Communication from Public

Name:	Ryan Schrader
Date Submitted:	12/07/2023 09:26 AM
Council File No:	22-0392
Comments for Public Posting:	We are entitled to have fair and proper transportation that is reliable and trustworthy!! Please keep it simple!!

Communication from Public

Name: J Nakao
Date Submitted: 12/07/2023 09:34 AM
Council File No: 22-0392
Comments for Public Posting: Any excuse will do, esp if it delays political actions that benefit the people who vote legitimately. As in your constituents????

Communication from Public

Name:	Rachel Ridgway
Date Submitted:	12/07/2023 08:27 AM
Council File No:	22-0392
Comments for Public Posting:	I have grave concerns about the TCN – Telecommunication Network being considered by the City Council on Friday which will allow for huge digital/electronic billboards. They will undermine highway safety by distracting drivers with their bright lights and refreshed content -- leading to more accidents that will cost lives and taxpayer dollars. Not only that, but they will exacerbate light pollution in our City, which pivots us away from the progress we have made in REDUCING light pollution. Excess nighttime lighting disrupts human sleep patterns as well as countless animals. Finally, these billboards are NOT NECESSARY. I urge you NOT to commit valuable resources to such a frivolous and unnecessary project. Thank you for noting my opposition to this plan. May your wisdom prevail!

Communication from Public

Name: Patrick Frank
Date Submitted: 12/07/2023 08:43 AM
Council File No: 22-0392
Comments for Public Posting: This is a ridiculous plan that should be scrapped.

Communication from Public

Name:	Celine Burk
Date Submitted:	12/07/2023 10:13 AM
Council File No:	22-0392
Comments for Public Posting:	Digital billboards are not only unsightly but potentially dangerous. They create yet another distraction to take drivers' eyes off the road and surrounding traffic. We have enough traffic accidents and fatalities as it is. Please do not add to that tally by authorizing digital billboards.

Communication from Public

Name:

Date Submitted: 12/07/2023 10:40 AM

Council File No: 22-0392

Comments for Public Posting: I live in the City of Los Angeles and oppose the TCN program for the many reasons enumerated in the Coalition for a Beautiful Los Angeles August 22 and September 5, 2023 comment letters and those further expressed in the September 12, 2023 Daily News article describing public safety hazards associated with distracting digital billboards. These horrible bright flashing signs will cause blight and light pollution. They will distract drivers and cause accidents. They will harm residents who need darkness at night time to relax, rest and sleep. They will harm wildlife which rely on the cover of darkness to hunt at night (owls, raccoons, opossums, coyotes) or to sleep (birds, rabbits, squirrels). They will interfere with migratory birds who travel long distances to stop and visit our wetlands and natural wildlife areas. Please do not allow these horrible signs to be installed and ruin our beautiful city.

Communication from Public

Name:	Joanna Parypinski
Date Submitted:	12/07/2023 11:35 AM
Council File No:	22-0392
Comments for Public Posting:	I have grave concerns about the TCN – Telecommunication Network being considered by the City Council on Friday which will allow for huge digital/electronic billboards. Some of the concerns about these billboards are: These huge electronic billboards will refresh every 8 seconds with commercial messages and only one 8 second message for the public safety. The claim is that they are replacing outdated signs and come with the ability to provide updated information to the public. Metro and the City will split the revenue. Many are concerned about safety. These billboards will be distracting. The Environmental Impact report included limited studies with small sample sizes most of which were industry sponsored. More recent studies have shown these billboards can be distracting to all drivers at higher speed or when driving is challenging, but are especially distracting to the young more inexperienced drivers and older drivers. None of the studies cited by METRO included cities such as ours that have so much traffic as our city. Additionally, none of the studies had large immigrant communities whose primary language is not English. We are concerned that these billboards can impact safety of pedestrians, bicyclists and motorists. See the LA Times editorial today: https://www.latimes.com/opinion/story/2023-12-06/los-angeles-ugly-unsafe-digital-billboards There is also concern for residents and wildlife. Light pollution impacts peoples ability to sleep. Wildlife cannot shut the blinds. Additionally, Los Angeles is a byway for migrating birds. Migrating birds can be distracted by the lights from these electronic billboards. Another concern is corruption. Billboard companies in the past have been implicated in corruption scandals including with Jose Huizar. Finally, there is a concern that the city will end up being sued when accidents occur near these signs which will end up eating up any revenue gained.

Communication from Public

Name: John Fisanotti
Date Submitted: 12/07/2023 12:22 PM
Council File No: 22-0392
Comments for Public Posting: Please reconsider the environmental, public safety and aesthetic damage, a proliferation of digital billboards will create. To those who find the visual blight and light pollution offensive, it is no different than being subjected unwillingly, and unescapably to loud, amplified constant noise, or noxious fumes. If digital billboards emitted either of the latter, there is no question municipal ordinances protect the public from such sensory offences. It should be no different with equally unescapable visual blight and light pollution. Your constituents depend upon you to make the right decisions to protect and, where possible, enhance the quality of living in this city. Please don't be the agent of a deteriorating quality of life for the profit of the few. Moreover, as a retired municipal government employee, it pains me when I see those elected to serve, not act in good faith in representing the people who elected them. It only gives credence to those who believe government is the problem and not a force for good. The fact that this item, concerning a massive, multi-year contract, was agendized as a consent item only one day after coming out of committee belies the a priori intent to approve, without any deliberation or public comment. Ramming this through, without full and honest deliberation, hearing from all sides, and consideration of alternatives is not democracy in action. I urge you to reconsider your apparent premeditated decision to approve the proposed contract. Vote for the protection of public safety, to make Los Angeles a more livable city, and to reduce the harmful effects of visual blight and environmental light pollution.

Communication from Public

Name: Sa Rei
Date Submitted: 12/07/2023 12:54 PM
Council File No: 22-0392
Comments for Public Posting: I oppose Metro’s Transportation Communication Network (TCN) (heard by the LA City Council) And lack 9f public input!! At yesterday's City Council meeting, CD 4’s Nitya Raman displayed tremendous leadership by requesting the ordinance be opened up for public comments (that’s right, it was on consent calendar one day after leaving PLUM!) and to have a separate vote. Her action along with several amendments caused the item to be continued to Friday where Public Comment will be allowed. This proposed ordinance has moved from Committee to Council at warp speed and that is unacceptable to us and our supporters. This is a 20-year contract that has not been reviewed by the Budget & Finance Committee or the Transportation Committee. Make sure you contact your Council member and let them know more time is needed to better understand what they are voting on.

Communication from Public

Name:	Betsy Handler
Date Submitted:	12/07/2023 12:55 PM
Council File No:	22-0392
Comments for Public Posting:	As a 38-year resident of LA, I am strongly opposed to the expansion of neon, animated billboards in LA. Such billboards will add to 5he visual blight of our city, and further degrade the darkness of the night sky. This is a terrible idea, and should be defeated.

Communication from Public

Name:
Date Submitted: 12/07/2023 03:04 PM
Council File No: 22-0392
Comments for Public Posting: Ads distract drivers and therefore are dangerous. 22-0392

Communication from Public

Name:	Anina Bach
Date Submitted:	12/07/2023 03:06 PM
Council File No:	22-0392
Comments for Public Posting:	WE urge you to Reject the proposed Billboard plan for land owned by the Metropolitan Transportation Authority. The electronic billboards will forever blight Los Angeles and will create safety hazards for everyone-drivers, pedestrians, bicyclists-forever. Please do not cover Los Angeles with dangerous electronic billboards. Please do not sacrifice street safety and the visual appeal of Los Angeles, which are its great economic and community assets, for a modest funding stream. No More Unnecessary Light Pollution!

Communication from Public

Name: Michael Johnson
Date Submitted: 12/07/2023 04:16 PM
Council File No: 22-0392
Comments for Public Posting: The idea of bright, distracting digital billboards along our local freeways is a concept that, if passed, will prove unequivocally that our local officials care only about the revenue it will produce, and not the impact on its constituents' daily lives. As it is, drivers distracted by their cellphones are a major problem without the additional distraction of bright billboards catching their eye to sell them products. I'll take a wild guess that Universal Studios is 100% behind the idea in order to promote its theme park and latest attractions. Universal has shown total disregard for their neighbors. Every person living near the 101, 134 and 170 freeways will be impacted by these looming, glowing signs that will be visible 24 hours a day, seven days a week. I live in the hills and have had problems with small signs and billboards along Ventura Blvd lighting the inside of my house at night. Weren't digital billboards banned a number of years ago for this reason? They are too bright. They are too invasive. They are too distracting to drivers. As a neighborhood, we are not willing to allow corporate interests and money grabs by the city to destroy our way of life with these obscene jumbo screens foisted upon us. This 'Blade Runner' future is NOT something any of us desire to be a part of. This must be voted down now otherwise it's a Pandora's Box of further intrusions into lives of taxpaying property owners who expect a certain amount of respect. Beware, because this is only the beginning. VOTE 'NO.'

Communication from Public

Name: Victoria Miller
Date Submitted: 12/07/2023 04:30 PM
Council File No: 22-0392
Comments for Public Posting: I strongly oppose the Metro TCN digital billboard advertising Program because of the impacts to housing, safety, historic-cultural, scenic, coastal, environmental and sensitive use resources. I ask the City Council to send the Metro TCN Program Ordinances back to the City Planning Commission for reconsideration per City Charter Sections 555 and 558, following substantive changes adopted by several motions introduced by Council Districts 1, 2, 5, 12, and 13. These changes include: PLUM restored freeway facing billboard FF-3 that was removed by CPC out of concern for saturation and public safety; PLUM reduced the CPC recommended distance of 2,640 feet to 1,500 feet between billboards on the same side of the freeway. This will set a negative precedent for all future signs, especially in the downtown area; PLUM expanded the hours of operation for freeway facing signs; PLUM reduced the number of existing static billboards to be removed prior to installation of new digital billboards from 125 to 50 initial removals + 4 signs after that (these numbers don't add up to the required 200 sign removals); PLUM lowered the minimum takedown square footage per sign from 300 square feet (minimum billboard size) to 200 square feet (poster board size); PLUM opened the door to extend the digital billboard program to a 30-year contract instead of the CPC recommended 20-year contact. I agree with Coalition for a Beautiful Los Angeles that the placement of offsite commercial advertising on Metro-owned and controlled property in partnership with the City subjects users of public spaces to unwanted sales pitches for goods and services and is antithetical to the idea that citizens should have public spaces/visual environment free of crass commercialization. Please send the Ordinances back to the City Planning Commission for reconsideration. Thank you, Victoria Miller Encino, 91436

Communication from Public

Name: Michael Gross
Date Submitted: 12/07/2023 04:34 PM
Council File No: 22-0392
Comments for Public Posting: I strongly oppose the Metro TCN digital billboard advertising Program because of the impacts to housing, safety, historic-cultural, scenic, coastal, environmental and sensitive use resources. I ask the City Council to send the Metro TCN Program Ordinances back to the City Planning Commission for reconsideration per City Charter Sections 555 and 558, following substantive changes adopted by several motions introduced by Council Districts 1, 2, 5, 12, and 13. These changes include: PLUM restored freeway facing billboard FF-3 that was removed by CPC out of concern for saturation and public safety; PLUM reduced the CPC recommended distance of 2,640 feet to 1,500 feet between billboards on the same side of the freeway. This will set a negative precedent for all future signs, especially in the downtown area; PLUM expanded the hours of operation for freeway facing signs; PLUM reduced the number of existing static billboards to be removed prior to installation of new digital billboards from 125 to 50 initial removals + 4 signs after that (these numbers don't add up to the required 200 sign removals); PLUM lowered the minimum takedown square footage per sign from 300 square feet (minimum billboard size) to 200 square feet (poster board size); PLUM opened the door to extend the digital billboard program to a 30-year contract instead of the CPC recommended 20-year contact. I agree with Coalition for a Beautiful Los Angeles that the placement of offsite commercial advertising on Metro-owned and controlled property in partnership with the City subjects users of public spaces to unwanted sales pitches for goods and services and is antithetical to the idea that citizens should have public spaces/visual environment free of crass commercialization. Please send the Ordinances back to the City Planning Commission for reconsideration.

Communication from Public

Name: Steve Graff
Date Submitted: 12/07/2023 04:36 PM
Council File No: 22-0392
Comments for Public Posting: I strongly oppose the Metro TCN digital billboard advertising Program because of the impacts to housing, safety, historic-cultural, scenic, coastal, environmental and sensitive use resources. I ask the City Council to send the Metro TCN Program Ordinances back to the City Planning Commission for reconsideration per City Charter Sections 555 and 558, following substantive changes adopted by several motions introduced by Council Districts 1, 2, 5, 12, and 13. These changes include: PLUM restored freeway facing billboard FF-3 that was removed by CPC out of concern for saturation and public safety; PLUM reduced the CPC recommended distance of 2,640 feet to 1,500 feet between billboards on the same side of the freeway. This will set a negative precedent for all future signs, especially in the downtown area; PLUM expanded the hours of operation for freeway facing signs; PLUM reduced the number of existing static billboards to be removed prior to installation of new digital billboards from 125 to 50 initial removals + 4 signs after that (these numbers don't add up to the required 200 sign removals); PLUM lowered the minimum takedown square footage per sign from 300 square feet (minimum billboard size) to 200 square feet (poster board size); PLUM opened the door to extend the digital billboard program to a 30-year contract instead of the CPC recommended 20-year contact. I agree with Coalition for a Beautiful Los Angeles that the placement of offsite commercial advertising on Metro-owned and controlled property in partnership with the City subjects users of public spaces to unwanted sales pitches for goods and services and is antithetical to the idea that citizens should have public spaces/visual environment free of crass commercialization. Please send the Ordinances back to the City Planning Commission for reconsideration. Thank you,

Communication from Public

Name:	Betsy
Date Submitted:	12/07/2023 04:55 PM
Council File No:	22-0392
Comments for Public Posting:	I urge you to Reject the proposed Billboard plan for land owned by the Metropolitan Transportation Authority. The electronic billboards will forever blight Los Angeles and will create safety hazards for everyone-drivers, pedestrians, bicyclists-forever. Please do not cover Los Angeles with dangerous electronic billboards. Please do not sacrifice street safety and the visual appeal of Los Angeles, which are its great economic and community assets, for a modest funding stream. Thank you so much.

Communication from Public

Name:	Claire Gerard
Date Submitted:	12/05/2023 03:43 PM
Council File No:	22-0392
Comments for Public Posting:	I oppose erecting 75 digital billboards. They are distracting and dangerous in any area of the city. Claire Gerard

Communication from Public

Name:	Tracy Thrower Conyers
Date Submitted:	12/07/2023 01:52 PM
Council File No:	22-0392
Comments for Public Posting:	My family is opposed to sensory blight in the form of double-sided digital billboards. They are a safety distraction and a full on assault to our mental health. Putting this blight in historic locations, high injury network streets and sensitive use locations is extra offensive. Use the land to build affordable homes.

Communication from Public

Name:	Burton Hunter
Date Submitted:	12/07/2023 01:07 PM
Council File No:	22-0392
Comments for Public Posting:	Burton Hunter here. I think that the only METRO electronic billboards that should be allowed will not be for commercial advertisements - rather they will ONLY be allowed at major METRO stops and will be ONLY for METRO details and information for directing riders (such as, to indicate the location of near-by parking features for the METRO line and to give anticipated route arrival times.) Also, these signs could be used to show interspersed Public Service Announcements. These informational signs should be sized considerably smaller than a commercial billboard and should be targeted in areas that help promote the easier use of the public transit system. Such signs should be equipped with equipment that regulates the brightness of the sign is such a way that produces appropriate brightness to the time of day. At night, these signs should not be overwhelmingly bright, so as to produce an annoying distraction. Be considerate and help keep LA's METRO system popular as well as safe.

Communication from Public

Name: Lauren Chang
Date Submitted: 12/07/2023 01:34 PM
Council File No: 22-0392
Comments for Public Posting: See letter with clarifying comments attached.

Los Angeles County
Metropolitan Transportation Authority

One Gateway Plaza
Los Angeles, CA 90012-2952

213.922.2000 Tel
metro.net

Metro

December 7, 2023

BY EMAIL

Office of the City Clerk
Los Angeles City Council
City of Los Angeles
200 N. Spring Street, City Hall – Room 395
Los Angeles, California 90012
email: Clerk.CPS@lacity.org

Re: Clarifying Comments on the Transportation Communication Network Program's Data Collection Capabilities and the Regional Integration of Intelligent Transportation Systems (RIITS) - Council File 22-0392

Honorable Councilmembers:

On December 5, 2023, the City Planning and Land Use Management ("PLUM") Committee recommended that the City Council approve three ordinances with respect to the Transportation Communication Network ("TCN") Program (the "TCN Ordinances"). The record before the City Council is voluminous; both Metro and the City have carefully considered the potential environmental, environmental justice, social, economic, and other aspects of the TCN Program. This letter addresses a specific topic—suggestions that the TCN Program will surreptitiously collect personal information from cell phones and other electronic devices from vehicles in the vicinity of TCN signs.

Citizens for a Better Los Angeles ("CBLA") has objected to the TCN Program because CBLA apparently believes the TCN structures will collect personal data from cell phones and other devices, and Metro could potentially use or share that data in ways that violate individuals' privacy rights. CBLA's stated concerns are unfounded. The purpose of this letter is to provide clarification regarding the collection and use of data Metro proposes for the TCN Program.

1. Regional Integration of Intelligent Transportation Systems ("RIITS")

The TCN signs will take advantage of the capabilities of the Regional Integration of Intelligent Transportation Systems ("RIITS") to share real-time traffic, emergency and transit information across various transportation agencies. RIITS is a multi-agency enabling tool that is used by transportation agencies in Southern California such as Metro to meet Southern California's mobility, sustainability, and emergency management challenges. Partners within RIITS include Metro, Caltrans District 7, and the City of Los Angeles Department of Transportation.

RIITS aggregates transportation data collected from multiple transportation agencies to serve as a tool for the various agencies to meet mobility, sustainability, and emergency

management challenges.[1] RIITS is organized with Members, Associates, and Users. Members are government agencies with transportation or related operations that agree to exchange transportation information and resources through RIITS. The Member agencies vote to include members, participate in improvements to member operations, and provide guidance on the direction of RIITS. Associates are non-voting government agencies that provide transportation or related operations and agree to share transportation and related information and resources through RIITS. Users may be government organizations, universities, or private entities that do not contribute operational resources through RIITS, but have access to RIITS through license agreements. RIITS is overseen and managed by the Configuration Management Committee, which is governed by a set of bylaws and is comprised of government source data agencies that vote to approve requests by other entities to become Members, Associates, and Users.

The Member and Associate agencies of RIITS gather data for use in RIITS through various means, including from video, sensors, reports, and community-reported information such as that provided through social media platforms (i.e. the Waze application). Governmental agencies with transportation or related operations such as public safety (i.e. police and fire departments) exchange transportation information and resources through RIITS.[2] Private entities may only gain access to RIITS with a license.[3] Access to the information is therefore limited, and the purposes for which the information may be used is also limited. *The requisite licenses expressly prohibit private and government organizations from using RIITS data for non-transportation-related purposes, such as for law enforcement, surveillance, or advertising purposes.*[4] All non-transportation uses suggested by CBLA, including following and tracking individuals' habits via RIITS data, and selling physical access to RIITS data are therefore prohibited by the RIITS partnership. RIITS does not involve the collection of personal cell phone data or other individual identifying information.

2. The TCN Program's Data Collection Capabilities

In its November 1, 2023 letter to the City, CBLA cites several articles discussing cell phone data collection from digital billboards owned and/or operated by private companies and advertisers, rather than government agencies. The situations described in these articles are not analogous to the TCN Program. The TCN Program only contemplates signs owned and operated exclusively by Metro—a government transportation agency—rather than signs owned and operated by private advertisers. As previously discussed, and notwithstanding CBLA's unsupported speculation to the contrary, Metro will not collect any personal data from the occupants of vehicles in the vicinity of the TCN signs. Any private entities, including advertisers, may only gain access to transportation data provided to RIITS through a license approved by the RIITS Configuration Management Committee.

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[1] Attachment 1 – RIITS, *Measure Up*, available at: https://www.riits.net/; Attachment 2 – RIITS, *About*, available at: https://www.riits.net/about/.

[2] Attachment 2 – RIITS, *About*, available at: https://www.riits.net/about/.

[3] *Ibid.*; see Attachment 3 – RIITS, *Transportation Data Access Agreement*, available at: https://www.riits.net/data-licenses/riits-data-license/ (prohibiting users of the RIITS from using data for unauthorized purposes).

[4] See Attachment 3 – RIITS, *Transportation Data Access Agreement*, available at: https://www.riits.net/data-licenses/riits-data-license/.

CBLA's claims that Metro is seeking to use the TCN signs to collect individualized personal data for sale or other non-transportation related purposes are entirely unfounded and incorrect. Metro is a transportation agency and has no plans to use the TCN signs to collect and sell individualized cell phone data or other personal data for individualized tracking, law enforcement, or other non-transportation purposes, such as advertising. Metro does not disseminate individualized personal data. Metro intends to collect only general traffic information via the TCN structures to be used in RIITS. While the specific details of the traffic monitoring technology that Metro will employ in the TCN Program have not yet been finalized, Metro will not collect any data that is not already being collected by its partner public agencies in the City of Los Angeles. Any such transportation data collected for use in RIITS—a system that CBLA endorsed in its letter—is controlled by strict rules, as discussed above.

We appreciate your consideration of these clarifications and look forward to discussing them with you at your earliest opportunity.

Very truly yours,

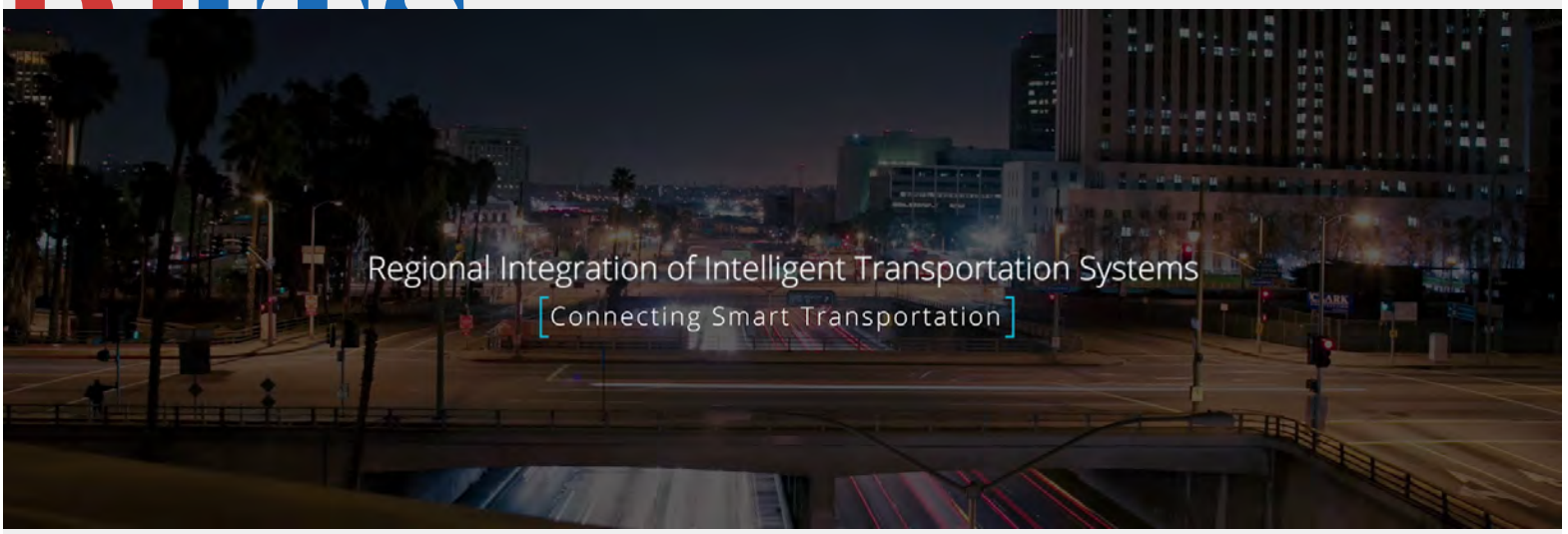
LOS ANGELES COUNTY METROPOLITAN
TRANSPORTATION AUTHORITY

E-SIGNED by Holly Rockwell
on 2023-12-07 17:28:04 GMT

By_____
Holly Rockwell
Senior Executive Officer
Transit Oriented Communities & Real Estate

cc: Ms. Hagu Solomon-Cary, AICP (w/encls.) (BY EMAIL)
Ms. Terri Osborne (w/encls.) (BY EMAIL)

Attachment 1



GET STARTED

SEARCH OVER 17 DATASETS

Search Datasets

Agencies recognize RIITS as an enabling tool to meet Southern California's mobility, sustainability and emergency management challenges. Visit **Measure Up!** to see how the **Los Angeles County Metropolitan Transportation Authority** is using RIITS.

Los Angeles County MTA

California Department of Transportation

California Highway Patrol

Los Angeles Department of Transportation

Long Beach Transit

Attachment 2

RIITS

About

Vision

RIITS' vision is to deliver multi-modal transportation information services through a flexible platform to achieve regional mobility, safety and sustainability goals.

Mission

Our primary mission is to support the exchange of transportation information and resources between and within government organizations for regional operational mobility improvements.

What can RIITS do for you?

RIITS aggregates real-time data from transportation systems throughout the Los Angeles region and across jurisdictional boundaries to produce value-added data on multi-modal transportation system operations between agencies and third-party providers.

RIITS complements other regional systems by being a 'system of systems'. The ability to integrate and disseminate transportation data from a variety of sources that includes transit, freeway operations, arterial operations, commercial vehicles, ports, airports and non-motorized transportation is part of RIITS. Through a flexible platform, RIITS can tailor information delivery to a particular customer or agency's needs. For instance, RIITS is used to support transportation operations such as traveler information, transportation analysis, congestion pricing, freight mobility and emergency management. RIITS is uniquely positioned to:

Membership

Members and Associates are government transportation or related organizations that want to contribute operational transportation resources to other government agencies through RIITS. Users have a license to use RIITS.

Members

Members are government agencies that have transportation or related operations like public safety (i.e. police and fire departments). These members agree to exchange transportation information and resources through RIITS. Membership includes voting to include members, participation in improvements to member operations, and guidance on the direction of RIITS.

Associates

- Operate regional inter-agency information technology;
- Bring together data from various transportation modes in a near real-time environment using modern technologies;
- Function as the regional transportation data aggregator and clearinghouse;
- Provide a strong institutional foundation for managing the configuration, management, and development of the system without placing undue limitations on the participation of current and potential future members; and
- Provide the platform to support the investigation, analysis and development of technologies and solutions to improve transportation operations throughout the region.

Associates are non-voting government agencies that provide transportation operations or provide related transportation operations. These agencies agree to share transportation and related information and resources through RIITS, but do not actively participate in RIITS as a voting member.

Users

Users have access to RIITS through a license. These members may be private entities, government organizations, or universities that are not contributing operational resources through RIITS or may not want to participate as a Member or Associate.

Configuration Management Committee

The Configuration Management Committee was established to oversee and manage the development of RIITS. It is governed by a set of Bylaws. The voting members are the source data agencies. They act by consensus and approve requests to become members, associates, or users.

Attachment 3

RIITS

TRANSPORTATION DATA ACCESS AGREEMENT

TRANSPORTATION DATA ACCESS AGREEMENT

between

Los Angeles County Metropolitan Transportation Authority ("LACMTA"), in its capacity as the Administrator of the Regional Integration of Intelligent Transportation Systems ("RIITS")

and

«Agency_Company_Name»("User")

This Transportation Data Access Agreement ("Agreement") is made and entered into as of the date the last party executes this Agreement, between LACMTA in its capacity as the RIITS Administrator ("Administrator"), and «Agency_Company_Name», a «Corp_State_Type» domiciled in «Domicile_State», whose principal place of business is «Agency_Address_Line_1», «Agency_City», «Agency_State» «Agency_Zip_Code».

Recitals

WHEREAS, data source agencies, LACMTA, State of California, Department of Transportation, District 7 ("Caltrans"), City of Los Angeles, Department of Transportation ("LADOT"), and various other public agencies (collectively referred to as "Source Agencies") have established RIITS to exchange transportation information, including, but not limited to, near real time traffic and transit data relating to all modes of transportation ("Transportation Data");

WHEREAS, a Configuration Management Committee ("CMC") was established by the Source Agencies to oversee RIITS;

WHEREAS, the CMC named LACMTA the RIITS Administrator and delegated to LACMTA as Administrator the authority to administer, maintain, operate, manage and monitor RIITS access; codify system changes, process standard service agreements with third parties, and enforce the terms and conditions of the service agreements;

WHEREAS, Transportation Data supplied to RIITS is owned exclusively by the Source Agencies, and eachSource Agency supplying Transportation Data through this Agreementhas authorized Administrator to make and change certain Transportation Data available to the User;

WHEREAS, User has expressed an interest in obtaining Transportation Data for the Greater Los Angeles region;

WHEREAS, User desires to reformat, redistribute, add value, display and/or disseminate Transportation Data to its clients, sub-licensees, and/or customers to help reduce transportation congestion in Los Angeles County;

WHEREAS, the LACMTA Board has authorized the transmission of Transportation Data provided by Source Agencies through RIITS to information service providers at the discretion of the LACMTA Chief Executive Officer;

WHEREAS, User is an information service provider;

WHEREAS, the general public will benefit from Transportation Data disseminated by User, increasing the efficiency of the regional transportation system; and

WHEREAS, LACMTA and User (collectivelythe "Parties") desire to enter into this Agreement to set forth their understanding and respective responsibilities regarding RIITS.

NOW, THEREFORE, the Parties agree hereto:

1. General Provisions

1. The CMC reserves the right to make changes to RIITS. Further, LACMTA, in its capacity as Administrator, may make changes to RIITS systems at any time. User understands such changes may include changes to the type of Transportation Data available and may affect User's use of and ability to use Transportation Data. The current Transportation Data available to the User may be found by visiting www.riits.net.

1. Administrator, the CMC, or Source Agencies may immediately disconnect User's access to Transportation Data without adherence to the Termination clause in this Agreement.

1. Source Agencies exercise full control of individual Closed Circuit Television ("CCTV") camera positions at all times, provide Transportation Data to the User through RIITS, and select individual CCTV locations to be made available for display to the User.

1. The User shall not contact Source Agency personnel for the purpose of requesting that specific CCTV be operated or that cameras be repositioned. Contacting Source Agencies for the purpose of requesting specific CCTV is grounds for Termination.

1. For the purpose of providing traveler information and live traffic video viewing only, User may distribute, sell, and provide access to Transportation Data to the general public and may sublicense, pursuant to Sublicense Section of this Agreement, Transportation Data to commercial entities for the purpose of distributing, selling, and providing Transportation Data access to the general public ("Secondary Users"). No other use is permitted.

1. Administrator, or designee, will configure RIITS to ensure IP addresses and associated User equipment are recognized by RIITS as authorized User devices.

- Prohibited Uses

The User may NOT do any of the following:

- Manipulate, modify, or change CCTV and images in any manner, unless as provided in this Agreement, approved in writing by Source Agencies and notification is given to the CMC via the Administrator;
- Change, obscure, or remove fonts and logos in the Transportation Data or CCTV crediting Sources Agencies, whether through web page, wireless, or any other device;
- Use Transportation Data for any non-transportation related purpose including, but not limited to, law enforcement;
- Reproduce or display Transportation Data other than as expressly permitted;
- Continuously record CCTV and images for long-term archival storage. However, User may retain copies of all news programs telecast by the User, which copies may include any video images supplied that are incorporated into the news program; and
- Sell or resell physical access to the limited resource granted by this Agreement, including, but not limited to, the Transportation Data. This does not include Secondary Users that the User provides Transportation Data access to, as long as the access is provided by the User and the Secondary User's equipment is not directly requesting Transportation Data from RIITS.
- Administrator Obligations

Upon CMC approval, LACMTA, as the Administrator, shall execute the Agreement hereby providing the User the following:

- A non-exclusive royalty-free license to Transportation Data to distribute, sell and provide Transportation Data to the general public and Secondary Users;
- Non-exclusive access through the Internet to Transportation Data with a user name and password unique to the User; and
- Information about the type of Transportation Data and how to access Transportation Data on the RIITS website (http://www.riits.net/), or a successor website designated by Administrator.
- User Obligations

The User shall:

- Provide a maximum of two (2) public and static IP Address numbers that User may use to access RIITS Transportation Data;
- Be responsible for preventing any unauthorized use of the Transportation Data by User's employees, clients, or customers;
- Provide necessary telecommunications between RIITS and User's center, including appropriate telecommunications hardware at each terminus, as well as any needed software and all other equipment required to transmit, receive, process, format and distribute the Transportation Data;
- Make a good faith effort to timely utilize Transportation Data to ensure current transportation conditions are presented to the public;
- Ensure that all images not broadcast "live" are differentiated in some manner from "live" images;
- Pay all User costs associated with the dissemination, transfer, or use of Transportation Data;

- Repair, replace, and return to operation any damage to RIITS and Source Agency property caused by User personnel and equipment at no cost to RIITS or Source Agencies, and in a manner satisfactory to Administrator;
- Respond to Administrator within 30 calendar days of notification concerning any problem with User equipment and/or property;
- Maintain regular correspondence with Administrator. Further, User shall respond to written requests and/or questions from Administrator within 30 calendar days of the date the request and/or question is sent to User;
- Meet and be responsible for all licensing requirements applicable to User's operations;
- Remedy any User equipment disrupting RIITS or Source Agency equipment or operations, in a manner satisfactory to Administrator;
- Pay Administrator a fee of one (1) hundred dollars ($100.00). User and all Sub-licensees to whom it provides the Transportation Data may be subject to further user charges should Administrator establish additional fees;
- Direct all User customer comments, complaints or suggestions about the Transportation Data to User's customer service staff;
- Provide the CMC regular feedback on the public's response to the Transportation Data, the minimum requirement for which will be a yearly report to the RIITS CMC;
- Provide Administrator with a technical contact person who shall be available to Administrator 24 hours a day, 7 days a week, every day of the year;
- Have no input into the camera views or camera angles used on CCTV. The camera views and camera angles shall be determined solely at the discretion of Source Agencies;
- Be responsible for, including, but not limited to, all personnel, programming, development, production, and equipment to view, receive, use and display the Transportation Data. User hardware and software shall be compatible with RIITS;
- Provide Transportation Data and marketing survey input on use of the Transportation Data as requested by Administrator for the purposes of assessing the regional benefit of RIITS; and
- Have a lead representative able to fluently read, write and speak the English language so as to sufficiently understand all job related directions and discussions with Administrator.
- Agreement Amendments

This Agreement may only be amended or modified through a separate written amendment, approved and executed in the same manner as the original Agreement.

- Public Records Act
- All records, documents, drawings, plans, specifications and other information relating to conduct of LACMTA's business, including information submitted by the User shall become the exclusive property of LACMTA and shall be deemed public records. Said materials are subject to the provisions of the California Public Records Act (Government Code sections 6250

et. seq.). LACMTA's use and disclosure of its records are governed by this Act. LACMTA will not advise as to the nature or content of documents entitled to protection from disclosure under the California Public Records Act.

- In the event of litigation concerning the disclosure of any information submitted by the User, LACMTA's sole involvement will be as a stakeholder, retaining the information until otherwise ordered by a court. The User, at its sole expense and risk, shall be responsible for any and all fees for prosecuting or defending any action concerning the information, and shall indemnify and hold LACMTA harmless from all costs and expenses including attorneys' fees, in connection with any such action.
- Confidentiality
- User agrees that for and during the entire term of the Agreement, all information, except Transportation Data, including, but not limited to data, figures, records, findings and the like received or generated by the Agreement and in the performance of the Agreement, shall be considered and kept as the private and confidential records of LACMTA, in its capacity as Administrator, and will not be divulged to any person, firm, corporation, or other entity except on the direct authorization of LACMTA and expressly permitted under this Agreement, unless required by law.
- Upon termination of the Agreement for any cause, User agrees that it will continue to treat as private and confidential any information, data, figures, records and the like, and will not release any such information to any person, firm, corporation or other entity, either by statement, deposition, or as a witness, except upon direct written authority of LACMTA, in its capacity as Administrator.
- The User shall not publish information, data, figures, records and the like acquired or generated by the User in performing the Agreement until such time as such information, data, figures, records and the like is released in published reports by LACMTA, in its capacity as Administrator.
- No Representation or Warranties
- User acknowledges and agrees that neither LACMTA nor any of the Source Agencies, nor any of their respective employees, officers, agents, or consultants makes any warranty, express or implied, with respect to Transportation Data nor with respect to its accuracy, sufficiency or completeness thereof, nor with respect to any of the software or other systems provided by LACMTA or any Source Agency under this Agreement. Transportation Data is provided on an "as is" and "with all faults" basis, with the User bearing the entire risk as to quality and performance of Transportation Data.
- LACMTA makes no representations or warranties, express or implied, that the Transportation Data will perform based on the User's equipment. Further, LACMTA makes no representations or warranties, express or implied, that Transportation Data will be suitable for the purposes for which it is permitted to be used under the terms of this Agreement. THE IMPLIED WARRANTIES OF MERCHANTABILITY AND OF THE FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY WAIVED.
- Warranty
- User warrants that it is aware of and understands the hazards which are presented to persons, property and the environment in the performing of transportation, storage, remediation and disposal of the materials associated with the equipment described within the Agreement. Further, to the extent applicable, User will transport, store, remediate and dispose of such materials in full compliance with all applicable governmental laws, regulations and orders.

- User warrants that all work completed to obtain the Transportation Data from RIITS shall be in accordance with the Agreement. In the event of breach of this warranty, the User shall take the necessary actions to correct the breach and the consequences thereof, at the User's sole expense, in the most expeditious manner as permitted by existing circumstances. If, upon notification from LACMTA, User does not promptly take steps to correct the breach. LACMTA, without waiving any other rights or remedies it may have at law or otherwise, may correct the breach or cause others to do so, and the User shall promptly reimburse LACMTA for all expenses and costs incurred in connection therewith.

1. Limitation of Liability

1. User acknowledges and agrees that neither LACMTA, nor or any of the Source Agencies, or any of their respective employees, officers, agents, or consultants shall be liable for any damages, claim or loss incurred by User (including without limitation, compensatory, incidental, indirect, special, consequential, or exemplary damages, lost profits, lost sales or business, expenditures, investments or commitments in connection with any business, or loss of goodwill) resulting from the Transportation Data or inability to use the provided Transportation Data irrespective of whether LACMTA and/or the Source Agencies have been informed of, knew of, or should have known of the likelihood of such damages, claim, or loss. This limitation applies to all causes of action in the aggregate, including, without limitation, breach of contract, breach of warranty, negligence, strict liability, misrepresentation, and other torts.

1. LACMTA and Source Agencies assume no liability or responsibility for the User's equipment.

1. The User will NOT hold LACMTA and any Source Agency liable or responsible in any way for unforeseen interruptions in providing the Transportation Data regardless of cause.

1. LACMTA and Source Agencies shall not be liable for special, incidental, exemplary or consequential damages suffered because of the User's use of Transportation Data; including, but not limited to, loss of profits, anticipated revenue, interest, loss of use, or other such claims arising from any causes whatsoever, whether or not such loss or damages is based on contract, warranty, tort, including negligence, indemnity or otherwise.

1. User, on behalf of itself and its sub-licensees, employees, clients, and customers, hereby waives and releases LACMTA and all Source Agencies from any and all claims, causes of action, losses, costs, damages, liability and expenses of any kind or nature whatsoever (known or unknown) to the extent attributable to RIITS or the use by User and its sub-licensees, clients, customers, and employees of the Transportation Data. User (for itself and its clients, customers and employees) expressly waives the benefit of Section 1542 of the California Civil Code, which provides as follows: "a general release does not extend to claims which the creditor does not know or suspect to exist in his or her favor at the time of executing the release, which if known by him or her must have materially affected his or her settlement with the debtor."

1. Third Party Liability

Nothing contained in this Agreement is intended to or shall have the effect of creating any rights in any third party against LACMTA or any of the Source Agencies. The inclusion of the Agreement or any part thereof in any other document shall not be deemed to be creating or incorporating any obligation, duty, or liability on the part of LACMTA or any of the Source Agencies. The User shall indemnify LACMTA and Source Agencies in accordance with the provisions of this section against any claim made by any third party claiming rights under this Agreement.

1. Indemnification

1. To the fullest extent permitted by law, and with counsel approved by Administrator, the User shall defend, indemnify and hold harmless LACMTA and all Source Agencies, any subsidiaries, and any of their respective members, directors, officers, employees and agents (individually and collectively, "Indemnities"), from and against any and all liabilities, including but not limited to claims, actions, suits (including but not limited to workers' compensation suits and breaches of contract), demands, costs, judgments, liens, penalties, damages, losses, and expenses, including but not limited to any fees of accountants, attorneys or other professionals arising out of, connected with, or resulting from any act, omission, fault or negligence of the User or any of its officers, authorized representative, employees, subcontractors or suppliers, or any person or organization directly or indirectly employed by any of them, in connection with, or relating to, or claimed to be in connection with, or relating to, User's use, possession or dissemination of Transportation Data or User's performance of any other obligation under the Agreement including but not limited to any costs or liability on account of:

1. Personal injury to or death of any person (including employees of the parties to be indemnified) or for damage to or loss of use of property (including property of LACMTA or Source Agencies); and

1. LACMTA's reasonable reliance upon the use of data or other information provided or delivered by the User pursuant to the Agreement.

1. The indemnification specified in this Section shall apply even in the event of the act, omission, fault or negligence whether active or passive, of the party or parties to be indemnified, but shall not apply to claims, actions, demands, costs, judgments, liens, penalties, liabilities, damages, losses, and expenses arising from the willful misconduct of the party or parties to be indemnified. LACMTA shall not be responsible for any negligence, willful misconduct or defects in design caused and/or furnished by the User.

1. The indemnification specified in this Section shall survive termination or closeout of the Agreement hereunder and is in addition to any other rights or remedies that LACMTA may have under the law or under this Agreement.

1. Claims against the indemnified parties by any employee of the User, its subcontractors, suppliers, anyone directly or indirectly employed by any of them, and/or anyone for whose acts any of them may be liable shall not in any way limit the User's indemnification obligation as set forth above, including the amount and/or type of damages, compensation, and/or benefits payable by or for the User or its subcontractors under workers' compensation acts, disability benefit acts, and/or other employee benefit acts and/or insurances.

1. No Waiver

1. Failure of Administrator to enforce at any time, or from time to time, any provision Agreement shall not be construed as a waiver thereof.

1. No waiver by Administrator of any breach of any provision of the Agreement shall constitute a waiver of any other breach or of such provision.

1. Failure or delay by Administrator to insist upon strict performance of any terms conditions of the Agreement, or to exercise any rights or remedies provided by law, shall not be deemed a waiver of any right of Administrator to insist upon

performance of the User's obligations set forth in the Agreement, or rights or remedies as to any prior or subsequent default hereunder.

1. Term of the Agreement

1. The term of the Agreement shall begin upon the date of the last party to sign this Agreement and shall continue for one (1) year (the "Initial Term").

1. The Agreement shall automatically renew month to month (each a "Renewal Term"), unless either party sends written notice to the other party at least thirty (30) days before expiration of the Initial Term or any Renewal Term that it does not wish to renew the Agreement.

1. The term of the Agreement shall consist of the Initial Term and any Renewal Term.

1. Termination

1. If the User fails to comply with any of the terms and conditions contained within this Agreement, Administrator may revoke User's access privileges to Transportation Data and, upon written notification, terminate this Agreement immediately. In addition, LACMTA shall have the right to enforce any and all rights and remedies herein or which may be now or hereafter available at law or in equity.

1. Except as provided in the preceding paragraph, Administrator reserves the right to revoke User's access privileges to RIITS and terminate this Agreement at any time, upon thirty (30) days prior written notice to the User.

1. User may terminate this Agreement upon thirty (30) days prior written notice to Administrator.

1. User must post a notice on its website for a minimum of sixty (60) days after cessation of service with a link to any new LACMTA website where Transportation Data is available.

1. Assignment

1. The User shall not assign, transfer, convey, or otherwise dispose of the Agreement (or the right, title, or interest in it or any part of it) without the prior written consent and endorsement of Administrator, which consent shall not be unreasonably withheld.

1. No right under the Agreement shall be asserted against Administrator, in law or in equity, by reason of any assignment of the Agreement, or any part thereof, unless authorized by Administrator as specified in this Section.

1. Sublicense

User may sublicense its rights hereunder subject to the following conditions:

1. User shall execute written sublicenses to Secondary Users. Said sublicense shall contain reasonable terms pursuant to and consistent with the terms and conditions of this Agreement, and shall be approved by Administrator;

1. User shall collect a one-time administrative fee of one hundred dollars ($100) from any and all Secondary Users of the Transportation Data and transmit said fees to Administrator;

1. User shall include, in each sublicense, the applicable terms and conditions from this Agreement; and

1. User shall provide a report to the CMC which lists all Secondary Users to whom access to Transportation Data has been provided, along with the administrative fees and relevant contract information. RIITS hereby agrees to hold all such relevant contract information in strict confidence and not disclose any such information to any third party.

1. Governing Law

The Agreement has been negotiated between LACMTA, as Administrator, and the User and shall be subject to the laws of the State of California.

By entering into the Agreement, the User consents and submits to the jurisdiction of the Courts of the State of California, County of Los Angeles, over any action at law, suit in equity, and/or other proceeding that may arise out of the Agreement.

1. Severability

In the event any article, section, sub-article, paragraph, sentence, clause, phrase contained in the Agreement shall be determined, declared, adjudged invalid, illegal, unconstitutional, or otherwise unenforceable, such determination, declaration, or adjudication shall in no manner affect the other articles, sections, sub-articles, paragraphs, sentences, clauses, or phrases of the Agreement, which shall remain in full force and effect as if the article, section, sub-article, paragraph, sentence, clause, or phrase declared, determined, or adjudged invalid, illegal, unconstitutional, or otherwise unenforceable, was not originally contained in the Agreement.

- Entire Agreement

This Agreement constitutes the entire agreement between the User and LACMTA, as Administrator, and supersedes all previous and contemporaneous agreements written or oral and all communications between the Parties relating to the subject matter of this Agreement.

- Binding on Successors and Assigns

This Agreement shall run to the benefit of and be binding upon any successors, administrators, heirs and assigns.

- Counterparts

This agreement may be executed in counterparts, each of which shall be deemed an original, but all of which taken together shall constitute one and the same instrument.

- Contact Information

Notices under this Agreement shall be sent by first-class U.S. mail, postage prepaid, to User and to the LACMTA, at the address specified. Notices shall be deemed effective five business days after such mailing.

User shall provide written notice on User letterhead to LACMTA within 30 days of any change in Official Point of Contact or IP Addresses. Official Points of Contact regarding any aspects of this Agreement are as follows:

- User Contact Information

The User shall provide Administrative and Technical contacts as well as a maximum of two (2) public and static IP addresses of devices used to contact RIITS in order to access the Transportation Data. User contact information is as follows:

- Administrative Contact Name

Name: «Agency_Company_Name»

Contact Name: «Agency_Title» «Agency_First_Name» «Agency_Last_Name»

Title: «Agency_Job_Title»

Address: «Agency_Address_Line_1»

«Agency_City»«Agency_State»«Agency_Zip_Code»

Telephone: «Agency_Phone»

Email: «Agency_Email_Address»

- Technical Contact Name

Name: «Tech_Company_Name»

Contact Name: «Tech_First_Name»«Tech_Last_Name»

Title: «Tech_Job_Title»

Address: «Tech_Address_Line_1»

«Tech_City»«Tech_State»«Tech_Zip_Code»

Telephone: «Tech_Phone»

Email: «Tech_Email_Address»

- IP Addresses

IP Address #1: «IP_Address_1»

IP Address #2: «IP_Address_2»

- Administrator Contact Information

Agency Name: Los Angeles County

Metropolitan Transportation Authority

Contact Name: Mr. Kali K Fogel

Title: RIITS Program Manager

Address: 1 Gateway Plaza

Los Angeles, California 90012

Telephone: (213) 922 – 2665

Fax: (213) 922 – 2955

Email: fogelk@metro.net

IN WITNESS WHEREOF, the parties have caused this Agreement to be executed by their duly authorized representatives as of the dates indicated below.

Los Angeles County Metropolitan Transportation Authority	«Agency_Company_Name»
Phillip A. Washington	«Member_Name»
Date	Date
Chief Executive Officer	«Member_Title»

APPROVED AS TO FORM

MARY C. WICKHAM

County Counsel

By:

Deputy Date

Communication from Public

Name: Carrie Tokunaga
Date Submitted: 12/07/2023 10:37 PM
Council File No: 22-0392
Comments for Public Posting: I strongly oppose the Metro TCN digital billboard advertising Program because of the impacts to housing, safety, historic-cultural, scenic, coastal, environmental and sensitive use resources. I ask the City Council to send the Metro TCN Program Ordinances back to the City Planning Commission for reconsideration per City Charter Sections 555 and 558, following substantive changes adopted by several motions introduced by Council Districts 1, 2, 5, 12, and 13. These changes include: PLUM restored freeway facing billboard FF-3 that was removed by CPC out of concern for saturation and public safety; PLUM reduced the CPC recommended distance of 2,640 feet to 1,500 feet between billboards on the same side of the freeway. This will set a negative precedent for all future signs, especially in the downtown area; PLUM expanded the hours of operation for freeway facing signs; PLUM reduced the number of existing static billboards to be removed prior to installation of new digital billboards from 125 to 50 initial removals + 4 signs after that (these numbers don't add up to the required 200 sign removals); PLUM lowered the minimum takedown square footage per sign from 300 square feet (minimum billboard size) to 200 square feet (poster board size); PLUM opened the door to extend the digital billboard program to a 30-year contract instead of the CPC recommended 20-year contact. I agree with Coalition for a Beautiful Los Angeles that the placement of offsite commercial advertising on Metro-owned and controlled property in partnership with the City subjects users of public spaces to unwanted sales pitches for goods and services and is antithetical to the idea that citizens should have public spaces/visual environment free of crass commercialization. Please send the Ordinances back to the City Planning Commission for reconsideration. Thank you, Carrie Tokunaga

Communication from Public

Name:
Date Submitted: 12/07/2023 10:42 PM
Council File No: 22-0392
Comments for Public Posting: I am an elderly pedestrian who relies on public transportation. I have had more than my share of "near death" incidents, where a distracted driver almost ran me over. I vehemently oppose the Metro TCN digital billboard advertising Program because its threat to public safety and its impacts to housing, historic-cultural, scenic, coastal, environmental, sensitive use resources. City Council must send the Metro TCN Program Ordinances back to the City Planning Commission for reconsideration per City Charter Sections 555 and 558, following substantive changes adopted by several motions introduced by Council Districts 1, 2, 5, 12, and 13. These changes include: --PLUM restored freeway facing billboard FF-3 that was removed by CPC out of concern for saturation and public safety; --PLUM reduced the CPC recommended distance of 2,640 feet to 1,500 feet between billboards on the same side of the freeway. This will set a negative precedent for all future signs, especially in the downtown area; --PLUM expanded the hours of operation for freeway facing signs; --PLUM reduced the number of existing static billboards to be removed prior to installation of new digital billboards from 125 to 50 initial removals + 4 signs after that (these numbers don't add up to the required 200 sign removals); --PLUM lowered the minimum takedown square footage per sign from 300 square feet (minimum billboard size) to 200 square feet (poster board size); --PLUM opened the door to extend the digital billboard program to a 30-year contract instead of the CPC recommended 20-year contact. The above is the minimum for public safety. And I agree with Scenic America and the Coalition for a Beautiful Los Angeles that the placement of offsite commercial advertising on Metro-owned and controlled property in partnership with the City turns our public rights of way into advertising vehicles for private interests and and is antithetical to the idea that citizens should have public spaces and a public sight lines free of all commercialization. Los Angeles continues to march in the wrong direction, toward more visual blight and clutter and privatization of public space, instead of the removal of all billboards from our cityscape. Why? So that a few giant billboard companies can profit? So that advertisers can bombard us with their commercial messages? Why are we selling off what little public visual space we have? Our city should instead be

banning billboards, not opening the floodgates for more -- and, in the case of these electronic billboards, the most dangerous form of billboards imaginable. In closing, you are Public Servants. Act like it! Shame on every member of our city council and our mayor for fast-tracking this wrongheaded, dreadful, and dangerous ordinance. Knock it off! Stop playing with our lives! Stop METRO TCN! Hana Kawano

Communication from Public

Name: Melinda Taylor
Date Submitted: 12/07/2023 11:12 PM
Council File No: 22-0392
Comments for Public Posting: I have been following this issue and commenting on it for many months. I am dismayed by what seems to me to be deliberate action on the part of the LA city government to put this proposal into law without fully vetting it to the public. Once again, I want to express my strong opposition to Metro's Transportation Communication Network proposal. Many community members have spoken eloquently about the downsides of the TCN proposal to date, many have written letters and called their council representatives. It seems that our comments are falling on deaf ears. We don't want to degrade our city by allowing for the installation of digital advertisements along our city streets. We want to go in the opposite direction: we want to lower the density of advertising in our outdoor spaces; we want our city's residents not to be tracked by advertising; we want to enhance dark sky policies to protect and strengthen bird habitats; we want to celebrate and support the diverse and abundant variety of trees and plants that grow here, and the fauna that these plants foster. We know and love our city. This proposal is not adding benefit to our city. It is a short-sighted grab for revenue with long-term adverse effects. Don't do it! Don't open our city to what will possibly be a far greater degradation than you can imagine now. If you have read any of the public comments submitted in meetings regarding this issue to date, you know the issues and the details of the issues at hand. Please listen to your constituents and do the right thing for our beautiful city of Los Angeles.

Communication from Public

Name: Theresa
Date Submitted: 12/07/2023 11:50 PM
Council File No: 22-0392
Comments for Public Posting: I strongly oppose the Metro TCN digital billboard advertising Program because of the impacts to housing, safety, historic-cultural, scenic, coastal, environmental and sensitive use resources. I ask the City Council to send the Metro TCN Program Ordinances back to the City Planning Commission for reconsideration per City Charter Sections 555 and 558, following substantive changes adopted by several motions introduced by Council Districts 1, 2, 5, 12, and 13. These changes include: PLUM restored freeway facing billboard FF-3 that was removed by CPC out of concern for saturation and public safety; PLUM reduced the CPC recommended distance of 2,640 feet to 1,500 feet between billboards on the same side of the freeway. This will set a negative precedent for all future signs, especially in the downtown area; PLUM expanded the hours of operation for freeway facing signs; PLUM reduced the number of existing static billboards to be removed prior to installation of new digital billboards from 125 to 50 initial removals + 4 signs after that (these numbers don't add up to the required 200 sign removals); PLUM lowered the minimum takedown square footage per sign from 300 square feet (minimum billboard size) to 200 square feet (poster board size); PLUM opened the door to extend the digital billboard program to a 30-year contract instead of the CPC recommended 20-year contact. I agree with Coalition for a Beautiful Los Angeles that the placement of offsite commercial advertising on Metro-owned and controlled property in partnership with the City subjects users of public spaces to unwanted sales pitches for goods and services and is antithetical to the idea that citizens should have public spaces/visual environment free of crass commercialization. Please send the Ordinances back to the City Planning Commission for reconsideration.

Communication from Public

Name: KC
Date Submitted: 12/07/2023 11:51 PM
Council File No: 22-0392
Comments for Public Posting: We are opposed to digital billboards. Has a long-term implication report been provided? How would XX number of digital bill boards be comparable to adding how many houses to our electric grid? Digital billboards distract drivers both visually and cognitively and can increase the risk of a crash. The bright lights, movement, and dynamic images easily draw drivers' attention and gaze, even when they do not mean to take their eyes off the road. This is a visual distraction. This go against the vision to eliminate traffic and more distractions on L.A. streets at a time when traffic deaths and severe injuries are on the rise, with 300 people killed last year, the highest number in two decades. Communities do not want television-like billboards looming over their streets, with images changing every eight seconds. Digital billboards use huge amounts of energy, contributing to greenhouse gas emissions and global warming. Digital billboards are energy hogs. Light Pollution:Digital billboards and signs are contributors to sky glow, a form of light pollution. Have alternative uses such as solar panels been reviewed?

Communication from Public

Name:	Anna Josenhans
Date Submitted:	12/07/2023 08:01 PM
Council File No:	22-0392
Comments for Public Posting:	I strongly oppose the Metro TCN digital billboard advertising Program! These billboards add unnecessary artificial light to our night skies -- compounding the serious issue of Artifical Light at Night (ALAN) which is responsible for disrupting our circadian rhythm (in turn causing detrimental health issues such as cancer and diabetes) and negatively impacting wildlife behavior, among other things. Let's work to limit light pollution not create new venues to make it worse! Please send the Ordinances back to the City Planning Commission for reconsideration.

Communication from Public

Name:	Gerry Hans
Date Submitted:	12/07/2023 08:02 PM
Council File No:	22-0392
Comments for Public Posting:	Will it matter to our elected Councilmembers what their constituency thinks? As I scan the Council File, I see only opposition to blighting our city with digital signs, making our city less safe and less natural. I see comments about adverse impacts on our nocturnal native species… bats, migratory birds. While we hope to become an enlightened city sustaining astounding biodiversity, will our electeds go for the money instead? While our Councilmembers approved a Dark Skies Initiative Council Resolution very recently, will they forget they did so? PLEASE SAY NO.

Communication from Public

Name:	Mark Baker
Date Submitted:	12/07/2023 08:03 PM
Council File No:	22-0392
Comments for Public Posting:	Dear City of Los Angeles, The Soft Lights Foundation opposes digital billboards that have not been vetted for health and safety through the US Food and Drug Administration. We oppose digital billboards because their use violates fundamental human and civil rights and because LED billboards have been documented to cause seizures, migraines, attention capture, decreased vision, and impaired cognitive functioning, and because LED billboards create a discriminatory barrier for certain individuals, in violation of the Americans with Disabilities Act. Sincerely, Mark Baker President Soft Lights Foundation

Communication from Public

Name:	Nancy Freedman
Date Submitted:	12/07/2023 08:14 PM
Council File No:	22-0392
Comments for Public Posting:	This ban was made years ago when many in our communities fought to keep our city beautiful, not dangerous by digital signs or intrusive by the light from them. Can we just abide by that and ask Metro to lighten the load where it is very intrusive? Do you really want to be known to have reinstated blight to make a few bucks?

Communication from Public

Name:	Alexandra Tangalos
Date Submitted:	12/07/2023 08:16 PM
Council File No:	22-0392
Comments for Public Posting:	I am opposed to the existing proposed locations for the digital billboards. There are many clustered around historic areas such as Union Station, Grand Central Market, Griffith Park, the Angel's Flight, and these would ruin the tourism aspect of these areas, as well as impede filming ability. I am actually opposed to the idea of digital billboards at all, as these would only make our roads more dangerous and accident-prone, but at the very least if we must have digital billboards, please move them to less historic and touristic areas of the city.

Communication from Public

Name: Ronald M Bitzer
Date Submitted: 12/07/2023 06:05 PM
Council File No: 22-0392
Comments for Public Posting: During conversations with CD#2 staff I have learned how the METRO TCN program apparently borrowed the vision of the commercial industry for City-wide freeway-facing digital billboards and therefore began the planning process for TCN to profit METRO and the City --- thereby denying this advertising revenue for now to the commercial billboard people. But can these people be far behind? Listen to the LA Times --- More Bright Digital Billboards? Meanwhile, I ask the City Council to send the Metro TCN Program Ordinances back to the City Planning Commission for reconsideration per City Charter Sections 555 and 558, following substantive changes adopted by several motions introduced by Council Districts 1, 2, 5, 12, and 13. These changes include: PLUM restored freeway facing billboard FF-3 that was removed by CPC out of concern for saturation and public safety; PLUM reduced the CPC recommended distance of 2,640 feet to 1,500 feet between billboards on the same side of the freeway. This will set a negative precedent for all future signs, especially in the downtown area; PLUM expanded the hours of operation for freeway facing signs; PLUM reduced the number of existing static billboards to be removed prior to installation of new digital billboards from 125 to 50 initial removals + 4 signs after that (these numbers don’t add up to the required 200 sign removals); PLUM lowered the minimum takedown square footage per sign from 300 square feet (minimum billboard size) to 200 square feet (poster board size); PLUM opened the door to extend the digital billboard program to a 30-year contract instead of the CPC recommended 20-year contact. Ron Bitzer

Communication from Public

Name:	maria gritsch
Date Submitted:	12/07/2023 06:10 PM
Council File No:	22-0392
Comments for Public Posting:	I strongly oppose the Metro TCN digital billboard advertising Program because of the impacts to housing, safety, historic-cultural, scenic, coastal, environmental and sensitive use resources. I ask the City Council to send the Metro TCN Program Ordinances back to the City Planning Commission for reconsideration per City Charter Sections 555 and 558, following substantive changes adopted by several motions introduced by Council Districts 1, 2, 5, 12, and 13. These changes include: PLUM restored freeway facing billboard FF-3 that was removed by CPC out of concern for saturation and public safety; PLUM reduced the CPC recommended distance of 2,640 feet to 1,500 feet between billboards on the same side of the freeway. This will set a negative precedent for all future signs, especially in the downtown area; PLUM expanded the hours of operation for freeway facing signs; PLUM reduced the number of existing static billboards to be removed prior to installation of new digital billboards from 125 to 50 initial removals + 4 signs after that (these numbers don't add up to the required 200 sign removals); PLUM lowered the minimum takedown square footage per sign from 300 square feet (minimum billboard size) to 200 square feet (poster board size); PLUM opened the door to extend the digital billboard program to a 30-year contract instead of the CPC recommended 20-year contact. I agree with Coalition for a Beautiful Los Angeles that the placement of offsite commercial advertising on Metro-owned and controlled property in partnership with the City subjects users of public spaces to unwanted sales pitches for goods and services and is antithetical to the idea that citizens should have public spaces/visual environment free of crass commercialization.

Communication from Public

Name: Warren TenHouten
Date Submitted: 12/07/2023 06:17 PM
Council File No: 22-0392
Comments for Public Posting: I strongly oppose the Metro TCN digital billboard advertising Program because of the impacts to housing, safety, historic-cultural, scenic, coastal, environmental and sensitive use resources. I ask the City Council to send the Metro TCN Program Ordinances back to the City Planning Commission for reconsideration per City Charter Sections 555 and 558, following substantive changes adopted by several motions introduced by Council Districts 1, 2, 5, 12, and 13. These changes include: PLUM restored freeway facing billboard FF-3 that was removed by CPC out of concern for saturation and public safety; PLUM reduced the CPC recommended distance of 2,640 feet to 1,500 feet between billboards on the same side of the freeway. This will set a negative precedent for all future signs, especially in the downtown area; PLUM expanded the hours of operation for freeway facing signs; PLUM reduced the number of existing static billboards to be removed prior to installation of new digital billboards from 125 to 50 initial removals + 4 signs after that (these numbers don't add up to the required 200 sign removals); PLUM lowered the minimum takedown square footage per sign from 300 square feet (minimum billboard size) to 200 square feet (poster board size); PLUM opened the door to extend the digital billboard program to a 30-year contract instead of the CPC recommended 20-year contact. I agree with Coalition for a Beautiful Los Angeles that the placement of offsite commercial advertising on Metro-owned and controlled property in partnership with the City subjects users of public spaces to unwanted sales pitches for goods and services and is antithetical to the idea that citizens should have public spaces/visual environment free of crass commercialization.

Communication from Public

Name:	probyn gregory
Date Submitted:	12/07/2023 06:27 PM
Council File No:	22-0392
Comments for Public Posting:	Greetings. I oppose the Metro TCN digital billboard advertising program because of the impacts to housing, safety, historic-cultural, scenic, coastal, environmental and sensitive use resources. I ask the City Council to send the Metro TCN Program Ordinances back to the City Planning Commission for reconsideration per City Charter Sections 555 and 558, following substantive changes adopted by several motions introduced by Council Districts 1, 2, 5, 12, and 13. These changes include: >PLUM restored freeway facing billboard FF-3 that was removed by CPC out of concern for saturation and public safety; >PLUM reduced the CPC recommended distance of 2,640 feet to 1,500 feet between billboards on the same side of the freeway. This will set a negative precedent for all future signs, especially in the downtown area; >PLUM expanded the hours of operation for freeway facing signs; >PLUM reduced the number of existing static billboards to be removed prior to installation of new digital billboards from 125 to 50 initial removals + 4 signs after that (these numbers don't add up to the required 200 sign removals); >PLUM lowered the minimum takedown square footage per sign from 300 square feet (minimum billboard size) to 200 square feet (poster board size); >PLUM opened the door to extend the digital billboard program to a 30-year contract instead of the CPC recommended 20-year contact. I agree with Coalition for a Beautiful Los Angeles that the placement of offsite commercial advertising on Metro-owned and controlled property in partnership with the City subjects users of public spaces to unwanted sales pitches for goods and services and is antithetical to the idea that citizens should have public spaces/visual environment free of crass commercialization. Please send the Ordinances back to the City Planning Commission for reconsideration. Thank you

Communication from Public

Name:
Date Submitted: 12/07/2023 06:43 PM
Council File No: 22-0392
Comments for Public Posting: I strongly oppose the Metro TCN digital billboard advertising Program because of the impacts to housing, safety, historic-cultural, scenic, coastal, environmental and sensitive use resources. I ask the City Council to send the Metro TCN Program Ordinances back to the City Planning Commission for reconsideration per City Charter Sections 555 and 558, following substantive changes adopted by several motions introduced by Council Districts 1, 2, 5, 12, and 13. These changes include: PLUM restored freeway facing billboard FF-3 that was removed by CPC out of concern for saturation and public safety; PLUM reduced the CPC recommended distance of 2,640 feet to 1,500 feet between billboards on the same side of the freeway. This will set a negative precedent for all future signs, especially in the downtown area; PLUM expanded the hours of operation for freeway facing signs; PLUM reduced the number of existing static billboards to be removed prior to installation of new digital billboards from 125 to 50 initial removals + 4 signs after that (these numbers don't add up to the required 200 sign removals); PLUM lowered the minimum takedown square footage per sign from 300 square feet (minimum billboard size) to 200 square feet (poster board size); PLUM opened the door to extend the digital billboard program to a 30-year contract instead of the CPC recommended 20-year contact. I agree with Coalition for a Beautiful Los Angeles that the placement of offsite commercial advertising on Metro-owned and controlled property in partnership with the City subjects users of public spaces to unwanted sales pitches for goods and services and is antithetical to the idea that citizens should have public spaces/visual environment free of crass commercialization. Please send the Ordinances back to the City Planning Commission for reconsideration. Thank you.

Communication from Public

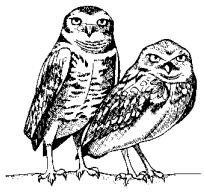
Name:
Date Submitted: 12/07/2023 07:11 PM
Council File No: 22-0392
Comments for Public Posting: No more electronic billboards in Los Angeles. Keep them downtown on Figueroa.

Communication from Public

Name: Ann Dorsey
Date Submitted: 12/07/2023 07:35 PM
Council File No: 22-0392
Comments for Public Posting: I strongly oppose the Metro TCN digital billboard advertising Program because of the impacts to housing, safety, historic-cultural, scenic, coastal, environmental and sensitive use resources. I ask the City Council to send the Metro TCN Program Ordinances back to the City Planning Commission for reconsideration per City Charter Sections 555 and 558, following substantive changes adopted by several motions introduced by Council Districts 1, 2, 5, 12, and 13. These changes include: PLUM restored freeway facing billboard FF-3 that was removed by CPC out of concern for saturation and public safety; PLUM reduced the CPC recommended distance of 2,640 feet to 1,500 feet between billboards on the same side of the freeway. This will set a negative precedent for all future signs, especially in the downtown area; PLUM expanded the hours of operation for freeway facing signs; PLUM reduced the number of existing static billboards to be removed prior to installation of new digital billboards from 125 to 50 initial removals + 4 signs after that (these numbers don't add up to the required 200 sign removals); PLUM lowered the minimum takedown square footage per sign from 300 square feet (minimum billboard size) to 200 square feet (poster board size); PLUM opened the door to extend the digital billboard program to a 30-year contract instead of the CPC recommended 20-year contact. I agree with Coalition for a Beautiful Los Angeles that the placement of offsite commercial advertising on Metro-owned and controlled property in partnership with the City subjects users of public spaces to unwanted sales pitches for goods and services and is antithetical to the idea that citizens should have public spaces/visual environment free of crass commercialization. Please send the Ordinances back to the City Planning Commission for reconsideration. Thank you,

Communication from Public

Name:	Dr. Travis Longore
Date Submitted:	12/07/2023 07:52 PM
Council File No:	22-0392
Comments for Public Posting:	Please see attached.



Land Protection Partners

P.O. Box 24020, Los Angeles, CA 90024-0020
Telephone: (310) 247-9719

December 7, 2023

Los Angeles City Council
City of Los Angeles
200 N. Spring Street
Los Angeles, California 90012

Re: CF 22-0392 Digital Off-Site Signs / Outdoor Advertising / Transportation Communication Network Program Structures / Los Angeles County Metropolitan Transportation Authority (MTA)

Dear President Krekorian and Councilmembers:

Please consider the following information when deliberating Metro's Transportation Communication Network (TCN), which consists of digital billboards, primarily for advertising, that would be installed throughout the City of Los Angeles. I have previously communicated with your Planning Department about the technical deficiencies in the proposed ordinance — the measures included to reduce the impacts of light pollution are vague, unenforceable, and ineffective and are discussed first — that I have updated and presented first in this letter. Then I present information about the adverse impacts of light at night on wildlife, which the environmental documentation for the project fails to consider at all, along with discussion of the human health impacts of exposure to excessive light at night. These comments build on my expertise as a researcher in this field and I have attached a bibliography of my own research publications on this topic to establish my credentials as an expert. Furthermore, I am a member of the Outdoor Nighttime Environment Committee of the Illuminating Engineering Society (IES) and have participated in drafting two Recommended Practices, including RP-39-19, the Recommended Practice for Off-Roadway Sign Luminance.

Problems with the Ordinance Language

First, the safety issues with digital billboards are well known and start with driver attention and alertness. The Illuminating Engineering Society Recommended Practice for Off-Roadway Sign Luminance (RP-39-19) states that the duration of a visible message on a sign should be no shorter duration than 20 seconds and that it should contain no video or rapidly flashing graphical units (Illuminating Engineering Society [IES] 2019). The City proposes to allow 8 second duration with 7 out of 8 images being advertisements. The least that can be done for traffic safety is to lengthen that refresh rate to the adopted IES standard of 20 seconds. Digital signs are distracting to drivers because that is their purpose as advertising. This fact was considered by the IES committee and resulted in the adopted standard of 20 seconds.

Second, the regulation on the brightness of the sign is drafted as follow:

> All illuminated Digital Display Signs shall have a brightness or light intensity limitations of 0.3 foot candles above ambient lighting measured from the property line of the nearest residentially zoned parcel.

As written, this can neither be measured nor enforced. And if one makes some assumptions about how it might be measured, then it is too high a standard. Foot-candles are a measurement of illumination, not brightness. Illumination is the light falling on a surface as an amount of light per area on the receiving surface. Brightness is the perception of luminance and indicates the intensity of light emerging from the light source. If the regulations are to address illumination, they would need to define upon what plane the illumination will be measured. The term "ambient" has no agreed-upon technical definition and therefore could not be enforced. There is absolutely no reason for the measurement to be at the "property boundary" if the intent is to control the illumination in a standard manner. It should be measured at a plane parallel to the sign face, or at all planes facing the billboard face at a standard distance from the sign. But as written, this provision is useless. Furthermore, 0.3 foot-candles is very bright — 30 times brighter than the full moon (Kyba et al. 2017). If this regulation is meant to prevent off-site impacts in an urban area, the limit should be more like 0.01 foot-candles.

Third, the regulations attempt to protect sensitive receptors with the following language:

> All illuminated Digital Display Signs shall be designed, located and screened so as to minimize light travel onto the exterior walls and windows for residential and commercial buildings, including those on the same site as the Digital Display Sign. If Digital Display Signs are to be externally lit, the source of the external illumination shall be shielded from public view at nearby residential uses.

Residential uses are not the only sensitive receptors. Standards should be adopted to protect parks, open space, and undeveloped land of all sorts where wildlife might be present. Furthermore, given the extreme amount of light produced by digital display signs, a regulation that only addresses direct glare will be ineffective. The reflected and scattered light will be extraordinarily bright in clear conditions and even brighter when low clouds and fog are present.

It is a matter of basic physics that light is scattered by aerosols in the air. These can be dust, pollen, or droplets of water. The ordinance and associated environmental documentation fail to account for the scattering of light from fog and clouds or other aerosols that will take place with light emitting from the digital display signs, or the exacerbating effect of fog and clouds on the light that is reflected from nearby surfaces. Fog is extremely efficient at reflecting light and recent research has shown that foggy conditions result in a sixfold increase in night sky brightness (a measure of light pollution) (Ścięžor et al. 2012). In my professional opinion, this measure will be ineffective at reducing the disturbance to people from light far exceeding the baseline conditions and does not serve as an effective mitigation measure for adverse impacts on plants and wildlife.

Fourth, the draft regulations set the following standard for brightness (luminance).

> All illuminated Digital Display Signs shall have a nighttime brightness no greater than 300 candelas per square meter and a daytime brightness no greater than 6000 candelas per square meter.

As shown in RP-39-19, the relevant national guidance document, sign brightness should correspond to the Lighting Zone for each sign. Lighting Zones should be defined already by the City under the California Energy Code. Signs in lower Lighting Zones should not be allowed to be the same brightness as ones in higher Lighting Zones. The proposed standard of 300 candelas per square meter are far higher than for any Lighting Zone in RP-39-19. Some of the TCN locations are in what should be Lighting Zone 2 (light commercial, high-density or mixed-use residential) where RP-39-19 sets a maximum luminance of 40 candela per square meter. Some may be in Lighting Zone 3 (business districts of a large city) where 80 candela per square meter are allowed. The regulations should be amended to reduce brightness based on Lighting Zones defined by the State of California and maximum luminance reduced to reflect the limits defined in RP-39-19. Otherwise, these signs are going to be the largest light pollution sources in entire neighborhoods of the City.

Fifth, the draft regulations attempt to limit the distribution of light as follows:

> "All light emitting diodes (LEDs) used within any illuminated Digital Display Sign shall have a maximum horizontal beam spread of 165 degrees. The maximum peak light output of any Digital Display Sign shall be at or below horizontal."

By allowing "peak" light output of any sign to be at the horizontal plane, it allows for substantial upward emissions. There is no reason that these signs should not be full cut-off, with no light emitted above 85 degrees above the ground. This means the signs would not be visible to passing airplanes and birds and would not create significant long-distance glare at distances far beyond where they would be legible. It would be a light pollution catastrophe not to eliminate upward emissions, and it would run directly counter to both the hard work done by the Bureau of Street Lighting to control upward emissions and the objective articulated by the Citywide Biodiversity Program to control light pollution. The City of Los Angeles Biodiversity Program recommends limiting maximum light output per acre in commercial and industrial areas to 100,000 lumens and to 5,500 lumens per acre in low density residential areas (see https://www.lacitysan.org/san/sandocview?docname=cnt076756 on the City's website, page 59). By my calculations based on the details specified in the environmental review, each billboard would produce on the order of 150,000 lumens — the entire lumen budget of 1.5 acres of a commercial area. It is beyond hypocritical for the City to attempt to reduce light pollution on the one hand, and then to write regulations that promote light pollution (the TCN district itself) on the other.

Adverse Impacts of Light Pollution on Biological Resources

The analysis of impacts on biological resources depends on understanding and describing the difference between illuminance and luminance (also known as irradiance and radiance when

measured in units not weighted to human vision). Although broadly related, it is possible for a project to cause significant new radiance sources in the nighttime visual environment (including through reflected light) even as irradiance around the property may or may not be elevated substantially. The environmental documentation for the project does not adequately describe either the luminance from the signs or the illuminance that would be experienced by sensitive receptors, including plants and wildlife, as a result of the signs.

Illuminance refers to the amount of light falling on a surface where something of interest is going on. It influences the visibility of items in the environment as well as the circadian (daily) rhythms of species. So, for example, small mammals respond to illumination in their foraging activities (Clarke 1983, Brillhart and Kaufman 1991, Vasquez 1994, Falkenberg and Clarke 1998, Kramer and Birney 2001, Prugh and Brashares 2010). It generally influences predator-prey relationships, including at levels of <0.01 foot-candle, far below the threshold of 0.3 foot-candle used in the Ordinance to attempt to protect people (but not wildlife) from adverse impacts of light pollution (Kotler 1984, Simons et al. 2022).

Birds would be affected by increased ambient illumination at levels produced by adding ~100,000–150,000 lumens at the sign locations. Species can forage at artificial lights (Goertz et al. 1980, Sick and Teixeira 1981, Frey 1993, Rohweder and Baverstock 1996) and experience significant changes in their morning singing times, especially since the lights will be turned on at 6 A.M. (Derrickson 1988, Miller 2006, Kempenaers et al. 2010b, Longcore 2010). Those birds that sing earliest are responding to increases in illumination so faint that they are undetectable by humans (Thomas et al. 2002), and well below the thresholds for any analysis in the environmental documentation.

Luminance refers to the brightness of the lights themselves, even as visible from a distance and even if they only negligibly increase *illuminance*. Merely seeing lights at a distance can influence the wayfinding and habitat use of an animal (Beier 1995, Barrientos et al. 2023). The proposed signs would create large luminance sources on the landscape that would be visible to migratory species (from the air) and by animals as they navigate in their habitats within the City. The environmental analysis does not consider such effects.

Attraction of insects to light at night

Insects are attracted to light because they perceive the luminance of the light and adjust their behavior in response. Many families of insects are attracted to lights, including moths, lacewings, beetles, bugs, caddisflies, crane flies, midges, hoverflies, wasps, and bush crickets (Šustek 1999, Kolligs 2000, Eisenbeis 2006, Longcore et al. 2015, Owens et al. 2020, Deichmann et al. 2021). Insects attracted to lights are subject to increased predation from a variety of predators including bats, birds, skunks, toads, and spiders (Blake et al. 1994, Frank 2006). Digital billboards are full-spectrum displays and have a high proportion of blue light output and consequently a high correlated color temperature (CCT). For that reason, they can be expected to be far more attractive to insects than low CCT light sources (Eisenbeis and Eick 2011, Hauptfleisch and Dalton 2015, Longcore et al. 2015, Donners et al. 2018, Longcore et al. 2018, Deichmann et al. 2021). Some studies have shown inconclusive results with respect to CCT (Pawson and Bader 2014, Haddock et al. 2019), but mechanistic assessments (Donners et al. 2018), studies in light-naïve environments with high insect diversity (Deichmann et al. 2021), and assessments of invertebrate visual systems (Longcore 2023) strongly suggest that light with

high blue content, such as the LEDs used in a digital billboard, will be highly attractive to insects.

Attraction of migratory birds at night

During a 2022 playoff game at Dodger Stadium between the San Diego Padres and the Los Angeles Dodgers, a Lesser White-fronted Goose entered the stadium and attempted a landing on the field. To light pollution experts, this was easily recognized as a case of a nocturnally migrating species being attracted to and disoriented by lights at night (Longcore 2022). The phenomenon of migratory birds being attracted to lights at night is well known and studied, in contexts ranging from communication towers to ceilometers to tall buildings and cruise ships (Gauthreaux and Belser 2006, Longcore et al. 2008, Bocetti 2011, Longcore et al. 2012, 2013, Van Doren et al. 2017, Horton et al. 2019, Van Doren et al. 2021, Burt et al. 2023, Horton et al. 2023). The environmental analysis for the TCN has not considered the interference with movement of native migratory species represented by the introduction of a large, highly visible light source in an area traversed by millions of birds each year. Recently developed tools using weather radar estimate that 22 million birds traversed Los Angeles County during the spring 2023 migration, with close to 200,000 at peak times (see https://dashboard.birdcast.info/region/US-CA-037?night=2023-05-17). These birds include many sensitive species that traverse the region during their migratory flights. The impacts of attraction of birds to urban lights include mortality as the birds then are exposed to predators and glass windows. The TCN and its enabling ordinance do not even limit upward emissions from digital displays, but rather allow upward radiance to be emitted, which will attract migratory birds, as documented in many recent studies (La Sorte et al. 2017, Van Doren et al. 2017, McLaren et al. 2018, Burt et al. 2023, Horton et al. 2023). Such adverse impacts must be disclosed and mitigated as part of CEQA review, but they have not been.

Adverse impacts on bat species

Bats, including sensitive species, occur throughout the City of Los Angeles (Remington and Cooper 2014, Remington 2016). Bats are known to be sensitive to lighting impacts (see Voigt et al. 2018) and lighting affects bats in complex ways (Rydell 2006). The environmental review for the TCN has done an inadequate job at describing the intersection of bat species ranges and TCN project elements and in disclosing and mitigating the potential adverse impacts. Some faster-flying and more maneuverable bat species will be attracted to the digital billboards, where they would forage on insects also attracted to the light. Slower and less maneuverable species would avoid lights, essentially being repulsed by their presence (Stone et al. 2009, Stone et al. 2012, Stone et al. 2015). Part-night lighting, where a light source is shut off after a curfew, is an improvement over whole-night lighting for bats, but not adequate to reduce all impacts (Azam et al. 2015, Day et al. 2015).

Lighting may affect roost sites for bats, which is also not adequately considered and analyzed by the project environmental documentation. If ambient illumination were to be increased at a roost site, it would cause adverse effects. One such adverse impact could be a delay in the onset of foraging time resulting from illumination near roosts, which has been shown for several species of bats (Boldogh et al. 2007, Stone et al. 2009).

Impacts on diurnal species

Artificial night lighting affects diurnal species substantially. As noted above, it affects timing of dawn and dusk song, seasonality of reproduction, mate choices, and can extend activities of diurnal species into the night (Stracey et al. 2014). This is true for impacts across species, where diurnal species are affected in numerous ways by an altered nighttime environment (Miller 2006, Kempenaers et al. 2010a, Titulaer et al. 2012, Dominoni et al. 2013a, Dominoni et al. 2013b, Da Silva et al. 2014, Dominoni et al. 2014, Zhang et al. 2014, Da Silva et al. 2015). The interruption of circadian signals causes significant impacts on the physiology and behaviors of other species.

Adverse Impacts of Light Pollution on Human Health

The mechanism by which light affects human circadian rhythms was only discovered in the past 20 years (Berson et al. 2002). The human eye has non-image-forming retinal ganglion cells that detect light and perhaps contribute to perception of brightness but not to discerning objects (Hattar et al. 2002). The pigment that detects the light is called melanopsin and it differs in its sensitivity to light from the rods and cones that humans use for vision (Brainard et al. 2001, Schmidt and Kofuji 2009).

Evidence is strong that chronic exposure to light at night increases risk of cancer, diabetes, obesity, and heart disease (Fonken and Nelson 2014, Bedrosian et al. 2016, Lunn et al. 2017). The question for human circadian impacts from outdoor lighting is whether the exposures are bright enough and whether time of exposure is sufficient to affect circadian rhythms.

Circadian rhythms can be affected by light in many pathways. The first pathway is suppression of melatonin through exposure in the evening, especially after dusk. This exposure could be indoors or outdoors, either in the sleeping habitat or not. Dose-response curves for light exposure and melatonin suppression have been developed and are the basis for the definition of Circadian Light (Rea et al. 2010). The second pathway is through sleep disruption through exposure to light in the sleeping habitat, even if the light levels are insufficient to suppress melatonin. Lack of sleep and reduced long wave sleep, which is critical to recovery and repair (Cho et al. 2016), can result from disturbance glare such as that caused by a changing digital billboard, as anyone ever awakened by moonlight can attest.

A set of studies from Haim, Kloog, Portnov, and colleagues provided correlational data connecting satellite-measured light at night to breast and prostate cancer, indicating a connection between outdoor lighting levels and rates of these cancers (Kloog et al. 2008, Kloog et al. 2009a, Kloog et al. 2009b, Kloog et al. 2010, Kloog et al. 2011, Haim and Portnov 2013). Similar studies have reinforced these findings in different populations around the world (Bauer et al. 2013, Hurley et al. 2014, James et al. 2017). Studies investigating sleep as the outcome also find an association with satellite-measured outdoor lighting (Koo et al. 2016, Ohayon and Milesi 2016) and an influence on use of insomnia drugs (Min and Min 2018). National-level investigations in the United States show that light at night impacts sleep duration (Xiao et al. 2020). Probability of reporting short or very short sleep increased from lowest to highest quintiles of light at night in models that adjusted for age, race, marital status, state of residency,

smoking, alcohol, vigorous physical activity, TV viewing at the individual level, and median home value, population density and poverty rate at census tract level (Xiao et al. 2020).

Experiments that involve exposures to light at night document illumination levels that affect health and sleep outcomes. Sleeping under 5 lux of 5779 K light caused more frequent arousals, more shallow sleep, and more REM sleep (at the expense of long wave deep sleep) (Cho et al. 2016). Light greater than 3 lux during the last hour of sleep was associated with weight gain in an elderly population (Obayashi et al. 2016). In another study of an elderly population, increased light at night and especially light at night > 5 lux was associated with 89% increased risk of depression (Obayashi et al. 2013). Further studies indicate that elevated illumination is associated with higher blood pressure as well, with associated excess deaths, at 3, 5, and 10 lux exposures (Obayashi et al. 2014). Metrics of sleep quality (efficiency) were also consistently lower with higher illumination at each category (3, 5, and 10 lux) (Obayashi et al. 2014). Taken together, this research is consistent with a few different interpretations of the influence of outdoor lighting on human circadian rhythms and health outcomes. It is possible that the correlations between light at night and adverse health outcomes indicate variation in another factor, such as air pollution, as suggested by Huss et al. (2019) but this has not been supported by subsequent research in California (Zhong et al. 2021) and the robustness of sleep disruption correlations when controlling for population density argues against that interpretation (Ohayon and Milesi 2016).

All this research points to exposure to light at night being an environmental justice issue (Xiao et al. 2023), as poor and vulnerable communities are subjected to more light at night with associated adverse health consequences (Nadybal et al. 2020). The TCN would exacerbate this environmental injustice, introducing more light at night to areas already disproportionately impacted by environmental hazards by virtue of proximity to freeways and major boulevards. The truth is that no community should be exposed to the circadian disruption caused by constantly cycling digital billboards and the proposed mitigation measures (shielding) do not address the root cause (brightness) or consider that light reflects and scatters in the environment.

Conclusion

The TCN project, in my expert opinion, will have significant adverse impacts on the environment through its contribution to local and regional light pollution. Information regarding such impacts would have been easy for the City or its experts to locate and incorporate but for whatever reason they did not. I have adapted much of the reviews in the second two sections of this letter from previously prepared and publicly available documents by Land Protection Partners, some of which have already been before the City, its Planning Commission, and City Council. I also offered my expertise to the Department of City Planning *pro bono* as it developed the Ordinance so that they might properly consider these impacts and devise a project that avoided or mitigated them. Despite the ready availability of both written resoruces and an offer of free expert assistance, I can only conclude that the City so far is intentionally pursuing a policy that would have substantial adverse impacts on the environment. I urge the City Council to now take a pause to properly consider the substantial evidence regarding the adverse impacts of the program on the environment before proceeding.

This letter has been prepared *pro bono* in support of better environmental review and decisionmaking on this important issue.

Sincerely,

Travis Longcore, Ph.D.
Principal

attachment

About the Author

Travis Longcore is a principal of Land Protection Partners. Dr. Longcore is Adjunct Professor in the Institute of the Environment and Sustainability at UCLA. He has taught, among other courses, Bioresource Management, Environmental Impact Analysis, Field Ecology, and Ecological Factors in Design. He was graduated *summa cum laude* from the University of Delaware with an Honors B.A. in Geography, holds an M.A. and a Ph.D. in Geography from UCLA, and is professionally certified as a Senior Ecologist by the Ecological Society of America and as a GIS Professional by the Geographic Information System Certification Institute. He is a 24-year member of the Los Angeles County Environmental Review Board and recently received the Galileo Award for outstanding academic work on light pollution over a multi-year period. Longcore has authored or co-authored over 70 scientific papers in top peer-reviewed journals such as *Auk, Biological Conservation*, *Conservation Biology*, *Environmental Management*, *Frontiers in Ecology and the Environment*, *Trends in Evolution and Ecology*, and *Urban Forestry and Urban Greening*. Longcore has provided scientific review of environmental compliance documents and analysis of complex environmental issues for local, regional, and national clients for 25 years.

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Guidelines for consideration of bats in lighting projects

C.C. Voigt • C. Azam • J. Dekker • J. Ferguson • M. Fritze
S. Gazaryan • F. Hölker • G. Jones • N. Leader • D. Lewanzik
H.J.G.A. Limpens • F. Mathews • J. Rydell • H. Schofield
K. Spoelstra • M. Zagmajster

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EUROBATS Secretariat
UN Environment
United Nations Campus
Platz der Vereinten Nationen 1
53113 Bonn, Germany
Tel (+49) 228 815 2421
Fax (+49) 228 815 2445
E-mail eurobats@eurobats.org
Web www.eurobats.org

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Contents

Foreword

Life on Earth has evolved over billions of years under cycles of natural light and darkness that vary diurnally and annually. Artificial light at night (ALAN), and sometimes also at daytime, can cause deviations from these natural patterns of darkness and may thus interfere with natural physiological and ecological rhythms (Longcore & Rich 2004, Hölker *et al.* 2010a, Gaston *et al.* 2013, 2015). In mammals, physiological features such as sleep, food digestion, immune response and body temperature are tightly adjusted to the diurnal light cycle (Arendt 1998). ALAN may disrupt these physiological processes and may further interfere with orientation and navigation, with severe consequences for individual behaviour, local animal populations and whole ecosystems (Rich & Longcore 2006; Gaston *et al.* 2015).

Among vertebrates, bats are almost exclusively nocturnal and extremely sensitive to ALAN, (Hölker *et al.* 2010a, Speakman 1995, Voigt & Lewanzik 2011, Bennie *et al.* 2014a). The information we have on the impact of ALAN on bats is gradually expanding, and helps us formulate management recommendations to mitigate the impact of old and new lighting schemes. The information currently available is a combination of scientific studies, case-reports, and the extensive experience of bat workers. An integration of this information forms the basis of these EUROBATS guidelines. However, it is important to measure the degree of success of the mitigation strategies described in this document, and determine whether they achieve local and landscape-scale benefits for bats. Further, it is important to investigate how these measures can be improved. In addition, quantitative assessments of the effectiveness of mitigation – vital to refine and improve strategies for the future – can only be achieved if structured data are collated from multiple sites.

In these guidelines, we tried to compile available evidence related to the effect of ALAN on bats, a field of research that is very dynamic. Using the current state of knowledge, solutions are formulated on how to avoid, mitigate or compensate the adverse effects which ALAN has on bats in their network of functional habitats, consisting of roosts (maternity, summer, transient, feeding, mating and/or hibernation), ***commuting routes*** and ***migratory*** corridors, ***foraging areas*** and ***swarming sites*** (hereafter, terms highlighted in bold and italics are included in the Glossary).

1 Introduction

All European bat species are protected by several international and European binding treaties, (*e.g.* by the ***EU Habitats Directive***). The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention) aims to conserve terrestrial, aquatic and avian migratory species throughout their range. It is an intergovernmental treaty concluded under the aegis of the United Nations Environment Programme (UNEP). Migratory species threatened with extinction are listed in the Appendix I to the Convention whereas migratory species that need or would significantly benefit from international co-operation (including all European bat species) are listed in the Appendix II. The Agreement on the Conservation of Populations of European Bats (EUROBATS) was set up under the Bonn Convention and aims to protect all European bat populations through legislation, education, conservation measures and international co-operation. According to the fundamental obligations, each EUROBATS Party shall identify important roosting sites and ***feeding areas*** for bats and protect such sites and areas from damage or disturbance such as ALAN.

The Habitats Directive requires that Member States do more than simply prevent the further decline of populations of the listed species. For the priority bat species, included in Annex II, they must also undertake positive conservation measures to ensure that populations are maintained and restored to a favourable conservation status throughout their natural range within the EU. Consequently, responsible authorities in all European countries shall ensure that bat populations are protected also from disturbance caused by light pollution.

A nocturnal lifestyle is inherent to all bats. They usually hide in roosts during the daytime, while fly to ***feeding areas*** or drinking sites using ***commuting routes*** during the night. On the annual scale, bats of the temperate zone aggregate in late summer and autumn for ***swarming*** and later spend the winter in hibernacula. Many bat species move between different roosts and habitats, whereas other perform long-distance ***migrations*** between reproduction and hibernation areas in different parts of Europe (Hutterer *et al.* 2005). In all situations, ALAN may significantly change their natural behaviour (Stone *et al.* 2015a; Rowse *et al.* 2016). A hypothetical case is presented in Figure 1.1. Overlap of illuminated patches with ***foraging areas*** and ***commuting routes*** results in a potential conflict between ALAN and bat conservation. *Plecotus auritus* would stop to use the lit side of the church for emergence; illuminated patches may disrupt flight paths of the bats and affect their foraging areas: tree lines and shores (*Pipistrellus pipistrellus* and *Plecotus auritus*) and waterbodies (*Myotis daubentonii*).

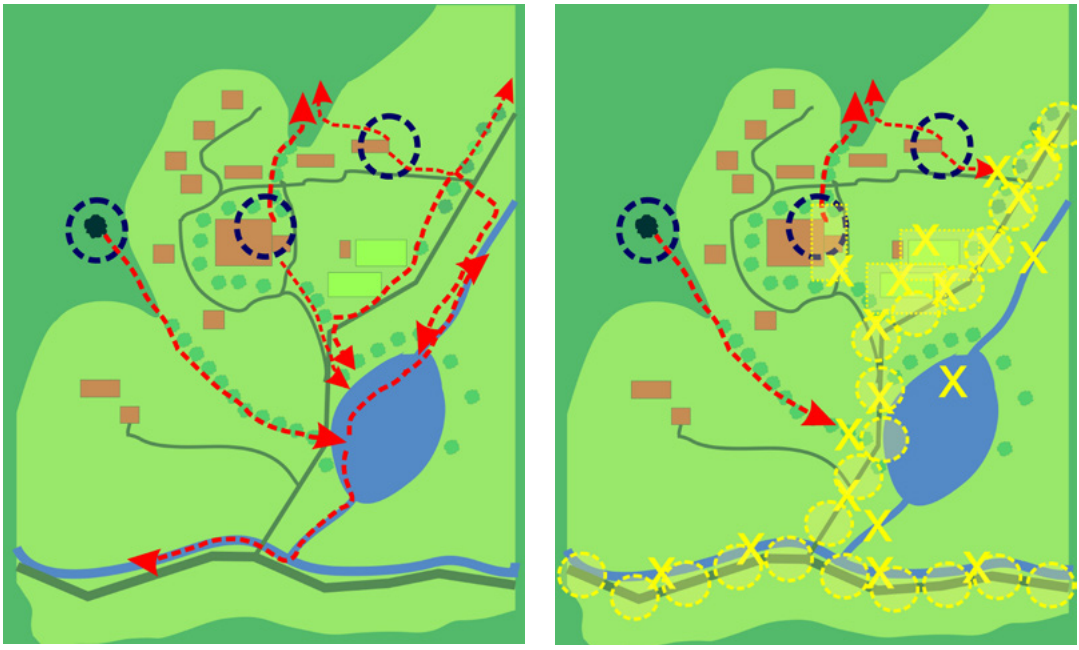

Figure 1.1. Schematic network of roosts, commuting routes and foraging areas of 3 bat species in a situation without ALAN (left picture) and with ALAN (right picture). Red rectangles denote buildings in a village, surrounded by forest (dark green); green circles – individual trees; blue areas – water bodies; grey lines – roads; green rectangles – stadiums. Roosts are encircled by dark blue dashed lines: M. daubentonii *roosting in a tree in the forest, long-eared bats roosting in the church attic (large red rectangle in the village centre) and* P. pipistrellus *roosting in a house. Commuting and foraging areas – red dashed lines with arrows. Illuminated areas are surrounded by yellow dashed lines. Crosses indicate places where the movement through the landscape is blocked by ALAN or the habitat is no longer functional.*

Bats are naturally exposed only to very low lighting levels produced by moonlight, starlight and low intensity twilight (Fig. 1.2). There are rare exceptions of daylight flight activity, such as in *Nyctalus azoreum,* a noctule species from the Azores (Speakman 1995), and in bats at northern latitudes that forage in daylight when nights are shortest (Speakman *et al.* 2000). In general, bat eyes are specialised for low light levels (Shen *et al.* 2010). Light levels as low as typical full moon levels, *i.e.* around 0.1 lx, are known to alter the flight activity of bats. It is important to note that the unit **lux** (symbol lx) is defined according to human spectral sensitivity and determining its relevance for animals with different spectral sensitivities can be problematic. We refer to this unit below, since it may facilitate interdisciplinary communication between biologists, the lighting community and developers.

Any level of artificial light above that of moonlight masks the natural rhythms of lunar sky brightness and, thus, can disrupt patterns of foraging and mating and might, for instance, interfere with entrainment of the circadian system (Fig. 1.3 and 1.4). In

Figure 1.2. Two Plecotus auritus *with rising full moon in the background (© J. Rydell).*

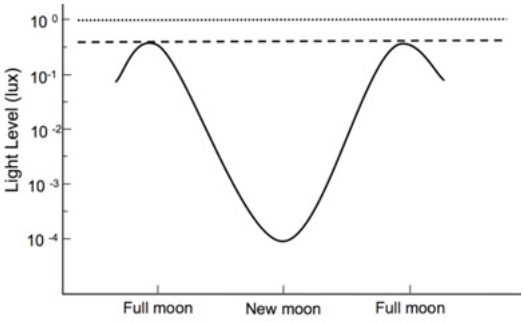

Figure 1.3. Skyglow can mask natural rhythms of lunar sky brightness. The solid line depicts full moon light levels in a temperate habitat without light pollution. The dashed and dotted lines indicate skyglow light levels under clear and cloudy skies respectively, as measured in the centre of Berlin. Figure from Perkin et al. (2011).

Figure 1.4. Skyglow outshining stars and the Milky Way in Cazorla City, Spain (© Jens Rydell).

the lab, even ***illuminance*** as low as 10^{-5} lx was sufficient for the entrainment of circadian rhythm of the Pallas's Mastiff Bat (*Molossus molossus*), the lowest threshold value observed for photic entrainment in vertebrates (Erkert 2004). Consequently, ALAN that may affect bats negatively can be of very low intensity: some bat species are repelled by very low light levels of only 4.5 lx (Lewanzik & Voigt 2016), 3.6 lx (Stone *et al.* 2012), 3.2 lx (Kuijper *et al.* 2008) and 1.9 lx (Lacoeuilhe *et al.* 2014). In comparison, those levels are all lower than the ***illuminance*** level of residential side streets, which is on average about 5 lx at street level, but which often is higher than this (Gaston *et al.* 2012, Azam *et al.* 2015).

Bats possess colour vision (Müller & Peichl 2005), including the ability to perceive UV (Winter *et al.* 2003, Müller *et al.* 2009, Gorresen *et al.* 2015), though UV sensitivity has been lost in some species, including horseshoe bats (Zhao *et al.* 2009). The general sensitivity of bats to light is obvious. Some species adjust their activity in response to the lunar cycle (*e.g.* lunar phobia), a response that is especially pronounced in species that forage over water and in the forest canopy, and live in tropical areas (Saldaña-Vázquez & Munguía-Rosas 2013; Roeleke *et al.* 2018). Polarised light at sunset seems to be important for orientation, *e.g.* for calibrating the magnetic compass of some bats (Greif *et al.* 2014). However, migratory species may represent an exception (Lindecke *et al.* 2015). Bats may also obtain cues from city lights for

homing (Tsoar *et al.* 2011) and possess the visual acuity to use information from stars for navigation (Childs & Buchler 1981, Eklöf *et al.* 2014). Bats may demonstrate reduced homing performance, if deprived of visual cues (Davis & Barbour, 1970). Thus, ALAN has the potential to seriously interfere with the vision and behaviour of bats.

ALAN is produced in a variety of ways, for example by street lights, illuminated buildings, lit advertisements, security and domestic lights, lights on vehicles, gas flares and stadiums (Kyba *et al.* 2015, Schoeman 2015; Fig. 1.5). An in-depth remote sensing study of Berlin showed that almost a third of the emitted light came from streets, with considerable amounts of light also originating from industrial areas (16%), public service areas (10%), block buildings (8%), city centre (6%), airfields (4%) and supply and disposal facilities (4%) (Kuechly *et al.* 2012). Direct lighting is affected by physical features of the atmosphere and terrain; it can also be scattered by atmospheric molecules or aerosols, especially under cloudy conditions (Aubé 2015, Kyba *et al.* 2015). Although the scattered artificial light (see ***skyglow***) is relatively dim and homogenous compared with point sources such as street lights, it is still bright compared to natural light sources, such as stars, and spreads over vast areas (Kyba & Hölker 2013, Falchi *et al.* 2016).

Figure 1.5. Artificial light at night from various sources such as streetlamps, illuminated buildings, lit advertisements, domestic lights, lights from vehicles, resulting in bright skyglow over Israel in the background. The image was captured from the West Bank, which is much darker and with less skyglow (© J. Rydell).

The spectral content of light can differ depending on the source (Fig. 1.6, Table 1.1), and many animals (including bats and insects) are able to perceive wavelengths beyond the range that humans can. For street lights, high-pressure mercury vapour (HPMV) lamps emit what humans recognize as blue-white light containing considerable amounts of UV. Low-pressure sodium (LPS) lamps emit monochromatic orange light, while high-pressure sodium (HPS) lamps emit a broader spectrum of mainly orange-yellow wavelengths. New technologies include light-emitting diodes (LEDs) and metal halide lamps. LEDs are available in 'warm white' and 'cold white' varieties, and typically do not emit UV. Metal halide lights emit UV, similar to HPMV lamps. Domestic lighting traditionally included many tungsten filament lamps that heat up to produce visible light (by incandescence). These lamps are being replaced by compact florescent lamps (that emit some UV), and especially by LEDs. The UV component of lamps seems to be especially important in determining how attractive lamps are to insects: lamps that emit UV attract more

insects (Eisenbeis & Eick 2011; Wakefield *et al.* 2016; 2018), and it has been shown that blue wavelengths attracted considerable more moths than lights of longer wavelengths (Verovnik *et al.* 2015). The dense concentrations of insects around these light sources may attract hunting bats of some species (*e.g.* Rydell 1991).

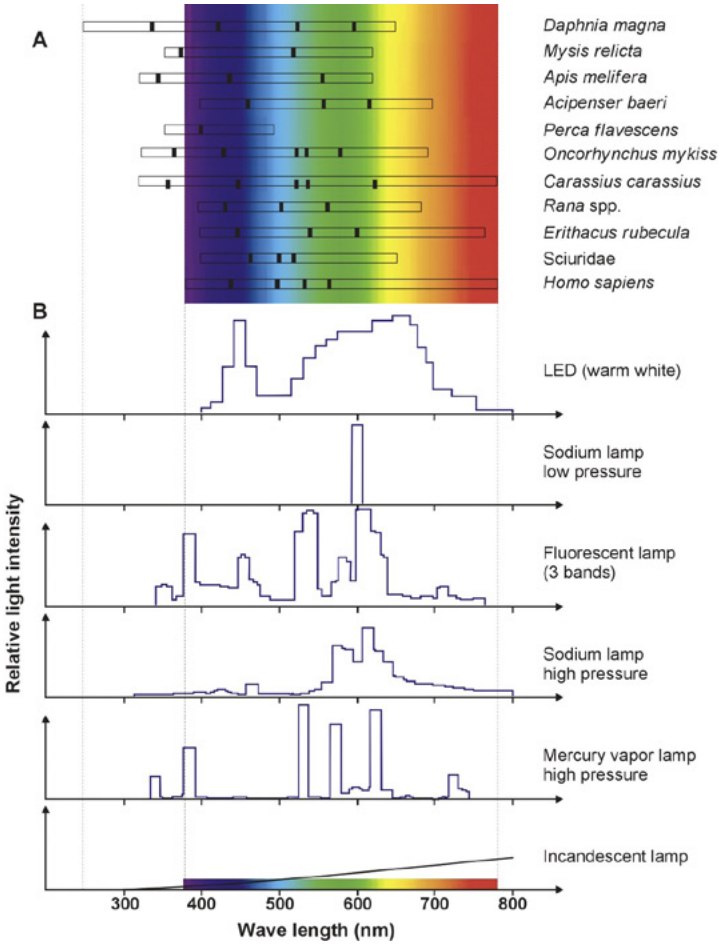

Figure 1.6. (A) The light sensitivities various animals displayed against a background of wavelengths that humans perceive as visible light. The dashed vertical lines cover the range of wavelengths, which the listed animals can perceive. Black marks in bars represent peak sensitivities of visual pigments for small crustaceans: Daphnia magna *and* Mysis relicta*; insect* Apis mellifera *(honeybee); fish* Acipenser baeri *(sturgeon),* Perca flavescens *(perch),* Onchorhychus mykiss *(trout) and* Carassius carassius *(carp); amphibians* Rana spp. *(frogs); bird* Erithacus rubecula *(robin) and mammals* Sciuridae *(squirrels) and* Homo sapience *(human). Figure (B) shows the wavelengths of light emitted from a range of artificial light sources. Some lamps emit light in the UV, and the spectral width varies among lamp types considerably. © Perkin et al. (2011).*

Spectrum	Types of lamps	% sales	Colour	UV	CCT	LE	CRI
Narrow	Low Pressure Sodium	37	Orange	0	1807	80-150	NA
Broad	High Pressure Sodium		Orange-yellow	+	2005-2108	45-110	22-80
Broad	High/low Pressure Mercury	27	White	++	2766-5193	25-52	22-43
Broad	Metal Halide	36	White	++	2874-4160	45-150	65-95
Broad	Light Emitting Diode	NA	White	0	1739-8357	160	>90

Table 1.1. Percentage of most common lamps sold in the EU from 2004 to 2007 (European Commission 2011) as well as their physical characteristics extracted from Gaston al. (2012) and from personal data of Georges Zissis. CCT refers to Correlated Colour Temperature (Kelvin); LE refers to Luminous Efficacy (lumens/W); CRI refers to Colour Rendering Index; NA – data are not available.

The growth of the human population and associated processes of urbanisation have resulted in further increases of ALAN at a rate of about 2–6% per year, resulting in ALAN being identified as an important threat to biodiversity (Hölker *et al.* 2010a; Kyba *et al.* 2017). Further, the switch to cost-effectiveness of LEDs has led to a so-called rebound effect, which describes the phenomenon that the increasing use of inexpensive LED outdoor lighting has further accelerated the spread of ALAN worldwide (Kyba *et al.* 2017).

Eighty percent of the world's population now lives under light polluted skies, and the Milky Way is no longer visible to more than a third of humanity (Falchi *et al.* 2016). The rate by which ALAN increases is faster than the rise in human population and economic growth (Hölker *et al.* 2010b). Although European directives have resulted in HPMV lamps being phased out, changes in and implementation of ALAN is unregulated across much of the EU, either generally, or specifically for bats.

Not only the amount of ALAN is increasing, the spectral content of light is changing too. In 2015, HPMV lamps were banned from new lighting installations in the EU in order to reduce costs and CO_2 emissions. In addition, street lighting is rapidly becoming whiter with many sodium lamps being replaced by LEDs, and to some extent by metal halide lamps both of which provide better colour rendition for humans. But, they still include light spectra (UV, blue light) with negative impacts on insects, bats main prey. There are potential benefits to these changes: new technology street lights are programmable from a central control centre, so their light intensity and timing of operation can be modified quickly and over large spatial scales.

In summary, the nightscape is changing as ALAN becomes more prevalent, and it also changes with technological advances that change lighting spectra. The effects of ALAN in general and of specific lighting schemes in particular on biodiversity, including bats, are currently poorly understood. Yet, it is agreed on by all specialists that bats, being nocturnal, are especially affected by ALAN. In the following chapter, we will summarize the state of knowledge with respect to how bats respond to ALAN.

2 Response of bats to artificial light at night

Early observations by *e.g.* Griffin (1958) and Roeder (1967) of bats chasing moths at street lights, which at that time usually were of the light-bulb type, suggests that bats coming near artificial lights to feed is as old as the use of such lights, *i.e.* approximately since the 1920´s. A first quantitative study on the impact of increased levels of natural light on bats was made by Nyholm (1965). He recorded that *Myotis daubentonii* and *M. mystacinus/M. brandtii* consistently avoided their preferred habitats, *i.e.* lakes and forest gaps, in response to the brightness of the Nordic midsummer nights. However, his observations did not include areas illuminated by artificial light, which were still few at that time, but highlighted the relevance of light for the overall activity and habitat use of bats. Soon naturalists and bat biologists observed differences in the way bat species responded to ALAN, and these behavioural differences were most often related to specific flight styles, *i.e.* fast-flying species were found to be more opportunistic to ALAN than slow-flying and hovering species. These differences were explained by the specific capability of species to avoid visually-oriented predators such as birds of prey (Rydell *et al.* 1996). Some bat species were also observed being attracted to ALAN because they feed on insects lured by the artificial light source (Rydell 1991). Following this attraction and avoidance scheme, bat species have been grouped into classes of species which are "sensitive to light" and those which are "tolerant to light" or even "attracted to light". However, Rowse *et al.* (2016a) recently suggested a reconsideration of this simplistic categorization. For a proper assessment of the impact of ALAN on bats in specific situations, several other factors must be considered.

Bats have evolved in darkness or dim light throughout their history and have become adapted to a nocturnal life over millions of years (Rydell & Speakman 1995; Voigt & Lewanzik 2011). Darkness is the principal protection against predation for bats in most situations. A comprehensive review of predation on bats at roosts and elsewhere was recently provided by Mikula *et al.* (2016). Bats are preyed on by various predators under many different conditions, both inside roosts and in flight. The activity patterns of bats and eventually their survival and reproduction rates are often constrained by predation (Speakman 1991). Emergence and foraging behaviour of individual bats are most likely governed by simple rules of optimality, such as the trade-off between the expected costs, including energetic costs of locomotion and predation risk, and the likely benefits of foraging such as energy intake. Yet, this relationship is far more complex, since it depends on various circumstances. First, the response of a bat

to ALAN depends on its nutritional status, which in turn is influenced by *e.g.* reproductive state, sex and age. According to a study on emergence time in three European species, bats emerge relatively early, and hence take higher risks, when being under nutritional stress due to persistent low ambient temperatures, during pregnancy, or when body reserves were low (Duvergé *et al.* 2000). Second, the responses to ALAN also depend on the specific location of bats and the specific motivation of bats for their presence in a habitat, *i.e.* the quality and functional relevance of a habitat. Third, natural or artificial light at any particular location may affect insect availability, as well as the presence of competitors and predators, and these factors influence the presence of bats (Rydell *et al.* 1996). Finally, wavelength, intensity and directionality of the light may be important as well (Mathews *et al.* 2015). In summary, the effect of ALAN on bats depends both on species and context (Fig. 2.1).

ALAN may make a location less attractive for one species, but more attractive for another, supposedly even resulting in competitive exclusion of some light-averse species (Arlettaz *et al.* 2000). On a larger scale, extensive use of ALAN along

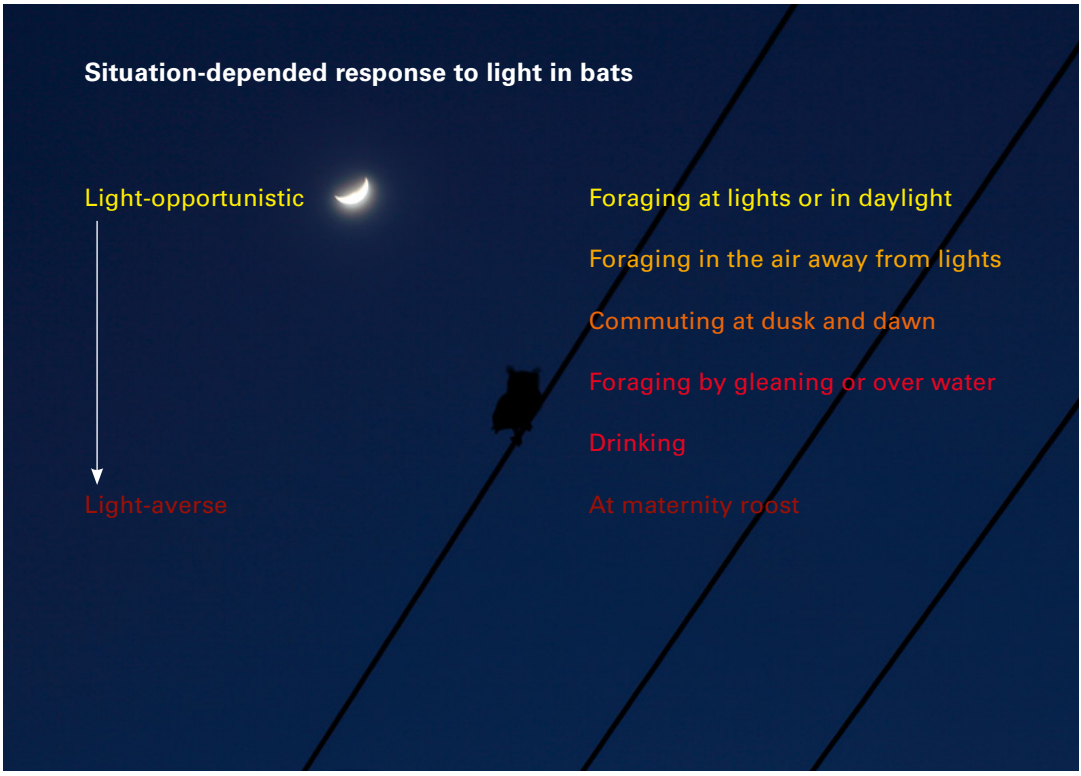

Figure 2.1. A hypothetical example illustrates the context-dependent response of opportunistic and light-averse bats. Note that a single species may display all responses and that these responses may vary seasonally because of factors such as reproduction, migration and hibernation (© J. Rydell).

with urbanisation in general may change bat species composition dramatically over large areas. Consequently, the relatively species-rich communities in unlit areas may be replaced by species-poor communities of opportunistic species that increase in abundance in relation to the intensity of ALAN, resulting in a simplification of the local bat fauna (*e.g.* Gaisler *et al.* 1998; Schoeman 2015; Russo & Ancilotto 2015; Lewanzik & Voigt 2016).

2.1 Impacts of ALAN on insects

European bats in general depend on insects for food and in order to understand the response of bats to ALAN, it is important to know how nocturnal insects respond to ALAN. Most nocturnal insects show phototaxis, that often involves considerable attraction towards and trapping of individuals at artificial light sources (Altermatt *et al.* 2009; Perkin *et al.* 2014; van Grunsven *et al.* 2014; Verovnik *et al.* 2015). Short wavelength emissions in the blue (< 490nm) and UV ranges (< 380nm) are responsible for this "flight-to-light" behaviour because most nocturnal insects have a peak of visual sensitivity in the UV, green and blue portion of the wavelengths spectrum (van Langevelde *et al.* 2011; Somers-Yeates *et al.* 2013; Pawson & Bader 2014). Hence, UV-emitting lamps such as HPMV, metal-halides and compact fluorescent lamps, attract significantly more insects than LED and HPS lamps, which emit less UV (Somers-Yeates *et al.* 2013; van Grunsven *et al.* 2014; Wakefield *et al.* 2016; 2018). Nevertheless, LED and HPS lamps have broad spectrum emissions including wavelengths in the blue range. Blue range has been shown to attract significantly more insects than yellow range light (Verovnik *et al.* 2015). In one study, both "cold" and "warm-white" LEDs attracted significantly more insects than HPS lamps (Pawson & Bader 2014). But, Eisenbeis (2013) found that LEDs attracted fewer insects than HPS and another study (Wakefield *et al.* 2018) reported no difference in the attraction of flying insects to LED and HPS lamps (though LEDs attracted more insect families).

The attraction effect of HPS lamps has been reported to work up to 23m from street lights for moths and 40m for aquatic insects (Perkin *et al.* 2014; Degen *et al.* 2016). Because the typical distance of municipal street lights for roads in the EU ranges between 20 and 45m, it is likely that moths crossing an urban road will be trapped in the zone of street light interference, which causes a further fragmentation of the night habitat, and may reduce landscape connectivity (Degen *et al.* 2016). Overall, ALAN appears to generate an accumulation of insect biomass in illuminated patches and may induce a depletion of insects in dark areas near street lights or other outdoor luminaries, a so called "vacuum cleaner effect of illumination" (Eisenbeis 2006, Verovnik *et al.* 2015). This shift in the spatial distribution of insects induced by ALAN likely triggers cascading impacts on their predators including bats, as it generates high quality foraging patches for opportunistic species, while decreasing the size and quality of dark areas for light-sensitive species (*e.g.* Manfrin *et al.* 2018).

The attraction effect of ALAN to insects likely causes massive mortality as individual insects can be killed directly by the

heat of lamps, or they may circle the light until exhaustion, or until being caught by predators (Eisenbeis 2006). In particular, natural as well as artificial light inhibits the evasive flight response of tympanate moths to bat echolocation calls, leading to an increase in the predation success of bats at *e.g.* street lights (Svensson & Rydell 1998; Svensson *et al.* 2003; Wakefield *et al.* 2015).

Additionally, ALAN probably reduces the reproduction success of exposed insect populations as it reduces sex pheromone production and inhibits mating in moths (van Geffen *et al.* 2015a, 2015b). These adverse impacts on moth reproduction occurred regardless of the wavelength spectrum of the lamp, suggesting a negative effect of ***illuminance*** on moth populations (van Geffen *et al.* 2015b). Furthermore, exposure of moth caterpillars to green and white lights probably decreases individual fitness by inducing a lower body mass of caterpillars and pupae and an advance in the date of pupation compared to conspecifics from red light and dark conditions (van Geffen *et al.* 2014).

Finally, many arthropods use celestial cues such as the moon, stars or skyline, for orientation (Dacke *et al.* 2013; Schultheiss *et al.* 2016). Hence, ALAN, including ***skyglow*** above cities, may negatively impact the dispersal movements of populations by masking natural lighting signals at night, with important implications for metapopulation dynamics and gene flow (Baguette *et al.* 2013; Kyba & Hölker 2013). Further, ALAN may also impact the fitness, mortality, and reproduction of insects which may ultimately induce long-term population declines in illuminated areas. Common macromoths in the UK have experienced major declines in recent decades (Conrad *et al.* 2006), and it has been hypothesized that urban areas and their associated ***skyglow*** may act as ecological sinks, depleting the surrounding landscapes of moth species (Bates *et al.* 2014). Thus, the widespread use of ALAN may induce a landscape-scale depletion of insect biomass, which in turn may negatively affect bat population trends by decreasing the amount of foraging resources (Azam *et al.* 2016).

Artificial lights may also inhibit the entire flight activity of nocturnal moths and other insects, because the conditions near the light source may simulate daylight or strong moonlight, both of which normally lead to inactivity in nocturnal moths (Williams 1936). If lit conditions persist continuously in an area, nocturnal insect activity may be expected to decline for this reason alone. In addition, bats prey upon such inactive moths sitting directly in the illuminated building walls (Verovnik *et al.* 2015).

The long-term impact of ALAN on insect populations is largely unknown, however, but recent evidence of dramatic declines in moths and other insects in Western Europe are quite alarming and suggest that the effect is already serious (Conrad *et al.* 2006; Hallman *et al.* 2017). Part of the observed decline can be linked to the increasing use of ALAN because larger moths and other phototactic insects are affected more seriously than others (*e.g.* diurnal or non-phototactic) insects (van Langevelde *et al.* 2018). Ecosystem services such as pollination provided by nocturnal insects are

disrupted seriously in lit areas but not in nearby unlit control areas (Macgregor *et al.* 2016) and may even have knock-on consequences for diurnal pollination interactions (Knop *et al.* 2017). In the long run, general decline in insect populations will obviously have negative effects on bats as well as on many other animals and perhaps on entire ecosystems.

2.2 Light averse and opportunistic bat species

Overall, European bats are all well adapted to nocturnal conditions, including a need for protective cover provided by darkness, and it can be expected that ALAN affects them in most situations (Rydell & Speakman 1995).

At the genus level, European bats can roughly be categorized according to the way they respond to ALAN (Table 2.1). This taxonomic simplification seems acceptable, because species of the same genus appear to show a similar response to ALAN, probably owing to similar wing morphology, habitat requirements and life history features. We distinguish between averse, neutral and opportunistic responses. An averse response means that the bat would normally avoid ALAN. A neutral response means that ALAN would not influence the spatial distribution and activity of a bat. An opportunistic response means that the bat turns towards locations with ALAN under certain conditions, for example for feeding, as the expected benefit due to higher insect density near artificial lights may outweigh the potentially increased predation risk. Such species may dominate at illuminated places. We avoid applying the terms "light-tolerant" or "light-exploiting" to bats, because they overlook the fact that the reaction of a species can be different, depending on multiple factors. Even species that readily forage on insect aggregations around street lights might avoid artificial light when commuting (Hale *et al.* 2015) or close to their roost (Downs *et al.* 2003).

Bats of some genera (*Nyctalus*, *Vespertilio*, *Miniopterus* and *Tadarida* spp.) typically feed and commute in the open space above vegetation and buildings and may only sometimes fly under or near street lights or floodlights. We have denoted these bats with n.a. (not applicable), although we acknowledge that they may still exploit insects attracted to ALAN by feeding above lit urban areas or illuminated infrastructure elements, *e.g.* at floodlights on airports, train stations and stadiums (*e.g.* Kronwitter 1988, Rydell 1992, Russo & Papadotou 2014). Hence, they may be considered as "opportunistic", like the pipistrelles and the species of the genus *Eptesicus*, although their behaviour usually is less obvious when observed from the ground. They usually fly at heights above the directly lit zone but within the area influenced by ***skyglow***. Information concerning response to ALAN during long distance ***migrations*** is available only for a few species of the genus *Pipistrellus* (Voigt *et al.* 2017), therefore we did not include migratory behaviour in Table 2.1. We consider maternity roosts, mating roosts and ***swarming*** sites as "roosts", but temporary night roosts used by single or only a few individuals are excluded, since there are no quantitative studies estimating the effect of ALAN at night roosts.

Genera	Daytime Roosts	Commuting	Foraging	Drinking	Hibernacula
Rousettus	Averse	Neutral	Neutral	Averse	Averse
Rhinopoma	Averse	DD	DD	Averse	Averse
Rhinolophus	Averse	Averse	Averse	Averse	Averse
Barbastella	Averse	Averse	Averse	Averse	Averse
Eptesicus	Averse	Averse	Opportunistic	Averse	Averse
Pipistrellus and *Hypsugo*	Averse	Neutral/ opportunistic	Opportunistic	Averse	Averse
Myotis	Averse	Averse	Averse	Averse	Averse
Plecotus	Averse	Averse	Averse	Averse	Averse
Vespertilio	Averse	DD	n.a./opportunistic	Averse	Averse
Nyctalus	Averse	DD	n.a./opportunistic	Averse	Averse
Miniopterus	Averse	DD	n.a./opportunistic	Averse	Averse
Tadarida	Averse	DD	n.a./opportunistic	Averse	Averse

Table 2.1. The likely taxon-specific response of bats to ALAN in relation to specific situations. The table is based on available literature and personal observations of the authors. Note that Nyctalus azoreum*, as well as* Eptesicus nilssonii *in the far north, may fly in broad daylight. N.a. = not applicable, DD = data deficient. Averse, neutral and opportunistic are defined in the text.*

2.3 Two illustrative cases of bat responses to ALAN

The complex response of bats to ALAN may be illustrated by the behaviour of two species that have been studied in detail, the notch-eared bat *Myotis emarginatus* and the northern bat *Eptesicus nilssonii*.

Although *M. emarginatus* belongs to the light-averse group, it occasionally forms maternity colonies in barns and attics that are sometimes brightly illuminated (Fig. 2.2). Nevertheless, when entrances to such maternity roosts are illuminated, notch-eared bats may emerge later than usual (Moermans 2000), which may reduce the total time available for foraging per night. This can lead to a slower growth of the young (Boldogh *et al.* 2007). In the Netherlands, radio-tagged *M. emarginatus* commuted in or above the canopy, thus avoiding lit areas, but can be seen foraging inside both lit and unlit stables (Dekker *et al.* 2013). Presumably, this dualism in response depends on the trade-off between feeding success and either real or perceived predation risk for various habitats. For *M. emarginatus*, the perceived predation risk is probably lower inside than outside stables.

Considered as relatively light-opportunistic, *E. nilssonii* often forages along rows of street lights (patrolling), where individuals sometimes establish and defend feeding territories (Fig. 2.3). However, they only occasionally dive into the light cone in pursuit of an insect. Such dives are short (less than one second) and unpredictable to a

Figure 2.2. Cluster of notch-eared bats Myotis emarginatus *in a maternity roost in the Netherlands, 2016 (© J. Dekker).*

Figure 2.3. The northern bat Eptesicus nilssonii *diving into the light cone of a mercury vapour streetlamp in Sweden (© J. Rydell).*

human observer. While patrolling, northern bats typically fly away from the lights, being very difficult to spot from any direction and hidden from predators. Hence, even this presumably light-opportunistic species may avoid unnecessary exposure to bright illumination (Rydell 1986, 1991).

2.4 Impact of exterior illumination on bat roosts in buildings

Aesthetic illumination of buildings has increased dramatically in Europe over the last 25 years. This is particularly true for churches, monasteries, castles, but also for old bridges, fortresses, towers and monuments (Fig. 2.4). Recently, the lighting of private houses, factories and other buildings has become a widespread practice. Conflicts between the human demand to illuminate such buildings and the protection of bat roosts are already apparent and expected to increase in future.

Numerous studies have reported negative effects of illumination on the persistence of bats inside the roost, on emergence timing, behaviour, foraging activity and on juvenile growth rates have been detected (Boldogh *et al.* 2007; Fuszara & Fuszara 2011; Zagmajster 2014; Kosor 2016; Kotnik 2016; Zeale *et al.* 2016).

Figure 2.4. Illumination of historical buildings repels bats from roosting in large attics. Wroclaw Historical Centre, Poland 2017 (© J. Rydell).

Regardless of bat species, maintenance of dark areas is particularly important around the entrances to maternity roosts, because these places are used consistently by many individuals over the critical peri-

ods of pregnancy, parturition and lactation. Maternity roosts are also places where the young learn to fly and where sit-and-wait predators such as owls or cats may pose a serious threat to bats (Downs *et al.* 2003). Therefore, special attention should be given to buildings with maternity roosts.

Short term effects. The effect of illumination on bat roosts has been studied for churches in several countries, ranging from Slovenia to Sweden and from the United Kingdom to Hungary. Although comparable studies for other types of buildings are missing, similar effects can be expected for constructions akin to churches.

Illumination of buildings with roosts exposes bats to increased predation risk, which in turn disrupts their emergence activity and results in deteriorating foraging opportunities. This applies especially to light-averse species such as *Rhinolophus* spp. and *Myotis* spp. (Boldogh *et al.* 2007; Zagmajster 2014; Kosor 2016; Kotnik 2016; Zeale *et al.* 2016), but also to bats of the genus *Pipistrellus* and *Eptesicus* that often feed opportunistically at lights (Downs *et al.* 2003; Fuszara & Fuszara 2011). However, the effects of ALAN on the emergence and activity patterns are also influenced by the presence of surrounding protective trees as well as the intensity, shading, direction and colour of the light close to the roost (Downs *et al.* 2003; Zagmajster 2014; Kosor 2016). When a colony may use several exits, illumination may affect bats differently. Overall, the magnitude of detrimental effects may be weaker when bats could use alternative unlit exits (Zagmajster 2014).

Bright illumination of roosts may cause a sudden decline in the number of emerging bats, as observed in a colony of notch-eared bats in Hungary (Boldogh *et al.* 2007). This decline could indicate that the bats either abandoned the roost or they were entombed inside and, in the latter case, may eventually starve (Zeale *et al.* 2016). Indeed, in several cases artificial illumination forced bat colonies to completely abandon roosts (Boldogh *et al.* 2007).

Long-term effects. Although long-term effects of illumination on bat colonies in buildings can be expected, there is only a single study addressing this topic by comparing colony presence in churches over a period of 25 years. In the 1980s, Rydell (1987) investigated 61 country churches in southern Sweden for the presence of *Pl. auritus*, before any floodlights were installed in this area. The same churches were then surveyed again in summer 2016, when about half of the churches had become illuminated at least partially (Rydell *et al.* 2017; Fig. 2.5). The percentage of churches with bat colonies had decreased by 38% in 2016 and all of the abandoned churches had been fitted with aesthetic lights (floodlights) in the period between the surveys, strongly suggesting that the illumination was causative for the disappearance of bats. Alternative explanations, such as renovations and targeted attempts to exclude bats from roosts, could be ruled out as a reason for colony collapses.

Bats were affected differently if churches were completely or only partly illuminated. For example, *Pl. auritus* were less often observed in churches that were illuminated

from all directions, compared to those that were only partly illuminated (Rydell *et al.* 2017). Illumination of buildings from all directions may be particularly detrimental since bats have no dark exits to emerge from, and no dark flyways between the roost and the surrounding areas. In the churches that remained unlit, all colonies of *Pl. auritus* remained in the same place after 25 years, hence showing consistent site fidelity. This study clearly shows that, in the long run, floodlights pointed towards buildings can have a devastating effect on the bats that live in the illuminated building. A smaller decrease in colony numbers was detected when at least part of the building was left dark for the bats' emergence and return. In a three-year study on emergence behaviour of *R. hipposideros* at church roosts, researchers observed differences in the proportion of emerging bats in relation to the level of illumination at roost openings (Zagmajster 2014). A significantly higher proportion of bats exited at the belfry opening closer to the woodland when it was shaded, while when heavily illuminated, a higher proportion of bats used the darker opening directed away from the woodland (Zagmajster 2014).

Disappearance of bats from lit buildings may not be obvious over the short term, as bat colonies are unlikely to abandon favourable roosts quickly. Indeed, *R. hipposideros* and *Pl. auritus* may remain in lit buildings for some time, despite the detrimental effects of ALAN, owing to the bats' extraordinary site fidelity (Zagmajster 2014; Rydell *et al.* 2017). The observation that some of the long-eared bats consistently returned to partly lit churches may be a consequence of the limited number of

Figure 2.5. Three examples of churches in Sweden included in the 2016 survey of Rydell et al. (2017). All had maternity colonies of Plecotus auritus *in the 1980´s.* ***(A)*** *Bats remained in some of the partially illuminated churches, when they could leave from and return to the roost without having to pass through the light cone.* ***(B)*** *Bats disappeared from churches that were illuminated from all sides, without any dark passage left. In this case, lights were also installed inside, where the bat colony lived previously.* ***(C)*** *Bats consistently remained in churches that were not illuminated by flood-light. (© J. Rydell).*

high-quality roosts for this species (Rydell *et al.* 2017). Fidelity of *R. hipposideros* to illuminated roosts has been attributed to a trade-off between the disadvantage of increased predation risk at the lit sites and the advantage of having high-quality feeding grounds unaffected by ALAN in the surrounding environment (Zagmajster 2014).

2.5 Impact of interior illumination on bat roosts in buildings

Lights installed inside lofts or church towers occupied by bats have a detrimental effect on bat colonies, even if these lights are only dim. A colony of *Myotis nattereri* in England did not emerge from the roost inside a church for several days after it was experimentally illuminated. The experiment had to be stopped to avoid starvation of bats and the potential collapse of the colony (Zeale *et al.* 2016). In Sweden, several colonies of *Pl. auritus* disappeared after the installation of light bulbs inside attics and church towers (Rydell *et al.* 2017). In Slovenia, the monitoring of a nursery colony of *R. hipposideros* in a church attic revealed that bats avoided the part of the attic that was illuminated by the sun during the day and by ALAN through a roof window during the night (Kotnik 2016).

2.6 Artificial light in underground roosts

Underground sites, such as caves, mines, drainage pipes and similar subterranean structures are crucial for European bats (Mitchell-Jones *et al.* 2007). Some underground structures such as caves and mines are often open to the public, particularly tourists and therefore are frequently illuminated, but empirical studies on bats using illuminated underground roosts are scarce. *M. bechsteinii* refused to leave the interior of an underground mine after the installation of illumination at the entrance (Kugelschafter pers. comm., in Zeale *et al.* 2016). As a general observation, bats rarely, if ever habituate to artificial lights in underground sites and likely desert illuminated parts of show caves. For instance, commercial use of Fourth Chute Cave in Quebec, Canada, resulted in abandonment of the largest hibernaculum of eastern small-footed Myotis *M. leibii* known at the time in eastern North America (Mohr 1972). High light intensities have the most detrimental effect on the activity of bats, when Mann *et al.* (2002) explored behavioural responses of a maternity colony of 1,000 Cave Myotis *M. velifer* at an underground site by experimentally exposing the colony to cave tours. However, it is usually impossible to disentangle the impact of artificial light in show caves from associated factors, such as noise and changes in temperature and humidity.

Figure 2.6. A root cellar in Latvia regularly used by hibernating brown long-eared bats. (© J. Rydell, 2014).

A special case may be the root cellars traditionally used in northern Europe for storage of potatoes and other root vegetables over winter. These cellars are also used by hibernating bats such as brown long-eared and northern bats (Vintulis & Petersons 2014). Temporary illumination of the interior of such cellars by light bulbs is tolerated by bats, presumably because the light is switched on for only a few minutes at a time (Fig. 2.6), yet long-term or comparative studies on this topic have not yet been undertaken.

2.7 Commuting routes and feeding areas

ALAN may affect the ***commuting routes*** of bats. The effects of light on commuting *M. dasycneme* were experimentally studied by placing a strong lamp (1 kW) along existing ***commuting routes*** (Kuijper *et al.* 2008). The artificial light reduced the percentage of ***feeding buzzes*** by more than 60%, although the abundance of insects tended to increase. Experiments at hedgerows at eight sites in southern Britain indicated that *R. hipposideros* reduced their activity in proximity of light sources (HPS lamps) and delayed the onset of commuting behaviour (Stone *et al.* 2009). The number of commuting bats declined even for bats on the dark side of a hedgerow, indicating that even low levels of light (in average 4.2 lx at 1.75m above the ground) have a negative effect on the commuting behaviour of this species (Stone *et al.* 2009). LED lights also reduced the commuting activity of *R. hipposideros*, even when the lights were dimmed to 3.6 lx at 1.7m above the ground (Stone *et al.* 2012).

Installation of ALAN had a substantial effect on the commuting behaviour of free-flying little brown bats (*M. lucifugus*). Apparently, ALAN prevented bats from flying into the illuminated area and made the flight situation more complex, resulting in a dramatic failure of orientation (McGuire & Fenton 2010). Recent studies revealed that even *P. pipistrellus*, the most common bat species in European cities, avoids highly illuminate areas when commuting even though this species tolerate ALAN when foraging around street lights (Alder 1993; Limpens *et al.* 1997; Verboom & Spoelstra 1999; Hale *et al.* 2015).

Street lights may have two principal effects on bat foraging. The first one is direct, as ALAN may repel light-averse bats from lit areas and restrict their use of commuting or feeding space. Indeed, rows of lights may form barriers which fragment the landscape and constrain flyways and therefore also the use of roosts and feeding grounds (Stone *et al.* 2009, 2015b; Mathews *et al.* 2015; Rowse *et al.* 2016a; Hale *et al.* 2015). Street lamps along roads might also act as fatal traps by increasing bat mortality due to more frequent collision with vehicles, an aspect that awaits investigation (Stone *et al.* 2015a; Fensome & Mathews 2016). The second one is indirect, as street lights may attract insects and thus influences availability and abundance of prey (see Chapter 2.1).

Generally, ALAN may be exploited by bats in diverse ways, depending on the species, as illustrated in Fig. 2.7. The smaller and more manoeuvrable species generally fly lower and closer to the light source, while the larger and faster species usually

fly higher and cover wider areas. How the largest and fastest bats such as *Tadarida* spp. exploit urban areas at high altitudes is generally unknown, although there may be considerable activity of bats above city centres.

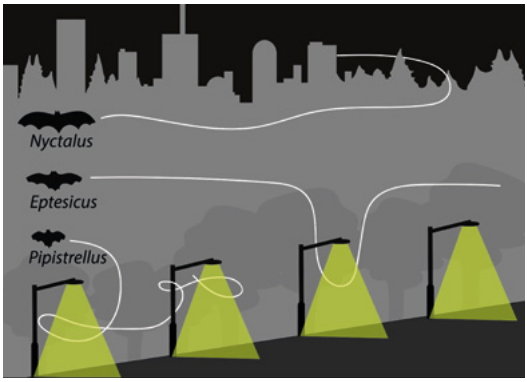

Figure 2.7. A general scheme showing how the size and wing shape relates to the way bats of different genera typically exploit a row of street lights. The smallest bats, e.g. P. pipistrellus*, normally use only one or a few lights at a time and spend some time in each light cone. Bats of the* genus Eptesicus *usually patrol the entire light row and make short and quick dives into the light cone in chase for insects, typically moths. Bats of the genera* Nyctalus *and* Vespertilio *are seldom seen in the light cones of small streetlamps, but occasionally at larger light sources, such as floodlights (© J. Eklöf).*

Stadiums, train stations, harbours and airports are often illuminated with very strong floodlights. There are early observations of bats hunting under floodlights of airports (Gould 1978), later confirmed for flood lights at stadiums (Schoeman 2015). Hunting for insects at such strong lights is observed in free-tailed bats (*Molossidae*) and sheath-tailed bats (*Emballonuridae*), particularly in the tropics. Such behaviour is also shown by other fast-flying species, *e.g.* the *V. murinus* and the *N. noctula* and *N. leisleri*.

Waterways, such as canals, streams and rivers, are important flyways and feeding sites for a diversity of bats. In particular, trawling mouse-eared bats, such as *M. daubentonii*, *M. dasycneme* and *M. capaccinii* are among the most light-averse bat species (Jones & Rydell 1994, Kuijper *et al.* 2008). Lighting of waterways and associated structures, *e.g.* valve bridges and locks, for aesthetic purposes may therefore have serious negative consequences for these species (Kuijper *et al.* 2008).

Drinking sites are important for a variety of bat species, particularly those in Mediterranean, semi-arid and arid areas, and probably for most or all female bats during lactation. Exposing these sites to ALAN has serious negative consequences for bats, almost regardless of species. Russo *et al.* (2017) illuminated ponds in Italy with a strong floodlight and found a negative effect on the drinking activity of all local bats, even on opportunistic species such as *P. kuhlii*. It is likely that bats at drinking sites are also affected when lighting levels are much lower. This applies not only to ponds in arid areas, but also to small bodies of water in forests. The widespread use of artificial lighting along rivers, canals or lake shores may therefore have severe consequences for bats and this fact should be considered whenever illumination of water bodies is planned or installed.

2.8 Effects of ALAN on bat communities

ALAN causes species-specific responses (Rydell 1992; Stone *et al.* 2009; Lewanzik & Voigt 2017), which could cause displacement of species (Polak *et al.* 2011; Stone *et al.* 2015b). For example, a competitive relationship between two bat species that respond differently to ALAN may possibly drive changes in local bat populations (Haffner & Stutz 1984/85; Arlettaz *et al.* 2000). In extensively lit areas, the light-averse species of bats may disappear, at the same time the abundance of opportunistic species may increase when competition is reduced. In the long run, this effect may alter local bat assemblages (Ancilotto *et al.* 2015; Schoeman 2015).

3 General aspects of the planning process

The increase of ALAN affects bats and ecosystems at various scales, reaching from local effects to regional or even global levels. Consequently, protective measures for bats should be integrated into planning and policy processes on all these spatial scales. Particularly, addressing the negative impacts of ALAN on bats (and other protected species) for all functional habitats should be a constituent and explicit part of national planning frameworks. The details of these measures should follow the principles of the mitigation hierarchy – starting with avoidance, then mitigation and lastly compensation (Chapter 5). To achieve this, at the national level the impact of ALAN should be incorporated in the state's ***Strategic Environmental Assessment*** (SEA) to detect environmental conservation problems in plans and programmes. The national implementation of ***SEA*** should then be included into regional and local plans and strategies.

Planning policies at the regional and local level deal with a broad range of issues, including economic development, transport, housing, environment and energy. Consequently, the plans and strategies at this level of governance have potential for adversely affecting the conservation status of protected species. The guidance produced for planning authorities at these levels of governance needs to address how to deal with conflicts between the provisioning of ALAN for humans and the conservation of our natural heritage. By considering possible conservation issues at an early stage in the planning process, conflicts between stakeholders can be avoided or reduced. At the regional or local level this should be achieved through ***Environmental Impact Assessment*** (EIA). GIS-based approaches (Fig. 3.1), *e.g.* the online application available at https://www.lightpollutionmap.info (Fig.3.2) may help to identify areas of potential conflicts. Guidance for carrying out ***EIAs*** around infrastructure construction or other developments should highlight the importance of standardised bat surveys that assess the potential impact of lighting schemes in a methodical manner and oblige developers to employ the mitigation hierarchy (Battersby *et al.* 2010). Where new lighting schemes are unavoidable, it should be mandatory to develop a lighting plan that considers the needs of bats and other wildlife so that a potential negative impact is avoided, or suitable mitigation and post-development monitoring schemes are put in place (Chapter 5).

Impact zone of artificial lighting	**Spatial scale**	**Planning tools for the consideration of lighting schemes**
Migration routes (autumn/spring, long and short distance)	National and regional	• National environmental programmes/regulations; • Regulations/aims of national parks, biosphere reserves, nature parks, Natura 2000 sites • Regulations in national infrastructure projects • Regional conservation plans/landscape plans
Landscape	National and regional	
Commuting route	Regional and local	• Regional conservation plans/landscape plans • Management plans for protected areas (*e.g.* Natura 2000) • Guidelines for ecology assessments surveys • Guidelines for new buildings/developments/ refurbishment • Municipal regulations of o historic buildings o roads o private properties o sport facilities o advertisement o agriculture (*e.g.* greenhouses) o local conservation sites o management plans for caves, parks, green spaces, lakes
Feeding area	Local	
Roost (*e.g.* maternity, hibernation, swarming, mating)	Local	
	Local	

Table 3.1. Summary of spatial scale impacts and planning considerations.

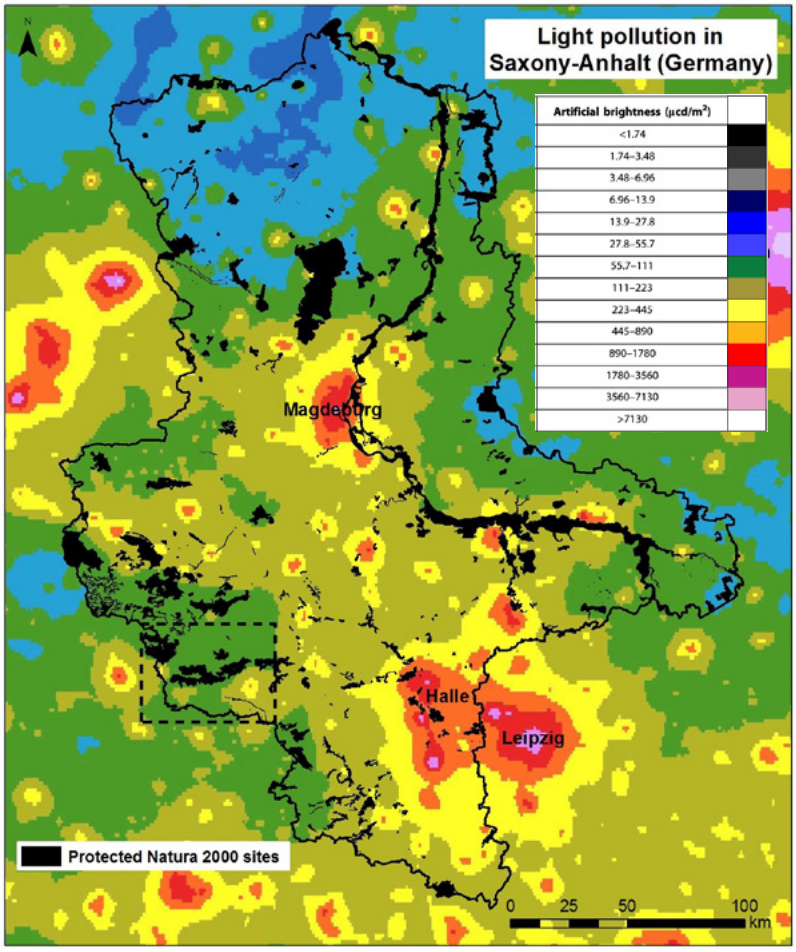

Figure 3.1. GIS map of the German state of Saxony-Anhalt showing Natura 2000 sites and ALAN for identifying zones of potential conflicts between light pollution and protected bat habitats. Dashed line indicates the area of Figure 3.2 (© K. Kuhring & M. Fritze, GIS layer source: F. Falchi et al. 2016).

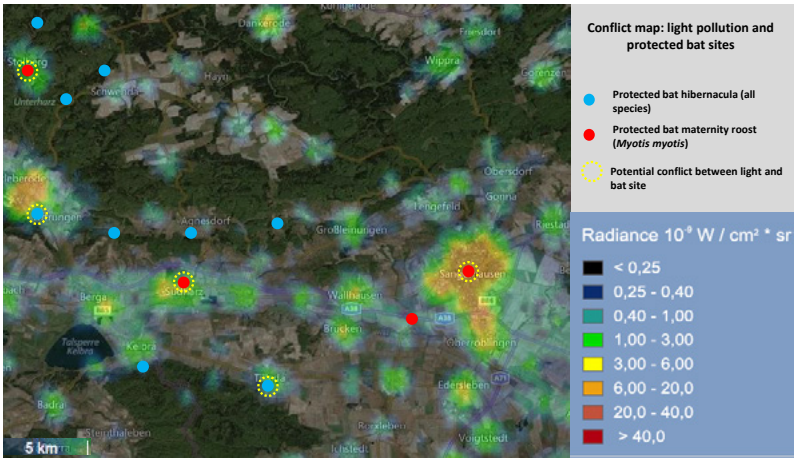

Figure 3.2. A map of the southern Harz in Saxony-Anhalt (local scale) showing protected bat hibernacula and maternity roosts of Myotis myotis *together with ALAN. Mapping may help to identify potential conservation conflicts (© K. Kuhring & M. Fritze, ALAN map source: https://www.lightpollutionmap.info).*

4 Carrying out impact assessments

4.1 General aspects of monitoring and assessment schemes

The most important feature of monitoring schemes, regardless of taxa and context, is a sound research question based in ecological theory, that is tested using a standardised survey technique, with all external factors kept constant (or as close to constant as possible) except for the change in the relevant factor, *i.e.* ALAN. For the assessment of the effects of the impact of a change in lighting, this is typically a before-after treatment assessment, such as counting the number of bats emerging from a roost before and after illumination was installed. A Before-After-Control-Impact approach (abbreviated as BACI) may consider co-varying factors such as the season or the year when multiple factors may change with the light treatment (*e.g.* Rowse *et al.* 2016b, 2018, Lewanzik & Voigt 2017). A standardized survey approach will ensure that other information required for interpreting the results, for example environmental conditions such as lunar cycle, ambient temperature, precipitation, is routinely recorded. More general aspects for surveillance and monitoring of bats can be found in the corresponding EUROBATS guidelines (Battersby *et al.* 2010). In the following, we will focus on specific aspects related to monitoring the impact of ALAN on bats.

4.2 When and where is monitoring important?

Monitoring is needed in all situations where bats are present and an installation or change in artificial light is planned. In some cases, the presence of bats may already be an established fact, especially for large roosts located in buildings, however ***commuting routes*** are usually unknown for these colonies. In most cases exploratory survey will be needed that target the planned change in ALAN. Changes may include the application of mitigation measures, the installation of new illumination, changes in the type of lamps or a modification of the lighting schedule (such as the duration of operation, or seasonal changes in lighting patterns).

Two situations in which the collection of data on the impact of ALAN on bats is particularly important are: 1) changes of ALAN at specific functional bat habitats such as roosts, ***commuting routes*** or ***foraging areas***, and 2) changes of ALAN on the landscape scale that could affect the ability of bats to access ***feeding areas*** and/or alternative roosts. Examples of the second case could include the illumination of river banks and roads.

4.3 Which data should be collected?

The following list provides a general guideline regarding the minimum level of data collection that should be conducted at each site.

General guidelines

- Check whether measures are implemented correctly, in case of the application of mitigation measures;
- Use the same equipment wherever possible, with the same settings, before and after the lighting change;
- Be aware of, and record, additional changes in the vicinity of the location being monitored. For example, habitat alterations which may affect bat activity independent of the effect of lighting.
- Ensure that sufficient data are collected to consider temporal variation in bat activity, *e.g.* from day to day or across seasons. In the case of landscape surveys, automated static bat detectors should be used as these allow efficient data collection over multiple nights;
- The surveys conducted before and after changes to the lighting regime should be performed at the same time of year and in comparable weather;
- When conducting roost surveys, ensure that all exit points are monitored;
- For surveys in the wider landscape away from roosts, conduct surveys over a distance of at least 100 meters, incorporating areas at which the lighting will be changed. Paired control sites where the lighting regime is unchanged should always be included as part of the survey design: this is particularly critical in situations where a before-after comparison is not possible. For a detailed description of how to set up schemes for the monitoring of roosts, see section 3.3 in the EUROBATS guidelines (Battersby *et al.* 2010).
- Surveyors are encouraged to interpret the data they collect to identify patterns of use. For example, peaks of activity at dawn and dusk may indicate proximity to a roost.
- Differences in illumination should be measured and compared with original lighting plans.
- Light meters can be useful, but must be calibrated appropriately, and the same instrument should be used for before- and after-change measurements.
- Another option for quantifying illumination is to use a digital single-lens reflex camera (DSLR) on a tripod. Before and after the change in lighting, photographs should be made from the same spot, with the same DSLR, the same lens, and with the same ISO, image format, aperture, shutter speed and white balance settings (*e.g.* Lamphar *et al.* 2014).

5 Avoidance, mitigation and compensation

As outlined before, ALAN directly affects bats in their activity at night. It is important to keep in mind that ALAN also affects the insects that they feed on. Thus, any consideration of lighting schemes should include both direct and indirect effects, *i.e.* via trophic interactions.

5.1 Avoidance

As a rule, ALAN should be strictly avoided, and artificial lighting should be installed only where and when necessary, *i.e.* when ALAN is needed for safety reasons or to comply with the legal framework. Through careful consideration prior to development of new infrastructure it is often possible to avoid illumination of bat habitats without putting human safety at risk. The protection of dark refuges is essential for bats, particularly in urban areas. Land-use planners and authorities should pay attention to the preservation of dark corridors between roosts and larger unlit, vegetated areas such as urban parks and gardens which might function as the ***feeding areas***. A network of dark corridors would allow bats to commute between roosts and feeding areas without exposure to direct illumination in a landscape that is otherwise fragmented by ALAN (Fig. 5.1). Particularly, in towns where vegetation is scarce and most of the soil is sealed, spatial planning of outdoor lighting and of a 'light-exclusion network', respectively, should be set up concomitantly with the planning of a green infrastructure network. Dark corridors should provide protective vegetation cover, *i.e.* optimally a closed canopy, which helps bats as a leading structure when commuting. Vegetation cover could also provide shade from ***skyglow***. Bright paving materials, that reflects moonlight, help to reduce ALAN since roads and trails are better visible for humans in the twilight. New solar-charged light-emitting materials which could substitute the use of artificial lights at bike paths are being tested (Fig 5.2). Influence of such 'glowing paths' on wildlife has to be evaluated and compared with that of conventional lighting.

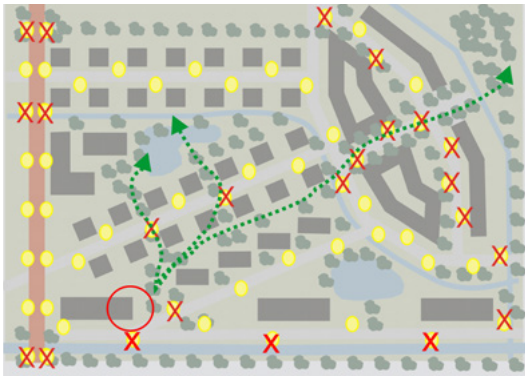

Figure 5.1. Schematic map of a village (dark grey: buildings; light grey: a small road; light blue: water bodies; brown: a large road; green-grey tree silhouettes: locations of trees). Bats emerge from a large building in the lower left corner (red circle) and commute (dashed green lines) along alleys to their foraging areas at a pond and in the forest. It is advised to avoid illumination or shield luminaries at the highlighted areas (red crosses) along treelines, waterbodies/channels and sites where treelines and channels cross the road (© H. Limpens).

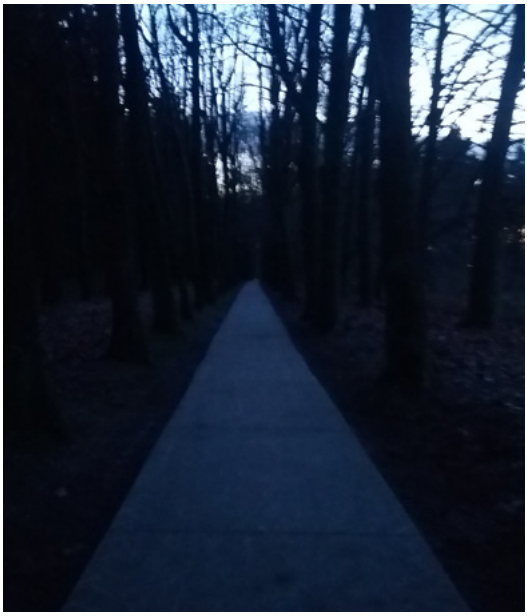

Figure 5.2. Example of a bicycle trail with a lighter paving material allowing to use it without street lights later in the evening (© H. Limpens).

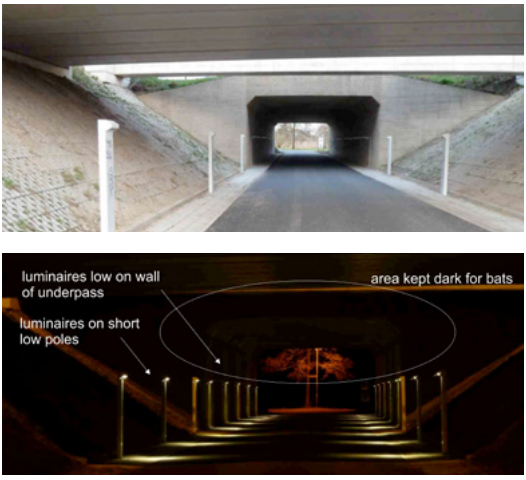

Figure 5.3. Installation of luminaires on short poles for mitigating the effect of ALAN on a commuting route through an underpass in the Netherlands (the same place in daylight and at night). This solution was proven as efficient for P. pipistrellus *but not for the low-flying species* M. daubentonii *(© F. Brekelmans).*

When ALAN is needed for safety reasons, dynamic lighting schemes that are switched on only when needed should be considered. Dynamic lighting schemes are usually triggered via motion sensors by a pedestrian, bicyclist or cars.

Use a minimal number of lighting points and ***luminaires*** on low positions in relation to the ground for minimising ***light trespass*** to adjacent bat habitats or into the sky (Fig. 5.3).

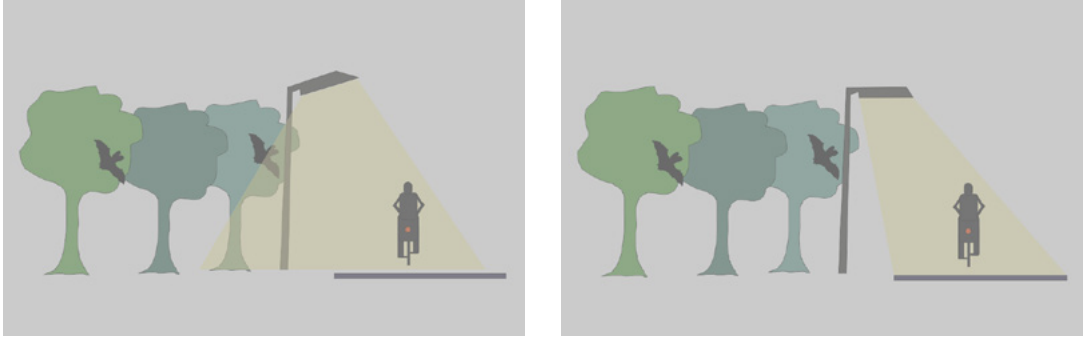

Figure 5.4. Avoidance of light trespass by installing shielded luminaries. Left – conventional luminaire with light spillage into the adjacent forest habitat, right – shielded luminaire that focuses the light cone only on the area where it is needed (© H. Limpens).

Use focused light, *e.g.* by using LED or shielded ***luminaires*** which limit the light flux only to the required areas and prevent ***light trespass*** into adjacent bat habitats (Figs. 5.4 and 5.5).

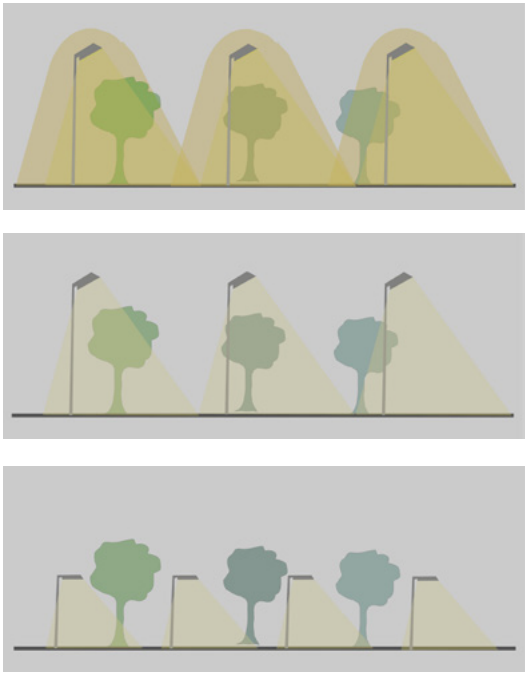

Figure 5.5. Combined effect of shielded luminaires and short poles on reducing light trespass. First picture – unshielded luminaires, second – luminaries with shields. The third picture shows shielded luminaires on short poles which cut-off light trespass and keep adjacent areas dark (© H. Limpens).

Create screens, either by erecting walls or by planting hedgerows or trees, to prevent ***light trespass***, *e.g.* from illuminated roads, to surrounding bat habitats. Screens can reduce the negative effects of ALAN on bats to some degree (Mathews *et al.* 2015; Fig. 5.6, 5.7).

Figure 5.6. In the Netherlands, walls were designed to avoid light trespass from a highway to a wildlife bridge with commuting routes (© H. Limpens).

Figure 5.7. Partially shielded noise screens, installed during the construction of a new motorway in the Netherlands for avoiding light trespass to a compensation area with bat habitats (© V. Loehr).

Exits of bat roosts and a buffer zone around them should be protected from direct or indirect lighting to preserve the natural circadian rhythm of bats. Given that aesthetic light is not required for safety, arguments for such illumination should be reconciled with the need to preserve the nature and nocturnal organisms. Corresponding adjustments to existing artificial lighting should be made.

The following prioritization for areas of conservation concern should be regarded when planning outdoor lighting:

P1: Protected areas (parks, natural monuments) including Natura 2000 sites

- Core zones of protected areas need strict avoidance of any external ALAN, except for inevitable purposes if required by a legal framework (safety). Mitigation measures (Chapter 5.2) must be considered and applied wherever possible.
- In buffer zones around the protected area only long-wavelengths luminaries should be allowed, which do not contribute significantly to ***skyglow***. In buffer zones, light pollution shall be minimised, and further lighting limited (Gaston *et al.* 2015). For unavoidable lighting, mitigation measures must be wherever possible applied. Any light in the buffer zone must be distant enough for ensuring that its ***illuminance*** level at the boundary of the protected area is lower than 0.1 lx, which roughly corresponds to the brightness of a full moon.

P2: Underground and overground roosts

- Strict avoidance of any direct artificial light inside the roost and at its entrances/exits. ***Illuminance*** levels caused by distant lights must be below 0.1 lx at the roost entrances, exits and along the emergence corridors outside the roost (measured by holding a luxmeter in a vertical position at 1.5 m above the ground, measuring perpendicular to the sky, or next to the roost entrance or exit).
- A flyway from the entrances/exits towards nearby unlit hedgerows, treelines or other structures used by bats for commuting must be kept unlit, with light levels below 0.1 lx. If possible, a preferable direction of emerging bats should be investigated beforehand, and the dark corridor accordingly outlined.

P3: Habitats that constitute key feeding areas of light-averse bat species, such as bodies of water (*e.g.* river banks, ponds, canals) and forests

- Strict avoidance of any direct ALAN. ***Illuminance*** levels due to distant lights must be below 0.1 lx.

P4: Habitats that are often used by bats for foraging and commuting, such as urban parks and gardens, the edges of forests, hedgerows and tree lines

- ALAN should be avoided whenever possible. Alternatively, partial lighting or dimming may be used to reduce the negative impact on foraging and commuting bats.

In summary, ALAN should be avoided wherever possible. For any unavoidable artificial lighting at night, adequate mitigation measures (see below) have to be considered and applied wherever possible.

5.2 Mitigation

Careful evaluations of the potential impact of light pollution on bats must be considered prior to any outdoor lighting projects. If artificial light is necessary for social, security or safety reasons, it is of major

importance to adopt a "need-based" outdoor lighting planning strategy in order to illuminate only WHEN and WHERE it is actually required (Kyba *et al.* 2014). In this context, limiting the temporal and spatial extent of ALAN is a key issue for mitigating the adverse impacts of light pollution on biodiversity (including bats).

Outdoor lighting planning requires ALAN management through five integrated levels of action that emphasize 1) the spatial arrangement of artificial light sources to enhance connectivity between dark refuges for foraging and roosting in the landscape (see 5.1 Avoidance) and 2) its duration to illuminate only when it is necessary for humans (Kyba *et al.* 2014). Once areas and time periods that actually need to be lit have been defined, outdoor lighting planning should focus on 3) reduction of ***light trespass*** on nearby vegetation through precise directionality of the luminous flux; 4) reduction in the ***illuminance*** of light sources; and 5) adaptation of the spectral composition of the lamps according to the ecological context (Gaston *et al.* 2012; Schroer & Hölker 2016). Outdoor lighting planning recommendations for mitigating the impact of ALAN on ***feeding areas*** and ***commuting routes*** are presented in Table 5.1.

5.2.1 Mitigating the impacts of ALAN on feeding areas and commuting routes

Limiting the duration of night-time lighting (part-night lighting schemes): Public outdoor lighting is responsible for a substantial part of local administration's energy consumption and electricity bills. Following the economic crisis of 2008, many rural administrations across Europe have therefore set up part-night lighting schemes by turning off public outdoor lighting from midnight (± 1 hour) to early morning (05-06 AM). Although these schemes have mostly been set up to reduce local electricity costs, they may effectively mitigate the adverse impacts of ALAN on bats as they allow restoring darkness at a landscape scale for several hours during the night. It may hence give light-sensitive species access to additional ***feeding areas*** and restore landscape connectivity for at least part of the night. However, nocturnal biodiversity is mostly active soon after sunset. Most insect biomass is available at dusk and peak of activity of Microlepidoptera occurs during the first two hours after sunset (Knight *et al.* 1994; Jetz *et al.* 2003). As a consequence, nocturnal insectivores including bats follow the same pattern (Jones & Rydell 1994; Jetz *et al.* 2003). Thus, current part-night lighting schemes appear to fail encompassing the range of activity of most bat species (Azam *et al.* 2015; Day *et al.* 2015). In this context, the dark phase of a lighting scheme must begin within the first 2 hours after sunset to capture more than 50% of nightly bat activity (Fig. 5.8; Day *et al.* 2015). This would be crucial for bats during reproduction and migration. For an entire city or village, such a scheme would likely face resistance from local inhabitants (Gaston *et al.* 2012). However, the emergence of adaptive lighting technologies may open new opportunities for adopting specific part-night lighting schemes at landscape features where bats commute and forage.

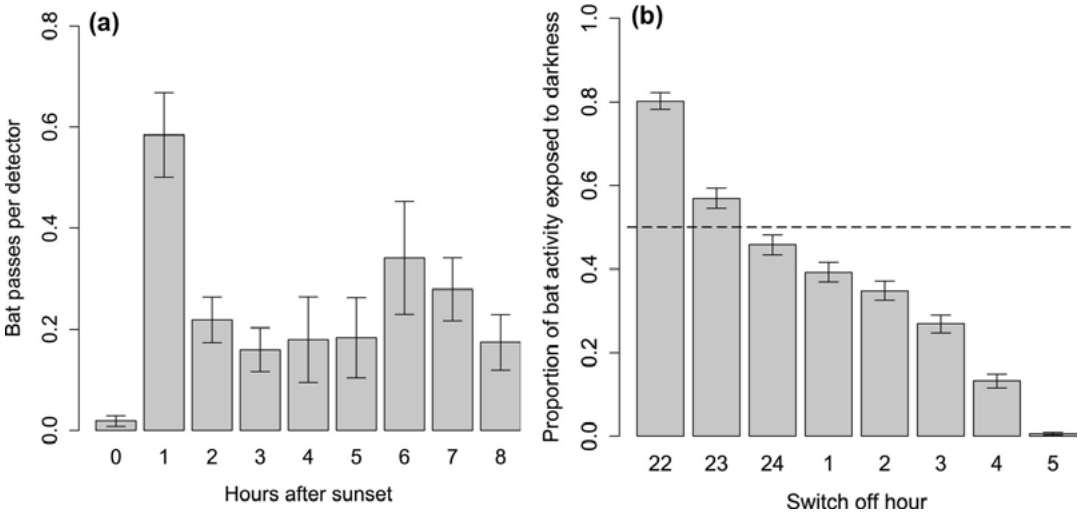

*Figure 5.8. Results of a study in the UK on the activity rhythm of greater horseshoe bats (*Rhinolophus ferrumequinum*) with **(a)** mean hourly bat passes (±se) across sites and **(b)** proportion of activity potentially exposed to dark conditions within part-night lighting scenarios. A dashed line represents 50% bat activity in the dark portion of the night (*Day *et al. 2015).*

Dimming illuminance and limiting light trespass: for safety reasons, the European standard EN 13201 recommends illuminating pedestrian pathways and low-traffic roads with a minimum of 7.5 to 10 lx, and commercial areas and access roads with a minimum of 15 to 20 lx. These guidelines conflict with bat conservation as light-sensitive bats avoid areas exposed to even lower ***illuminance*** values (Kuijper *et al.* 2008; Stone *et al.* 2012; Lacoeuilhe *et al.* 2014; Lewanzik & Voigt 2017). Furthermore, many bat species show lunar phobia and reduce foraging and commuting activities during full-moon nights (Saldaña-Vázquez & Munguía-Rosas 2013). In this context, it is important to stress again that exposure to ***illuminance*** as low as full moon (*i.e.* 0.1 lx) may already have a negative impact on bats. Thus, it is probably impossible to define an ***illuminance*** threshold that is compatible with both security standards and conservational requirements. However, the night-time light pollution is often exacerbated by poor lighting designs that emit light in upward and horizontal directions and induce ***light trespass*** (Gaston *et al.* 2012). The trespass may impact significant amounts of natural and semi-natural vegetated patches (Marcantonio *et al.* 2015). Therefore, reducing ***light trespass*** may effectively limit impacts of light pollution on biodiversity, and simultaneously decreasing electricity consumption.

Falchi *et al.* (2011) provide practical recommendations for limiting light pollution in outdoor lighting:

1. Dim light according to actual human usage of a given area to avoid overly illumination. This is particularly relevant for

commercial and industrial areas which are often brightly lit (Hale *et al.* 2013).
2. Use fully shielded ***luminaires*** that have no light emitted above the horizontal.
3. Direct downward light flux only toward the area that needs to be lit. Correcting a luminaire's height can help to focus light and avoid pollution.

These recommendations should help to avoid the vertical illumination of important bat ***commuting routes*** and ***feeding areas*** such as forest edges and hedgerows. Furthermore, controlling luminaires' height could also allow darkness restoration in the upper canopies of trees.

Finally, it is important to note that light reflected from lit surfaces can also induce significant upward light emissions and hence light pollution. For example, in Lombardia, Italy, although 75% of the artificial sky brightness is produced by light escaping directly from fixtures, 25% of it is induced by the reflections off lit surfaces (Falchi *et al.* 2011). Thus, replacing light-reflective surfaces by light-absorbent ones could be an effective way to reduce ***light trespass*** (Gaston *et al.* 2012).

Limiting the short wavelength (UV and blue) content of the light spectrum: In the EU, the most widely used types of light sources for streetlamps are sodium vapour lamps (HPS and LPS), MH and HPMV lamps representing 37, 36, and 27% sales, respectively, for the period 2004-2007 (European Commission 2011). However, since the European Eco-Design Directive (245/2009) became effective, HPMV lamps are being progressively phased out because of their low energetic efficiency (Table 5.1). This change occurs concomitantly with the increased cost-effectiveness of energy-efficient LEDs, representing so far approximately 7% of the European market (Zissis & Bertoldi 2014). HPMV, MH and standard white LED lamps often have broad-spectrum emissions, with an important peak of energy in the blue range and Correlated Colour Temperatures (CCT) > 3000 K.

Short wavelength emissions in the blue and UV ranges are responsible for the "flight-to-light" behaviour of billions of insects (van Langevelde *et al.* 2011) (see Chapter 2.1). During their search for insects, fast-flying aerial-hawking bats such as *Pipistrellus* spp. are therefore more attracted to MH and HPMV than to sodium lamps and white LEDs (Stone *et al.* 2015a; Lewanzik & Voigt 2016). However, although blue and UV emissions may offer foraging benefits for some bat species, they raise environmental concerns as they control melatonin secretions in mammals (Falchi *et al.* 2011, Schroer & Hölker 2016) and likely induce long-term population declines in insect communities (Conrad *et al.* 2006). Furthermore, blue and UV emitting light sources may attract insects from adjacent dark habitats, and thus may lower the quality of these adjacent habitats for bats (Eisenbeis 2006, chapter 3). In this context, it is important to avoid streetlamps emitting "cold-white" light containing wavelengths below 540 nm and with a CCT > 2700 K. It is important to point out that UV light is useless in street lights since it cannot be perceived by humans. Hence, wavelengths in the UV range can be filtered without any decrease in ***illuminance*** level. In contrast to humans, many bats can per-

ceive UV light (Zhao *et al.* 2009, Fujun *et al.* 2012, Gorresen *et al.* 2015). For them, light sources emitting UV waste light presumably appear brighter than light sources with longer wavelength spectra. Consequently, UV-emitting lamps are particularly disturbing for light-averse bats and filtering the UV part of the spectrum may mitigate the effect of ALAN on them.

Nevertheless, it is important to note that slow-flying light-sensitive species such as *Myotis* spp. and *Rhinolophus* spp. avoid illuminated areas regardless of conventional lamp spectra. Negative effects of artificial lighting on their activity have been reported for HPMV (Lewanzik & Voigt 2016), HPS (Stone *et al.* 2009; Azam *et al.* 2015b), and white LEDs (Stone *et al.* 2012). This evidence supports the hypothesis that there are no "bat-friendly" conventional lamp types. Specifically designed light sources can however be an alternative. For example, deterrence of slow-flying bats (*Myotis* spp. and *Plecotus* spp.) and artificial attraction of agile species because of insect attraction (*e.g. Pipistrellus*) in foraging habitat can be avoided by using light with a reduced amount of blue, and an increased amount of red in its spectrum (Spoelstra *et al.* 2017).

Excluding any unwanted effects of any light type or spectrum remains difficult, and it is therefore important to state that darkness is always preferable. However, streetlamps with a pronounced blue content such as "cold-white" LEDs or MH significantly increase light pollution on a landscape scale because blue light is more easily scattered in the atmosphere than green and red lights (Falchi *et al.* 2011). A simulation of a transition from HPS outdoor lighting to white LEDs (4000 K) across Europe revealed a 2.5-fold increase in night sky brightness perceived by a human dark-adapted eye (*i.e.* Falchi *et al.* 2016). Thus, broad spectrum lamps emitting a substantial proportion of their energy in the short wavelength range are likely to exacerbate nightscape fragmentation and induce landscape-scale loss of dark refuges for bats.

New lighting technologies – opportunities and threats: We are currently witnessing an important development in outdoor lighting management as most existing lighting infrastructure is reaching its end-of-life in Europe. In the meantime, the increased cost-effectiveness of LEDs which are highly energy-efficient and have good luminous efficacy, will likely engender an exponential deployment of this technology in outdoor lighting in the coming decade (Zissis & Bertoldi 2014). As with many technological innovations, LEDs not only offer opportunities to limit light pollution, but also potent to increase it (Stanley *et al.* 2015). On the one hand, they can allow light to be directed with unprecedented precision and dimmed, via central management systems, according to human rhythms of activity throughout the night over large scale (Kyba *et al.* 2014). The potential of the adaptability of the spectrum of LEDs can be further explored to reduce impact on natural systems and be used to optimize light for different social contexts. Accordingly, this technology can offer promising options to design outdoor lighting schemes that can limit both the spatial and the temporal extents of ALAN and restore dark-

ness integrity in human-inhabited landscapes. On the other hand, the massive deployment of LEDs in public infrastructure may come with a "rebound effect", characterized by both 1) the introduction of new artificial light sources in previously unlit areas, and 2) the use of brighter and often "cold-white" street lights (Kyba *et al.* 2014, 2017). Therefore, an ecological expertise of outdoor lighting projects will be particularly crucial in the coming decades to ensure that this technological innovation does not increase light pollution (emissions). Additional information on outdoor lighting recommendations can be found on the COST "Loss of the Night Network" website (http://www.cost-lonne.eu/recommendations/).

	Measure	Recommendations
Avoidance	*Conserve dark areas*	High priority areas that should remain dark: • protected areas, including roosting and underground hibernation sites • feeding areas (natural areas, vegetation patches) • commuting routes (forest edges, hedgerows, rivers, tree lines)
Only if lighting is necessary, and after an assessment of bat occupancy and patterns of activity within the landscape framework of functional habitats:		
Mitigation	*Part-night lighting*	Turn off public outdoor lighting within **2 hours after sunset** (civil twilight): • Especially during bat reproduction and migration periods • Particular attention within home ranges of maternity colonies
	Dimming	• Adapt dimming strategy to human activities • Keep illuminance levels as low as possible according to EU standards (not going over minimum illuminance required)
	Avoid light trespass	Avoid light trespass over 0.1 lx on surrounding surfaces: • Use fully shielded luminaires • No illumination at or above horizontal • Control street light height, especially along pedestrian pathways and tree lines • Use fewer light sources at points low to the ground • Consider the interaction between light from luminaires and reflecting structures, such as roads and walls
	Adapt lamp spectra	Avoid lamps emitting wavelengths below **540 nm** (blue and UV ranges) and with a correlated colour temperature > 2700 K
Compensation	*Restore dark areas*	No net loss of darkness: • Restore darkness to the same extent as the proportion of dark areas lost • Enhance alternative dark corridors that connect roosts and feeding areas

Table 5.1. Synthesis of the outdoor lighting planning recommendations to limit the impacts of ALAN on bat feeding areas and commuting routes.

5.2.2 Mitigating the impacts of artificial lighting on bat roosting sites

It is paramount to completely avoid artificial illumination at bat roosts. The mitigation measures should be applied only when compelling arguments are present, as absolutely "bat friendly" illumination is impossible (Mohar *et al.* 2014). The proposed mitigation measures should not be regarded as equal alternatives to avoidance, but only as actions with diverse levels of effectiveness for bat conservation. ALAN at bat roosts may originate from sources situated either inside (*e.g.* in caves or church interiors) or outside the roosting structure (*e.g.* external illumination of cultural heritage buildings, or natural rocky walls).

Artificial light outside of bat roosts (see Chapter 2.4): ALAN in front of a roost can affect the evening emergence behaviour and impact ***commuting*** bats (Boldogh *et al.* 2007; Stone *et al.* 2009, 2012). This impact can be reduced by installation of screens or masks that exclude the surfaces with flight openings, and that are directed on the walls of a building to reduce or avoid ***light trespass*** to the environment (Mohar *et al.* 2014). Similarly, light sources illuminating a tree roost exit could be equipped with a shield, which prevents direct illumination of the exit and attributed ***commuting routes***. Wherever exits are already indirectly illuminated, the ***light trespass*** on such surfaces should be stopped. The effectiveness of such measures was studied in a project in Slovenia, on some roosts of *R. hipposideros* (Mohar *et al.* 2014). If a church was illuminated by exaggerated light intensities and light spilled on some flight openings, more bats left the roost from those flight openings that were left dark (Zagmajster 2014). When masks that shaded the illumination of flight opening were installed, bats started to use the shaded flight openings.

Seasonal part-time lighting refers to controlling the illumination according to the season when the roost is occupied by bats. Some churches in Slovenia are lit with external illumination only during the most important religious events, like Christmas and Easter, while during the rest of the year the illumination is switched off. As bats inhabit such churches only during the time of nursery colonies, such a roost can be regarded non-illuminated from the bat perspective (Zagmajster & Hercog, submitted).

Seasonal effects of human impact on bat roosts are more common at places that are visited by tourists throughout specific seasons. For example, the Predjama cave in Slovenia, one of the most important bat hibernation sites in Slovenia (Presetnik *et al.* 2009) is not visited by tourists during the winter. In the case of the Ajdovska jama cave in south east Slovenia, tourist visits and illumination of the cave interior is prohibited in summer, due to the presence of a Mediterranean horseshoe bat (*Rhinolophus euryale)* nursery colony (Presetnik 2004).

The timing of external illumination may also be adjusted on a daily basis. For example, Slovenian guidelines recommend that the illumination should be switched off after 23.00 hours (Mohar *et al.* 2014). This proposal was made mainly to provide enough time for night active moths to leave their resting places near the lights and con-

tinue their life cycle, although any effect of this proposed timing on bats was not specifically studied. At least, in case of *R. hipposideros*, *Plecotus macrobullaris* and *Eptesicus serotinus* bats left the roost also under illuminated conditions, but with a delayed emergence time (Zagmajster 2014; Zagmajster, unpublished data). However, switching the lights on later in the night can present a new light barrier when bats return to the roost; especially when mothers return to feed the juveniles. However, there is no empirical evidence that a temporary illumination scheme is less impairing for bats than continuous lighting. Therefore, the regime of part-time lighting should be avoided in favour of total darkness (Boldogh *et al.* 2007) or evaluated before applied on a larger scale.

Artificial light inside bat roosts (see Chapters 2.5, 2.6): Internal illumination of roosts may occur both in buildings (both at the above- and underground level) and natural underground sites (*e.g.* caves). When lights are installed close to bat roosts, *e.g.* in the attics of a church, they are often used only during the visit of maintenance staff. In such cases, if unavoidable, only weak and highly directed light sources should be installed inside buildings or other structures with roosts. It should only provide sufficient light for short term visits by humans, but without trespass to the spaces below the roof and on roost entrances (see also Boldogh *et al.* 2007). Bats may become trapped in the roost in case lights would have accidentally left on (*e.g.* Kugelschafter unpublished, referred to in Zeale *et al.* 2016).

Any internal lighting (including that of hand-held torches and headlamps) as well other as disturbances due to visits shall be avoided at underground sites with either maternity or hibernation roosts. As show caves are sometimes large and complex, tourist trails should guide visitors in a distance from sensitive parts used by bats. Such parts must not be illuminated under any circumstances. A smart lighting design can be applied in show caves, *e.g.* by directing light only at specific cave formations. To avoid ***light trespass*** when illuminating the footpaths, only directional or low path lighting should be used. There are many examples where larger subterranean sites are split into illuminated parts for tourists and dark parts for bats, which show how the conflict between economic interests and conservation requirement can be reconciled. For instance, fortifications in Nietoperek (Poland) and abandoned limestone mines in Mönsted and Daugbjerg (Denmark) have been split into dark and lit parts, with latter ones opened for tourists. Part-time lighting in caves may also represent an effective method to mitigate the effect of interior lights on bats, *i.e.* illumination is only switched on when visitors are present. However, the evidence is lacking whether this scheme might aid bats inside the cave. Further, artificial light in caves can be dimmed to low intensities since the human eye will adjust to these low light levels over time (Mohar *et al.* 2014).

5.2.3 Adjusting light spectra

Little is known about the wavelength-specific response of light receptors in European bats and less so about the light spectra that affect their behaviour most severely.

However, different light spectra can have different effects on the emergence behaviour of bats (Downs *et al.* 2003; Fig. 5.9). Compared to no artificial illumination, red light had the least effect on number of emerging *Pipistrellus pygmaeus* from two roosts while the number dropped significantly when the roost exits were illuminated with blue and white light (Downs *et al.* 2003). Red light was proposed for being used in bat roost checks, supposedly having least effect on bats (Downs *et al.* 2003). A recent study (Spoelstra *et al.* 2017; see Fig. 5.10) showed that reducing the blue and increasing the red part of the spectrum of a light source significantly mitigates its impact on slow-flying *Myotis* and *Plecotus* species in their foraging habitat. Conversely, the absence of blue light reduced the attraction of insects and thereby the attraction of agile, opportunistic species such as *Pipistrellus* spp.

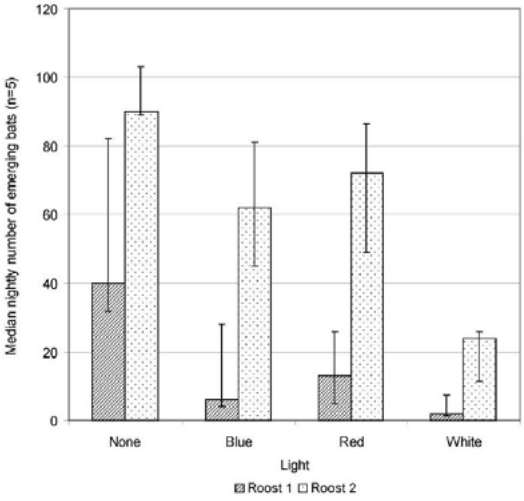

Figure 5.9. The median number of emerging P. pygmaeus *with different light treatments for two roosts (plus IQ range) (Downs et al. 2003: the difference was insignificant between the red-light and no-light treatments).*

Voigt *et al.* (2018) observed an increase in flight activity for migrating *P. pygmaeus* and a trend for a higher activity for *Pipistrellus nathusii* around red LED lights, which is unrelated to foraging and could be explained by phototaxis. Therefore, response of bats to light spectra modifications may differ during migration season and seems site and species specific.

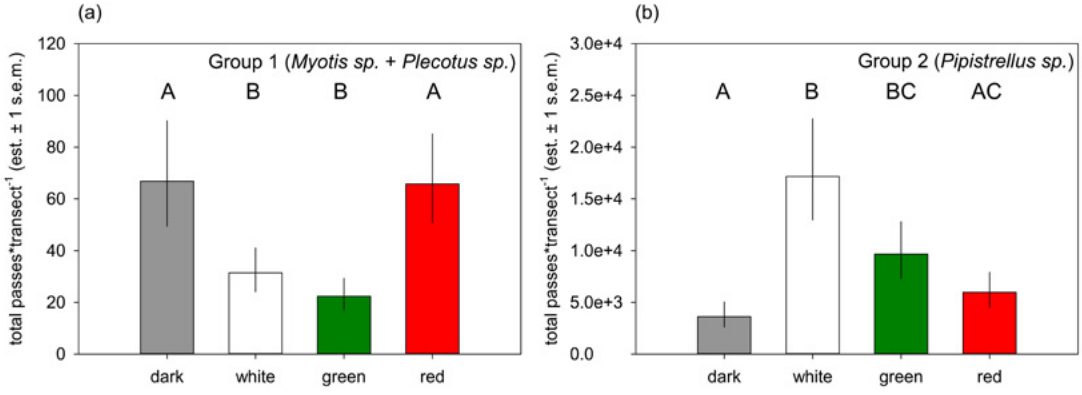

*Figure 5.10. Bat activity under four (permanent) lighting conditions (darkness, white, green, and red light) measured over the course of five years in forest edge habitat (model estimates). Group 1 includes slow-flying light-averse species (*Myotis *and* Plecotus *spp.); Group 2 includes opportunistic, agile* Pipistrellus *species. Capitals identify significant differences between groups in post-hoc tests (figure from Spoelstra et al. 2017).*

	Roosts		
		External illumination of building facades	*Internal illumination of caves and other roosts*
Avoidance	*Conserve dark areas*	Bat roosts should not be illuminated.	Underground roosts (natural or anthropogenic) with hibernating bats and nursery colonies should be kept dark. Tourist visits should be forbidden in such sections.
Only if lighting is considered necessary, and after an assessment of bat occupancy and emergence behaviour:			
Mitigation	*Directional light, avoid light trespass*	Smart lighting onto only specific architectural parts: • surfaces and facades with flight openings must not be illuminated; • luminaires with shades to limit trespass on roost entrances; • directed (controlled) light – no trespass above horizontal.	Smart lighting design only: • low path lighting; • light only on selected speleothems.
	Part-time lighting	Only in season when the roost is not occupied. Evening illumination delayed, or lights switched off after critical time period (when needed for human safety).	Temporary lighting only when tourists are present (*e.g.* for emergency exit signs). Sector lighting of interior, light switched off when tourists not present.
	Dimming	Low intensity (below 0.1 lx)	Low intensity
	Adapt lamp spectra	> 500 nm	> 500 nm
Compensation	*Restore dark areas*	Priority roosts should be strictly protected and not illuminated. Provide alternative roosts nearby.	Provide dark chambers and dark flight tunnels.

Table 5.3. Synthesis of the lighting planning recommendations to limit the impacts of artificial lighting on bats in roosts.

5.2.4 Mitigating indirect effects of ALAN on bats prey

For mitigating the impacts of ALAN on insects, it appears of major importance to limit the amount of blue and UV emissions in outdoor lighting by favouring warm colour temperature lamps (such as low-pressure sodium lamps or amber-LEDs). However, it is important to note that long wavelengths are as attractive as short ones to geometrid moths (Somers-Yeates *et al.* 2013), and that the negative effects of ALAN on moth reproduction was detected regardless of the lamp colour spectrum (van Geffen *et al.* 2015b). Thus, the enhancement of dark corridors and patches in human-inhabited landscapes seems to be a key strategy to effectively limit adverse impacts on biodiversity, including insects (Gaston *et al.* 2012). Outdoor lighting should be separated by at least 25m from vegetated areas, and by at least 40m from riverbanks to limit its effects on insects (Perkin *et al.* 2014; Degen *et al.* 2016). The attraction radius of street lights to moths also suggests that standard inter-street light distances (approximately 20–45m) should be broadened without a concomitant increase in light intensity to allow individual dispersal and increase landscape connectivity (Degen *et al.* 2016). Furthermore, particular attention should be given to dimming and orientating street lights for avoiding ***light trespass***.

Finally, although most dipteran and microlepidopteran activity is highest during the first few hours after sunset (Knight *et al.* 1994; Jetz *et al.* 2003), some taxa of macromoths are active much later at night (*i.e.* peak of activity at midnight; Rydell *et al.* 1996). Because of their large eye size, they appear to be more attracted to ALAN than micromoths, which may result in a size-dependent mortality of moths at street lights (van Langevelde *et al.* 2011). Hence, restoring darkness in human-inhabited landscapes for a part of the night, by turning-off street lights from around midnight to morning hours when traffic and human activities resume (*i.e.* part-night lighting schemes) may effectively limit the adverse impacts of artificial lighting on large moth species, which in turn may positively affect the bats that feed on them (such as *Plecotus* spp.; Azam *et al.* 2015).

5.5 Compensation

Compensating the impacts of ALAN on feeding areas and commuting routes: A "No Net Loss of Darkness" approach should be adopted when planning new outdoor lighting projects. These efforts should be paired with a decrease in light emissions from existing illuminated areas in order to halt the yearly increase in night sky brightness over Europe (Falchi *et al.* 2011; Bennie *et al.* 2014b). The extent of ***feeding areas*** and ***commuting routes*** impacted by ALAN should be quantified for restoring the same amount of dark refuges and corridors in alternative areas. These areas should be located nearby outdoor lighting projects, so that the impacted bat population can benefit from these compensation measures.

Compensating the impacts of ALAN on bat roosting sites: Bats use roosts year after year, and some species do not accept new alternative roosts in the vicinity easily (*e.g.*

Zeale *et al.* 2016). For this reason, it is very difficult to formulate compensation measures for the loss of roosts caused by ALAN. Therefore, the known important roosts in buildings should not be illuminated, or mitigation efforts employed. The same applies to caves and other natural roosts. Alternative dark roosts could be offered, but the effectiveness of these measures should be monitored.

6 Research priorities

We have already collated substantial knowledge about various detrimental effects ALAN has on bats, yet the effects of ALAN are multifaceted and may be long-term. Therefore, we need further research. It is important to collate and analyse reports and single case studies to draw broader conclusions about the effect of ALAN on bats. Here, we propose some directions for future investigations.

6.1 Fitness consequences

Since bats have a low reproductive rate, it is particularly important to understand higher-level responses of bat species to ALAN. Besides a recent study from Sweden on declines in colonies of *Pl. auritus* (Rydell *et al.* 2017), no other long-term studies, covering several decades, have been carried out to determine if any of the observed behavioural changes in response to ALAN have consequences for fitness of bats. Although a potential effect of different illumination schemes on juvenile growth of *R. hipposideros* was studied in Slovenia at three roosts, observed differences could not be unambiguously related to differences in light regimes (Kotnik 2016). Boldogh *et al.* (2007) reported growth rates of juvenile bats in illuminated and dark roosts and interpreted the differences as a result of illumination. However, Kotnik *et al.* (2017) emphasized that multiple factors can influence reproductive success in a complex manner, and attention should be paid to disentangle the effect of illumination from other factors that may affect juvenile growth. Overall, we need to better understand how ALAN affects critical population parameters such as sex ratio, birth rate, dispersal and survival to understand and predict population-level effects.

6.2 Impacts on bat communities

The current literature highlights that ALAN may cause species-specific responses, which could alter the competitive interactions of bat species. For example, decreases in *R. hipposideros* numbers have been linked to increases in *P. pipistrellus* populations in Switzerland. It was suggested that growing, due to the improved food availability at recently installed streetlights, population of *P. pipistrellus* outcompetes and displaces that of *R. hipposideros* (Arlettaz *et al.* 2000). Further studies are needed to address the impact of artificial lighting on bat communities (Davies *et al.* 2013).

6.3 Emerging lighting technologies – spectra

Given the rapid technological advances outdoor lighting, research on how novel light sources may impact bat activity and reproduction are urgently required. Such studies should use sufficient replicates and a controlled design to generate meaningful data. One such example is the "Lichtopnatuur project" in the Netherlands where the effect of white, red and green LED lighting on various taxa is studied on a large spatial scale (Spoelstra *et al.* 2017; see http://www.lichtopnatuur.org).

6.4 Bat vision

To improve our ability to predict the response behaviour of bats, it is key to better understand the spectral sensitivity of bat vision. Determining spectral and intensity thresholds for different species would aid to improve mitigation strategies and conservation initiatives (Gaston *et al.* 2013).

6.5 Efficiency of mitigation

Part-night lighting: some initial research has been performed in this area (see Chapter 5.2), but more studies must be done across a broader geographical range to encompass more species.

Motion detection: the dynamic lighting schemes, *e.g.* via the use of motion detectors, have already been implemented in Portugal, the Netherlands and France, and may have ecological benefits. The lights remain switched off unless needed, and so still provide all the perceived public safety benefits (Royal Commission on Environmental Pollution 2009). However, these fluctuations in lighting levels may also be damaging to bats and should be studied.

Light trespass: Currently, it is largely unknown how bats respond to efforts for minimizing the ***light trespass***.

Dimming: More research needs to be launched to improve our ability to define the optimal light intensities that serve both purposes human safety and nature conservation.

Dark zones: effectiveness of dark areas and corridors for bats should be more thoroughly investigated.

Spectrum adjustment: further studies on the impact of altered spectra are essential, for example at various roost types, ***commuting routes*** and on different bat species.

6.6 Measuring light objectively

Illumination is measured in ***lux***, which is defined as the brightness of a light according to human spectral sensitivities; spectral sensitivities of other taxa are often very different from ours. Since the unit is commonly used by lighting engineers, designers and environmental regulators, migrating from this term may thwart interdisciplinary communication (Longcore & Rich 2004). Although outdoor lighting is usually installed for humans and hence measuring light in ***lux*** is a logical approach, this unit lacks key biological information.

6.7 Migration

Migratory animals are particularly sensitive towards anthropogenic changes because they depend on a serious of intact habitats. Some migratory birds are known to get distracted by ALAN, particularly in the red wavelength spectrum. Indeed, a recent study highlights that migratory *P. nathusii* might as well get disoriented, when exposed to artificial green or red light (Voigt *et al.* 2017, 2018), yet the underlying causes and any potential interference of ALAN with the navigational system of bats are still under debate and require further research.

6.8 Hibernation

The effects of lighting on bat hibernation are currently not known: field observations are contradictory and anecdotal. Given the importance of hibernation for the survival of many temperate species, this is an area which requires urgent attention. Key questions include the impacts of lighting on arousal and overwinter survival.

6.9 Developing a predictive framework at the landscape level

Predicting areas where bats may be most at risk from light pollution will allow planning, avoidance and mitigation on larger scales. Development of methods and techniques for such predictions is crucial for conducting SEAs and EIAs.

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8 Glossary

Commuting routes – flight paths that bats use regularly to fly from a roost to a foraging area (and back) or to move between foraging areas or roosts.

Environmental impact assessment (EIA) – a national procedure for evaluating the likely environmental effects of those public and private projects which may have significant effects on the environment (see for instance Council Directive 85/337/EEC).

Feeding areas – habitat patches where bats perform area-restricted foraging.

Feeding buzzes – stereotypic sequences of echolocation calls indicating an insect hunt.

Illuminance – the total luminous flux per unit area; previously called brightness.

Habitats Directive – Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

Light trespass – artificial light in areas where it is not wanted; spill light.

Luminaire – a lighting unit.

Lux – a measure for the illuminance (lumen per square meter) as perceived by humans, derived from the international system of units (SI).

Migration – regular, usually seasonal, movement of all or part of an animal population to and from a given area.

Mitigation – action taken to mitigate, reduce or minimize any negative environmental impact such as habitat loss, animal fatality or injury where it is not possible to avoid such impacts.

Photic entrainment – adjustment of circadian rhythms by light.

Skyglow – brightness of sky caused by artificial light at night.

Strategic environmental assessment (SEA) – procedure for integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development (see for instance Directive 2001/42/EC).

Swarming – "autumn swarming" is a behaviour of some temperate bat species (particularly *Myotis*, *Plecotus, Eptesicus* spp. and *B. barbastellus*) that occurs from late summer to autumn. *Pl. auritus* performs a "spring swarming" as well. Bats may travel many kilometres to underground "swarming sites", arriving several hours after dusk, flying in and around the site and departing before dawn. Swarming is important part of social interactions, including courtship. Some swarming sites may also be used as hibernacula later in the year. Swarming ("dawn swarming") also refers to the circling flight pattern of some bat species that occurs outside the entrance to a roost (especially maternity roosts) before the bats enter at dawn.

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Authors' affiliations:

Christian C. Voigt: Department of Evolutionary Ecology, Leibniz Institute for Zoo and Wildlife Research, Alfred-Kowalke-Str. 17, 10315 Berlin, Germany; Institute of Biology, Freie Universität, Takustr. 6, 14195 Berlin, Germany

Clémentine Azam: Centre d'Ecologie et des Sciences de la Conservation, Muséum National d'Histoire Naturelle, 55 rue Buffon, 75005 Paris, France

Jasja Dekker: Batlife Europe, 250 Kennington Ln, Kennington, London SE11 5RD, UK

Jo Ferguson: Bat Conservation Trust, Quadrant House, 250 Kennington Lane, London, SE11 5RD, United Kingdom

Marcus Fritze: Department of Evolutionary Ecology, Leibniz Institute for Zoo and Wildlife Research, Alfred-Kowalke-Str. 17, 10315 Berlin, Germany

Suren Gazaryan: UNEP/EUROBATS, United Nations Campus, Platz der Vereinten Nationen 1, 53113 Bonn, Germany

Franz Hölker: Leibniz Institute of Freshwater Ecology and Inland Fisheries, Müggelseedamm 310, 12587 Berlin, Germany

Gareth Jones: University of Bristol, 24 Tyndall Avenue, Bristol BS8 1TQ, UK

Noam Leader: Ecology Department, Science Division, Israel Nature & Parks Authority, Israel

Daniel Lewanzik: Acoustic and Functional Ecology Research Group, Max Planck Institute for Ornithology, 82319 Seewiesen, Germany

Herman J.G.A. Limpens: Dutch Mammal Society, Thoernooiveld 1, 6525 ED Nijmegen, the Netherlands

Fiona Mathews: University of Sussex, Sussex House, Falmer, Brighton, BN1 9RH, United Kingdom

Jens Rydell: Biology Department, Lund University, 22362 Lund, Sweden

Henry Schofield: The Vincent Wildlife Trust, Railsgate Barn, Kinnerton, Presteigne, OWYS LD8 2PD

Kamiel Spoelstra: Netherlands Institute of Ecology, P.O. box 50, 6700 AB Wageningen, The Netherlands

Maja Zagmajster: Department of Biology, Biotechnical Faculty, University of Ljubljana, Jamnikarjeva 101, SI1000 Ljubljana, Slovenia

EUROBATS

Eighty percent of the world's population are currently exposed to light-polluted skies, and the Milky Way is no longer visible to more than a third of humanity. The pace the light pollution is increasing is faster than global population growth and economic development. While environmental conditions at night are being dramatically and rapidly altered, circadian rhythms, behaviour and ecology of plants and animals are imminently influenced. In the same time, effects of artificial lighting, various illumination schemes and spectra on biodiversity, including bats, are currently insufficiently understood, whereas only a vague notion of required mitigation and compensation activities exists among decision-makers and other parties involved in lighting projects. Although the bats are almost exclusively nocturnal and extremely sensitive to multiple effects of light pollution, its negative impact on bats alongside essential measures needed to preserve unfragmented nightscapes for these animals are often disregarded during impact assessments, planning and operation.

In this volume, we tried to compile available evidence related to the effect of artificial light at night on the European bats. Based on the current state of knowledge, solutions are proposed concerning possible ways to avoid, mitigate and compensate the adverse effects which lighting projects may have on bats and their functional habitats. We also outlined research priorities for future studies, required for in-depth understanding of the problem and assessing efficiency of proposed mitigative measures.

These guidelines were developed by the EUROBATS Advisory Committee in collaboration with external experts in pursuance of Resolution 7.13 on Implementation of the Conservation and Management Plan.

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Communication from Public

Name: Carol Hahn
Date Submitted: 12/07/2023 02:44 PM
Council File No: 22-0392
Comments for Public Posting: I urge you to Reject the proposed Billboard plan for land owned by the Metropolitan Transportation Authority. This is an insane plan, which is only going to cause more dangerous driving and accidents. In addition to being unsafe, electronic billboards are glaring and obnoxious! Drivers are forced to look away from the road and focus on the bright, moving digital artwork, rather than the cars and traffic around them. Just a few seconds of distraction can cause a driver to slam on the brakes in a panic, trying to avoid rear-ending the car in front, or colliding head-on with another car in an intersection. I know, because this almost happened to me looking at an electronic billboard while driving west on the 10 freeway in LA -- for ONLY THREE SECONDS. Thankfully, I caught myself, and avoided hitting a car in front of me; but, I had to slam on the brakes. I panicked and looked in my rear view mirror, in the hope that the driver behind me would not hit me. This could have been a dangerous chain reaction, all because of me looking at an electronic billboard for 3 seconds! It was scary. I can't believe you would think this is a safe idea for the City of LA. We already have multiple accidents every day of the year without electronic billboards. Not only do these accidents cause drivers money in insurance costs and damage repair, they clog the streets and freeways in the city. We do not need the additional problem of annoying electronic billboards causing more accidents, traffic jams, damage, and loss of life. Is this all worth it for companies making money with digital advertising while people drive? I don't think so. Do the safe and sane thing -- please, please do not approve this plan! Thank you, Carol Hahn

Communication from Public

Name:	Rosalinde and Arthur Gilbert Foundation
Date Submitted:	12/07/2023 02:28 PM
Council File No:	22-0392
Comments for Public Posting:	There is enough blight in this City without our being blinded by more electronic billboards. this matter is being rushed through the Council without publicity and without sufficient notice.

Communication from Public

Name:	Lauren Chang
Date Submitted:	12/07/2023 04:59 PM
Council File No:	22-0392
Comments for Public Posting:	Please see attached letter with comments on the TCN Program and Implementing Ordinances.

REMY | MOOSE | MANLEY
LLP

Tiffany K. Wright
twright@rmmenvirolaw.com

December 7, 2023

Via Electronic Mail

Office of the City Clerk
Los Angeles City Council
City of Los Angeles
200 N. Spring Street, City Hall – Room 395
Los Angeles, California 90012
Email: Clerk.CPS@lacity.org

RE: Council File 22-0392: Comments Received on the Transportation Communication Network (TCN) Program and Implementing Ordinances

Honorable Councilmembers:

On behalf of the Los Angeles County Metropolitan Transportation Authority (Metro), this letter responds to comments submitted to the City as it considers Metro's proposed Transportation Communication Network (the Project). Prior to the Planning & Land Use Management Committee's consideration of the proposed TCN Program, opponents of the Project and digital billboards in general submitted comments regarding the environmental review for the Project. The comments generally raise issues that were already addressed in the Certified Final EIR and the subsequent Addendum prepared for the Project. Comments asserting that further environmental review is required are unsupported, particularly because all of the changes to the TCN Program required by the City in the proposed implementing ordinances (Ordinance) will reduce the environmental impacts of the TCN Program. Importantly, PLUM's recommendation includes the removal of eight TCN structures from the TCN Program addressing many of the alleged concerns raised by commenters.

I. Improper Lead Agency & Lack of City Authority

Comments stated that the City, and not Metro, should have been the lead agency for the Project because the Project is located within City boundaries and requires several discretionary approvals from the City. In the alternative, comments stated that the City failed to fulfill its obligations and properly consult in its role as a responsible agency by failing to comment on the Notice of Preparation (NOP) or Draft EIR for the Project, and failing to meet with Metro regarding the scope of the EIR and accuracy of analysis. Neither assertion is correct.

Metro proposes to carry out the TCN Program and is therefore the appropriate lead agency according to the CEQA. (CEQA Guidelines, § 15051, subd. (a) ["If the project will be

carried out by a public agency, that agency shall be the lead agency even if the project would be located within the jurisdiction of another public agency"].) Metro is also the proper lead agency for the Project because Metro has primary responsibility for implementation of the proposed Project as the region's transportation authority. (CEQA Guidelines, §15051, subd. (b).) Under state law, Metro has broad authority over public transportation planning and coordination for the region's transportation system and is authorized to do "any and all things" to carry out these purposes. (Public Utilities Code, § 130105, subd. (f).) Although the TCN structures will be located within the City, they will be located entirely on Metro-owned property, and Metro is responsible for their construction and operations.

The fact that the City is responsible for several key discretionary approvals for the Project does not mean that it should be the lead agency for the Project. A responsible agency, by definition, is a public agency other than the lead agency with discretionary approval power over a project. (CEQA Guidelines, § 15381.) The City participated in the environmental review process as a CEQA responsible agency and has cooperated in that process, including consultation in preparation of the Draft EIR. (CEQA Guidelines, § 15096.) The City has also prepared an Addendum to the Certified Final EIR that analyzes the modifications to the TCN Program proposed by the City in its Ordinance. And as required by CEQA, the City will make all the appropriate findings required for a responsible agency under CEQA. (*Ibid*.)

Moreover, none of the circumstances that would allow the City to assume the role of a lead agency exist here. (CEQA Guidelines, § 15052.) Because an EIR has been prepared for the TCN Program, and the City has properly participated in the CEQA process as a responsible agency, the City could only assume the role of a lead agency if the circumstances requiring a supplemental or subsequent EIR exist. (CEQA Guidelines, § 15052, subd. (a)(2)(A).) As explained in the Addendum, modifications to the TCN Program will only reduce environmental impacts, and as explained further below, none of the comments on the Ordinance provide evidence of new significant impacts or substantial increases in the severity of previously identified significant impacts.

II. Improper Pre-Commitment

Comments stated that the Memorandum of Agreement (MOA) between Metro and the City imposes a "financial penalty" on the City should the no build alternative be selected or if the City fails to approve the Ordinances and permits for the Project, and therefore amounts to an unlawful pre-commitment to approve the Project. This is not an accurate characterization of the MOA, which merely provides an agreement on how Metro and the City shall bear the costs of CEQA compliance. Agencies proposing projects must generally bear the costs of CEQA compliance. Thus, there is always the potential that the investment in environmental review will not be returned because the agency retains discretion to deny the project. Here, Metro and the City have merely agreed on how to share the costs for EIR preparation.

The California Supreme Court, however, provided definitive markers for determining whether an agency has committed itself to a project in such a way that amounts to a pre-environmental-analysis approval in *Save Tara v. City of West Hollywood* (2008) 45 Cal.4th 116

("*Save Tara*"). In *Save Tara*, the Supreme Court of California held that an "approval" for purposes of CEQA exists "when an agency's favoring of and assistance to a project ripens into a 'commit[ment].'" (*Id.* at p. 130.) The issue, the court explained, "is to determine when an agency's favoring of an assistance to a project ripens into a 'commit[ment].'" (*Id.* at pp. 130–131.) To answer that question, the court employed the following two-pronged test: (1) "first, the analysis should consider whether . . . the agency indicated that it would perform environmental review before it makes any further commitment to the project, and if so, whether the agency has nevertheless effectively circumscribed or limited its discretion with respect to that environmental review"; and (2) "second, the analysis should consider the extent to which the record shows that the agency or its staff have committed significant resources to shaping the project. If, as a practical matter, the agency ***has foreclosed any meaningful options to going forward with the project***, then for purposes of CEQA the agency has 'approved' the project." (*Id.* at p. 139, emphasis added, internal quotes omitted; see also *Saltonstall v. City of Sacramento* (2015) 234 Cal.App.4th 549, 567 [same].)

The MOA's cost-sharing provision did not foreclose the City's ability to challenge any portion of the EIR prepared by Metro, nor does it foreclose the City's ability to refuse to approve the required Ordinances and permits for the Project. These markers have not been demonstrated in this case. The City's actions here are not parallel to those of the public agency in *Save Tara*, and therefore do not amount to an "approval" of a project. Moreover, pre-commitment is only a concern under CEQA if an agency approves a project before complying with CEQA. Here, a Final EIR has been certified for the TCN Program, and the City has further prepared and Addendum to the Certified Final EIR. The time to challenge the MOA as an improper pre-commitment expired long ago.

III. Inadequate Project Description

Comments stated that the Project Description as provided in the EIR is inadequate for various reasons. Comments asserted that more detail on the TCN structure's hardware and network infrastructure was required or that only general descriptions of the proposed Ordinance were provided. But the comments provide no evidence or explanation of how those further details were necessary for an analysis of the TCN Programs environmental impacts. Nor do they set forth any environmental impacts of the Ordinance that were not adequately analyzed in the Certified Final EIR or Addendum. Relatedly, comments stated that the Project Description is not stable or finite due to minor tweaks to several sign locations—including the removal of several structures, changes to operating hours, and the development of the proposed Ordinances.

The Project Description is adequate as it complies with all requirements in CEQA Guidelines section 15124. The Certified Final EIR does describe the benefits to drivers and bus-riders resulting from the Project, as it explains that the TCN Structures would transmit traffic and accident data and bus arrival time to the public, thus providing drivers and bus-riders with the information necessary to streamline their travel. (See, e.g. Section II – Project Description, pp. II-5–II-6.) Moreover, funding resulting from the Project would be used to create new and expanded transportation programs—directly benefiting drivers and bus-riders. (*Id.* at p. II-6.) The specific technology that the Project will employ to connect with the existing RIITS has not

yet been determined—therefore, it was not possible to include a description of that technology or any potential disposal plans relating to that technology at the time the EIR was drafted. CEQA requires only a general description of a project's technical, economic, and environmental characteristics. (CEQA Guidelines, § 15124.)

The Addendum covered all minor changes to the Project, including those resulting from the proposed Ordinances.

IV. Subsequent EIR Required

Comments stated that the Certified Final EIR for the Project is inadequate because the proposed Ordinances include changes to the Project since the Certified Final EIR was prepared, such as location restrictions, and that a Subsequent EIR is therefore required. Specifically, comments stated that the environmental documentation for the Project should disclose and analyze that signs will be permitted within 200.01 feet of an ecological preserve and the centerline of a scenic highway, scenic parkway, scenic corridor or scenic route; within 1000.01 feet of another digital signs; and within 2640.01 feet of another freeway facing TCN structure. Comments also stated that no analysis has been done to determine whether the proposed Ordinances' requirement that signs within 200 feet of residential zones be oriented away from such zones will ensure that illuminance from the Project at night would not exceed 3.0 fc at residences, and that this is therefore a new potential impact requiring preparation of a Subsequent EIR.

These impacts were already analyzed in the Certified Final EIR and Addendum for the Project. As explained in the Certified Final EIR, all Project impacts to ecological resources, scenic highways, and residences and reasonably foreseeable residences were determined to be less than significant or less than significant with mitigation. The revisions to the Project resulting from the proposed Ordinances were specifically analyzed in the Addendum to the EIR, which concluded that all impacts resulting from the Project as a result of the changes from the proposed Ordinances would be the same or further reduced due to changes such as the elimination of several TCN structures, additional illumination standards to even further reduce the light and glare impact of new digital displays on nearby uses, and revised limits on the ours of nighttime operation of the digital displays.

None of the information that the comments referenced constitutes new information requiring recirculation, as any additional information merely clarifies, amplifies, or makes insignificant clarifications to the already adequate Draft EIR. (See CEQA Guidelines, § 15088.5.)

V. Inadequate Findings

Comments stated that the City's amended findings for the Project are inadequate because they are not supported by substantial evidence, and offer few details—such as how the Project

will improve RIITS and how the Project supports Mobility Plan policies. Relatedly, comments stated that the City's adopted General Plan consistency findings cannot be made because the proposed Ordinances for the Project do not include the proper distancing required under state law, and that the City's adopted environmental findings cannot be adopted because a Subsequent EIR is required to be prepared prior to any action on the Project.

The City's findings—including with regard to the Project's General Plan Consistency and environmental impacts—comply with the requirements in CEQA Guidelines section 15091, and are supported by substantial evidence. As discussed elsewhere in this letter, no new information exists that would require the circulation of a Subsequent EIR. Moreover, as discussed below in the "Land Use Impacts" section, the Project and Ordinances are consistent with all General Plan requirements. The City's findings are therefore adequate.

VI. Inadequate Impact Analysis

a. Environmental Changes Over Time

Comments stated that the EIR does not account for changes in the environment that might occur over time, and that the City lacks authority to amend the Project in light of environmental changes over time to mitigate new impacts. Contrary to the comments, the Ordinance does not need to expressly include provisions allow changes in the future. As a legislative enactment, the City Council is free to amend the Ordinance as appropriate in the future.

CEQA only requires that the EIR analyze a project's impacts on the environmental conditions as determined at the time the notice of preparation is published, and the Certified Final EIR analyzed the potential impacts on known and reasonably foreseeable residential uses near the Project sites. (CEQA Guidelines, § 15125.) Speculative future changes in the environment are irrelevant to the adequacy of the environmental analysis for the Project.

b. Traffic Safety Impacts

Comments stated that moving or flashing images, video, and animation on the digital billboards could result in an increase in distracted driving, potentially resulting in increased traffic injuries and fatalities, and stated that the City and Metro failed to conduct proper analysis of safety risks associated with the Project. Relatedly, comments stated that the Project should employ a 20-second refresh rate for the digital displays, as recommended by the Illuminating Engineering Society (IES) for off-roadway sign luminance.

As the lead agency and responsible agency for the Project, Metro and the City have the authority to use significance thresholds they deem appropriate. (CEQA Guidelines, § 15064.7, subd. (b).) As stated in the Certified Final EIR for the Project, the digital billboards will have an 8-second refresh rate—double the 4-second minimum refresh rate required by Caltrans—and would transition instantly with no motion, moving parts, flashing, or scrolling messages. (See Draft EIR, Appendix K – Transportation and Traffic Safety Review, pp. 10–12.; Draft EIR, Appendix B – Metro TCN Lighting Study, p. 4; Final EIR Responses to Comments, pp. II-65–II-

67.) Metro's lighting experts, Francis Krahe & Associates, have reviewed these comments, and in response note that the IES standard cited in the comments has received a lot of push back, and is currently being reconsidered by the IES.

Furthermore, Metro's transportation experts, Gibson Transportation, studied the safety of the proposed digital displays in detail, and have determined that the proposed 8-second refresh rate is appropriate. Impacts to traffic safety resulting from the Project—including the 8-second refresh rate—have been fully analyzed and addressed in the Certified Final EIR for the Project. The Certified Final EIR explained that the 8-second refresh rate would not result in a significant risk to safety on roadways. (Draft EIR, Section IV.K – Transportation, pp. IV.K-27–24.)

c. Land Use Impacts

Comments stated that the Project and proposed Ordinances will conflict with existing zoning in the General Plan, Specific Plan, and several Community Plans because the proposed Ordinances will supersede current plans and future updates to these plans. Comments stated that there are several Project inconsistencies previously identified in the Draft Environmental Impact Report for the original version of the Project, including the conflict of FF-30 with the General Plan and a Community Plan, and the conflict of NFF-7 and NFF-12 with the Mobility Plan. Comments also stated that the Project and proposed Ordinances will conflict with joint development agreements for housing projects because several of the Project's Site Locations are in locations that Metro identified as suitable for joint development agreements for housing. Commenters further claimed that the Project and proposed Ordinances will conflict with Vision Zero because 11 of the Project's 16 non-freeway facing signs are located on the City's high injury network (HIN) streets.

As explained in the Certified Final EIR and Addendum, after receiving a formal coastal boundary line from the California Coastal Commission, it was determined that TCN Structure FF-30 would *not* be located in the Coastal Zone and would therefore not be inconsistent with the General Plan or any Community Plans. (See Addendum to Final EIR, p. 25.) As also explained in the Certified Final EIR and Addendum, impacts resulting from any inconsistencies of NFF-7 and NFF-12 with the Mobility Plan would be less than significant. (Draft EIR, Section IV.I – Land Use, p. IV.I-21.) Further, NFF-7, NFF-12, and FF-30 have been eliminated from the Project, therefore further reducing any potential impacts relating to inconsistencies with the Mobility Plan.

The Draft EIR concluded that the Project would not interfere with the City's ability to install Vision Zero improvements to enhance the safety of the High Injury Network, and would therefore not conflict with the Vision Zero Program. (See Draft EIR, Section IV.K – Transportation, p. IV.K-16.)

d. Historic Resource Impacts

Comments stated that TCN structure NFF-6 is located too close to the historic Angels Flight Railway. As analyzed and discussed in the Certified Final EIR for the Project, impacts

associated with NFF-6 on the Angels Flight Railway would be less than significant. (Draft EIR, Section IV – Cultural Resources, pp. IV.D-37, IV.D-49.)

e. Aesthetics, Light, and Glare Impacts

Comments stated that the Project has the potential to result in significant light and glare impacts on housing at Site Locations NFF-4, NFF-5, NFF-10, and NFF-17 because the proposed Ordinances only require signs to face away from residential zones and not *residences*, and therefore do not require that the face of any signs be oriented away from housing located in public facilities, light industrial or commercial zones. Comments also claimed that no analysis has been done to determine whether the proposed Ordinances' requirement that signs within 200 feet of residential zones be oriented away from such zones would exceed 3.0 fc at residences.

The Certified Final EIR evaluated potential impacts on all known *and* reasonably foreseeable residential uses—including those in non-residentially-zoned areas—located within the vicinity of a TCN structure. A site-specific evaluation for each individual TCN structure was performed and took into account each individual Site Location's height, and nearby sensitive uses including residential uses. The Lighting Study explained that residential use locations located more than 175 feet from Non Freeway Facing (NFF) signs will receive less than 0.30 fc, or less than 10% of the maximum 3.0 fc permitted by the Los Angeles Municipal Code. (Draft EIR, Appendix B – Lighting Study, pp. 2–3.) Impacts to residential uses were concluded to be less than significant based on the detailed analysis in the EIR. (Final EIR, Responses to Comments, pp. II-58, II-65–II-66.)

f. Biological Resources Impacts

Comments stated that several of the signs are located too close to biological resources, and therefore inconsistent with the proposed Ordinances' requirements. Specifically, comments stated that TCN structures FF-29 and FF-30 are within 200 feet of an ecological reserve, and the proposed Ordinances prohibit signs within 200 feet of an ecological preserve. Commenters also claimed that TCN structures are also located too close to Bowtie State Park (FF-13 and FF-14), Ballona Wetlands (FF-30), the Barnsdall Art Park/World UNESCO Site (NFF-1), and Sepulveda Basin Wildlife Reserve/Woodley Park (FF-25).

FF-13, FF-14, FF-29, FF-30, and NFF-1 have been eliminated from the Project. As discussed in the Certified Final EIR and Addendum, impacts to biological resources resulting from the Project would be less than significant. (See Addendum, pp. 18–19.)

g. Energy Impacts

Comments stated that the Certified Final EIR does not offer any assessment of the energy to be consumed by the communications network component of the Project.

The Certified Final EIR and Addendum analyzed the Project's energy consumption during operation—which primarily includes lighting and display purposes. (Draft EIR, Section

IV.E – Energy.) The exact traffic monitoring mechanisms have not yet been decided and are therefore too speculative to evaluate in the scope of an EIR for the Project. Moreover, as explained in the EIR, estimating the energy usage associated with the end-life of the materials used during the construction or operational life of the Project would be too speculative to be included in the EIR's analysis for the Project. (Draft EIR, Section IV.E – Energy, pp. IV.E-25–IV.E-26.)

h. Cumulative Impacts

Comments stated that the Certified Final EIR for the Project fails to assess cumulative impacts from billboards outside the scope of the TCN Program in surrounding cities, including West Hollywood, Inglewood, Long Beach, and Downey. Relatedly, comments stated that the Certified Final EIR also failed to assess cumulative impacts resulting from the Sidewalk & Transit Amenities Program (STAP). To the contrary, the Certified Final EIR considered cumulative impacts in detail, including from the STAP program. (See Draft EIR, Section III – Environmental Setting, p. 12; Draft EIR, Section IV.E – Energy, pp. IV.E-37–IV.E-38; Final EIR, Responses to Comments, p. II-142.) Digital billboards in other jurisdictions are too remote to have impacts that would be cumulative with the TCN Program. Importantly the TCN Program is expected to reduce light pollution by virtue of eliminating three static signs for each TCN sign, which means existing light sources will be eliminated while new light sources will be highly engineered to reduce slight spillover.

VII. Additional Mitigation

Comments stated that additional mitigation that should be implemented, including increasing the takedown of static signs to further offset the impact of digital signs, increase the digital display refresh rate from 8 seconds to 20 seconds, change the start of digital display operating hours to begin at 7 am instead of 5am, increase the buffer from scenic highways from 200 feet to 500 feet, and require vertical and horizontal louvers on all signs to mitigate impacts to future projects or other sensitive uses.

As discussed in the Certified Final EIR and Addendum, all potential impacts resulting from the Project—including modifications recommended by the City Council's Planning and Land Use Management Committee (PLUM)—are already less than significant or less than significant with mitigation. Therefore, no additional mitigation is required. (CEQA Guidelines, § 15204, subd. (a).)

VIII. Additional Alternatives

Comments stated that the EIR failed to explain why the existing or an expanded RIITS system is insufficient to meet the Project's goals in lieu of the proposed TCN Program.

The EIR contains a reasonable range of alternatives. (CEQA Guidelines, § 15126.6.) The EIR analyzed three alternatives in detail, including a No Project Alternative, an Elimination of Impacts Relating to Historical Resources Alternative, and an Elimination of All Project

Significant and Unavoidable Impacts. (Draft EIR, pp. V-1–V-55.) Notably, the suggested alternatives would not meet some of the primary objectives of the Project. For example, the suggested alternatives would not meet (or not as effectively meet) the Project objectives to (1) geographically space the TCN Structures to expand Metro's transportation public messaging network and ability to further increase Metro's visibility and accessibility for all commuters, (2) maximize efficiency of the congested road network by promoting public awareness of travel alternatives, and (3) maximize advertising revenue that would be utilized by both Metro and the City to fund new and expanded transportation programs that would further Goal 2 of the Metro Vision 2028 Strategic Plan. (See Draft EIR, Section V – Alternatives, pp. V-15–V-16, V-34, V-52–V-53.) The range of alternatives analyzed in the Certified Final EIR is sufficient to permit the Board to make a "reasoned choice." (CEQA Guidelines, § 15126.6, subd. (f).) Metro is not required to consider every conceivable proposed alternative to the Project.

IX. Privacy and Data Collection

Comments stated that the Project will collect cell phone and/or other personal data from drivers as they pass by the TCN structures and potentially sell or use such data to track individuals' movements and travel.

Issues related to data collection and privacy are not CEQA issues required to be analyzed in an EIR. As discussed in greater detail in Metro's December 7, 2023 letter to the City, Metro is a transportation agency and has no plans to use the TCN Structures to collect and sell individualized cell phone data or other personal data for individualized tracking, law enforcement, or other non-transportation purposes. Metro intends to collect only general traffic information via the TCN Structures to be used in the Regional Integration of Intelligent Transportation Systems (RIITS) and will not collect any data that is not already being collected by its partner public agencies in the City of Los Angeles.

Sincerely,

Tiffany K. Wright

Communication from Public

Name:	Marcia Hanscom
Date Submitted:	12/07/2023 05:18 PM
Council File No:	22-0392
Comments for Public Posting:	Please see attached letter and also article re: impacts to wildlife & public health from Sky & Telescope - submitted by Robert Jan van de Hoek

December 7, 2023

Los Angeles City Council
Council File # 22-0392 – re: digital signage

Dear Councilmembers:

Los Angeles has participated in "Lights Out" programs in order to clarify our reliance on and desire for dark skies and, at the same time, using less energy. https://naturalhistory.si.edu/exhibits/lights-out So why is the City contemplating adding MORE lights to the dark sky with the digital lighted billboard project?

We are writing because we are concerned about the addition of significant lighting to the night sky in Los Angeles – with effects from the proposed digital signage program. We object to this program proceeding due to the impacts to wildlife and to public health.

We understand that the digital signage slated to be installed near the Ballona Wetlands – at Culver and the 90 fwy. has been removed. We hope that is the case, and if it is not, we urge you to remove those planned digital signs from the program.

Regardless, we have concerns about the overall program and ask that you consider the science about the effects on both wildlife and public health from these installations.

Please see the attached article: "*Light Pollution: Wildlife & Health*," by Dr. Travis Longcore, adjunct professor at the UCLA Institute of the Environment and Sustainability and co-chair of UCLA's Environmental Science and Engineering (D.Env.) Program. The article appears in the January, 2024, edition of ***Sky & Telescope***.

We humans do not live alone in Los Angeles, and we are blessed to be part of a biodiversity richness, in part due to the mosaics of ecosystems in our midst and surrounding us. Numerous species on California's List of Species of Special Concern, as well as species listed on both state and federal Endangered Species rely on habitat in the Los Angeles area.

Excerpt from article referenced above:

> *Insects are essential to the functioning of the natural world — think pollination and decomposition — but are in global decline. Some locations have seen upwards of 75% fewer insects in the last three decades, leading to fears of an "insect apocalypse." We suspect light pollution is one of the causes, because lights can draw insects significant distances away from their natural habitats and into areas dangerous for them*

Additionally, much of the food humans and other species rely on are dependent on pollinators at the base of the food chain. Pollinators are increasingly at risk. These situations cause us to want to not add stressors to those species.

While there are alleged mitigations through the addition of louvres, those additions do not minimize the brightness of the lights that still will be present.

Here is what the article referenced above states are the effects of such lit billboards:

> *The effects of light at night on the natural world fall into three main categories: 1) movement, including attraction, disorientation, and resulting fragmentation; 2) disruption of ecological interactions between species; and 3) disruption of those daily, lunar, and seasonal rhythms, which also encompasses the effects light at night has on humans.*

Wildlife species that are nocturnal – feeding during the crepuscular hours and at night – will be especially impacted by these lit up digital billboards. Turning the lights off at midnight will not be sufficient to mitigate the impacts.

There is a great deal of movement of wildlife that happens beginning at dusk each day, and disrupting that movement with lighted billboards translates to disrupting foraging (feeding) and other behaviors essential for the continuation of these species.

Please deny approval of this program because the mitigations are insufficient and because we all need the dark skies that we have evolved with.

With best regards,

Robert Jan van de Hoek
Environmental Scientist
Ballona Institute

Marcia Hanscom
Community Organizer
Defend Ballona Wetlands

Communication from Public

Name: Greg Goldin
Date Submitted: 12/07/2023 05:22 PM
Council File No: 22-0392
Comments for Public Posting: I strongly oppose the Metro TCN digital billboard advertising Program because of the impacts to housing, safety, historic-cultural, scenic, coastal, environmental and sensitive use resources. City Council must send the Metro TCN Program Ordinances back to the City Planning Commission for reconsideration per City Charter Sections 555 and 558, following substantive changes adopted by several motions introduced by Council Districts 1, 2, 5, 12, and 13. These changes include: --PLUM restored freeway facing billboard FF-3 that was removed by CPC out of concern for saturation and public safety; --PLUM reduced the CPC recommended distance of 2,640 feet to 1,500 feet between billboards on the same side of the freeway. This will set a negative precedent for all future signs, especially in the downtown area; --PLUM expanded the hours of operation for freeway facing signs; --PLUM reduced the number of existing static billboards to be removed prior to installation of new digital billboards from 125 to 50 initial removals + 4 signs after that (these numbers don't add up to the required 200 sign removals); --PLUM lowered the minimum takedown square footage per sign from 300 square feet (minimum billboard size) to 200 square feet (poster board size); --PLUM opened the door to extend the digital billboard program to a 30-year contract instead of the CPC recommended 20-year contact. I agree with Scenic America and the Coalition for a Beautiful Los Angeles that the placement of offsite commercial advertising on Metro-owned and controlled property in partnership with the City turns our public rights of way into advertising vehicles for private interests and and is antithetical to the idea that citizens should have public spaces and a public sight lines free of all commercialization. Los Angeles continues to march in the wrong direction, toward more visual blight and clutter and privatization of public space, instead of the removal of all billboards from our cityscape. Why? So that a few giant billboard companies can profit? So that advertisers can bombard us with their commercial messages? Why are we selling off what little public visual space we have? Our city should instead be banning billboards, not opening the floodgates for more -- and, in the case of these electronic billboards, the most dangerous form of billboards imaginable. Shame on Los Angeles. Shame on every member of our city council and our mayor for

fast-tracking this wrongheaded, dreadful, pernicious ordinance. Reverse course! Stop billboard blight! Stop METRO TCN. Thank you, Greg Goldin

Communication from Public

Name:	Robert Jan van de Hoek
Date Submitted:	12/07/2023 05:24 PM
Council File No:	22-0392
Comments for Public Posting:	Attached article from Sky & Telescope to go with letter from Ballona Institute and Defend Ballona Wetlands

No Creature Comfort

Artificial light at night robs us of more than the stars.

I give a lot of talks about light pollution and its effects on things other than our view of the stars. Everyone working in light pollution generally has a story about dark skies and being inspired by the aurora borealis (or australis) or a first view of the Milky Way. The threat of light pollution to that experience is easy to explain, visceral.

But many people have never experienced the Milky Way firsthand. Those billions of people growing up in cities around the world, often without the personal capital to travel outside the surrounding glow, have no experience with, let alone connection to, the night sky.

One of the ways in which I try to connect with such urban audiences is to talk about the effects of light pollution on things more familiar to them. These include human health — everyone has experience with sleep disrupted by lights, sooner or later — and wildlife that they may know and care about.

It should come as no surprise that anthropogenic light at night (that is, light from human sources) affects living organisms. And yet, it *does* surprise people. It also surprises them that many creatures in the marvelous landscapes surrounding us are falling prey to the effects of nighttime lighting, and that they themselves may suffer the medical consequences of long-term exposure.

For all of evolutionary history, the major patterns of light and dark were defined by Earth's rotation, the Moon reflecting the Sun's light back at us, and the stars and other glowing phenomena of the sky. Daily, monthly, and seasonal patterns were so predictable that they became the metaphor for predictability — like clockwork.

As a result of this predictability, many events in life are tied to light levels. Birds begin their dawn song when the light levels increase to a certain point. Gerbils come out to search for food when moonlight is low and darkness provides a refuge. Moth-pollinated flowers open as dusk falls. Some plants set seed as daytime shortens. Humans (usually) sleep at night. All of these rhythms are tied to light levels that had billions of years of predictability.

In nature, whenever there are predictably variable resources available in an environment, species will evolve to specialize and divide up those resources. Some birds specialize in looking for food in the highest branches of trees, some in the lowest branches, some on the ground, and some wherever they can (this last group is known as *generalists*). Over the long arc of the history of life on this planet, species have evolved to exploit all the different conditions of darkness — and, in doing so, have come to rely on those conditions for their survival. The darkest nights of the month, the *crepuscular* period between night at day, and the full Sun of noon are all unique conditions to which species have adapted. The generalists may be able to persevere if part of that natural variation is curtailed, but the specialists will not. So it is that light pollution, through simplifying the physical environment and eliminating certain conditions, threatens some species' persistence.

In any given system, although generalists may be numerous in terms of individuals, the number of specialist species can be equal or greater. A world without the species that need the natural patterns of light and darkness would be depauperate indeed.

The effects of light at night on the natural world fall into three main categories: 1) movement, including attraction, disorientation, and resulting fragmentation; 2) disruption of ecologi-

◀ **CAPTIVATED** Thousands of moths swarm around floodlights at the Newcastle United Jets home game at EnergyAustralia Stadium (today, McDonald Jones Stadium) in Newcastle, Australia, on October 1, 2005.

MOTHS AT NIGHT LIGHT: FAIRFAX MEDIA / GETTY IMAGES; MOTH ILLUSTRATIONS: ARTOPHOTODESIGNO STUDIO / SHUTTERSTOCK.COM; SEA TURTLE ILLUSTRATION: TANVIR AHMED SIDDIQUE / SHUTTERSTOCK.COM

cal interactions between species; and 3) disruption of those daily, lunar, and seasonal rhythms, which also encompasses the effects light at night has on humans.

Movement and Its Consequences

Influences on animal movement are some of the most well-known effects of light at night, because they can leave dead bodies on the ground. Sea turtles are one familiar example. Female sea turtles normally lay their eggs in nests they excavate on sandy beaches. Once the baby turtles hatch, they emerge from the nest and head for the ocean. Before the advent of electric lighting, the hatchlings simply crawled away from the darkest horizon — which was always the landward dune and vegetation — to find the water.

Coastal and offshore development and lighting have altered these patterns. Lights disorient and misorient the hatchlings, so that they are much less likely to reach the ocean. Recent studies have shown that even skyglow (scattered light in the atmosphere from artificial lighting) can be bright enough to confuse hatchling turtles. Female turtles will also not lay on beaches that are brightly lit, reducing the area of habitat available to them.

Although some jurisdictions have enacted lighting limitations to protect nesting sea turtles, there remain many tropical beaches around the world where anthropogenic lights threaten these animals.

Other creatures also go toward the light. Many groups of insect species are attracted to lights, so much so that their behavior has been woven into the imagery of language ("like a moth to a flame"). Insects are essential to the functioning of the natural world — think pollination and decomposition — but are in global decline. Some locations have seen upwards of 75% fewer insects in the last three decades, leading to fears of an "insect apocalypse." We suspect light pollution is one of the causes, because lights can draw insects significant distances away from their natural habitats and into areas dangerous for them.

Outdoor light that penetrates into bedrooms in a major city can be more than double that of a full Moon — within the same order of magnitude as the melatonin suppression threshold.

Some insect species flee light instead, while others simply become quiet and do not move at a time when they would normally be active. The degree of such effects is often related to the contrast between the light and the ambient conditions, such that even a dim light in an environment with little light pollution is highly attractive to insects.

Birds, too, are attracted to light, through mechanisms that researchers have not yet fully been able to explain. People have used fire and lights to hunt birds for centuries, and great masses of birds have been recorded at light sources such as lighthouses, lightships, communication towers, buildings, ceilometers (beams of light directed at the sky to measure cloud height), and light displays erected for aesthetic purposes. The annual 9/11 Tribute in Light in New York, for instance, draws around 160,000 birds to its beams in a single night. Very often the species attracted by lights are normally

WILDFLOWERS: NIKIPARONAK / SHUTTERSTOCK.COM; STATS: SOURCE: C. A. HALLMANN ET AL. / *PLOS ONE* 2017

active during the daytime but migrate at night. These birds may die when they collide with lit structures, especially glass windows as day breaks.

Research with weather radar, which is sensitive enough to detect individual birds, has shown that birds are indeed attracted to lighted areas from even kilometer-scale distances and that anthropogenic light influences the distribution of birds across the landscape during their migration. In these cases, the birds aren't choosing their stopover habitats because the locations are the highest quality but because they're lured by lights. As a consequence, migrating birds are exposed to the excess dangers associated with urban conditions.

A major consequence of animals changing their movement patterns in response to lights can be the fragmentation of landscapes into smaller pieces. Lights themselves can create a barrier to movement, acting alone or in concert with other features such as roads. In aquatic environments, for example, bridge lights can prevent young salmon from migrating downstream, even without a physical barrier in their way. Young salmon naturally move during darkness, and when under lights they will hunker down like it's daytime. Some species of bats commuting from their roosts will avoid lighted areas and consequently must fly around them. Researchers think these behaviors are attempts to avoid being seen by predators.

In other instances, nocturnally active species avoid lights to reduce contact with humans. Several studies show that mountain lions keep to the darkest parts of the landscapes they are in and will avoid areas with lights. For this reason, controlling lights and creating dark pathways of approach is important for the design of wildlife-crossing structures for roadways.

Physiology: A Matter of Timing

Artificial light also serves as a signal that affects the timing and rhythms of organisms, resulting in a wide number of physiological and behavioral changes. It is here where research on human health and on other species overlaps.

Nearly every organism that lives on Earth's surface (as opposed to in the abyss of the ocean or deep in caves) has intrinsic daily rhythms that are kept synchronized by light. Exposure to light at night, even at relatively low levels, can upset those rhythms. Researchers have extensively investigated this for humans, often using mice as a model organism. Exposure to light at night has been associated with a whole suite of diseases, most notably breast, prostate, and several other cancers, as well as diabetes, obesity, sleep disorders, depression, and stress.

For breast cancer, researchers think nighttime light exposure prompts disease by suppressing the production of the hormone melatonin. Melatonin serves many roles in regulating systems in the body, suppresses cancerous growth, and is produced only in the dark. Large studies consistently connect outdoor nighttime lighting levels measured by satellites with

▼ **SOYBEANS** This drone photo of a soybean field in Fairview, Alabama, shows how the crop's behavior changes when exposed to artificial light at night. Under normal conditions, the soybeans mature, die, and dry out (brown areas), after which they're harvested. But near the streetlight, the plants stay green. Note the long brown strip inside the green area: This is where the pole's shadow blocked light from reaching the plants, enabling them to mature naturally.

HONEYCOMB: ALEKSA_CH / SHUTTERSTOCK.COM; BEE: BELENOVA_ART / SHUTTERSTOCK.COM; SOYBEANS: BEN TANKERSLEY / ALABAMA COOPERATIVE EXTENSION SYSTEM

elevated rates of breast cancer. Of course, much of the light that humans are exposed to at night is self-directed (indoor lighting, devices, computers, televisions), but outdoor lighting is still highly correlated with risk.

My own preliminary research with my students indicates that outdoor light that penetrates into bedrooms in a major city can be more than double that of a full Moon — within the same order of magnitude as the melatonin suppression threshold (about 5 lux, similar to civil twilight). Individuals vary enormously in their sensitivity to light at night, though, with some people being up to 50 times more sensitive than others.

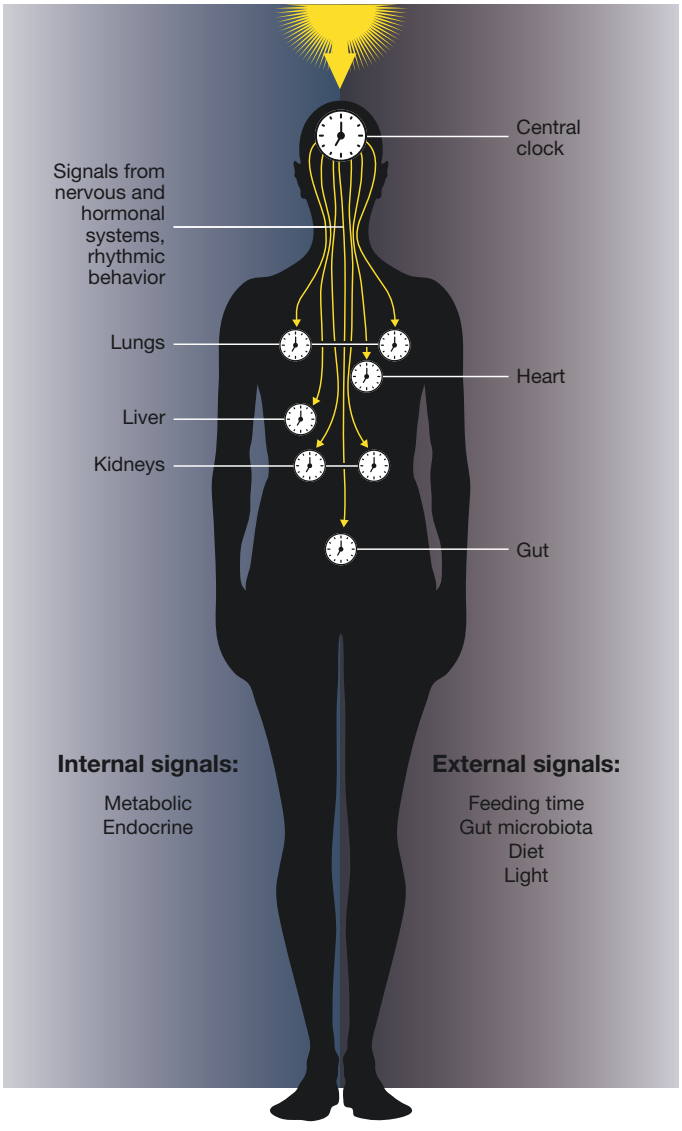
The association between increased outdoor light and sleep disruption is quite strong. In a recent study, my colleagues and I showed that light at night is a significant influence even when considering other stressors like noise, air pollution, and lack of green space. Sleep disruption is associated with cardiovascular disease, diabetes, and cancer. But because our study was based on survey results, we could not conclusively tie the effects to melatonin suppression.

Wildlife species can be up to 1,000 times more sensitive to melatonin suppression by light than humans, so they must be experiencing the adverse effects of light at night in their most basic inner workings. Birds are one example.

Lights, as a signal of seasonal timing, induce birds to lay eggs. This was noted first in London in the 1920s, where starlings were ready to breed earlier when they lived close to streetlights. Poultry growers harnessed this technique, stimulating decades of research on the timing and types of light to maximize not only egg production but growth for human consumption. To this day, the industry uses lights to keep the billions of hens around the world laying as desired.

Even plants react to artificial lighting. Under normal circumstances, soybeans set seed when the number of daylit hours dwindles. Once they set seed, they die and can be harvested. But under streetlights and in fields affected by lights, soybeans never set seed — they don't know that summer has ended, because the artificial lights make it seem as though the daylight levels remain the same.

Humans also can exhibit seasonal and monthly patterns in response to the light environment. At high latitudes, humans show a seasonal pattern of melatonin production, with more produced during the winter and less during the summer. Urban residents, however, who are exposed to more artificial light at night, do not show this pattern. Recently, researchers have also shown that human sleep in the absence of electric light shows a monthly pattern that tracks the illumination from the Moon. A similar but smaller lunar influence was found in the sleep patterns of a nearby village that did have electric lights, and it was still detectable in college students in a highly urbanized North American city. Whether the lunar patterns' weakening results from illumination in the urban environment remains to be proven, but the patterns' presence indicates how much human sleep is influenced by the environment.



▲ **CIRCADIAN RHYTHM** Light exposure sets the master clock in the brain. The brain in turn sets clocks in various organs via nervous and hormonal signals. External and internal factors influence these peripheral clocks, too: Internal signals include metabolic and endocrine sources (such as body temperature and hormones), and external signals include light, feeding time, gut microbiota, and diet composition.

BEATRIZ INGLESSIS / *S&T*; SOURCE: K. SU ET AL. / *BRAIN, BEHAVIOR & IMMUNITY—HEALTH* 2022

Spectrum Matters

The effects of light pollution are amplified or reduced by the light's color. Outdoor lighting often involves broad-spectrum white lights, which emit a wide range of wavelengths. This light triggers both humans' daytime (color) and nighttime (monochromatic) vision. But other species form images using light at wavelengths outside the sensitivity of human vision. Many non-human species, including some insects, spiders, birds, reptiles, amphibians, and mammal species, see very short wavelengths in the ultraviolet range, while humans generally do not because we filter these wavelengths out in our corneas. Insects in particular are attracted to ultraviolet light, making them vulnerable to lamps that emit in this range.

116 minutes
Time before civil dawn when robins began singing in a light-polluted town

48 minutes
Time before civil dawn when robins began singing in a rural area

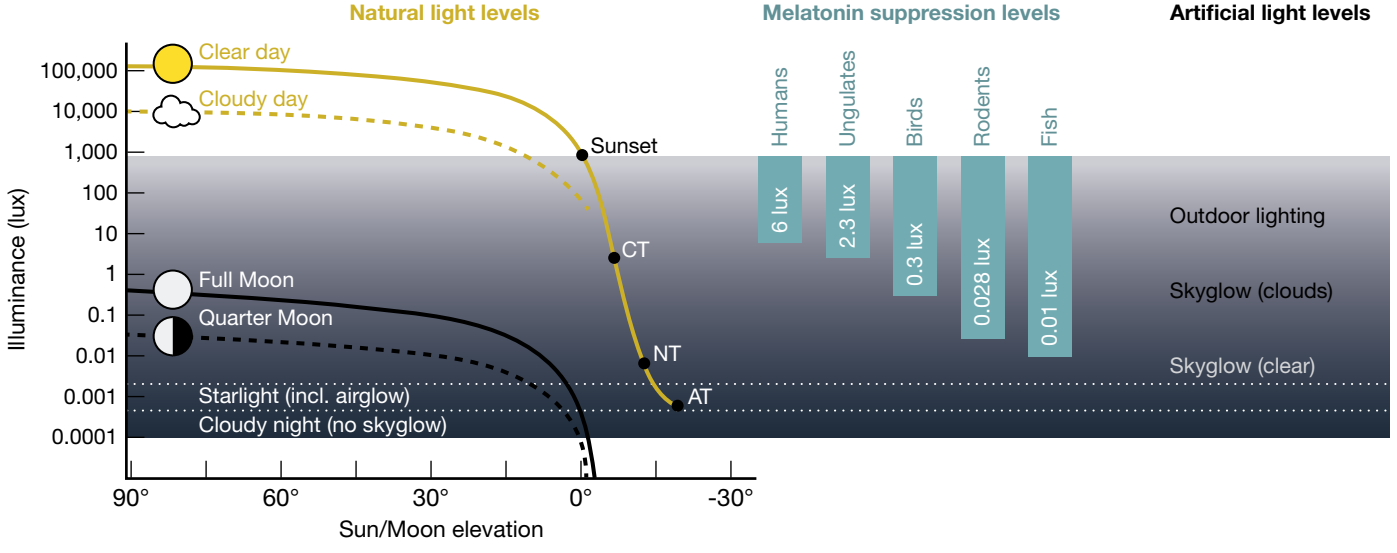
9 minutes
Time before civil dawn when robins began singing in a dark-sky area

I recently compiled and digitized visual sensitivity information for a wide array of terrestrial wildlife species, pulling from published studies dating from the middle of the 20th century to today. I was looking for similarities in the degree to which different groups of animals respond to different light colors, to find out which areas of the spectrum we should avoid. It was not a new idea: Estimates of the degree to which moths are attracted to short (ultraviolet, violet, and blue) and long (red and yellow) wavelengths have been around since the 1960s, and several research groups have suggested using color to mitigate the ecological and health effects of light pollution.

After compiling results from 175 measurements scattered across nearly as many studies, I found considerable variation. But on average, the light sensitivity of terrestrial species' eyes follows a double-peaked wave: We have one peak of sensitivity to ultraviolet light, relatively high sensitivity to blue, another peak in response to green light, declining sensitivity to yellow, and then lowest sensitivity to red. Importantly, the peak sensitivity of human color vision is offset to longer wavelengths from the peak sensitivity of most other species, suggesting that the use of lights that are yellow and red instead of white could provide visibility for humans while reducing their apparency to other species.

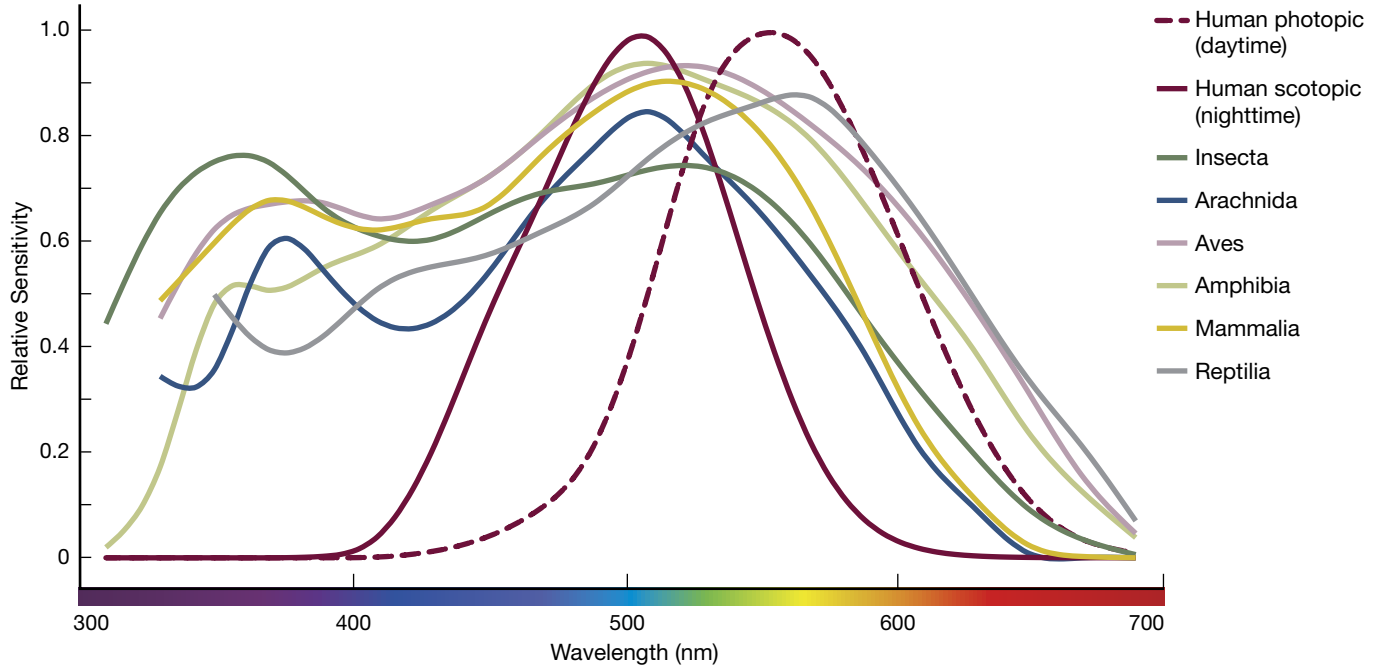
The lower effect of amber and red will come as no surprise to amateur and professional astronomers, who have long relied on red-hued lights to preserve their night vision. But the benefits go far beyond detecting faint fuzzies in telescopes. Light that is more visible to a given species should have a larger impact on behaviors that arise from its visual perception. With this new database, I could calculate the likely effect of lights with different color compositions for groups of organisms — birds, mammals, amphibians, reptiles, insects, and spiders. To do this, I used a technique my colleagues and I had previously developed to compare the light from different real-world sources based on their *correlated color temperature* (CCT), which describes the proportions of different wavelengths in the light.

Those calculations predicted greater effects for lights at higher color temperatures (bluer) and lower effects for lower color temperatures (more yellow and red). The predicted effect was more pronounced for some groups (mammals, insects, spiders) than for others, but it held true across all groups. For example, light-loving insects tend to be more



▲ **LIGHT AND MELATONIN** Natural light levels change throughout the day and month (left). When light levels rise to a certain threshold, animals stop producing the key hormone melatonin (center, minimum light levels shown). But typical artificial light at night (right) can exceed these thresholds. Human sensitivity to light varies widely — on average, 25 lux will suppress melatonin production by 50%, but some people are sensitive to much less, while others can handle 10 times more. CT = civil twilight, NT = nautical twilight, and AT = astronomical twilight.

ROBIN: MIS VECTOR / SHUTTERSTOCK.COM; STATS: SOURCE: M. W. MILLER / *THE CONDOR* 2006; MELATONIN GRAPH: BEATRIZ INGLESSIS / *S&T*; SOURCE: M. GRUBISIC ET AL. / *SUSTAINABILITY* 2019, A. J. K. PHILLIPS ET AL. / *PNAS* 2019



▲ **SEEING THE LIGHT** Each class in the animal kingdom (six shown here) reacts in its own way to different wavelengths, although there are a lot of similarities. These average sensitivities have a similar peak to those of humans' day and night vision, but we are far less sensitive to short wavelengths than other animals are.

attracted to shorter wavelengths, and horses and related species shouldn't be disturbed by red light at night because it's at the edge of what they can see. This would also apply to most insect groups and some species of rodents, as well as bats.

The prospect of using color to reduce lights' impacts comes with some conspicuous exceptions and challenges. Bioluminescent species such as fireflies are often sensitive to the very yellow to amber wavelengths that are less harmful to other species. For these groups, which communicate using light, it is far better to avoid exposing them to stray light altogether. The other challenge is that some species are sensitive to light no matter where it is on the spectrum, so spectrum is not a "get out of jail free" card that allows indiscriminate use of light without adverse effects.

My work looked at color vision, which uses photoreceptors called cones; we also have rods, for dim light. But our eyes, as well as those of other species, also have daylight detectors that set our circadian rhythms yet don't contribute to vision. These photoreceptors are most sensitive to blue light, very close to the color of the blue sky, because before artificial light we only encountered bright bluish light during the day. The deleterious effect on our internal clocks — which govern our sleep patterns — gives another reason to avoid blue light at night.

Takeaways

We can conclude a few things from the research covered here. To minimize the impact on wildlife, plants, and even ourselves, we need to control both light levels and light colors in nighttime environments. We should avoid shorter wavelengths (ultraviolet through blue) in favor of yellow and red, to enable us to see at night while reducing adverse effects on other species.

But the best solution is to reduce light overall and direct it only where it is needed, when it is needed. From a technical perspective, this means shielding lights to make them "full cut-off," so that no light escapes upward, and directed, so that light falls on its target and not in nearby habitats.

For color, I recommend lights with a CCT less than 2200K, which looks like warm candlelight. Such lights are increasingly available from manufacturers who recognize the growing market potential, as awareness of the impacts of light pollution grows.

Once the harms of disrupting darkness are explained, people tend to intuitively understand them and are open to supporting better lighting. When I give presentations, I hear stories about sleep lost from a neighbor's light and hear wonder at the nuanced patterns of activity in response to light at night. Some places we should not light at all, but great strides could be made by simply lighting better — in a way that is less wasteful and aware of the natural rhythms of life on Earth.

■ **TRAVIS LONGCORE** is an adjunct professor at the UCLA Institute of the Environment and Sustainability and co-chair of the Environmental Science and Engineering (D.Env.) Program.

FURTHER READING: Catherine Rich and Travis Longcore, eds. *Ecological Consequences of Artificial Night Lighting*. Island Press. 2006.

BEATRIZ INGLESSIS / *S&T*, SOURCE: THE AUTHOR

Communication from Public

Name: JOHN Miller
Date Submitted: 12/07/2023 05:37 PM
Council File No: 22-0392
Comments for Public Posting: I strongly oppose the Metro TCN digital billboard advertising Program because of the impacts to housing, safety, historic-cultural, scenic, coastal, environmental and sensitive use resources. I ask the City Council to send the Metro TCN Program Ordinances back to the City Planning Commission for reconsideration per City Charter Sections 555 and 558, following substantive changes adopted by several motions introduced by Council Districts 1, 2, 5, 12, and 13. These changes include: PLUM restored freeway facing billboard FF-3 that was removed by CPC out of concern for saturation and public safety; PLUM reduced the CPC recommended distance of 2,640 feet to 1,500 feet between billboards on the same side of the freeway. This will set a negative precedent for all future signs, especially in the downtown area; PLUM expanded the hours of operation for freeway facing signs; PLUM reduced the number of existing static billboards to be removed prior to installation of new digital billboards from 125 to 50 initial removals + 4 signs after that (these numbers don't add up to the required 200 sign removals); PLUM lowered the minimum takedown square footage per sign from 300 square feet (minimum billboard size) to 200 square feet (poster board size); PLUM opened the door to extend the digital billboard program to a 30-year contract instead of the CPC recommended 20-year contact. I agree with Coalition for a Beautiful Los Angeles that the placement of offsite commercial advertising on Metro-owned and controlled property in partnership with the City subjects users of public spaces to unwanted sales pitches for goods and services and is antithetical to the idea that citizens should have public spaces/visual environment free of crass commercialization. Please send the Ordinances back to the City Planning Commission for reconsideration. Thank you, John Miller

Communication from Public

Name:	Lin Oliver
Date Submitted:	12/07/2023 10:18 PM
Council File No:	22-0392
Comments for Public Posting:	Dear Council Members, I'm writing to oppose the proposition to increase the number of electronic/digital billboards in Los Angeles. These billboards create light pollution, driving and traffic issues, and are unsightly and defacing to our beautiful city. I hope you will join those of us who oppose these billboards which sacrifice a calming and lovely environment in favor of a modest revenue stream for the city. Thanks for your considering, with trust that you'll do the right thing. Best, Lin Oliver 344 S. Las Palmas Ave Los Angeles 90020