Case Study: Anonymous, Ontario

LED Street Lighting Assessment using the SEAD Street Lighting Tool

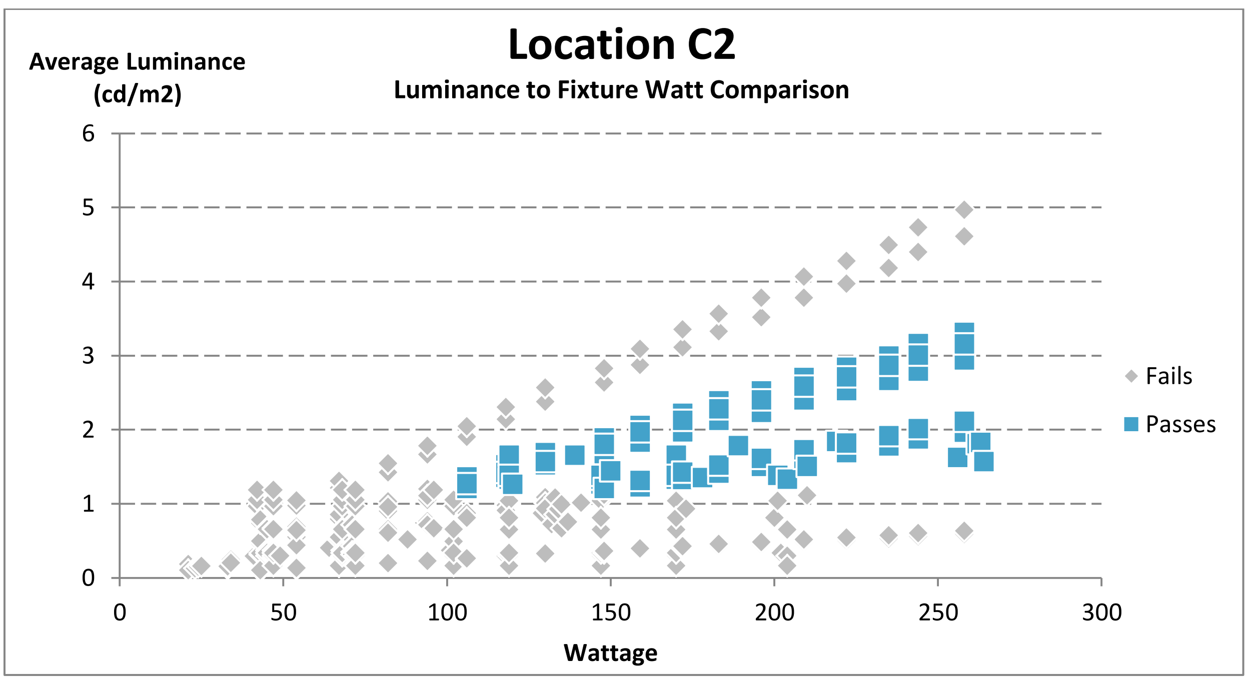
This paper summarizes the results of an analysis of several of the locations being studied by a city in Ontario for street lighting fixture upgrades, as part of the trial implementation of the SEAD Street Lighting Tool with LightSavers Canada.

The SEAD Street Lighting Tool is set up to quickly analyze a large number of fixtures for basic road configurations, calculating photometric performance and energy consumption, as well as cost analysis. For this analysis, only photometric and energy considerations were considered. Basic characteristics about each of the sites – road width, pole height and spacing, etc. – were taken from the table of site parameters provided by the city through LightSavers. For each location, 486 fixtures from five major manufacturers were analyzed, including GE Lighting, Philips Lumec, Cree, LED Roadway, Holophane.

Results from the fixtures were reduced from the light output values provided in the relevant IES files to account for end-of-life performance. The two key factors in this are dirt depreciation and lumen depreciation, as noted below.

Dirt Depreciation Factor	Lumen Depreciation Factor	Total Depreciation Factor
0.88	0.70	0.616

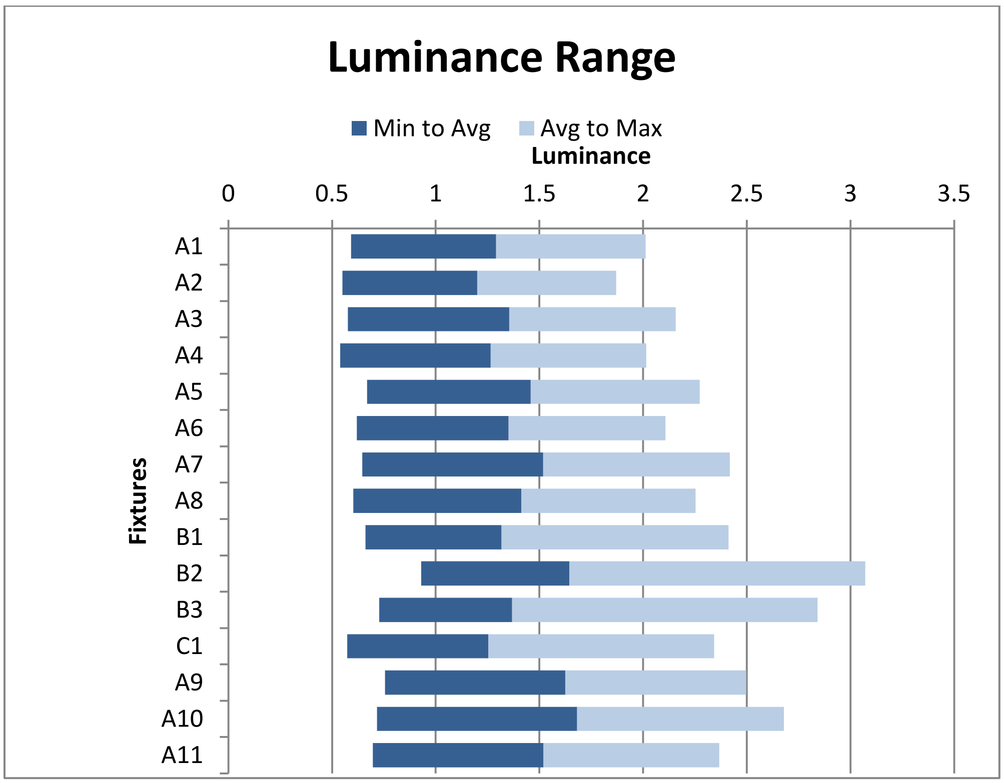
The first graph, below, indicates the average luminance on the measurement grid of the as compared to the fixture wattage. The fixtures that passed the luminance criteria (both average luminance and average to minimum uniformity ratio) are indicated with blue, while those that fail at least one of the criteria are shown in gray.



Of the fixtures analyzed, the lowest energy consuming fixture that met the light performance criteria had an energy consumption of 106 watts. While some fixtures with lower energy consumption were able to provide this level of average luminance, they failed due to unacceptable uniformity.

Existing Fixture	400 watts
Top Fixture	106 watts
Percent Savings	**74%**

The 16 fixtures with the lowest energy consumption that met the luminance criteria are shown below. The range of the two bars indicates the full range of luminance across the measurement grid, with the midpoint of the two bars being the average luminance across the grid. The full set of results for luminance for all 486 fixtures are available in the accompanying Excel file.



The table below provides a summary table of the inputs that were used to produce these results.

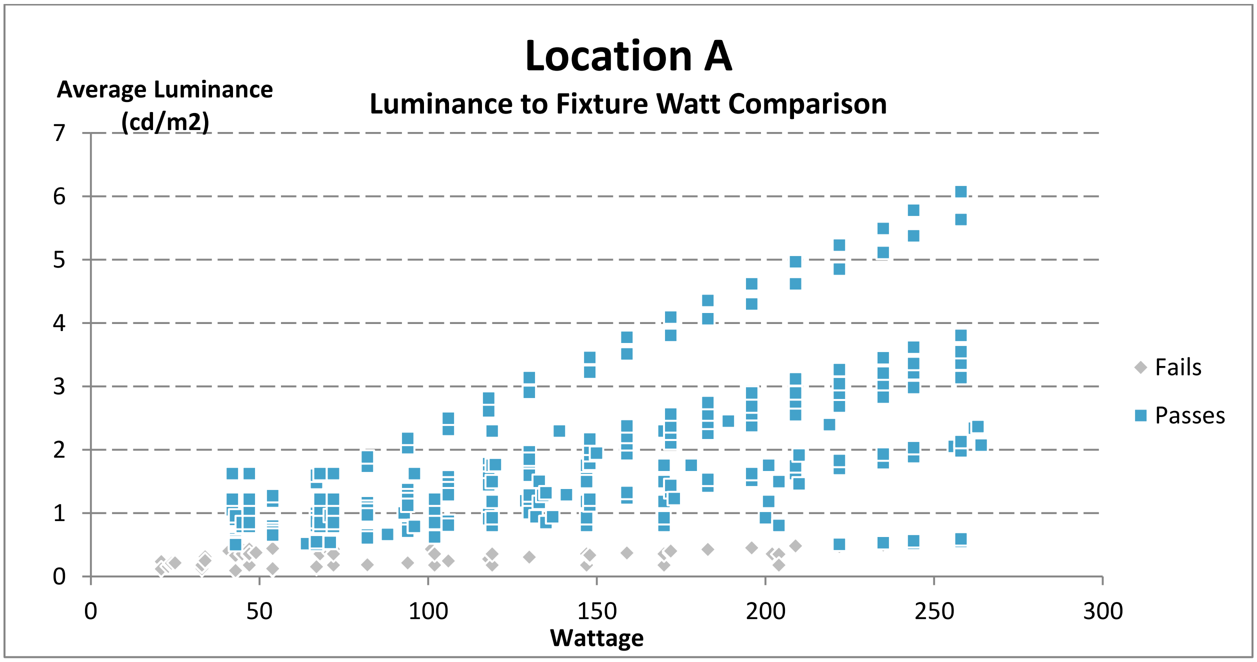
Table 1: Inputs for Location C2

Description:	Baseline	Units
Road Geometry		
Number of Lanes	4	lanes
Lane Width	2.7	meters
Shoulder Width	0	meters
Median Width	0	meters
Light Geometry:		
Pole Placement	Single-side	
Pole Height	10	meters
Pole Spacing	28	meters
Pole Setback	0.2	meters
Arm length	3	meters
Number of Points in Grid	10	
Lighting Standards		
Illuminance Method		
Average Illuminance Target (Iavg)	17	Lux
Uniformity Ratio (Eavg/Emin)	4	unitless
Luminance Method		
Road Surface Type	R3	Standard Surface
Average Luminance Target (Lav)	1.2	cd/m2
Overall Uniformity (U0 - avg/min)	3	unitless
Lamp Lumen Depreciation	0.73	unitless
Luminaire Dirt Depreciation	0.88	unitless
Temperature Effects	1	unitless
Operating hours	4380	hours

Location A

The SEAD Tool was also used for a similar analysis for another roadway section, Location A, in the same municipality.

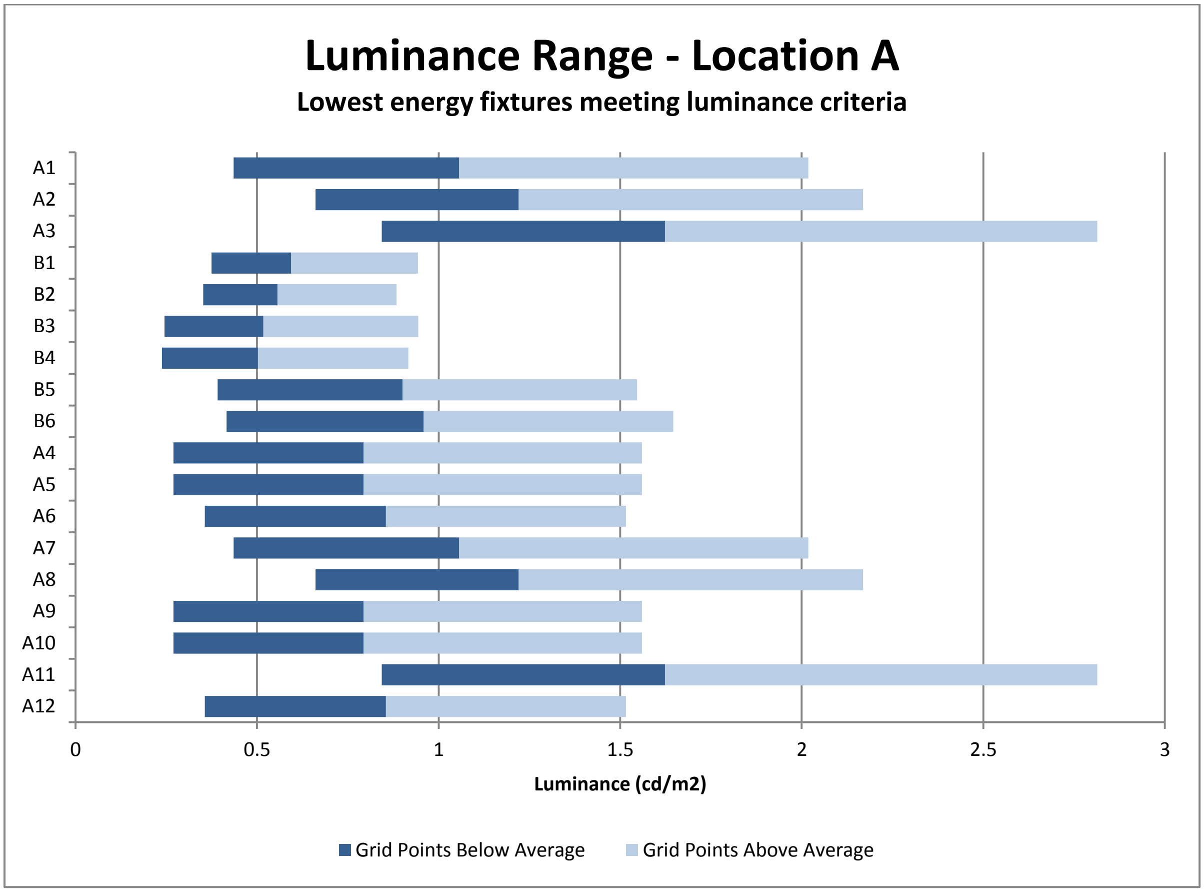
This graph indicates the average luminance on the measurement grid of the as compared to the fixture wattage. The fixtures that passed the luminance criteria (both average luminance and average to minimum uniformity ratio) are indicated with blue, while those that fail at least one of the criteria are shown in gray.



Of the fixtures analyzed, the lowest energy consuming fixture that met the light performance criteria had an energy consumption of 42 watts. While some fixtures with lower energy consumption were able to provide this level of average luminance, they failed due to unacceptable uniformity.

Existing Fixture	100 watts
Top Fixture	42 watts
Percent Savings	**58%**

The 18 fixtures with the lowest energy consumption that met the luminance criteria are shown below. The range of the two bars indicates the full range of luminance across the measurement grid, with the midpoint of the two bars being the average luminance across the grid. The full set of results for luminance for all 486 fixtures are available in the accompanying Excel file.



Luminance Range - Location A
Lowest energy fixtures meeting luminance criteria
A1
A2
A3
B1
B2
B3
B4
B5
B6
A4
A5
A6
A7
A8
A9
A10
A11
A12
0
0.5
1
1.5
2
2.5
3
Luminance (cd/m2)
Grid Points Below Average
Grid Points Above Average

Table 2: Summary of Inputs for Location A

Description:	Baseline	Units
Road Geometry		
Number of Lanes	2	lanes
Lane Width	4	meters
Shoulder Width	0	meters
Median Width	0	meters
Light Geometry:		
Pole Placement	Single-side	
Pole Height	9	meters
Pole Spacing	35	meters
Pole Setback	1.7	meters
Arm length	3	meters
Number of Points in Grid	10	
Lighting Standards		
Illuminance Method		
Average Illuminance Target (Iavg)	7	Lux
Uniformity Ratio (Eavg/Emin)	6	unitless
Luminance Method		
Road Surface Type	R3	Standard Surface
Average Luminance Target (Lav)	0.5	cd/m2
Overall Uniformity (U0 - avg/min)	6	unitless
Lamp Lumen Depreciation	0.73	unitless
Luminaire Dirt Depreciation	0.88	unitless
Temperature Effects	1	unitless
Operating hours	4380	hours

Conclusions

This analysis shows that there are many LED fixtures available on the market that meet the luminance requirements for these two locations. The fixtures identified by the tool can cut energy use by 74% in location C2 and 58% in location A. This municipality can use the results from the SEAD Street Lighting

Tool to pre-screen fixtures and complete simple payback calculations before initiating the street lighting upgrades process. The tool can also validate data submitted by manufacturers during the RFQ process. SEAD will continue to work with LightSavers, NRCan, and interested municipalities in deploying the tool and accelerating the transition to efficient street lighting in Canada.