malbon Street are installed with an up-tilt angle of at least 5° and some are up-tilted substantially more.

These luminaires do not appear to incorporate any capacity for their installation angle to be adjusted relative to the bracket arm. As a result, all trial luminaires in this street have some degree of up-tilt, some excessively so. Given that BCC-Energex are unlikely to modify existing bracket arms in any Brisbane-wide roll-out this luminaire has a serious design flaw.

Light Distribution

The control of trespass light to the rear of this luminaire is poor. If these luminaires had been installed in the correct horizontal position the rear light trespass would be even more of a problem. Their light distribution is not considered suitable for residential streets.



This luminaire projects considerable trespass light to the rear on to private properties. It is also excessively bright and glary for residential streets.

Overall Assessment as a LED Luminaire for Brisbane-wide Roll-out

These luminaires are poorly suited for use in residential streets where street lighting is primary designed to meet the needs of pedestrians. These luminaires are an uncomfortable source of light for pedestrians. These luminaires should not be selected for deployment in a Brisbane-wide roll-out of LED luminaires.

7 - Malbon Streets, West, Eight Mile Plains – Comment on Trial LED

Luminaires

This is an entirely different make and model of LED luminaire to that being trialed in the eastern end of this street.

Luminaire

It is assumed this luminaire is a - Pierlight GreenstreetLED.

Colour

This is a harsh white light assumed to be 4000K. Such harsh lighting is not necessary or suitable for residential streets.

Brightness

The combination of the lumen output of this luminaire, its angle of installation, its lack of shielding, its poor control of light distribution and its high colour temperature make this an excessively bright luminaire totally unsuited for use in residential streets.

Glare

The design of this luminaire appears to make no attempt to reduce glare. For all the reasons cited above this is an excessively glary luminaire and totally unsuited for use in residential streets.

Pedestrians will find this luminaire very uncomfortable to walk beneath. Pedestrians will find they need to squint and divert their gaze to the ground to protect their eyes from the glare and excessive brightness.

Luminaire Installation



All these trial luminaires have been installed with a significant up-tilt angle, some excessively so.

All these luminaires have been installed with an up-tilt angle. This may be a contributing factor in the excessive light trespass on to private property. This luminaire does not appear to have any capacity for its installation angle to be adjusted relative to the bracket arm. This is a serious design flaw.

Light Distribution

The lack of light trespass control to the rear and forward of this luminaire is appalling. Light is cast for many meters into private property and may annoy residents at some considerable distance from an installation.



Malbon street – west. Excessive rear light trespass.



Malbon street – west. Excessive rear light trespass.



Malbon street – west. Excessive forward light trespass.

Overall Assessment as a LED Luminaire for Brisbane-wide Roll-out

This luminaire should never have been considered for inclusion in this trial and it should never be considered for Brisbane-wide roll-out. It is an insult to Brisbane residents.

8 - Cricket Street, Petrie Terrace – Comment on Trial LED Luminaires

Luminaire

It is assumed this luminaire is a - Pecan Ledway Road Lighting NXT.

Colour

The emitted light is a harsh white that is unnecessary for this residential street.

Brightness

This is a very bright luminaire, possible made more so by the lack of shielding of the LED array. It is too bright for this narrow street. BCC-Energex should publish the illumination data for this luminaire and indicate if it exceeds the minimum level required by the Australian Standard for this category of street.

Glare



Every trial luminaire in Cricket street has been installed with the LED array at an uptilt angle of up to 10°.

This luminaire is intensely glary for pedestrians and vehicle drivers. This may, in part, be due to the Type 4 design and significant proportion of light emitted in to above 80° glare zone.

Luminaire Installation

It appears none of the trial luminaires in this street are installed with the LED array horizontal. It also appears this luminaire does not have any internal mechanism to allow the installation angle to be adjusted to horizontal.

Light Distribution

Cricket Street is very narrow and this luminaire casts a substantial proportion of its lights to the rear and forwards on to private property. The resulting light trespass makes this luminaire unsuitable for such narrow streets. The forward light trespass is exacerbated by the up-tilt angle of installation. The semi cut-off design also means this luminaire directs light beyond the primary task area and may have a higher operating cost than a luminaire with better control that just delivers the light that is needed to the location where it is needed.



While this photo is overexposed it does clearly indicate the wide dispersal of light and high illumination.



This luminaire is very glary for pedestrians and causes significant light trespass.

Overall Assessment as a LED Luminaire for Brisbane-wide Roll-out

This luminaire is a poor choice for narrow Brisbane streets. It's high colour temperature, excessive glare, lack of shielding, semi cut-off design and challenge to install horizontal makes this a poor choice for Brisbane-wide rollout.

9 - Emma Street, Holland Park West – Comment on Trial LED Luminaires

Luminaire

It is assumed this luminaire is a - Pecan Ledway Road Lighting NXT.

Colour

The emitted light is a harsh white that is unnecessary for this residential street.

Brightness

This luminaire appears very bright and delivers a level of illumination well in excess of that in neighboring streets. A resident of this street could easily read a book while walking under these lights – is that the design objective of this trial? It is assumed the lighting in neighboring streets was designed to meet the minimum illumination required by the Australian Standard. This level of illumination in Emma Street may exceed that specified by the Australian Standard for this category of street. If this is so, why is this high level of illumination being trialed?

Glare

The semi cut-off design and lack of shielding make this a very glary luminaire and uncomfortable for pedestrians. It is likely the glare and light trespass is causing annoyance to some residents in this street.

Luminaire Installation



None of the trial luminaires in this street have been installed with the LED array aligned horizontal. Some appear to have about a 12° up-tilt and the luminaire appears to lack any internal mechanism for adjusting the installation angle. It is difficult to understand why the BCC LED Trial would install luminaires with such a large up-tilt. Are BCC-Energex actually trialing the implications of various up-tilt angles or is this just part of a poorly designed trial? If this is intentional BCC-Energex should make public the assessment criteria being used to evaluate

the performance of this and other non-horizontal luminaires.

Light Distribution

The luminaire appears to be designed to project a very wide lateral beam along a street, however, this results in making the LED array very glary and a light trespass nuisance. The BCC LED Trial should include a range of luminaires with a progression of light distribution patterns that may best suit narrow or wider streets. This luminaire seems best suited to very wide streets where the rear private property boundary is set back some considerable distance from the mounting pole.



This luminaire delivers a very wide field of illumination and substantial rear light trespass.



Even though Emma Street is wide this luminaire still causes forward light trespass.

Overall Assessment as a LED Luminaire for Brisbane-wide Roll-out

This luminaire is not suitable for a Brisbane-wide roll-out. It is too bright, too glary, directs light too broadly to allow good control and minimize light trespass and appears to be difficult to install horizontal.

10 - Union Street, Clayfield – Comment on Trial LED Luminaires

Luminaire

It is assumed this luminaire is a - Betacom GL520.

Colour

This is a harsh white light that is unnecessary in this residential street.

Brightness

This street is over-illuminated. The BCC LED Trial report should publish illumination data for this, and all streets and luminaires in the trial, and indicate if the trial illumination meets or exceeds the minimum required by the Australian Standard.

Union Street is very narrow, perhaps only six meters wide, and yet this extremely bright and large illumination pattern luminaire is being trialed in this narrow street. BCC-Energex should publish its reasoning and performance evaluation criteria for trialing this luminaire in this narrow street.

Glare

This is an extremely glary semi cut-off luminaire and uncomfortable for pedestrians. These are one of the worst LED luminaires in the trial for glare and excessive brightness.

Installation



Some of the trial luminaires appear to have an up-tilt of nearing 5°.

While one of the trial luminaires are installed horizontal the others appear to be up-tilted by a few degrees and some may be approaching 5°. It appears this luminaire is attached to the bracket arm by just a simple pipe clamp and has no internal ability to adjust to horizontal installation.

Light Distribution

This luminaire produces a lot of light over a large illumination pattern. In this narrow street this causes very substantial rear and forward light trespass on to homes. This luminaire is totally unsuited to such a narrow street. What is the BCC-Energex justification for trialing this luminaire in this street? What is the objective and what are the performance evaluation criteria?



In such a narrow street this luminaire creates significant forward and rear light trespass on to private properties



Overall Assessment as a LED Luminaire for Brisbane-wide Roll-out

This luminaire is totally unsuited for narrow residential streets. In addition, for all the reasons indicated above, this luminaire is also not suitable for a Brisbane-wide roll-out.

11 - Weekes Road, Carindale – Comment on Trial LED Luminaires

Luminaire

It is assumed this luminaire is a - Betacom GL520 and the same luminaire on trial in Union Street, Clayfield.

Colour

This is a harsh white light, assumed to be 4000K, that is unnecessary in this residential street.

Brightness

This is a very bright luminaire projecting a very large illumination area. This street is illuminated substantially more than neighboring streets and may exceed the minimum required by the Australian Standard for a residential street of this category.

Glare

This is an extremely glary semi cut-off luminaire and uncomfortable for pedestrians. These are one of the worst LED luminaires in the trial for glare and excessive brightness.

Installation



All trial luminaires have been properly installed horizontal, or very nearly so. However, it does appear this luminaire has no internal capacity to adjust the up-tilt angle if the mounting bracket arm is not horizontal.

Light Distribution

This luminaire has a very significant light trespass problem to the rear and forwards. Residential streets should be illuminated boundary-to-boundary and minimize light trespass on to neighboring properties – this luminaire fails this design requirement.



This luminaire appears to deliver illumination in excess of the minimum required for this street. Rear and forward light trespass is a substantial problem with this luminaire.



Poor control of rear light trespass.

Overall Assessment as a LED Luminaire for Brisbane-wide Roll-out

For all the reasons indicated above, and in the Union Street, Clayfield, assessment, this luminaire is also not suitable for a Brisbane-wide roll-out.

12 - Gaynor Road, Banyo – Comment on Trial LED Luminaires

Luminaire

It is assumed this luminaire is a - Sylvania Street LED.

Colour

This is a harsh white light, assumed to be 4000K, that is unnecessary in this residential street.

Brightness

This is a very bright and glary luminaire. Some residents in the street who were spoken to as part of this evaluation complained about the brightness and glare hampering vision. This is an uncomfortable luminaire for pedestrians and they may find they squint and avert their vision downwards when walking under these lights. This luminaire provides significantly greater illumination than in surrounding streets and may exceed the minimum Australian Standard.

Glare

This is a semi cut-off luminaire and so emits a significant proportion of its light in the glare zone above 80°. There is no shielding of the LED array and so pedestrians may find this luminaire uncomfortable.

Installation



Almost all the trial luminaires in this street are installed with an up-tilt, some by as much as 10°.

While one trial luminaire appears to be installed close to horizontal all the others have an up-tilt of up to around 10°. The luminaires do not appear to incorporate a mechanism to allow the installation angle to be adjusted.

Light Distribution

This luminaire has a light trespass problem, particularly to the rear. The glare light that falls on properties forward and to the rear of this luminaire may also create nuisance for residents.



This luminaire is intensely glary and creates too much light trespass to the rear.



Overall Assessment as a LED Luminaire for Brisbane-wide Roll-out

This luminaire is intensely glary, creates rear light trespass, is difficult to install horizontal and brighter than required for this category of residential street. This luminaire is not suitable for Brisbane-wide roll-out.

13 - Dutton Street, Hawthorne – Comment on Trial LED Luminaires

Luminaire

It is assumed this luminaire is a - Sylvania Street LED.

Colour

This is a harsh white light, assumed to be 4000K, that is unnecessary in this residential street.

Brightness

This is a very bright and glary luminaire that is uncomfortable for pedestrians. This luminaire provides significantly greater illumination than in surrounding streets and may exceed the minimum Australian Standard.

Glare

This is an intensely glary luminaire as it appears to have no shielding of the LED array. The Type 4 design delivers excessive and unnecessary illumination into the glare zone and may cause discomfort to pedestrians. Pedestrians walking under this luminaire at night were observed walking along the roadway rather than along the footpath. Glare could be causing pedestrians to seek the surer footing of the roadway rather than the footpath.

Installation



Most luminaires are installed with an up-tilt angle of around 5°.

While one luminaire appeared to be installed horizontal the majority had an up-tilt angle of up to about 5°. The luminaire does not appear to have any internal ability to adjust the installation angle to horizontal.

Light Distribution

Even with a slight up-tilt angle this luminaire still delivers significant rear light trespass.



This luminaire is intensely glary and projects trespass light to the rear.



Overall Assessment as a LED Luminaire for Brisbane-wide Roll-out

This luminaire incorporates no shielding of the LED array and is too glary for residential streets. It's angle of installation cannot be easily adjusted to horizontal. It creates a light trespass problem to the rear. This luminaire is not suitable for Brisbane-wide roll-out.

14 - Brisbane Street, St Lucia – Comment on Trial LED Luminaires

Luminaire

This luminaire could not be identified on the trial list provided by BCC-Energex. However, the luminaire appears to be closely related to the Cooper – Streetworks XVN.

Colour

This is an intensely bright white light of at least 4000K that is unnecessary in this residential street.

Brightness

This is an intensely bright luminaire that projects very high levels of illumination in the immediate vicinity of the luminaire but also casts unnecessarily bright illumination over a wide area. It can be somewhat disconcerting for pedestrians to move into the luminaire's primary beam close to the pole as the rapid increase in illumination is very uncomfortable and forces pedestrians into a strong squint. The discomfort is exacerbated as a pedestrian moves along the street and passes in and out of the intense primary beams. The result is a process of squint then relax, squint then relax as the pedestrian progresses along the street. The brightness of this luminaire may also impact the vision of vehicle drivers, particularly in older age groups, as a vehicle moves into and out of the primary beam again and again along the street.

Glare

This is one of the worst luminaires in this trial for excessive glare. The design of the LED array flat on the lower surface with no shielding makes the array visible from any angle below the horizontal and exacerbates the intense glare. This is a very uncomfortable luminaire for pedestrians as they will find they need to squint and avert their vision downwards to reduce glare and vision discomfort as they enter the primary beam zone.

Installation



None of the trial luminaires in this street have been installed horizontal.

None of these trial luminaires have been installed horizontal and some appear to have an up-tilt angle of around 15°. This high variability of installation may create great difficulty in effectively controlling the distribution of light and light trespass. It appears this luminaire has no internal capacity for installation angle adjustment.

If these luminaires were installed horizontal it would likely result in a much more significant rear light trespass problem.

Light Distribution

This luminaire projects a wide illumination pattern laterally along the street and forwards across the street. The very bright primary beam area directly below the

luminaire is a significant problem as it causes rapid changes in brightness for pedestrians and drivers.

The extent of forward light trespass on to properties on the other side of the street is also a substantial problem with this luminaire.



These luminaires cast a very extensive illumination pattern with very bright regions below each pole.



Forward light trespass is substantial.

Overall Assessment as a LED Luminaire for Brisbane-wide Roll-out

For all the reasons of high colour temperature, excessive brightness, uneven illuminations, inability to adjust up-tilt angle and excessive forward light trespass this luminaire is unsuitable for Brisbane-wide roll-out in residential streets or high vehicle traffic streets.

15 - Hipwood Street, Norman Park – Comment on Trial LED Luminaires

Luminaire

This luminaire could not be identified on the trial list provided by BCC-Energex. However, the luminaire appears to be identical to that deployed in Brisbane Street, St Lucia, and is closely related to the Cooper – Streetworks XVN.

Colour

This is an intensely bright white light of at least 4000K that is unnecessary in this residential street.

Brightness

As explained in the evaluation of this luminaire in Brisbane Street, St Lucia, this luminaire is intensely bright and exhibits significant brightness variability across the task area – see the Brisbane Street evaluation comments.

Glare

This luminaire has a very intense glare zone and the unshielded LED array make this a very uncomfortable light source for pedestrians. Please see the detailed Brisbane Street, St Lucia, evaluation comments for this luminaire.

Installation



All the trial luminaires have been installed with an up-tilt angle of at least a few degrees. This may play a role in the forward light trespass problem with this luminaire. It appears this luminaire has no internal capacity for installation angle adjustment.

The steep slope across Hipwood Street, falling from south to north, leaves these trial luminaires installed at a very high elevation above homes along the northern side of the street. Even though the street is relatively wide, due to the split roadway design, this luminaire still

projects forward trespass light onto the north-side properties.

Light Distribution

The sharp cutoff of the primary illumination beam to the rear of this luminaire creates deep shadow areas very close to the south-side footpath and property boundary. The intense glare from these luminaires exacerbates this problem for pedestrians and may result in a personal safety issue due to reduce visual performance for pedestrians.

The light distribution and control problems with this luminaire are covered in detail in the evaluation for Brisbane Street, St Lucia, please see those comments.



The sharp cut-off of the primary beam below the luminaire creates areas of deep shadow for pedestrians and highly variable footpath illumination that progress from intensely bright to tolerably bright again and again along the street.



This luminaire projects light trespass and glare far forward and into properties across the street and far from the luminaire.

Overall Assessment as a LED Luminaire for Brisbane-wide Roll-out

For all the reasons of high colour temperature, excessive brightness, uneven illuminations, inability to adjust up-tilt angle and excessive forward light trespass this luminaire is unsuitable for Brisbane-wide roll-out in residential streets or high vehicle traffic streets.

16 - Playford Street, Bracken Ridge – Comment on Trial LED Luminaires

It is assumed this luminaire is a - Austeknis LL17025

Colour

This is an extremely harsh white light, assumed to be 6000K, that emits a high proportion of blue wavelength light that is unnecessary in this residential street. Research indicates such blue-rich light may create a glare and driving hazard for drivers aged over 65 years.

Brightness

This is a very bright luminaire and delivers task area illumination that may substantially exceed the minimum requirement of the Australian Standard for this category of residential street. Roadway illumination of this intensity is unnecessary for this street.

Glare

This is an intensely glary luminaire. The problem may be exacerbated by the extremely high colour temperature causing discomfort-glare for pedestrians. The lack of LED array shielding and up-tilt angle of this luminaire may also exacerbate the glare problem.

Installation



Just one trial luminaire appears to be installed at near horizontal all others have a significant up-tilt, in some cases approaching 10° .

This luminaire does not appear to have any internal capacity to adjust the installation angle to horizontal.

Light Distribution

This luminaire creates an unnecessarily bright primary beam area below the pole and excessive light trespass particularly to the rear. It also casts a wide glare zone along the street and to the rear and forward above the primary light trespass area.



Substantial rear light trespass from this luminaire.



Substantial forward light trespass and glare zone nuisance light on to private properties.

Overall Assessment as a LED Luminaire for Brisbane-wide Roll-out

This luminaire should never have been trialed in a residential street such as this. The potential for glare and harsh unpleasant illumination should have been recognized just by the correlated colour temperature and lack of shielding. This luminaire is unsuitable for Brisbane-wide roll-out.

17 - Weenga Street, Geebung – Comment on Trial LED Luminaires

Luminaire

It is assumed this luminaire is a - Austeknis LL17025 and is also being trialed in Playford Street, Bracken Ridge.

Colour

This is an extremely harsh white light, assumed to be 6000K, that emits a high proportion of blue wavelength light that is unnecessary in this residential street. Research indicates such blue-rich light may create a glare and driving hazard for drivers aged over 65 years.

Brightness

This is a very intensely bright luminaire and delivers task area illumination that is unnecessary for this street. Light is cast a long way laterally along the street and this also contributes to the very bad glare problem.

Glare

This is an intensely glary luminaire. The problem may be exacerbated by the extremely high colour temperature causing discomfort-glare for pedestrians. The lack of LED array shielding also exacerbates the glare problem. Pedestrians will find they must squint strongly under this luminaire and avert their vision downwards for glare protection. The intense glare may create a safety risk for pedestrians as shadow areas are accentuated and line-of-sight is directed down and away from these luminaires.

Residents interviewed in this street complained about excessive glare and brightness.

Installation



Trial luminaire installed with an up-tilt angle estimated at 17°.

At appears none of the trial luminaires have been installed horizontal. The up-tilt of some luminaires is extreme and estimated at 17°. BCC-Energex should make public and explain its luminaire performance evaluation criteria and provide an explanation as to why such an extreme up-tilt angle is being trialed. Such an up-tilt angle is likely to make control of forward light trespass impossible.

Light Distribution

The intense glare zone of this luminaire is a major design weakness. The extent of rear light trespass, in particular, also makes this luminaire a poor choice for residential streets. The excessive brightness of the primary beam and glare also make this luminaire an uncomfortable light source for pedestrians.



Light trespass in Bayview Terrace caused by light cast along the length of Weenga Street.



Excessive rear light trespass on to private property.

Overall Assessment as a LED Luminaire for Brisbane-wide Roll-out

This luminaire should never have been trialed in a residential street such as this. This luminaire is unsuitable for Brisbane-wide roll-out.

18 - Drake Street, West End – Comment on Trial LED Luminaires

Luminaire

The make and model of this luminaire is unknown.

Colour

This is assumed to be a 4000K LED array and delivers a harsh white light that is unnecessary for this residential street.

Brightness

The level of task area illumination in this street is significantly higher than for neighboring streets. BCC-Energex should publish actual on-site measured illumination data for this luminaire and ensure illumination does not significantly exceed the minimum requirement of the Australian Standard.

Glare

This luminaire creates a significant glare zone nuisance for pedestrians. The unshielded glare zone of this luminaire creates nuisance for pedestrians along the length of the street and particularly so when pedestrians step into the primary beam and are forced to squint and avert their vision downwards. This discomfort is repeated as the pedestrian progresses from pole to pole along the street.

Installation



While one or two trial luminaires appear to be installed at close to horizontal alignment the others incorporate an up-tilt.

This luminaire does not appear to incorporate any capacity to adjust the up-tilt angle to horizontal.

Light Distribution

This luminaire has very poor control of rear light trespass. Like many of the older streets of Brisbane Drake Street has very short setbacks between property boundary and dwelling. This accentuates the rear light trespass and bathes many rearward homes in the primary illumination beam. Forward light trespass is mainly due to light from the glare zone falling on to homes across the street.



Significant rear light trespass problem with this luminaire.



Significant rear light trespass into homes.

Overall Assessment as a LED Luminaire for Brisbane-wide Roll-out

The high colour temperature, inability to adjust the tilt angle, unshielded LED array, glare and excessive rear light trespass make this luminaire unsuitable for this category of residential street and Brisbane-wide roll-out.