Appendix K

Transportation and Traffic Safety Review

MEMORANDUM

TO: Stephanie Eyestone Jones, Eyestone Environmental

FROM: Sarah Drobis, P.E., and David Roachford

DATE: August 29, 2022

RE: Transportation and Traffic Safety Review for the Metro Transportation Communication Network Program **Ref:** J2001

Gibson Transportation Consulting, Inc. (GTC) analyzed the proposed Los Angeles County Metropolitan Transportation Authority (Metro) Transportation Communication Network (TCN or Project) Program to assess whether the Program's TCN Structures present potentially significant traffic safety concerns for the surrounding street system.

As part of this assessment, GTC reviewed relevant published studies and articles concerning the potential impacts of Commercial Electronic Variable Message Signs (CEVMS) on roadway safety, analyzed state and local signage regulations outlining the requirements for CEVMS systems, and researched ongoing updates to local ordinances. GTC also conducted a review of the Project locations, adjacent roadways, and adjacent freeways in the surrounding community for consistency with the requirements and best practices for digital signage.

PROJECT BACKGROUND

Project Description

Metro proposes to implement a TCN Program, which would provide a network of TCN Structures throughout the City of Los Angeles (City) that would incorporate intelligent technology components to promote roadway efficiency, improve public safety, increase communication, and provide for outdoor advertising that would be used to fund new and expanded transportation programs consistent with the goals of the Metro Vision 2028 Plan.

The Metro TCN Program also includes the removal of existing static signage throughout the City. Implementation of the Project would include the installation of up to 34 Freeway-Facing (FF) TCN Structures and 22 Non-Freeway Facing (NFF) TCN Structures, all on Metro owned property. The total maximum amount of digital signage associated with the TCN Structures would be up to approximately 65,000 square feet (sf). As part of implementation of the TCN Structures, a take-down program would also be implemented whereby existing static displays would be removed. Signage to be removed includes approximately 200 static displays on Metro-owned property located within the City. The City would establish a Zoning Ordinance that would provide a mechanism to review and approve the TCN Structures citywide and would regulate the location, operation, design, take-down program and community benefits of the TCN Structures. The Zoning Ordinance would also impose digital display and illumination standards to support the TCN Structures.

The proposed locations of the TCN Structures are provided in Tables 1-2 and are shown in Figures 1-3.

TCN Structure Design and Locations

The digital display faces of the TCN Structures would use light emitting diode (LED) lighting with up to 6,000 maximum daytime candelas and 300 maximum nighttime candelas, depending on the location. Louvers would be installed to shade the LED lights from creating unintentional light spillage, assist in reducing reflection, and in turn would create a sharper image. Further, the digital display faces would be set to refresh every eight seconds and would transition instantly with no motion, moving parts, flashing, or scrolling messages. Illumination of the digital displays would conform to applicable Federal and State regulations for signs oriented toward roadways and freeways.

The Project would include up to 34 FF TCN Structures with digital display faces that would range in size from 672 sf to 1,200 sf per sign with the majority being approximately 672 sf. Additionally, as several of the FF TCN Structures are located adjacent to elevated freeways or freeway on/off ramps the FF TCN Structures would be located up to 50 feet in height above finished grade of the adjacent highway. Additionally, 22 NFF TCN Structures with digital display faces that would range in size from 300 sf to 672 sf per sign, with the majority being approximately 300 sf. Additionally, the NFF TCN Structures would be located up to 30 feet in height above finished grade.

LITERATURE REVIEW

A literature review of studies researching traffic hazards and CEVMS was conducted to assess the potential for roadway safety impacts caused by CEVMS systems similar to those proposed by the Project. With numerous reports available on digital signage, the following criteria was established to narrow the focus of research included in this assessment:

- Studies included were required to measure the relationship between digital billboards and roadway safety in order to include the most pertinent information related to the Metro TCN Program.

- Studies included were required to be conducted in the United States. The United States has a unique set of roadway characteristics defined by the United States Department of Transportation (USDOT), state agencies (i.e., the California Department of Transportation [Caltrans]), and local governments (i.e., the Los Angeles Department of Transportation [LADOT]) through documents such as the Manual on Uniform Traffic Control Devices. While some of these characteristics may be the same or similar to those in other countries, for the purpose of consistency in roadway conditions, only studies in the United States were included.

- Studies included were required to be conducted by a government agency or have their results published in an academic journal. Both government agencies and academic journals have rigorous standards for research that may include, but are not limited to, peer reviewed findings, feedback through a formal public engagement process, and

technical expertise on the subject matter. Thus, these are verifiable and fact-based sources.

- Studies included were required to provide the latest information available from that resource. Numerous studies on billboards and traffic safety were conducted in the late 1990s and early 2000s that have since been updated, such as the Federal Highway Administration study referenced below. Thus, only studies that provided the most current information were included in the literature review.

Based on this established criteria, three studies were selected for inclusion in the literature review. It should be noted that this is not an exhaustive list of studies that meet these criteria, as dozens of published studies have been conducted over the past few decades. The selected studies were specifically relevant and can inform the potential safety effects of the Metro TCN Program. The following provides an overview of the research conducted and the findings of the studies.

Federal Highway Administration

Driver Visual Behavior in the Presence of Commercial Electronic Variable Message Signs (USDOT Federal Highway Administration, September 2012) (FHWA Study) is an independent investigation of the effect of CEVMS on driver visual behavior utilizing an eye tracking system. The research was conducted during daytime and nighttime conditions on freeways and roadways adjacent to CEVMS, standard billboards, and no billboard signage in the cities of Richmond, Virginia and Reading, Pennsylvania. The CEVMS used in the study were all considered standard signs with a refresh rate of eight to 10 seconds, adjustable brightness, and no blinking or flashing permitted.

This study analyzed the probability of drivers looking at the road ahead for each scenario. The findings indicated that for the control condition (i.e., no billboard), the proportion of time spent looking at the road ahead ranged 78% to 92% for freeways and arterial streets. The conditions for both the CEVMS and static billboard scenarios indicated that the proportion of time spent looking at the road ahead slightly decreased to between 73% and 85%. However, multiple factors contributed to this variability including nearby businesses, on-site signage, and traffic conditions. The FHWA Study concludes that “the drivers in this study directed the majority of their visual attention to areas of the roadway that were relevant to the task at hand (i.e., the driving task). Furthermore, it is possible, and likely, that in the time that the drivers looked away from the forward roadway, they may have elected to glance at other objects in the surrounding environment (in the absence of billboards) that were not relevant to the driving task. When billboards were present, the drivers in this study sometimes looked at them, but not such that overall attention to the forward roadway decreased.”

The FHWA Study found that drivers were generally more likely to fixate on a CEVMS than a static billboard; however, the results varied by location. In Reading, participants were more likely to fixate on standard billboards on freeways, with drivers fixating on standard billboards 67% of the time compared to 33% for CEVMS. On arterial streets, the opposite was true, with 63% fixation on CEVMS compared to 37% for standard billboards. The analysis conducted in Richmond found that drivers were more likely the fixate on CEVMS on both arterials and freeways. On arterials the results were a near even split, with 55% fixation on CEVMS

compared to 45% on standard billboards. On freeways, drivers fixated on CEVMS 68% of the time compared to 32% for standard billboards. Per the FHWA Study, likely causes for the discrepancies may be due to the slower speed of arterial streets and the placement of signage in more visible locations.

This study tracked the drivers' longest and average fixation to roadside objects, including CEVMS and standard billboard signage. The study found that the longest fixation on a CEVMS was 1.34 seconds, which is higher than the highest standard billboard fixation of 1.28 seconds. However, both were found to be well below the accepted standard set by the National Highway Traffic Safety Administration (NHTSA), which considers 2.0 seconds to be the threshold when roadway safety concerns arise. Further, the FHWA Study found that the average fixation on a CEVMS was 379 milliseconds (ms) and to standard billboards was 335 ms. These results show that average fixations were similar between CEVMS and standard billboards with no long single fixations for either type of sign. Thus, this study found that drivers still dedicated their visual attention to driving, with minimal fixations on CEVMS, billboards, and/or other objects in the surrounding environment when billboards were not present.

Foundation for Outdoor Advertising Research and Education

Two studies were prepared by the Foundation for Outdoor Advertising Research and Education that met the established criteria for the literature review.

***Driving Performance and Digital Billboards* (2007) (Driving Performance Study).** This study conducted an experiment with drivers using an instrumented vehicle that tracked eye movement. Drivers were asked to drive around a 50-mile loop in Cleveland, Ohio that contained a variety of roadway environments including five digital billboards, 15 conventional billboards, 12 comparison sites (i.e., logo boards, on-site signage, and other roadside items), and 12 baseline sites with no signage. During daytime conditions, 36 drivers drove the route, and 12 drivers made the drive during nighttime conditions. Drivers were not made aware of the type of study being conducted. In addition to the data gathered from the vehicle, a survey of the drivers was completed after their participation in the experiment.

The result of this study showed that several driving performance measures in the presence of digital billboards are similar to those associated with everyday driving, such as the on-site signs located at businesses. The study also found that while the fixations to CEVMS, billboards, and comparison sites were similar, fixation duration was higher for the CEVMS and comparison sites relative to the static billboards and baseline sites. The study found that mean fixation duration was less than 1.0 second, which is well below the 2.0 second fixation duration threshold that is considered dangerous by the NHTSA.

As stated in the report, "because of the lack of crash causation data, no conclusions can be drawn regarding the ultimate safety of digital billboards. Although there are measurable changes in driver performance in the presence of digital billboards, in many cases these differences are on a par with those associated with everyday driving, such as the on-premises signs located at businesses."

***A Study of the Relationship Between Digital Billboards and Traffic Safety in Cuyahoga County, Ohio* (2007) (Cuyahoga County Study).** This study conducted research to find a statistical correlation between digital billboards and traffic safety. The study looked at traffic and collision data near seven digital billboards in Cuyahoga County, Ohio for a 12-month and an 18-month period prior to and after the installation of the digital billboards in 2005. The study also included an analysis to determine if a spatial statistical correlation existed between the locations of digital billboards and traffic crashes.

Using both methods to analyze traffic crashes and digital billboards, no statistical relationship was found. Further, the study found no statistical difference between conventional and digital billboards and concluded "the accident statistics on sections of Interstate routes near billboards are comparable to the accident statistics on similar sections that have no billboards."

Additional Research

In addition to the resources provided above, numerous studies on roadway safety and electronic signage did not meet the established criteria for consideration but are detailed below for informational purposes. Similar to the other studies, these studies generally supported the conclusion that a relationship between digital billboards and an increase in traffic hazards is inconclusive.

The Impact of Billboards on Driver Visual Behavior: A Systematic Literature Review (Decker JS, Stannard SJ, McManus B, Wittig SM, Sisiopiku VP, Stavrinos D., Traffic Injury Prevention Journal, 2015) provided an overview of research around the world on the issue of billboards and traffic safety. The results of their literature review concluded that, in general, billboard distraction was minor and varied depending on the demands of the task of driving, consistent with the FHWA Study. Evidence of a relationship between digital billboards and driver distraction was inconclusive and would require more studies with different age groups. This study was not included in the literature review, as eight of the 13 studies analyzed were not based in the United States.

The Debate over Digital Billboards: Can New Technology Inform Drivers without Distracting Them? (Birdsall, Michelle S., Institute of Transportation Engineers Journal, April 2008) provided an overview of the background and capabilities of digital billboards and signs, current regulations surrounding the technology's usage, and the contrasting opinions about the billboards' potential effect on traffic safety. The CEVMS used in the study were all considered standard signs with a refresh rate of six to eight seconds. Evidence of a relationship between digital billboards and driver distraction was inconclusive and would require additional studies. These additional studies would need to analyze different localities, as road conditions can vary from state to state, consider how they are different from on-site signage, and develop a methodology which establishes causality between safety and CEVMS. This source was not included in the literature review as some of the studies referenced have since been updated. This includes the FHWA Study.

Literature Review Summary

Overall, the studies indicate that a correlation between roadway hazards and CEVMS is, at best, inconclusive. There are countless factors that can change driver attention and fixation on the road ahead, including scenery, on-site signage at local business, and other off-road distractions. Further, traffic conditions can impact the frequency and duration of driver fixation away from the road ahead. The studies included in this literature review were also conducted in three different locations using different methodologies, which may explain some of the variability in the results.

The studies also contain contradicting information, with the FHWA Study stating that average fixation time between CEVMS and billboards is effectively negligible, but the Driving Performance Study found that the fixation times on CEVMS locations were longer. However, the data in the FHWA Study and the Driving Performance Study suggest that drivers overwhelming pay attention to the road ahead, regardless of the presence of CEVMS or billboards. Further, the difference between CEVMS and billboards is effectively negligible in terms of focus on the road ahead. Specifically, the mean fixation on both CEVMS and billboards is less than 1.0 second and the longest fixation on a CEVMS was 1.34 seconds, which is well below the 2.0 second threshold for potentially dangerous driving conditions established by the NHTSA.

Additionally, it should be noted that the CEVMS analyzed in these studies were standard signs, with refresh rates equal to or greater than 6.0 seconds and adjustable brightness for daytime and nighttime operation. No signs with videos, animations, or flashing were included in these studies.

REGULATIONS

California Vehicle Code 21466.5

The California Vehicle Code (CVC) is the set of statewide legislation regulating the operation and ownership of vehicles. The CVC also regulates traffic signs, signals, and markings used within the state, including those of off-site billboard signs. CVC 21466.5 sets the criteria for illuminated signs in view of highways in the state. Specifically, it ensures that signage brightness would not impair driver vision and cause a safety risk to roadway users. The text of the ordinance is as follows:

> *No person shall place or maintain or display, upon or in view of any highway, any light of any color of such brilliance as to impair the vision of drivers upon the highway. A light source shall be considered vision impairing when its brilliance exceeds the values listed below.*
>
> *The brightness reading of an objectionable light source shall be measured with a 11/2-degree photoelectric brightness meter placed at the driver's point of view. The maximum measured brightness of the light source within 10 degrees from the driver's normal line of sight shall not be more than 1,000 times the minimum measured brightness in the driver's field of view, except that when the minimum measured brightness in the field of view is 10 foot-lamberts or less, the measured brightness of the light source in foot- lambert shall not*

exceed 500 plus 100 times the angle, in degrees, between the driver's line of sight and the light source.

The provisions of this section shall not apply to railroads as defined in Section 229 of the Public Utilities Code.

An analysis of this ordinance is provided in the Draft environmental Impact Report (EIR) for the Project. Per the Draft EIR, the Project would be in compliance with CVC 21466.5 and, thus, would not impair driver vision on the roadway.

Caltrans Outdoor Advertising Permit Requirements

Caltrans regulates signage that are visible from Caltrans facilities (i.e., freeways and highways) and generally requires the following criteria be met when an Outdoor Advertising Permit is being considered:

- *Must be outside the right of way of any highway.*
- *Must be existing business activity within 1,000 ft of proposed display location on either side of the highway.*
- *Location may not be adjacent to a landscaped freeway.*
- *Location may not be adjacent to a scenic highway.*
- *Display must be 500 ft from any other permitted display on the same side of any highway that is a freeway.*
- *Display must be 100 ft from any other permitted display on same side of any primary highway that is not a freeway and is within the limits of an incorporated city.*
- *An electronic changeable message center display must meet the above spacing requirements and be 1,000 ft from another electronic message center display.*
- *Maximum height for the advertising display area is, 25 ft in height and 60 ft in length, not to exceed an overall maximum of 1,200 sf.*

A further review of the Project's consistency with the Caltrans Outdoor Advertising Permit Requirements is provided below in the Analysis section.

Los Angeles Municipal Code

Los Angeles Municipal Code (LAMC) Section 41.40 limits construction activities to the hours from 7:00 a.m. to 9:00 p.m. on weekdays and from 8:00 a.m. to 6:00 p.m. on Saturdays and national holidays. No construction is permitted on Sundays.

LAMC Section 12.37 sets forth requirements for street dedications and improvements for new development projects. Specifically, LAMC Section 12.37 states that no building or structure shall be erected or enlarged on any property and no building permit shall be issued on any R3 or less restrictive zone or in any lot in the RD1.5, RD2, or R3 Zones if the lot abuts a major or

secondary highway or collector street unless one-half of the street adjacent to the subject property has been dedicated and improved to the full width to meet the standards for a highway or collector street as provided in the LAMC. While LAMC Section 12.37 generally applies to projects meeting the above criteria, the authority to require right-of-way dedications and improvements for discretionary projects that involve zone changes or divisions of land falls under LAMC Sections 12.32 G.1 and 17.05.

The LAMC regulates all aspects of building development in the City, including aesthetic aspects such as lighting and signage. Article 4.4 of the LAMC regulates signs within the City. These regulations address various signage types, prohibited sign types, prohibited locations, maintenance, hazards to traffic as determined by LADOT, and freeway exposure. These regulations are not applicable to signs located primarily within a public right-of-way. With regard to lighting, Section 14.4.4 E of these regulations require that "No sign shall be arranged and illuminated in a manner that will produce a light intensity of greater than three-foot candles above ambient lighting, as measured at the property line of the nearest residentially zoned property."

Article 3 of the LAMC also provides for Specific Plan – Zoning and Supplemental Use Districts. Within this Article, Section 13.11 provides for the establishment of "SN" Sign Districts in areas of the City, the unique characteristics of which can be enhanced by the imposition of special sign regulations designed to enhance the theme or unique qualities of that district, or which eliminate blight through a sign reduction program. Each "SN" Sign District shall include only properties in the C or M Zones, with some specified limited exceptions. The development regulations for each "SN" Sign District shall be determined at the time the district is established. The sign regulations shall enhance the character of the district by addressing the location, number, square footage, height, light illumination, hours of illumination, sign reduction program, duration of signs, design and types of signs permitted, as well as other characteristics, and can include murals, supergraphics, and other on-site and off-site signs. However, the regulations for a "SN" Sign District cannot supersede the regulations of an Historic Preservation Overlay District, a legally-adopted specific plan, supplemental use district or zoning regulation needed to implement the provisions of an approved development agreement.

Vision Zero

The Vision Zero Los Angeles program, implemented by LADOT, represents a citywide effort to eliminate traffic deaths in the City by 2025. Vision Zero has two goals: a 20% reduction in traffic deaths by 2017 and zero traffic deaths by 2025. In order to achieve these goals, LADOT has identified a network of streets, called the High Injury Network (HIN), which has a higher incidence of severe and fatal collisions. The HIN, which was last updated in 2018, represents 6% of the City's street miles but accounts for approximately two thirds (64%) of all fatalities and serious injury collisions involving people walking and biking.

The TCN Structures would be located outside of the public right-of-way on Metro property. Thus, the TCN Structures would not preclude the city from installing Vision Zero improvements to enhance the safety of the HIN.

ANALYSIS

The following section presents the analysis for the Project's consistency with relevant literature, Caltrans guidelines, and City guidelines. A brief overview of data collection is also included.

Data Collection

Data regarding traffic volumes, locations, Council District, Community or Specific Plan areas, etc. was reviewed to assess the potential for roadway safety hazards. Average daily traffic counts were collected where data was available from the Caltrans Performance Measurement System (PeMS) for FF locations and from NavigateLA for arterial streets.

The FF TCN Structure locations are summarized in Table 1. For FF locations, traffic volume data was collected from PeMS for January 2019 to January 2020. The NFF TCN Structure locations are summarized in Table 2. For NFF locations, the most recent available traffic data, which ranged from Years 2005 to 2019, was collected from NavigateLA.

In addition to traffic count data, a review of each TCN Structure location was conducted in June 2022 to determine if other signage, scenic highways, or businesses are located within close proximity to the proposed TCN Structures.

Consistency with Literature Review

The TCN Structures would provide digital messaging with a refresh rate of 8.0 seconds. As part of the TCN Structures operation, motion and flashing images would be prohibited and transitions would be instant without using a black screen between messages. Light emitted by the TCN Structures would also be adjustable throughout the day and night, ensuring that the signs would not cause excessive glare on nearby roadways. Thus, the Project would be consistent with the CEVMS studied in the literature review and conclusions can be drawn based on those in the studies.

As indicated in the FHWA Study, the addition of new CEVMS may have a higher frequency of fixations than a standard static billboard. However, as previously discussed, the data in both the FHWA Study and the Driving Performance Study suggest that drivers overwhelming pay attention to the road ahead, regardless of the presence of CEVMS or billboards. Furthermore, the difference between CEVMS and static billboards are effectively negligible in terms of focus on the road ahead. Specifically, the mean fixations on both CEVMS and billboards were less than one second and the longest fixation on a CEVMS was 1.34 seconds, which is well below the 2.0 second threshold for potentially dangerous driving conditions established by the NHTSA.

Since the Metro TCN Program would be consistent with the signage analyzed in these studies, it is not anticipated that the Project would lead to a significant safety risk on adjacent roadways.

Consistent with the Cuyahoga County Study, it is not anticipated that the number of crashes would increase or occur in close proximity to the digital signage due to the Project. The study

found no statical correlation between the quantity of collisions or clusters near similar CEVMS structures in Ohio. Since the Metro TCN Program would be consistent with the signage analyzed in the Cuyahoga County Study, it is not anticipated that the Project would lead to a significant safety risk on adjacent roadways.

Ultimately the findings within the literature review did not provide evidence that CEVMS definitively lead to an increase in road hazards. As the Metro TCN Program would be deploying similar CEVMS signage throughout the City, it can be concluded that the Project would be consistent with the findings of the literature review.

Consistency with Caltrans Guidelines

Each of the proposed FF TCN Structures would be compliant with all Caltrans requirements, as detailed above. All of the locations would be located at least 500 feet away from any freeway designated as a Scenic Highway and their locations would be outside of the freeway right of way. All locations would be at least 500 feet away from a landscaped freeway, consistent with the Caltrans guidelines. Further, at Project completion, none of the TCN Structures would be located within 500 feet of an existing sign or within 1,000 feet of an existing digital billboard on the same side of the freeway. All TCN Structures would be located within proximity of a business.

Additionally, all TCN Structures would be located on Metro-owned property and would be equipped with Metro's Regional Integration of Intelligent Transportation Systems (RIITS), which provides comprehensive, timely, and real-time information among freeway, traffic, transit, and emergency systems across various agencies including local and regional transit agencies, to improve traffic and transportation systems, and to disseminate information regarding roadway improvements, and during emergency events.

Thus, the Project would be consistent with Caltrans guidelines for digital signage locations near freeways.

Consistency with LAMC

As discussed in the section on consistency with the literature review, the TCN Structures would provide digital messaging with a refresh rate of every 8.0 seconds. As part of the TCN Structures operation, motion and flashing images would be prohibited and transitions would be instant without using a black screen between messages. Light emitted by the TCN Structures would also be adjustable throughout the day and night, ensuring that the signs would not cause excessive glare on nearby roadways. The signs would also be positioned in a way to focus on the intended roadways and minimize visibility from adjacent streets.

As discussed above, the TCN Program would be implemented through the adoption of an enabling Zoning Ordinance by the City. The proposed Zoning Ordinance would amend the City's sign regulations to authorize the TCN Structures. The Zoning Ordinance would create a mechanism for the review and approval of the TCN Structures and would not authorize new signage other than the TCN Structures. The Zoning Ordinance would address the time, manner, and place aspects of the TCN Program, including the allowable locations, size and height

limitations, urban design requirements, and applicable community benefits including the take-down requirements for the removal of existing static off-premise signs. The Zoning Ordinance would not otherwise change the existing regulations for signs, including off-site and digital signage, in the City. Based on the above, the anticipated development from the Zoning Ordinance would be limited to the 56 TCN Structures, as well as the take-down of up to 200 signs and the overall removal of the square footage of existing static signs at a ratio of two sf per each sf of new digital display signage constructed. Therefore, with implementation of the Zoning Ordinance for the TCN Structures, the Project would not conflict with the LAMC.

CONCLUSIONS

The proposed Metro TCN Program would provide a network of TCN Structures that would incorporate intelligent technology components to promote roadway efficiency, improve public safety, increase communication, and provide for outdoor advertising that would be used to fund new and expanded transportation programs consistent with the goals of the Metro Vision 2028 Plan. The Project would construct 56 TCN Structures throughout the City on Metro-owned property. Of the 56 signs, up to 34 would be FF and up to 22 would be NFF.

An extensive literature review of research related to traffic safety and billboards dating back to 2007 was conducted. Using criteria developed to narrow the scope of studies included, three studies were analyzed and an additional two studies were provided for informational purposes and background. Upon review, the findings of the FHWA Study determined that, while driver fixation length was shown to slightly increase with CEVMS when compared to a static billboard, the mean fixation was well below the NHTSA 2.0 second threshold for dangerous driver distraction. Therefore, based on our review of the studies, and since the Metro TCN Program would operate similarly to the CEVMS, it is anticipated that the Metro TCN Program would similarly be below the NHTSA 2.0 second threshold.

The potential roadway glare impacts are analyzed with respect to the Project luminance compliance with the CVC requirements for night, twilight, and day conditions. Bright sources within the driver's field of view, from the centerline of the roadway to angles up to 90 degrees from the center line of the roadway, may create glare if the light source is brighter than the limits established by the CVC.

A detailed lighting study was prepared for the Project to evaluate potential light and glare impacts associated with the TCN Structures. As discussed therein, the results of the lighting study demonstrate that the maximum Project luminance is less than the limits established by the CVC for excessive luminance, or glare, during night, twilight (sunset and sunrise) and during the day. Accordingly, the Project luminance is far below the maximum permitted luminance by the CVC requirements for roadways approaching the signs from all directions.

Further, upon approval, the Project would operate in compliance with the established guidelines and standards in the agreed upon Zoning Ordinance and, therefore, the LAMC.

The FF TCN Structures were reviewed for consistency with Caltrans guidelines and all of the signs were found to be compliant with the guidelines for digital signage adjacent to a freeway. The review of the technical specifications found that the NFF signs would operate based on established industry standards for refresh rate and would not include any motion or flashing,

which may increase distractions for nearby drivers. The signs would also be positioned in a way to focus on the intended roadways and minimize visibility from adjacent streets. Thus, it was concluded that the TCN Structures would operate similarly to a static sign.

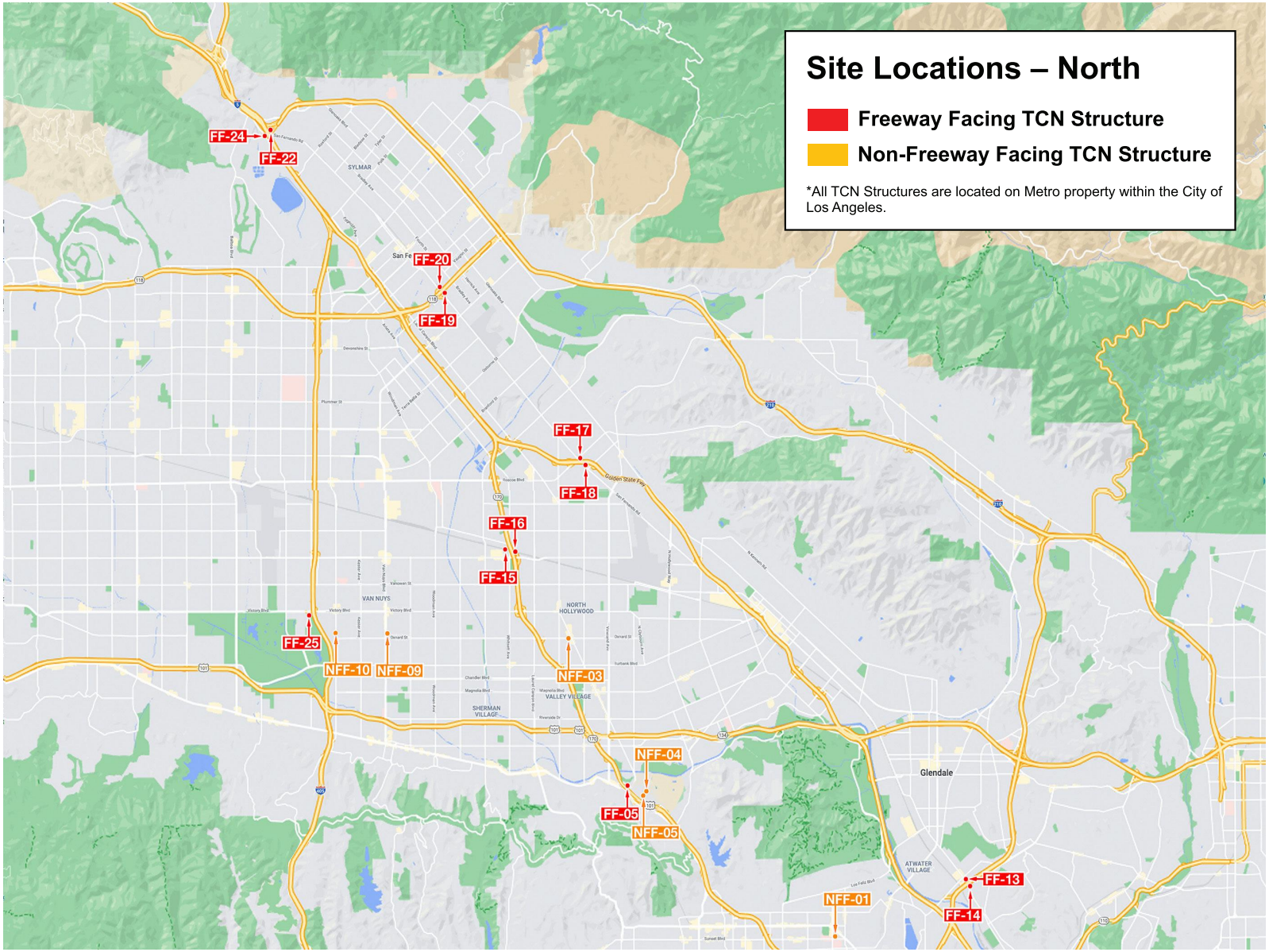

Figure 1

Regional Project Location Map – North

Source: ALLVISION, 2022.

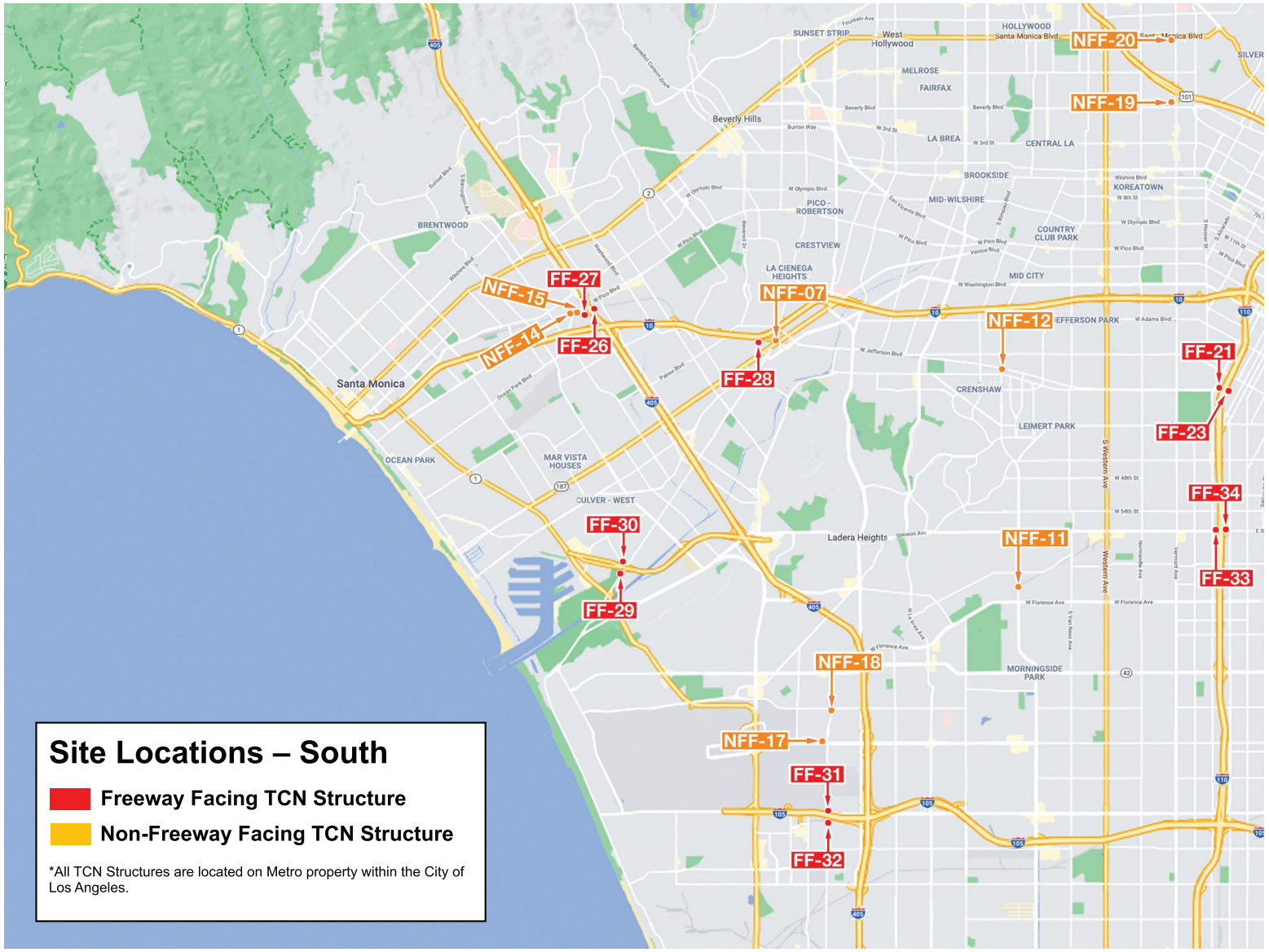

Figure 2

Regional Project Location Map – South

Source: ALLVISION, 2022.

Figure 3

Regional Project Location Map – Downtown

Source: ALLVISION, 2022.

TABLE 1
FREEWAY FACING TCN STRUCTURE LOCATIONS

Sign ID	Location [a]	Council District	Community Plan	Existing Signage Nearby [b]	Business Activity within 1,000 ft	Total Average Daily Traffic (Both Directions) [c]
FF-01	US-101 North Lanes at Union Station	14	Central City North	None	Yes	195,000
FF-02	US-101 South Lanes at Center Street	14	Boyle Heights	None	Yes	195,000
FF-03	US-101 North Lanes at Keller Street	14	Central City North	None	Yes	195,000
FF-04	US-101 South Lanes at Beaudry Street	1	Silver Lake - Echo Park - Elysian Valley	None	Yes	255,000
FF-05	US-101 North Lanes, Northwest of Lankershim Boulevard	2	Sherman Oaks - Studio City - Toluca Lake - Cahuenga Pass	None	Yes	230,000
FF-06	I-5 South Lanes at North Avenue 19	1	Northeast Los Angeles	None	Yes	185,000
FF-07	I-5 North Lanes at San Fernando Road	1	Northeast Los Angeles	None	Yes	185,000
FF-08	I-5 South Lanes and Exit Ramp to I-10	14	Boyle Heights	None	Yes	195,000
FF-09	I-10 West Lanes (Bus Yard)	14	Boyle Heights	None	Yes	140,000
FF-10	1-10 West Lanes and Entrance Ramp from I-5	14	Boyle Heights	None	Yes	140,000
FF-11	I-10 East Lanes and Exit Ramp to SR-60 and I-5	14	Boyle Heights	None	Yes	140,000
FF-12	I-10 West Lanes at Griffin Avenue and east 16th Street	14	Central City	~450 ft away [d]	Yes	140,000
FF-13	SR-2 South Lanes Northeast of Casitas Avenue	13	Northeast Los Angeles	None	Yes	70,000
FF-14	SR-2 North Lanes Northeast of Casitas Avenue	1	Northeast Los Angeles	None	Yes	70,000
FF-15	SR-170 South Lanes at Raymer Street	6	North Hollywood - Valley Village	None	Yes	N/A
FF-16	SR-170 North Lanes North of Sherman Way	6	North Hollywood - Valley Village	None	Yes	N/A
FF-17	I-5 North Lanes South of Tuxford Street	6	Sun Valley - La Tuna Canyon	None	Yes	125,000
FF-18	I-5 South Lanes South of Tuxford Street	6	Sun Valley - La Tuna Canyon	None	Yes	125,000
FF-19	SR-118 East of San Fernando Road	7	Arleta - Pacoima	None [e]	Yes	115,000
FF-20	SR-118 East of San Fernando Road	7	Arleta - Pacoima	None [e]	Yes	115,000
FF-21	I-110 South Lanes at Exposition Boulevard	9	South Los Angeles	~1,000 ft away	Yes	200,000
FF-22	I-5 North Lanes at San Fernando Road	7	Sylmar	None	Yes	175,000
FF-23	I-110 North Lanes at Exposition Boulevard	9	Southeast Los Angeles	~1,000 ft away	Yes	200,000
FF-24	I-5 South Lanes at San Fernando Road and Sepulveda Boulevard	7	Sylmar	None	Yes	175,000
FF-25	I-405 South Lanes at Victory Boulevard	6	Encino - Tarzana	None	Yes	165,000
FF-26	I-405 North Lanes at Exposition Boulevard	6	Van Nuys - North Sherman Oaks	None	Yes	270,000
FF-27	I-405 South Lanes at Exposition Boulevard	11	West Los Angeles	None	Yes	270,000
FF-28	I-10 West at Robertson Boulevard	5	West Los Angeles	None	Yes	250,000
FF-29	SR-90 East at Culver Boulevard	11	Palms - Mar Vista - Del Rey	~500 ft away	Yes	55,000
FF-30	SR-90 West at Culver Boulevard	11	Palms - Mar Vista - Del Rey	~500 ft away	Yes	55,000
FF-31	I-105 West Lanes at Aviation Boulevard	11	Westchester - Playa Del Rey	None	Yes	140,000
FF-32	I-105 East Lanes at Aviation Boulevard	11	Westchester - Playa Del Rey	None	Yes	140,000
FF-33	I-110 South Lanes at Slauson Avenue	9	South Los Angeles	None	Yes	220,000
FF-34	I-110 North Lanes at Slauson Avenue	9	Southeast Los Angeles	None	Yes	220,000

Notes:
[a] Locations provided by Metro, April 2022
[b] Existing signage includes static or digital billboards along the site of the freeway.
[c] Based on Caltrans Performance Measurement System (PeMS)
[d] Installation of Site FF-12 would remove the existing sign within 500 feet. An existing digital billboard greater than 1,000 ft away would remain.
[f] Sites FF-19 and FF-20 are located within close proximity of Pacoima Plaza mall sign, however this is an on-site billboard which is not located immediately adjacent to the freeway.

TABLE 2
NON-FREEWAY FACING TCN STRUCTURE LOCATIONS

Sign ID	Location [a]	Council District	Community Plan	Total Average Daily Traffic (All Directions) [b]
NFF-01	Northeast corner of Vermont Avenue and Sunset Boulevard	13	Hollywood	65,000
NFF-02	Spring Street Bridge, 326 feet North of Aurora Street	1	Central City North	20,000
NFF-03	Northwest corner of Lankershim Boulevard and Chandler Boulevard	2	North Hollywood - Valley Village	35,000
NFF-04	Northwest corner of Lankershim Boulevard and Universal Hollywood Drive	4	Sherman Oaks - Studio City - Toluca Lake - Cahuenga Pass	60,000
NFF-05	Southwest corner of Lankershim Boulevard and Universal Hollywood Drive	4	Sherman Oaks - Studio City - Toluca Lake - Cahuenga Pass	60,000
NFF-06	Southwest corner of 4th Street and Hill Street	14	Central City	35,000
NFF-07	Venice Boulevard, 240 ft west of Robertson Boulevard	5	Palms - Mar Vista - Del Mar	60,000
NFF-08	Southeast corner of Alameda Street and Commercial Street	14	Central City North	45,000
NFF-09	Northeast corner of Van Nuys Boulevard and Orange Line Busline	6	Van Nuys - North Sherman Oaks	35,000
NFF-10	Southeast corner of Sepulveda Boulevard and Erwin Street	6	Van Nuys - North Sherman Oaks	45,000
NFF-11	Southwest of Crenshaw Boulevard, 175 ft South of 67th Street	8	West Adams - Baldwin Hills - Leimert	45,000
NFF-12	Southeast corner of Crenshaw Boulevard and Exposition Boulevard	10	West Adams - Baldwin Hills - Leimert	50,000
NFF-13	Southeast corner of East Cesar Chavez Avenue and North Vignes Street	14	Central City North	55,000
NFF-14	Pico Boulevard and Exposition Boulevard, South of rail	11	West Los Angeles	45,000
NFF-15	Pico Boulevard, 445 ft West of Sawtelle Boulevard	11	West Los Angeles	80,000
NFF-16	Southeast corner of South Central Avenue and East 1st Street	14	Central City	40,000
NFF-17	Century Boulevard, 152 ft West of Aviation Boulevard	11	Westchester - Playa Del Rey	55,000
NFF-18	Southwest Aviation Boulevard and South of Arbor Vitae Street	11	Westchester - Playa Del Rey	45,000
NFF-19	Northwest corner of Vermont Avenue and Beverly Boulevard	13	Wilshire	80,000
NFF-20	Southwest corner of Santa Monica Boulevard and Vermont Avenue	13	Hollywood	70,000
NFF-21	South of 4th Street and 210 feet East of South Santa Fe Avenue	14	Central City North	30,000
NFF-22	Northwest corner of East 7th Street and South Alameda Street	14	Central City	40,000

Notes:
[a] Locations provided by Metro, April 2022
[b] Based on traffic count data from NavigateLA and local traffic studies. For signs located at a corner, all approaches were totaled as there may be visibility from multiple streets. Results were rounded.