

**International Dark-Sky Association
Massachusetts Chapter**

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To: Gautam Sen, Massachusetts Dept. of Transportation
CC: Rep. Lindsay Sabadosa, Sen. Jo Comerford, Mayor David Narkewicz
Re: Lighting at I-91 Interchange 19 roundabout, project # 604597, in Northampton, MA

Dear MassDOT:

I am writing on behalf of the International Dark-Sky Association Massachusetts chapter (IDA-MA) with serious concerns about the lighting plan for the above-referenced project, which calls for 32 new 144-Watt LED lights mounted on poles 13-to-22 feet high.

I see in the lighting plans that you have designed the lighting to adhere to lighting level recommendations by the Illuminating Engineering Society (IES), and I am sure you do so with safety in mind.

However, the planned lights are more than 10 times brighter than necessary, and they will produce dangerous and unnecessary glare that defeats the safety purpose of the lighting. They will shine directly onto the sensitive riparian habitat of the neighboring Connecticut River, will cause light trespass onto neighboring properties, and will add significantly to Northampton's already serious light pollution. The planned lighting is excessive and harmful to humans and wildlife, and inconsistent with best practices. I urge you to redesign the lighting plan so that it adheres to the five lighting principles jointly adopted by the International Dark-Sky Association (IDA) and the Illuminating Engineering Society (IES): Outdoor lighting should be 1. Useful, 2. Targeted, 3. Low light level, 4. Controlled, and 5. Warm color (<https://www.ies.org/pressroom/reducing-light-pollution-and-its-negative-affects-ies-and-ida-new-collaboration/>). This can be done by keeping the planned poles but simply changing the fixtures to have lower glare, much lower illumination levels than currently planned, warm color (CCT<3000K), and timing controls to further reduce the illumination late at night. Safety will be enhanced, not compromised.

These are the problems I see in the current plan and some suggested solutions:

1. Lighting zone should be LZ-1, not LZ-3.

- In Note 1 on Sheet 157 of the plans, you refer to the Model Lighting Ordinance (MLO) of IDA and the Illuminating Engineering Society (IES), and you state that the "City of Northampton, MA is determined to be within Zone 3, based on the location, as well as the night time safety requirements. Zone 3 allows for a "U3" BUG rating which allows for up to 500 lumens in the UL and UH zones, and 1,000 lumens total. This Lumark luminaire is Dark Sky Compliant based on independent testing data."

But the concept of lighting zones in the MLO was not intended to apply to entire cities, but neighborhoods and geographic areas within cities, and most cities have a wide range of different lighting zones. The MLO defines Zone 3 as areas such as "commercial corridors, high intensity suburban commercial areas, town centers, mixed use areas, industrial uses and shipping and rail yards with high night time activity, high use recreational and playing fields, regional shopping malls, car dealerships, gas stations, and other nighttime active exterior retail areas." This clearly does not

apply to the I-91 Exit 19 / Route 9 interchange, which is over 1 mile from downtown, 0.5 miles from Industrial Drive, and immediately abuts both quiet residential streets and sensitive riparian habitats bordering the Connecticut River, home to hundreds of species of birds, fish, mammals, amphibians, and insects. **Much more appropriate would be Lighting Zone 1.** According to the MLO, "Lighting Zone 1 pertains to areas that desire low ambient lighting levels. These typically include single and two family residential communities, rural town centers, business parks, and other commercial or industrial/ storage areas typically with limited nighttime activity. May also include the developed areas in parks and other natural settings."

2. Total illumination level should be at least 7 times lower than planned.

- In Note 2 on Sheet 157, you quote IES RP-8-14 and IES DG-19-08: "[T]he calculated roundabout illuminance and roadway luminance levels meet and exceed the minimum maintained average requirements stated below...IES Illumination Standards for Roundabouts: Major/Collector Classification with Medium Pedestrian Activity = 2.2 fc"
- In the Statistics table on Sheet 157, you indicate predicted average, maximum, and minimum illumination levels in the roundabout of 2.4 fc, 6.9 fc, and 0.7 fc, respectively.
- On Sheet 149, you indicate that each of the 32 LED lamps has wattage 144W.
- On Sheets 154-156, you show predicted illumination levels in the horizontal plane as high as 9.5 foot-candles.
- On Sheet 149, Note 3 states that "Functional Classification for this roundabout per IES guidelines shall be major /collector with a pedestrian area classification of medium. Therefore the maintained average illuminance shall be not less than 2.2 foot candles (FC) and the uniformity shall be 3:1 (Eavg/Emin)."
- Also on Sheet 157, you list the lumens per lamp as 13,199.4 lumens for each of 31 single lamps and 1 double lamp, for a total of 435,580 lumens.

The Base Allowance for Lighting Zone 1 in the IES/IDA MLO (Table B, p. 24) is 1.25 lumens per square foot of hardscape, vs. 5.0 lumens lumens per square foot for Lighting Zone 3 – *a factor of 4 times*.

From the project plans, I estimate the area of the roundabout from curb to curb to be less than 45,000 square feet. For Lighting Zone 3, the MLO would then recommend no more than 225,000 total lumens – *about half the total lumens currently shown in the plan*. For Lighting Zone 1, the MLO recommendation is 56,250 lumens – *more than 7 times lower lumens than currently planned*.

Maximum illumination levels allowed in The City of Northampton's Administrative Code Section 350-12.2 range from 0.8 foot-candles for Rural Residential districts to 5.0 fc for Highway Business, compared with maximum levels shown in the current plans that are *nearly two times higher than that (HB) to nearly 10 times higher (RR)*.

Furthermore, the IES recommendations are widely used, but they are not standards or regulations per se, and they are not supported by scientific evidence. I realize that you are aiming to err on the side of safety by meeting or exceeding the IES recommendations. But the goal should be actual safety, achieved through enhanced visibility. That visibility is achieved through careful lighting design that minimizes glare – not by making the lights brighter than they need to be. In fact, Bhagavathula, Gibbons, & Nussbaum (2019, TRBJ, DOI: 10.1177/0361198119827928) find that visibility of pedestrians by drivers plateaus when the illumination level in intersections is 7-10 lux, or 0.7-1.0 fc, and when glare is minimized – there is no additional benefit from higher illumination level. The current plan however is *nearly 10 times higher than that level*.

For all these reasons, the **appropriate illumination levels for the roundabout are about 10 times less than currently planned.**

3. Glare and uplighting should be eliminated.

- In Note 2 on Sheet 157, you state that “Zone 3 allows for a “U3” BUG rating which allows for up to 500 lumens in the UL and UH zones, and 1,000 lumens total.”

Uplighting and glare benefit no one. On the contrary, they are only detrimental to good visibility and safety. The Federal Highway Administration states (FHWA-SA-11-22, https://safety.fhwa.dot.gov/roadway_dept/night_visib/lighting_handbook/) that “disability glare is one of the most important elements to control in a lighting system. It affects your ability to adequately see, particularly for older drivers.”

The Lumark fixtures shown in the plan are good in that they are down-facing. But they are not fully shielded against glare and uplighting. Good lighting that enhances roadway safety should have not only zero uplighting but also zero glare, i.e. BUG rating 0/0/0. *Much better, safer, and environmentally friendly fixtures – with lower glare, better shielding, and lower lumens – are easily available and should be used in place of the currently planned fixtures.*

4. Blue light should be minimized, with maximum CCT 2700K.

I see no indication in the specifications of the planned correlated color temperature (CCT) of the lights. The IDA and the American Medical Association recommend CCT no bluer than 3000K, and emphasize that the level of blue light emitted should be as low as possible, to minimize glare and harm to health of humans or animals. LED fixtures with CCT 2700K and even 2200K are now widely and easily available, have lumens-per-watt efficiency within a few percent of higher CCT LEDs, and have been adopted by numerous cities, states, and nations worldwide. Note that legacy high-pressure sodium lights, which have been the industry standard worldwide for 50 years, have CCT around 2000K. *The lights used in the roundabout should have CCT no higher than 2700K.*

5. The lights should be controlled with timers that dim the light levels significantly late at night when motor vehicle and pedestrian traffic volumes are much reduced.

Many models of LED streetlights are now designed to be controlled with such electronic dimmers and timers. Route 9 and Exit 19 traffic drops to a small fraction of rush-hour peak volumes late at night, i.e. after 8 pm and especially after midnight. Maintaining full lighting levels all night long is a waste of energy and money, causes unnecessary greenhouse gas emissions to provide the needed electricity, and benefits no one while causing significant harm to nearby humans and wildlife, adding to artificial sky glow and blocking the view of the stars.

Some examples of alternative fixtures that can safely and efficiently address all the above problems include:

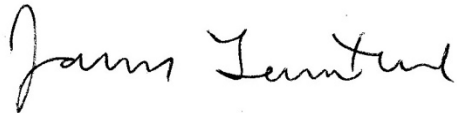
1. GE Evolve model ERL1 02: 14Watt, 1900 lumens, 2700K CCT
2. Cree RSW small: 13 W, 1633 lumens
3. LeoTek GCJ H Series: 15 W

I recently visited the roundabout construction site at night, in the light of the Full Moon, which provides illumination levels of around 0.01 fc (see Figure 1). The roundabout itself had no artificial lighting; the nearest streetlight was before the entrance to the roundabout from the westbound lane of the Coolidge Bridge. I observed the roundabout for about 20 minutes, during which time there was nearly constant traffic, with at least one vehicle approaching, in, or exiting the roundabout at any given time. Even without

artificial lighting, traffic flowed smoothly and safely, and there was no hint of confusion or imminent hazard. *The planned lighting would increase that illumination level by over 200 times.* This is truly overkill. It is worse than unnecessary – it is wasteful, dangerous to motorists and pedestrians, a nuisance to neighboring residents, and harmful to wildlife in and along the nearby Connecticut River that needs darkness at night to thrive. It is far in excess of recommendations by the IDA, the IES, and the City of Northampton.

I urge you to abandon the plan to install 32 poorly-shielded fixtures of 144 watts each and replace it instead with a safer, more appropriate, more environmentally friendly design.

Sincerely,



**James Lowenthal, President
IDA-MA**



Figure 1: The new roundabout at I-91 Exit 19 / Route 9, Aug 4, 2020. Note the lack of artificial light, apart from vehicle headlights and one streetlight (at left), and the Full Moon (upper right). The current lighting plan would make the average illumination **more than 200 times brighter than in this photo.**