BKF 100+ YEARS
ENGINEERS . SURVEYORS . PLANNERS

TECHNICAL MEMORANDUM

Date: June 2019 **BKF Job Number:** 20145104-40

Deliver To: Philip Buckley, PE & Reuel Brady (County of Marin Public Works)

From: April Miller, PE & Monique Fuhrman, PE (BKF Engineers)

Subject: **Sir Francis Drake Boulevard Existing Lighting Assessment**

INTRODUCTION

As part of the Sir Francis Drake Boulevard Rehabilitation Project, which proposes to improve the corridor from US101 to the Town of Ross, the County of Marin is undergoing an investigation of the existing street lighting along the corridor and design of additional new lighting. It is the County's understanding that the lighting was relinquished to the County from PG&E, who installed and maintained the lighting infrastructure. The lighting along this corridor is currently owned by a Joint Power Street Lighting Association, which includes the County, and is maintained through a maintenance contract with DC Electric. This memorandum discusses the investigation of the existing lighting system, as well as the approach for installation of new lighting along the corridor.

GLOSSARY OF TERMS

AGI 32	Industry standard lighting software for lighting simulation
Caltrans	California Department of Transportation
fc	Foot candle – unit of measure equaling illuminance on a one square foot survey from uniform source of light
IES	Illuminating Engineering Society – Non-profit technical and educational authority on illumination and accredited Standards Development Organization (SDO) under American National Standards Institute (ANSI) approved procedures
Illuminance	The amount of luminous flux (incident light) per unit area
LED	Light-emitting diode – A semi-conductor light source that emits light when current flows through
Luminaire	A complete lighting unit consisting of a lamp or lamps together with the parts designed to distribute the light, to position and protect the lamps, and to connect the lamps to the power supply
SFDB	Sir Francis Drake Boulevard

EXISTING CONDITIONS

To determine the existing conditions of the lighting system, BKF engineers and a DC Electric representative inspected the lighting system to document the existing system in a CAD base file and photos. The inspection included documentation of pole types, fixture type and wattage, pull box size, and approximate conduit size, if visible.

Existing Infrastructure

The existing street lighting infrastructure includes cobra head style and Caltrans type 15 poles with single mast arms and double mast arms. Lighting along the corridor is generally concentrated at signalized intersections, with some more regularly spaced lighting near the College of Marin and between College Avenue and Corte Comoda.

Lighting circuits along the corridor are typically one to five luminaires, generally believed to be directly fed power from PG&E service boxes throughout the corridor. The lighting is not currently metered. Most of the existing light fixtures along the corridor were recently retrofitted in 2011 to 105-watt LED fixtures manufactured by Leotek. These lights are currently under a ten-year warranty.

The lighting circuits are contained within locked pull boxes marked "Street Lighting." Conductors for the street lighting circuits are within 1.5" and 2" conduit. Safety lighting at intersections utilize traffic signal conduits, which range in size from 2" to 4", to reach service pedestals for power service.

Existing Lighting

Existing lighting is not continuous or regular along the corridor. Intersections are generally well-lit with integrated safety lighting at the traffic signals. As previously mentioned, portions of roadway segments are lit, while others are not.

To approximate the existing lighting levels on the corridor, a model of the lighting along the corridor was produced using AGI 32 software and fixture model files acquired from product manufacturers.[1] The table below summarizes average illuminance levels at and between intersections along the corridor.

[1] IES files utilized were approximate with similar characteristics as existing Leotek fixture. Exact fixture has been discontinued by the manufacturer.

Table 1: Existing Illuminance along Sir Francis Drake Boulevard

Cross Street	*Average Illuminance (fc) at intersection*	*Average Illuminance (fc) between this and preceding intersection*
Ross Terrace	0.05	-
Toussin Avenue	1.19	0.68
Altamira Avenue	1.17	0.19
Laurel Avenue	0.49	0.49
Butterfly Lane	1.49	1.04
Elm Avenue	2.80	1.58
Maple Avenue	1.22	1.14
College Avenue	1.42	1.50
Stetson Avenue	1.68	1.39
Terrace Avenue	1.23	1.14
Ash Avenue	1.43	1.61
McAllister Avenue West	1.47	0.54
Rosebank Avenue West	0.46	0.55
Oak Avenue	0.58	0.59
Broadway	0.41	0.61
Rosebank Avenue East	1.71	0.75
Laurel Grove Avenue	2.46	1.03
McAllister Avenue East	1.42	1.50
Wolfe Grade	1.18	0.68
Manor Road	0.92	0.60
Corte Comoda	0.90	0.09
Bon Air Road	2.59	0.16
El Portal Drive	2.67	0.41
La Cuesta Drive	1.32	0.30
Eliseo Drive/Barry Way	2.04	0.16

Source: BKF Engineers, 2019

LIGHTING STANDARDS

The County of Marin does not currently adhere to a defined lighting standard. For the purpose of our analysis within this memorandum, we are considering several different standards to inform our design. Lighting recommendations and standards which were reviewed are the following:

- City of Los Angeles Bureau of Street Lighting
- City of Santa Rosa Lighting Requirements
- IES RP-8-14 Roadway Lighting Manual
- Caltrans Standard Specifications

The goal for adding and retrofitting lighting along this corridor is to improve safety as much as possible by installing regularly-spaced street lights along the entire corridor. Sir Francis Drake Boulevard is classified by Caltrans as a principal arterial. In developing our light spacing recommendations, the average lighting levels shown in **Table 2** were considered as a baseline for light placement along the corridor for this functional classification.

Table 2: Suggested Average Illuminance for Major Arterials

	Low Pedestrian Conflicts	High Pedestrian Conflicts
Roadway	0.6 fc	1.2 fc
Intersections	1.3 fc	2.6 fc

Source: IES RP-8-14 Roadway Lighting Manual

In addition to lighting levels, the standards specify other lighting assembly equipment, such as pull boxes, conduit, wires, etc. For the purpose of this design, the **Table 3** specifies the standards to which this design should adhere based on discussion with the County of Marin and designer recommendations.

Table 3: Minimum Standards for Lighting Design Elements

Design Element	*SFDB Standard/Specifications*	*Standard Reference*
Pull boxes	• Size 5 minimum • Shall be marked 'Street Lighting' • Maximum spacing of 250'	• City of Santa Rosa • Caltrans
Conduit	• 2" minimum • Schedule 40 PVC minimum, schedule 80 PVC for street crossings	• City of Santa Rosa • City of Los Angeles
Wiring & Circuitry	• Max voltage drop: 5% • Wire sizing: typically #6 AWG, #10 AWG minimum • Minimum service point breaker: 30 Amps • Minimum luminaire breaker: 10 Amps • Voltage: 120-240V	• National Electric Code
Poles & Foundations	• Caltrans type 15 for single luminaire • Caltrans type 15D for double luminaire	• Caltrans
Luminaire	• LED lighting • Color temperature 3000K maximum • Type III lighting distribution	• Caltrans • County of Marin

LIGHTING ASSESSMENT & RECOMMENDATIONS

The following section summarizes assessment of lighting levels along the corridor based on the typical average lighting guidance shown in **Table 2**.

Intersection-Level Lighting (Safety Lighting)

Intersection-level lighting along SFDB is planned to be improved as part of traffic signal upgrades. Generally, many agencies adhere to Caltrans standards and specifications for lighting at signalized intersections. However, lighting at non-signalized intersections is more nuanced and may not require the high levels of lighting that are required at a signalized intersection. This is due to the lesser number of pedestrian conflict zones at non-signalized intersections due to the absence of push buttons and crosswalks. This would not apply to specialized mid-block crossings with special signalization, such as Rectangular Rapid Flashing Beacons (RRFBs) or High-Intensity Activated Crosswalk Beacons (HAWKs). These mid-block crossings should provide lighting more consistent with safety lighting levels in order to minimize visibility issues for vehicles and improve the sense of safety for pedestrians. With any type of intersection, however, the goal of the lighting is to provide sufficient illumination such that vehicle and pedestrian conflict zones are sufficiently visible for vehicles to make necessary movements through the intersection. For non-signalized intersections, lower levels at or around 1 foot candle may be considered sufficient. **Table 4** summarizes the intersection lighting levels and assesses their adherence to previously discussed standards. Recommendations for light placement based on modelling proposed lights are also provided for consideration during design.

Roadway Lighting

Roadway lighting between intersections along the corridor is planned to be upgraded as part of a separate design from safety lighting. Roadway lighting is desired to provide continuous lighting along the corridor at a prescribed regular spacing, thus providing a more uniform lighting experience for drivers, and improve lighting at the darker non-signalized intersection locations. **Table 5** summarizes the roadway segment lighting levels and assesses their adherence to previously discussed standards. Recommendations for additional light placement based on modelling proposed lights are also provided for consideration during design. Recommendations for roadway lighting attempt to provide lighting at a regular spacing interval to assist in achieving the goal for uniformity of lighting.

Table 4: Assessment and Recommendations for Illuminance at Intersections along SFDB

Cross Street	*Intersection Control*	*Existing Average Illuminance (fc) at intersection*	*Assessment*	*Recommendation*
Ross Terrace	Stop	0.05	**Insufficient**	Add light at NE corner for existing pedestrian crossing
Toussin Avenue	Stop	1.19	Sufficient	-
Altamira Avenue	Stop	1.17	Sufficient	-
Laurel Avenue	Stop	0.49	**Insufficient**	Add additional light at NW corner to better illuminate entire intersection
Butterfly Lane	Stop	1.49	Sufficient	-
Elm Avenue	Stop	2.80	Sufficient	-
Maple Avenue	Stop	1.22	Sufficient	-
College Avenue	Signal	1.42	Sufficient	-
Stetson Avenue	Stop	1.68	Sufficient	-
Terrace Avenue	Stop	1.23	Sufficient	-
Ash Avenue	Stop	1.43	Sufficient	-
McAllister Avenue West	Stop	1.47	Sufficient	-
Rosebank Avenue West	Stop	0.46	**Insufficient**	Add light at or near intersection
Oak Avenue	Stop	0.58	**Insufficient**	Add light at or near intersection
Broadway	Stop	0.41	**Insufficient**	Add light at or near intersection
Rosebank Avenue East	Stop	1.71	Sufficient	-
Laurel Grove Avenue	Signal	2.46	Sufficient	-
McAllister Avenue East	Stop	1.42	Sufficient	-
Wolfe Grade	Signal	1.18	**Insufficient**	Reassess safety lighting levels with signal modification
Manor Road	Stop	0.92	**Insufficient**	Add light at SE corner to better illuminate entire intersection
Corte Comoda	Stop	0.90	**Insufficient**	Add light at or near intersection
Bon Air Road	Signal	2.59	Sufficient	-
El Portal Drive	Signal	2.67	Sufficient	-
La Cuesta Drive	Signal	1.32	Sufficient	-
Eliseo Drive/Barry Way	Signal	2.04	Sufficient	-

Source: BKF Engineers, 2019

Table 5: Assessment and Recommendations for Illuminance along Roadway Segments on SFDB

Cross Street	*Average Illuminance (fc) along roadway segment*	*Assessment*	*Recommendation*
Ross Terrace to Toussin Avenue	0.68	Sufficient	-
Toussin Avenue to Altamira Avenue	0.19	**Insufficient**	Add a midblock light.
Altamira Avenue to Laurel Avenue	0.49	**Insufficient**	Add a midblock light.
Laurel Avenue to Butterfly Lane	1.04	Sufficient	-
Butterfly Lane to Elm Avenue	1.58	Sufficient	-
Elm Avenue to Maple Avenue	1.14	Sufficient	-
Maple Avenue to College Avenue	1.50	Sufficient	-
College Avenue to Stetson Avenue	1.39	Sufficient	-
Stetson Avenue to Terrace Avenue	1.14	Sufficient	-
Terrace Avenue to Ash Avenue	1.61	Sufficient	-
Ash Avenue to McAllister Avenue West	0.54	**Insufficient**	Replace lighting fixtures to improve light levels.
McAllister Avenue West to Rosebank Avenue West	0.55	**Insufficient**	Install lighting on median at approximately 150′ intervals.
Rosebank Avenue West to Oak Avenue	0.59	Sufficient	-
Oak Avenue to Broadway	0.61	Sufficient	-
Broadway to Rosebank Avenue East	0.75	Sufficient	-
Rosebank Avenue East to Laurel Grove Avenue	1.03	Sufficient	-
Laurel Grove Avenue to McAllister Avenue East	1.50	Sufficient	-
McAllister Avenue East to Wolfe Grade	0.68	Sufficient	-
Wolfe Grade to Manor Road	0.60	Sufficient	-
Manor Road to Corte Comoda	0.09	**Insufficient**	Add a midblock light on east side of pedestrian overcrossing.
Corte Comoda to Bon Air Road	0.16	**Insufficient**	Install lighting on median at approximately 150′ intervals.
Bon Air Road to El Portal Drive	0.41	**Insufficient**	Install lighting on street shoulders at approximately 150′ intervals.
El Portal Drive to La Cuesta Drive	0.30	**Insufficient**	Install lighting on median at approximately 150′ intervals.
La Cuesta Drive to Eliseo Drive/Barry Way	0.16	**Insufficient**	Install lighting on median at approximately 150′ intervals.

Source: BKF Engineers, 2019