Lighting Task Force Report
Chaired by Sunder Sai
Executive Summary: What You Need to Know

What We Researched:

The USG Lighting Task Force used Lux Meters to measure light posts in the area of the University District known as the Core, one of the most populated off-campus living areas for OSU students. The area that was evaluated encompassed street segments east to west, from North High Street to 4th Street, and north to south, from Chittenden Avenue to Northwood Avenue. According to NOAA, the recommended luminance level is 5 lux for local sidewalks. We considered measurements below 5 lux to be low and this was the standard we used to evaluate lighting off-campus. Spring 2018 crime rates were analyzed and compared to lighting measurements by street to see if there was any correlation between lighting and crime. Finally, we compared streetlight-reporting procedures across the cities of Big Ten Schools.

Our Findings:

The results indicated that all streets had light posts with adequate lighting (5 lux or higher). However, the following streets had segments in-between light posts with poor lighting (below 5 lux): E. 12th, E. 13th, E. 14th, E. 15th, E. 16th, E. 18th, Woodruff, Frambes, Indianola, N. Pearl, E. Lane, Norwich, Waldeck, and E. Northwood. There was a negative correlation between average light in-between posts and incidence of crime \( r = -0.329 \), meaning that streets with lower average light in-between posts, had higher incidence of crime. Columbus is comparable to Big Ten cities in streetlight reporting procedures, but lacks a website specific to streetlight reporting, a video tutorial on how to report, and an effective follow up procedure.

Our Recommendations

1. Establish more light posts along off-campus streets if financially feasible.
2. Reconsider the type of light bulb used: upgrade to Metal Halide bulb fixtures or LED bulbs, as they provide better color rendition and an even light distribution.
3. Reconsider the type of light post used: upgrade light posts to install more cobra head lighting instead of acorn light posts, as cobra head provides greater illumination
4. Create a website specific to streetlight reporting with a video tutorial on how to request for repairs. Additionally, improve follow up procedures after request is made.
Introduction and Background

Off-campus safety has been a priority for the Undergraduate Student Government at OSU and many students have voiced their concerns regarding street lighting off campus. Quality street lighting contributes greatly to overall living environment in our off-campus neighborhood. This is of importance to OSU students especially in regards to their mental, physical health, and safety. For several years, our students have expressed a desire for OSU and the city of Columbus to focus on the issues of off-campus lighting in order to create a safer living environment and ensure an increased sense of security.

USG was tasked to create an ad-hoc Lighting Task Force with the purpose of discussing, researching, and investigating issues regarding the current lighting conditions surrounding areas east of North High Street, particularly in an area of the University District known as the Core: one of the most populated off-campus living areas for OSU students. In previous years, student evaluation of lighting has been limited to subjective and anecdotal observations of off-campus streets that students typically walk along at night. Our team took an objective approach to lighting by finding a way to quantitatively measure and record street lighting off-campus.

Measuring light is a common practice in the field of urban planning and construction. One way to measure light is by using a special instrument known Light Meter, which captures light waves and quantifies them into a unit known as a Lux: the SI unit of illuminance equal to one lumen per square meter. Before our team took several light measurements we hypothesized that there would be several streets with poor and under-sufficient lighting within our own off-campus community that may also correlate with increased rates of crime. This could potentially contribute to unsafe conditions and overall sense of insecurity for Ohio State students and pedestrians walking off-campus.

Literature Review

The USG Lighting Task Force conducted an analysis of peer-reviewed journals to understand the literature associated with street lighting, pedestrian safety, and crime. The following literature discussion has been included in our report for readers to get a general sense of existing scholarly research that our team has read through.

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1 [https://www.atp-instrumentation.co.uk/blog/how-to-measure-light-levels/#types-lux-meter](https://www.atp-instrumentation.co.uk/blog/how-to-measure-light-levels/#types-lux-meter)
One of the first studies we looked at by Painter and Farrington 2001 suggested that better lighting lowers crime rates and that the financial savings from crime reduction outweigh costs associated with updating light fixtures. Their research indicates that improved street lighting can be cost effective. Additionally, research has shown that streets with low lux luminance are associated with higher instances of crimes. Parent and Kuhlke 2009 conducted an assessment at the University of Minnesota-Duluth and found that nearly 40% of its campus crimes were committed in areas that measured less than 5 lux. Their work indicates that higher levels of lux luminance levels could deter crime around college campuses.

Furthermore, a 2008 Policing Services Report from the U.S. Department of Justice found that better lighting could reduce the number of “target areas,” or ideal spots for criminals to commit crimes. The report stated that if a crime were to happen in a better lit environment, victims would be able to better identify their attacker by being able to notice details in their appearance or attire - such distinctions that might be difficult or impossible in poorly lit conditions.

As students at OSU, our Task Force cares about the mental health of students on and off-campus. We believe that students should not have to feel scared to walk at night or fear for their safety. Malcolm Ramsey 1991 found that the amount of street lighting has implications for the mental health of populations. His study indicates that better lighting can reduce the public’s fear of crime and improve their overall mental health and well-being.

Improved lighting has implications outside of the realm of crime as well. Adequate street lighting is not just important to pedestrians on sidewalks, but also important for drivers particularly to see pedestrians crossing the street at night. According to the Virginia Tech Transportation Institute 2008, a vertical luminance of at least 20 lux in street crosswalks provided an acceptable detection distance for drivers. This has implications for the safety of both

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3 [https://pdfs.semanticscholar.org/2a0d/bd693a42a06d64ff45a153fbfed766a38cb7.pdf](https://pdfs.semanticscholar.org/2a0d/bd693a42a06d64ff45a153fbfed766a38cb7.pdf) (An Assessment of Nighttime Lighting Conditions on the Campus of the University of Minnesota-Duluth)
pedestrians and drivers. The study was taken into consideration when we completed our Task Force project, especially since preliminary findings show that many street segments did not reach the suggested 20-lux cited in the research. According to the National Oceanic and Atmospheric Administration (NOAA), a luminance level of 5 lux is recommended for local sidewalks. Luminance below 5 lux is considered as low lighting. This guideline was used in our evaluation.

When approaching the topic of lighting off-campus, the type of lighting should be taken into consideration as well. As students we wish to advocate for sustainable lighting means and efficient Light Emitting Diodes (LEDs) are a step towards this sustainable direction. According to the Central Ohio Group of the Sierra Club, if LED lights are executed properly, Columbus will be able to “cut energy consumption by up to 80%, reduce maintenance costs of lamp replacement, reduce the incidence of light trespass on private residences, reduce road glare, improve the quality of light, and reduce light pollution in the night sky.” They reason that the implementation of LED lighting could not only solve the low lighting issues in Columbus, but also approach environmentally conscious means in reducing light pollution.

Lastly, the Task Force noticed that the majority of streetlights off-campus was categorized as either mercury-vapor or high-pressure sodium bulb fixtures. These lights cast of a yellowish hue and the light distribution is uneven, typically waning the further one moves away from the light post. Metal Halide bulb fixtures or LED bulbs are types of light that are used on the campus of OSU and have been recognized to provide better color rendition and an even light distribution when compared to the current light fixtures off-campus. Additionally, the majority of off-campus lights were either acorn light posts, which are acorn shaped lamps mounted onto polls, or cobra headlights that are tall posts that extend overhead towards the street. It is known that cobra headlights will generally provide greater illumination distance compared to other headlamps because they tend to distribute light in a larger circumference, shining on both sidewalks and streets. This suggests a solution that might favor financial concerns, rather than adding more lights, the type of light can be changed to more efficient means.

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7 https://www.noao.edu/education/QLTkit/ACTIVITY_Documents/Safety/LightLevels_outdoor-indoor.pdf (NOAA Recommended Light Levels)
8 https://www.sierraclub.org/ohio/central-ohio/columbus-street-lighting-upgrade-has-opportunities-and-potential-drawbacks (Columbus Street Lighting Upgrade Has Opportunities and Potential Drawbacks)
In summary, there is a growing body of literature that indicates that improved lighting conditions prevents and lowers crime rates in major cities and around college campuses. Improving lighting could also be financially cost-effective in the long run. Additionally, lighting levels of 20 lux in street crosswalks provide an acceptable detection distance for drivers when pedestrians cross the street. The types of lighting used should also be taken into consideration. It is observed that Metal Halide bulbs and LED light bulbs that are used on campus provide better lighting distribution than the types of light fixtures used off-campus. Additionally, cobra headlights are observed to be the type of light posts that maximize light.

**Methodology**

The USG Lighting Task Force used Lux Meters to measure light posts in the area of the University District known as the Core, one of the most populated off-campus living areas for OSU students. The area that was evaluated encompassed street segments east to west, from North High Street to 4th Street, and north to south, from Chittenden Avenue to Northwood Avenue. Recordings were taken from January 2nd to March 25th after the sun had set between the times of 7:15 P.M. and 11:00 P.M.

In addition to individual light posts being measured, the segment of sidewalks between light posts were also measured. Recordings were taken in equidistant increments one-fourth, one-half, and three-fourths of the way between the light posts. These recordings in between posts were averaged to estimate the levels of luminance. NOAA’s recommended luminance level is 5 lux for local sidewalks. Light posts or street segments that were below 5 lux were considered to be low and this was the standard we used to evaluate lighting off-campus.

Light posts that were overly dim (below 2 lux) or not operating were noted and reported to the Columbus’s citywide online reporting system. Recordings for 17th street were not completed due to construction on the street and numerous light posts that were overly dim or not operating. These light posts were reported to the online system. Additionally, light measurements for Tuller Street and Summit Street were not recorded due to the immense size of the streets and time constraints for spring semester.

Crime rates for OSU’s off-campus area were analyzed from January 2nd to March 25th during the time period of our light recordings and for the specific streets we measured. These crime rates were compared to the recorded lighting measurements by street to see if there was
any correlation between lighting and crime. Additionally, street light reporting procedures were compared across the cities of Big Ten schools to evaluate the effectiveness of the city of Columbus’s system. The following criteria were evaluated for each Big Ten city’s streetlight reporting system: whether there was a specific online website for light reporting, whether there was a listed phone number to call, whether there was a video tutorial for reporting, whether there was a follow up procedure, where there was a place to provide and describe details.

**Data and Results**

The results shown in Figure 1 provide the number of crime incidents from January 2\textsuperscript{nd} to March 25\textsuperscript{th} during the time period we recorded per street. Additionally, the average lux measurements directly underneath light posts and the average of lux measurements in between light posts are also broken down by street.

The results indicated that all streets had light posts with adequate lighting (5 lux or higher). However, the following streets had segments in-between light posts with poor lighting (below 5 lux): E. 12th, E. 13th, E. 14th, E. 15th, E. 16th, E. 18th, Woodruff, Frambes, Indianola, N. Pearl, E Lane, Norwich, Waldeck, and E. Northwood.

**Figure 2** provides a graph of average light levels in between light posts compared to the incidence of crime. Each point on the graph represents a respective street. As the graph indicates, there was a negative correlation between average light in-between posts and incidence of crime ($r = -0.329$), meaning that streets with lower average light in-between posts, had higher incidence of crime.

**Figure 3** provides an evaluation of streetlight reporting procedures that were compared across the cities of Big Ten schools. The following criteria were evaluated for each city’s streetlight reporting system: whether there was a specific online website for light reporting, a listed phone number to call, a video tutorial explaining how to use/report, a follow up procedure, and if there was a place to provide and describe details. The chart shows that Columbus is comparable to Big Ten cities in procedures, but lacks a website specific to streetlight reporting, a video tutorial on how to report, and an effective follow up procedure. Cities surrounding University of Michigan, University of Maryland, and University of Nebraska lead in streetlight reporting procedures, meeting 4 out of 5 criteria.
<table>
<thead>
<tr>
<th>Street</th>
<th># of Crime Incidents</th>
<th>Average Under Light (Lux)</th>
<th>Average Between Lights (Lux)</th>
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</thead>
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<tr>
<td>Chittenden</td>
<td>5</td>
<td>17.41</td>
<td>6.32</td>
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<tr>
<td>12th</td>
<td>11</td>
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<td>1.70</td>
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<td>13th</td>
<td>17</td>
<td>16.29</td>
<td>1.61</td>
</tr>
<tr>
<td>14th</td>
<td>18</td>
<td>9.98</td>
<td>0.47</td>
</tr>
<tr>
<td>15th</td>
<td>14</td>
<td>17.53</td>
<td>1.70</td>
</tr>
<tr>
<td>16th</td>
<td>6</td>
<td>11.39</td>
<td>2.29</td>
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<tr>
<td>18th</td>
<td>5</td>
<td>17.66</td>
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<tr>
<td>19th</td>
<td>2</td>
<td>11.98</td>
<td>5.29</td>
</tr>
<tr>
<td>Iuka</td>
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<td>9.94</td>
<td>13.33</td>
</tr>
<tr>
<td>Woodruff</td>
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<td>17.78</td>
<td>2.25</td>
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<td>2.38</td>
</tr>
<tr>
<td>East Northwood</td>
<td>5</td>
<td>7.35</td>
<td>3.47</td>
</tr>
</tbody>
</table>

**Figure 1**: Crime incidents, average light measurements under light posts, and average light measurements between light posts are broken down by street. Crime rates taken from Columbus PD’s unofficial database, Zone 4, filtered by streets.

![Light Levels Between Light Posts vs. Incidence of Crime](image)

**Light Levels Between Light Posts vs. Incidence of Crime**

- **y = -0.6173x + 8.7522**
- **R² = 0.1088**

**Figure 2**: Graph of average light levels between light posts versus incidences of crime. Each point represents a street. 14th street had the highest rate of crime and low lux levels. Graph overall shows a downward sloping trend r = -0.329.
**Figure 3**: The evaluation of streetlight reporting procedure systems at cities of Big Ten schools. Ohio State has 2 out of the 5 criteria and is comparable to other universities. The cites of University of Michigan, University of Maryland, and University of Nebraska lead, meeting 4 out of 5 criteria.
Figure 4 (below): City of Columbus 3-1-1 Portal for city utilities requests. Users must search among request options to select “street light needs repair.” Score: 3/5

WELCOME TO THE NEW 311 WEBSITE.

IF YOU WOULD LIKE TO LEARN MORE ABOUT THE NEW FEATURES, CLICK HERE.

The City of Columbus Service Center provides a way for you, the resident, to submit a request for City Services. The Service Center is the single point of contact for non-emergency City services and is available to residents, City businesses, and visitors.

The Columbus Service Center is also known as “3-1-1,” its mission is to provide access to City services and City information with the highest possible levels of service.

The “3-1-1” initiative strives to help City agencies provide efficient service delivery by allowing them to focus on their core missions, manage workloads efficiently, and meet the needs of residents, and measure how well services are delivered.

Figure 5 (below): Ann Arbor, MI website for streetlight and utility repairs. Score: 4/5

Figure 6 (above): College Park, MD website for street maintenance. Score: 4/5

Figure 7 (above): Lincoln, NE website for streetlight reporting. Score: 4/5
Discussion and Recommendations

Off-campus safety has been a priority for the Undergraduate Student Government at OSU and many students have voiced their concerns regarding street lighting off campus. The USG Lighting Task Force used Lux Meters to measure streetlights in the area of the University District known as the Core, one of the most populated off-campus living areas for OSU students. The area that was evaluated encompassed street segments east to west, from North High Street to 4th Street, and north to south, from Chittenden Avenue to Northwood Avenue. According to research and NOAA, a luminance level of 5 lux is recommended for local sidewalks. This established our standards for lighting, and any areas below 5 lux were considered as having low lighting. Additionally, crime rates were analyzed for these street segments for spring semester 2018.

Results indicated that all streets had light posts with adequate lighting (5 lux or higher). However, nearly all streets measured had segments in between light posts with extremely poor lighting. There was a negative correlation between average light in-between posts and incidence of crime ($r = -0.329$), meaning that streets with lower average light in-between posts, had a higher incidence of crime.

In regards to streetlight reporting, Columbus is comparable to Big Ten cities, but lacks a website specific to streetlight reporting, a video tutorial on how to report, and an effective follow up procedure. A website specific to streetlight reporting that contains the identified criteria mentioned above is important, as it makes it easier for people to report. The current website shown in Figure 4 contains links for a variety of public utilities requests. This has many pros and cons. While it may be convenient to provide all service options on one website, users may have a difficult time finding where to submit a request to specifically fix streetlights.

Furthermore, having a video tutorial on how to submit a request may make it easier for users to navigate the website and submit a request. Currently in order to submit a request, users must make an account through the 3-1-1 portal system and users must submit a lengthy form providing personal details. Users are currently less inclined to submit requests to fix light posts, as it is a huge inconvenience. Lastly, there was no efficient follow up procedures following requests. Although we were given an email saying the request has been filed, we did not receive
any updates or correspondence from the city regarding our requests and this should be improved. Cities surrounding University of Michigan, University of Maryland, and University of Nebraska currently lead in streetlight reporting procedures, meeting at least 4 out of 5 criteria. Columbus may consider reviewing these cities’ websites to improve their own streetlight reporting procedures.

The Task Force also found that the majority of streetlight bulbs off-campus was categorized as either mercury-vapor or high-pressure sodium bulb fixtures. These lights cast of a yellowish hue and the light distribution is uneven, typically waning the further one moves away from the light post. Metal Halide bulb fixtures or LED bulbs are types of light that are used on the campus of OSU and have been recognized to provide better color rendition and an even light distribution when compared to the current light fixtures off-campus.

Additionally, the majority of off-campus light fixtures were either acorn light posts, which are acorn shaped lamps mounted onto polls, or cobra headlights that are tall posts that extend overhead towards the street. It is known that cobra headlights will generally provide greater illumination distance compared to other headlamps because they tend to distribute light in a larger circumference, shining on both sidewalks and streets. This suggests a solution that might favor financial concerns, rather than adding more lights, the type of light can be changed to more efficient means.

An important note should be made lighting between light posts. A variety of light from adjacent streets and houses may cast light in between the post, making it brighter than actual light posts. This was true in regards to Iuka Street: the average light level underneath the light posts are lower than average light levels in between posts (Figure 2). This is due to the particular position that Iuka is in, as there are a variety of other lighting sources illuminating the sidewalk.

Additionally, relative lighting on any given night can vary from atmospheric conditions, time of night, and adjacent streets and housing. Our Task Force has worked very hard to collect and record our data to the best of our ability, but results may vary on any given night. Our report provides preliminary evidence suggesting poor street lighting in between light posts and a correlation to crime.
Recommendations
In consideration of our methodology, data, and results, the USG Lighting Task Force recommends the following to Undergraduate Student Government, The Ohio State University, and the City of Columbus:

1. Establish more light posts along off-campus streets if financially feasible.
2. Reconsider the type of light bulb used: upgrade to Metal Halide bulb fixtures or LED bulbs, as they provide better color rendition and an even light distribution.
3. Reconsider the type of light post used: upgrade light posts to install more cobra head lighting instead of acorn light posts, as cobra head provides greater illumination.
4. Create a website specific to streetlight reporting with a video tutorial on how to request for repairs. Additionally, improve follow up procedures after request is made.

We provide these recommendations on the basis that they will follow city regulations in consideration of both pedestrians and drivers. Further research should be completed evaluating lighting off-campus and USG, OSU, and the City of Columbus should continue their partnership in improving the health and safety of students living in the off-campus area.
**Literature Cited**


[http://library.college.police.uk/docs/hopolicers/fcpu29.pdf](http://library.college.police.uk/docs/hopolicers/fcpu29.pdf)

“Recommended Light Levels (Illuminance) for Outdoor and Indoor Venues.” *Recommended Light Levels*,  