



## 1 - Illumination

A driver must be able to perceive the general layout and operation of an intersection in time to make appropriate maneuvers. Whenever a facility is designed for use by several user groups (motor vehicles, pedestrians and bicycles or mopeds), the roundabout must be illuminated. Therefore, adequate lighting needs to be at all roundabouts. Additional illumination guidance is found in TGM 11-11-1.

When state and/or federal funds are used they should pay 100 percent of the initial installation cost for non-decorative lighting fixtures and materials. The ownership type will determine whether the equipment maintenance and the electricity use is paid by the local unit of government or the State. When the lighting is on a local highway system or a connecting highway the local unit of government is responsible for the cost associated with maintenance of the equipment and the electricity use. For roundabouts on state highways, the lighting equipment maintenance and electricity may be paid by the State.

### 1.1 - Need for Illumination

The need for illumination varies depending on the location of the roundabout.

1. Urban Conditions - Illuminate urban roundabouts if all or most of the approaches are illuminated and where necessary to improve the visibility of pedestrians and bicyclists. If the designer's goal is to emphasize the role of this facility as a transition speed zone, illumination becomes an important asset.
2. Suburban Conditions - In general, illumination is beneficial and needs to be considered for all suburban roundabouts. Illumination is particularly recommended for safety reasons when any of the following conditions are present.
  - One or more approaches are illuminated.
  - Competing non-roadway illumination in the vicinity can distract the driver's attention (i.e. highly illuminated parking lots, car lots or filling stations).
  - Heavy nighttime traffic is anticipated.
  - Pedestrian traffic is anticipated (approaches have sidewalks).

Provide continuity of illumination level between approaches and the roundabout itself to avoid distracting drivers and to minimize the need for the driver's eye to adjust to changing lighting levels.

3. Rural Conditions - Illumination should be installed at rural roundabouts. Use reflective pavement marking and retroreflective signs (including chevrons supplementing the ONE-WAY signs) regardless of whether illumination is provided. Reflectivity shall conform to the Standard Specifications.

Illuminate the approach nose of the splitter island and any raised channelization or curbing. In general, provide a gradual illumination transition zone of approximately 250 feet beyond the final trajectory changes at each exit. This helps drivers adjust their vision back into the dark environment of the exiting roadway, which takes approximately 1 to 2 seconds. In addition, avoid short-distance dark areas between two consecutive illuminated areas.

### 1.2 - Standards and Recommended Practices

#### Category I

Illumination of new or temporary roundabouts where existing adjacent roadways are not illuminated or current illumination of adjacent roadways are below standard.

Generally, the illumination levels of conventional intersections should be approximately equal to the sum of the illumination levels of the intersecting roadways.

The basic principle behind the lighting of roundabouts in urban and suburban areas is that the amount of light on the intersection should be proportional to the light provided on the intersecting streets and equal to the sum of the values used for each separate street.

WisDOT recommends a simplified approach to street illumination, which is to design illumination for asphaltic

pavement surface conditions. Illumination recommendations for concrete pavement will generally not be considered on the state trunk highway system. For roundabouts, WisDOT will use the information presented in [Table 1](#) and [Table 2](#) to determine the design level of illumination (computed using [Table 3](#)) rather than the existing light levels of the streets that approach the roundabout.

Design the roundabout to have the illumination levels given in [Table 1](#). This would result in illumination levels at the roundabout ranging from 8 lux (0.7 fc) for roundabouts at the intersection of two local streets with low pedestrian traffic volume (two intersecting local streets each having an illumination level of 4 lux, the resulting sum is 8 lux), to 34 lux (3.4 fc) for roundabouts at the intersection of two major streets with high pedestrian traffic volume. [Table 2](#) provides a description of roadway classification with related volumes and pedestrian conflict area classification with related volumes. Complete the form in [Table 3](#) to determine the intersection illumination level.

**Table 1. Illuminance Levels at Roundabouts and Other Intersections**

| Recommended Illuminance for Intersections     |   |                    |                 |  |
|---|---|--------------------|-----------------|--|
| Roadway Classification<br>(Street A/Street B) | Average Maintained Illuminance at Pavement <sup>1</sup> |                    |                 | Uniformity Ratio<br>(E <sub>avg</sub> /E <sub>min</sub> ) <sup>2</sup> |
|   | Pedestrian/Area Classification                          |                    |                 |  |
|   | High<br>lux (fc)  | Medium<br>lux (fc) | Low<br>lux (fc) |  |
| Major/Major                                   | 34.0 (3.2)  | 26.0 (2.4)         | 18.0 (1.7)      | 3.0  |
| Major/Collector                               | 29.0 (2.7)  | 22.0 (2.1)         | 15.0 (1.4)      | 3.0  |
| Major/Local                                   | 26.0 (2.4)  | 20.0 (1.9)         | 13.0 (1.2)      | 3.0  |
| Collector/Collector                           | 24.0 (2.2)  | 18.0 (1.7)         | 12.0 (1.1)      | 4.0  |
| Collector/Local                               | 21.0 (2.0)  | 16.0 (1.5)         | 10.0 (0.9)      | 4.0  |
| Local/Local                                   | 18.0 (1.7)  | 14.0 (1.3)         | 8.0 (0.7)       | 6.0  |

<sup>1</sup> fc = foot candles (conversion factor from lux to foot candles is 10.67.)

fc has been rounded to the nearest tenth

<sup>2</sup> E<sub>avg</sub> = Horizontal Illuminance, E<sub>min</sub> = Vertical Illuminance

Source: ANSI / IESNA RP-8-00 Table 9

Values in [Table 1](#) assume typical asphalt roadway surface. WisDOT will not use different pavement classifications to determine illumination levels.

**Table 2. ANSI/IESNA RP-8-00 Guidance for Roadway and Pedestrian/Area Classification For Purposes of Determining Intersection Illumination Levels**

| Roadway Classification                  | Description   | Existing Daily Vehicular Traffic Volumes <sup>1</sup>        |
|---|---|--|
| Major                                   | That part of the roadway system that serves as the principal network for through-traffic flow. The routes connect areas of principal traffic generation and important rural roadways leaving the city. Also often known as "arterials," thoroughfares," or "preferentials." | Over 3,500 ADT   |
| Collector                               | Roadways servicing traffic between major and local streets. These are streets used mainly for traffic movements within residential, commercial, and industrial areas. They do not handle long, through trips.   | 1,500 to 3,500 ADT   |
| Local                                   | Local streets are used primarily for direct access to residential, commercial, industrial, or other abutting property.  | 100 to 1,500 ADT   |
| Pedestrian Conflict Area Classification | Description   | Guidance on Existing Pedestrian Traffic Volumes <sup>2</sup> |
| High                                    | Areas with significant numbers of pedestrians expected to be on the sidewalks or crossing the streets during darkness. Examples are downtown retail areas, near theaters, concert halls, stadiums, and transit terminals.   | Over 100 pedestrians/hour                                    |
| Medium                                  | Areas where lesser numbers of pedestrians use the streets at night. Typical are downtown office areas blocks with libraries, apartments, neighborhood shopping, industrial, older city areas, and streets with transit lines.   | 11 to 100 pedestrians/hour                                   |
| Low                                     | Areas with very low volumes of night pedestrian usage. These can occur in any of the cited roadway classifications but may be typified by suburban single-family streets, very low-density residential developments and rural or semi-rural areas.                          | 10 or fewer pedestrians/hour                                 |

<sup>1</sup> For purposes of intersection lighting levels only

<sup>2</sup> Pedestrian volumes during the average annual first hour of darkness (typically 6:00 pm-7:00 pm) representing the total number of pedestrians walking on both sides of the street plus those crossing the street at non-intersection locations in a typical block or 200 m (656 ft) section. RP-8-00 clearly specifies that the pedestrian volume thresholds presented here are a local option and should not be construed as a fixed warrant.

### Category II

Illumination of new or temporary roundabouts where existing adjacent roadways are illuminated and meet the AASHTO Informational Guide to Roadway Lighting (1984, Table 3 values).

The roundabout illumination level should be equal to the sum of the illumination values used/available for each individual street. For example if Street A has existing illumination level  $x$  and Street B has an existing illumination level of  $y$ , then illuminate the roundabout at a level of  $x+y$ .

If the existing roadways do not meet the AASHTO roadway lighting levels, then the lighting criteria used is specified using category I.

**Table 3. Roundabout Illumination Determination Form**

| Intersection Information  |                         |
|---|-------------------------|
| Location: _____   |                         |
| Street Name A: _____  | ADT: _____              |
| Street Name B: _____  | ADT: _____              |
| Pedestrian Count: _____ (See Table 2)   |                         |
| Roadway Classification  |                         |
| Street A Classification: _____ (Major, Collector, Local from Table 2)   |                         |
| Street B Classification: _____ (Major, Collector, Local from Table 2)   |                         |
| Pedestrian Classification: _____ (High, Medium, Low from Table 2)   |                         |
| Determine Illumination Level  |                         |
| Use information from Roadway Classification above and go to Table 1 to select appropriate illumination level. |                         |
| Illumination Level: _____   | Uniformity Ratio: _____ |

**1.3 - General Recommendations**

The primary goal of illumination is to avoid surprising drivers by enabling them to see and navigate the geometric features and the deflection of the roundabout and the approach geometry and traffic control. Lighting also facilitates mutual visibility among the various users. To achieve this, the following features are recommended:

- Provide good illumination on the approach nose of the splitter islands, at all conflict areas where traffic is entering the circulating stream, and at all places where the traffic streams separate to exit the roundabout.
- Light the roundabout from the outside in towards the center to improve the visibility of the central island and the visibility of circulating vehicles to vehicles approaching to the roundabout. Avoid lighting from the central island outward since vehicles become shadows against the light, and thus, less visible. If it is desired to illuminate specific objects in the central island, use ground-level lighting within the central island that shines upwards towards the objects and away from the nearest roadway. Always put accent lighting on separate electrical disconnects from roadway lighting for the purpose of blackout protection.
- Consider lighting pedestrian crossing and bicycle merging areas.

**1.4 - Light pole position**

The position of lighting poles relative to the curbs at a roundabout is governed in part by the speed environment in which the roundabout is located and the potential speeds of errant vehicles that can be reasonably expected. Providing good pedestrian recognition is an important issue at roundabouts. Crosswalks at roundabouts should typically be lit with the pedestrians in positive contrast. Light poles placed 10 feet to 30 feet before the crosswalk is recommended for this purpose. It should also be noted that poles should be offset 10 feet from the roadway especially for signal lane approaches to allow adequate spacing for farming equipment to safely maneuver the roundabout and is preferred on multi-lane approaches.

At locations where pedestrian facilities do not exist, consideration should be given to a layout that assumes a future multi-use path will be provided. The layout should take into consideration longitudinal placement as described above as well as lateral offset to avoid major facility relocations when pedestrian and/or bicycle paths are provided in the future.

Avoid placing lighting supports and other poles or hazards within the splitter islands or on the right-hand perimeter just downstream of an exit point. Avoid placing light poles in the central island.

**2 - Landscaping**

The goal for State owned and maintained roundabouts is to achieve a landscape design that enhances the safety in the area of the central island and splitter islands with little or no landscape maintenance required over time. Landscape design elements should minimize areas of mulch and the planted vegetation that requires maintenance. When hardscape materials are included in the design they must not appear to be traversable

either by motorists or pedestrians.

Landscape elements are vital to the proper operation of a roundabout, and needs to be in place when the roundabout is opened to traffic. The purposes of landscape elements in the roundabout are to:

- Make the central island conspicuous to drivers as they approach the roundabout.
- Clearly indicate to drivers that they cannot pass straight through the intersection. Restrict the ability to view traffic from across the roundabout through mounding of the earth and plantings.
- Require motorist's to focus toward on-coming traffic from the left.
- Discourage pedestrian traffic through the central island.
- Help blind and visually impaired pedestrians locate sidewalks and crosswalks.
- Improve and complement the aesthetics of the area

When designing landscaping for a roundabout it is important to:

- Consider maintenance requirements early in the program stages of development.
- Develop a formal municipal agreement describing the landscaping and maintenance requirements for roundabouts elements early in the scoping process and prior to design of the facility.
- Maintain adequate sight distances
- Avoid obscuring the view to signs
- Minimize fixed objects such as trees, poles, walls, guard rail, community signs, statues, or large rocks.
- Apply the guidance below relative to approach speeds and the permissible use of fixed objects such as trees, poles, walls, guard rail, or large rocks.

Landscape the central island by mounding the earth and providing planting. Refer to [Figure 1](#) for the general layout of the central island. The clear zone and lateral clearance requirements for roundabouts are provided in [FDM 11-26-30](#), Section 5.24. The combination of the earth mound and plantings in the central island shall provide a visual blocking such that drivers will not be able to see through the roundabout central island. The central island area is considered a low speed environment however errant vehicles occasionally end up in the central island or crossing the central island. The approach highway speed is an indicator of the probability of an errant vehicle entering the central island. Therefore, when the posted speed on any approaching leg to the roundabout is greater than 40 mph the following items are prohibited with the central island: concrete, stone, or wood walls or other fixed objects, including trees having a mature diameter greater than 4-inches. Where the approaching leg to a roundabout has a posted speed of 40 mph or less there may be fixed objects within the central island they but must be located outside the calculated clear zone. The truck apron, when present, is not part of this clear zone distance. The clear zone for the central island is considered to begin at the inside vertical curb adjacent to the central island landscaping.

Design the slope of the central island with a minimum grade of 4% and a maximum of 6:1 sloping upward toward the center of the circle. The earth surface in the central island area forms an earth mound that is a minimum of 3.5-feet to a maximum of 6-feet in height, measured from the circulating roadway surface at the curb flange. As an absolute minimum, keep the outside 6 feet of the central island free from landscape features to provide a minimum level of roadside safety, snow storage, and unobstructed sight distance. On the outside 6-feet of central island use some type of pavement surface such as concrete, or stabilized stone like that provided as slope pavement under a bridge.

Avoid items in the central island that may be considered an attractive nuisance that may encourage passersby to go to the central island for pictures, or other objects that might distract drivers from the driving task.

When reasonable, consider a frost proof water supply (small hand hydrant, not fire hydrant) and electrical supply to the central island. The water supply should be considered for long term use not just to establish plant material during the two-year surveillance and care period.

When planning utilities such as water and/or electricity in the central island, they must be discussed with the local unit of government as to need, proximity to the site and who would pay operating costs after installation. Cost agreements shall be included in the project agreement for water and electric costs and agreed to prior to design of the roundabout.

Do not install street furniture in the central island that may attract pedestrian traffic, such as benches, decorative statues, community welcome signs, monuments or large fixed landscaping objects (trees, rocks, etc.).

Comply with the intersection sight distance as described in the FHWA Roundabout Guide, section 6.3.10.

Landscape design elements for municipalities/communities that are in excess of department standards may wish to seek funding through Community Sensitive Design (CSD) or enhancement funds.

## **2.1 - Landscape Design**

Landscape design is an important aspect of roundabout operation. Before starting the landscape design first determine the maintaining authority. More flexibility is allowed on projects that are not maintained by WisDOT.

### **2.1.1 - Owned, Operated, and Maintained by WisDOT**

Low maintenance planting plans for roundabout landscapes are required. Vegetation approved for use by the department requires minimum maintenance and has been demonstrated to tolerate highway site conditions.

The central island earth berm may be planted with trees and shrubs and/or a prairie grass mixture that doesn't require mowing. Plant materials approved for use by the department, including trees and shrubs listed in [FDM 27-25-1, Attachment 3](#) are approved for use on roundabouts owned, operated and maintained by the department. Certain native grasses are also approved at roundabouts and are included in the grasses portion of the "Table of Native Seed Mixtures" in [standard spec 630](#).

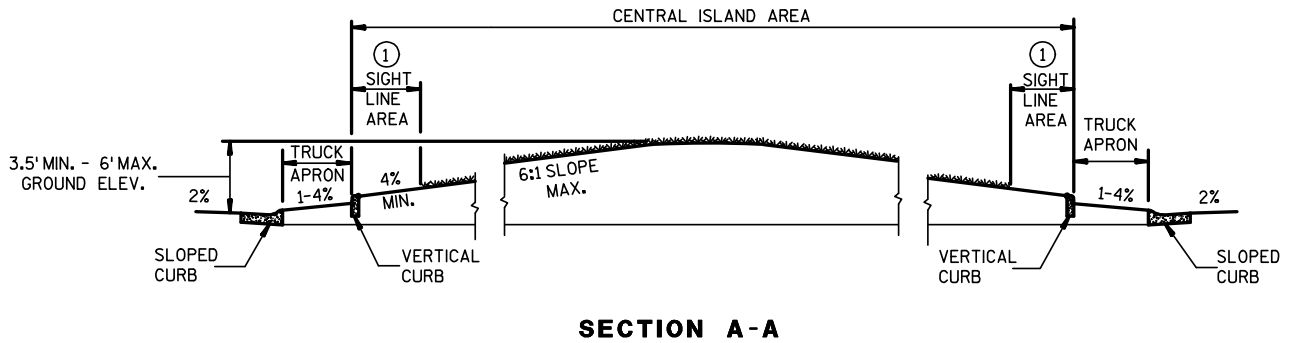
Low-to-the-ground landscape plantings in the splitter islands and approaches can both benefit public safety and enhance the visual quality of the intersection and the community. In general, unless the splitter islands are very long or wide they should not contain trees, planters, or light poles.

Landscape plantings on the approaches to the roundabout can enhance safety by making the intersection more conspicuous and by countering the perception of a high-speed through traffic movement. Avoid landscaping within 50 ft in advance of the yield point. Plantings in the splitter islands (where appropriate) and on the right and left side of the approaches (except within 50 ft of the yield point) can help to create a funneling effect and induce a decrease in speeds approaching the roundabout. Low profile landscaping in the corner radii can help to channelize pedestrians to the crosswalk areas and discourage pedestrian crossings to the central island.

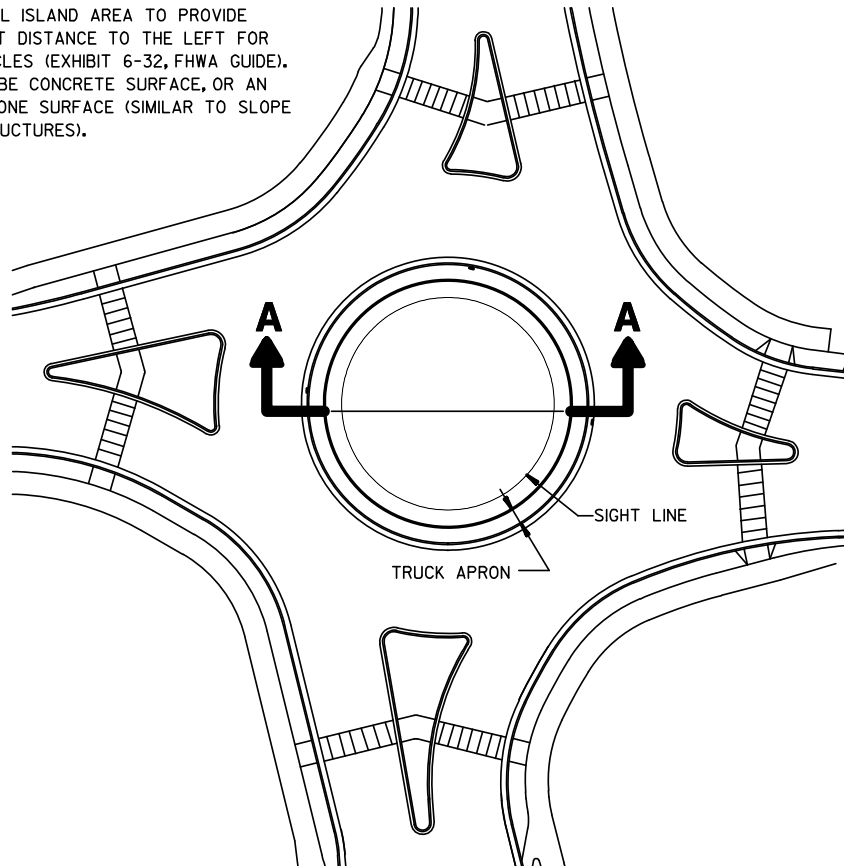
Locations of plant materials shall be selected for salt tolerance and be located to allow for sufficient snow storage in the winter. Snow removal operations typically radiate out from the central island. Plant materials shall not be placed so as to impede snow removal practices.

The uses of pre-emergent herbicides are recommended for use in plant bed and "hardscape" areas. Follow label instructions provided on the product container for use and application procedures.

Contact the Highway Maintenance and Roadside Management Section in the Bureau of Highway Operations for additional landscape design guidance.



① THE SIGHT LINE AREA SHOULD BE 6' - 10' JUST INSIDE THE CENTRAL ISLAND AREA TO PROVIDE INTERSECTION SIGHT DISTANCE TO THE LEFT FOR APPROACHING VEHICLES (EXHIBIT 6-32, FHWA GUIDE). THIS AREA SHALL BE CONCRETE SURFACE, OR AN EPOXY COATED STONE SURFACE (SIMILAR TO SLOPE PAVING UNDER STRUCTURES).



**Figure 1. Low maintenance central island landscaping**

**2.1.2 - Owned by WisDOT but Maintained by Others**

Landscape design requests in excess of Section 2.1.1 will be considered only upon receipt of a formal, signed project agreement prior to design of the facility and are the sole responsibility of the requesting municipality. These agreements are to be obtained in the planning stages -of the project.

**2.1.3 - Local Roads and Connecting Streets**

Landscape design costs in excess of department standards described in Section 2.1.1 on local roads and connecting streets are the sole responsibility of the municipality.

**2.2 - Landscape Maintenance**

Maintenance responsibilities for roundabouts will vary by ownership. Roundabouts are located on the local road system, on connecting state highways, and state highways.

**2.2.1 - Owned, Operated, and Maintained by WisDOT**

All maintenance costs and operations of roundabout landscaping owned, operated and maintained by the

department are the responsibility of the department, except as provided below. Landscape design elements and guidance have been outlined to minimize maintenance and operational costs to the department. Plants shown on the approved list have been selected to best meet these needs, [FDM 27-25-1, Attachment 3](#), [FDM 11-26-30](#) and [Figure 1](#) provide detailed layout dimensions of the area to be planted within the central island area.

Only those landscape maintenance operations necessary to maintain the safe operation of the department roundabout will be undertaken.

### **2.2.2 - Owned by WisDOT but Maintained by Others**

Municipalities often request special landscaping. Landscape requests in excess of requirements contained in Section 2.1.1 are the responsibility of the requesting municipality. Such requests will be considered only upon receipt of a formal, signed municipal agreement approved by the department prior to the design of those roundabouts. This procedure shall be completed early in the planning stages of project development.

### **2.2.3 - Local Roads and Connecting Streets**

Maintenance and operating costs of roundabouts located on local roads and connecting streets are the responsibility of the local government.

## **3 - Multi-use Path Installation and Maintenance.**

For urban, suburban, and suburbanizing locations for roundabouts, a circulating multi-use path should be provided. When state and/or federal funds are used they should pay 100 percent of the installation cost of the multi-use path around the outside of the roundabout to accommodate bicyclists that choose to leave the roadway and for pedestrians that may use the crossing. To receive this funding the path shall be constructed at the time of the roadway improvement. When the distance between consecutive roundabouts is around 500 feet or less 100% of the cost of the path between roundabouts should be paid for with State and federal funds also.

Path width guidance is provided in the [Wisconsin Bicycle Facility Design Handbook](#), but generally varies from 6' to 10'. Typically the most common movement on the path is in the same direction as vehicle movement through the intersection, hence they are considered unidirectional. A local agreement is required for maintenance of the path on all three ownership types.

In situations where the local unit of government refuses to sign a maintenance agreement for the path, that refusal must be documented in writing from the local unit of government. The Department should grade the perimeter of the roundabout to accommodate the installation of the path at some future date and cut-throughs should be provided on splitter islands. The cost of the path installation and maintenance after the original roadway improvement is the total responsibility of the local unit of government. There have been situations where land uses change, the local government leaders change, and/or attitudes about such improvements change, or that pedestrian or bicycle volume increase over time, and later there is a strong desire to install the path.

## **4 - References**

- [1] AASHTO, *An Information Guide for Roadway Lighting*. This is the basic guide for highway lighting. It includes information on warranting conditions and design criteria. AASHTO Bookstore item code GL-5.
- [2] AASHTO, *Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals*. This specification contains the strength requirements of the poles and bracket arms for various wind loads as well as the frangibility requirements. All luminaire supports, poles, and bracket arms must comply with these specifications. AASHTO Bookstore item code LTS-4-M.
- [3] ANSI / IESNA RP-8-00: *American National Standard Practice for Roadway Lighting*. This Recommended Practice, published by the Illuminating Engineering Society of North America provides standards for average maintained illuminance, and small target visibility, as well as uniformity of lighting.
- [4] Centre d'Etudes sur les Reseaux les Transport. L'Urbanisme et les constructions publiques CERTU), L'Eclairage des Carrefours a Sens Giratoire (The Illumination of Roundabout Intersections), Lyon, France: CERTU, 1991.