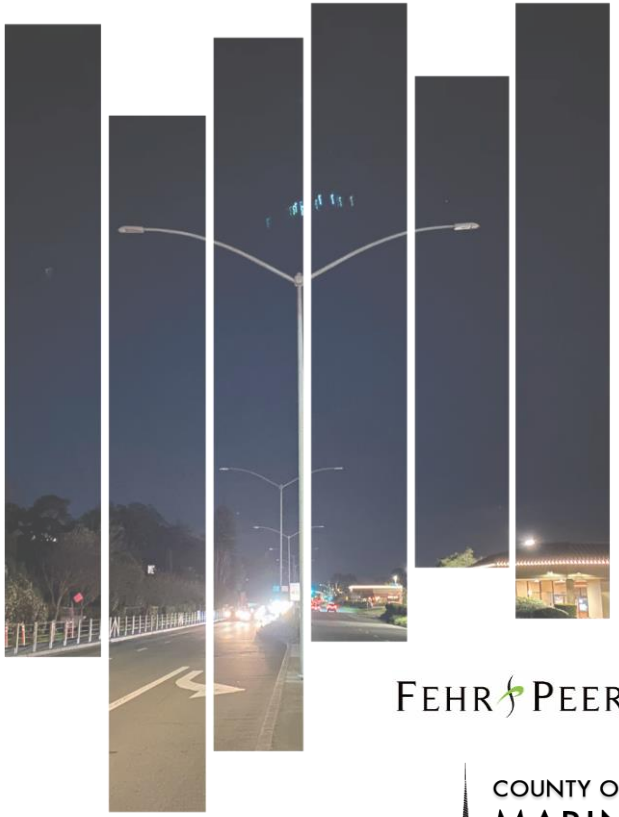


FEHR PEERS

COUNTY OF MARIN

Sir Francis Drake Boulevard Corridor Rehabilitation

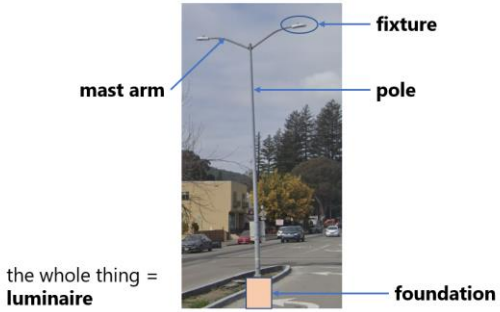
Lighting Assessment Update

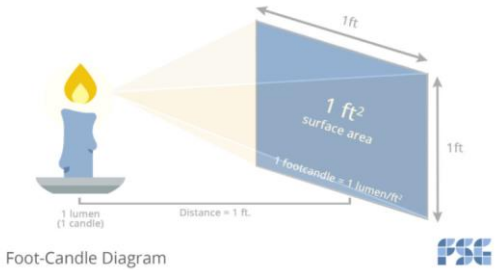
Meeting Agenda & Objectives

- **Refresher of Previous Discussion**
- **Additional Analysis & Design Refinement**
- **Presentation of Our Recommended Modifications (And Expected Outcomes)**

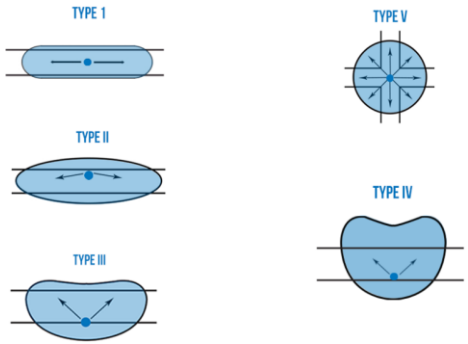
Refresher of Previous Discussion

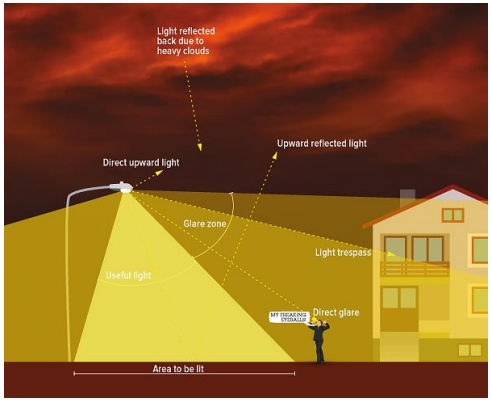
Refresher





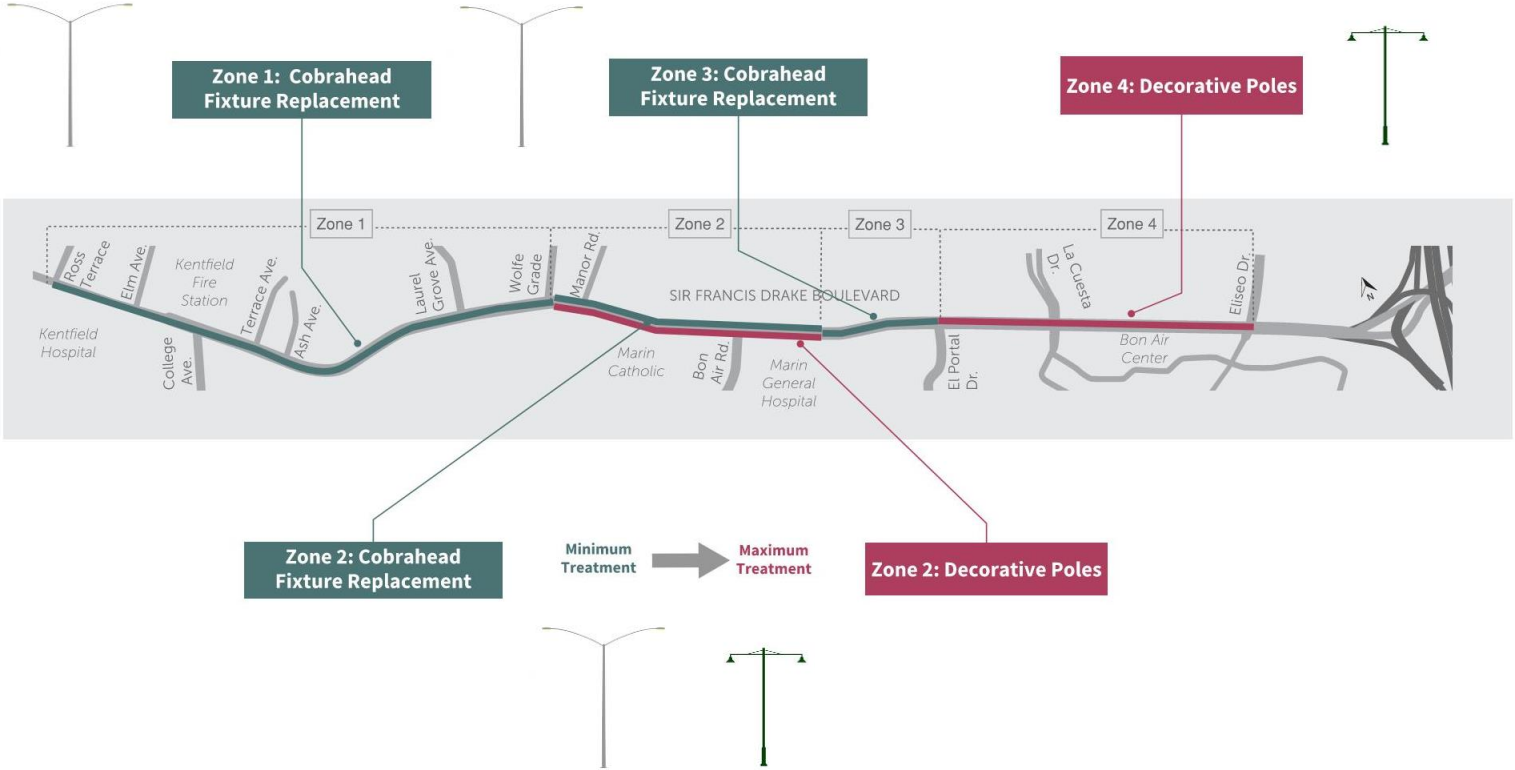
Foot-Candle Diagram



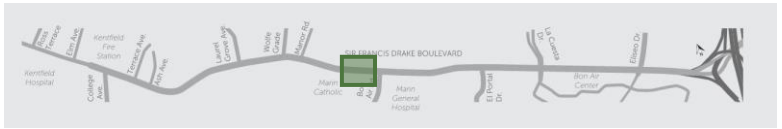


Road and Pedestrian Conflict Area		Pavement Classification (Minimum Maintained Average Values)			Uniformity Ratio	Veiling Luminance Ratio
Road	Pedestrian Conflict Area	R1 lux/fc	R2 & R3 lux/fc	R4 lux/fc	E_{avg}/E_{min}	L_{vmax}/L_{avg}
Freeway Class A		6.0/0.6	9.0/0.9	8.0/0.8	3.0	0.3
Freeway Class B		4.0/0.4	6.0/0.6	5.0/0.5	3.0	0.3
Expressway	High	10.0/1.0	14.0/1.4	13.0/1.3	3.0	0.3
	Medium	8.0/0.8	12.0/1.2	10.0/1.0	3.0	0.3
	Low	6.0/0.6	9.0/0.9	8.0/0.8	3.0	0.3
Major	High	12.0/1.2	17.0/1.7	15.0/1.5	3.0	0.3
	Medium	9.0/0.9	13.0/1.3	11.0/1.1	3.0	0.3
	Low	6.0/0.6	9.0/0.9	8.0/0.8	3.0	0.3
Collector	High	8.0/0.8	12.0/1.2	10.0/1.0	4.0	0.4
	Medium	6.0/0.6	9.0/0.9	8.0/0.8	4.0	0.4
	Low	4.0/0.4	6.0/0.6	5.0/0.5	4.0	0.4
Local	High	6.0/0.6	9.0/0.9	8.0/0.8	6.0	0.4
	Medium	5.0/0.5	7.0/0.7	6.0/0.6	6.0	0.4
	Low	3.0/0.3	4.0/0.4	4.0/0.4	6.0	0.4

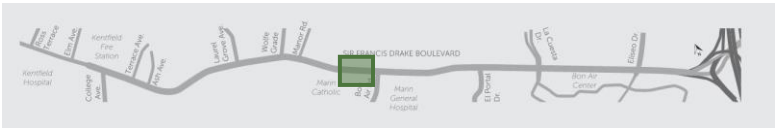
Overview of Potential Solutions

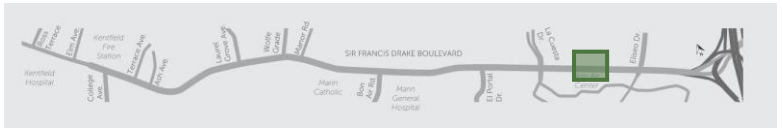


Zone 2 Existing



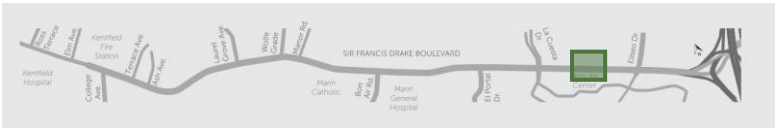
Zone 2 Decorative Poles





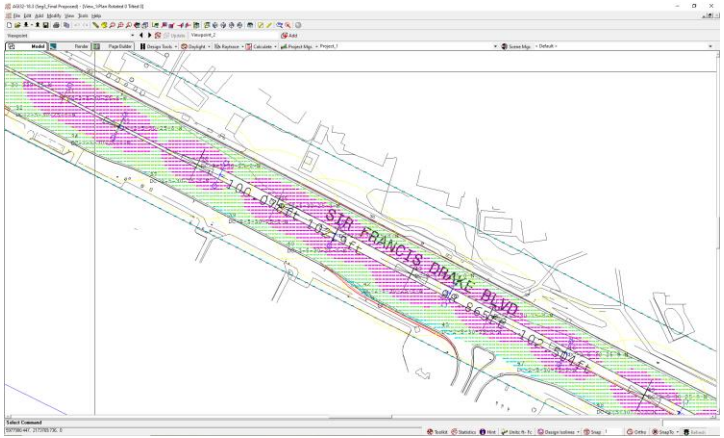
Zone 4 Existing

Zone 4 Decorative Poles



Additional Analysis & Design Refinement

Refined Analysis



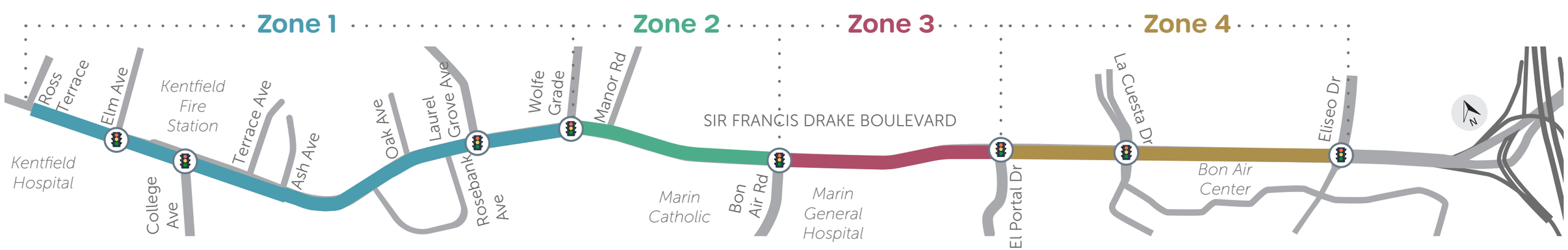
Recommended Modifications (And Expected Outcomes)

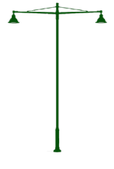
FIXTURE AND POLE CHANGES

Sir Francis Drake Lighting Update

DRAFT 2021

Based on our analysis and discussions with the County and community representatives, we recommend modifications to the recently installed roadway lighting. With our recommended changes, lighting poles and fixtures would be replaced along about one third of the corridor with shorter, decorative poles and fixtures. The shorter poles would require closer spacing to sufficiently and uniformly light the roadway, resulting in a net increase in total street lights. To reduce additional cost, the placement of these decorative poles would reuse light foundations already installed to the extent possible. The remaining light fixtures on the other two thirds of the project corridor, excluding intersection lighting, would be replaced with different fixtures that reduce overall brightness, improve consistency of light, and cast less light outside of the roadway and sidewalks. In addition, backlight shields would be installed on all sidewalk light poles to further minimize light spill into neighboring yards.



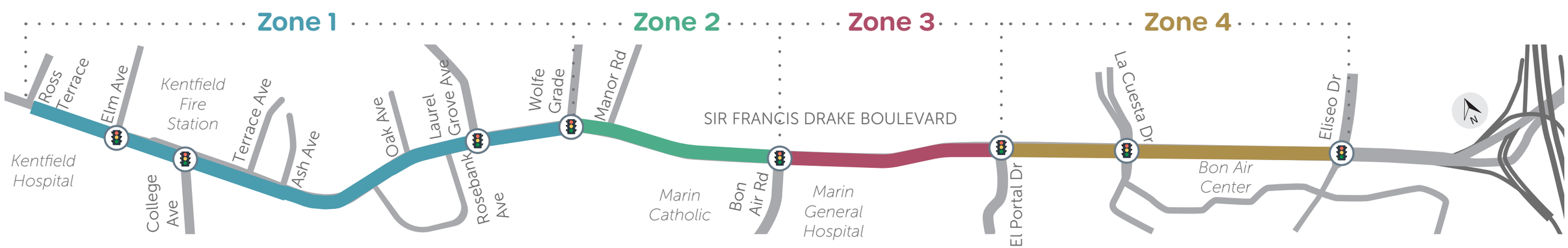
	Zone 1		Zone 2		Zone 3		Zone 4	
Before Upgrade the Drake	42 Existing Fixtures	28 Existing Poles	2 Existing Fixtures	2 Existing Poles	4 Existing Fixtures	4 Existing Poles	2 Existing Fixtures	2 Existing Poles
Today As-installed February 2021 with all lights on	+18 Additional Fixtures 60 Total Fixtures	+16 Additional Poles 44 Total Poles	+14 Additional Fixtures 16 Total Fixtures	+9 Additional Poles 11 Total Poles	+13 Additional Fixtures 17 Total Fixtures	+9 Additional Poles 13 Total Poles	+26 Additional Fixtures 28 Total Fixtures	+13 Additional Poles 15 Total Poles
Proposed Details may be refined during design phase	 Replace 50 of 60 Cobrahead fixtures All 44 poles remain		 Replace all 11 poles with Decorative fixtures and poles +4 additional poles Reuse 10 of 11 foundations		 Replace 10 of 17 Cobrahead fixtures All 9 poles remain		 Replace all 15 poles with Decorative fixtures and poles +6 additional poles Reuse 9 of 15 foundations	

AVERAGE BRIGHTNESS OF LIGHT SPILLOVER

Sir Francis Drake Lighting Update

DRAFT 2021

Light cast outside of the roadway and sidewalk should be **minimized**. Based on updated model results, the proposed improvements would reduce the average light spillover significantly – 37 to 75 percent, depending on the block analyzed.



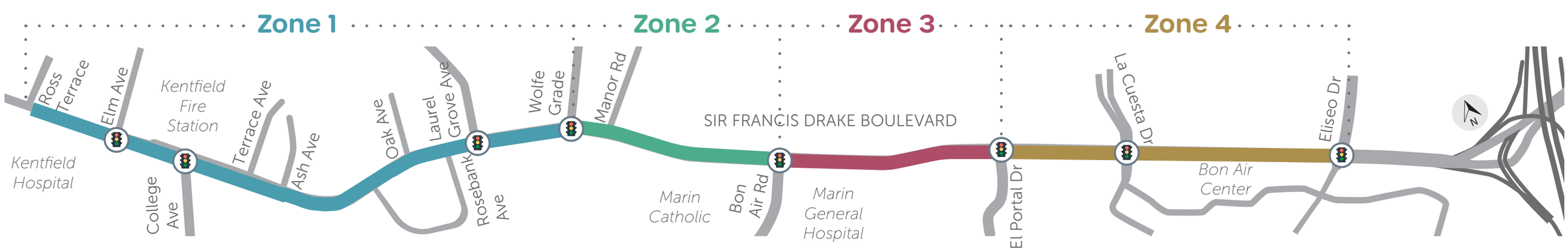
	Zone 1	Zone 2	Zone 3	Zone 4
Before Upgrade the Drake	N/A	N/A	N/A	N/A
Today As-installed February 2021 with all lights on	0.39 fc	0.32 fc	0.30 fc	0.45 fc
Proposed Details may be refined during design phase	0.21 fc 46% Reduction from today	0.20 fc 37% Reduction from today	0.16 fc 47% Reduction from today	0.11 fc 75% Reduction from today

AVERAGE ROADWAY BRIGHTNESS

Sir Francis Drake Lighting Update

DRAFT 2021

Lighting guidance suggests that roadways with characteristics like Sir Francis Drake Boulevard (Major asphalt roadway with low pedestrian activity) are lit with an **average of 0.9 foot candles (fc)** (ANSI/IESNA RP-8-00 Table 2). Before the Upgrade the Drake Project, light levels on the roadway were well below this, averages ranging from 0.2 fc to 0.8 fc. The Upgrade the Drake project installed lights that resulted in brightness levels with averages ranging from 1.2 fc to 1.5 fc. The Proposed modifications would reduce the average roadway brightness compared to the recently installed condition between 5 and 22 percent, resulting in lighting levels of 1.0 fc to 1.2 fc.



	Zone 1	Zone 2	Zone 3	Zone 4
Before Upgrade the Drake	0.79 fc	0.19 fc	0.32 fc	0.18 fc
Today As-installed February 2021 with all lights on	1.48 fc	1.32 fc	1.24 fc	1.31 fc
Proposed Details may be refined during design phase	1.16 fc 21% Reduction from today	1.19 fc 10% Reduction from today	1.16 fc 6% Reduction from today	1.02 fc 22% Reduction from today

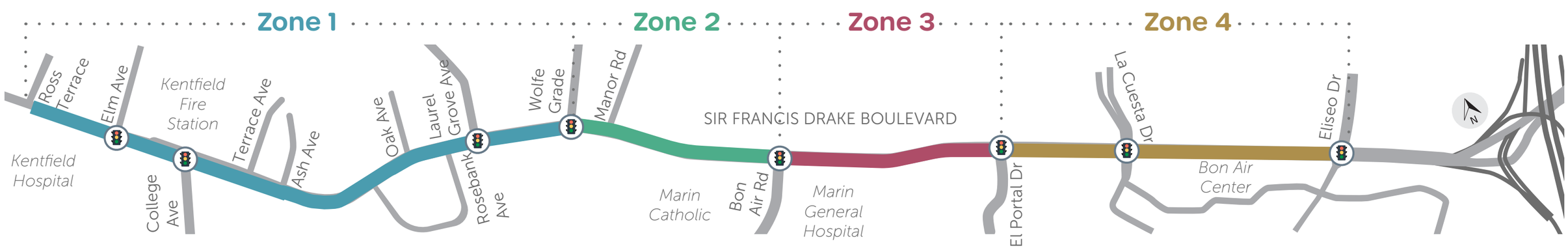
Values reflect roadway segments only
Does not include signalized intersections where roadway lighting is brighter due to safety standards

UNIFORMITY (LIGHT CONSISTENCY)

Sir Francis Drake Lighting Update

DRAFT 2021

Lighting guidance also suggests that uniformity, or light consistency, along a roadway like Sir Francis Drake should be **less than 3.0** (uniformity is calculated by dividing the average illuminance by the minimum illuminance on a segment of roadway). Prior to the Upgrade the Drake project, the infrequent lighting resulted in indeterminate uniformity (large segments of the roadway had no illuminance whatsoever). With the lights installed by the Upgrade the Drake project, most of the corridor has an average uniformity ranging from 2.4 to 3.6. The Proposed modifications would have an average uniformity ranging from 1.9 to 3.1, a 5 to 22 percent improvement reduction (similar to the average brightness) compared to the recently installed condition.



	Zone 1	Zone 2	Zone 3	Zone 4
Before Upgrade the Drake	6.24	Only at intersections	Only at intersections	Only at intersections
Today As-installed February 2021 with all lights on	2.43	3.55	3.10	3.51
Proposed Details may be refined during design phase	1.90 22% Improvement from today	3.10 13% Improvement from today	3.87 0% Improvement from today	2.94 16% Improvement from today

Values reflect roadway segments only
Does not include signalized intersections where roadway lighting is brighter due to safety standards