Ontario
Ministry of Transportation

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LAUZON PARKWAY IMPROVEMENTS

CITY OF WINSOR
COUNTY OF ESSEX

ENVIRONMENTAL STUDY REPORT

MINISTRY OF TRANSPORTATION

ENVIRONMENTAL STUDY REPORT - ELECTRICAL

November 2013

MRC

A member of MMM GROUP

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APPENDICES

1. INTRODUCTION

This Electrical Report, as part of the overall Environmental Study Report (ESR) has been completed to address the future illumination for Lauzon Parkway Improvements Class EA Study. The study has the following main components:

i) Lauzon Parkway from E.C. Row Expressway to County Road 42 (2.5 km);

ii) Lauzon Parkway's extension to Highway 401 (3 km);

iii) Lauzon Parkway's further extension to Highway 3 (2.5 km);

iv) County Road 42 from Walker Road to City/County Boundary (5.5 km);

v) County Road 42 from City/County Boundary to County Road 25 (E. Puce Road) (10 km); and

vi) The future East-West Arterial from Walker Road to County Road 17 (10th Concession Road) (5 km)

The Electrical Report addresses pre-design issues related to the following:

i) Full illumination on Lauzon Parkway, County Road 42 and the future E-W Arterial along the project limits.

ii) Full illumination at the Lauzon Parkway and Highway 401 Interchange within the project limits.

iii) Full illumination at the roundabouts along Lauzon Parkway, County Road 42, and E-W Arterial within the project limits.

iv) Underpass illumination at the Highway 401 and Lauzon Parkway underpass.

v) Power supplies.

2. EXISTING CONDITIONS

2.1 ILLUMINATION AND TRAFFIC SIGNALS

Within the study limits, there are existing illumination and traffic signal installations as follows:

2.1.1 MTO

There are currently no MTO illumination or traffic signal installations within the study limits.

2.1.2 City of Windsor

A) Lauzon Parkway from Twin Oaks Drive/South Service Road to County Road 42

There is no existing illumination of Lauzon Parkway within these limits.

The Lauzon Parkway and Twin Oaks Drive/South Service Road intersection is a typical four-legged intersection. This intersection is signalized and has partial illumination consisting of two (2) conventional lighting poles.

The Lauzon Parkway and County Road 42 intersection is a T-intersection, with Lauzon Parkway terminating at County Road 42. This intersection is signalized and has partial illumination consisting of two (2) combination traffic signal/illumination poles.

B) County Road 42 between Walker Road and CN Rail Crossing

Currently, there is continuous illumination along County Road 42 between Walker Road and the CN Rail crossing, approximately 300 m east of Walker Road, consisting of conventional lighting poles along the north and south sides of County Road 42.

The County Road 42 and Walker Road intersection is a typical four-legged intersection. This intersection is signalized and has full illumination consisting of three (3) combination traffic signal/illumination poles, one (1) conventional illumination pole, and three (3) luminaires and bracket arms mounted on hydro poles.

C) County Road 42 from CN Rail Crossing to County Road 17 (10th Concession Road)

There is no existing illumination of County Road 42 within these limits.

The County Road 42 and County Road 17 (10th Concession Road) intersection is a T-intersection, with County Road 17 (10th Concession Road) terminating at County Road 42. This T-intersection is adjacent to the Lauzon Parkway and County Road 42 T-intersection and is also signalized and partially illuminated. The illumination consists of one (1) combination traffic signal/illumination pole, one (1) single illumination pole, and one (1) luminaire and bracket arm mounted on a hydro pole.

D) County Road 42 from County Road 17 (10th Concession Road) to the City/County Boundary (700m west of County Road 43 (Banwell Road))

There is no existing illumination of County Road 42 within these limits.

2.1.3 County of Essex

A) County Road 42 from the City/County Boundary (700m west of County Road 43 (Banwell Road)) to Lesperance Road

There is no existing illumination of County Road 42 within these limits.

The County Road 42 and County Road 43 (Banwell Road) intersection is a T-intersection, with County Road 43 (Banwell Road) terminating at County Road 42. This existing intersection is signalized with an aerial installation on steel messenger cables.

B) County Road 42 from Lesperance Road to County Road 19 (Manning Road)

There is continuous illumination along County Road 42 between Lesperance Road and County Road 19 (Manning Road), consisting of conventional poles along the south side of County Road 42.

The County Road 42 and Lesperance Road intersection is a typical four-legged intersection. This intersection is signalized and has partial illumination consisting of two (2) combination traffic signal/illumination poles.

The County Road 42 and County Road 19 (Manning Road) intersection is a typical four-legged intersection. This intersection is signalized and has partial illumination consisting of two (2) combination traffic signal/illumination poles.

C) County Road 42 from County Road 19 (Manning Road) to County Road 25 (E. Puce Road)

There is no existing illumination of County Road 42 within these limits.

The County Road 42 and Patillo Road intersection is a T-intersection, with Patillo Road terminating at County Road 42. This intersection is signalized and has partial illumination consisting of two (2) combination traffic signal/illumination poles.

The County Road 42 and County Road 25 (E. Puce Road) intersection is a typical four-legged intersection. This intersection is signalized and has partial illumination consisting of two (2) combination traffic signal/illumination poles.

2.2 UTILITIES

The following is a brief summary of the utilities. For more details refer to the ESR for complete existing utility information.

2.2.1 Hydro One Networks

A) Lauzon Parkway between Twin Oaks Drive and Highway 401

There is a Hydro One transmission corridor running east-west crossing Lauzon Parkway south of the CP Rail Windsor Subdivision Line. In addition, there are overhead power lines along the east side of Lauzon Parkway from Service Road B to County Road 42.

There is also a Transformer Station located between Lauzon Parkway and Lauzon Road, just south of the CP Rail line. The access to the sub-station is on Lauzon Road.

B) County Road 42 between Walker Road and the City/County Boundary (700 m west of County Road 43 (Banwell Road))

Between the CN Pelton Spur and the City/County Boundary (700 m west of County Road 43 (Banwell Road)) (Windsor/Tecumseh Boundary) Hydro One lines are located, intermittently along the north and south side of County Road 42, as follows:

i) CN Pelton Spur to Baseline Road: above ground, north side
ii) Baseline Road to 3645 County Road 42: above ground, south side
iii) 3645 County Road 42 to 4205 County Road 42: underground
iv) 4205 County Road 42 to 5255 County Road 42: above ground, south side
v) 5255 County Road 42 to 6424 County Road 42: underground
vi) 6424 County Road 42 to the Windsor/Tecumseh Boundary: above ground, north side

C) County Road 42 between the City/County Boundary (700 m west of County Road 43 (Banwell Road)) and County Road 25 (E. Puce Road)

There is a Hydro One corridor which crosses County Road 42 east of County Road 19 (Manning Road). Hydro lines extend on the north side of the roadway from the Windsor/Tecumseh Boundary to County Road 25 (E. Puce Road).

D) E-W Arterial

There are hydro lines on the west side of 8th Concession Road, 9th Concession Road, and County Road 17 (10th Concession Road).

E) Lauzon Parkway between Highway 401 and Highway 3

There are hydro poles on Sexton Sideroad from County Road 46 to Highway 3. Southerly from County Road 46, the hydro poles are located on the west side of Sexton Sideroad for approximately 250 m, and then on the east side to Highway 3

2.2.2 ENWIN Utilities

A) Lauzon Parkway between Twin Oaks Drive and Highway 401

There are hydro poles on the west side of Lauzon Parkway from the CP Rail line south, approximately 350 m, at which point they cross Lauzon Parkway and enter Hydro One's Transformer Station.

B) County Road 42 between Walker Road and the City/County Boundary (700 m west of County Road 43 (Banwell Road))

Between Walker Road and the CN Pelton Spur at-grade crossing there are hydro poles located on both sides of County Road 42.

2.2.3 Essex Power

Essex Power does not have any infrastructure within the study area.

2.2.4 Other Utilities

The existing Bell, Cogeco, Hydro One Networks/ENWIN Utilities, and Union Gas facilities located along the existing County Road 42 right-of-way may be impacted by the proposed widening and require relocation.

3. EVALUATION OF ELECTRICAL SYSTEMS REQUIREMENTS

3.1 ROADWAY ILLUMINATION

The primary objective of roadway illumination is to improve safety. MTO, the City of Windsor and County of Essex all strive to achieve this objective in a cost effective and energy efficient manner while considering local needs and environmental impacts. In addition to reviewing the existing roadway illumination, proposed illumination alternatives were assessed to ultimately establish whether or not lighting is warranted for the various sections of roadway within the study limits.

3.1.1 Warrant Analysis

As part of the warrant analysis and as a means to ultimately obtain a cost estimate for the illumination requirements of the various sections of the roadways within the study limits, a Life Cycle Cost Analysis (LCCA) was performed. The LCCA considers the initial installation costs as well as the maintenance and operational costs over the service life of the equipment. These costs will vary depending on the number of fixtures that are required to sufficiently illuminate the roadway or Interchange.

The warrant analysis was conducted to determine whether or not full illumination is warranted for each section of roadway within the study area. The warrant analysis was performed in accordance with Ministry Policy for Highway Illumination Directive PLNG-B-05 which includes the following:

- Life Cycle Cost Analysis (LCCA)
- Highway Element Investment Review (HEIR)
- Benefit/Cost Ratio
- Warrant FORM

The Ministry's warrants analysis procedures were also used for the roadways with the jurisdiction of County of Essex in the absence of a documents policy by the County.

For roadways within the jurisdiction of the City of Windsor, the illumination guidelines set by the City of Windsor superseded the Ministry Directive outlined above and was considered as the sole standard in warranting illumination.

Furthermore, the Ministry's policy for roundabout lighting was also used for the roundabouts within the study area for warranting illumination.

3.1.1.1 Design Criteria

The adequate illumination for the roadways and Interchange within the entire study area was determined using the following design criteria

A) Full Roadway Illumination Design Criteria – MTO

MTO guidelines for freeways were followed for the Lauzon Parkway and Highway 401 Interchange, based on the current roadway classification (refer to Section 1.0) and an R3 pavement type:

a) Luminance

Minimum Average Maintained	0.6 cd/m^2
Average to Minimum Uniformity	3:1
Maximum to Minimum Uniformity	6:1

b) Illuminance

Minimum Average Maintained	8.5 Lux
Average to Minimum Uniformity	3:1
Maximum to Minimum Uniformity	6:1

c) Veiling Luminance Ratio

Maximum	0.3

B) Full Roadway Illumination Design Criteria – City of Windsor and County of Essex

Illumination calculations for Lauzon Parkway, County Road 42 and the future E-W Arterial were performed to achieve the following criteria provided by City of Windsor standards.

d) Illuminance

Minimum Average Maintained	2 footcandle (21.5 Lux)
Average to Minimum Uniformity	3:1
Maximum to Minimum Uniformity	6:1

C) Roundabout Illumination Design Criteria – City of Windsor and County of Essex

Illumination calculations for the roundabouts along Lauzon Parkway, County Road 42 and the future E-W Arterial were performed to achieve the following criteria provided by the IES DG-19-08 Design Guide for Roundabout Lighting. The criteria for each roundabout depend on the classification of the aforementioned roadways and intersecting roadways, as well as the pedestrian conflict for the area. The criteria were narrowed down to the following classifications:

e) Illuminance for Major/Collector with Low Pedestrian Conflict

Minimum Average Maintained	15 Lux
Average to Minimum Uniformity	3:1

f) Illuminance for Major/Collector with Medium Pedestrian Conflict

Minimum Average Maintained	22 Lux
Average to Minimum Uniformity	3:1

D) Multi-Use Trail Illumination Design Criteria – City of Windsor and County of Essex

Illumination calculations for the multi-use trails (walkways/bikeways) along Lauzon Parkway, County Road 42 and the future E-W Arterial were performed to achieve the following criteria provided by the ANSI/IESNA RP-8-00 Roadway Lighting. The criteria for the multi-use trails

depend on the level of pedestrian conflict, and in some cases, the classification of the area. The criteria were narrowed down to the following classifications:

Illuminance for Rural/Semi-Rural Area with Low Pedestrian Conflict

Average Horizontal Illuminance Maintained	2 Lux
Minimum Vertical Illuminance	0.6 Lux
Horizontal Average to Minimum Uniformity	10:1

g) Illuminance for Low Density Residential Area with Low Pedestrian Conflict

Average Horizontal Illuminance Maintained	3 Lux
Minimum Vertical Illuminance	0.8 Lux
Horizontal Average to Minimum Uniformity	6:1

h) Illuminance for Medium Density Residential Area with Low Pedestrian Conflict

Average Horizontal Illuminance Maintained	4 Lux
Minimum Vertical Illuminance	1 Lux
Horizontal Average to Minimum Uniformity	4:1

i) Illuminance for Medium Pedestrian Conflict Area

Average Horizontal Illuminance Maintained	5 Lux
Minimum Vertical Illuminance	2 Lux
Horizontal Average to Minimum Uniformity	4:1

3.1.1.2 Types of Roadway Illumination

High mast illumination was selected as the preferred alternative for the Highway 401 and Lauzon Parkway interchange, while conventional illumination was used for full roadway illumination of Lauzon Parkway, County Road 42 and the future E-W Arterial.

All illumination alternatives utilized photometric data from the Ministry's current approved photometric list, dated October 2011, and illumination calculations were calculated with *AGI32 by Lighting Analysts Inc, version2.3 Revision 0*.

A) High Mast Illumination

High mast illumination, utilizing clusters of 400 watt High Pressure Sodium (HPS) luminaires on 35m poles was used for Highway 401 and Lauzon Parkway interchange. The number of luminaires on a typical pole ranges from eight (8) to ten (10) luminaires.

The following luminaires were selected from the MTO's list of Approved Luminaires for performing typical calculations:

a) Holophane Lighting

i) Medium Full Cutoff Type V, 400 Watt HPS in 400 Watt Housing. Photometric Curve Number LTL19834
ii) Short Cutoff Type II, 400 Watt HPS in 400 Watt Housing. Photometric Curve Number 43122

B) Conventional Illumination

The conventional illumination for municipal roadways utilizes 10.7 m, direct buried concrete poles along both sides of the roadways with LED luminaires and aluminium tapered elliptical arm bracket on each pole.

The pole layout was optimized for the worst performing luminaire to ensure that products from at least two manufacturers would be specified.

The typical cross sections developed as part of this assignment show that the multiuse path and the sidewalks along the roadways would be located behind the lighting poles. Therefore, it] was important to ensure that the selected luminaires provide adequate backlighting, for the purpose of pathway/sidewalk illumination, while providing the required roadway illumination. A very preliminary analysis showed that optimizing the roadway lighting pole spacing to satisfy both the roadway lighting and pedestrian lighting requirements simultaneously would be less costly than having a separate lighting system for the pedestrian facilities. This resulted in a typical pole spacing of 25 m for the widest section of the roadways to approximately 45 m for the narrowest sections.

3.1.1.3 Analysis Results and Recommendations

A) MTO Illumination – Highway 401 and Lauzon Parkway Interchange

Lauzon Parkway will be fully illuminated as per the City of Windsor's practices. Furthermore, the Interchange includes roundabouts in lieu of intersections at the interchange ramp terminals, requiring full illumination in accordance with the Ministry's policy. The limits of the roundabout illumination are to extend a minimum of 80m along the ramps. Considering that, at the minimum, partial illumination would be installed at the Highway 401 off-ramp exit bullnoses, fill-in illumination would be required as per MTO practices.

Thus, full illumination is warranted for the entire Highway 401 and Lauzon Parkway interchange, including Lauzon Parkway within the Controlled Access Highway (CAH) limits.

B) City of Windsor Illumination

The City of Windsor indicated that the City's policy is to provide full illumination for all new roadways within developed areas. Thus, continuous illumination is warranted for Year 2031as described below:

a) Roadway Illumination

i) Lauzon Parkway between Twin Oaks Drive and Highway 401

ii) Lauzon Parkway at Highway 401 roundabout interchange

iii) E-W Arterial between Walker Road to County Road 17 (10th Concession Road)

iv) County Road 42 between Walker Road and 700 m west of County Road 43 (Banwell Road)

b) Roundabout Illumination

Full illumination of the roundabouts is warranted in Year 2021 at the following locations:

i) County Road 42 at 7th Concession Road

ii) County Road 42 at 8th Concession Road

iii) County Road 42 at 9th Concession Road

This illumination shall be integrated into the continuous illumination for Lauzon Parkway, County Road 42 and E-W Arterial.

Full illumination of the roundabouts for the interim design is warranted in Year 2021 at the following locations:

i) Lauzon Parkway at Baseline Road

ii) Lauzon Parkway at E-W Arterial

The interim roundabouts will be converted to signalized intersections during construction of the ultimate design.

Full illumination of the roundabouts for the ultimate design is warranted in Year 2031 at the following locations:

i) E-W Arterial at the entrance to 4490 7th Concession Road

ii) E-W Arterial at Future Collector Road

iii) E-W Arterial at 8th Concession Road

iv) E-W Arterial at 9th Concession Road

v) E-W Arterial at County Road 17 (10th Concession Road)

c) Multi-Use Trail and Sidewalk Illumination

Continuous illumination of all multiuse trails and sidewalks along the roadways is warranted as per discussion with the City of Windsor.

C) County of Essex Illumination

In the absence of a documented policy for illumination warrants for roadways within the jurisdiction of County of Essex, the analysis was carried out in accordance with the Ministry Direction PLNG-B05 FORM 4: Non-Freeway – Continuous Illumination.

All data used for the analysis was based on the proposed geometrics for the road, projected 2031 traffic and projected night time accident data.

The results of the illumination warrants analyses are as follows:

a) Lauzon Parkway from Highway 401 to County Road 46

The warranting condition for this section of the Lauzon Parkway was not satisfied as the number of points is lower than the 50% threshold indicated in Directive PLNG-B-05. In addition, the Benefit/Cost (B/C) Ratio is lower than 1, rendering the full illumination "Not Warranted".

The results of the warrant analysis are summarized below in Table A.

Table A – Illumination Warrants Summary

Location	**Total Points**	**Warranting Condition** (min number of points required = 70)	**Benefit/Cost Ratio**	**Illumination Warrant**
Lauzon Parkway - Highway 401 to County Road 46	45.0	Not Satisfied	-0.34	Not Warranted

b) Lauzon Parkway between County Road 46 and Highway 3

The warranting condition for this section of the Lauzon Parkway was not satisfied as the number of points is lower than the 50% threshold indicated in Directive PLNG-B-05. In addition, the Benefit/Cost (B/C) Ratio is lower than 1, rendering the full illumination "Not Warranted".

The results of the warrant analysis are summarized below in Table B.

Table B – Illumination Warrants Summary

Location	**Total Points**	**Warranting Condition** (min number of points required = 70)	**Benefit/Cost Ratio**	**Illumination Warrant**
Lauzon Parkway - County Road 46 – Highway 3	47.5	Not Satisfied	0.27	Not Warranted

c) County Road 42 between the City/County Boundary (700 m west of County Road 43 (Banwell Road)) and County Road 19 (Manning Road)

The warranting condition for this section of the County Road 42 was not satisfied as the number of points is lower than the 50% threshold indicated in Directive PLNG-B-05. In addition, the Benefit/Cost (B/C) Ratio is lower than 1, rendering the full illumination "Not Warranted".

The results of the warrant analysis are summarized below in Table C.

Table C – Illumination Warrants Summary

Location	**Total Points**	**Warranting Condition** (min number of points required = 70)	**Benefit/Cost Ratio**	**Illumination Warrant**
County Road 42 – 700 m west of County Road 43 (Banwell Road) to County Road 19 (Manning Road)	45.6	Not Satisfied	-0.54	Not Warranted

However, it is noteworthy to mention that the County Road 42 between the County Road 43 (Banwell Road) and County Road 19 (Manning Road) there will be a 5 lane cross section, with the centre lane being a shared left turn lane by both eastbound and westbound traffic. There are numerous driveways providing access to the residential and commercial properties along the roadway.

County Road 42 within the City of Windsor boundary will be continuously illuminated. In addition, there is existing continuous illumination along the south side of County Road 42 between Lesperance Road and County Road 19 (Manning Road) that will require re-instatement. The roundabouts on County Road 42 at County Road 43 (Banwell Road) and County Road 19 (Manning Road) will also require continuous illumination.

Therefore, in order to provide safe driving environment as well as to ensure the safety of the pedestrians, continuous illumination of County Road 42 from the City of Windsor boundary to County Road 19 (Manning Road) considered as "Warranted".

d) County Road 42 between County Road 19 (Manning Road) and County Road 25 (E. Puce Road) – Continuous Illumination

The warranting condition for this section of County Road 42 was not satisfied as the number of points is lower than the 50% threshold indicated in Directive PLNG-B-05. In addition, the Benefit/Cost (B/C) Ratio is lower than 1, rendering the full illumination "Not Warranted".

The results of the warrant analysis are summarized below in Table D.

Table D – Illumination Warrants Summary

Location	**Total Points**	**Warranting Condition** (min number of points required = 70)	**Benefit/Cost Ratio**	**Illumination Warrant**
County Road 42 – County Road 19 (Manning Road) to **County Road 25 (E.** Puce Road)	49.5	Not Satisfied	-0.43	Not Warranted

e) Roundabout Illumination

Full illumination of the roundabouts is warranted in Year 2031at the following locations:

i) County Road 42 at County Road 43 (Banwell Road)

ii) County Road 42 at County Road 19 (Manning Road)

iii) County Road 42 at Patillo Road

iv) County Road 42 at County Road 25 (E. Puce Road)

The illumination at the County Road 43 (Banwell Road) roundabout and the County Road 19 (Manning Road) roundabout shall be integrated into the continuous roadway illumination for County Road 42.

3.2 UNDERPASS ILLUMINATION

Underpass lighting will be required for the Highway 401 structure at Lauzon Parkway as a result of the full interchange illumination.

3.3 TEMPORARY ILLUMINATION

All existing illumination will be maintained in full night-time operation where roads remain open to traffic during construction. Temporary illumination/electrical work will be provided, as required, where the existing illumination is affected during construction staging. The extent of temporary electrical work will be determined during detail design in consultation with the construction staging designers.

3.4 TRAFFIC SIGNALS

3.4.1 City of Windsor

According to the Traffic Analysis performed for the City of Windsor, traffic signals are required in Year 2021 at the following intersections:

i) Lauzon Parkway and Service Road B

i) Lauzon Parkway and County Road 42

ii)

iii)

iv) County Road 42 and Walker Road

v) County Road 42 and Lauzon Road

Traffic signals are required in Year 2031 at the following intersections:

vi) Lauzon Parkway and Baseline Road

vii) Lauzon Parkway and E-W Arterial

3.4.2 County of Essex

According to the Traffic Analysis performed for the County of Essex, traffic signals are required at the following intersections:

i) Lauzon Parkway and County Road 46

ii) Lauzon Parkway and Highway 3

iii) County Road 42 and Lesperance Road

3.5 TRAFFIC COUNTING STATIONS

The requirements for traffic counting stations on Highway 401 shall be reviewed with the Regional Traffic Section during detail design.

3.6 POWER SUPPLIES

The existing power supply hook-up at the Lauzon Parkway and Twin Oaks Drive requires upgrading to a separate pole mounted cabinet with underground feed.

New power supplies will be required for the full illumination at the Highway 401 and Lauzon Parkway Interchange, as well as the for continuous illumination along Lauzon Parkway, County Road 42 and the future E-W Arterial. The locations of the new power supplies should be reviewed during detail design.

All power supplies for MTO illumination shall be metered as per MTO practices. The metering requirements for municipal illumination and traffic signal shall be reviewed during detail design.

3.7 EMBEDDED WORK

Electrical Embedded Work will be required at the Highway 401 structure at Lauzon Parkway. The extent of embedded work will be reviewed during detail design.

3.8 ELECTRICAL REMOVALS

All existing electrical lighting equipment not forming part of the new illumination systems, and all impacted electrical equipment, will be removed and returned to the City of Windsor and County of Essex as per the Owner's recommendations during detail design.

4. CONCLUSIONS AND RECOMMENDATIONS

A) MTO Illumination - Highway 401 and Lauzon Parkway Interchange

Full illumination of the proposed Highway 401 and Lauzon Parkway interchange is recommended. The Lauzon Parkway within the CAH limits, including the roundabouts at the ramp terminals, shall be illuminated using conventional lighting consisting of City of Windsor standard concrete/steel poles with LED luminaires. The Highway 401 main line and the ramps shall be illuminated using 35m high mast poles and 400 watt HPS luminaires. Shielding shall be utilised on high mast luminaires to ensure conformance to MTO's Light Trespass policy. All electrical work for the interchange shall be designed to current MTO standards.

In addition, the multi-use trail within the limits of the interchange, including the separate pedestrian bridge crossing, shall be illuminated to ensure the nighttime safety of pedestrians. This lighting installation shall consist of 6 m conventional poles with low wattage LED lighting luminaires.

B) City of Windsor Illumination - Lauzon Parkway, County Road 42, and E-W Arterial

Continuous illumination using conventional concrete poles and LED luminaires to the City of Windsor standards shall be provided for the following roadways:

i) Lauzon Parkway from Twin Oaks Drive to Highway 401

ii) Lauzon Parkway at Highway 401 Roundabout Interchange

iii) County Road 42 between Walker Road and City limits 700 m west of County Road 43 (Banwell Road)

iv) E-W Arterial between Walkers Road and County Road 17 (10^{th} Concession Road)

The multiuse trails and pedestrian sidewalk illumination shall be accomplished using the backlight spill of the roadway lighting luminaires.

C) County of Essex Illumination – County Road 42

Continuous illumination using conventional concrete poles and LED luminaires to the County of Essex and local municipal standards shall be provided for the following roadways:

i) County Road 42 from 700m west of County Road 43 (Banwell Road) to east of the County Road 19 (Manning Road) roundabout

ii) Roundabouts at Patillo Road, and at County Road 25 (E. Puce Road)

5. CONSTRUCTION COST ESTIMATES

The cost estimate for the installation of the recommended illumination is as follows:

5.1 MTO ILLUMINATION

A) Lauzon Parkway and Highway 401 Interchange – Full Illumination

The installation for this Interchange would consist of approximately sixteen (16) High Mast poles and five (5) conventional lighting poles, with an estimated initial construction cost of $1,500,000 as a 2013 Net Present Value. Refer to Appendix C.1.

5.2 CITY OF WINDSOR ILLUMINATION AND TRAFFIC SIGNALS

A) Lauzon Parkway between Twin Oaks Drive and Highway 401 – Continuous Illumination

The installation for this of roadway would consist of approximately three hundred twenty (320) conventional poles, with an estimated initial construction cost of approximately $2,100,000 as a 2013 Net Present Value. Refer to Appendix C.2.

B) Lauzon Parkway at Highway 401 Roundabout Interchange

The installation for this section of roadway along Lauzon Parkway at the Highway 401 interchange which includes two (2) two-lane roundabouts, would consist of approximately thirty (30) conventional poles, with an estimated initial construction cost of approximately $470,000 as a 2013 Net Present Value. Refer to Appendix C.2.

C) E-W Arterial between Walker Road to County Road 17 (10th Concession Road) – Continuous Illumination

The installation for this section of roadway would consist of approximately one hundred sixty-five (165) conventional poles, with an estimated initial construction cost of approximately $1,100,000 as a 2013 Net

D) County Road 42 between Walker Road and the City/County Boundary (700 m west of County Road 43 (Banwell Road)) – Continuous Illumination

The installation for this section of roadway would consist of approximately two hundred ninety-five (295) conventional poles, with an estimated initial construction cost of approximately $1,900,000 as a 2013 Net Present Value. Refer to Appendix C.2.

E) Roundabouts along County Road 42, E-W Arterial and Lauzon Parkway – Full Illumination

The installation for each of the three (3) roundabouts along County Road 42 at 7th Concession Road, 8th Concession Road and 9th Concession Road would involve a typical two-lane roundabout lighting layout consisting of fourteen (14) conventional poles. The estimated construction cost for each roundabout is approximately $91,000 as a 2013 Net Present Value.

In addition, the installation for each of the five (5) roundabouts along the future E-W Arterial at the entrance to 4490 7th Concession Road, Future Road, 8th Concession Road, 9th Concession Road, and County Road 17 (10th Concession Road), would involve a typical single-lane roundabout lighting layout consisting of eleven (11) conventional poles. The estimated construction cost for each roundabout is approximately $ 72,000 as a 2013 Net Present Value.

Furthermore, the installation of the two (2) roundabouts for the interim design along Lauzon Parkway at Baseline Road and E-W Arterial would involve a typical roundabout lighting layout consisting of eleven (11) conventional poles. The estimated construction cost for each roundabout is approximately $72,000 as a 2013 Net Present Value.

F) Multi-Use Trail along Lauzon Parkway at Highway 401 Interchange – Continuous Illumination

The installation for this section of the multi-use trail at the Lauzon Parkway and Highway 401 Interchange would consist of approximately sixty (60) 6 m conventional lighting poles, with about six (6) mounted on the pedestrian bridge crossing Highway 401. The estimated initial construction cost for this work is approximately $375,000 as a 2013 Net Present Value.

G) Traffic Signals along Lauzon Parkway and County Road 42

The estimated initial construction cost for each installation of traffic signal equipment at the four (4) intersections along Lauzon Parkway at Service Road B, County Road 42, Baseline Road, and E-W Arterial and two (2) intersections along County Road 42 at Walker Road and Lauzon Road is approximately $150,000 as a 2013 Net Present Value.

5.3 COUNTY OF ESSEX ILLUMINATION AND TRAFFIC SIGNALS

A) Roundabouts along County Road 42 – Full Illumination

The installation of the three-legged two-lane roundabout at County Road 42 and Patillo Road consists of eleven (11) conventional poles with an estimated construction cost is approximately $72,000 as a 2013 Net Present Value.

The installation of the three (3) typical two-lane roundabouts along County Road 42 at County Road 43 (Banwell Road), County Road 19 (Manning Road) and County Road 25 (E. Puce Road) consists of fourteen (14) conventional poles, each with an estimated construction cost of approximately $91,000 as a 2013 Net Present Value.

B) Lauzon Parkway between Highway 401 and County Road 46 – Continuous Illumination

Although illumination along this section of roadway is not warranted as per Ministry Directive PLNG-B-05, the initial constructions costs have been included should illumination of this section be considered in the future. The installation for this section would consist of approximately fifty (50) conventional poles, with an estimated initial construction cost of approximately $330,000 as a 2013 Net Present Value. Refer to Appendix C.3.

C) Lauzon Parkway between County Road 46 and Highway 3 – Continuous Illumination

Although illumination along this section of roadway is not warranted as per Ministry Directive PLNG-B-05, the initial constructions costs have been included should illumination of this section be considered in the future. The installation for this section would consist of approximately sixty (60) conventional poles, with an estimated initial construction cost of approximately $380,000 as a 2013 Net Present Value. Refer to Appendix C.3.

D) County Road 42 between the City/County Boundary (700 m west of County Road 43 (Banwell Road)) and County Road 19 (Manning Road) – Continuous Illumination

Although illumination along this section of roadway is not warranted as per Ministry Directive PLNG-B-05, it is still a recommendation of this report. The installation for this section would consist of approximately one hundred fifty-five (155) conventional poles, with an estimated initial construction cost of approximately $1,000,000 as a 2013 Net Present Value. Refer to Appendix C.3.

E) County Road 42 between County Road 19 (Manning Road) and County Road 25 (E. Puce Road) – Continuous Illumination

Although illumination along this of roadway is not warranted as per Ministry Directive PLNG-B-05, the initial constructions costs have been included should illumination of this section be considered in the future. The installation for this section would consist of approximately three hundred thirty (330) conventional poles, with an estimated initial construction cost of approximately $2,200,000 as a 2013 Net Present Value. Refer to Appendix C.3.

F) Traffic Signals along Lauzon Parkway and County Road 42

The estimated initial construction cost for each installation of traffic signal equipment at the two (2) intersections along Lauzon Parkway at County Road 46 and Highway 3 and one (1) intersection at County Road 42 and Lesperance Road is approximately $150,000 as a 2013 Net Present Value.

5.4 SUMMARY OF ELECTRICAL WORK AND CONSTRUCTION COSTS

5.4.1 MTO Illumination

The following table summarizes the recommended electrical improvements within the MTO corridor described in Section 5.1 and the associated construction costs:

Table 5.4.1 – Electrical Improvement Costs for MTO

Description	Cost
Warranted Interchange Illumination	$1,500,000
TOTAL ELECTRICAL COST	**$1,500,000**

5.4.2 City of Windsor Illumination

The following table summarizes the recommended electrical improvements within the City of Windsor described in Section 5.2 and the associated construction costs:

Table 5.4.2 – Electrical Improvement Costs for City of Windsor

Description	Cost
Warranted Roadway Illumination	$5,100,000
Warranted Roadway Illumination at Interchange	$470,000
Warranted Roundabout Illumination	$780,000
Interim Roundabout Illumination	$145,000
Multi-Use Trail at Lauzon Parkway and Highway 401 Interchange	$375,000
Traffic Signals	$900,000
TOTAL ELECTRICAL COST	**$7,770,000**

5.4.3 County of Essex Illumination

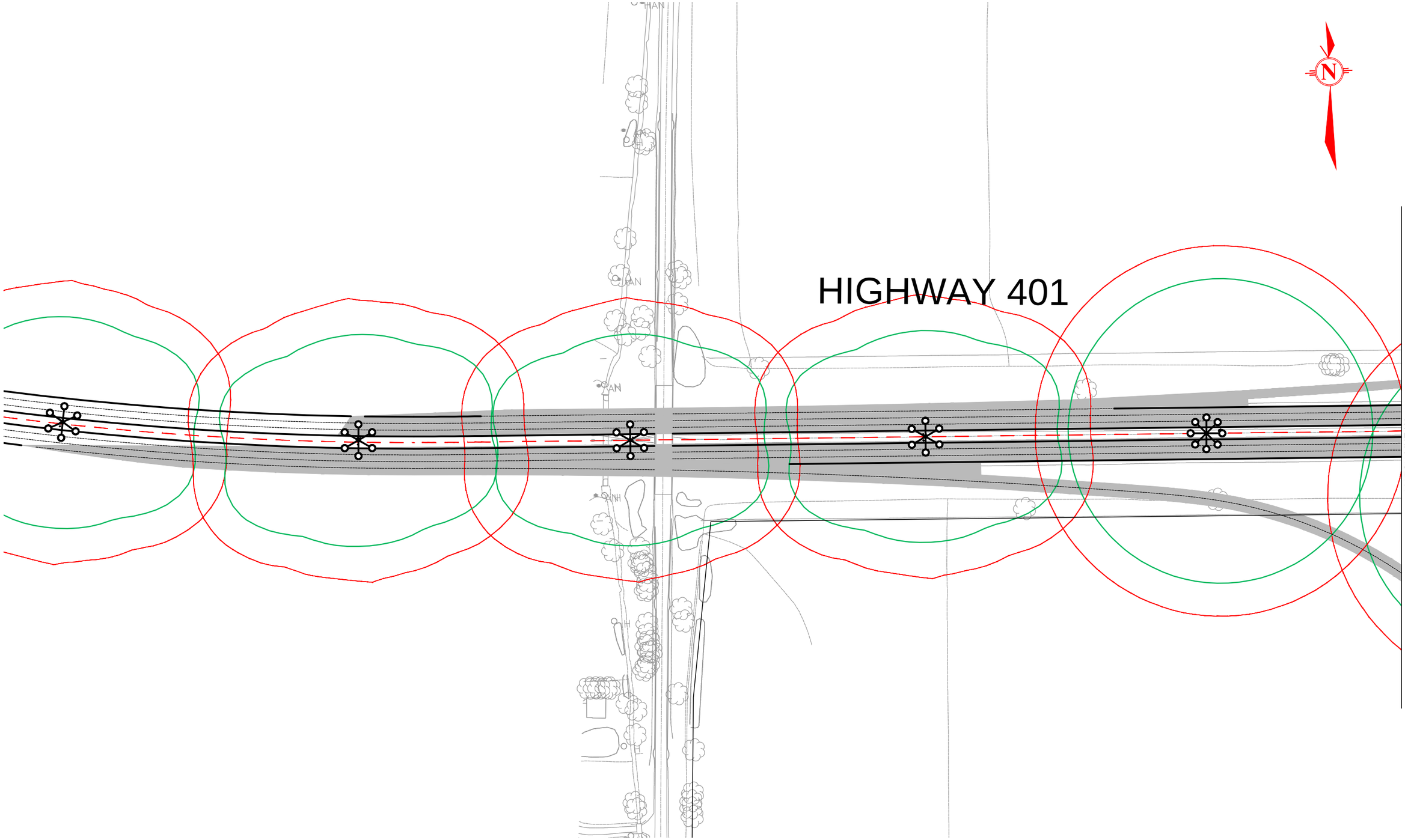
The following table summarizes the recommended electrical improvements within the County of Essex described in Section 5.3 and the associated construction costs:

Table 5.4.3 – Electrical Improvement Costs for County of Essex

Description	Cost
Recommended Roadway Illumination	$1,000,000
Warranted Roundabout Illumination	$345,000
Traffic Signals	$450,000
TOTAL ELECTRICAL COST	**$1,795,000**
Non-Warranted Roadway Illumination	$2,900,000

APPENDIX A

Recommended Lighting Layout – MTO



MRC
A member of MMM GROUP

Ontario

LEGEND:

400W HPS LUMINAIRE C/W
30m HIGH MAST POLE

3 LUX

1.5 LUX

KEY PLAN

LAUZON PARKWAY - PRELIMINARY PLAN
FROM STA 7+225 TO STA 9+000

LAUZON PARKWAY IMPROVEMENTS CLASS
ENVIRONMENTAL ASSESSMENT STUDY

8 0 40
HOR. 1:2000

0.8 0 4
VER. 1:200

PLATE
1

NOVEMBER 2013

MATCH LINE 'A'

MATCH LINE 'B'

N

MRC
A member of MMM GROUP

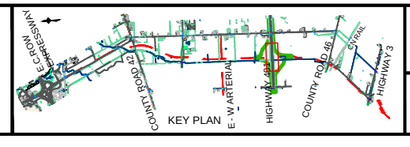
Ontario

LEGEND:

400W HPS LUMINAIRE C/W
30m HIGH MAST POLE

3 LUX

1.5 LUX



LAUZON PARKWAY - PRELIMINARY PLAN FROM STA 9+050 TO STA 9+775

LAUZON PARKWAY IMPROVEMENTS CLASS ENVIRONMENTAL ASSESSMENT STUDY

8 0 40
HOR. 1:2000

0.8 0 4
VER. 1:200

PLATE
2

NOVEMBER 2013

MATCH LINE 'B'

MATCH LINE 'C'

LEGEND:

400W HPS LUMINAIRE C/W
30m HIGH MAST POLE

3 LUX

1.5 LUX

KEY PLAN

LAUZON PARKWAY - PRELIMINARY PLAN
FROM STA 10+200 TO STA 10+975

LAUZON PARKWAY IMPROVEMENTS CLASS
ENVIRONMENTAL ASSESSMENT STUDY

8 0 40
HOR. 1:2000

0.8 0 4
VER. 1:200

PLATE
3

NOVEMBER 2013

APPENDIX B

Ministry Directive PLNG-B-05 FORMS

B.1 COUNTY OF ESSEX ILLUMINATION

FORM 4
NON-FREEWAY - CONTINUOUS ILLUMINATION

Highway: *Lauzon Parkway* ***WP No.:*** *3017-09-00*
Limits: *from: Highway 401 to: County Road 46* ***Name:*** *McCormick Rankin* ***Date:*** *May 2013*
2 pages

CLASSIFICATION FACTOR	RATING (i) 1	2	3	4	5	UNLIT WEIGHT (A)	LIGHTED WEIGHT (B)	DIFF. (A - B)	SCORE [RATING X (A - B)]
Geometric Factors No. of lanes (2-way)	□ 4	5	6	7	□ 8	1.0	0.5	0.5	1.5
Lane Width (m)	> 3.50	3.50	3.25	3.0	< 3.0	3.0	2.5	0.5	0.5
Critical Curves m (deg.)	>600 (< 3.0°)	600-290 (3.0 - 6.0°)	289-220 (6.1 - 8.0°)	219-170 (8.1 - 10.0 °)	<170 (> 10°)	13.0	5.0	8.0	16.0
Grades (vertical)	< 3%	3.0 - 3.9%	4.0 - 4.9%	5.0 - 6.9%	□ 7%	3.2	2.8	0.4	0.4
Sight Distance (m)	> 210	151 - 210	91 - 150	60 - 90	< 60	2.0	1.0	1.0	1.0
Raised Curb Median	none	continuous	all intersections	at signalized intersections	few locations	1.0	0.5	0.5	1.0
Parking	prohibited both sides	loading zones only	off-peak only	permitted one side	permitted both sides	0.2	0.1	0.1	0.1
							Geometric Total		20.5
Operational Factors Signals	all major intersections signalized	majority of intersections signalized	most major intersections signalized	about half the intersections signalized	frequent non-signalized intersections	3.0	2.8	0.2	0.2
Level of Service (ii) (any dark hour)	A	B	C	D	E, F	5.0	3.0	2.0	6.0
Median Width (m)	> 15.0 or barrier		10.0 - 15.0		< 10.0	1.0	0.6	0.4	2.0
Median Openings Per km	< 3.0 or one-way operation	3.0 - 5.0	5.1 - 8.0	8.1 - 10.0	> 10.0 or no access control	5.0	4.0	1.0	1.0
Curb Cuts	< 10%	10-20%	21-30%	31-40%	> 40%	5.0	4.5	0.5	0.5
Operating Speed (km/h) (iv)	□ 50	60	70	80	> 80	1.0	0.2	0.8	3.2.
Pedestrian Traffic at Night (peds/km)	0 - 10	11 - 30	31 - 60	61 - 100	> 100	1.5	0.5	1.0	1.0

FORM 4
NON-FREEWAY - CONTINUOUS ILLUMINATION

Highway: *Lauzon Parkway* ***WP No.:*** *3017-09-00*
Limits: *from: Highway 401 to: County Road 46* ***Name:*** *McCormick Rankin* ***Date:*** *May 2013*
2 pages

CLASSIFICATION FACTOR	RATING (i) 1	2	3	4	5	UNLIT WEIGHT (A)	LIGHTED WEIGHT (B)	DIFF. (A - B)	SCORE [RATING X (A - B)]
							Operational Total		13.9
Environmental Factors Type of Development	undeveloped	residential	residential &/or commercial	industrial or commercial	strip industrial or commercial	0.5	0.1	0.4	0.4
Advertising or Area Illumination	none	0 - 40%	41 - 60%	61 - 80%	essentially continuous	3.0	0.8	2.2	2.2
							Environmental Total		2.6
Accidents % of Night-to-Total Accidents (3 yr. avg.) (iii)	< 20%	20 - 30%	31 - 40%	41 - 50%	> 50%	10.0	2.0	8.0	8.0
							Accidents Total		8.0

Benefit Cost Ratio (B/C) - See Calculation Sheet

GEOMETRIC TOTAL	=	20.5
OPERATIONAL TOTAL	=	13.9
ENVIRONMENTAL TOTAL	=	2.6
ACCIDENT TOTAL	=	8.0
SUM	=	**45.0** **POINTS**
CONTINUOUS ILLUMINATION WARRANTING CONDITION	=	**70** **POINTS**

i. A rating of between 1 and 5 shall be assigned for each factor in the FORM depending on the conditions that are encountered by motorists on the roadway. The higher the rating, the more critical the need for illumination with regard to that particular factor.
ii. Use LOS methodology approved by the MTO.
iii. For night-to-total accident ratio, accidents during darkness are used (including dusk/dawn).
iv. Operating speed, if available, otherwise use posted speed.
v. The number of points for the warranting condition is based on 50% of the total points attainable, if all factors were rated 5.
Note: Worst case scenarios should be considered when assigning the ratings. For example, a section of roadway could have rush hour volumes during the hours of darkness in wintertime.

FORM 4
NON-FREEWAY - CONTINUOUS ILLUMINATION

Highway: *Lauzon Parkway* ***WP No.:*** *3017-09-00*
Limits: *from: County Road 46 to: Highway 3* ***Name:*** *McCormick Rankin* ***Date:*** *May 2013*
2 pages

CLASSIFICATION FACTOR	RATING (i) 1	2	3	4	5	UNLIT WEIGHT (A)	LIGHTED WEIGHT (B)	DIFF. (A - B)	SCORE [RATING X (A - B)]
Geometric Factors No. of lanes (2-way)	□ 4	5	6	7	□ 8	1.0	0.5	0.5	0.5
Lane Width (m)	> 3.50	3.50	3.25	3.0	< 3.0	3.0	2.5	0.5	0.5
Critical Curves m (deg.)	>600 (< 3.0°)	600-290 (3.0 - 6.0°)	289-220 (6.1 - 8.0°)	219-170 (8.1 - 10.0 °)	<170 (> 10°)	13.0	5.0	8.0	16.0
Grades (vertical)	< 3%	3.0 - 3.9%	4.0 - 4.9%	5.0 - 6.9%	□ 7%	3.2	2.8	0.4	0.4
Sight Distance (m)	> 210	151 - 210	91 - 150	60 - 90	< 60	2.0	1.0	1.0	1.0
Raised Curb Median	none	continuous	all intersections	at signalized intersections	few locations	1.0	0.5	0.5	0.5
Parking	prohibited both sides	loading zones only	off-peak only	permitted one side	permitted both sides	0.2	0.1	0.1	0.1
							Geometric Total		19.0
Operational Factors Signals	all major intersections signalized	majority of intersections signalized	most major intersections signalized	about half the intersections signalized	frequent non-signalized intersections	3.0	2.8	0.2	0.2
Level of Service (ii) (any dark hour)	A	B	C	D	E, F	5.0	3.0	2.0	6.0
Median Width (m)	> 15.0 or barrier		10.0 - 15.0		< 10.0	1.0	0.6	0.4	2.0
Median Openings Per km	< 3.0 or one-way operation	3.0 - 5.0	5.1 - 8.0	8.1 - 10.0	> 10.0 or no access control	5.0	4.0	1.0	5.0
Curb Cuts	< 10%	10-20%	21-30%	31-40%	> 40%	5.0	4.5	0.5	0.5
Operating Speed (km/h) (iv)	□ 50	60	70	80	> 80	1.0	0.2	0.8	3.2.
Pedestrian Traffic at Night (peds/km)	0 - 10	11 - 30	31 - 60	61 - 100	> 100	1.5	0.5	1.0	1.0
							Operational Total		17.9
Environmental Factors Type of Development	undeveloped	residential	residential &/or commercial	industrial or commercial	strip industrial or commercial	0.5	0.1	0.4	0.4
Advertising or Area Illumination	none	0 - 40%	41 - 60%	61 - 80%	essentially continuous	3.0	0.8	2.2	2.2

FORM 4
NON-FREEWAY - CONTINUOUS ILLUMINATION

Highway: *Lauzon Parkway* ***WP No.:*** *3017-09-00*
Limits: *from: County Road 46 to: Highway 3* ***Name:*** *McCormick Rankin* ***Date:*** *May 2013*
2 pages

CLASSIFICATION FACTOR	RATING (i) 1	2	3	4	5	UNLIT WEIGHT (A)	LIGHTED WEIGHT (B)	DIFF. (A - B)	SCORE [RATING X (A - B)]
							Environmental Total		2.6
Accidents % of Night-to-Total Accidents (3 yr. avg.) (iii)	< 20%	20 - 30%	31 - 40%	41 - 50%	> 50%	10.0	2.0	8.0	8.0
							Accidents Total		8.0

Benefit Cost Ratio (B/C) - See Calculation Sheet

GEOMETRIC TOTAL = 19.0
OPERATIONAL TOTAL = 17.9
ENVIRONMENTAL TOTAL = 2.6
ACCIDENT TOTAL = 8.0

SUM = 47.5 POINTS
CONTINUOUS ILLUMINATION = 70 POINTS
WARRANTING CONDITION

i. A rating of between 1 and 5 shall be assigned for each factor in the FORM depending on the conditions that are encountered by motorists on the roadway. The higher the rating, the more critical the need for illumination with regard to that particular factor.
ii. Use LOS methodology approved by the MTO.
iii. For night-to-total accident ratio, accidents during darkness are used (including dusk/dawn).
iv. Operating speed, if available, otherwise use posted speed.
v. The number of points for the warranting condition is based on 50% of the total points attainable, if all factors were rated 5.

Note: Worst case scenarios should be considered when assigning the ratings. For example, a section of roadway could have rush hour volumes during the hours of darkness in wintertime.

FORM 4
NON-FREEWAY - CONTINUOUS ILLUMINATION

Highway: *County Road 42* ***WP No.:*** *3017-09-00*
Limits: *from: 700 m west of County Road 43 (Banwell Road)* *to: County Road 19 (Manning Road)* ***Name:*** *McCormick Rankin* ***Date:*** *May 2013*

2 pages

CLASSIFICATION FACTOR	RATING (i) 1	2	3	4	5	UNLIT WEIGHT (A)	LIGHTED WEIGHT (B)	DIFF. (A - B)	SCORE [RATING X (A - B)]
Geometric Factors No. of lanes (2-way)	□ 4	5	6	7	□ 8	1.0	0.5	0.5	1.0
Lane Width (m)	> 3.50	3.50	3.25	3.0	< 3.0	3.0	2.5	0.5	0.5
Critical Curves m (deg.)	>600 (< 3.0°)	600-290 (3.0 - 6.0°)	289-220 (6.1 - 8.0°)	219-170 (8.1 - 10.0 °)	<170 (> 10°)	13.0	5.0	8.0	8.0
Grades (vertical)	< 3%	3.0 - 3.9%	4.0 - 4.9%	5.0 - 6.9%	□ 7%	3.2	2.8	0.4	0.4
Sight Distance (m)	> 210	151 - 210	91 - 150	60 - 90	< 60	2.0	1.0	1.0	1.0
Raised Curb Median	none	continuous	all intersections	at signalized intersections	few locations	1.0	0.5	0.5	0.5
Parking	prohibited both sides	loading zones only	off-peak only	permitted one side	permitted both sides	0.2	0.1	0.1	0.1
							Geometric Total		12.4
Operational Factors Signals	all major intersections signalized	majority of intersections signalized	most major intersections signalized	about half the intersections signalized	frequent non-signalized intersections	3.0	2.8	0.2	0.2
Level of Service (ii) (any dark hour)	A	B	C	D	E, F	5.0	3.0	2.0	6.0
Median Width (m)	> 15.0 or barrier		10.0 - 15.0		< 10.0	1.0	0.6	0.4	2.0
Median Openings Per km	< 3.0 or one-way operation	3.0 - 5.0	5.1 - 8.0	8.1 - 10.0	> 10.0 or no access control	5.0	4.0	1.0	5.0
Curb Cuts	< 10%	10-20%	21-30%	31-40%	> 40%	5.0	4.5	0.5	1.0
Operating Speed (km/h) (iv)	□ 50	60	70	80	> 80	1.0	0.2	0.8	2.4
Pedestrian Traffic at Night (peds/km)	0 - 10	11 - 30	31 - 60	61 - 100	> 100	1.5	0.5	1.0	3.0
							Operational Total		19.6

FORM 4
NON-FREEWAY - CONTINUOUS ILLUMINATION

Highway: *County Road 42* ***WP No.:*** *3017-09-00*
Limits: *from: 700 m west of County Road 43 (Banwell Road)* *to: County Road 19 (Manning Road)* ***Name:*** *McCormick Rankin* ***Date:*** *May 2013*

2 pages

CLASSIFICATION FACTOR	RATING (i) 1	2	3	4	5	UNLIT WEIGHT (A)	LIGHTED WEIGHT (B)	DIFF. (A - B)	SCORE [RATING X (A - B)]
Environmental Factors Type of Development	undeveloped	residential	residential &/or commercial	industrial or commercial	strip industrial or commercial	0.5	0.1	0.4	1.2
Advertising or Area Illumination	none	0 - 40%	41 - 60%	61 - 80%	essentially continuous	3.0	0.8	2.2	4.4
							Environmental Total		5.6
Accidents % of Night-to-Total Accidents (3 yr. avg.) (iii)	< 20%	20 - 30%	31 - 40%	41 - 50%	> 50%	10.0	2.0	8.0	8.0
							Accidents Total		8.0

Benefit Cost Ratio (B/C) - See Calculation Sheet

GEOMETRIC TOTAL	=	12.4
OPERATIONAL TOTAL	=	19.6
ENVIRONMENTAL TOTAL	=	5.6
ACCIDENT TOTAL	=	8.0
SUM	=	**45.6** **POINTS**
CONTINUOUS ILLUMINATION WARRANTING CONDITION	=	**70** **POINTS**

i. A rating of between 1 and 5 shall be assigned for each factor in the FORM depending on the conditions that are encountered by motorists on the roadway. The higher the rating, the more critical the need for illumination with regard to that particular factor.
ii. Use LOS methodology approved by the MTO.
iii. For night-to-total accident ratio, accidents during darkness are used (including dusk/dawn).
iv. Operating speed, if available, otherwise use posted speed.
v. The number of points for the warranting condition is based on 50% of the total points attainable, if all factors were rated 5.

Note: Worst case scenarios should be considered when assigning the ratings. For example, a section of roadway could have rush hour volumes during the hours of darkness in wintertime.

FORM 4

NON-FREEWAY - CONTINUOUS ILLUMINATION

Highway: *County Road 42* **WP No.:** *3017-09-00*
Limits: *from: County Road 19 (Manning Road) to: County Rod 25* **Name:** *McCormick Rankin*
Date: *May 2013*

2 pages

CLASSIFICATION FACTOR	RATING (i) 1	2	3	4	5	UNLIT WEIGHT (A)	LIGHTED WEIGHT (B)	DIFF. (A - B)	SCORE [RATING X (A - B)]
Geometric Factors No. of lanes (2-way)	□ 4	5	6	7	□ 8	1.0	0.5	0.5	0.5
Lane Width (m)	> 3.50	3.50	3.25	3.0	< 3.0	3.0	2.5	0.5	0.5
Critical Curves m (deg.)	>600 (< 3.0°)	600-290 (3.0 - 6.0°)	289-220 (6.1 - 8.0°)	219-170 (8.1 - 10.0 °)	<170 (> 10°)	13.0	5.0	8.0	8.0
Grades (vertical)	< 3%	3.0 - 3.9%	4.0 - 4.9%	5.0 - 6.9%	□ 7%	3.2	2.8	0.4	0.4
Sight Distance (m)	> 210	151 - 210	91 - 150	60 - 90	< 60	2.0	1.0	1.0	1.0
Raised Curb Median	none	continuous	all intersections	at signalized intersections	few locations	1.0	0.5	0.5	0.5
Parking	prohibited both sides	loading zones only	off-peak only	permitted one side	permitted both sides	0.2	0.1	0.1	0.1
							Geometric Total		11.4
Operational Factors Signals	all major intersections signalized	majority of intersections signalized	most major intersections signalized	about half the intersections signalized	frequent non-signalized intersections	3.0	2.8	0.2	0.2
Level of Service (ii) (any dark hour)	A	B	C	D	E, F	5.0	3.0	2.0	6.0
Median Width (m)	> 15.0 or barrier		10.0 - 15.0		< 10.0	1.0	0.6	0.4	2.0
Median Openings Per km	< 3.0 or one-way operation	3.0 - 5.0	5.1 - 8.0	8.1 - 10.0	> 10.0 or no access control	5.0	4.0	1.0	5.0
Curb Cuts	< 10%	10-20%	21-30%	31-40%	> 40%	5.0	4.5	0.5	0.5
Operating Speed (km/h) (iv)	□ 50	60	70	80	> 80	1.0	0.2	0.8	4.0
Pedestrian Traffic at Night (peds/km)	0 - 10	11 - 30	31 - 60	61 - 100	> 100	1.5	0.5	1.0	1.0
							Operational		18.7

FORM 4

NON-FREEWAY - CONTINUOUS ILLUMINATION

Highway: *County Road 42* **WP No.:** *3017-09-00*
Limits: *from: County Road 19 (Manning Road) to: County Rod 25* **Name:** *McCormick Rankin*
Date: *May 2013*

2 pages

CLASSIFICATION FACTOR	RATING (i) 1	2	3	4	5	UNLIT WEIGHT (A)	LIGHTED WEIGHT (B)	DIFF. (A - B)	SCORE [RATING X (A - B)]
							Total		
Environmental Factors Type of Development	undeveloped	residential	residential &/or commercial	industrial or commercial	strip industrial or commercial	0.5	0.1	0.4	0.4
Advertising or Area Illumination	none	0 - 40%	41 - 60%	61 - 80%	essentially continuous	3.0	0.8	2.2	2.2
							Environmental Total		2.6
Accidents % of Night-to-Total Accidents (3 yr. avg.) (iii)	< 20%	20 - 30%	31 - 40%	41 - 50%	> 50%	10.0	2.0	8.0	16.0
							Accidents Total		16.0

Benefit Cost Ratio (B/C) - See Calculation Sheet

GEOMETRIC TOTAL	=	11.4
OPERATIONAL TOTAL	=	18.7
ENVIRONMENTAL TOTAL	=	2.6
ACCIDENT TOTAL	=	16.0
SUM	=	**48.7 POINTS**
CONTINUOUS ILLUMINATION WARRANTING CONDITION	=	**70 POINTS**

i. A rating of between 1 and 5 shall be assigned for each factor in the FORM depending on the conditions that are encountered by motorists on the roadway. The higher the rating, the more critical the need for illumination with regard to that particular factor.
ii. Use LOS methodology approved by the MTO.
iii. For night-to-total accident ratio, accidents during darkness are used (including dusk/dawn).
iv. Operating speed, if available, otherwise use posted speed.
v. The number of points for the warranting condition is based on 50% of the total points attainable, if all factors were rated 5.

Note: Worst case scenarios should be considered when assigning the ratings. For example, a section of roadway could have rush hour volumes during the hours of darkness in wintertime.

APPENDIX C

Life Cycle Cost Analysis

Lauzon Parkway & Highway 401 Interchange

High Mast Illumination

Lifecycle Cost Analysis

Present Value Lifecycle Cost
$1,502,000

Present Value of Initial Construction Costs $ 1,069,316
Present Value of Maintenance and Operationa $ 432,684
(including any Salvage Vaule)

Basic Information

Current Year	2013		
Year of Construction	2031		
Delay in Construction	18		
Time Frame For Analysis	30	years	(Should be <= 100 years)
Inflation Rate	2.5%	(eg .05 For 5%)	
Discount Rate	5.0%	(eg .1 For 10%)	

Relevant Information

		Replacement Period in years (eg if every 5 years enter 5)
Inital Construction Cost	$1,650,000	
Other Construction Cost	$0	
Detour Lighting Cost	$0	
Replacement Cost "A"	$23,470	4
Replacement Cost "B"	$313,840	20
Replacement Cost "C"	$18,300	40
Annual Energy Cost	$16,963	
Annual Maintenance Cost	$7,680	
Annual Incident Cost (pole replacement due to collisions)	$342	
Salvage Value	$343,000	

Description:

10	Number of High Mast poles in median
6	Number of High Mast poles along shoulder
62	Number of Luminaires on Median Poles (Default = 8 Lum/pole) - OVERRIDE CELL 'H7' IF REQUIRED
52	Number of Luminaires on Shoulder Mounted Poles (Default = 8 Lum/pole) - OVERRIDE CELL 'H8' IF REQUIRED
5	Number of Conventional poles
5	Number of Conventional luminaires
1,600,000	Initial Construction Cost of High Mast Lighting on a per pole basis $100,000
50,000	Initial Construction Cost of Conventional Lighting on a per pole basis $10,000
	Other Initial Costs (e.g.; mods to conceret barrier for ltg, anticipated future mods to lighting due to widening, etc.)
	Detour/Temporary Lighting Costs
23,470	GROUP RE-LAMPING = material+labor (Conv & med HM ltg=6, shldr HM ltg=2)+equip (Conv & med HM Ltg=3, shldr HM ltg=1)
313,840	GROUP LUM. REPLACEMENT = material+labor (Conv & med HM ltg=6, shldr HM ltg=2)+equip (Conv & med HM Ltg=3, shldr HM ltg=1)
18,300	GROUP POLE REPLACEMENT (CONV ONLY) = material+labor (6 workers)+equip (2 workers)
16,963	kW/lum*no. lum*4000 hrs/yr*rate per KWh 310 Total Watt/ HM Lum Total Watts / Conv Lum
7,680	labour (conv & med HM pole =6 workers, shldr HM Pole=2 workers)+ equip (conv & med HM pole=3 trucks, shldr HM pole =1 truck))
342	2% of CONV POLE ONLY= material+labour (6 workers)+ equip (3 trucks)
343,000	= % life*no of lum *price/lum + % life*no of pole*price/pole

PERCENT LFE REMAINIG: 50% HM Lum 50% CONV Lum 25% HM Pole 0% CONV Pole

MATERIAL COSTS

$50	Price / Lamp
$2,500	Price / High Mast Lum
$200	Price / Conv Luminaire
$50,000	Price / HM Pole
$1,500	Price / Conv Pole

RATES

$ 20.00	Worker/Hr
$ 120.00	Vehicle/hr
$ 0.12	Energy/kWH

LABOUR HOURS FOR REPLACEMENT

0.5	One Lamp Replacement - Conv Ltg
1.0	One Lum. Replacement - Conv Ltg
2.0	Lamp Replacement / SHLDR HM Pole
2.5	Lamp Replacement / MED HM Pole
4.0	Lum. Replacement / SHLDR HM Pole
4.5	Lum. Replacement / MED HM Pole
4.0	CONV Pole due to knockdown

LABOUR HOURS FOR ANNUAL MAINT.

1.0	Per CONV or median HM Pole
0.5	Per shldr HM Pole

Analysis Of Alternative (all costs $x10(	Year 2,013	Year 2,014	Year 2,015	Year 2,016	Year 2,017	Year 2,018	Year 2,019	Year 2,020	Year 2,021	Year 2,022	Year 2,023	Year 2,024	Year 2,025	Year 2,026	Year 2,027	Year 2,028	Year 2,029	Year 2,030	Year 2,031	Year 2,032	Year 2,033
Delay In Construction	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2
Inflation Index	1.000	1.025	1.051	1.077	1.104	1.131	1.160	1.189	1.218	1.249	1.280	1.312	1.345	1.379	1.413	1.448	1.485	1.522	1.560	1.599	1.639
Inital Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,573,437	0	0
Other Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detour Lighting Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "A"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "B"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "C"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Energy Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27,118	27,796
Annual Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12,278	12,585
Annual Incident Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	547	560
Salvage Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,573,437	39,943	40,941
Discount Factors	1.0000	0.9524	0.9070	0.8638	0.8227	0.7835	0.7462	0.7107	0.6768	0.6446	0.6139	0.5847	0.5568	0.5303	0.5051	0.4810	0.4581	0.4363	0.4155	0.3957	0.3769
Discounted Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,069,316	15,807	15,430

<Lauzon Parkway - Twin Oaks Drive to Highway 401>

Conventional Illumination (LED)

Lifecycle Cost Analysis

Present Value of Initial Construction Costs	$	2,073,825	
Present Value of Maintenance and Operationa (including any Salvage Vaule)	$	2,901,175	

Present Value Lifecycle Cost
$4,975,000

Basic Information

Current Year	2013		
Year of Construction	2031		
Delay in Construction	18		
Time Frame For Analysis	30	years	(Should be <= 100 years)
Inflation Rate	2.5%	(eg .05 For 5%)	
Discount Rate	5.0%	(eg .1 For 10%)	

Relevant Information

		Replacement Period in years (eg if every 5 years enter 5)
Inital Construction Cost	$3,200,000	
Other Construction Cost	$0	
Detour Lighting Cost	$0	
Replacement Cost "A"	$0	30
Replacement Cost "B"	$409,600	20
Replacement Cost "C"	$1,094,400	30
Annual Energy Cost	$27,648	
Annual Maintenance Cost	$153,600	
Annual Incident Cost (pole replacement due to collisions)	$21,888	
Salvage Value	$128,000	

Description:

0	Number of poles in median
320	Number of poles along shoulder
320	Total number of poles
320	Number of proposed lumianires (ASSUMES 2 LUMINAIRS PER MEDIAN POLE - OVERWRITE CELL'H9' IF REQUIRED)
0	Number of existing luminaires
320	Total number of Luminaires
3,200,000	Initial Construction Cost on a per pole basis **$10,000**
	Other Initial Costs (e.g.; mods to concrete barrier for mounting poles, anticipated future mods to lighting due to widening, etc.)
	Detour/Temporary Lighting Costs
0	GROUP RE-LAMPING = (no of lamps*material cost) + (time per lamp*no. lamps) * (6 worker*hourly rate + 3 trucks*hourly rate)
409,600	GROUP LUM. REPLACEMENT = (no of lum * price/lum) + (time per lum*no. of lum) * (6 Workers*hourly rate + 3 trucks*hourly rate)
1,094,400	GROUP POLES REPLCEMENT- life of a pole is 30 years and therefore not required within the 30 year life cycle..
27,648	kW/lum*no. lum*4000 hrs/yr*rate per KWh
153,600	labour (6 workers)+ equip (3 trucks)
21,888	2% of POLE ONLY= material+labour (6 workers)+ equip (3 trucks)
128,000	= % life*no of lum *price/lum + % life*no of pole*price/pole

180 WATT / LAMP (inc ballast)
1.0 TIME PER POLE (IN HRS)
4.0 TIME PER POLE (IN HRS)
50% LUM LIFE REMAINING
0% POLE LIFE REMAINING

MATERIAL COSTS

$0	Price / Lamp
$800	Price / Luminaire
$1,500	Price / Pole

RATES

$ 20.00	Worker/Hr
$ 120.00	Vehicle/hr
$ 0.12	Energy/kWH

LABOUR HOURS FOR REPLACEMENT

0.0	One Lamp Replacement
1.0	One Lum. Replacement
4.0	One Pole Replacement

Analysis Of Alternative (all costs $x10(	Year 2,013	Year 2,014	Year 2,015	Year 2,016	Year 2,017	Year 2,018	Year 2,019	Year 2,020	Year 2,021	Year 2,022	Year 2,023	Year 2,024	Year 2,025	Year 2,026	Year 2,027	Year 2,028	Year 2,029	Year 2,030	Year 2,031	Year 2,032	Year 2,033
Delay In Construction	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2
Inflation Index	1.000	1.025	1.051	1.077	1.104	1.131	1.160	1.189	1.218	1.249	1.280	1.312	1.345	1.379	1.413	1.448	1.485	1.522	1.560	1.599	1.639
Inital Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,990,908	0	0
Other Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detour Lighting Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "A"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "B"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "C"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Energy Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44,199	45,304
Annual Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	245,553	251,691
Annual Incident Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34,991	35,866
Salvage Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,990,908	324,743	332,862
Discount Factors	1.0000	0.9524	0.9070	0.8638	0.8227	0.7835	0.7462	0.7107	0.6768	0.6446	0.6139	0.5847	0.5568	0.5303	0.5051	0.4810	0.4581	0.4363	0.4155	0.3957	0.3769
Discounted Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,073,825	128,512	125,452

<Lauzon Parkway at Highway 401 Interchange>

Conventional Illumination (LED)

Lifecycle Cost Analysis

Present Value Lifecycle Cost
$466,000

Present Value of Initial Construction Costs $ 194,421
Present Value of Maintenance and Operationa $ 271,579
(including any Salvage Vaule)

Basic Information

Current Year	2013		
Year of Construction	2031		
Delay in Construction	18		
Time Frame For Analysis	30	years	(Should be <= 100 years)
Inflation Rate	2.5%	(eg .05 For 5%)	
Discount Rate	5.0%	(eg .1 For 10%)	

Relevant Information

		Replacement Period in years (eg if every 5 years enter 5)
Inital Construction Cost	$300,000	
Other Construction Cost	$0	
Detour Lighting Cost	$0	
Replacement Cost "A"	$0	30
Replacement Cost "B"	$38,400	20
Replacement Cost "C"	$102,600	30
Annual Energy Cost	$2,592	
Annual Maintenance Cost	$14,400	
Annual Incident Cost (pole replacement due to collisions)	$2,052	
Salvage Value	$12,000	

Description:

0	Number of poles in median
30	Number of poles along shoulder
30	Total number of poles
30	Number of proposed lumianires (ASSUMES 2 LUMINAIRS PER MEDIAN POLE - OVERWRITE CELL'H9' IF REQUIRED)
0	Number of existing luminaires
30	Total number of Luminaires
300,000	Initial Construction Cost on a per pole basis — $10,000
	Other Initial Costs (e.g.; mods to concrete barrier for mounting poles, anticipated future mods to lighting due to widening, etc.)
	Detour/Temporary Lighting Costs
0	GROUP RE-LAMPING = (no of lamps*material cost) + (time per lamp*no. lamps) * (6 worker*hourly rate + 3 trucks*hourly rate)
38,400	GROUP LUM. REPLACEMENT = (no of lum * price/lum) + (time per lum*no. of lum) * (6 Workers*hourly rate + 3 trucks*hourly rate)
102,600	GROUP POLES REPLCEMENT- life of a pole is 30 years and therefore not required within the 30 year life cycle..
2,592	kW/lum*no. lum*4000 hrs/yr*rate per KWh — 180 WATT / LAMP (inc ballast)
14,400	labour (6 workers)+ equip (3 trucks) — 1.0 TIME PER POLE (IN HRS)
2,052	2% of POLE ONLY= material+labour (6 workers)+ equip (3 trucks) — 4.0 TIME PER POLE (IN HRS)
12,000	= % life*no of lum *price/lum + % life*no of pole*price/pole — 50% LUM LIFE REMAINING — 0% POLE LIFE REMAINING

MATERIAL COSTS

$0	Price / Lamp
$800	Price / Luminaire
$1,500	Price / Pole

RATES

$ 20.00	Worker/Hr
$ 120.00	Vehicle/hr
$ 0.12	Energy/kWH

LABOUR HOURS FOR REPLACEMENT

0.0	One Lamp Replacement
1.0	One Lum. Replacement
4.0	One Pole Replacement

Analysis Of Alternative (all costs $x10(	Year 2,013	Year 2,014	Year 2,015	Year 2,016	Year 2,017	Year 2,018	Year 2,019	Year 2,020	Year 2,021	Year 2,022	Year 2,023	Year 2,024	Year 2,025	Year 2,026	Year 2,027	Year 2,028	Year 2,029	Year 2,030	Year 2,031	Year 2,032	Year 2,033
Delay In Construction	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2
Inflation Index	1.000	1.025	1.051	1.077	1.104	1.131	1.160	1.189	1.218	1.249	1.280	1.312	1.345	1.379	1.413	1.448	1.485	1.522	1.560	1.599	1.639
Inital Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	467,898	0	0
Other Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detour Lighting Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "A"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "B"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "C"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Energy Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,144	4,247
Annual Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23,021	23,596
Annual Incident Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,280	3,362
Salvage Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	467,898	30,445	31,206
Discount Factors	1.0000	0.9524	0.9070	0.8638	0.8227	0.7835	0.7462	0.7107	0.6768	0.6446	0.6139	0.5847	0.5568	0.5303	0.5051	0.4810	0.4581	0.4363	0.4155	0.3957	0.3769
Discounted Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	194,421	12,048	11,761

<E-W Arterial - Walker Road to County Road 17>

Conventional Illumination (LED)

Lifecycle Cost Analysis

Present Value Lifecycle Cost
$2,565,000

Present Value of Initial Construction Costs $ 1,069,316
Present Value of Maintenance and Operationa $ 1,495,684
(including any Salvage Vaule)

Basic Information

Current Year	2013		
Year of Construction	2031		
Delay in Construction	18		
Time Frame For Analysis	30	years	(Should be <= 100 years)
Inflation Rate	2.5%	(eg .05 For 5%)	
Discount Rate	5.0%	(eg .1 For 10%)	

Relevant Information

		Replacement Period in years (eg if every 5 years enter 5)
Inital Construction Cost	$1,650,000	
Other Construction Cost	$0	
Detour Lighting Cost	$0	
Replacement Cost "A"	$0	30
Replacement Cost "B"	$211,200	20
Replacement Cost "C"	$564,300	30
Annual Energy Cost	$14,256	
Annual Maintenance Cost	$79,200	
Annual Incident Cost (pole replacement due to collisions)	$11,286	
Salvage Value	$66,000	

Description:

0	Number of poles in median
165	Number of poles along shoulder
165	Total number of poles
165	Number of proposed lumianires (ASSUMES 2 LUMINAIRS PER MEDIAN POLE - OVERWRITE CELL'H9' IF REQUIRED)
0	Number of existing luminaires
165	Total number of Luminaires
1,650,000	Initial Construction Cost on a per pole basis $10,000
	Other Initial Costs (e.g.; mods to concrete barrier for mounting poles, anticipated future mods to lighting due to widening, etc.)
	Detour/Temporary Lighting Costs
0	GROUP RE-LAMPING = (no of lamps*material cost) + (time per lamp*no. lamps) * (6 worker*hourly rate + 3 trucks*hourly rate)
211,200	GROUP LUM. REPLACEMENT = (no of lum * price/lum) + (time per lum*no. of lum) * (6 Workers*hourly rate + 3 trucks*hourly rate)
564,300	GROUP POLES REPLCEMENT- life of a pole is 30 years and therefore not required within the 30 year life cycle..
14,256	kW/lum*no. lum*4000 hrs/yr*rate per KWh — 180 WATT / LAMP (inc ballast)
79,200	labour (6 workers)+ equip (3 trucks) — 1.0 TIME PER POLE (IN HRS)
11,286	2% of POLE ONLY= material+labour (6 workers)+ equip (3 trucks) — 4.0 TIME PER POLE (IN HRS)
66,000	= % life*no of lum *price/lum + % life*no of pole*price/pole — 50% LUM LIFE REMAINING — 0% POLE LIFE REMAINING

MATERIAL COSTS

$0	Price / Lamp
$800	Price / Luminaire
$1,500	Price / Pole

RATES

$ 20.00	Worker/Hr
$ 120.00	Vehicle/hr
$ 0.12	Energy/kWH

LABOUR HOURS FOR REPLACEMENT

0.0	One Lamp Replacement
1.0	One Lum. Replacement
4.0	One Pole Replacement

Analysis Of Alternative (all costs $x10(	Year 2,013	Year 2,014	Year 2,015	Year 2,016	Year 2,017	Year 2,018	Year 2,019	Year 2,020	Year 2,021	Year 2,022	Year 2,023	Year 2,024	Year 2,025	Year 2,026	Year 2,027	Year 2,028	Year 2,029	Year 2,030	Year 2,031	Year 2,032	Year 2,033
Delay In Construction	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2
Inflation Index	1.000	1.025	1.051	1.077	1.104	1.131	1.160	1.189	1.218	1.249	1.280	1.312	1.345	1.379	1.413	1.448	1.485	1.522	1.560	1.599	1.639
Inital Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,573,437	0	0
Other Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detour Lighting Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "A"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "B"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "C"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Energy Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22,790	23,360
Annual Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	126,613	129,778
Annual Incident Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18,042	18,493
Salvage Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,573,437	167,446	171,632
Discount Factors	1.0000	0.9524	0.9070	0.8638	0.8227	0.7835	0.7462	0.7107	0.6768	0.6446	0.6139	0.5847	0.5568	0.5303	0.5051	0.4810	0.4581	0.4363	0.4155	0.3957	0.3769
Discounted Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,069,316	66,264	64,686

<County Road 42 - Walker Road to 700m west of Banwell Road>

Conventional Illumination (LED)

Lifecycle Cost Analysis

Present Value Lifecycle Cost
$4,587,000

Present Value of Initial Construction Costs $ 1,911,808
Present Value of Maintenance and Operationa $ 2,675,192
(including any Salvage Vaule)

Basic Information

Current Year	2013		
Year of Construction	2031		
Delay in Construction	18		
Time Frame For Analysis	30	years	(Should be <= 100 years)
Inflation Rate	2.5%	(eg .05 For 5%)	
Discount Rate	5.0%	(eg .1 For 10%)	

	Description:
0	Number of poles in median
295	Number of poles along shoulder
295	Total number of poles
295	Number of proposed lumianires (ASSUMES 2 LUMINAIRS PER MEDIAN POLE - OVERWRITE CELL'H9' IF REQUIRED)
0	Number of existing luminaires
295	Total number of Luminaires

Relevant Information

		Replacement Period in years (eg if every 5 years enter 5)		
Inital Construction Cost	$2,950,000		2,950,000	Initial Construction Cost on a per pole basis $10,000
Other Construction Cost	$0			Other Initial Costs (e.g.; mods to concrete barrier for mounting poles, anticipated future mods to lighting due to widening, etc.)
Detour Lighting Cost	$0			Detour/Temporary Lighting Costs
Replacement Cost "A"	$0	30	0	GROUP RE-LAMPING = (no of lamps*material cost) + (time per lamp*no. lamps) * (6 worker*hourly rate + 3 trucks*hourly rate)
Replacement Cost "B"	$377,600	20	377,600	GROUP LUM. REPLACEMENT = (no of lum * price/lum) + (time per lum*no. of lum) * (6 Workers*hourly rate + 3 trucks*hourly rate)
Replacement Cost "C"	$1,008,900	30	1,008,900	GROUP POLES REPLCEMENT- life of a pole is 30 years and therefore not required within the 30 year life cycle..
Annual Energy Cost	$25,488		25,488	kW/lum*no. lum*4000 hrs/yr*rate per KWh
Annual Maintenance Cost	$141,600		141,600	labour (6 workers)+ equip (3 trucks)
Annual Incident Cost (pole replacement due to collisions)	$20,178		20,178	2% of POLE ONLY= material+labour (6 workers)+ equip (3 trucks)
Salvage Value	$118,000		118,000	= % life*no of lum *price/lum + % life*no of pole*price/pole

180 WATT / LAMP (inc ballast)
1.0 TIME PER POLE (IN HRS)
4.0 TIME PER POLE (IN HRS)
50% LUM LIFE REMAINING
0% POLE LIFE REMAINING

MATERIAL COSTS

$0	Price / Lamp
$800	Price / Luminaire
$1,500	Price / Pole

RATES

$ 20.00	Worker/Hr
$ 120.00	Vehicle/hr
$ 0.12	Energy/kWH

LABOUR HOURS FOR REPLACEMENT

0.0	One Lamp Replacement
1.0	One Lum. Replacement
4.0	One Pole Replacement

Analysis Of Alternative (all costs $x10(	Year 2,013	Year 2,014	Year 2,015	Year 2,016	Year 2,017	Year 2,018	Year 2,019	Year 2,020	Year 2,021	Year 2,022	Year 2,023	Year 2,024	Year 2,025	Year 2,026	Year 2,027	Year 2,028	Year 2,029	Year 2,030	Year 2,031	Year 2,032	Year 2,033
Delay In Construction	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2
Inflation Index	1.000	1.025	1.051	1.077	1.104	1.131	1.160	1.189	1.218	1.249	1.280	1.312	1.345	1.379	1.413	1.448	1.485	1.522	1.560	1.599	1.639
Inital Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,600,993	0	0
Other Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detour Lighting Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "A"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "B"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "C"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Energy Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40,746	41,765
Annual Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	226,369	232,028
Annual Incident Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32,258	33,064
Salvage Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,600,993	299,373	306,857
Discount Factors	1.0000	0.9524	0.9070	0.8638	0.8227	0.7835	0.7462	0.7107	0.6768	0.6446	0.6139	0.5847	0.5568	0.5303	0.5051	0.4810	0.4581	0.4363	0.4155	0.3957	0.3769
Discounted Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,911,808	118,472	115,651

<Lauzon Parkway - Highway 401 to County Road 46>

Conventional Illumination (LED)

Lifecycle Cost Analysis

Present Value Lifecycle Cost
$777,000

Present Value of Initial Construction Costs $ 324,035
Present Value of Maintenance and Operationa $ 452,965
(including any Salvage Vaule)

Basic Information

Current Year	2013		
Year of Construction	2031		
Delay in Construction	18		
Time Frame For Analysis	30	years	(Should be <= 100 years)
Inflation Rate	2.5%	(eg .05 For 5%)	
Discount Rate	5.0%	(eg .1 For 10%)	

Relevant Information

		Replacement Period in years (eg if every 5 years enter 5)
Inital Construction Cost	$500,000	
Other Construction Cost	$0	
Detour Lighting Cost	$0	
Replacement Cost "A"	$0	30
Replacement Cost "B"	$64,000	20
Replacement Cost "C"	$171,000	30
Annual Energy Cost	$4,320	
Annual Maintenance Cost	$24,000	
Annual Incident Cost (pole replacement due to collisions)	$3,420	
Salvage Value	$20,000	

Description:

0	Number of poles in median
50	Number of poles along shoulder
50	Total number of poles
50	Number of proposed lumianires (ASSUMES 2 LUMINAIRS PER MEDIAN POLE - OVERWRITE CELL'H9' IF REQUIRED)
0	Number of existing luminaires
50	Total number of Luminaires
500,000	Initial Construction Cost on a per pole basis $10,000
	Other Initial Costs (e.g.; mods to concrete barrier for mounting poles, anticipated future mods to lighting due to widening, etc.)
	Detour/Temporary Lighting Costs
0	GROUP RE-LAMPING = (no of lamps*material cost) + (time per lamp*no. lamps) * (6 worker*hourly rate + 3 trucks*hourly rate)
64,000	GROUP LUM. REPLACEMENT = (no of lum * price/lum) + (time per lum*no. of lum) * (6 Workers*hourly rate + 3 trucks*hourly rate)
171,000	GROUP POLES REPLCEMENT- life of a pole is 30 years and therefore not required within the 30 year life cycle..
4,320	kW/lum*no. lum*4000 hrs/yr*rate per KWh — 180 WATT / LAMP (inc ballast)
24,000	labour (6 workers)+ equip (3 trucks) — 1.0 TIME PER POLE (IN HRS)
3,420	2% of POLE ONLY= material+labour (6 workers)+ equip (3 trucks) — 4.0 TIME PER POLE (IN HRS)
20,000	= % life*no of lum *price/lum + % life*no of pole*price/pole — 50% LUM LIFE REMAINING — 0% POLE LIFE REMAINING

MATERIAL COSTS

$0	Price / Lamp
$800	Price / Luminaire
$1,500	Price / Pole

RATES

$ 20.00	Worker/Hr
$ 120.00	Vehicle/hr
$ 0.12	Energy/kWH

LABOUR HOURS FOR REPLACEMENT

0.0	One Lamp Replacement
1.0	One Lum. Replacement
4.0	One Pole Replacement

Analysis Of Alternative (all costs $x10(	Year 2,013	Year 2,014	Year 2,015	Year 2,016	Year 2,017	Year 2,018	Year 2,019	Year 2,020	Year 2,021	Year 2,022	Year 2,023	Year 2,024	Year 2,025	Year 2,026	Year 2,027	Year 2,028	Year 2,029	Year 2,030	Year 2,031	Year 2,032	Year 2,033
Delay In Construction	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2
Inflation Index	1.000	1.025	1.051	1.077	1.104	1.131	1.160	1.189	1.218	1.249	1.280	1.312	1.345	1.379	1.413	1.448	1.485	1.522	1.560	1.599	1.639
Inital Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	779,829	0	0
Other Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detour Lighting Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "A"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "B"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "C"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Energy Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,906	7,079
Annual Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38,368	39,327
Annual Incident Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,467	5,604
Salvage Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	779,829	50,741	52,010
Discount Factors	1.0000	0.9524	0.9070	0.8638	0.8227	0.7835	0.7462	0.7107	0.6768	0.6446	0.6139	0.5847	0.5568	0.5303	0.5051	0.4810	0.4581	0.4363	0.4155	0.3957	0.3769
Discounted Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	324,035	20,080	19,602

<Lauzon Parkway - Highway 401 to County Road 46>

Conventional Illumination (LED)

Lifecycle Cost Analysis

Present Value of Initial Construction Costs $ 324,035
Present Value of Maintenance and Operationa $ 452,965
(including any Salvage Vaule)

Present Value Lifecycle Cost
$777,000

Basic Information

Current Year	2013		
Year of Construction	2031		
Delay in Construction	18		
Time Frame For Analysis	30	years	(Should be <= 100 years)
Inflation Rate	2.5%	(eg .05 For 5%)	
Discount Rate	5.0%	(eg .1 For 10%)	

Relevant Information

Inital Construction Cost	$500,000		
Other Construction Cost	$0		
Detour Lighting Cost	$0	Replacement Period in years (eg if every 5 years enter 5)	
Replacement Cost "A"	$0	30	
Replacement Cost "B"	$64,000	20	
Replacement Cost "C"	$171,000	30	
Annual Energy Cost	$4,320		
Annual Maintenance Cost	$24,000		
Annual Incident Cost (pole replacement due to collisions)	$3,420		
Salvage Value	$20,000		

	Description:
0	Number of poles in median
50	Number of poles along shoulder
50	Total number of poles
50	Number of proposed lumianires (ASSUMES 2 LUMINAIRS PER MEDIAN POLE - OVERWRITE CELL'H9' IF REQUIRED)
0	Number of existing luminaires
50	Total number of Luminaires
500,000	Initial Construction Cost on a per pole basis $10,000
	Other Initial Costs (e.g.; mods to concrete barrier for mounting poles, anticipated future mods to lighting due to widening, etc.)
	Detour/Temporary Lighting Costs
0	GROUP RE-LAMPING = (no of lamps*material cost) + (time per lamp*no. lamps) * (6 worker*hourly rate + 3 trucks*hourly rate)
64,000	GROUP LUM. REPLACEMENT = (no of lum * price/lum) + (time per lum*no. of lum) * (6 Workers*hourly rate + 3 trucks*hourly rate)
171,000	GROUP POLES REPLCEMENT- life of a pole is 30 years and therefore not required within the 30 year life cycle..
4,320	kW/lum*no. lum*4000 hrs/yr*rate per KWh
24,000	labour (6 workers)+ equip (3 trucks)
3,420	2% of POLE ONLY= material+labour (6 workers)+ equip (3 trucks)
20,000	= % life*no of lum *price/lum + % life*no of pole*price/pole

180	WATT / LAMP (inc ballast)
1.0	TIME PER POLE (IN HRS)
4.0	TIME PER POLE (IN HRS)
50%	LUM LIFE REMAINING
0%	POLE LIFE REMAINING

MATERIAL COSTS

$0	Price / Lamp
$800	Price / Luminaire
$1,500	Price / Pole

RATES

$ 20.00	Worker/Hr
$ 120.00	Vehicle/hr
$ 0.12	Energy/kWH

LABOUR HOURS FOR REPLACEMENT

0.0	One Lamp Replacement
1.0	One Lum. Replacement
4.0	One Pole Replacement

Analysis Of Alternative (all costs $x10(	Year 2,013	Year 2,014	Year 2,015	Year 2,016	Year 2,017	Year 2,018	Year 2,019	Year 2,020	Year 2,021	Year 2,022	Year 2,023	Year 2,024	Year 2,025	Year 2,026	Year 2,027	Year 2,028	Year 2,029	Year 2,030	Year 2,031	Year 2,032	Year 2,033
Delay In Construction	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2
Inflation Index	1.000	1.025	1.051	1.077	1.104	1.131	1.160	1.189	1.218	1.249	1.280	1.312	1.345	1.379	1.413	1.448	1.485	1.522	1.560	1.599	1.639
Inital Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	779,829	0	0
Other Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detour Lighting Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "A"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "B"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "C"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Energy Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,906	7,079
Annual Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38,368	39,327
Annual Incident Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,467	5,604
Salvage Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	779,829	50,741	52,010
Discount Factors	1.0000	0.9524	0.9070	0.8638	0.8227	0.7835	0.7462	0.7107	0.6768	0.6446	0.6139	0.5847	0.5568	0.5303	0.5051	0.4810	0.4581	0.4363	0.4155	0.3957	0.3769
Discounted Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	324,035	20,080	19,602

<Lauzon Parkway - County Road 46 to Highway 3>

Conventional Illumination (LED)

Lifecycle Cost Analysis

Present Value of Initial Construction Costs	$	382,362	
Present Value of Maintenance and Operationa (including any Salvage Vaule)	$	534,638	

Present Value Lifecycle Cost
$917,000

Basic Information

Current Year	2013		
Year of Construction	2031		
Delay in Construction	18		
Time Frame For Analysis	30	years	(Should be <= 100 years)
Inflation Rate	2.5%	(eg .05 For 5%)	
Discount Rate	5.0%	(eg .1 For 10%)	

Relevant Information

Inital Construction Cost	$590,000		
Other Construction Cost	$0		
Detour Lighting Cost	$0		
		Replacement Period in years (eg if every 5 years enter 5)	
Replacement Cost "A"	$0	30	
Replacement Cost "B"	$75,520	20	
Replacement Cost "C"	$201,780	30	
Annual Energy Cost	$5,098		
Annual Maintenance Cost	$28,320		
Annual Incident Cost (pole replacement due to collisions)	$4,036		
Salvage Value	$23,600		

	Description:
0	Number of poles in median
59	Number of poles along shoulder
59	Total number of poles
59	Number of proposed lumianires (ASSUMES 2 LUMINAIRS PER MEDIAN POLE - OVERWRITE CELL'H9' IF REQUIRED)
0	Number of existing luminaires
59	Total number of Luminaires
590,000	Initial Construction Cost on a per pole basis $10,000
	Other Initial Costs (e.g.; mods to concrete barrier for mounting poles, anticipated future mods to lighting due to widening, etc.)
	Detour/Temporary Lighting Costs
0	GROUP RE-LAMPING = (no of lamps*material cost) + (time per lamp*no. lamps) * (6 worker*hourly rate + 3 trucks*hourly rate)
75,520	GROUP LUM. REPLACEMENT = (no of lum * price/lum) + (time per lum*no. of lum) * (6 Workers*hourly rate + 3 trucks*hourly rate)
201,780	GROUP POLES REPLCEMENT- life of a pole is 30 years and therefore not required within the 30 year life cycle..
5,098	kW/lum*no. lum*4000 hrs/yr*rate per KWh — 180 WATT / LAMP (inc ballast)
28,320	labour (6 workers)+ equip (3 trucks) — 1.0 TIME PER POLE (IN HRS)
4,036	2% of POLE ONLY= material+labour (6 workers)+ equip (3 trucks) — 4.0 TIME PER POLE (IN HRS)
23,600	= % life*no of lum *price/lum + % life*no of pole*price/pole — 50% LUM LIFE REMAINING — 0% POLE LIFE REMAINING

MATERIAL COSTS

$0	Price / Lamp
$800	Price / Luminaire
$1,500	Price / Pole

RATES

$ 20.00	Worker/Hr
$ 120.00	Vehicle/hr
$ 0.12	Energy/kWH

LABOUR HOURS FOR REPLACEMENT

0.0	One Lamp Replacement
1.0	One Lum. Replacement
4.0	One Pole Replacement

Analysis Of Alternative (all costs $x10(	Year 2,013	Year 2,014	Year 2,015	Year 2,016	Year 2,017	Year 2,018	Year 2,019	Year 2,020	Year 2,021	Year 2,022	Year 2,023	Year 2,024	Year 2,025	Year 2,026	Year 2,027	Year 2,028	Year 2,029	Year 2,030	Year 2,031	Year 2,032	Year 2,033
Delay In Construction	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2
Inflation Index	1.000	1.025	1.051	1.077	1.104	1.131	1.160	1.189	1.218	1.249	1.280	1.312	1.345	1.379	1.413	1.448	1.485	1.522	1.560	1.599	1.639
Inital Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	920,199	0	0
Other Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detour Lighting Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "A"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "B"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "C"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Energy Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,149	8,353
Annual Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45,274	46,406
Annual Incident Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,452	6,613
Salvage Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	920,199	59,875	61,371
Discount Factors	1.0000	0.9524	0.9070	0.8638	0.8227	0.7835	0.7462	0.7107	0.6768	0.6446	0.6139	0.5847	0.5568	0.5303	0.5051	0.4810	0.4581	0.4363	0.4155	0.3957	0.3769
Discounted Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	382,362	23,694	23,130

<County Road 42 - 700m west of Banwell Road to Manning Road>

Conventional Illumination (LED)

Lifecycle Cost Analysis

Present Value Lifecycle Cost
$2,379,000

Present Value of Initial Construction Costs $ 991,548
Present Value of Maintenance and Operationa $ 1,387,452
(including any Salvage Vaule)

Basic Information

Current Year	2013		
Year of Construction	2031		
Delay in Construction	18		
Time Frame For Analysis	30	years	(Should be <= 100 years)
Inflation Rate	2.5%	(eg .05 For 5%)	
Discount Rate	5.0%	(eg .1 For 10%)	

Relevant Information

			Replacement Period in years (eg if every 5 years enter 5)
Inital Construction Cost	$1,530,000		
Other Construction Cost	$0		
Detour Lighting Cost	$0		
Replacement Cost "A"	$0		30
Replacement Cost "B"	$195,840		20
Replacement Cost "C"	$523,260		30
Annual Energy Cost	$13,219		
Annual Maintenance Cost	$73,440		
Annual Incident Cost (pole replacement due to collisions)	$10,465		
Salvage Value	$61,200		

	Description:
0	Number of poles in median
153	Number of poles along shoulder
153	Total number of poles
153	Number of proposed lumianires
0	Number of existing luminaires
153	Total number of Luminaires

(ASSUMES 2 LUMINAIRS PER MEDIAN POLE - OVERWRITE CELL'H9' IF REQUIRED)

1,530,000	Initial Construction Cost on a per pole basis	$10,000
	Other Initial Costs (e.g.; mods to concrete barrier for mounting poles, anticipated future mods to lighting due to widening, etc.)	
	Detour/Temporary Lighting Costs	
0	GROUP RE-LAMPING = (no of lamps*material cost) + (time per lamp*no. lamps) * (6 worker*hourly rate + 3 trucks*hourly rate)	
195,840	GROUP LUM. REPLACEMENT = (no of lum * price/lum) + (time per lum*no. of lum) * (6 Workers*hourly rate + 3 trucks*hourly rate)	
523,260	GROUP POLES REPLCEMENT- life of a pole is 30 years and therefore not required within the 30 year life cycle..	
13,219	kW/lum*no. lum*4000 hrs/yr*rate per KWh	180 WATT / LAMP (inc ballast)
73,440	labour (6 workers)+ equip (3 trucks)	1.0 TIME PER POLE (IN HRS)
10,465	2% of POLE ONLY= material+labour (6 workers)+ equip (3 trucks)	4.0 TIME PER POLE (IN HRS)
61,200	= % life*no of lum *price/lum + % life*no of pole*price/pole	50% LUM LIFE REMAINING; 0% POLE LIFE REMAINING

MATERIAL COSTS

$0	Price / Lamp
$800	Price / Luminaire
$1,500	Price / Pole

RATES

$ 20.00	Worker/Hr
$ 120.00	Vehicle/hr
$ 0.12	Energy/kWH

LABOUR HOURS FOR REPLACEMENT

0.0	One Lamp Replacement
1.0	One Lum. Replacement
4.0	One Pole Replacement

Analysis Of Alternative (all costs $x10(	Year 2,013	Year 2,014	Year 2,015	Year 2,016	Year 2,017	Year 2,018	Year 2,019	Year 2,020	Year 2,021	Year 2,022	Year 2,023	Year 2,024	Year 2,025	Year 2,026	Year 2,027	Year 2,028	Year 2,029	Year 2,030	Year 2,031	Year 2,032	Year 2,033
Delay In Construction	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2
Inflation Index	1.000	1.025	1.051	1.077	1.104	1.131	1.160	1.189	1.218	1.249	1.280	1.312	1.345	1.379	1.413	1.448	1.485	1.522	1.560	1.599	1.639
Inital Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,386,278	0	0
Other Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detour Lighting Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "A"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "B"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "C"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Energy Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21,133	21,661
Annual Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	117,405	120,340
Annual Incident Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16,730	17,148
Salvage Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,386,278	155,268	159,150
Discount Factors	1.0000	0.9524	0.9070	0.8638	0.8227	0.7835	0.7462	0.7107	0.6768	0.6446	0.6139	0.5847	0.5568	0.5303	0.5051	0.4810	0.4581	0.4363	0.4155	0.3957	0.3769
Discounted Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	991,548	61,445	59,982

<County Road 42 - Manning Road to County Road 25>

Conventional Illumination (LED)

Lifecycle Cost Analysis

Present Value of Initial Construction Costs	$	2,138,632		
Present Value of Maintenance and Operationa (including any Salvage Vaule)	$	2,992,368		

Present Value Lifecycle Cost
$5,131,000

Basic Information

Current Year	2013		
Year of Construction	2031		
Delay in Construction	18		
Time Frame For Analysis	30	years	(Should be <= 100 years)
Inflation Rate	2.5%	(eg .05 For 5%)	
Discount Rate	5.0%	(eg .1 For 10%)	

Relevant Information

Inital Construction Cost	$3,300,000		
Other Construction Cost	$0		
Detour Lighting Cost	$0		
		Replacement Period in years (eg if every 5 years enter 5)	
Replacement Cost "A"	$0	30	
Replacement Cost "B"	$422,400	20	
Replacement Cost "C"	$1,128,600	30	
Annual Energy Cost	$28,512		
Annual Maintenance Cost	$158,400		
Annual Incident Cost (pole replacement due to collisions)	$22,572		
Salvage Value	$132,000		

	Description:
0	Number of poles in median
330	Number of poles along shoulder
330	Total number of poles
330	Number of proposed lumianires (ASSUMES 2 LUMINAIRS PER MEDIAN POLE - OVERWRITE CELL'H9' IF REQUIRED)
0	Number of existing luminaires
330	Total number of Luminaires
3,300,000	Initial Construction Cost on a per pole basis $10,000
	Other Initial Costs (e.g.; mods to concrete barrier for mounting poles, anticipated future mods to lighting due to widening, etc.)
	Detour/Temporary Lighting Costs
0	GROUP RE-LAMPING = (no of lamps*material cost) + (time per lamp*no. lamps) * (6 worker*hourly rate + 3 trucks*hourly rate)
422,400	GROUP LUM. REPLACEMENT = (no of lum * price/lum) + (time per lum*no. of lum) * (6 Workers*hourly rate + 3 trucks*hourly rate)
1,128,600	GROUP POLES REPLCEMENT- life of a pole is 30 years and therefore not required within the 30 year life cycle..
28,512	kW/lum*no. lum*4000 hrs/yr*rate per KWh — 180 WATT / LAMP (inc ballast)
158,400	labour (6 workers)+ equip (3 trucks) — 1.0 TIME PER POLE (IN HRS)
22,572	2% of POLE ONLY= material+labour (6 workers)+ equip (3 trucks) — 4.0 TIME PER POLE (IN HRS)
132,000	= % life*no of lum *price/lum + % life*no of pole*price/pole — 50% LUM LIFE REMAINING — 0% POLE LIFE REMAINING

MATERIAL COSTS

$0	Price / Lamp
$800	Price / Luminaire
$1,500	Price / Pole

RATES

$ 20.00	Worker/Hr
$ 120.00	Vehicle/hr
$ 0.12	Energy/kWH

LABOUR HOURS FOR REPLACEMENT

0.0	One Lamp Replacement
1.0	One Lum. Replacement
4.0	One Pole Replacement

Analysis Of Alternative (all costs $x10(	Year 2,013	Year 2,014	Year 2,015	Year 2,016	Year 2,017	Year 2,018	Year 2,019	Year 2,020	Year 2,021	Year 2,022	Year 2,023	Year 2,024	Year 2,025	Year 2,026	Year 2,027	Year 2,028	Year 2,029	Year 2,030	Year 2,031	Year 2,032	Year 2,033
Delay In Construction	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2
Inflation Index	1.000	1.025	1.051	1.077	1.104	1.131	1.160	1.189	1.218	1.249	1.280	1.312	1.345	1.379	1.413	1.448	1.485	1.522	1.560	1.599	1.639
Inital Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,146,874	0	0
Other Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detour Lighting Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "A"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "B"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement Cost "C"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Energy Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45,581	46,720
Annual Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	253,226	259,557
Annual Incident Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36,085	36,987
Salvage Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,146,874	334,892	343,264
Discount Factors	1.0000	0.9524	0.9070	0.8638	0.8227	0.7835	0.7462	0.7107	0.6768	0.6446	0.6139	0.5847	0.5568	0.5303	0.5051	0.4810	0.4581	0.4363	0.4155	0.3957	0.3769
Discounted Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,138,632	132,528	129,373

APPENDIX D

Benefit/Cost Ratio

Benefit/Cost Ratio Calculation

<Lauzon Parkway - Highway 401 and County Road 46>

BENEFIT / COST RATIO

The Ministry's Directive PLNG-B-05, Form 4, provides a warranting condition for non-freeway continuous illumination at this location.

The Benefit Cost Analysis is based on Conventional Illumination.

DELAY FOR BASE CASE (yrs)	=		ENTER 1 IF DO NOTHING AT ALL		1
Inflation Rate	=	*2.50%*	**Discounting Factor**	=	*5.00%*

Consult with MTO Project Manager to obtain the current Inflation Rate and Discounting Factors in use.

Initial Construction Costs (Present Value - Should be zero if not constructing at all)	=	$0	Initial Construction Costs First Opportunity to Construct (in 19 years)	=	$324,035
Benefits (Present Worth)	=	$319,335.74	*(Obtained from HEIR Spreadsheet)*		
Disbenefits (Present Worth)	=	$452,965.00	*(Obtained from the LCCA Spreadsheet)*		
Benefit Cost Ratio	=	(PW Benefits-PW Disbenefit) / ((PW Alt Costs-PW Base Case Costs) * 20% OH)			
	=	**-0.34**			

Benefit/Cost Ratio Calculation

<Lauzon Parkway - County Road 46 to Highway 3>

BENEFIT / COST RATIO

The Ministry's Directive PLNG-B-05, Form 4, provides a warranting condition for non-freeway continuous illumination at this location.

The Benefit Cost Analysis is based on Conventional Illumination.

DELAY FOR BASE CASE (yrs)	=		ENTER 1 IF DO NOTHING AT ALL		1
Inflation Rate	=	*2.50%*	**Discounting Factor**	=	*5.00%*

Consult with MTO Project Manager to obtain the current Inflation Rate and Discounting Factors in use.

Initial Construction Costs (Present Value - Should be zero if not constructing at all)	=	$0	Initial Construction Costs First Opportunity to Construct (in 19 years)	=	$382,362
Benefits (Present Worth)	=	$658,054.18	*(Obtained from HEIR Spreadsheet)*		
Disbenefits (Present Worth)	=	$534,638.00	*(Obtained from the LCCA Spreadsheet)*		
Benefit Cost Ratio	=	(PW Benefits-PW Disbenefit) / ((PW Alt Costs-PW Base Case Costs) * 20% OH)			
	=	**0.27**			

Benefit/Cost Ratio Calculation

County Road 42 - 700m west of Banwell Road to Manning Road

BENEFIT / COST RATIO

The Ministry's Directive PLNG-B-05, Form 4, provides a warranting condition for non-freeway continuous illumination at this location.

The Benefit Cost Analysis is based on Conventional Illumination.

DELAY FOR BASE CASE (yrs)	=		ENTER 1 IF DO NOTHING AT ALL		*1*
Inflation Rate	=	*2.50%*	**Discounting Factor**	=	*5.00%*

Consult with MTO Project Manager to obtain the current Inflation Rate and Discounting Factors in use.

Initial Construction Costs	=	$0	Initial Construction Costs	=	$991,548
(Present Value - Should be zero if not constructing at all)			First Opportunity to Construct (in 19 years)		
Benefits (Present Worth)	=	$744,319.87	*(Obtained from HEIR Spreadsheet)*		
Disbenefits (Present Worth)	=	$1,387,452.00	*(Obtained from the LCCA Spreadsheet)*		
Benefit Cost Ratio	=	(PW Benefits-PW Disbenefit) / ((PW Alt Costs-PW Base Case Costs) * 20% OH)			
	=	**-0.54**			

Benefit/Cost Ratio Calculation

County Road 42 - Manning Rd to County Rd 25

BENEFIT / COST RATIO

The Ministry's Directive PLNG-B-05, Form 4, provides a warranting condition for non-freeway continuous illumination at this location.

The Benefit Cost Analysis is based on Conventional Illumination.

DELAY FOR BASE CASE (yrs)	=		ENTER 1 IF DO NOTHING AT ALL		*1*
Inflation Rate	=	*2.50%*	**Discounting Factor**	=	*5.00%*

Consult with MTO Project Manager to obtain the current Inflation Rate and Discounting Factors in use.

Initial Construction Costs	=	$0	Initial Construction Costs	=	$2,138,632
(Present Value - Should be zero if not constructing at all)			First Opportunity to Construct (in 18 years)		
Benefits (Present Worth)	=	$1,891,891.72	*(Obtained from HEIR Spreadsheet)*		
Disbenefits (Present Worth)	=	$2,992,368.00	*(Obtained from the LCCA Spreadsheet)*		
Benefit Cost Ratio	=	(PW Benefits-PW Disbenefit) / ((PW Alt Costs-PW Base Case Costs) * 20% OH)			
	=	**-0.43**			