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Mandatory Discretionary Review Analysis

HEARING DATE: JULY 18, 2019

Record No.:	**2017-013308DRM**
Project Address:	**1 La Avanzada Street– Sutro Tower**
Zoning:	RH-1(D) (Residential-House, One Family-Detached) Zoning District 40-X Height and Bulk District
Block/Lot:	2724/003
Project Sponsor:	Kristen Thall Peters 201 California Street, 17th Floor San Francisco, CA 94111
Property Owner:	Sutro Tower, Inc. 1 La Avanzada Street San Francisco, CA 94131
Staff Contact:	Ashley Lindsay – (415) 575-9178 ashley.lindsay@sfgov.org

PROJECT DESCRIPTION

This Mandatory Discretionary Review was initiated by the Planning Department pursuant to Resolution No. 11399, adopted by the Planning Commission on July 14, 1988, which established the Commission's policy requiring Mandatory Discretionary Review over building permit applications regarding Sutro Tower, its transmission equipment building, or any other part of its site (Lot 003 in Assessor's Block 2724). The Project proposes to repack broadcast frequencies as mandated by the FCC consisting of adding seven new broadcast antennas, removing and replacing four existing broadcast antennas, and removing four existing broadcast antennas; temporarily remove cladding; and re-evaluate structural adequacy of the tower, per SF Building Code and perform structural strengthening as necessary.

SITE DESCRIPTION AND PRESENT USE

The Project Site is located at 1 La Avanzada (also known as 250 Palo Alto Avenue). The 5.6-acre site is owned by Sutro Tower, Incorporated. The site contains a 977-foot tall steel communications tower (Sutro Tower), a three-story 31,000-square-foot facilities building, a one-story 1,200 square-foot garage and storage building, and a one-story guard station, emergency generators, underground storage tanks, ancillary antennas and equipment associated with radio communications, landscaping and a surface parking lot.

The facility, although not the entire parcel, is completely enclosed within a security fence. Most of the area immediately surrounding the facility, including most of the northern half of the Project Site, consists of open space. The Tower has been in operation since 1973.

The Tower is located on one of the highest points in San Francisco (834 feet above sea level) and is generally visible from most places throughout the City.

La Avanzada forms the northern and a portion of the eastern boundary of the Project Site. Roughly the southernmost 320 feet of La Avanzada is owned by Sutro Tower, Inc.

SURROUNDING PROPERTIES AND NEIGHBORHOOD

The Project Site is situated in the Twin Peaks neighborhood. The surrounding neighborhoods are characterized by single-family neighborhoods such as Midtown Terrace.

Summit Reservoir, owned and operated by the San Francisco Public Utilities Commission (SFPUC), is located adjacent to and northeast of the Sutro Tower facility. Open space exists on undeveloped land located immediately south of the Project Site. The closest residences to the Project Site are located along Dellbrook Avenue, Farview Court, and Palo Alto Avenue. Residential properties abut portions of the west side of the Project Site boundary; the nearest dwelling is located on Dellbrook Avenue, approximately 200 feet from the Tower.

ENVIRONMENTAL REVIEW

On October 23, 2008, the Planning Commission certified the Final Environmental Impact Report (FEIR, Case no. 2007.0206E) for the conversion of the antennas on the Tower from analog to digital television. That FEIR included a discussion of additional antennas on the Tower and concluded that capacity remained for additional facilities on the Tower. The present request has been reviewed and is covered under the July 5, 2019 - Sutro Tower Spectrum Repacking Addendum to EIR.

ISSUES AND OTHER CONSIDERATIONS.

- All required public notifications were conducted in compliance with the Planning Code and adopted WTS policies.
- This Mandatory Discretionary Review covers building permit applications: 2017.09.22.9393, 2019.07.02.4914, and 2019.05.90.2084

REQUIRED COMMISSION ACTION

Pursuant to Section 306.9 of the Planning Code, Mandatory Discretionary Review is required for building permits submitted that include work to be performed on the site of Sutro Tower.

BASIS FOR RECOMMENDATION

This Project is necessary and desirable under Section 303 of the Planning Code for the following reasons:

- The Project complies with the applicable requirements of the Planning Code.
- The Project is consistent with the Objectives and Policies of the General Plan.
- The Project would improve the overall condition of and maintenance of the Sutro Tower site.

RECOMMENDATION:	**Do not take DR and Approve as Proposed, Subject to the standard Sutro Tower Conditions of Approval**

Attachments:
Standard Sutro Tower Conditions of Approval
Parcel Map
Sanborn Map
Aerial Photograph
Zoning Map
EIR Addendum
Photo Simulations
Reduced Plans
RF Report
DPH Approval

STANDARD ANTENNA CONDITIONS

The Conditions contained in this document were imposed by the Planning Commission on the antenna-related permits (the above-referenced permit application) at its hearing on July 18, 2019. It is the intent of the Commission, as so moved and adopted as Commission policy at said hearing, to impose these standard conditions (as a Notice of Special Restrictions) regarding inspections, RF levels (monitoring), operation and neighborhood communication (including notification) on all future antenna-related permits for Sutro Tower.

A. **STRUCTURAL INSPECTIONS:** In June of 1999, the Department of Building Inspection accepted an Inspection Protocol governing Sutro Tower. Sutro Tower, Inc. (hereinafter STI) shall adhere to said Inspection Protocol as summarized below:

1. Annual Inspection ("Routine Inspection"):

a. STI shall have an independent testing laboratory approved by the Department of Building Inspection ("independent laboratory") conduct Annual Inspections. The Annual Inspection shall consist of visual observations and/or measurements needed to determine the physical and functional condition of the Tower and to identify any changes from the Baseline Inspection that was conducted in 1999 pursuant to the Inspection Protocols or from previously recorded conditions. Each Annual Inspection shall cover approximately one-third of the Tower such that the entire structure will be evaluated over a three-year interval.

b. A California-licensed professional engineer retained by STI ("licensed engineer") shall review the results of the Annual Inspection, along with prior inspection results, to determine the extent of remedial action that may be necessary. The licensed engineer shall also ensure that the detailed inspection plan for subsequent years is modified to reflect any additional inspection requirements or areas where more in-depth inspection is required.

c. STI shall undertake all additional inspections recommended by the licensed engineer as a result of the Annual Inspection.

d. STI shall undertake all remedial action recommended by the licensed engineer as a result of the Annual Inspection. A Special Inspection shall thereafter be conducted to assess the performance of any repairs resulting from the Annual Inspection.

e. A report of each Annual Inspection shall be prepared by the licensed engineer and submitted to the Planning Department and to the Department of Building Inspection within 45 days of the inspection, and those reports shall be made available to members of the public.

f. STI shall send notice of the availability of each Annual Inspection report to representatives of the Twin Peaks Improvement Association and Midtown Terrace Homeowners Association.

2. In-Depth Inspection:

a. In 2004 and every five years thereafter or as otherwise required by the licensed engineer during an Annual Inspection or Event Inspection, STI shall have an independent laboratory conduct a close-up, hands-on inspection of one or more structural members or connections to identify problems not readily detectable with a visual review in the Annual Inspection.

b. If recommended by the licensed engineer to fully ascertain the presence or extent of damage, STI shall have non-destructive field-testing, load tests, and/or materials tests performed by an independent testing laboratory.

c. STI shall undertake all additional inspections recommended by the licensed engineer as a result of the In-Depth Inspection.

d. STI shall undertake all remedial action recommended by the licensed engineer as a result of the In-Depth Inspection. A special Inspection shall thereafter be conducted to assess the performance of any repairs resulting from the In-Depth Inspection.

e. A report of each In-Depth Inspection shall be prepared by the licensed engineer and submitted to the Planning Department and to the Department of Building Inspection within 45 days of the inspection, and those reports shall be made available to members of the public.

f. STI shall send notice of the availability of each In-Depth Inspection report to representatives of the Twin Peaks Improvement Association and Midtown Terrace Homeowners Association.

3. Event Inspection ("Unscheduled Inspection"):

a. As required by a licensed engineer, STI shall have an independent laboratory conduct an Event Inspection as soon as practical after the occurrence of a severe storm, earthquake, mudslide, or other triggering environmental event that exceeds the design load of the Tower (winds in excess of 70 miles per hour at 10 meters in elevation, or a 1000-year seismic event as defined in the dynamic analysis report of June 1999).

b. Following a severe storm or earthquake, particular inspection attention shall be given to detecting damage and indirect signs of damage such as areas of missing cladding, paint cracking due to yielding of steel members, spalling of concrete, misalignment in

connections, loosening or lengthening of bolts, or obvious structural displacements. Depending on the severity of the triggering storm or earthquake, an In-Depth Inspection may be appropriate in areas of local damage to the Tower.

c. STI shall undertake all additional inspections recommended by the licensed engineer as a result of the Event Inspection.

d. STI shall undertake all remedial action recommended by the licensed engineer as a result of the Event Inspection. A Special Inspection shall thereafter be conducted to assess the performance of any repairs resulting from the Event Inspection.

e. A report of each Event Inspection shall be prepared by the licensed engineer and submitted to the Planning Department and to the Department of Building Inspection within 45 days of the inspection, and those reports shall be made available to members of the public.

f. STI shall send notice of the availability of each In-Depth Inspection report to representatives of the Twin Peaks Improvement Association and Midtown Terrace Homeowners Association.

4. Special Inspections:

a. STI shall have an independent laboratory conduct a Special Inspection to monitor repairs resulting from previous inspections or to otherwise assess the performance of repairs implemented to ensure the structural integrity of the Tower. The Special Inspection shall be undertaken as part of an Annual Inspection conducted within one year after completion of the repair, if practical, or during the next inspection cycle.

b. STI shall have an independent laboratory conduct a Special Inspection as recommended by a licensed engineer for any reason, including monitoring defects, damage, local corrosion, or other conditions potentially affecting the structural integrity of the Tower.

c. STI shall undertake all additional inspections recommended by the licensed engineer as a result of the Special Inspection.

d. STI shall undertake all remedial actions recommended by the licensed engineer as a result of the Special Inspection.

e. A report of each Special Inspection shall be prepared by the licensed engineer and submitted to the Planning Department and to the Department of Building Inspection within 45 days of the inspection, and those reports shall be made available to members of the public.

f. STI shall send notice of the availability of each In-Depth Inspection report to representatives of the Twin Peaks Improvement Association and Midtown Terrace Homeowners Association.

5. Enforcement:

a. Technical compliance with conditions regarding structural inspection shall be monitored and enforced by the Department of Building Inspection. The Planning Department shall enforce these conditions only at the recommendation of the Director of the Department of Building Inspection.

b. STI shall provide to the Planning Department a complete set of all building permit application materials required by the Department of Building Inspection, including but not limited to: scaled drawings, elevations, site plans, engineering or structural analyses, and photographs.

B. **RADIO-FREQUENCY (RF) LEVEL**

1. **FCC Emission Compliance:** It shall be a continuing condition of this permit that the subject antennas be operated in such a manner so as not to contribute to ambient RF emissions in excess of the then-current FCC emission standards for public exposure. Violation of this condition shall be grounds for revocation.

2. **Publicly-Accessible Property:**

a. Consistent with the agreement between STI and the Planning Commission at its February 26, 1998, hearing on DTV antenna installation, STI shall measure RF public exposure levels at 200 publicly-accessible sites within 1000 feet of the Tower. Measurement shall be made each three years, or within six months of the activation of any DTV broadcasting antenna, or within six months of any increase in power from any main DTV antenna's initial power level, whichever is earliest.

b. STI shall notify the Department of Public Health at least three days before taking any RF exposure measurements at publicly accessible sites. A representative of the Department of Public Health and up to two community observers identified by the Department of Public Health may observe the measurement session and recommend sites for measurement.

c. STI shall promptly remedy any ambient or localized field found by these measurements to exceed the FCC standard for RF exposure ("Guidelines for the Evaluation of the Environmental Effects of Radio Frequency Radiation") and then take new measurements to demonstrate compliance with the standard.

d. A report of any RF exposure measurements required herein shall be submitted to the Planning Department and the Department of Public Health within 45 days of the measurements, and those reports shall be made available to members of the public.

e. STI shall send notice of the availability of each RFR exposure report exposure to representatives of the Twin Peaks Improvement Association and Midtown Terrace Homeowners Association.

3. **Private Property:**

a. Upon a written request to STI from an individual property owner within 1000 feet of the Tower, STI shall measure RF exposure levels at the accessible front yard and rear yard of the property. If RF levels in the yards comply with the 1996-FCC standard for RF exposure, then no additional measurements shall be thereafter required for any reason until three years have elapsed, at which time the property owner may submit a new written request for exposure level measurements.

b. With the cooperation and approval of the property owner, STI shall promptly remedy any ambient or localized field found by these measurements to exceed the FCC standard and then take new measurements to confirm compliance with the standard.

c. With the written approval of the owner of the private property requesting the RF exposure level measurements, STI shall submit a report to the Planning Department and the Department of Public Health within 45 days of the measurements, and those reports shall be made available to members of the public.

4. **Enforcement**:

a. Technical compliance with conditions pertaining to RFR exposure shall be monitored and enforced by the Department of Public Health. The Planning Department shall enforce these conditions only at the recommendation of the Director of the Department of Public Health.

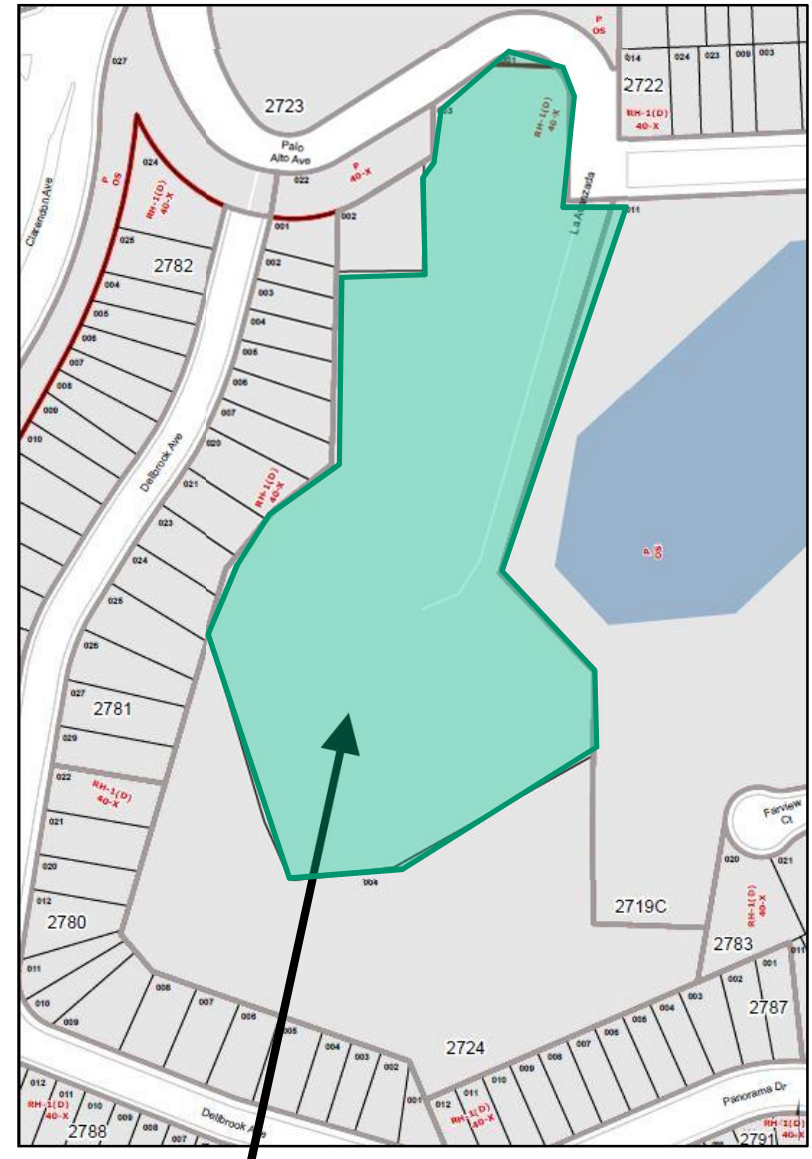
C. **NEIGHBORHOOD COMMUNICATION**

1. **Notice**: Within ten days of submitting any report required herein to any public agency, STI shall send notice of the availability of that report to representatives of the Twin Peaks Improvement Association, Forest Knolls Neighborhood Association and Midtown Terrace Homeowners Association.

2. **Community Liaison:** STI shall appoint a community liaison to respond to neighborhood inquiries and concerns. STI shall invite the Twin Peaks Improvement Association, Forest Knolls Neighborhood Association and the Midtown Terrace Homeowners Association to

appoint one community liaison each with whom to communicate regarding Sutro Tower operations.

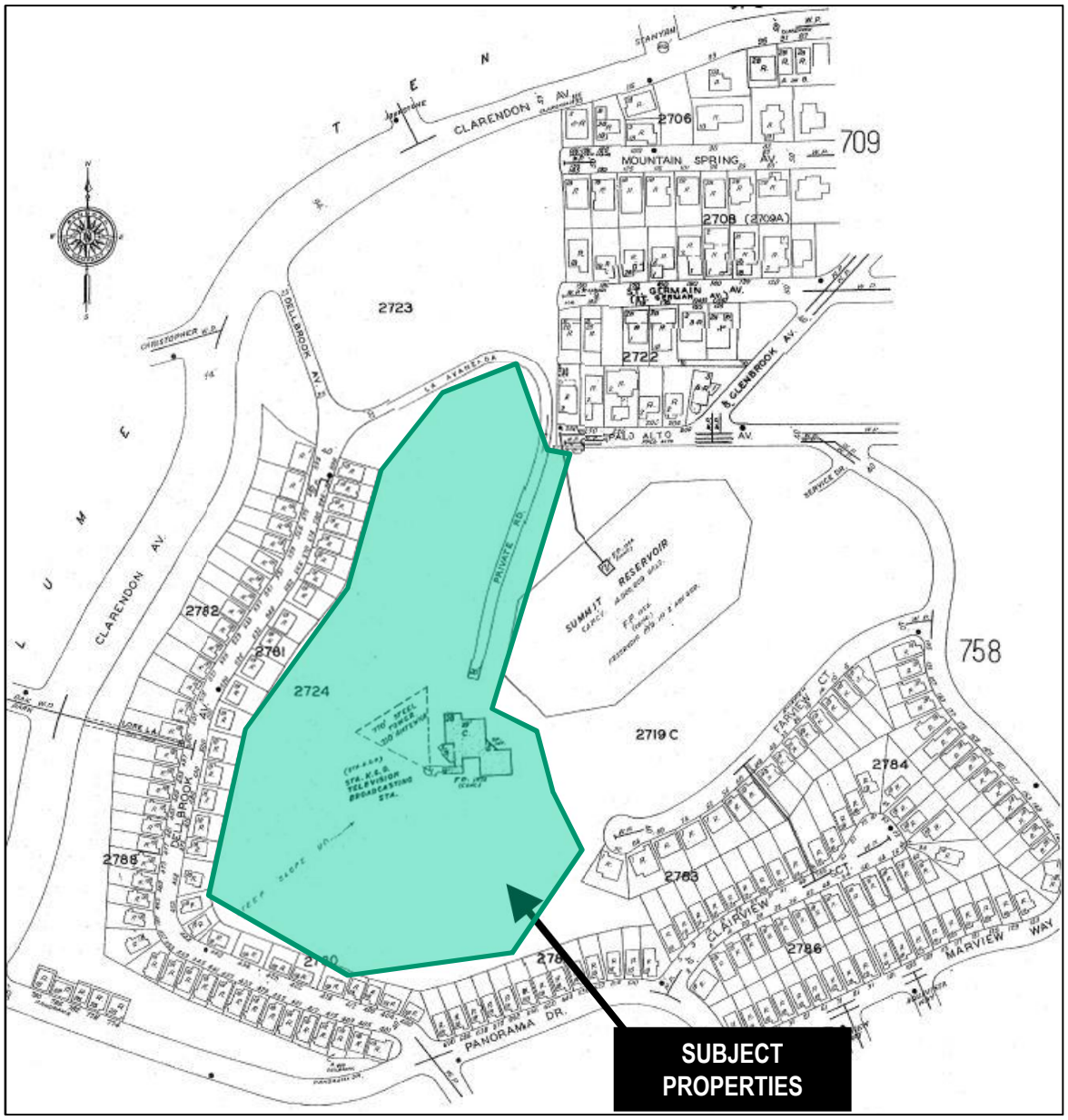
Block Book Map



Case Number 2017-013308DRM
Sutro Tower
1 La Avanzada Street

SAN FRANCISCO
PLANNING DEPARTMENT

Sanborn Map*



*The Sanborn Maps in San Francisco have not been updated since 1998, and this map may not accurately reflect existing conditions.

Case Number 2017-013308DRM
Sutro Tower
1 La Avanzada Street

SAN FRANCISCO
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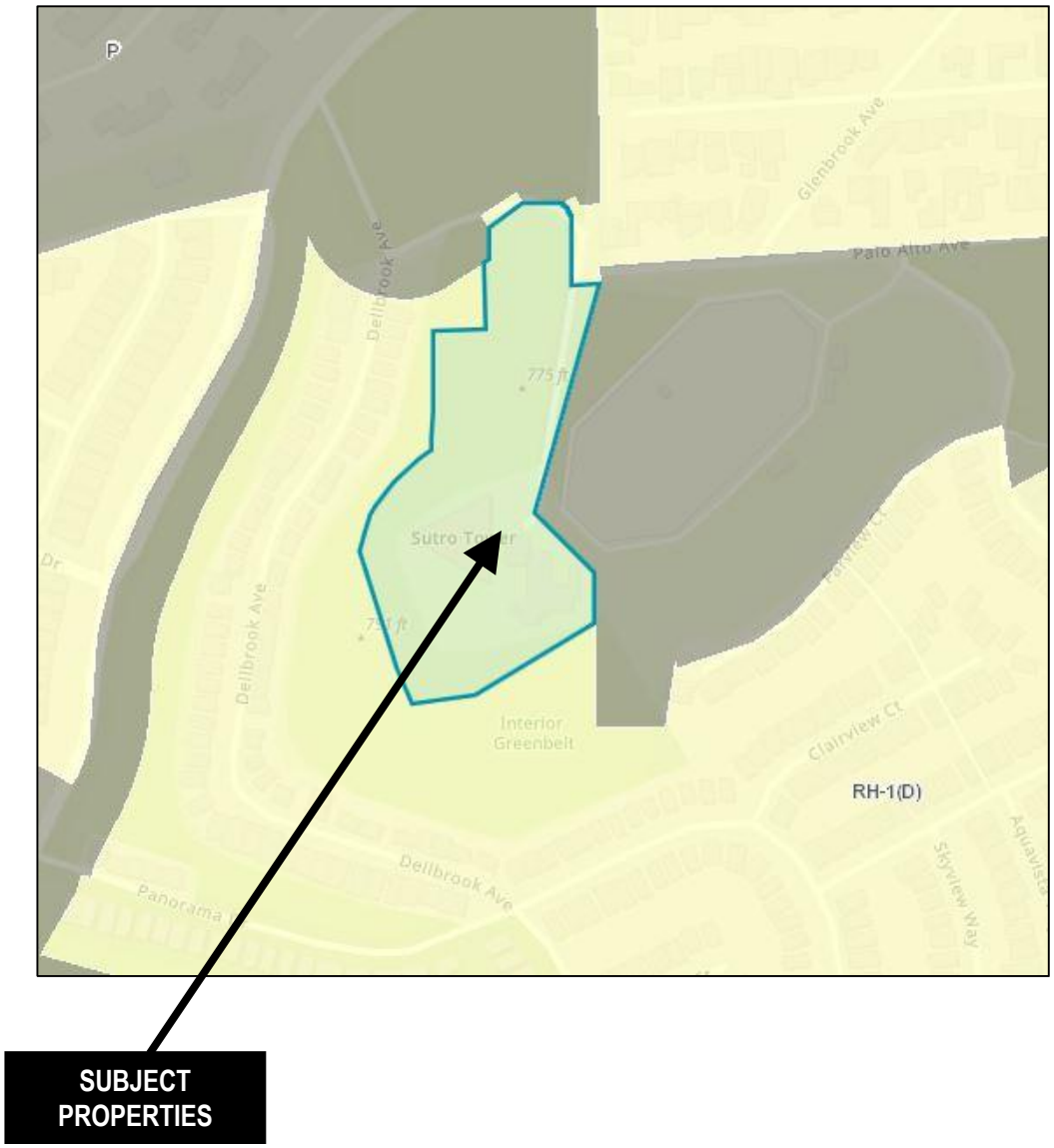
Zoning Map



Case Number 2017-013308DRM
Sutro Tower
1 La Avanzada Street

SAN FRANCISCO
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Aerial Photo

Case Number 2017-013308DRM
Sutro Tower
1 La Avanzada Street

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Addendum to Environmental Impact Report

Date:	July 5, 2019
Case No.:	**2007.0206ENV-4**
Project Title:	Sutro Tower Spectrum Repacking Project
EIR:	Sutro Tower Digital Television Project Final EIR
Zoning:	RH-1(D); 40X Height and Bulk District
Block/Lot:	2724/003
Lot Size:	224,996 square feet (5.2 acres)
Project Sponsor	Sutro Tower, Inc. (STI) Eric Dausman – 415.681.8850 - ericd@sutrotower.com
Lead Agency:	San Francisco Planning Department
Staff Contact:	Kei Zushi – 415.575.9038 - kei.zushi@sfgov.org

PROJECT DESCRIPTION

Prior Environmental Review

2008 Final EIR

In October 2008, the San Francisco planning commission (planning commission) certified the Sutro Tower Digital Television Project Final Environmental Impact Report, Planning Department Case No. 2007.0206E, (2008 FEIR) in compliance with the California Environmental Quality Act (CEQA). The 2008 FEIR addressed the conversion of television antennas on Sutro Tower from an analog/digital system to an all-digital system (hereafter referred to as the 2008 project). These improvements included replacement of a number of the tower's large antennas; structural upgrades to the tower to meet San Francisco Building Code (building code) wind resistance requirements and to accommodate the placement of new digital television equipment on the tower; alteration, replacement or addition of a number of small ancillary antennas and equipment on the tower, transmitter building rooftop and secured grounds; and addition of auxiliary equipment, and electrical, elevator, and public safety improvements. The 2008 FEIR determined that the 2008 project would not result in any potentially significant impacts that could not be avoided or reduced to a less-than-significant level with mitigation. Under its mandatory discretionary review policy for improvements to Sutro Tower, the planning commission took discretionary review and approved building permits for the project in October 2008. The improvements noted above were completed in the summer of 2011.[1]

2014 Addendum

In December 2014, the planning department prepared an addendum (2014 addendum) to the 2008 FEIR to analyze a modified project (hereafter referred to as the 2014 modified project). The 2014 addendum

[1] It should be noted that in January 2011, the planning commission also determined that the subsequent addition to the tower of 14 new antennas and one microwave dish for wireless data service provider Clearwire, LLC fell within the project analyzed in the 2008 FEIR and was not subject to further CEQA analysis. These subsequent improvements were completed in May 2013.

analyzed the addition of 50 broadcast and reception antennas, microwave dish antennas and camera mounts at various levels on the tower, and replacement and relocation of an auxiliary radio antenna to a higher level on the tower. The 2014 addendum also analyzed proposed at-grade improvements on the project site, including the installation of a retaining wall, on-site erosion control and drainage measures, repairs to the existing driveway, installation of exterior stairways and a walkway, and installation of an at-grade, receive-only, satellite dish antenna to replace an existing similar use antenna. The 2014 addendum found that the conclusions of the 2008 FEIR remained valid and that no new or substantially more severe significant impacts would result from the 2014 modified project, and no new mitigation measures were required. The planning commission took discretionary review and approved building permits for the 2014 modified project in March 2015. The majority of the 2014 modified project has been completed, however, certain Sutro Tower, Inc.'s (STI) customers for whom limited numbers of antennas were to be constructed on the tower have postponed installation of some of the approved antennas.

Setting

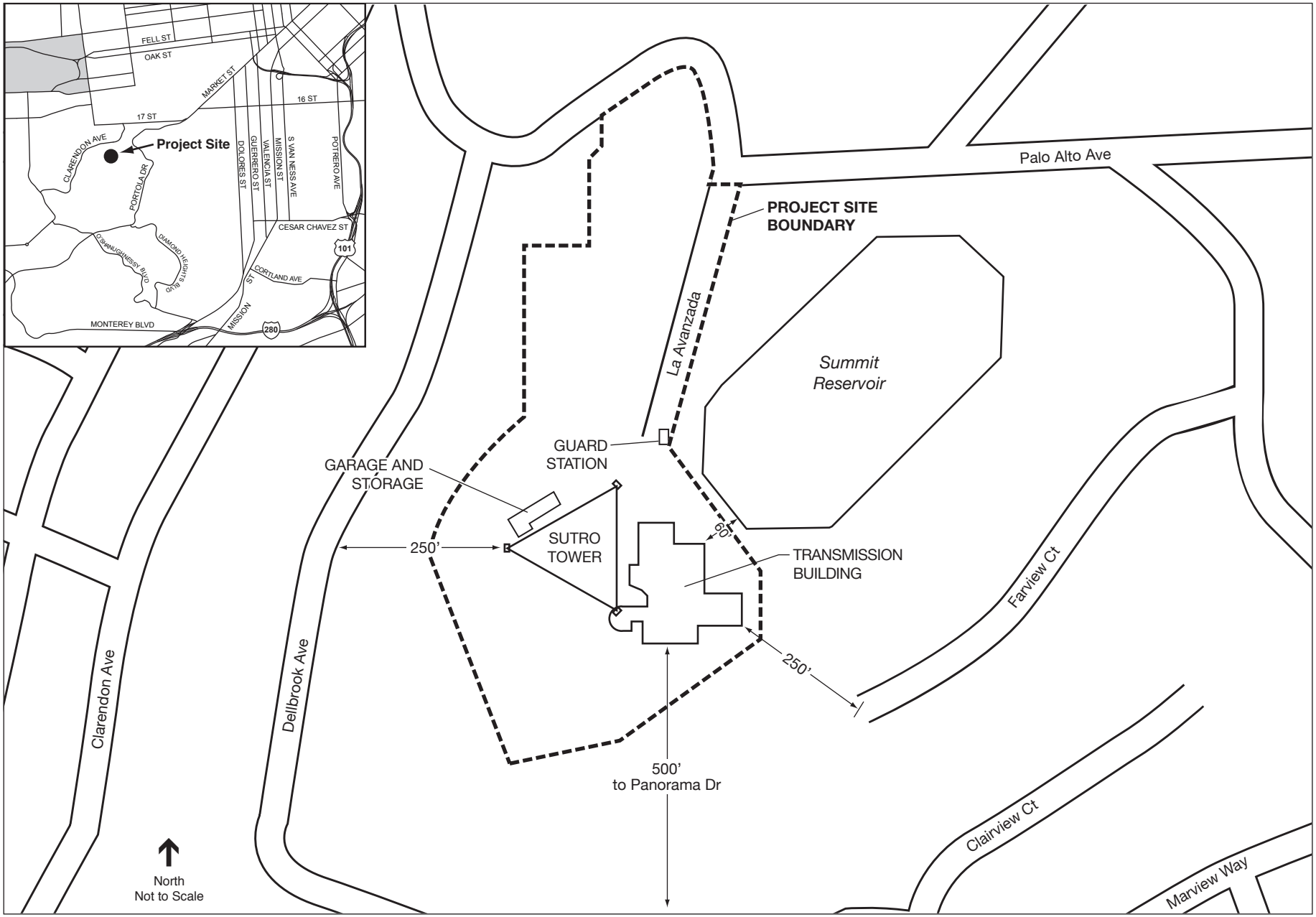
The project site is located at 1 La Avanzada Street in San Francisco's Midtown Terrace neighborhood (see **Figure 1**, Project Location). The 5.2-acre site is owned by STI, the project sponsor. The site contains a 977-foot-tall steel communications tower (Sutro Tower), a three-story[2] 31,000-square-foot (sf) transmission building, a one-story 1,200-sf garage and storage building, and a one-story guard station, emergency generators, underground storage tanks, ancillary antennas and equipment associated with radio communications, landscaping and a surface parking lot. The facility, although not the entire 5.2-acre parcel, is completely enclosed within a security fence. Most of the area immediately surrounding these facilities, including the great majority of the northern half of the project site, consists of open space. The tower has been in operation since 1973.

The tower is located on one of the highest points in San Francisco (834 feet above sea level) and is generally visible from most places in the city. Surrounding neighborhoods include Forest Hill and the Sunset to the west, the Castro and Noe Valley to the east, Diamond Heights and Miraloma Park to the south, and Haight Ashbury and Cole Valley to the north. La Avanzada Street forms the northern and a portion of the eastern boundary of the project site. Roughly the southmost 320 feet of La Avanzada Street is owned by STI. Summit Reservoir, owned and operated by the San Francisco Public Utilities Commission (SFPUC), is located adjacent to and east of the Sutro Tower property. Open space exists on undeveloped land located immediately north and south of the project site. The closest residences to the project site are located along Dellbrook Avenue, Farview Court, and Palo Alto Avenue. Residential properties abut portions of the west side of the project site boundary; the nearest dwelling is located on Dellbrook Avenue, approximately 200 feet from the tower.

Proposed 2019 Modified Project

In July 2018, STI submitted an Environmental Evaluation (EE) Application to the planning department for a number of improvements on Sutro Tower, consisting of changes to certain antennas and supports on the tower to accommodate the Federal Communications Commission (FCC) spectrum repacking requirements. Due to concerns about timing of project approval required from the planning commission, the project sponsor split the project into four separate components, three of which (herein referred to as the 2019 modified project) are covered by this Addendum, as discussed below.

[2] The transmission building is three stories on the reservoir side and two stories on the parking lot side.



D181102.00 - Sutro Tower\05 Graphics-GIS-Modeling\Illustrator

SOURCE: ESA, 2019

Sutro Tower Spectrum Repacking Addendum

Figure 1
Project Location

These components include: 1) addition, removal, and/or replacement of broadcast antennas on Sutro Tower in support of the FCC spectrum repacking requirements, referred to as "repacking project" (Environmental Planning Case No. 2007.0206ENV-4, Department of Building Inspection [building department] Application No. 2017.09.22.9393); 2) voluntary structural upgrades to Sutro Tower (Environmental Planning Case No. 2007.0206ENV-4, Building Department Application No. 2019.05.30.2084); 3) temporary removal of existing cladding[3] from Sutro Tower and reinstallation of the removed cladding, referred to as "temporary cladding removal" (Environmental Planning Case No. 2007.0206ENV-4, Building Department Application No. 2019.07.02.4914); and 4) permanent removal of existing cladding from Sutro Tower, referred to as "permanent cladding removal" (Building Department Application No. 2019.01.08.9873).[4]

This Addendum only addresses environmental impacts resulting from the 2019 modified project, which includes the repacking project, the voluntary structural upgrades, and the temporary cladding removal. The permanent cladding removal project would be subject to environmental review separate from this Addendum. The repacking project, any of the voluntary structural upgrades, the temporary cladding removal, and the permanent cladding removal have independent utility under CEQA in that each exists for its own purpose and can be implemented one without the other.

As described in more detail below, the repacking project is proposed because the FCC spectrum repacking requirements mandate the reassignment of some portions of the television radio frequency spectrum to cellular phone and mobile broad band service providers and other wireless communications. To accommodate the spectrum repacking requirements at Sutro Tower, STI proposes to add, remove, and/or replace multiple broadcast antennas on the three antenna supports and multiple ancillary antennas at various locations on the tower. While the tower structure currently complies with the building code, the entire south spire's steel supports would be replaced to accommodate the new antenna configuration.

Also explained further below, the voluntary structural upgrades are proposed to fulfill a commitment to Sutro Tower's neighbors to structurally enhance Sutro Tower to meet the building code as applied to essential facilities, even though the repacking project does not trigger such upgrades.

Both the proposed repacking project and voluntary structural upgrades would require temporary cladding removal. The temporary cladding removal would require a maintenance permit from the building department in order to access portions of the tower for the respective improvements. Cladding on the three tower legs at locations between levels four and six of the tower would be temporarily removed and reinstalled for access to the tower structure, but no cladding would be permanently removed. The temporary cladding removal would affect about 11 percent of the tower's approximately 1,500 cladding panels; the panels are anticipated to be reinstalled in 2020.

The permanent cladding removal project, which as discussed above, would be subject to environmental review separate from this Addendum, is intended to allow the tower to comply with the upgraded building code for seismic and wind load.

The 2019 modified project would not include any ground-level improvements, ground disturbance, or vegetation removal.

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[3] Cladding in this context refers to the the painted metal panels that are attached to the truss work that comprises the tower's structure.

[4] As of July 5, 2019, the sponsor has not submitted all materials and application fees required for the environmental review concerning the permanent cladding removal.

FCC Spectrum Repacking

Background

In 2017, the FCC implemented the Broadcast Television Spectrum Incentive Auction (Incentive Auction), which consisted of a two-part process designed to address the need to increase spectrum available for mobile broadband services by narrowing the portion of the frequency spectrum available for broadcasters.

When the nationwide reconfiguration of the frequency spectrum is complete, hereafter referred to as "spectrum repacking," or simply, "repacking," wireless companies will have the bandwidth to deliver 5th Generation (5G) mobile broadband services throughout the country. This repacking requires certain antennas to be moved to different locations on communications towers in order to make use of newly assigned spectrum.

On April 13, 2017, following completion of the auction process, the FCC issued a Channel Reassignment Public Notice announcing the final post-auction television channel assignments.[5] All television broadcasters that will remain on the air must complete any required transition to new channels, including, but not limited to, permitting, construction, testing and on-air broadcasting in their newly assigned spectrum on FCC deadlines so transition to new frequencies can be activated by the affected broadcasters simultaneously on the FCC's compulsory nationwide repack rollout schedule.

Proposed Modifications Associated with Proposed Spectrum Repacking

Three existing broadcasters on Sutro Tower have completely relinquished their spectrum. As such, under the 2019 modified project, two broadcast antennas would be removed from Sutro Tower. The third broadcaster occupies a shared antenna so, while the antenna itself would remain, one of the broadcasters would cease transmission from this shared antenna. This would involve minor modifications to Sutro Tower's Stacks A and C, but substantial reconstruction and reconfiguration of the tower's Stack B (also known as the south spire) is necessary to accommodate changes for the remaining broadcasters:[6,7]

The spectrum repacking project would add seven new broadcast antennas, replace four existing broadcast antennas with new antennas, and remove four existing broadcast antennas. Following repacking, 24 total broadcast antennas serving 18 TV and FM broadcast stations would exist on the tower. The modifications to Sutro Tower are shown in **Figure 2** and **Table 1**. In addition, 21 ancillary antennas would also be added as shown in **Figure 2** and **Table 2**.

- **Stack A.** The spectrum repacking work to Stack A would involve removing one antenna completely (antenna E in Figure 2), and installing an already permitted but unbuilt antenna with a different antenna than was approved previously (Planning Case No. 2007.0206E, Building Department Application No. 2013.04.12.4452). Three users would share the remaining antenna at the top but with different channels as required by the FCC spectrum repacking.

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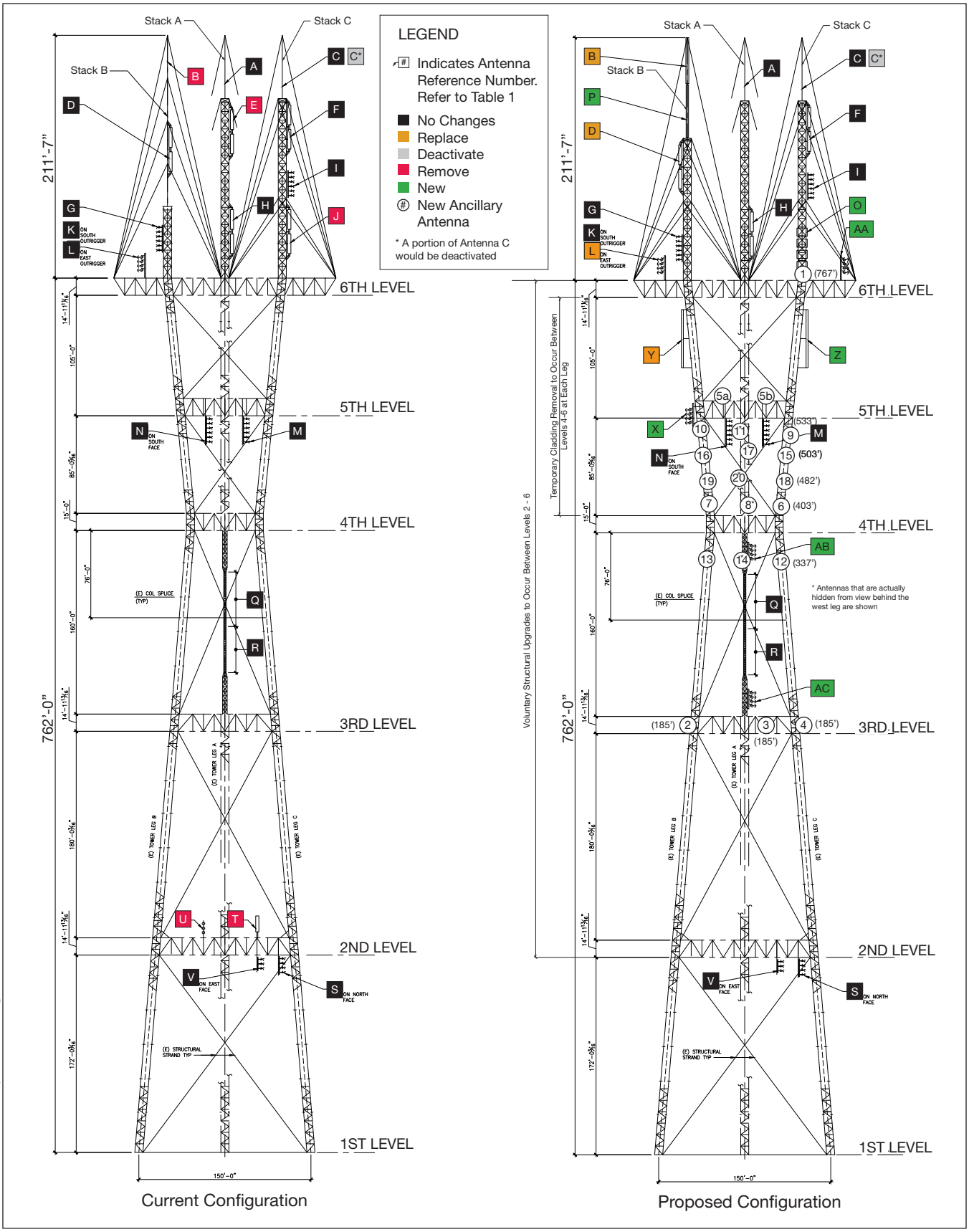
5 FCC, *Incentive Auction Closing and Channel Reassignment Public Notice, The Broadcast Television Incentive Auction Closes; Reverse Auction and Forward Auction Results Announced; Final Television Band Channel Assignments Announced; Post-Auction Deadlines Announced*, April 13, 2017. This document (and all other documents cited in this report, unless otherwise noted), is available for review at the San Francisco planning department, 1650 Mission Street, Suite 400 as part of Case File No. 2007.0206E.

6 Stacks A, B, and C refers to the three primary broadcast antenna supports mounted on the tower structure, and does not refer to the tower legs.

7 An antenna stack is two or more antennas bolted on top of one another. As such, the antenna manufacturers refer to these as antenna stacks. The term is often used interchangeably with masts or spires.



NOTE: This figure only illustrates antennas that will be replaced, deactivated, removed, or added to Sutro Tower, but does not illustrate other minor antenna modifications proposed under the 2019 modified project.

SOURCE: Simpson Gumpertz & Heger, 2017

Sutro Tower Spectrum Repacking Addendum

Figure 2
Proposed Modifications to Sutro Tower

TABLE 1
LIST OF POST-REPACK SUTRO TOWER BROADCAST (INCLUDING AUXILIARY) ANTENNAS

Antenna Reference	Description (channel)	Antenna Changes (No Change, Replace, Deactivate, Remove, or New)	Height Above Ground (ft.)	Weight (lbs)	Antenna Height (ft.)	Antenna Width (ft.)	Main ERP (kW)[a]	Aux ERP (kW)
A	TV Broadcast--KCSM (27)	No Change	945.7	35,000	54.5	6	465	--
	TV Broadcast--KPIX (29)	No Change					1000	--
	TV Broadcast--KTVU (31)	No Change					1,000	--
B	TV Broadcast--KGO (12)	Replace[b]	953.8	12,200	37.9	3	47.0	--
C	TV Broadcast--KQED (30)	No Change	945.7	35,000	54.5	6	1,000	--
	TV Broadcast--KCNS (32)	No Change					1,000	--
	TV Broadcast--KMTP (33)	Deactivate					N/A	N/A
D	TV Broadcast--KBCW (28)	Replace[b]	861.9	1,420	47.9	2	1,000	--
E	TV Broadcast--KOFY (19)	Remove	n/a	1,800.0	n/a	n/a	100	--
F	TV Broadcast--KFSF (34)	No Change	884.2	1,000	48.4	2	850	--
G	FM Broadcast--KQED	No Change	782.2	1,800	40.0	n/a	--	22
H	TV Broadcast--KQTA-CD (14)	No Change	800.2	1,650	28.9	2	15	--
I	FM Broadcast--KOIT	No Change	843.2	510	30.0	n/a	24	--
J	TV Broadcast--KEMO (32)	Remove	n/a	5,851	n/a	n/a		--
K	FM Broadcast--KOSF	No Change	782.2	248	15.0	n/a	7.2	--
L	FM Broadcast--KFOG	Replace	774.3	156	20.0	n/a	7.1	--
M	FM Broadcast--KSOL	No Change	610.3	186	25.0	n/a	6.1	--
N	FM Auxiliary--KOIT	No Change	620.1	510	30.0	n/a		36H/24V
O	TV Broadcast--KRCB (5)	New	792.0	3,170	48.0	12.0	25.0	--
P	TV Broadcast--KRON (7)	New	907.9	17,800	44.0	40.19	50	--
AA	TV Broadcast--LPTV (3 & 4)	New	783.9	1,000	23.0	n/a	3.0	--
Q	TV Auxiliary--KQTA-CD (14)	No Change	485.8	14,900	47.6	5	--	400
	TV Auxiliary --KCSM (27)						--	250
	TV Auxiliary--KPIX (29)						--	500
	TV Auxiliary--KTVU (31)						--	427.9
R	TV Auxiliary--KBCW (28)	No Change	438.2	14,900	48	5	--	500
	TV Auxiliary--KQED (30)						--	500
	TV Auxiliary--KCNS (32)						--	500
	TV Auxiliary--KFSF (34)						--	185
S	FM Auxiliary--KOSF	No Change	157.5	248	20.0	n/a	--	10
T	TV Auxiliary--KGO (7)	Remove	n/a	9,750	n/a	n/a	N/A	N/A
U	FM Auxiliary--KFOG	Remove	n/a	62	n/a	n/a	N/A	N/A
V	FM Auxiliary--KSOL	No Change	157.0	147	20.0	n/a	--	6.1
X	FM Auxiliary--KFOG	New	642.6	348	41.5	n/a	--	7.5
Y	TV Auxiliary--KGO (12)	Replace	707.1	1,350	43.8	2.0	--	70.0
Z	TV Auxiliary--KRON (7)	New	707.1	1,550	41.5	2.0	--	70.0
AB	TV Auxiliary--KRCB (5)	New	526	1,000	23.0	n/a	--	12.5
AC	TV Auxiliary--LPTV (3 & 4)	New	398	1,000	23.0	n/a	--	3.0

NOTE:
[a] For broadcast service, indicated power is effective radiated power (ERP) in kilowatts (kW).
[b] All replacement antennas would have approximately the same weight, height, width, and height above ground as the antennas they are replacing.

SOURCE: Simpson, Gumpertz & Heger, 2019

TABLE 2
LIST OF SUTRO TOWER AUXILIARY ANTENNA ADDITIONS

Antenna Reference	Client	Antenna Changes (No Change, Replace, Deactivate, Remove, or New)	Height Above Ground (ft)	Location	Weight (lbs)	Antenna Size (diameter or height, ft.)	RF Emission (EIRP in watts each)
1	KGO-TV	New	767.0	N Stack	500.0	8.0	39,018
2	KQED-FM	New	185.0	E Face	85.0	4.0	29,512
3	KQED-FM	New	185.0	E Face	100 est	6.0	1,660
4	KRCB-TV	New	185.0	N Leg	254.0	6.0	20,943
5A 5B	KTVU-TV	New	557.0	Top of L4	44.0	8.0	200
6	Skyriver	New	403.0	N Leg	10.5	3.5	18
7	Skyriver	New	403.0	S Leg	10.5	3.5	18
8	Skyriver	new	403.0	W leg	10.5	3.5	18
9	Puloli	New	533.0	N Leg	210.0	9.0	11
10	Puloli	New	533.0	S Leg	210.0	9.0	11
11	Puloli	New	533.0	W leg	210.0	9.0	11
12	Unwired	New	337.0	N Leg	7.0	1.8	126
13	Unwired	New	337.0	S Leg	7.0	1.8	126
14	Unwired	New	337.0	W leg	7.0	1.8	126
15	CommSites West	New	503.0	N Leg	10.5	3.5	18
16	CommSites West	New	503.0	S Leg	10.5	3.5	18
17	CommSites West	New	503.0	W leg	10.5	3.5	18
18	CommSites West	New	482.0	N Leg	7.0	1.8	126
19	CommSites West	New	482.0	S Leg	7.0	1.8	126
20	CommSites West	New	482.0	W leg	7.0	1.8	126

SOURCE: Simpson, Gumpertz & Heger, 2019

- **Stack B.** Stack B currently has two operating TV antennas and one operational FM antenna. Due to spectrum repacking, one additional antenna would be added to this stack to accommodate a move from UHF to VHF, increasing the total antenna count on Stack B from three to four (antennas B, P, D, and G on Figure 2). In order to accommodate this reconfiguration of Stack B, the entire south spire would need to be reconstructed as shown in Figure 3. This would include replacement of existing steel supports and antennas and the addition of the new antennas, in compliance with current code requirements.

- **Stack C.** The spectrum repacking work to Stack C would involve removing one antenna (antenna J in Figure 2). Two users would share the top antenna (antenna C in Figure 2) on this stack, but on different channels to comply with the FCC spectrum repacking requirements.

In order to accommodate the changes in equipment associated with the spectrum repacking reconfiguration on the tower, certain improvements would be necessary in the interior of the main transmission building to allow the new tower equipment to actively broadcast transmissions through each customer's internal transmission broadcast centers, including upgrading certain equipment housed therein and associated electrical equipment and wiring. Since each broadcaster occupies its own space within the transmission

building, the tenant improvement work for each such broadcaster would be processed through individual building permit applications and approved separately. Additionally, some broadcasters would need to replace and/or upgrade their existing air conditioning units and/or generators to support the interior modifications. In each such instance, building permit applications for the installation of quieter replacement units would be applied for in connection with the applicable tenant improvements. These future tenant improvements would be subject to all applicable electrical and building permit requirements, and, because the improvements would occur entirely within the existing transmission building, these improvements are not anticipated to result in environmental impacts under CEQA.

It should be noted that as a result of the proposed spectrum repacking project at Sutro Tower, it is possible that the customers with broadcast antennas on Sutro Tower may need to replace their small ancillary subscriber antennas to rebroadcast their transmissions in their newly allocated spectrum (depending upon make and model of those existing antennas located at such broadcast facilities). However, such antenna replacements are speculative at this time and, therefore, are not considered part of the 2019 modified project.

Structural Strengthening of Tower Members

In connnection with the repacking, STI committed to certain neighbors living nearby Sutro Tower to structurally upgrade the tower in compliance with 403.9 of the building code even though the repacking permit did not trigger such upgrades.[8] The upgrades consist of: strengthening of columns with the addition of cover plates; strengthening of selected braces with the insertion of new WT strong back elements between existing double angle members; strengthening of connections by welding and supplemental gusset plate extensions, and strengthening of existing masts with round sections that encase the existing round structural member.[9] These upgrade measures would not be discernible, except by knowledgeable engineers and contractor personnel when in close proximity (on the tower) to the upgrades. They would not be discernible to observers on the ground, either at the tower base or at more distant locations.

Temporary Cladding Removal

The repacking project and voluntary structural upgrades would not include any permanent cladding removal from Sutro Tower. However, cladding on the three tower legs at locations between levels four and six of the tower may be temporarily removed and reinstalled for access to the tower structure. Up to 160 panels, each approximately 30 inches wide and 30 feet tall, would be temporarily removed. Each cladding panel is currently attached with self-tapping screws or bolts which need to be removed by hand. Any removed panel would be lowered to the ground via cable and stored on-site until it can be replaced onto the tower. At such time, each panel would be lifted into place and reattached by hand with similar bolts being reinserted into the prior hole. Such panels would be removed for the duration of the 2019 modified project with an estimated timeline of an additional six months to reinstall the cladding after completion of the improvements.

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[8] Yau, Willy, P.E., Plan Review Services Division, San Francisco Department of Building Inspection, June 13, 2019 e-mail correspondence with Kei Zushi, Senior Environmental Planner, San Francisco Planning Department, confirming that with the proposed repacking project, no structural upgrade to the existing Sutro Tower would be required per San Francisco Existing Building Code.

[9] A WT strongback element is the "T" shaped member inserted between the double angles. The "T" is formed by splitting a wide flange ("W") in half. Strongback is an industry standard term for a "strong" member that is used to support a weaker member.

Construction Characteristics

Antennas/Equipment Additions

Project construction for the proposed tower improvements is anticipated to commence upon project approval, and the majority of these improvements would be installed intermittently over a six-month period. Most installations would be completed in two-week timeframes with three person crews, however, two antenna installations, which would occur at different times, would require four-person crews. Due to the potential for overlapping installations, a maximum of six construction workers could be at the site on any given construction day. Project construction equipment would include the use of hydraulic cranes, a forklift and skid winches. Physical attachment of each improvement to Sutro Tower would be in the same manner that antennas have been attached to the tower since it was constructed: trained installers physically climb to the particular installation point on the tower and hand install each attachment with hand tools and/or handheld air-powered wrenches. Total deliveries of materials for this project component are estimated at approximately 21 large truck (e.g., 5-axle semi-trailer) round-trips, and 20 to 30 smaller delivery (e.g. UPS, FedEx) truck round trips over the construction period.

Construction would comply with the San Francisco Noise Ordinance, which generally prohibits construction activities between 8 p.m. and 7 a.m. No night-time construction would occur.

Proposed Auxiliary Antenna Operational Limitations During Construction

During periods of construction of the proposed tower improvements when the tower's main antenna(s) would be temporarily out of service, one or more of the tower's auxiliary antennas for the corresponding radio or TV station(s) would be temporarily used. Additional detail on RFR from auxiliary antennas, including applicable regulations and project effects, are discussed in detail below, in the Radio Frequency Radiation section of this EIR Addendum.

Approvals Required

Communication facilities such as Sutro Tower are conditionally permitted in an RH-1(D) district as "Public Facilities and Utilities" under planning code section 209.6. Because the 2019 modified project does not include major remodeling of the tower, expansion of the transmitter building at the base of the tower, or a change in use, an amendment to the existing conditional use authorization would not be required for the 2019 modified project. However, pursuant to City Planning Commission Resolution No. 11399, adopted July 14, 1988, the planning commission will hold a public hearing to review the 2019 modified project under its Discretionary Review authority. The project would not increase the height or bulk of the tower; thus, the 2019 modified project would be consistent with the height and bulk controls, as it would not change the height or bulk of a legally noncomplying structure.

Every Sutro Tower building permit since 2000 has been subject to a series of "Standard Sutro Tower Conditions" imposed by the planning commission, which require mandatory structural inspections, monitoring of RFR, and communications with neighborhood organizations. The 2019 modified project would require building and maintenance permits from the building department for the proposed tower antenna additions and structural improvements. The project may also require building and electrical permits to allow the project sponsor's tenants to make improvements to their leased space located within the existing transmission building to accommodate the described antennas and accessory equipment or to alter, replace, or add accessory and ancillary equipment.

In addition, each broadcaster is responsible for obtaining individual Television Broadcast Station Construction Permits from the FCC. Each broadcaster has already been issued this permit at the time of preparation of this addendum. No other permits or approvals are required.

ANALYSIS OF POTENTIAL ENVIRONMENTAL EFFECTS

San Francisco Administrative Code section 31.19(c)(1) states that a modified project must be reevaluated and that "if, on the basis of such reevaluation, the Environmental Review Officer determines, based on the requirements of CEQA, that no additional environmental review is necessary, this determination and the reasons therefore shall be noted in writing in the case record, and no further evaluation shall be required by this Chapter."

CEQA Guidelines section 15164 provides for the use of an addendum to document the basis of a lead agency's decision not to require a subsequent or supplemental EIR for a project that is already adequately covered in an existing certified EIR. The lead agency's decision to use an addendum must be supported by substantial evidence that the conditions that would trigger the preparation of a subsequent EIR, as provided in CEQA Guidelines section 15162, are not present. These conditions include: substantial changes are proposed in the project, substantial changes in the circumstances under which the project is undertaken, or new information of substantial importance is identified. If it is determined that any of these conditions would result in new significant environmental effects or a substantial increase in the severity of previously identified significant effects, then a subsequent or supplemental EIR would need to be prepared.

The 2008 FEIR evaluated the potential impacts of construction and operation of the 2008 project and found that all impacts would be less than significant with implementation of a mitigation measure (2008 FEIR Mitigation Measure No. 1, Construction Air Quality). Since certification of the 2008 FEIR, no changes have occurred in the circumstances under which the 2019 modified project would be implemented that would change the severity of the project's physical impacts as explained herein, and no new information has emerged that would materially change the analyses or conclusions set forth in the 2008 FEIR.

As demonstrated below, the 2019 modified project would not result in any new significant environmental impacts, substantial increases in the significance of previously identified effects, or necessitate implementation of additional or considerably different mitigation measures than those identified in the 2008 FEIR. Furthermore, the single mitigation measure identified for the 2008 project (2008 FEIR Mitigation Measure No. 1, Construction Air Quality) has since been largely adopted as part of a City ordinance, commonly referred to as the Construction Dust Control Ordinance, which would apply to the 2019 modified project; consequently, as discussed below, no mitigation measures are required for the 2019 modified project. The effects associated with the 2019 modified project would be substantially the same as those reported for the 2008 project in the 2008 FEIR. The following discussion provides the basis for this conclusion.

Aesthetics

Summary of Aesthetic Effects Analyzed in Prior Environmental Analyses

The 2008 FEIR discussed existing views of the project site from surrounding public vantage points, described the visibility of the tower from these off-site locations and how existing vegetation in the site vicinity serves to partially screen views of on-site buildings. The 2008 FEIR then addressed potential aesthetic impacts of the 2008 project and determined that the project would not substantially degrade the existing visual character of the site and its surroundings. This determination was made on the basis that the proposed change in tower antennas or their reconfiguration would not be generally noticeable, except from relatively close inspection. The 2008 FEIR (in the project's initial study) also determined the project would have a less-than-significant aesthetic impact on scenic vistas and scenic resources, and would have no impact on light and glare.

As described above in the Project Description under the heading, "2014 Addendum," under the 2014 modified project, the project sponsor installed 50 new broadcast and reception antennas, microwave dish antennas and

camera mounts at various levels on the tower; one existing auxiliary radio antenna was replaced and relocated to a higher level on the tower, and one ground-level satellite dish antenna replaced an existing smaller antenna. In addition, a number of on-site eucalyptus trees were removed, and several new Coast Live oak trees were planted. The 2014 addendum determined that the 2014 modified project would not result in new or substantially more severe significant impacts related to aesthetics, including effects on visual character, scenic vistas, scenic resources, and light and glare, either individually or cumulatively.

Short-Term Aesthetic Effects During Construction of the 2019 Modified Project

The tower modifications would have the potential to result in short-term aesthetic effects during construction, expected to last approximately six months. Construction activities would include the daily arrival and departure of construction workers, truck deliveries of construction materials to, and hauling of debris from, the site, and various construction activities that would occur on-site. The proposed repacking project and voluntary structural upgrades components of the 2019 modified project would entail the temporary removal of the tower's cladding on all three legs at locations between levels four and six (beginning approximately 550 feet above grade) of the tower. Following the installation of strengthening components on the tower structure, the cladding panels would be reinstalled. The temporary cladding removal would affect about 11 percent of the tower's approximately 1,500 cladding panels; the panels are anticipated to be reinstalled in 2020. Although this work would require the temporary removal of the tower's character-defining cladding, the cladding would be stored on site and reinstalled within six months of the completion of the antenna replacement and structural work. Accordingly, these short-term aesthetic effects associated with the 2019 modified project would be substantially similar to the effects described in the 2008 FEIR, and would not result in new significant impacts or substantially more severe significant impacts than were identified in the 2008 FEIR or require new mitigation not previously discussed in the 2008 FEIR.

Long-Term Aesthetic Effects Associated With Antennas/Equipment Additions Proposed under the 2019 Modified Project

Similar to the tower improvements proposed under the 2008 project and the 2014 modified project, the additional antennas/equipment proposed under the 2019 modified project would not be highly noticeable. **Figure 3** presents an existing view and a visual simulation of the tower from the Twin Peaks overlook, looking west. As described in the Project Description, the 2019 modified project would result in the addition of eight new broadcast antennas, replacement of two existing broadcast antennas with new antennas, and removal of four antennas. The new antennas/equipment would be distributed across multiple levels on the tower (at elevations between 172 feet above ground and 953 feet above ground). Six new antennas (see Antenna Reference letters O, P, AA, X, Y, and Z on Figure 2) would be placed at the fifth level or above (642–953 feet above ground), and two other proposed new antennas would be placed at 526 and 398 feet above ground (see Antenna Reference letters AB and AC on Table 1 and Figure 2). In addition, 21 ancillary antennas would also be added. Dimensions for each antenna are shown in Tables 1 and 2 and on Figure 2.

As shown in Figure 3, the additional antennas and equipment proposed under the 2019 modified project would not result in a substantial visual change compared to existing conditions. While the additional antennas/equipment would be noticeable upon relatively close inspection when in proximity to the tower, from longer range views, these installations would not be noticeable, as these elements would blend in with the tower's main structural elements. As under the 2008 project and the 2014 modified project, all new antennas/equipment proposed under the 2019 modified project would be composed of non-reflective metal (unpainted) or be painted the same color as the existing tower structure and antennas to blend in with the existing facility.

D181102.00 - Sutro Tower\05 Graphics-GIS-Modeling\Illustrator

SOURCE: Simpson Gumpertz & Heger, 2017

Sutro Tower Spectrum Repacking Addendum

Figure 3
Photosimulation of View Looking West from Twin Peaks

Aesthetics Conclusion

The 2008 FEIR as amended by the 2014 addendum did not identify any significant effects related to aesthetics. The improvements proposed under the 2019 modified project would not result in new significant aesthetic impacts not identified in the 2008 FEIR as amended by the 2014 addendum and would not substantially increase the severity of any previously identified significant impact, nor would new mitigation measures be required. No new information has arisen, nor have there been any changes in circumstances, such that the 2019 modified project would result in new or substantially more severe significant impacts related to aesthetics, including effects on visual character, scenic vistas, scenic resources, and light and glare, either individually or cumulatively.

Geology, Soils and Seismicity

Summary of Geologic, Soil and Seismic Effects Analyzed in Prior Environmental Analyses

The 2008 FEIR described existing geologic, soil and seismic conditions at the project site. The 2008 FEIR reported that the project site is not within an Alquist-Priolo Earthquake Fault Zone, and that no known active fault exists on the project site or in the vicinity, and consequently, that the risk of ground rupture at the site is very low. In addition, the 2008 FEIR also reported that the project site is underlain by soil types that 1) are not expected to contribute greatly to shaking amplification in the event of an earthquake; 2) have a very low liquefaction hazard level; and 3) do not contain high expansive soil potential. The 2008 FEIR also reported that the relatively flat portion of the site that supports the Sutro Tower foundation is not within a seismic hazard zone; however, an area southwest and down slope of the tower is mapped as being within an area susceptible to seismically induced landslides.

The 2008 FEIR summarized a seismic and structural analysis completed by the project sponsor in 2008 in support of the project. Based on the analysis, structural upgrades proposed as part of the 2008 project, and since completed in 2011, included strengthening of one of three columns on each of the three tower legs above tower Level 3, upgrading bolted connections to welded connections on Level 6 of the Tower, and replacement of bolted connections with welded connections, along with the addition of "stiffener plates"[10] to existing triangular "gusset plates,"[11] on existing diagonal braces within the tower legs, at various locations between grade and tower Level 2, between Levels 2 and 3, and between Levels 5 and 6.

The 2008 FEIR reported that these structural upgrades would enable Sutro Tower to meet all applicable building code wind and seismic criteria for an essential facility and accommodate the additional antenna improvements, and concluded that the proposed project would result in a less-than-significant impact to seismic groundshaking, including catastrophic failure.

The 2008 FEIR also reported that because the tower is anchored to its foundation, and the increase in total tower weight from the then-existing mass would be relatively small, the 2008 project would not be expected to alter the current slope stability. The 2008 FEIR concluded that since the tower is not on a geologic unit that is unstable, or would become unstable as a result of the project, that the project would not result in landslides, lateral spreading, subsidence or collapse. Consequently, the 2008 FEIR found that all project impacts to geology, soils and seismicity from the proposed tower improvements would be less than significant.

[10] "Stiffener plates" are metal plates attached to a beam used to increase the beam's stiffness and thereby its resistance to buckling.

[11] "Gusset plates" are steel plates, typically rectangular or triangular in shape, that are welded to a beam fastened to other members to make a truss.

The 2014 addendum determined that with the additional antennas and equipment proposed as part of the 2014 modified project, the tower would continue to meet all applicable building code wind and seismic criteria for an essential facility, and that no additional structural upgrades would be required for Sutro Tower beyond those already completed as part of the 2008 project.[12] The 2014 addendum also analyzed the effects of a number of ground improvements on the project site, including for erosion and drainage control, to repair and/or improve vehicular and pedestrian access, and to install an at-grade satellite dish antenna and foundation. Overall, the 2014 addendum determined that the 2014 modified project would not result in new or substantially more severe significant impacts related to geology, soils and seismicity, including from earthquakes and seismic related hazards, an unstable geologic unit or soils, and soil erosion, either individually or cumulatively.

Geologic, Soil and Seismic Impacts of the Tower Improvements Proposed under the 2019 Modified Project

In 2019, a wind and seismic analysis was prepared for the proposed spectrum repacking project at Sutro Tower to determine whether the building code would require a mandatory retrofit of the tower.[13] The wind and seismic analysis determined that, with implementation of the 2019 modified project, wind and seismic loads would increase by 1.2 percent and 0.5 percent, respectively. The building code as applied to essential facilities requires structural upgrade only if a modification increases the forces on a structural element, or the structure as a whole, by more than ten percent for wind or seismic load cases, or by more than five percent for gravity (self-weight) load cases. Therefore, because the increase in wind and seismic loads would be well below building code thresholds, the building department determined that no structural upgrade would be required.[14]

The proposed tower improvements would be subject to review and approval by the building department to ensure all building code provisions are met. Consequently, consistent with the conclusions reached in the 2008 FEIR as amended by the 2014 addendum, the tower improvements proposed under the 2019 modified project would result in a less-than-significant impact from seismic groundshaking, including catastrophic failure, and no new significant impacts would result from the 2019 modified project, compared to those analyzed in the 2008 FEIR as amended by the 2014 addendum. Similarly, the proposed tower improvements would not affect any conclusions previously reached in the 2008 FEIR regarding landslides, lateral spreading, subsidence or collapse.

Geology, Soils and Seismicity Conclusion

The 2008 FEIR did not identify any significant effects related to geology, soils and seismicity. The improvements proposed under the 2019 modified project would not result in new significant geology, soils, or seismicity impacts not identified in the 2008 FEIR as amended by the 2014 addendum and would not substantially increase the severity of any previously identified significant impact, nor would new mitigation measures be required. No new information has arisen, nor have there been any changes in circumstances, such that the 2019 modified project would result in new or substantially more severe significant impacts related to geology, soils and seismicity, including from earthquakes and seismic-related hazards, an unstable geologic unit or soils, and soil erosion, either individually or cumulatively.

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[12] Simpson, Gumpertz & Heger, *Addition of Broadcast Equipment to Sutro Tower, Structural Seismic Analysis Report*, April 10, 2013.
[13] Simpson, Gumpertz & Heger, *Evaluation of Code Upgrade Triggers Stack B Repacking Project*, Inc., April 15, 2019.
[14] Yau, Willy, Plan Review Services Division, San Francisco Department of Building Inspection, e-mail correspondence with Kei Zushi, Senior Environmental Planner, San Francisco Planning Department, June 13, 2019.

Radio Frequency Radiation (RFR)[15]

Summary of RFR Effects in Prior Environmental Analyses

The Federal Communications Commission (FCC) has adopted maximum permissible exposure limits for radio frequency radiation (RFR) that vary by frequency of the RFR emitted, and has established separate maximum permissible exposure limits for worker exposure and public exposure.[16] The FEIR indicated that there are two forms of electromagnetic waves: ionizing and non-ionizing. The shortest wavelengths, or highest frequencies, are ionizing electromagnetic radiation: ionizing radiation (such as X-rays) has higher energy than non-ionizing radiation.[17] However, Sutro Tower only emits radio frequency waves in the form of non-ionizing electromagnetic waves, and consequently, there is no ionizing radiation present at Sutro Tower.[18] High exposures to radiation are necessary to cause biological damage.[19,20] The FEIR reported that during normal main antenna operation, the total maximum existing ambient RFR exposure level at ground level for any publicly accessible location around Sutro Tower was 8.5 percent of the public maximum permissible exposure limit, well within the FCC's maximum permissible exposure limit for public locations.[21]

The FEIR evaluated three project scenarios (construction phase using main and auxiliary antennas, normal operation using the main antennas, and an unlikely theoretical scenario of use of all auxiliary antennas operating simultaneously). The FEIR reported that during construction of the 2008 project, there would be periods when the RFR ground level exposure level would be temporarily higher than under existing conditions (i.e., up to 15.3 percent of the maximum permissible exposure limit) for any publicly accessible location around Sutro Tower, which is well within the FCC standard. The FEIR also reported that during normal operation, the 2008 project would reduce the RFR exposure level of the digital TV and FM station main antennas from existing conditions (i.e., a reduction from 8.5 to 8.4 percent of the maximum permissible exposure limit between the pre-2008 project and the post-2008 project conditions) for any publicly accessible location around the tower.[22] For the theoretical scenario that assumed simultaneous use of all auxiliary antennas, the FEIR explained that, as under existing conditions, continued compliance by Sutro Tower, Inc. and all tenant stations with the "Table of Contributions" procedures would ensure that

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15 Although radio frequency radiation is not explicitly identified in the Appendix G as a topic that requires analysis, the Appendix G topics are only suggested ones. (See CEQA Guidelines section 15063(f)). In addition, the 2008 FEIR included analysis of RFR effects, as did the 2014 addendum.

16 Additional information on maximum permissible exposure limit limits is presented in *Sutro Tower Inc., San Francisco, California, Statement of Hammett & Edison Consulting Engineers*, *FCC Radio Frequency Protection Guide Exhibit*, Hammett & Edison, Inc., December 28, 2018.

17 The energy level of these ionizing radiation waves is enough to expel an electron (or ionize it) from a molecule, which can alter the function of biological molecules and cause irreversible and cumulative biological damage.

18 As noted in the FEIR, RFR is distinguishable from another type of non-ionizing radiation commonly referred to as extremely low frequency radiation, that is commonly used in the transmission of electric power from generating stations to substations, and to consumers of electricity. Sutro Tower television and radio antennas do not emit these extremely low frequencies.

19 Ionizing radiation, such as X-rays, has higher energy content than non-ionizing radiation such as radio waves.

20 As noted in the FEIR, RFR is distinguishable from another type of non-ionizing radiation commonly referred to as extremely low frequency radiation, that is commonly used in the transmission of electric power from generating stations to substations, and to consumers of electricity. Sutro Tower television and radio antennas do not emit these extremely low frequencies.

21 This assumed simultaneous operation of all antennas on the tower, including smaller scale antennas and accessory equipment located at the Sutro Tower site, and consequently, existing RFR exposure levels were reported to be conservatively estimated.

22 An incremental reduction in the estimated existing 2008 RFR exposure level as a result of the 2008 project was due to a reconfiguration of television antennas.

the cumulative operation of auxiliary antennas during construction and operation at the site under the 2008 project would stay within the RFR public maximum permissible exposure limit.[23]

The FEIR also determined that since RFR levels decline rapidly with increased distance, the 2008 project RFR levels at the nearest school (Clarendon Elementary School, located one-eighth mile from the tower) would be even lower than the allowable values reported for locations much closer to Sutro Tower (please see also discussion of RFR made in normal operations in 2018 which shows the RFR levels are considerably lower near the school than much closer to the tower). The FEIR concluded the 2008 project would have a less-than-significant impact to occupants of nearby schools with regard to RFR emissions.

In addition, the FEIR also reported that Sutro Tower is subject to a mandatory RFR measurement program (as part of the Standard Antenna Conditions originally adopted in 2000). The mandatory RFR measurement program currently requires the project sponsor to measure RFR public exposure levels at a minimum of 200 publicly accessible sites within 1,000 feet of the tower every three years, within two weeks of the activation of any digital to television (DTV) broadcasting antenna, or within two weeks of any increase in power from any DTV antenna's initial power level, whichever is earliest.[24] The project sponsor is required to submit those measurements to the Department of Public Health (health department), the planning department, and designated liaisons for local neighborhood associations (the results are also posted on the project sponsor's website). Such measurements provide analytical data to ensure that RFR exposure from tower operations is protective of human health at the project site and vicinity during construction and operation. In measurements made in 2018 of RFR levels from all sources, but during normal operations at Sutro Tower, the greatest RFR level recorded was 6 percent of the FCC's maximum permissible exposure limit for publicly accessible locations. This measurement was taken at a location along the southern edge of Summit Reservoir. The highest level measured near the more distant Clarendon Elementary School was 2.3 percent of the maximum permissible exposure limit for publicly accessible locations.[25,26]

The 2014 addendum evaluated the same three scenarios as the 2008 FEIR: 1) a construction phase using main and auxiliary antennas, 2) normal operation using the main antennas, and 3) an unlikely theoretical scenario of use of all auxiliary antennas simultaneously. The 2014 addendum reported similar findings as those of the FEIR. During construction of the 2014 modified project, the project sponsor would limit the power of certain of the tower's auxiliary antennas such that the total ground-level RFR exposure, as estimated, would be less than or equal to 15 percent of the maximum permissible exposure limit for any publicly accessible location, and less than 10 percent of the public maximum permissible exposure limit at the nearest residence. During normal operation, the 2014 modified project would result in an estimated RFR exposure level of 6.2 percent of the maximum permissible exposure limit for any publicly accessible

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[23] Ground level RFR for operation of auxiliary antennas is higher than for the main antennas, due to their lower height installation and the broad elevation plane patterns in which they emit. The "Table of Contributions" is a set of engineering formulae and procedures developed by Sutro Tower, Inc. that identifies the maximum power limit for each auxiliary antenna, describes each radio frequency contribution to cumulative conditions at different power levels, and indicates how each station must reduce auxiliary antenna or auxiliary power levels as needed to ensure the cumulative operation of these antennas do not exceed FCC public maximum permissible exposure limit.

[24] The FEIR referenced the version of the RFR measurement program that was in effect at the time the FEIR was certified. Revisions agreed to shortly thereafter require that the noted RFR measurements be conducted within two weeks (rather than within six months) after activation of a DTV broadcasting antenna or an increase in power from any DTV antenna's initial power level. The last two rounds of measurements, in 2015 and 2018, have included 208 locations, plus an additional four locations on Twin Peaks.

[25] Hammett & Edison, Inc., *Sutro Tower Inc., San Francisco, California, Statement of Hammett & Edison Consulting Engineers*, August 23, 2018.

[26] Other nearby schools, including the Corbett (Mayeda) and Burnett campuses of Rooftop School, Grattan Elementary School, and Ruth Asawa San Francisco School of the Arts high school, are considerably farther from Sutro Tower than is Clarendon school.

location. For the theoretical scenario that assumed simultaneous use of all auxiliary antennas, the 2014 addendum, like the FEIR, explained that, as under existing conditions, continued compliance by Sutro Tower, Inc. and all tenant stations with the "Table of Contributions" procedures would ensure that the cumulative operation of auxiliary antennas during construction and operation at the site under the 2008 project would stay within the RFR public maximum permissible exposure limit.

RFR Impacts of the 2019 Modified Project

The project sponsor's consultant, Hammett and Edison, Inc., conducted a supplemental analysis to determine RFR exposure of the 2019 modified project.[27] As was the case for the analysis of both the 2008 project and the 2014 modified project, the analysis of the 2019 modified project estimates RFR exposure levels, and as explained below likely overstates results. Similar to the FEIR, this EIR Addendum evaluates 1) the construction phase, using main and auxiliary antennas, 2) normal operation using the main antennas, and 3) the use of all auxiliary antennas simultaneously.

RFR Impacts During Construction Phase

Similar to the 2014 modified project, during the approximately six-month construction phase of the tower improvements for the 2019 modified project, the project sponsor would limit the operation of the tower's auxiliary antennas such that the total ground-level RFR exposure, as estimated, would be less than or equal to those levels shown in the 2015 Auxiliary Measurement Report[28] for any publicly accessible location, which do not exceed 34 percent of the public maximum permissible exposure limit, with RFR exposure at the nearest residence likely lower.[29] As such, the 2019 modified project would generate RFR at less than the RFR maximum permissible exposure limit for public locations. Furthermore, as with the 2008 project and the 2014 modified project, under the 2019 modified project, to protect worker health and safety, construction-period measures are in place to restrict access to on-tower areas that would exceed the occupational exposure limit, and to ensure that if access to the tower above ground level is required, steps are taken, if necessary, to switch broadcasting to an applicable main or auxiliary antenna and/or to reduce power to appropriate levels in antennas located in proximity to planned work.[30] These measures would ensure worker safety during the construction period for the 2019 modified project and maintain RFR levels in publicly accessible areas well below the maximum permissible public exposure limit.

RFR Impacts During Normal Operation

During normal operation, the 2019 modified project would result in an estimated RFR exposure level of 14 percent of the public maximum permissible exposure limit for any publicly accessible location. It should be noted that this exposure level is greater than what was estimated in both the 2008 FEIR and the 2014 addendum because the project sponsor's consultant has adopted a more conservative approach to calculating estimated RFR than was used previously. The reason for this change in methodology is that physical measurements of RFR exposure at ground level taken since 2008 have revealed that, while actual RFR

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[27] Hammett & Edison, Inc., *Sutro Tower Inc., San Francisco, California, Statement of Hammett & Edison Consulting Engineers*, December 28, 2018; and Rajat Mathur, P.E., Hammett & Edison Consulting Engineers, letter to Eric Dausman, Sutro Tower, Inc., March 8, 2019.

[28] Hammett & Edison, Inc., *Sutro Tower Inc., San Francisco, California, Statement of Hammett & Edison Consulting Engineers*, October 6, 2015.

[29] To accomplish this, the power level of the auxiliary antennas would be restricted to certain designated power levels. These levels were established by Hammett & Edison in 2007 for each television broadcaster on the tower. The individual power limitations applicable to each auxiliary broadcast antenna during the tower improvements construction phase would be directly monitored by the project sponsor to ensure compliance pursuant to terms and conditions in the license agreement entered into with each television broadcaster.

[30] Guidelines for ensuring that on-tower worker exposure remains within applicable FCC exposure standards are contained in *Sutro Tower, Inc. San Francisco, California, Statement of Hammett & Edison Consulting Engineers,* January 11, 2011.

exposure levels are less than the calculated levels, the actual levels are less than the calculated levels by a smaller margin than is typically observed. The project sponsor's consultant indicates that the less-than-expected difference between calculated and actual RFR exposures may result from radiofrequency signals being reflected by the stacks (uppermost vertical spires) of the tower itself.[31] The project sponsor's consultant notes that, while the more conservative calculation approach results in a greater calculated RFR exposure than was the case for the 2008 and 2014 projects, no physical change in the tower spires would result from the 2019 modified project and therefore, "actual RF exposure levels will be similar to those previously measured [in 2018]," or 6-7 percent of the public maximum permissible exposure limit.[32]

RFR Impacts During the Simultaneous Use Scenario

In contrast to the 2008 project and the 2014 modified project, the 2019 modified project would require periods of the simultaneous use of all auxiliary antennas to allow for the removal and replacement of main broadcast antennas on the three stacks of Sutro Tower while local broadcasting continues during construction. However, as documented in the 2015 Auxiliary Measurement Report, such simultaneous use produces a maximum measured RFR level of 34 percent of the public maximum permissible exposure limit at a single publicly accessible location at Summit Resevoir on the SFPUC's property, based on measurements conducted at and around Sutro Tower. The RFF levels at sites other than at Summit Resevoir during simultaneous operation of the auxiliary antennas range from 0.08 percent to 8.5 percent of the RFR public maximum permissible exposure limit. All RFR measurements in any residential neighborhool were less than 10 percent percent of the maximum permissible exposure limit for publicly accessible locations. Continued compliance by Sutro Tower, Inc. and all tenant stations with the "Table of Contributions" procedures under the 2019 modified project would ensure that the cumulative operation of auxiliary antennas during operation at the site would remain within the public maximum permissible exposure limit.

As was the case with the 2008 and 2014 projects, because RFR levels decline rapidly with increased distance, the 2019 modified project RFR levels at Clarendon Elementary School, the nearest school from the project site, would be even lower than the allowable values estimated for locations much closer to Sutro Tower. In the 2015 measurements of Sutro Tower RFR emissions during auxiliary antenna operations, the highest level measured near Clarendon Elementary School was 1.8 percent of the maximum permissible exposure limit for publicly accessible locations.[33] Accordingly, the 2019 modified project would have a less-than-significant impact to nearby schools with regard to RFR emissions.

As under the 2008 project and the 2014 modified project, under the 2019 modified project, Sutro Tower would also continue to be subject to the mandatory RFR measurement program (as part of the Standard Antenna Conditions originally adopted in 2000) that currently requires the project sponsor to measure RFR public exposure levels at a minimum of 200 publicly accessible sites within 1,000 feet of the tower every three years or within two weeks after the activation of any DTV broadcasting antenna or an increase in power from any DTV antenna. These measurements are then submitted to the health department and to the planning department and provide analytical data to ensure that RFR exposure from tower operations is protective of human health at the project site and vicinity during construction and operation.

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31 Rajat Mathur, P.E., Hammett & Edison Consulting Engineers, letter to Eric Dausman, Sutro Tower, Inc., March 8, 2019.
32 *Ibid.*
33 Hammett & Edison, Inc., *Sutro Tower Inc., San Francisco, California, Statement of Hammett & Edison Consulting Engineers*, October 6, 2015.

RFR Conclusion

The FEIR did not identify any significant effects related to RFR. The antennas and equipment additions proposed under the 2019 modified project, when considered in conjunction with existing frequency emitting sources at Sutro Tower, would result in RFR levels that would be well within the FCC maximum permissible exposure levels. Consequently, the 2019 modified project would not result in new significant impacts related to RFR emissions not identified in the FEIR or 2014 addendum and would not substantially increase the severity of any previously identified significant impact, nor would new mitigation measures be required. No new information has arisen, nor have there been any changes in circumstances, such that the 2019 modified project would result in new or substantially more severe significant impacts related to RFR emissions, either individually or cumulatively.

Risk of Fire

Summary of Risk of Fire Effects Analyzed in Prior Environmental Analyses

The FEIR described the presence of forested areas within the project site and adjacent areas, and summarized existing fire protection services and emergency water availability in the project vicinity. The 2008 FEIR also discussed existing vegetation management measures that the project sponsor implements on an on-going basis to minimize fire risk on the project site. The 2008 FEIR analyzed potential project construction-phase impacts associated with the risk of fire (e.g., from welding), and concluded that with the adherence to Sutro Tower's safety plan during construction, and continued implementation of the project sponsor's ongoing vegetation management practices at the site, the project impacts to public safety from risk of fire would be less than significant. The safety plan measures include, but are not limited to, having trained crewmembers assigned to continuously monitor the surrounding area for fire; ensuring that the fire monitor maintains two-way radio contact with work crews in the construction work areas to notify them of any fire danger; use of welding blankets to contain sparks and slag; and provision of fire extinguishers.

For the purposes of the 2014 addendum, and as a follow-up to previous site inspections conducted by the San Francisco Fire Department (fire department) in 2008, the fire department staff inspected the project site on January 14, 2014, to assess the relative fire risk to the tower from existing on-site vegetation. The fire department's inspection indicated that the majority of trees surrounding the tower were set back more than 30 feet from the tower (with the exception of a few tree branches), and that shrubs and weeds had been largely cleared by the project sponsor from around these trees. The 2014 addendum concluded the construction-related risk of fire effects from the 2014 modified project would be similar to those effects previously discussed for the 2008 project in the 2008 FEIR because the 2014 modified project would adhere to Sutro Tower's safety plan during construction, and that the 2014 modified project would not result in new significant impacts to public safety from risk of fire during construction and operation and would not substantially increase the severity of any previously identified significant impact, nor would new mitigation measures be required.

Fire Risk Impacts of the 2019 Modified Project

While no specific inspection of landscaping on the project site has been conducted by the fire department since 2014, STI continues to implement the fire department's suggestions for vegetation removal and continues to comply with the fire department's long-term recommendations for vegetation management as set forth in the 2014 correspondence, including STI's own inspection of the property on a daily basis to monitor fire safety. In addition, fire department inspectors are on-site annually to inspect high-risk areas at Sutro Tower and all interior remodel plans are reviewed, approved, and inspected by the fire department after construction to confirm that all regulations regarding fire safety are adhered to. All site landscaping is

readily viewable by inspectors who are on site annually. STI no longer maintains a full 30-foot clearance around the north leg of the tower due to the desire for low growing landscaping, which was approved by the planning commission in 2014 in connection with the 2014 erosion control permit. The fire department also noted that certain existing tower features provide exposure protection from fire (e.g., at locations below the treeline), including architectural cladding that encloses the tower's legs and trusses below the 5th level.[34] Given the temporary cladding removal would only occur between levels four and six of the tower – well above the tree line – this temporary activity would not increase potential for exposure of the tower from fire.

Under the 2019 modified project, the risk of fire effects related to the installation of additional tower antennas and equipment improvements during construction would be similar to those effects previously discussed for the 2008 and 2014 projects in the 2008 FEIR and 2014 addendum. The construction contractor would be required to adhere to Sutro Tower's safety plan during construction.

Site access improvements made as part of the 2014 modified project, including widening and paving of STI's privately-owned driveway at the end of La Avanzada Street (located on the project site), and new exterior on-site walkways and stairways along the southern hillside, improved overall access for emergency response personnel to and within the site. Furthermore, the sponsor has confirmed that STI would continue to implement existing vegetation management measures on an on-going basis to minimize fire risk on the project site, consistent with the recommendations of the fire department.[35] Consistent with these recommendations, STI maintains access trails to ensure that the fire department has emergency access. STI also implements other fire safety practices, including removing dead wood from trees; periodically thinning or cutting trees back within the fence line; and inspecting access trails and trees within the fence line on a daily basis to monitor ongoing fire safety and on-site security.[36]

Risk of Fire Conclusion

The 2008 FEIR and 2014 addendum did not identify any significant effects related to risk of fire. With adherence to Sutro Tower's safety plan during construction, and continued implementation of the sponsor's on-going vegetation management practices at the site, the 2019 modified project would not result in new significant impacts to public safety from risk of fire during construction and operation and would not substantially increase the severity of any previously identified significant impact, nor would new mitigation measures be required. No new information has arisen, nor have there been any changes in circumstances, such that the 2019 modified project would result in new or substantially more severe significant impacts related to risk of fire, either individually or cumulatively.

Biological Resources

Summary of Biological Resource Impacts Analyzed in Prior Environmental Analyses

The 2008 FEIR reported (in the initial study) that due to the project site's developed nature and location, the 2008 project would have no effect on any riparian habitat or sensitive community, federally protected wetlands or adopted conservation plan. The 2008 FEIR also reported that, since the tower improvements proposed under the 2008 project were limited to a previously disturbed area within the site property and would not involve any ground disturbance, the 2008 project would not affect any rare plant or animal habitats, or any rare, threatened or endangered species. The 2008 FEIR also determined that given the minor

[34] San Francisco Fire Department, letter to Cooper, White & Cooper LLP, January 16, 2014.

[35] Dausman, Eric, General Manager, Sutro Tower Inc., memorandum to Kristen Thall Peters, Cooper, White & Cooper LLP, April 23, 2019.

[36] San Francisco Fire Department, letter to Cooper, White & Cooper LLP, January 16, 2014.

changes the 2008 project would make to the tower, it would not increase the potential for avian bird impacts with respect to the tower. Accordingly, the 2008 FEIR concluded that the 2008 project would not result in any significant impacts to biological resources.

In support of the 2014 modified project and EIR addendum, biological resources within the project site were verified by an Environmental Science Associates (ESA) biologist through field reconnaissance conducted on October 2, 2013. The primary purpose of this reconnaissance visit was to record visual observations within the project site boundary and of the adjacent environments in the areas of the proposed erosion control zone. The field survey focused on identifying vegetation communities and habitat within the project site that could support special-status plant and wildlife species.

The area of the erosion control zone approved as part of the 2014 modified project on the southern hillside contains several blue gum eucalyptus (*Eucalyptus globulus*) trees. Ground cover in this area includes substantial eucalyptus leaf litter on slopes beneath the tree canopy, and grass and weedy species covering the open flat area at the top of the slope including, but not limited to, wild oats (*Avena barbata*), soft chess (*Bromus hordeaceus*), Italian ryegrass (*Festuca perennis*), bristly ox-tongue (*Helminthotheca echioides*), cheeseweed (*Malva parviflora*), buckhorn plantain (*Plantago coronopus*) and nightshade (S*olanum* sp.).

The area of the ground-level improvements approved as part of the 2014 modified project on La Avanzada Street contains several blue gum eucalyptus trees, and minimal road shoulder vegetation consisting of English ivy (*Hedra helix*), Himalayan blackberry (*Rubus armeniacus*), German ivy (*Delairea odorata*), nasturtium (*Tropaeloum majus*), native poison oak (*Toxicodendron diversilobum*) and sword fern (*Polystichum* sp.).

The 2014 addendum determined no special-status plant or wildlife species have a moderate or high potential to occur within the project site (i.e., there is a low potential for all relevant species to be present) due to the historically disturbed nature of the property and absence of suitable vegetation communities for special status plants or suitable habitat for special status wildlife species. Consequently, the 2014 modified project's effects on special-status plant and wildlife species were determined to be less than significant. With respect to nesting birds, the 2014 addendum determined that impacts to nesting birds would be less than significant through compliance with various best management practices regarding tree removal during the non-breeding season, preconstruction surveys to locate active nests, and avoidance of nests based on an exclusion zone. Overall, the 2014 addendum determined that the 2014 modified project would not result in a new significant impact to biological resources and would not substantially increase the severity of any previously identified significant impact, nor would new mitigation measures be required.

Biological Resource Impacts of the 2019 Modified Project

2019 Modified Project Effect on Riparian Habitat, Sensitive Communities, Jurisdictional Wetlands, and Conflicts with Tree Preservation Policies or Adopted Conservation Plan

The project setting remains in a developed urban area that is not located within or adjacent to any riparian habitat or federally protected wetlands, included in a sensitive natural community, or subject to an adopted conservation plan. Therefore, as was previously determined in the 2008 FEIR for the 2008 project, the 2019 modified project would have no impact on any riparian habitat or sensitive community, federally protected wetlands or adopted conservation plan. In addition, no trees would be removed. Therefore, the 2019 modified project would not conflict with any tree preservation policy or ordinance.[37] The improvements

[37] Article 16 of the Public Works Code protects San Francisco's street trees, significant trees, and landmark trees regardless of species. The ordinance protects the following three categories of trees, which are defined as follows: A *street tree* is "any tree growing within the public right-of-way, including unimproved public streets and sidewalks, and any tree growing

proposed under the 2019 modified project would not result in a new significant impact to riparian habitat, sensitive communities, jurisdictional wetlands, nor would it conflict with adopted plans or policies related to biological resources.

2019 Modified Project Effect on Special Status Species

Similar to the 2008 project, the 2019 modified project area would be limited to a previously disturbed area within the site property and would not involve any ground disturbance.

As stated in the 2014 addendum, no special-status plant or wildlife species have a moderate or high potential to occur within the project site (i.e., there is a low potential for all relevant species to be present) due to the historically disturbed nature of the property and absence of suitable vegetation communities for special status plants or suitable habitat for special status wildlife species. Because the 2019 modified project would be located on previously disturbed land, project effects on special-status plant and wildlife species would be less than significant.

Potential Effects on Nesting Birds During 2019 Modified Project Construction

No trees would be removed as part of the 2019 modified project. Therefore, there would be no loss of active nests or bird mortality, and thus no significant effects on nesting birds would ensue.

Potential Avian Hazards with Tower Operation under 2019 Modified Project

As indicated in the 2008 FEIR, Sutro Tower's existing design minimizes adverse effects to migratory birds by using the minimum amount of warning and obstruction lighting required by the Federal Aviation Administration (FAA). In addition, the 2008 FEIR acknowledged that as a self-supporting structure, the tower's few guy wires are located within the tower structure itself, and consequently, not positioned in a manner that would likely lead to avian impacts.[38] The 2019 modified project would not affect the tower's existing guy wires nor would it add additional guy wires. The 2008 FEIR also reported that Sutro Tower's design complies with the United States Fish and Wildlife Service (USFWS) guidelines developed to help protect migratory birds from communications towers.[39]

Similar to the 2008 and 2014 projects, the proposed antennas and equipment additions on Sutro Tower under the 2019 modified project are generally small in scale compared to the existing tower structure, and these improvements would not alter the height or bulk of the tower. Furthermore, similar to the 2008 and 2014 projects, the tower improvements proposed under the 2019 modified project would not involve any additional lighting or change in existing lighting on the tower. When considering that Sutro Tower has not posed a substantial threat to local avian migration in the past, and furthermore, that the 2014 modified project was found to pose no additional threat, the 2019 modified project's effects on migratory birds both individually and cumulatively would not be substantially greater than reported in the 2008 FEIR or 2014 addendum, and no new significant effect would result from the 2019 modified project.

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on land under the jurisdiction of the Department [of Public Works]" as defined in section 802 of the ordinance. A *significant tree* is defined in section 810A as any tree: (1) located on property under the jurisdiction of the Department or on privately owned property with any portion of its trunk within 10 feet of the public right-of-way, and (2) that satisfies at least one of the following criteria: (a) a diameter at breast height in excess of 12 inches, (b) a height in excess of 20 feet, or (c) a canopy in excess of 15 feet. A *landmark tree* is any tree that: (1) has been nominated as such by a member of the public, a landowner, the San Francisco Planning Commission, the Board of Supervisors, or the Historic Preservation Commission, (2) the Urban Forestry Council (within the San Francisco Department of the Environment) has subsequently recommended as a landmark tree, and (3) is designated a landmark tree by ordinance approved by the Board of Supervisors.

[38] A guy wire is a tensioned cable designed to add stability to a free-standing structure.

[39] USFWS, *Service Guidance on the Siting, Construction, Operation and Decommissioning of Communication Towers*, undated.

Biological Resources Conclusion

Neither the 2008 FEIR nor the 2014 addendum identified any significant effects related to biological resources. The improvements proposed under the 2019 modified project would not result in a new significant impact to biological resources and would not substantially increase the severity of any previously identified significant impact, nor would new mitigation measures be required. No new information has arisen, nor have there been any changes in circumstances, such that the 2019 modified project would result in new or substantially more severe significant impacts related to biological resources, including special status species, riparian habitat and sensitive communities, jurisdictional wetlands, wildlife corridors, or conflict with policies or ordinances protecting biological resources, either individually or cumulatively.

Air Quality

Summary of Air Quality Effects Analyzed in Prior Environmental Analyses

The 2008 FEIR (in the initial study) analyzed the potential for air quality impacts of the 2008 project and determined that only construction-related impacts would occur and that these impacts would be less than significant with implementation of a mitigation measure identified in the 2008 FEIR that would implement Bay Area Air Quality Management District (BAAQMD) fugitive dust control measures.

The 2014 addendum determined that with implementation of the City's Construction Dust Control Ordinance, 2008 FEIR Mitigation Measure No. 1 would no longer be required. The 2014 addendum concluded that the 2014 modified project would not result in new significant air quality impacts and would not substantially increase the severity of any previously identified significant impact, nor would new mitigation measures be required.

Construction Air Quality Impacts of the 2019 Modified Project

Construction activities (short-term) typically result in emissions of ozone precursors and particulate matter in the form of dust (fugitive dust) and exhaust (e.g., vehicle tailpipe emissions). Emissions of ozone precursors and particulate matter are primarily a result of the combustion of fuel from on-road and off-road vehicles. However, reactive organic gases (ROG) are also emitted from activities that involve painting, other types of architectural coatings, or asphalt paving. Construction activities related to the 2019 modified project would have the potential to result in fugitive dust and emissions of ozone precursors and particulate matter, as discussed below.

Fugitive Dust

Unlike the 2014 modified project, the 2019 modified project would not result in excavation, grading, or other construction activities that may cause wind-blown dust that could contribute particulate matter into the local atmosphere. Therefore, for the 2019 modified project, there would be no potential for substantive generation of fugitive dust and neither the San Francisco Construction Dust Control Ordinance or Mitigation Measure No. 1 (Construction Air Quality) from the 2008 FEIR would apply.

Criteria Air Pollutants

As discussed above, construction activities would result in emissions of criteria air pollutants from the use of off-and on-road vehicles and equipment. Construction-related emissions were calculated using the California Emissions Estimator Model (CalEEMod version 2016.3.2). Based on the equipment list provided

by the project sponsor[40] and the number of days of construction, construction-related average daily emissions of the 2019 modified project would be 0.22 pounds per day of ROG, 2.05 pounds per day of nitrogen oxides (NO_x), 0.07 pounds per day of fine particulate matter ($PM_{2.5}$) and 0.08 pounds per day of PM_{10}. All of these would be well below the BAAQMD thresholds of significance for construction-related emissions, which are 54 pounds per day of ROG, oxides of nitrogen (NOx) or fine particulate matter ($PM_{2.5}$) and 80 pounds per day of particulate matter (PM_{10}). Consequently, construction-related emissions of criteria air pollutants would be less than significant. Therefore, the 2019 modified project would not result in any new significant effects not identified in the 2008 FEIR.

Health Risks

Short-term construction activities such as those proposed by the 2019 modified project do not lend themselves to analysis of long-term health risks because of their temporary and variable nature. The 2019 modified project would involve relatively minimal use of heavy diesel requirement for a relatively short time frame. Specifically, construction equipment required for the tower improvements would involve one crane for two days to off-load the antennas, a forklift and two skid winches. Therefore, diesel emissions would not expose sensitive receptors to substantial health risks from construction emissions.

Although on-road heavy-duty diesel vehicles and off-road equipment would be used during the six-month construction duration, emissions would be temporary and limited and would not be expected to expose sensitive receptors to substantial air pollutants. Therefore, construction period toxic air contaminants (TAC) emissions would not result a new significant impact not identified in the 2008 FEIR.

Operational Impacts of the 2019 Modified Project

Similar to the 2008 and 2014 projects, the tower improvements would not generate air emissions as a result of project operations and the 2019 modified project would not generate appreciable new vehicle trips in the long-term. Likewise, there would be no air quality impacts with regard to the tower improvements being a source or a receptor of odor or TAC emissions.

Air Quality Conclusion

Neither the 2008 FEIR nor the 2014 addendum identified any significant effects related to air quality. The improvements proposed under the 2019 modified project would not result in new significant air quality impacts and would not substantially increase the severity of any previously identified significant impact, nor would new mitigation measures be required. With implementation of the City's Construction Dust Control Ordinance, 2008 FEIR Mitigation Measure No. 1 is no longer required. No new information has arisen, nor have there have been any changes in circumstances, such that the 2019 modified project would result in new or substantially more severe significant impacts related to air quality from either construction or operation, either individually or cumulatively.

Noise and Vibration

Summary of Noise and Vibration Effects Analyzed in Prior Environmental Analyses

The 2008 FEIR (in the initial study) analyzed the potential for noise from the 2008 project to result in exposure of persons to noise levels in excess of standards under the General Plan or San Francisco Noise Ordinance (Article 29 of the San Francisco Police Code); substantial temporary increases in noise levels; and exposure to excessive vibration largely in the context of construction-related noise. These impacts were identified as less

[40] Peters, Kristen, Cooper, White and Cooper, LLP, e-mail correspondence to ESA, April 23, 2019.

than significant in the 2008 FEIR because no unusual construction methods were proposed, standard construction equipment would be required to comply with Noise Ordinance standards, and the majority of the proposed construction would be performed over 200 feet from the nearest residences.

The 2008 FEIR analysis also determined that there would be no noise impacts with regard to substantial permanent increases in noise levels because no new noise generating equipment was proposed at the site as part of operations of the 2008 project, and because the 2008 project would not generate new operational-related vehicle trips. The 2008 FEIR also reported that there would be no noise impacts with regard to the 2008 project being substantially affected by existing noise levels, as it would not result in a new sensitive land use. In addition, the 2008 FEIR also determined that the proposed improvements to the tower would not alter noise conditions related to wind noise.

The 2014 addendum determined that construction noise from the 2014 modified project would be temporary, restrictive in hours and occurrence, and would comply with the restrictions set forth in Article 29. Thus, construction noise and vibration was determined to be less than significant. With respect to operational noise, the 2014 addendum concluded that noise would be similar to the 2008 project, and that tower improvements would not result in substantial permanent increases in noise levels because no new noise generating equipment would be installed and the project would not generate appreciable new vehicle trips in the long-term. Likewise, there would be no noise impacts with regard to the tower improvements being substantially affected by existing noise levels, as the 2014 modified project would not result in a new noise sensitive land use. The 2014 addendum concluded that improvements proposed under the 2014 modified project would not result in a new significant impact related to noise and vibration and would not substantially increase the severity of any previously identified significant impact, nor would new mitigation measures be required.

Noise Levels on Project Site

A survey of existing noise levels around the perimeter of the project site was conducted in October 2013 as part of the analysis of the 2014 addendum. Short-term noise monitoring was conducted at three locations. There have been no changes to the project site or vicinity since 2013 and these noise levels are expected to also be reflective of existing conditions in 2019. The first location (ST1) was at the western property boundary approximately 200 feet from residences on Dellbrook Avenue. The second location (ST2) was at the southern property boundary approximately 300 feet from residences on Panorama Drive and Fairview Court. Monitored noise levels are presented in **Table 2**, below. The third location (ST3) was at the north of the former project site at the intersection of La Avanzada Street and Palo Alto Avenue and was included to assess noise from roadway improvements which are no longer proposed.

TABLE 2
SHORT- TERM AMBIENT NOISE LEVEL DATA IN THE PROJECT AREA

Measurement Location[a]	Time	Noise Levels in dBA		Predominant Sources
		Hourly L_{eq}	L_{max}	
ST1. Western property boundary approximately 200 feet from residences on Dellbrook Avenue	11:48	66	71	Crane operations
ST2. Southern property boundary approximately 300 feet from residences on Panorama Drive	12:01	65	69	HVAC equipment
ST3. North of the project site at the intersection of La Avanzada Street and Palo Alto Avenue	12:35	50	50	Distant Traffic

NOTE: L_{eq} represents the constant sound level; L_{max} is the maximum noise level.

[a] Please see Figure 1 for street locations.

SOURCE: Environmental Science Associates, 2013.

Construction Noise and Vibration Impacts of the 2019 Modified Project

As described in the Project Description, the tower improvements proposed under the 2019 modified project would involve six months of construction. As also noted above, there would be up to six tower workers at the site on any given construction day. In addition, there would be a total of approximately 40 to 50 truck round-trips over the duration of the six-month construction period. These construction-related vehicle trips would temporarily increase traffic volumes above existing volumes, but would still not be substantial enough to generate a noticeable increase in local roadway noise (which requires a doubling of existing traffic volumes).

Construction equipment required for the tower improvements would involve one crane for two days to off-load the antennas, a forklift and two skid winches. **Table 3** presents the maximum noise levels generated by construction equipment identified by the project sponsor as likely to be used during construction.[41] Physical attachment of each proposed antenna/equipment improvement to Sutro Tower would be in the same manner that antennas have been attached to the tower since it was constructed: trained installers would climb to the particular installation point on the tower and would hand install each attachment with hand tools and/or handheld air-powered wrenches. Proposed construction would be required to comply with the San Francisco Noise Ordinance, which prohibits construction activities between 8 p.m. and 7 a.m. and limits noise from any individual piece of construction equipment, except impact tools approved by San Francisco Public Works, to 80 dBA at 100 feet. As shown in Table 3, all equipment proposed for tower improvements would be consistent with the San Francisco Noise Ordinance. Accordingly, the proposed tower improvements would not generate noise levels in excess of standards established in the local noise ordinance, and the 2019 modified project would not result in new or substantially more severe impacts, compared to those reported in the 2008 FEIR.

TABLE 3
TYPICAL NOISE LEVELS FROM CONSTRUCTION EQUIPMENT FOR PROPOSED TOWER IMPROVEMENTS

Construction Equipment	Noise Level (dBA, Lmax at 50 Feet)	Noise Level (dBA, Lmax at 100 Feet)
Crane	81	75
Fork Lift (Gradall)	83	77
Front End Loader	79	73

NOTE: Lmax = maximum instantaneous noise level. Cranes have an acoustical use factor of 16% which reduces the average noise level during a given hour.

SOURCE: FHWA *Roadway Construction Noise Model User's Guide, Final Report*, 2006.

With regard to temporary increases in noise levels, operation of one crane and a forklift would result in noise levels of approximately 69 dBA at the nearest receptor 200 feet away, as calculated by the Roadway

[41] While reference noise level data is not available for a skid steer loader with a winch as proposed for construction, the motor on a skid winch is typically approximately 70 horsepower (hp), which is relatively small compared to a front end loader used as a proxy, and consequently, would be expected to generate less noise than the front end loader.

Construction Noise Model. However, receptors are at a lower elevation than the project site and shielding/absorption of noise by the vegetated hillside of up to 5 dBA would be expected to occur, depending on the location, reducing noise levels to approximately 64 dBA.[42] Existing monitored daytime noise levels at the western property boundary were found to be 66 dBA, Leq.[43] Existing monitored daytime noise levels at the southern property boundary were determined to be 65 dBA, Leq.[44] Construction noise associated with the proposed tower improvements would be below the existing ambient monitored noise level at these locations. Moreover, construction-related noise of the proposed tower improvements would be temporary, restrictive in hours and occurrence, and would comply with Article 29; thus, the project's construction noise impacts would be considered less than significant.

None of the equipment that would be used for the tower improvements is identified by Caltrans[45] as a potential source of vibration; consequently, no vibration impacts would be associated with these activities.

Operational Impacts of the 2019 Modified Project

Similar to the 2008 and 2014 projects, the tower improvements would not result in substantial permanent increases in noise levels because no new noise generating equipment would be installed and the 2019 modified project would not generate appreciable new vehicle trips in the long-term. Likewise, there would be no noise impacts with regard to the tower improvements being substantially affected by existing noise levels, as the 2019 modified project would not result in a new noise sensitive land use. Similar to the 2008 and 2014 projects, none of the proposed tower improvements would substantially alter noise levels resulting from wind passing through the tower structure.

Noise and Vibration Conclusion

Neither the 2008 FEIR nor the 2014 addendum identified any significant effects related to noise. The improvements proposed under the 2019 modified project would not result in a new significant impact related to noise and vibration and would not substantially increase the severity of any previously identified significant impact, nor would new mitigation measures be required. No new information has arisen, nor have there been any changes in circumstances, such that the 2019 modified project would result in new or substantially more severe significant noise or vibration impacts, either individually or cumulatively.

Hydrology and Water Quality

Summary of Hydrologic and Water Quality Effects Analyzed in Prior Environmental Analyses

The 2008 FEIR (in the initial study) reported that during construction, the project would be required to comply with all applicable local wastewater discharge and water quality requirements. The 2008 FEIR determined that since no ground disturbance was proposed during construction, the project would not result in short-term increases in erosion and siltation. The 2008 FEIR also determined that since the project would not change the amount of impervious area or alter drainage patterns, it would not affect surface runoff rates, increase potential for flooding, or affect groundwater resources. Furthermore, the 2008 FEIR also determined that the proposed antennas and equipment that would be installed on the tower would

[42] Caltrans, Technical Noise Supplement to the Traffic Noise Analysis Protocol, September, 2013; pp. 2-35 and 5-23.
[43] Leq = equivalent noise level. The equivalent sound level is used to describe noise over a specified period of time, typically 1 hour, in terms of a single numerical value.
[44] San Francisco Planning Department, Addendum to Environmental Impact Report, Sutro Tower Antenna Additions and Site and Erosion Control Improvements, p. 35, December 19, 2014.
[45] Caltrans, Transportation and Construction Vibration Guidance Manual, 2013.

not result in degradation of surface runoff water quality. The 2008 FEIR concluded that the project impact to water resources would not be significant, either individually or cumulatively.

The 2014 modified project resulted in a minor increase (approximately 1,700 square feet) in impervious surfaces on site, but also included a number of permanent stormwater improvements, including installation of new stormdrains on the southern hillside, and installation of a riprap lined swale on the east side of La Avanzada Street within the project site. The 2014 addendum concluded that the minor increase in impervious surfaces combined would not demonstrably increase peak stormwater runoff rates from the project site that would result in flooding, or affect groundwater recharge. Overall, the 2014 addendum concluded that stormwater collection improvements, in combination with the proposed permanent erosion control improvements, would serve to reduce the potential for erosion and associated sedimentation in stormwater runoff. The 2014 addendum concluded that the 2014 modified project would not result in a new significant impact to hydrology and water quality, nor would it substantially increase the severity of any previously identified significant impact.

Hydrologic and Water Quality Impacts of the Tower Improvements Proposed under the 2019 Modified Project

The tower improvements proposed under the 2019 modified project would not result in any different or greater impacts on hydrology and water quality than that discussed in the 2008 FEIR or the 2014 addendum. As with the 2008 and 2014 projects, construction of the tower improvements proposed under the 2019 modified project would be required to comply with all applicable local wastewater discharge and water quality requirements. Similar to the 2008 project, the tower improvements proposed under the 2019 modified project would not result in ground disturbance or an increase in impervious surfaces and, consequently, these improvements would not affect surface runoff rates, increase flooding, contribute to siltation, or affect groundwater resources. Tower modifications are not anticipated to involve significant amounts of paint (estimated to be less than ten gallons). As referenced in the Aesthetics analysis above, the 2019 modified project would be composed of non-reflective metal (unpainted) or be painted the same color as the existing tower structure. Thus, there would be limited potential for paint to leach into surface water during storm events. Therefore, the short- and long-term effects of the tower improvements proposed under the 2019 modified project on hydrology and water quality would be the similar to those identified in the 2008 FEIR and the 2014 addendum (less than significant), and no new significant impact would result.

Hydrology and Water Quality Conclusion

The 2008 FEIR and 2014 addendum did not identify any significant effects related to hydrology and water quality. The improvements proposed under the 2019 modified project would not result in a new significant impact to hydrology and water quality and would not substantially increase the severity of any previously identified significant impact, nor would new mitigation measures be required. No new information has arisen, nor have there been any changes in circumstances, such that the 2019 modified project would result in new or substantially more severe significant impacts related to hydrology or water quality, including the potential for flooding, effects of runoff and water quality from sedimentation and pollutants, and effects on groundwater supply and recharge, either individually or cumulatively.

Greenhouse Gases

Summary of Greenhouse Gas Effects Analyzed in Prior Environmental Analyses

Current requirements related to greenhouse gas (GHG) analysis were established in 2010, subsequent to certification of the 2008 FEIR. However, the 2014 addendum analyzed the 2014 modified project's GHG impacts consistent with current procedures and requirements and determined that the 2014 modified

project would be consistent with San Francisco's Qualified GHG Reduction Strategy. The 2014 addendum determined that the 2014 modified project would result in a less-than-significant GHG impact.

Greenhouse Gas (GHG) Evaluation

GHG emissions and global climate change represent cumulative impacts. GHG emissions cumulatively contribute to the significant adverse environmental impacts of global climate change. No single project could generate enough GHG emissions to noticeably change the global average temperature; instead, the combination of GHG emissions from past, present, and future projects have contributed and will contribute to global climate change and its associated environmental impacts.

The BAAQMD has prepared guidelines and methodologies for analyzing GHGs. These guidelines are consistent with CEQA Guidelines sections 15064.4 and 15183.5 which address the analysis and determination of significant impacts from a proposed project's GHG emissions. CEQA Guidelines section 15064.4 allows lead agencies to rely on a qualitative analysis to describe GHG emissions resulting from a project. CEQA Guidelines section 15183.5 allows for public agencies to analyze and mitigate GHG emissions as part of a larger plan for the reduction of greenhouse gases and describes the required contents of such a plan. Accordingly, San Francisco has prepared the 2017 Greenhouse Gas Reduction Strategy Update (GHG Reduction Strategy)[46] which presents a comprehensive assessment of policies, programs, and ordinances that collectively represent San Francisco's Qualified GHG Reduction Strategy in compliance with the CEQA Guidelines. These GHG reduction actions have resulted in a 36 percent reduction in GHG emissions in 2017 compared to 1990 levels,[47] exceeding the year 2020 reduction goals outlined in the air district's Bay Area 2017 Clean Air Plan, Executive Order (EO) S-3-05, and Assembly Bill (AB) 32 (also known as the Global Warming Solutions Act).[48]

Given that the City's local greenhouse gas reduction targets are more aggressive than the state and region's 2020 GHG reduction targets and consistent with the long-term 2050 reduction targets,[49] the City's GHG Reduction Strategy is consistent with the goals of EO S-3-05, AB 32, and SB 32.

Individual project compliance with the City's GHG Reduction Strategy is demonstrated by completion of the Compliance Checklist for GHG Analysis. Projects that are consistent with San Francisco's 2017 GHG Reduction Strategy Update[50] are determined to be consistent with San Francisco's Qualified GHG Reduction Strategy and therefore would result in a less-than-significant GHG impact. An assessment of the 2019 modified project's compliance with San Francisco's Strategies to Address GHG Emissions is provided in the Compliance Checklist for GHG Analysis, which concluded the modified project would comply with the GHG Reduction strategies.[51]

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[46] San Francisco planning department, *2017 Greenhouse Gas Reduction Strategy Update*, 2017. The final document is available online at: http://sfmea.sfplanning.org/GHG/GHG_Strategy_October2017.pdf.

[47] San Francisco Department of the Environment, San Francisco's Carbon Footprint (2019), April 2019. Available at https://sfenvironment.org/carbon-footprint, accessed April 22, 2019.

[48] Executive Order S-3-05, Assembly Bill 32, and the *Bay Area 2010 Clean Air Plan* set a target of reducing GHG emissions to below 1990 levels by year 2020.

[49] San Francisco's Greenhouse Gas Reduction ordinance requires that by 2008, the City determine its GHG emissions for the year 1990, the baseline level with reference to which target reductions are set; by 2017, reduce GHG emissions by 25 percent below 1990 levels; by 2025, reduce GHG emissions by 40 percent below 1990 levels; and by 2050, reduce GHG emissions by 80 percent below 1990 levels.

[50] San Francisco planning department, *2017 Greenhouse Gas Reduction Strategy Update*, 2017. The final document is available online at: http://sfmea.sfplanning.org/GHG/GHG_Strategy_October2017.pdf.

[51] San Francisco planning department, *Compliance Checklist for Greenhouse Gas Analysis: Table 1. Private Development Projects, Sutro Tower Antenna Additions and Site and Erosion Control Improvements*. July 3, 2019.

Therefore, the 2019 modified project would not result in a new significant impact associated with greenhouse gases. The contribution to cumulative impacts related to greenhouse gas emissions would not be cumulatively considerable.

Other Less than Significant Environmental Impacts

The 2008 FEIR, in the initial study, and subsequently in the 2014 addendum, determined that the two previous projects proposed at the 2019 modified project site would not result in significant impacts in the following areas: Land Use and Land Use Planning; Population and Housing; Cultural Resources; Transportation and Circulation; Wind and Shadow; Utilities and Service Systems; Public Services; Hazards and Hazardous Materials (excluding RFR); Mineral and Energy Resources; and Agriculture Resources.

In November 2018, the California Natural Resources Agency updated Appendix G of the California Environmental Quality Act (CEQA) Guidelines.[52,53] On March 28, 2019, the San Francisco planning department, environmental planning division (EP) issued the city's revised initial study checklist to reflect the Appendix G revisions and provided a memorandum explaining these changes.

The following discussion briefly describes why environmental effects associated with the 2019 modified project under these topics would also be less than significant, as was the case for the 2008 and 2014 projects, and why the 2019 modified project would not result in any new significant impacts.

- **Land Use and Land Use Planning.** All construction proposed under the 2019 modified project would occur within the site property, and subsequent operations with implementation of the modified project would be unchanged from those at present. Consequently, the 2019 modified project would not physically divide the arrangement of existing uses and activities that surround it. Sutro Tower is an existing use that has been operating on the project site since 1973. The 2019 modified project would add, remove, and deactivate antennas, but these uses are substantially similar to the existing uses. The proposed tower antenna additions would not change the use of the existing facility, physically divide an established community.

  The 2019 modified project would not conflict with any applicable land use plan, policy or regulation of an agency with jurisdiction over the project adopted for the purpose of avoiding or mitigating an environmental effect. The Conditional Use (CU) authorization issued for Sutro Tower authorizes the construction of the tower and accessory structures and the use of the facility for radio frequency broadcasting. No amendment to Sutro Tower's CU authorization is required under the 2019 modified project.

  As such, the 2019 modified project would neither result in a new significant effect on land use nor increase the severity of any previously identified impact, and no new mitigation is required.

- **Population and Housing.** As discussed in the Project Description, the 2019 modified project would generate a short-term demand for up to approximately six construction workers. Since the proposed construction activities would be temporary, the 2019 modified project would not result in an unplanned increase in the local population or housing, and would not indirectly induce growth by creating new opportunities for local industry or commerce. Once the proposed facilities are operational, no change in long-term employment at or occupancy of the tower facilities is anticipated.

[52] California Environmental Quality Act Appendix G. 2019. Available at http://resources.ca.gov/ceqa/docs/ab52/final-approved-appendix-G.pdf.

[53] The California Natural Resources Agency's Final Statement of Reasons for Regulatory Action Amendments to the State CEQA Guidelines provides the rationale for changes to the checklist and can be found at http://resources.ca.gov/ceqa/docs/2018_CEQA_Final_Statement_of%20Reasons_111218.pdf

Given the minor improvements proposed under the 2019 modified project, and that all proposed facilities under the 2019 modified project would occur within the site property, the modified project (similar to the 2008 and 2014 projects) would not result in displacement of any housing or people. As with the 2008 and 2014 projects, the 2019 modified project would also not contribute to any potential cumulative effects related to population and housing. As such, the modified project would neither result in a new significant effect on population and housing nor increase the severity of any previously identified significant impact, and no new mitigation is required.

- **Cultural Resources.** The portions of the project site proposed for improvements have been disturbed by construction in the past, primarily during the original construction of Sutro Tower and its ancillary buildings. The 2008 FEIR reported that no cultural resources have been previously identified within or directly adjacent to the project site, or within a one-quarter mile of the project area. The 2019 modified project would not include any ground-level disturbance and thus would not adversely affect any subsurface cultural resources. Concerning historical resources, the 2008 EIR and the 2014 addendum both found that Sutro Tower is not an historical or cultural resource as defined by CEQA Guidelines section 15064.5, and is not in an historic district. However, since publication of the 2014 Addendum, the planning department has determined that Sutro Tower is a historical resource eligible for individual listing in the California Register of Historical Resources, and that Sutro Tower and its associated transmission building (constructed in the early 1970s) are contributors to a historic district that is eligible for listing in the California Register of Historical Resources.[54]

  The planning department has determined that the two structures are eligible for the California Register of Historic Resources because they constitute a crucial piece of technological infrastructure that collectively possesses a notable association with the history of regional broadcasting under Criterion 1 (association with important events).[55] Because the structures' significance derives in part from their functional interdependence, neither Sutro Tower, nor the transmission building alone fully conveys the association with historic events, and thus neither building is individually eligible for the California Register of Historical Resources under Criterion 1. Rather, the two buildings collectively convey the historic association and thus both contribute to a historic district eligible for the California Register of Historical Resources under Criterion 1. The period of significance is 1973 to 1998, which corresponds to the period of analog transmission for which the subject buildings were custom built (although adapted to the subsequent era of digital signals, the subject buildings do not have a direct association with this later broadcasting technology).[56]

  In addition, the planning department has determined that Sutro Tower is also individually eligible for the California Register of Historical Resources under Criterion 3 (architecture) as an unmistakable landmark that embodies the distinctive characteristics of a high-tech broadcast tower designed during the 1960s and constructed in the earlier 1970s.[57] As noted in the Historic Resources Evaluation prepared for the project, Sutro Tower is "the most recognizable broadcast tower in the greater San Francisco Bay Area and arguably one of the most recognizable broadcast towers in the

[54] Jorgen G. Cleemann, San Francisco Planning Department¸ Preservation Team Review Form: 1 La Avanzada Street, July 2, 2019.

[55] *Ibid*.

[56] *Ibid*.

[57] *Ibid*.

United States."[58] The period of significance is 1971 to 1973, which covers the construction period for Sutro Tower.[59]

Given the foregoing, both Sutro Tower and the transmission building are considered historical resources for purposes of CEQA. The repacking project would add seven new broadcast antennas, replace four existing broadcast antennas with new antennas, and remove four existing antennas. The proposed repacking project and voluntary structural upgrades would entail the temporary removal of the tower's cladding on all three legs at locations between levels four and six (beginning approximately 550 feet above grade) of the tower. The cladding panels would be reinstalled within six months of the completion of the antenna replacement and structural work. The temporary cladding removal would affect about 11 percent of the tower's aproximately 1,500 cladding panels; the panels are anticipated to be reinstalled in 2020.

The replacement of one of the top three stacks with a new stack would maintain the tower's overall height, appearance, and three-part organization. Although the new stack would have a more lattice structure than the existing mast, this difference would not be apparent when viewed from the public way, particularly at a distance. The changes to the tower resulting from voluntary structural upgrades would not be immediately discernible and would have a negligible effect on the tower's overall appearance. Although this work would require the temporary removal of the tower's character-defining cladding, the cladding would be stored on site and reinstalled within six months of the completion of the antenna replacement and structural work. Given the above factors, the 2019 modified project would neither result in a new significant effect on cultural resources, nor increase the severity of any previously identified impact, and no new mitigation is required.

- **Tribal Cultural Resources.** Assembly Bill No. 42, passed in 2014, requires the lead agency to consider the effects of a project on tribal cultural resources for projects that have a notice of preparation or a notice of negative declaration filed or mitigation negative declaration on or after July 1, 2015. EP's 2019 revised initial study checklist added tribal cultural resources as a separate topic to be analyzed in environmental documents. The 2008 FEIR and 2014 addendum did not, and were not required to, analyze impacts to tribal cultural resources. The 2019 modified project includes modification to the above ground Tower and would not include ground disturbance. Therefore, the 2019 modified project would have no potential to cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074. No mitigation would be required.

- **Transportation and Circulation**. The 2008 FEIR determined that the construction and operation impacts of the 2008 project would be less than significant and that no mitigation was required. The 2014 addendum determined that the 2014 modified project would neither result in new significant effects with regard to transportation nor increase the severity of any previously identified impact, and no new mitigation was required.

  The project site is accessible via Dellbrook Avenue and La Avanzada Street. Dellbrook Avenue is a residential street that intersects with Clarendon Avenue. La Avanzada Street is a paved road that leads to the site, a portion of which is privately owned by the project sponsor. The 2019 modified project would not introduce any new uses to the project site that would generate long-term changes

[58] Historic Resources Evaluation, 1 La Avanzada Street, March 2019.
[59] Jorgen G. Cleemann, San Francisco Planning Department¸ Preservation Team Review Form: 1 La Avanzada Street, July 2, 2019.

in traffic on local roadways. Thus, potential traffic and transportation effects on area roadways would be confined to construction of the proposed project.

Construction activities would include daily vehicle trips generated by the arrival and departure of construction workers. As described in the Project Description, the proposed antenna/tower improvements would require up to six construction workers intermittently over a six-month period. The proposed antenna/tower improvements would generate a modest number of truck deliveries (e.g. pre-fabricated antenna sections and associated assembly materials) estimated at a total of 21 large truck (e.g., 5-axle semi-trailer) round trips, and 20 to 30 smaller delivery truck trips. La Avanzada Street would be used to access the site to haul the equipment and materials, with trucks likely arriving via Market Street, 17th Street, Clayton Street, Twin Peaks Boulevard, and Clarendon Avenue. Construction of the proposed project would not require any lane closures.

The 2008 project determined construction-generated traffic associated with the project would be temporary and would not result in any long-term degradation in operating conditions or level of service on any of the roadways in the vicinity of the proposed project. However, on March 3, 2016, the San Francisco planning commission adopted a resolution to modify the environmental review process by removing automobile delay, as described solely by level of service or similar measures of vehicular capacity or traffic congestion, as a significant impact on the environmental pursuant to the California Environmental Quality Act and replacing it with vehicle miles traveled (VMT) criteria.[60] Therefore, pursuant to CEQA Guidelines section 15064.3, level of service analysis is no longer a metric for analysis of transportation impacts under CEQA in San Francisco.

The 2019 modified project's impacts would result from the movement of construction trucks, which would include short-term and intermittent lessening of roadway capacities due to slower movements and larger turning radii of the trucks compared to passenger vehicles. Because relatively few trucks would be used, and such truck activity would be dispersed throughout the construction duration, truck traffic associated with project construction would not conflict with a program, plan, ordinance, or policy addressing the circulation system.

Once constructed, the new antennas/equipment would require routine maintenance trips and inspections, as is the case under existing conditions. Maintenance activities would not noticeably increase above existing levels for the facility and therefore, would not result in a substantial increase of traffic in the project area. With respect to VMT, which is a measure of the amount and distance of vehicle travel attributable to a project, the 2019 modified project would not result in an increase in long-term employment or an increase in parking at the project site, and as a result, would not result in an increase in future VMT after the conclusion of construction. Therefore, the 2019 modified project would not result in an impact related to VMT.

There are no unusual geometric design features or uses proposed as part of the 2019 modified project that would substantially increase traffic hazards. Likewise, the 2019 modified project would not result in an adverse change with regard to emergency access, as the project site is accessible from major streets, including Clarendon Avenue and Twin Peaks Boulevard. All proposed improvements would occur within the project site boundary and above ground, thus, improvements would not affect the geometric design of roadways.

The nearest airport to the project site is the San Francisco International Airport, located about 13 miles southeast of the City of San Francisco. At present, the tower is in compliance with all FAA regulations. The 2019 modified project would not require additional FAA-approved lighting, as it would not add additional height or bulk to the tower. There are no other elements of the 2019

[60] San Francisco Planning Commission Resolution No. 19579, adopted March 3, 2016.

modified project that would create a safety hazard for air traffic. Consequently, the 2019 modified project would not alter conditions with respect to air traffic safety.

In summary, the 2019 modified project would neither result in new significant effects with regard to transportation nor increase the severity of any previously identified impact, and no new mitigation is required.

- **Wind and Shadow.** The tower modifications under the 2019 modified project would be relatively small in scale, and these improvements would not increase the height or bulk of the tower. Consequently, the tower improvements would not result in changes to ground-level winds nor substantially alter shadows in the area. Similarly, given the scale of ground-level site improvements proposed under the 2019 modified project, such improvements would not have a noticeable effect on wind or shadow. As a result, the 2019 modified project (similar to the 2008 and 2014 projects) would not have any new significant adverse impacts on wind and shadow nor increase the severity of any previously identified impact, and no new mitigation is required.

- **Utilities and Service Systems.** The 2019 modified project would not increase population on the site or area, and consequently, would not increase long-term demand for or create a need for the relocation of existing utilities or the construction of new or expanded water supplies, water and wastewater treatment facilities, stormwater drainage facilities or solid waste collection facilities. The 2019 modified project would create a finite amount of construction debris during the construction phase. Of this amount, the project sponsor has indicated that 75-80 percent would be recycled in some manner, and that they adhere to all applicable refuse separation requirements contained in Chapter 19 of the Environment Code. Any portion of this that would not be recycled and thus disposed of at a landfill would not substantially affect remaining landfill capacity. Therefore, the 2019 modified project would comply with federal, state, and local management reduction statutes and regulations and would neither result in a new significant effect on utilities or service systems nor increase the severity of any previously identified significant impact, and no new mitigation is required.

- **Recreation and Public Services.** The 2019 modified project would not increase demand for parks, recreation facilities, or other public services such that it would require construction of new or altered facilities for fire and police protection, schools, parks or other services. Consequently, the 2019 modified project would neither result in a new significant effect on parks, recreation facilities, or other public services nor increase the severity of any previously identified significant impact, and no new mitigation is required. See also Risk of Fire discussion, above.

- **Hazards and Hazardous Materials.** As reported in the 2008 FEIR and the 2014 addendum, the project site is not located on any environmental database, nor in proximity to any properties listed on the State Cleanup Sites List or Leaking Underground Storage Tanks List, or lists of other sites of potential environmental concern.[61] No elements of the 2019 modified project would create a public safety hazard. Standard construction materials (e.g., concrete, rebar steel, drainage rock, storm drains) would be used during project construction and/or maintenance during operation. The 2019 modified project would not involve installation or alteration of any fuel tanks or emergency generators, or increase the use of any hazardous materials at the project site during operation. The tower is currently in compliance with all applicable FAA regulations, and under the 2019 modified project would not require additional safety lighting; consequently, the 2019 modified project would have a less-than-significant effect on air traffic safety. Therefore, because the 2019 modified project would not result in ground disturbance or result in the transport of

[61] Department of Toxic Substances Control EnviroStor database at https://www.envirostor.dtsc.ca.gov; State Water Resources Control Board Geotracker database at http://geotracker.waterboards.ca.gov.

hazardous materials, it would neither result in a new significant effect related to hazards or hazardous materials nor increase the severity of any previously identified impact, and no new mitigation is required. See also Radio Frequency Radiation, Risk of Fire, and Hydrology and Water Quality discussion, above.

- **Mineral and Energy Resources.** No mineral resources are located on or near the project site, and as a result, the 2019 modified project would not result in the loss of availability of a locally-important mineral resource site. Sutro Tower currently meets all applicable state and local codes concerning energy consumption, and would continue to do so under the 2019 modified project; consequently, the 2019 modified project would not encourage activities which would result in the use of large amounts of energy in a wasteful manner or conflict with a state or local plan for renewable energy or energy efficiency. Therefore, the 2019 modified project would neither result in a new effect on mineral or energy resources nor increase the severity of any previously identified significant impact, and no new mitigation is required.

- **Agriculture and Forest Resources.** The project site is identified by the Department of Conservation Farmland Mapping and Monitoring Program as Urban and Built-Up Land. Because the site does not contain agricultural uses and is not zoned for such uses, the 2019 modified project would not convert any important farmland or conflict with a Williamson Act contract. As stated in the Project Description, the 2019 modified project would not involve ground disturbance. Consequently, the 2019 modified project would neither result in a new significant effect on agricultural or forest resources nor increase the severity of any previously identified impact, and no new mitigation is required.

CONCLUSION

Based on the foregoing, it is concluded that the analyses conducted and the conclusions reached in the Final EIR certified on October 23, 2008, remain valid, and that no Subsequent or Supplemental EIR is required for the proposed project modifications. The proposed 2019 modified project would not cause new significant impacts not identified in the 2008 FEIR, nor result in significant impacts that would be substantially more severe than those described in the 2008 FEIR, and no new mitigation measures would be necessary to reduce significant impacts. No changes have occurred with respect to circumstances surrounding the proposed project that would cause significant environmental impacts to which the project would contribute considerably, and no new information has been put forward to demonstrate that the 2019 modified project would cause new significant environmental impacts or a substantial increase in the severity of previously identified significant impacts. Therefore, no further environmental review is required beyond this Addendum.

I do hereby certify that the above determination has been made pursuant to state and local requirements.

7/5/19
Date

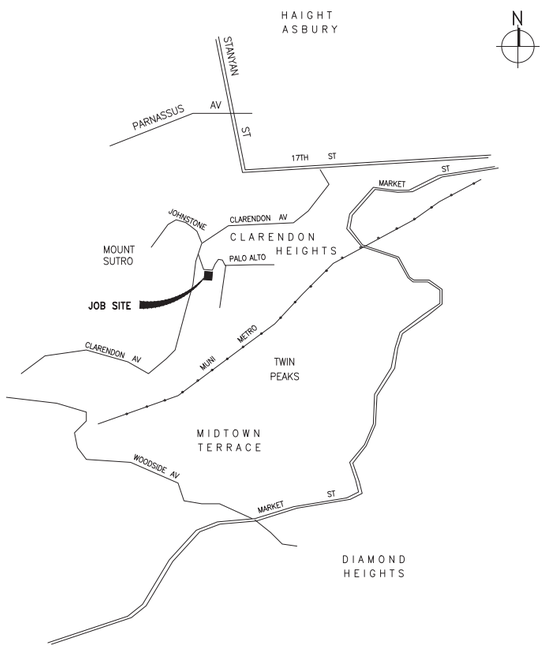
Lisa Gibson
Environmental Review Officer


BEFORE

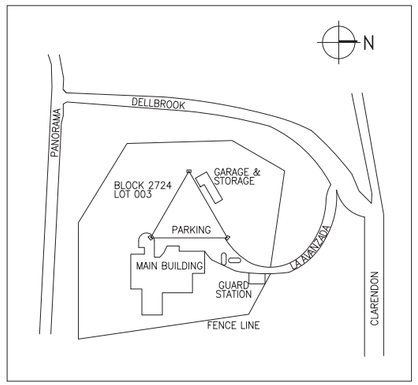

AFTER

BROADCAST CHANNEL REPACKING PROJECT SUTRO TOWER 1 LA AVANZADA STREET SAN FRANCISCO, CALIFORNIA

VICINITY MAP



SITE MAP



LIST OF DRAWINGS

SCOPE OF WORK

1. To repack broadcast frequencies, as mandated by the FCC, broadcast antennas will be modified and relocated on the tower as follows:
   a. Replace KGO antenna on the top of Stack B
   b. Add new KRON antenna under KGO antenna on Stack B
   c. Replace KBCW antenna under KRON antenna on Stack B
   d. Replace existing KEMO side-mounted antenna on Stack C with new VHF panel antenna in the same location
   e. Remove KOFY antenna on Stack A
   f. Replace KFOG antenna on the south end of the outrigger of the Level 6 east face
   g. Add new KFOG and KRON/KGO auxiliary antennas side mounted to Leg B below Level 6
   h. Remove old KFOG and KGO auxiliary antennas from Level 2
   i. Miscellaneous small antenna modifications
2. To accommodate this work, Mast B will be removed in its entirety and replaced with a new mast support structure, and mast
3. Complete re-evaluation of the structural adequacy of the tower in accordance with the San Francisco Building Code (SFBC). Where broadcast modifications increase lateral load demands on an element by more than 10%, or gravity load demands on an element by more than 5%, and the element is not adequate per the SFBC, structural strengthening is performed. Our analysis has shown that no mandatory retrofits are required. Refer to S1.8 for a summary.

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San Francisco
Washington, DC

Consultant

No.	Date	Description	By
0	5/22/19	ISSUED FOR PERMIT	ROH
	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

BROADCAST CHANNEL REPACKING PROJECT

**1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA**

Project

**TITLE SHEET
VICINITY MAP
&
LIST OF DRAWINGS**

Drawing Title

Commission	Checked	Date
067199.24	EW	09/06/17
Drawn	Approved	Scale
GPN	ROH	AS NOTED

REGISTERED PROFESSIONAL ENGINEER
RONALD O. HAMBURGER
No. 2951
STRUCTURAL
STATE OF CALIFORNIA

Seal

Drawing No.

S0.0

Date Signed:
5/22/19

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GENERAL

1. General notes and typical details apply to all structural features, unless otherwise indicated.

2. If certain features are not fully shown or called out on the drawings or in the specifications, their construction shall be of the same character as for similar conditions.

3. Codes and standards noted in the contract documents shall be of the latest edition, unless otherwise noted.

4. Dimensions shall not be scaled off of the drawings.

5. All work shall conform to minimum standards of the 2016 California Building Code, of any codes listed in the drawings or specifications and of any regulating agencies which have authority over any portion of the work, including the State of California Division of Industrial Safety.

6. Non-structural features not fully shown or noted on the structural drawings may include but are not limited to:

   A. Architectural features

   - size and location of all door and window openings
   - size and location of all non-bearing partitions
   - size and location of all concrete curbs, floor drains, slopes and depressed areas
   - changes in level, chamfers, grooves, inserts, etc.
   - size and location of all floor and roof openings
   - stair framing and details

   B. Mechanical, plumbing and electrical features

   - pipe runs, sleeves, hangers, trenches, wall, roof and floor openings, etc.
   - electrical conduit runs, boxes, outlets in walls and slabs
   - anchorage and bracing for electrical, mechanical or plumbing equipment
   - anchor bolts for motor mounts
   - size and location of machine and equipment bases

7. Openings, pockets, etc. shall not be placed in structural members unless specifically detailed on the structural drawings. Notify the structural engineer when work requires openings, pockets, etc. in structural members not shown on the structural drawings.

8. The contractor shall be responsible for coordinating the work of all trades and shall check all dimensions and holes and openings required in structural members. All discrepancies shall be called to the attention of the structural engineer and shall be resolved before proceeding with the work.

9. The contract documents represent the finished structure. They do not indicate the method of construction. The contractor shall provide all measures necessary to protect life and property during construction. Such measures shall include, but are not limited to, bracing and shoring for loads due to construction equipment and materials. Observation visits to the site by the structural engineer shall not include inspection of the above items.

10. Construction materials shall be spread out if placed on framed floors or roofs. Load shall not exceed the design live load per square foot. Provide adequate shoring where overload is anticipated.

11. The contractor shall use extreme caution to protect all conduits, pipes, ducts, architectural finishes and utilities not indicated as being removed from damage during construction and shall restore all damaged or otherwise affected elements to their preconstruction condition, unless otherwise noted.

12. The Sutro Tower transmission facilities must remain in operation at all times during the construction period. Contractor shall submit a written work plan indicating the proposed sequence and schedule of work and specific operations to be conducted, to Sutro Tower for review, prior to performing any work on site. The work plan shall be revised and resubmitted on a weekly basis to alert Sutro Tower as to the progress of work accomplished to date and current schedule for performing additional work.

13. Sutro Tower is a radio transmission facility and emits high energy radio waves. The contractor shall be responsible for determining and implementing appropriate protective measures for personnel working on site.

14. The contractor shall maintain a fire watch end employ the necessary protective measures when welding near flammable materials.

EXISTING CONSTRUCTION

1. Work shown is new unless noted as existing: (E).

2. Existing construction shown on these drawings was obtained from site investigation and can be used for bidding purposes. The contractor shall verify all existing job conditions, review all drawings and verify dimensions prior to construction. The contractor shall notify the Engineer of all discrepancies and exceptions before proceeding with the work.

3. The removal, cutting, drilling, etc. of existing work shall be performed with care in order not to jeopardize the structural integrity of the structure. If structural members or mechanical, electrical or architectural features not indicated for removal interferes with the new work, the Engineer shall be notified immediately and prior approval shall be obtained before removal of members.

4. The contractor shall safely shore existing construction wherever existing supports are removed for the new work.

5. The contractor shall perform the work with minimal inconvenience to the owner and without interruption of day-to-day work operations. The contractor shall ensure safe travel of persons around areas of construction and shall coordinate all operations with the owner or the owner's agent.

6. The contractor shall promptly repair any damage caused during operations, using materials and workmanship similar to that which was damaged.

7. All removed items, materials and debris, unless otherwise noted, shall be removed promptly from the site and disposed of in a legal manner.

STRUCTURAL STEEL & MISC. METALS

1. Fabrication and erection of structural steel shall be in accordance with the "Code of Standard Practice for Steel Buildings and Bridges" AISC 303-16.

2. Materials:

A.	W shapes & MC channels:	ASTM A992 (fy = 50 ksi)
B.	Structural steel & angles:	ASTM A36 (fy = 36 ksi)
C.	All other shapes & plates:	ASTM A572 grade 50 u.o.n.
D.	Structural steel tubes:	ASTM A500 grade B (fy = 46 ksi)
E.	Structural steel pipes:	ASTM A53 grade B (fy = 35 ksi)

3. Bolts, unless otherwise noted on drawings:

A.	High-strength bolts:	ASTM A490-X
B.	Machine bolts:	ASTM A307
C.	Anchor bolts:	ASTM F1554, Gr36

4. Bolt holes in steel shall be 1/16 inch larger diameter than nominal size of bolt used, unless otherwise noted.

5. For bolted connections, provide 1½ inch edge and end distance, unless otherwise noted.

6. All welds shall be prequalified or qualified by test in conformance with the "Structural Welding Code – Steel" (AWS D1.1-04) of the American Welding Society. Minimum tensile strength of weld metal shall be 70 ksi typical, unless otherwise noted. Welding electrodes shall be as recommended by their manufacturer for the position and other conditions of actual use. Weld filler metal shall have minimum Charpy V-notch toughness of 20 ft-lbs at 0°F.

7. Weld symbols shown on the drawings do not necessarily differentiate between shop weld and field welds. When field welds are necessary due to construction procedure or sequence, welds shall be provided and be inspected per specifications. All welds shown as field welds shall be done in the field as indicated.

8. All structural steel, miscellaneous metal and connectors exposed to weather shall be hot-dip galvanized after fabrication. Finish paint shall be in accordance with owner's specification. Galvanizing of ASTM A490 bolts shall conform to ASTM F1136 Grade 3.

9. No penetrations through structural steel columns, beams or girders are allowed except as indicated on the structural drawings.

10. The structural steel fabricator shall furnish shop drawings of all steel for the engineer's review before fabrication.

11. A welding procedure specification (W.P.S.) per A.W.S. D1.1 shall be developed by the fabricator/erector and approved by the engineer of record or his designee. The W.P.S. shall include the welding parameters recommended by the electrode manufacturer.

12. All complete joint penetration groove welds shall be inspected and tested per City of San Francisco requirements.

13. Inspectors are to be S.F. City deputy inspectors and A.W.S. Q.C.I. Certified (a C.W. Inspector), reference A.W.S. D1.1-10, Section 6.1.3.1.

14. All bolted connections shall be installed as required for Slip-Critical (SC) joints including the preparation of faying surfaces and tensioning.

15. All faying surfaces for friction-bolted connections of galvanized members shall be roughened by means of hand wire brushing after galvanizing and before erection

TOWER STRUCTURE

Seismic design of tower and appurtenances has been conducted to provide equivalent performance capability to that required of essential structures under 2016 CBC. A project-specific criteria that incorporates non-linear dynamic analysis, site specific spectra and ground motions scaled to the 2475 year hazard level have been employed. A total of 11 pairs of ground motions were used for the analysis at four conditioning periods, 0.9s, 1.5s, and 3.0s. Maximum response quantities were compared against the following criteria: Tensile yielding of members – max strain $10\varepsilon_y$ compressive yielding of braces – max strain $3\varepsilon_y$ columns and connections are designed to remain elastic. Wind analysis is based on a site specific wind hazard study and wind tunnel test conducted by RWDI, and dated December 2017. Wind loads were combined with dead loads and live loads in accordance with ASCE 7-10. Steel design is in accordance with AISC 360-10.

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Consultant

No.	Date	Description	By
0	5/22/19	ISSUED FOR PERMIT	ROH
	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

BROADCAST CHANNEL REPACKING PROJECT

1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

GENERAL NOTES ABBREVIATIONS & LEGEND

Drawing Title

Commission	Checked	Date
067199.24	EW	09/06/17
Drawn	Approved	Scale
GPN	ROH	AS NOTED

REGISTERED PROFESSIONAL ENGINEER RONALD O. HAMBURGER No. 29511 STRUCTURAL STATE OF CALIFORNIA

Seal

Date Signed: 5/22/19

Drawing No.

S0.1

STRUCTURAL INSPECTION, OBSERVATION AND TESTING

1. Special Inspection and Testing are required by Chapter 17 of the CBC. The "Statement of Special Inspections," submitted with the permit application, indicates the specific inspections and tests that are required, as well as the persons or firms responsible for this work.

2. All tests and inspections shall be performed by a certified Special Inspector from an independent testing agency who is employed by the Owner (or agent of the Owner) and not the Contractor.

   A. The Special Inspector shall observe the work assigned for conformance with the approved design drawings and specifications.

   B. The Special Inspector shall furnish inspection reports to the building official, the Architect, Structural Engineer and other designated persons. All discrepancies shall be brought to the immediate attention of the Contractor for correction, then, if uncorrected, to the proper design authority and to the building official.

   C. The Special Inspector shall submit a final signed report stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance with the approved plans and specifications and applicable standards of quality and workmanship of the CBC.

3. The contractor shall hold a pre-construction meeting involving Structural Engineer and the Special Inspector in order to discuss the specific requirements of this project.

4. Material testing requirements are indicated in the specifications and/or general notes.

5. Structural Observation is required by Chapter 17 of the CBC. Types of work listed in the following table and indicated as requiring "structural observation" shall be observed during periodic site visits by the Structural Engineer. Contractor is responsible for notifying structural engineer 48 hours before work is ready for observation. These visits do not constitute Special Inspection.

6. The following types of work are included in this project:

Portions of Structure	Types of Work	Work Included in This Project	Structural Observation Required
Structural Steel	Shop Welding	X	
	Field Welding	X	X
	High-strength bolting	X	X
Light-Gage Metal Framing	Screwed attachments	X	X
	Welded attachments	X	X

STRUCTURAL STEEL WELDING: INSPECTION AND NON-DESTRUCTIVE TESTING (NDT) REQUIREMENTS

1. GENERAL: Testing and inspection shall conform to Appendix Q of AISC "Seismic Provisions for Structural Steel Buildings" (AISC 341-05), unless specifically noted otherwise.

2. INSPECTION: The following inspection items are required for all welding:

   A. Confirm that applicable and approved Welding Procedure Specifications (WPS) are available for all welds to be performed.
   B. Confirm that filler metal selection conforms to the requirements of the approved WPS.
   C. Inspection of materials handling and storage
   D. Inspection of profile soundness of finished welds

   In addition, continuous inspection of the following items is required, except for shop welds performed in approved shops per CBC 1704.2.2 and single-pass fillet welds not exceeding 5/16" weld size:

   E. Inspection of joint fit-up and preparation
   F. Inspection of welding machine settings
   G. Verification of application of preheat
   H. Verification of interpass temperature control
   I. Verification that all applicable requirements of the approved WPS are followed

3. NON-DESTRUCTIVE TESTING: There are three categories of welds. Non-destructive testing requirements for each weld category are indicated below:

   A. Demand Critical welds (indicated "DC" in the tail of the weld symbol)

      Magnetic Particle Testing (MT) and Ultrasonic Testing (UT) of 100% of joints, full length.

   B. Other welds that are part of the Seismic Load-Resisting System.

      CJP welds: MT of 100% of joints, 50% of length and UT of 100% of joints, 50% of length. The rate of UT may be reduced to 25% after 40 welds, if an individual welder's reject rate is less than 5%. If the welder's reject rate increases above 5%, the 100% rate of UT shall be resumed.

      PJP welds and fillet welds (throat 5/16" or greater): MT of 25% of joints, full length.

      PJP welds and fillet welds (throat less than 5/16"): No requirements for non-destructive testing.

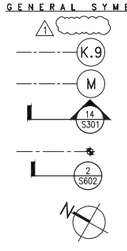
   C. Welds that are not part of the Seismic Load-Resisting System

      No requirements for non-destructive testing, unless specifically noted otherwise.

ABBREVIATIONS

&	And	JST.	Joist
@	At		
A.B.	Anchor bolt	K	Kips
ADD'L	Additional	KSI	Kips per Square Inch
AISC	American Institute of Steel Construction	LBS.	Pounds
ALT.	Alternate	LL	Live Load
ARCH.	Architect	L.L.H.	Long Leg Horizontal
ASD	Allowable Strength Design	L.L.V.	Long Leg Vertical
ASTM	American Society for Testing and Materials	LTWT	Lightweight
		L.V.L.	Laminated Veneer Lumber
A.W.P.A.	American Wood Preservers Assoc.		
AWS	American Welding Society	MAX.	Maximum
		M.B.	Machine Bolt
BLKG.	Blocking	MECH.	Mechanical
BM.	Beam	MFR.	Manufacturer
B.N.	Boundary Nail	M.I.	Malleable Iron
BOCA	Building Officials and Code Administrators International, Inc.	MIL.	Millimeter
		MIN.	Minimum
		MISC.	Miscellaneous
BOTT.	Bottom		
BRG.	Bearing	(N)	New
B.S.	Both Sides	NO.,#	Number
BTWN.	Between	N.S.	Near Side
		N.T.S.	Not to Scale
CBC	California Building Code	NWT	Normalweight
C.C.	Center to Center		
CCR	California Code of Regulations	O.C.	On Center
		O.D.	Outside Diameter
C.J.	Control Joint	O.H.	Opposite Hand
C.I.P.	Cast-in-place	OPNG.	Opening
C.L.,℄	Center Line	OPP.	Opposite
CLG.	Ceiling	OSHPD	Office of Statewide Health Planning and Development
CLR.	Clear		
CMU	Concrete Masonry Unit		
COL.	Column		
CONC.	Concrete	P.A.F.	Powder-Actuated Fasteners
CONN.	Connection		
CONT.	Continuous	PART.	Partial
C.P.	Complete Penetration	PCF	Pounds per Cubic Foot
CSK	Countersink	PL.,℘	Plate
CTBR.	Counterbore	PLY.	Plywood
CTR.	Center	P.P.	Partial Penetration
		PSF	Pounds per Square Foot
DBA	Deformed Bar Anchor	PSI	Pounds per Square Inch
DBL.	Double	PWJ	Plywood Web Joists
DC	Demand Critical (Weld)		
DET., DETL.	Detail	RAD.	Radius
DF	Douglas Fir	R.D.	Roof Drain
DIA.,ø	Diameter	REINF.	Reinforcing
DIAG.	Diagonal	REQ.	Required
DL	Dead Load	RF.	Roof
DN	Down	R.O.	Rough Opening
DO	Ditto	RND.	Round
DSA	Division of the State Architect	R.R.	Remove & Replace
DWG(S).	Drawing(s)	S.A.D.	See Architectural Drawings
(E)	Existing	SCHED.	Schedule
EA.	Each	SFRS	Seismic Force-Resisting System
E.F.	Each Face		
E.J.	Expansion Joint	SHT.	Sheet
ELEV.,EL.	Elevation	SHTG.	Sheathing
EMB.,EMBED.	Embedment	SIM.	Similar
E.N.	Edge Nail	S.M.D.	See Mechanical Drawings
EQ.	Equal	S.O.G.	Slab on Grade
EQUIP.	Equipment	S.P.	Southern Pine
E.W.	Each Way	SSTL.	Stainless Steel
		STAGG'D.	Staggered
FDN.	Foundation	STD.	Standard
F.F.	Finish Floor	STIFF.	Stiffener
F.G.	Finish Grade	STL.	Steel
FIN.	Finish	STRUCT.	Structural
F.O.C.	Face of Concrete	SYMM.,SYM	Symmetrical
F.O.M.	Face of Masonry		
F.O.S.	Face of Stud	T&B	Top and Bottom
FRMG.	Framing	T&G	Tongue & Groove
F.S.	Far Side	T.N.	Toe Nail
FTG.	Footing	T.O.C.	Top of Concrete
		T.O.S.	Top of Steel
GA.	Gage	T.O.W.	Top of Wall
GALV.	Galvanized	TS	Tube Steel
G.L.	Grid Line	TYP.	Typical
GLB	Glue-Laminated Beam		
GR.	Grade	UBC	Uniform Building Code
		U.O.N.	Unless Otherwise Noted
HDG.	Hot-dip Galvanized		
HGR.	Hanger	VERT.	Vertical
HK.	Hook	V.I.F., ±	Verify in Field
HORIZ.	Horizontal		
H.S.B.	High Strength Bolt	W/	With
HSS	Hollow Structural Sections	W/O	Without
		WCLIB	West Coast Lumber Inspection Bureau
HT.	Height	W.P.	Working Point
ICBO	International Council of Building Officials	W.H.S.	Welded Headed Stud
		W.T.S.	Welded Threaded Stud
ICC	International Code Council	W.W.F.	Welded Wire Fabric
INT.	Interior	WWPA	Western Wood Products Association
INV.	Inverted		

GENERAL SYMBOLS AND LEGEND



REVISION

GRIDLINE INDICATING CENTERLINE OF CONCRETE OR PLYWOOD SHEAR WALL

TYPICAL GRIDLINE INDICATING FACE OF CONCRETE WALL

BUILDING SECTION OR ELEVATION

WORK POINT, DATUM OR CONTROL POINT, FIN. FLR. ELEVATION, S.A.D.

DETAIL REFERENCE

PROJECT NORTH, S.A.D. FOR TRUE NORTH

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Consultant

No.	Date	Description	By
0	5/22/19	ISSUED FOR PERMIT	ROH
	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

BROADCAST CHANNEL REPACKING PROJECT

1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

GENERAL NOTES ABBREVIATIONS & LEGEND

Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	AS NOTED

REGISTERED PROFESSIONAL ENGINEER RONALD O. HAMBURGER No. 29511 STATE OF CALIFORNIA STRUCTURAL

Seal

Date Signed: 5/23/19

Drawing No.

S0.2

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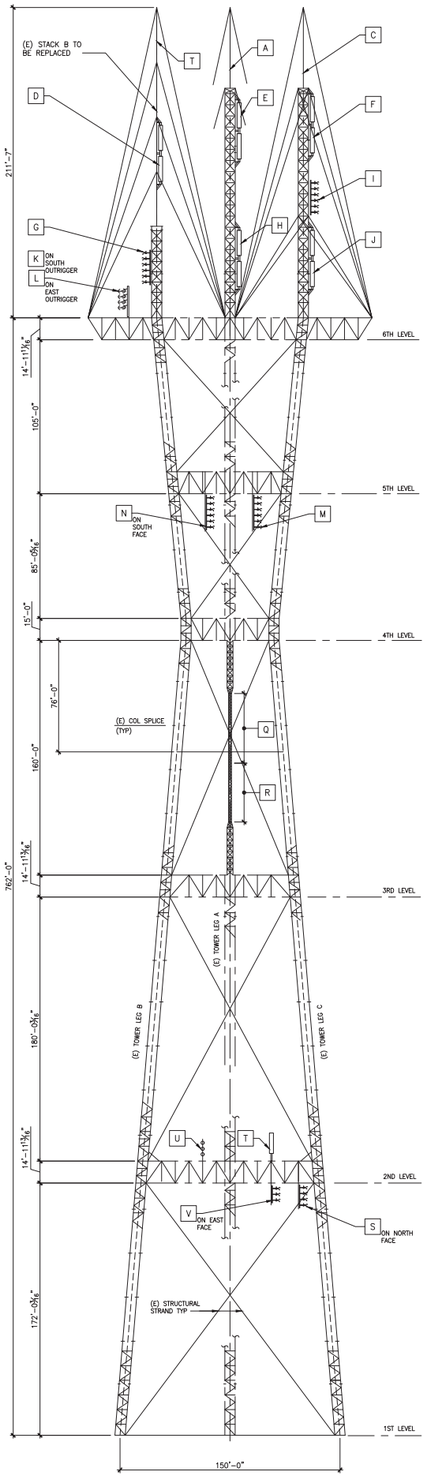


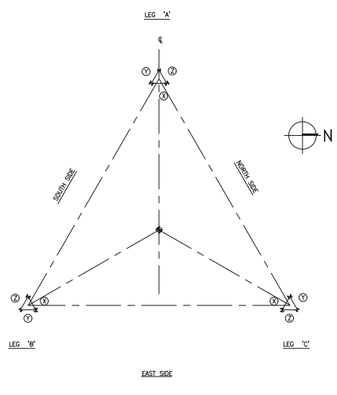
EAST SIDE ELEVATION
(OTHER ELEVATIONS SIMILAR)

TOWER REFERENCE ELEVATION
CURRENT CONFIGURATION

NOTES:

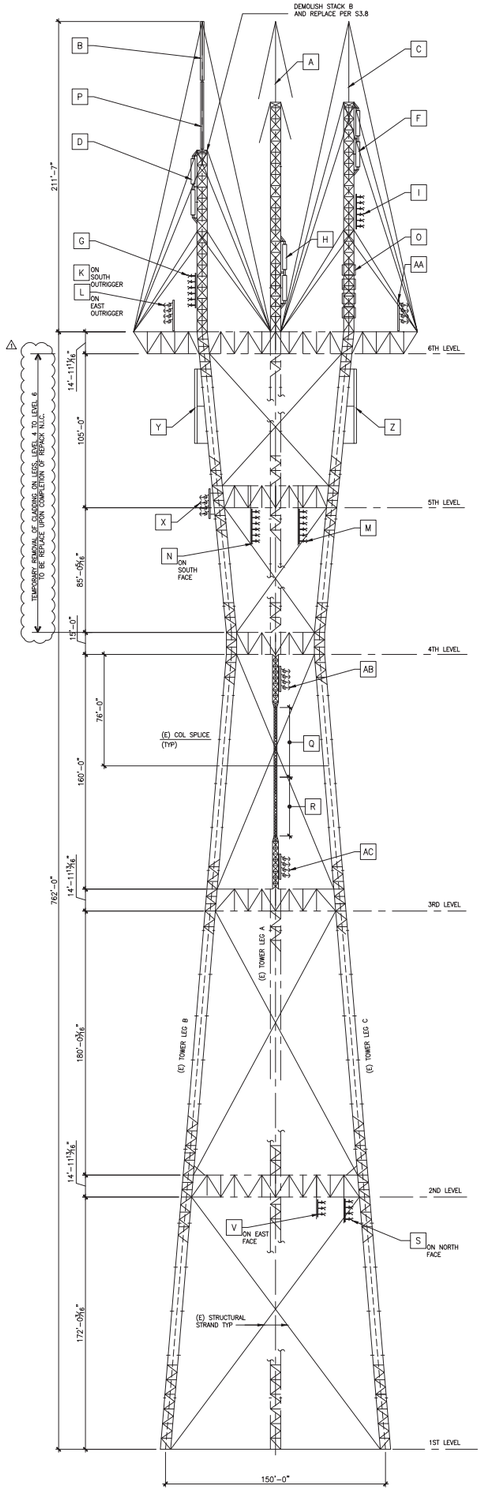
THIS SHEET ONLY PRESENTS A SUMMARY OF BROADCAST ANTENNAS. IT DOES NOT INCLUDE OTHER PERMITTED POINT-TO-POINT MICROWAVE ANTENNAS, BROADBAND ANTENNAS, DISH ANTENNAS, TWO-WAY RADIO ANTENNAS, ETC.

# INDICATES BROADCAST ANTENNA REFERENCE ID. REFER TO THE TABLE 1/S1.1



EAST SIDE

REFERENCE PLAN



EAST SIDE ELEVATION
(OTHER ELEVATIONS SIMILAR)

TOWER REFERENCE ELEVATION
PROPOSED CONFIGURATION

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No.	Date	Description	By
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0	5/22/19	ISSUED FOR PERMIT	ROH
1	6/24/19	REVISED AND REISSUED FOR PERMIT	ROH

BROADCAST CHANNEL REPACKING PROJECT

1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

TOWER REFERENCE PLAN & ELEVATION

Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	N.T.S.

Drawing No.

S1.0

REGISTERED PROFESSIONAL ENGINEER — RONALD O. THAMBURAJ — No. 29511 — STRUCTURAL — STATE OF CALIFORNIA

Seal

Date Signed: 6/24/19

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Summary of New Repack Antennas

Antenna Reference	Post-Repacking Station	New, Replace, or Existing	Antenna Type	Center Elevation Above Ground (ft)	Weight	Antenna Dimensions--Height (ft)	Antenna Dimensions--Diameter or Width (ft)	Configuration	Main RF Emission	Auxiliary RF Emission	Main ERP (KW)	Aux ERP (KW)	SF Building Permit #
O	TV Broadcast--KRCB (5)	New	CBR-C2-04MBA/BH-1	792.0	3,170	48.0	12.00	Panel array	Yes		25.0		New
P	TV Broadcast--KRON (7)	New	Die THV-6A7/VP-R 4C160	907.9	17,800	44.0	3.50	Cylindrical	Yes		50.0		New
X	FM Auxiliary--KFOG	New	ERI MPX4CW	642.6	348	41.9	n/a	Rototiller		Yes		7.5	New
Z	TV Auxiliary--KRON (7)	New	Die TLS-V8/VP-R C160	707.1	1,550	41.5	2.00	Cylindrical		Yes		70.0	New
AA	TV Broadcast--LPTV (3 & 4)	New	Die DCRQ450	783.9	1,000	23.0		Rototiller	Yes		3.0		New
AB	TV Auxiliary--KRCB (5)	New	Die DCRQ450	526.0	1,000	24.0	n/a	Rototiller		Yes		12.5	New
AC	TV Auxiliary--LPTV (3 & 4)	New	Die DCRQ450	398.0	1,000	24.0	n/a	Rototiller		Yes		3.0	New
Total Weight					***22,698***								

Summary of Replacement Repack Antennas

Antenna Reference	Post-Repacking Station	New, Replace, or Existing	Antenna Type	Center Elevation Above Ground (ft)	Weight	Antenna Dimensions--Height (ft)	Antenna Dimensions--Diameter or Width (ft)	Configuration	Main RF Emission	Auxiliary RF Emission	Main ERP (KW)	Aux ERP (KW)	SF Building Permit #
B	TV Broadcast--KGO (12)	Replace	Die THV-6A12/CP-R 4C160	953.8	12,200	37.9	3.00	Cylindrical	Yes		47.0		New
D	TV Broadcast--KBCW (28)	Replace	Die TFU-24DSC/VP-R C140 DC	861.9	1,420	47.9	2.00	Cylindrical	Yes		1000.0		New
L	FM Broadcast--KFOG	Replace	ERI MPX4CW	774.3	348	41.9	n/a	Rototiller	Yes		7.1		New
Y	TV Auxiliary--KGO (12)	New	Die TLS-V8/VP-R C160	707.1	1,350	43.8	2.0	Cylindrical		Yes		**70.0**	New
Total Weight					***15,338***								

List of All Post Repack Broadcast Antennas

Antenna Reference	Post Repacking Station	Existing, Replaced, or Deactivate	Antenna Type	Center Elevation Above Ground (ft)	Weight	Antenna Dimensions--Height (ft)	Antenna Dimensions--Diameter or Width	Configuration	Main RF Emission	Auxiliary RF Emission	Main ERP (KW)	Aux ERP (KW)	SF Building Permit #
A	TV Broadcast--KCSM (27)	Existing	Die TUM-CSSP-14/60H-2-T-R	945.7	35,000	54.5	6	Cylindrical	Yes		465		2007-12-20-0973S
	TV Broadcast--KPIX (29)	Existing							Yes		1000		2007-12-20-0973S
	TV Broadcast--KTVU (31)	Existing							Yes		1,000		2007-12-20-0973S
B	TV Broadcast--KGO (12)	Replace	Die THV-6A12/CP-R 4C160	953.8	12,200	37.9	3	Cylindrical	Yes		47.0		2007-12-20-0973S
C	TV Broadcast--KQED (30)	Existing	Die TUM-CSSP-14/60H-2-T-R	945.7	35,000	54.5	6	Cylindrical	Yes		1,000		2007-12-20-0973S
	TV Broadcast--KCNS (32)	Existing							Yes		1,000		2007-12-20-0973S
	TV Broadcast--KMTP (33)	***Deactivate***							No		N/A	N/A	
D	TV Broadcast--KBCW (28)	Replace	Die TFU-24DSC/VP-R C140 DC*	861.9	1,420	47.9	2	Cylindrical	Yes		1,000		2007-12-20-0973S
F	TV Broadcast--KFSF (34)	Existing	Die TFU-26DSC/VP-R-P190	884.2	1,000	48.4	2	Cylindrical	Yes		850		2007-12-20-0973S
G	FM Broadcast--KQED	Existing	Die DCRS-8DSPF10	782.2	1,800	40.0	n/a	Rototiller	No	Yes		22	20130412452-F
H	TV Broadcast--KQTA-CD (14)	Existing	Die TFU-16WB C160	800.2	1,650	28.9**	2	Cylindrical	Yes		15		20130412452-F
I	FM Broadcast--KOIT	Existing	ERI MPX-6C-HW	843.2	510	30.0	n/a	Rototiller	Yes		24		9823350
K	FM Broadcast--KOSF	Existing	ERI LPX-4E-HW	782.2	248	15.0	n/a	Rototiller	Yes		7.2		9823350
L	FM Broadcast--KFOG	Existing	ERI MPX4CW	774.3	156	20.0	n/a	Rototiller	Yes		7.1		9823350
M	FM Broadcast--KSOL	Existing	ERI LPX 3E SP	610.3	186	25.0	n/a	Rototiller	Yes		6.1		9823350
N	FM Auxiliary--KOIT	Existing	ERI SHP-6AC-HW	620.1	510	30.0	n/a	Rototiller	Yes			3GH/24V	20130412452-F
P	TV Broadcast--KRON (7)	New	Die THV-6A7/VP-R 4C160	907.9	17,800	44.0	40.19	Cylindrical	Yes		50		New
AA	TV Broadcast--LPTV (3 & 4)	New	Die DCRQ450	783.9	1,000	23.0		Rototiller	Yes		3.0		New
O	TV Broadcast--KRCB (5)	New	CBR-C2-04MBA/BH-1	792.0	3,170	48.0	12.00	Panel array	Yes		25.0		New
Q	TV Auxiliary--KQTA-CD (14)	Existing	TUA-C4SP-12/40U-1-S	485.8	14,900	47.6	5	Panel Array		Yes		400	20130412452-F
	TV Auxiliary--KCSM (27)									Yes		250	2007-12-20-0973S
	TV Auxiliary--KPIX (29)									Yes		500	2007-12-20-0973S
	TV Auxiliary--KTVU (31)									Yes		427.9	2007-12-20-0973S
R	TV Auxiliary--KBCW (28)	Existing	TUA-C4SP-12/40U-1-S	438.2	14,900	48	5	Panel Array		Yes		500	2007-12-20-0973S
	TV Auxiliary--KQED (30)									Yes		500	2007-12-20-0973S
	TV Auxiliary--KCNS (32)									Yes		500	2007-12-20-0973S
	TV Auxiliary--KFSF (34)									Yes		185	2007-12-20-0973S
S	FM Auxiliary--KOSF	Existing	ERI LPX-4E-HW	157.5	248	20.0	n/a	Rototiller		Yes		10	392685
V	FM Auxiliary--KSOL	Existing	SHI 6813-NP (3 bay)	157.0	147	20.0	n/a	Rototiller		Yes		6.1	392685
X	FM Auxiliary--KFOG	New	ERI MPX-4C-W	642.6	348	41.5	n/a	Rototiller		Yes		7.5	392685
Y	TV Auxiliary--KGO (12)	New	Die TLS-V8/VP-R C160	707.1	1,350	43.8	2.0	Cylindrical		Yes		70.0	New
Z	TV Auxiliary--KRON (7)	New	Die TLS-V8/VP-R C160	707.1	1,550	41.5	2.0	Cylindrical		Yes		70.0	New
AB	TV Auxiliary--KRCB (5)	New	Die DCRQ450	526	1,000	23.0	n/a	Rototiller		Yes		12.5	New
AC	TV Auxiliary--LPTV (3 & 4)	New	Die DCRQ450	398	1,000	23.0	n/a	Rototiller		Yes		3.0	New
Total Weight					***147,093***								

List of Antennas Being Removed

Antenna Reference	Post Repacking Station	Existing, Replaced, or Deactivate	Antenna Type	Center Elevation Above Ground (ft)	Weight	Antenna Dimensions--Height (ft)	Antenna Dimensions--Diameter or Width	Configuration	Main RF Emission	Auxiliary RF Emission	Main ERP (KW)	Aux ERP (KW)	SF Building Permit #
E	***TV Broadcast--KOFY (19)***	***Remove***	DIE TFU-30DSC/VP-R		-1800.0	n/a	n/a	Cylindrical	Yes		100		2007-12-20-0973S
J	***TV Broadcast--KEMO (32)***	***Remove***	RFS RD24-D-578/704-FR		-5,851	n/a	n/a	n/a	No				
T	***TV Auxiliary--KGO (7)***	***Remove***	DIE THV-5A7-R C170		-9,750	n/a	n/a	Cylindrical		No	N/A	N/A	2007-12-20-0973S
U	***FM Auxiliary--KFOG***	***Remove***	ERI LPX-1/2		-62	n/a	n/a	Rototiller		No	N/A	N/A	392685
					-17,463								

Summary of Ancillary Antenna Additions

Antenna Reference	Client	New, Replace, or Existing	Quantity	Antenna Type	Frequency	Center Elevation Above Ground (ft)	Location	Weight (# each)	Size (diameter or height ft each)	RF Emission (EIRP in watts each)	Comments
1	KGO-TV	New	1	CommScopeHP8-65	6425-7125 MHz	767.0	N Stack	500.0	8.0	39,018	Pointed east
2	KQED-FM	New	1	Radiowaves HPD4-18	18 GHz	185.0	E Face	85.0	4.0	29,512	Pointed south
3	KQED-FM	New	1	Mark P-9A72GN-U	950 MHz	185.0	E Face	100 est	6.0	1,660	Pointed east
4	KRCB-TV	New	1	CommScope HP6-65	6425-7125 MHz	185.0	N Leg	254.0	6.0	20,943	Pointed north
5A 5B	KTVU-TV	New	2	Telewave ANT450F6	450 MHz	557.0	Top of L4	44.0	8.0	200	omni two-way radio
6	Skyriver	New	1	Ibiquiti AM-5AC21	5.8 GHz	403.0	N Leg	10.5	3.5	18	6 x antenna array pointed east
7	Skyriver	New	1	Ibiquiti AM-5AC21	5.8 GHz	403.0	S Leg	10.5	3.5	18	6 X antenna array pointed NW
8	Skyriver	new	1	Ibiquiti AM-5AC21	5.8 GHz	403.0	W leg	10.5	3.5	18	6 X antenna array pointed SW
9	Puloli	New	1	Kathrein 80010666v01	Dual Band Panel 694 – 960 MHz / 3400 - 3600 MHz	533.0	N Leg	210.0	9.0	11	3 X antenna array pointed east
10	Puloli	New	1	Kathrein 80010666v01	Dual Band Panel 694 – 960 MHz / 3400 - 3600 MHz	533.0	S Leg	210.0	9.0	11	3 X antenna array pointed NW
11	Puloli	New	1	Kathrein 80010666v01	Dual Band Panel 694 – 960 MHz / 3400 - 3600 MHz	533.0	W leg	210.0	9.0	11	3 X antenna array pointed SW
12	Unwired	New	1	Ibiquiti PBE500	5.8 GHz	337.0	N Leg	7.0	1.8	126	5 X antenna array pointed east
13	Unwired	New	1	Ibiquiti PBE500	5.8 GHz	337.0	S Leg	7.0	1.8	126	5 X antenna array pointed NW
14	Unwired	New	1	Ibiquiti PBE500	5.8 GHz	337.0	W leg	7.0	1.8	126	5 X antenna array pointed SW
15	CommSites West	New	1	Ibiquiti AM-5AC21	5.8 GHz	503.0	N Leg	10.5	3.5	18	6 X antenna array pointed east
16	CommSites West	New	1	Ibiquiti AM-5AC21	5.8 GHz	503.0	S Leg	10.5	3.5	18	6 X antenna array pointed NW
17	CommSites West	New	1	Ibiquiti AM-5AC21	5.8 GHz	503.0	W leg	10.5	3.5	18	6 X antenna array pointed SW
18	CommSites West	New	1	Ibiquiti PBE500	5.8 GHz	482.0	N Leg	7.0	1.8	126	5 X antenna array pointed east
19	CommSites West	New	1	Ibiquiti PBE500	5.8 GHz	482.0	S Leg	7.0	1.8	126	5 X antenna array pointed NW
20	CommSites West	New	1	Ibiquiti PBE500	5.8 GHz	482.0	W leg	7.0	1.8	126	5 X antenna array pointed SW
Total			21								

1 ANTENNA CHANGES

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Consultant

No.	Date	Description	By
0	5/22/19	ISSUED FOR PERMIT	ROH
	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

BROADCAST CHANNEL REPACKING PROJECT

1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

ANTENNA CHANGES

Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	N.T.S.

Drawing No.

S1.1

REGISTERED PROFESSIONAL ENGINEER — RONALD O. HAMBURGER — No. 2951 — STRUCTURAL — STATE OF CALIFORNIA

Seal

Date Signed: 5/22/19

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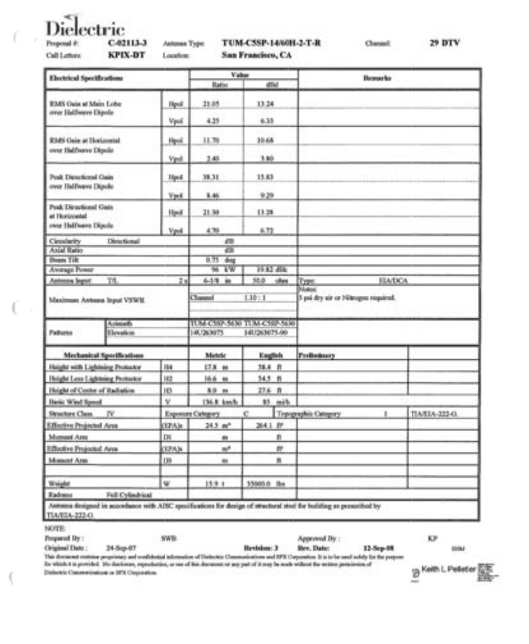

Dielectric

Proposal #:	C-02113-3	Antenna Type:	TUM-C5SP-14/60H-2-T-R	Channel:	29 DTV
Call Letters:	KPIX-DT	Location:	San Francisco, CA		

Electrical Specifications		Value Ratio	Value dBd	Remarks
RMS Gain at Main Lobe over Halfwave Dipole	Hpol	21.05	13.24	
	Vpol	4.25	6.33	
RMS Gain at Horizontal over Halfwave Dipole	Hpol	11.70	10.68	
	Vpol	2.40	3.80	
Peak Directional Gain over Halfwave Dipole	Hpol	38.31	15.83	
	Vpol	8.46	9.29	
Peak Directional Gain at Horizontal over Halfwave Dipole	Hpol	21.30	13.28	
	Vpol	4.70	6.72	
Circularity Directional		dB		
Axial Ratio		dB		
Beam Tilt		0.75 deg		
Average Power		96 kW	19.82 dBk	
Antenna Input: T/L 2 x		6-1/8 in	50.0 ohm	Type: EIA/DCA
Maximum Antenna Input VSWR		Channel	1.10 : 1	Notes: 5 psi dry air or Nitrogen required.
Patterns	Azimuth	TUM-C5SP-5630	TUM-C5SP-5630	
	Elevation	14U263075	14U263075-00	

Mechanical Specifications		Metric	English	Preliminary	
Height with Lightning Protector	H4	17.8 m	58.4 ft		
Height Less Lightning Protector	H2	16.6 m	54.5 ft		
Height of Center of Radiation	H3	8.0 m	27.6 ft		
Basic Wind Speed	V	136.8 km/h	85 mi/h		
Structure Class IV	Exposure Category C		Topographic Category 1		TIA/EIA-222-G.
Effective Projected Area	(EPA)s	24.5 m²	264.1 ft²		
Moment Arm	D1	m	ft		
Effective Projected Area	(EPA)s	m²	ft²		
Moment Arm	D3	m	ft		
Weight	W	15.9 t	35000.0 lbs		
Radome Full Cylindrical					

Antenna designed in accordance with AISC specifications for design of structural steel for building as prescribed by TIA/EIA-222-G.

NOTE:

Prepared By : SWB Approved By : KP

Original Date : 24-Sep-07 Revision: 3 Rev. Date: 12-Sep-08

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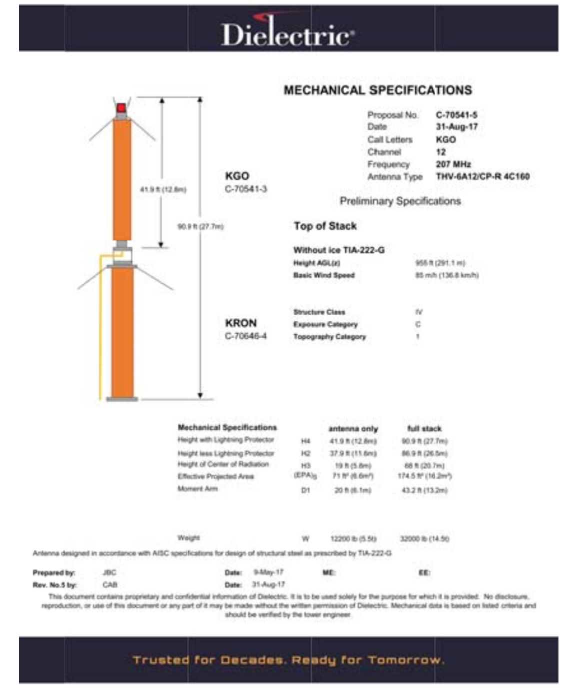
Keith L Pelletier

6 ANTENNA REFERENCE A



Dielectric®

MECHANICAL SPECIFICATIONS

Proposal No.	C-70541-5
Date	31-Aug-17
Call Letters	KGO
Channel	12
Frequency	207 MHz
Antenna Type	THV-6A12/CP-R 4C160

Preliminary Specifications

Top of Stack

Without ice TIA-222-G

Height AGL(z)	955 ft (291.1 m)
Basic Wind Speed	85 mi/h (136.8 km/h)
Structure Class	IV
Exposure Category	C
Topography Category	1

Mechanical Specifications		antenna only	full stack
Height with Lightning Protector	H4	41.9 ft (12.8m)	90.9 ft (27.7m)
Height less Lightning Protector	H2	37.9 ft (11.6m)	86.9 ft (26.5m)
Height of Center of Radiation	H3	19 ft (5.8m)	68 ft (20.7m)
Effective Projected Area	(EPA)g	71 ft² (6.6m²)	174.5 ft² (16.2m²)
Moment Arm	D1	20 ft (6.1m)	43.2 ft (13.2m)
Weight	W	12200 lb (5.5t)	32000 lb (14.5t)

Antenna designed in accordance with AISC specifications for design of structural steel as prescribed by TIA-222-G

Prepared by: JBC Date: 9-May-17 ME: EE:

Rev. No.5 by: CAB Date: 31-Aug-17

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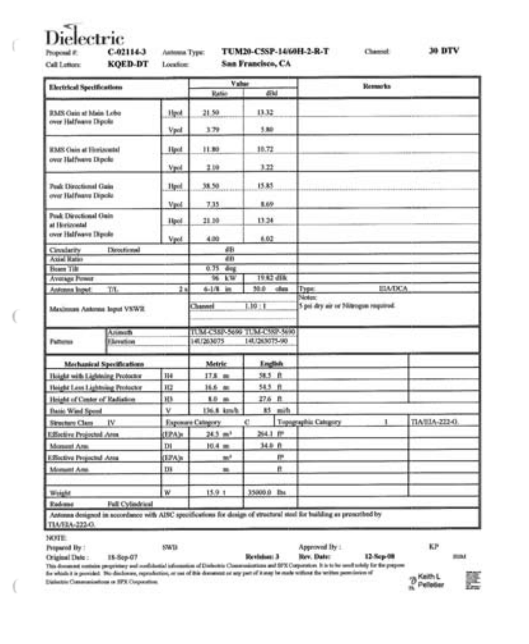
8 ANTENNA REFERENCE B



Dielectric

Proposal #:	C-02114-3	Antenna Type:	TUM20-C5SP-14/60H-2-R-T	Channel:	30 DTV
Call Letters:	KQED-DT	Location:	San Francisco, CA		

Electrical Specifications		Value Ratio	Value dBd	Remarks
RMS Gain at Main Lobe over Halfwave Dipole	Hpol	21.50	13.32	
	Vpol	3.79	5.80	
RMS Gain at Horizontal over Halfwave Dipole	Hpol	11.80	10.72	
	Vpol	2.10	3.22	
Peak Directional Gain over Halfwave Dipole	Hpol	38.50	15.85	
	Vpol	7.35	8.69	
Peak Directional Gain at Horizontal over Halfwave Dipole	Hpol	21.10	13.24	
	Vpol	4.00	6.02	
Circularity Directional		dB		
Axial Ratio		dB		
Beam Tilt		0.75 deg		
Average Power		96 kW	19.82 dBk	
Antenna Input: T/L 2 x		6-1/8 in	50.0 ohm	Type: EIA/DCA
Maximum Antenna Input VSWR		Channel	1.10 : 1	Notes: 5 psi dry air or Nitrogen required.
Patterns	Azimuth	TUM-C5SP-5690	TUM-C5SP-5690	
	Elevation	14U263075	14U263075-90	

Mechanical Specifications		Metric	English		
Height with Lightning Protector	H4	17.8 m	58.5 ft		
Height Less Lightning Protector	H2	16.6 m	54.5 ft		
Height of Center of Radiation	H3	8.0 m	27.6 ft		
Basic Wind Speed	V	136.8 km/h	85 mi/h		
Structure Class IV	Exposure Category C		Topographic Category 1		TIA/EIA-222-G.
Effective Projected Area	(EPA)s	24.5 m²	264.1 ft²		
Moment Arm	D1	10.4 m	34.0 ft		
Effective Projected Area	(EPA)s	m²	ft²		
Moment Arm	D3	m	ft		
Weight	W	15.9 t	35000.0 lbs		
Radome Full Cylindrical					

Antenna designed in accordance with AISC specifications for design of structural steel for building as prescribed by TIA/EIA-222-G.

NOTE:

Prepared By : SWB Approved By : KP

Original Date : 18-Sep-07 Revision: 3 Rev. Date: 12-Sep-08

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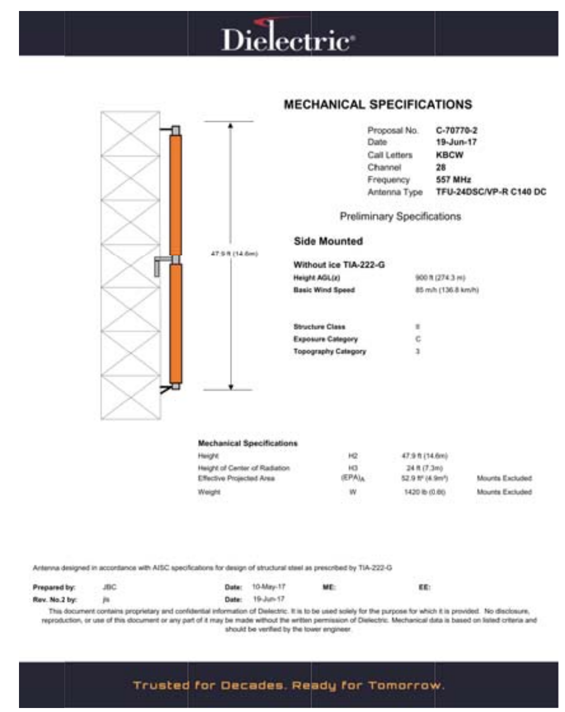
16 ANTENNA REFERENCE C



Dielectric®

MECHANICAL SPECIFICATIONS

Proposal No.	C-70770-2
Date	19-Jun-17
Call Letters	KBCW
Channel	28
Frequency	557 MHz
Antenna Type	TFU-24DSC/VP-R C140 DC

Preliminary Specifications

Side Mounted

Without ice TIA-222-G

Height AGL(z)	900 ft (274.3 m)
Basic Wind Speed	85 mi/h (136.8 km/h)
Structure Class	II
Exposure Category	C
Topography Category	3

Mechanical Specifications			
Height	H2	47.9 ft (14.6m)	
Height of Center of Radiation	H3	24 ft (7.3m)	
Effective Projected Area	(EPA)A	52.9 ft² (4.9m²)	Mounts Excluded
Weight	W	1420 lb (0.6t)	Mounts Excluded

Antenna designed in accordance with AISC specifications for design of structural steel as prescribed by TIA-222-G

Prepared by: JBC Date: 10-May-17 ME: EE:

Rev. No.2 by: jis Date: 19-Jun-17

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18 ANTENNA REFERENCE D

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Consultant

No.	Date	Description	By
0	5/22/19	ISSUED FOR PERMIT	ROH
	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

BROADCAST CHANNEL REPACKING PROJECT

**1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA**

Project

ANTENNA REFERENCES

Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	N.T.S.

REGISTERED PROFESSIONAL ENGINEER RONALD O. HAMBURGER No. 2951 STRUCTURAL STATE OF CALIFORNIA

Seal

Date Signed: 5/22/19

Drawing No.

S1.2

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Dielectric

Proposal #: C-02886 Antenna Type: TFU-26DSC/VP-S P190 Channel: 34 DTV
Call Letters: KFSF-DT Location: San Francisco, CA 135° Horl.

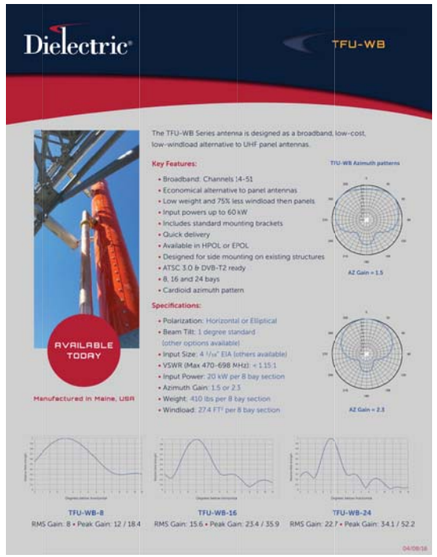
Electrical Specifications		Value Ratio	Value dBd	Remarks
RMS Gain at Main Lobe over Halfwave Dipole	Hpol			
	Vpol			
RMS Gain at Horizontal over Halfwave Dipole	Hpol			
	Vpol			
Peak Directional Gain over Halfwave Dipole	Hpol	33.12	15.45	
	Vpol	5.62	7.48	
Peak Directional Gain at Horizontal over Halfwave Dipole	Hpol	25.1	14.00	
	Vpol	4.0	6.02	
Circularity Directional		dB		
Axial Ratio		dB		
Beam Tilt		0.75 deg		
Average Power DTV		33 kW	15.44 dBk	
Antenna Input T/L		6-1/8 in	75.0 ohm	Type: EIA/DCA
Maximum Antenna Input VSWR		Channel	1.08 : 1	Notes:
Patterns	Azimuth	TFU-P190	TFU-P140-VP	
	Elevation	20Q225075	20Q225075-90	

Mechanical Specifications		Metric	English	Preliminary
Height with Lightning Protector	H4	m	ft	Side mounted
Height Less Lightning Protector	H2	14.8 m	48.4 ft	
Height of Center of Radiation	H3	7.0 m	24.2 ft	
Basic Wind Speed	V	136.8 km/h	85 m/h	
Structure Class IV	Exposure Category	C	Topographic Category 1	TIA/EIA-222-G
Effective Projected Area	(EPA)a	3.4 m²	36.2 ft²	Excludes Mounts
Moment Arm	D1	m	ft	
Effective Projected Area	(EPA)b	m²	ft²	
Moment Arm	D3	m	ft	
Pole Bury Length	D2	m	ft	
Weight	W	0.5 t	1,000 lbs	Excludes Mounts
Radome				

Antenna designed in accordance with AISC specifications for design of structural steel for building as prescribed by TIA/EIA-222-G **Mechanical Loads Exclude Mounts**

NOTE:
Prepared By : SWD Original Date : 23-Sep-08 TLB Approved By : JLS

STAB_S103 6 ANTENNA REFERENCE F



STAB_S103 16 ANTENNA REFERENCE H

Dielectric

Proposal #: C-06217 Antenna Type: DCRS8D50PF10 Frequency: 93.1 MHz
Call Letters: Location: San Francisco, CA

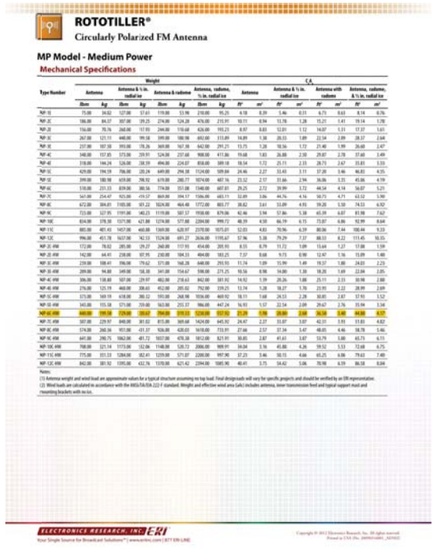
Electrical Specifications		Value Ratio	Value dBd	Remarks
RMS Gain at Main Lobe over Halfwave Dipole	Hpol	2.32	3.65	
	Vpol	2.32	3.62	
RMS Gain at Horizontal over Halfwave Dipole	Hpol	2.30	3.62	
	Vpol	2.30	3.62	
Peak Directional Gain over Halfwave Dipole	Hpol			
	Vpol			
Peak Directional Gain at Horizontal over Halfwave Dipole	Hpol			
	Vpol			
Circularity Directional		dB		
Axial Ratio		dB		
Beam Tilt		0.00 deg		
FM Power Rating		50 kW Ave	16.99 dBk	
Antenna Input T/L		4-1/16 in	50.0 ohm	Type: EIA/DCA
Maximum Antenna Input VSWR		Channel	1.15 : 1	Note: 88-98 MHz
Patterns	Azimuth			
	Elevation	08C0466000	08C0466000-90	

Mechanical Specifications		Metric	English	Preliminary
Height with Lightning Protector	H4	m	ft	Side mounted
Height Less Lightning Protector	H2	11.3 m	37.0 ft	
Height of Center of Radiation	H3	6.0 m	18.5 ft	
Basic Wind Speed	V	182.7 km/h	70 m/h	
Force Coeff x Projected Area	CdA	4.5 m²	7000 ft²	
Moment Arm	D1			
Force Coeff x Projected Area	CdAc			
Moment Arm	D3			
Pole Bury Length	D2			
Weight	W	0.8 t	1800.0 lbs	

Antenna designed in accordance with AISC specifications for design of structural steel for building as prescribed by TIA/EIA-222-F **Preliminary Specifications**

Notes:
Prepared By : CAB RMS Approved By : JLS
Original Date : 18-Feb-15

STAB_S103 8 ANTENNA REFERENCE G



STAB_S103 18 ANTENNA REFERENCE I

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Consultant

No.	Date	Description	By
0	5/22/19	ISSUED FOR PERMIT	ROH
	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

BROADCAST CHANNEL REPACKING PROJECT

1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

ANTENNA REFERENCES

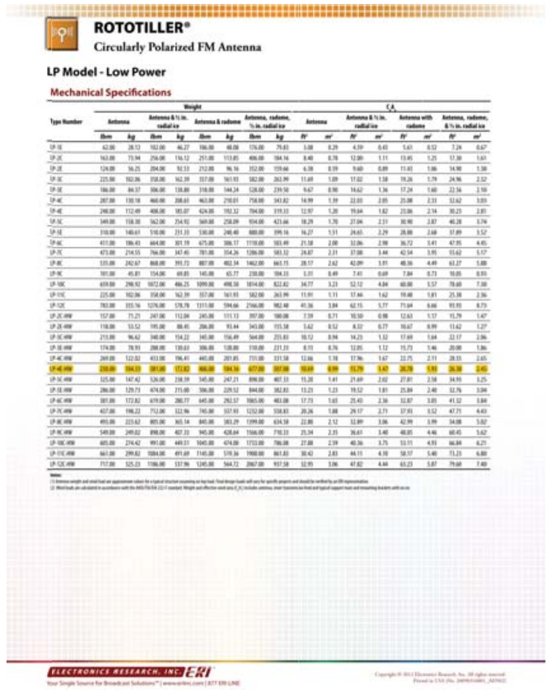
Drawing Title

Commission	Checked	Date
067199.24	EW	09/06/17
Drawn GPN	Approved ROH	Scale N.T.S.

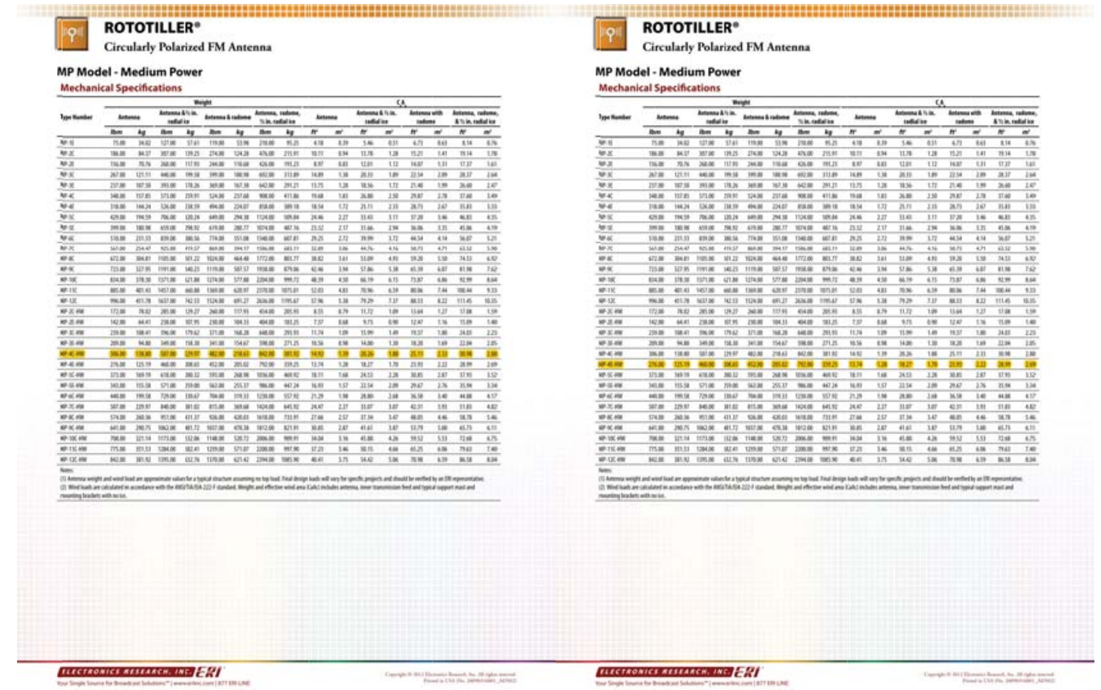
REGISTERED PROFESSIONAL ENGINEER RONALD D. HAMBURGER No. 2951 STRUCTURAL STATE OF CALIFORNIA

Seal Date Signed: 5/22/19

Drawing No. **S1.3**



6 ANTENNA REFERENCE K



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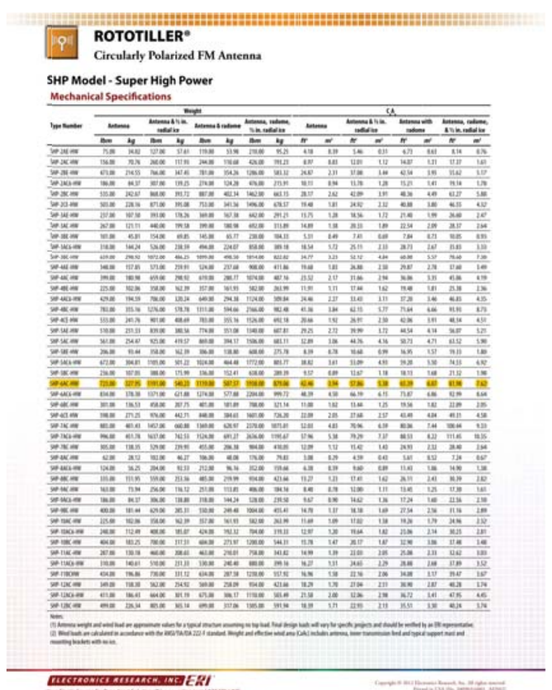

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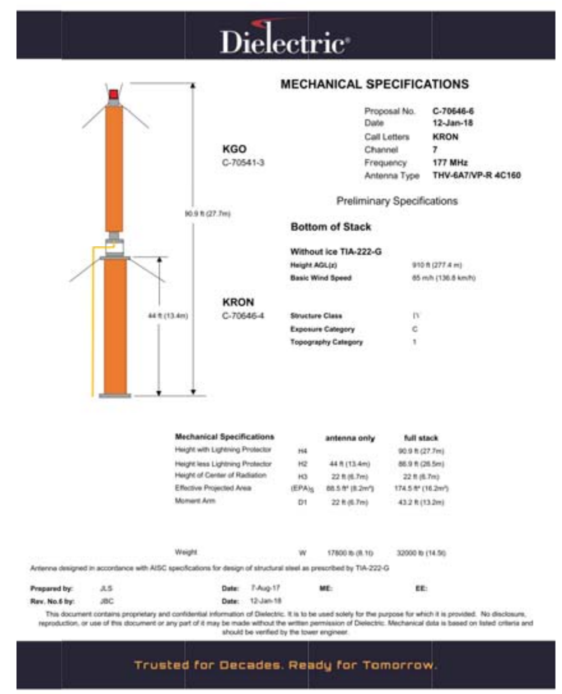

18 ANTENNA REFERENCE P

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Consultant

No.	Date	Description	By
0	5/22/19	ISSUED FOR PERMIT	ROH
	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

Project

BROADCAST CHANNEL REPACKING PROJECT

**1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA**

Drawing Title

ANTENNA REFERENCES

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	N.T.S.

Drawing No.

S1.4

Seal

Date Signed: 5/22/19

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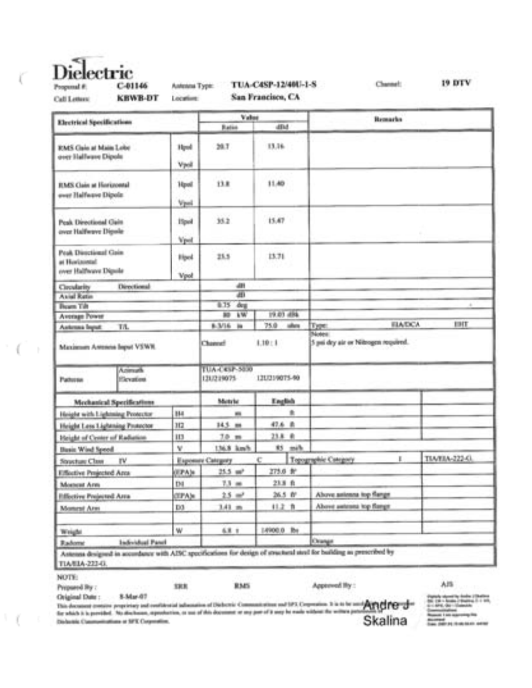

Dielectric

Proposal #:	C-01146	Antenna Type:	TUA-C4SP-12/40U-1-S	Channel:	19 DTV
Call Letters:	KBWB-DT	Location:	San Francisco, CA		

Electrical Specifications		Value Ratio	Value dBd	Remarks
RMS Gain at Main Lobe over Halfwave Dipole	Hpol	20.7	13.16	
	Vpol			
RMS Gain at Horizontal over Halfwave Dipole	Hpol	13.8	11.40	
	Vpol			
Peak Directional Gain over Halfwave Dipole	Hpol	35.2	15.47	
	Vpol			
Peak Directional Gain at Horizontal over Halfwave Dipole	Hpol	23.5	13.71	
	Vpol			
Circularity Directional		dB		
Axial Ratio		dB		
Beam Tilt		0.75 deg		
Average Power		80 kW	19.03 dBk	
Antenna Input T/L		8-3/16 in	75.0 ohm	Type: EIA/DCA EHT
Maximum Antenna Input VSWR		Channel	1.10 : 1	Notes: 5 psi dry air or Nitrogen required.
Patterns Azimuth / Elevation		TUA-C4SP-5030 12U219075	12U219075-90	

Mechanical Specifications		Metric	English		
Height with Lightning Protector	H4	m	ft		
Height Less Lightning Protector	H2	14.5 m	47.6 ft		
Height of Center of Radiation	H3	7.0 m	23.8 ft		
Basic Wind Speed	V	136.8 km/h	85 mi/h		
Structure Class IV	Exposure Category	C	Topographic Category	1	TIA/EIA-222-G
Effective Projected Area	(EPA)a	25.5 m²	275.0 ft²		
Moment Arm	D1	7.3 m	23.8 ft		
Effective Projected Area	(EPA)a	2.5 m²	26.5 ft²	Above antenna top flange	
Moment Arm	D3	3.41 m	11.2 ft	Above antenna top flange	
Weight	W	6.8 t	14900.0 lbs		
Radome Individual Panel				Orange	

Antenna designed in accordance with AISC specifications for design of structural steel for building as prescribed by TIA/EIA-222-G.

NOTE:
Prepared By : SRR RMS Approved By : AJS
Original Date : 8-Mar-07
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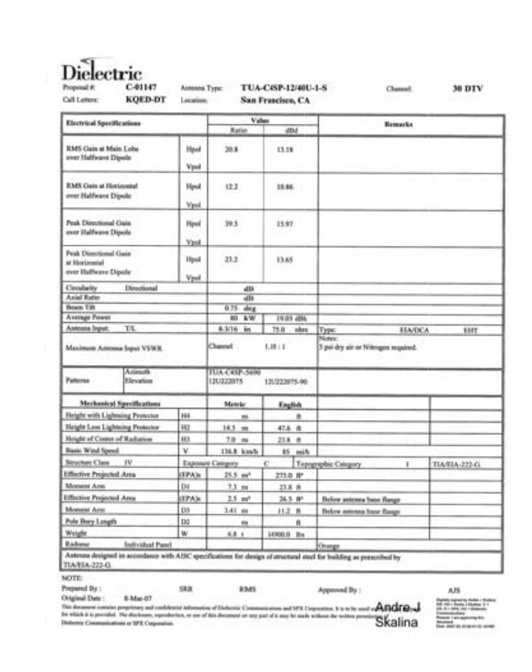
6 ANTENNA REFERENCE Q



Dielectric

Proposal #:	C-01147	Antenna Type:	TUA-C4SP-12/40U-1-S	Channel:	30 DTV
Call Letters:	KQED-DT	Location:	San Francisco, CA		

Electrical Specifications		Value Ratio	Value dBd	Remarks
RMS Gain at Main Lobe over Halfwave Dipole	Hpol	20.8	13.18	
	Vpol			
RMS Gain at Horizontal over Halfwave Dipole	Hpol	12.2	10.86	
	Vpol			
Peak Directional Gain over Halfwave Dipole	Hpol	39.5	15.97	
	Vpol			
Peak Directional Gain at Horizontal over Halfwave Dipole	Hpol	23.2	13.65	
	Vpol			
Circularity Directional		dB		
Axial Ratio		dB		
Beam Tilt		0.75 deg		
Average Power		80 kW	19.03 dBk	
Antenna Input T/L		8-3/16 in	75.0 ohm	Type: EIA/DCA EHT
Maximum Antenna Input VSWR		Channel	1.10 : 1	Notes: 5 psi dry air or Nitrogen required.
Patterns Azimuth / Elevation		TUA-C4SP-5690 12U222075	12U222075-90	

Mechanical Specifications		Metric	English		
Height with Lightning Protector	H4	m	ft		
Height Less Lightning Protector	H2	14.5 m	47.6 ft		
Height of Center of Radiation	H3	7.0 m	23.8 ft		
Basic Wind Speed	V	136.8 km/h	85 mi/h		
Structure Class IV	Exposure Category	C	Topographic Category	1	TIA/EIA-222-G
Effective Projected Area	(EPA)a	25.5 m²	275.0 ft²		
Moment Arm	D1	7.3 m	23.8 ft		
Effective Projected Area	(EPA)a	2.5 m²	26.5 ft²	Below antenna base flange	
Moment Arm	D3	3.41 m	11.2 ft	Below antenna base flange	
Pole Bury Length	D2	m	ft		
Weight	W	6.8 t	14900.0 lbs		
Radome Individual Panel				Orange	

Antenna designed in accordance with AISC specifications for design of structural steel for building as prescribed by TIA/EIA-222-G.

NOTE:
Prepared By : SRR RMS Approved By : AJS
Original Date : 8-Mar-07
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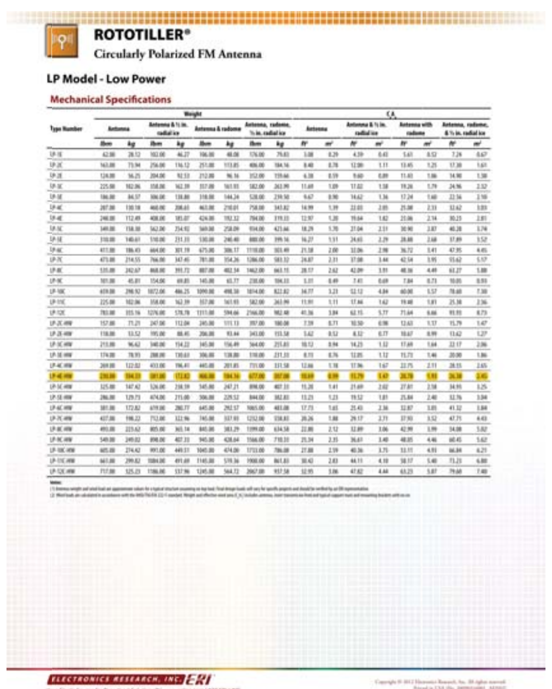


ROTOTILLER®
Circularly Polarized FM Antenna

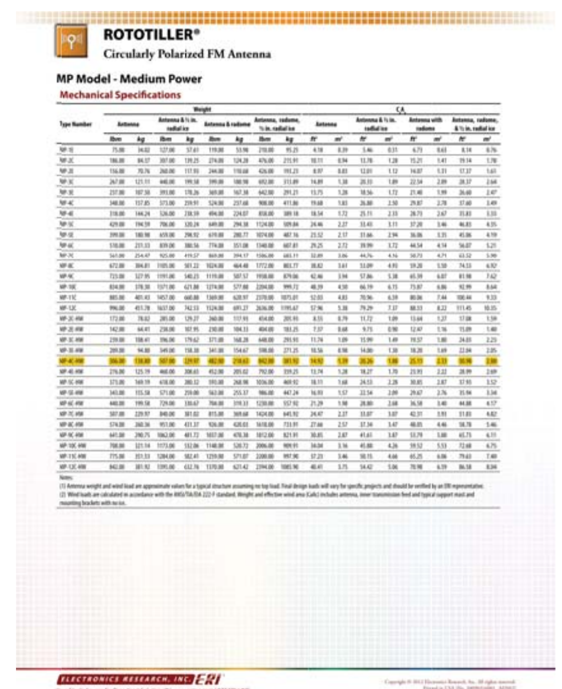
LP Model - Low Power

Mechanical Specifications

Type Number	Weight: Antenna lbm	kg	Antenna & ½ in. radial ice lbm	kg	Antenna & radome lbm	kg	Antenna, radome, ½ in. radial ice lbm	kg	C_A: Antenna ft²	m²	Antenna & ½ in. radial ice ft²	m²	Antenna with radome ft²	m²	Antenna, radome, & ½ in. radial ice ft²	m²

ELECTRONICS RESEARCH, INC. ERI

16 ANTENNA REFERENCE S



ROTOTILLER®
Circularly Polarized FM Antenna

MP Model - Medium Power

Mechanical Specifications

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18 ANTENNA REFERENCE X

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Consultant

No.	Date	Description	By
0	5/22/19	ISSUED FOR PERMIT	ROH
	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

Project: BROADCAST CHANNEL REPACKING PROJECT
1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Drawing Title: ANTENNA REFERENCES

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	N.T.S.

Seal: REGISTERED PROFESSIONAL ENGINEER RONALD O. HAMBURGER No. 2951 STRUCTURAL STATE OF CALIFORNIA
Date Signed: 5/22/19

Drawing No. S1.5

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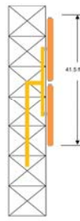
Dielectric

MECHANICAL SPECIFICATIONS



Proposal No.	C-71095
Date	23-Feb-18
Call Letters	KGO
Channel	12
Frequency	207 MHz
Antenna Type	TLS-V8/VP-R C160

Preliminary Specifications

Side Mounted

Without ice TIA-222-G

Height AGL(a)	720 ft (219.5 m)
Basic Wind Speed	85 mih (136.8 km/h)
Structure Class	IV
Exposure Category	C
Topography Category	1

Mechanical Specifications

Height	H2	41.5 ft (12.6m)	
Height of Center of Radiation	H3	20.8 ft (6.3m)	
Effective Projected Area	$(EPA)_A$	71.25 ft² (6.6m²)	Mounts Excluded
Weight	W	1350 lb (0lb)	Mounts Excluded

Antenna designed in accordance with AISC specifications for design of structural steel as prescribed by TIA-222-G

Prepared by: JBC **Date:** 23-Feb-18 **ME:** **EE:**

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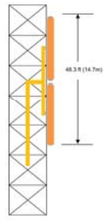
5706.3106 6 ANTENNA REFERENCE Y

Dielectric

MECHANICAL SPECIFICATIONS



Proposal No.	C-71094
Date	23-Feb-18
Call Letters	KRON
Channel	7
Frequency	177 MHz
Antenna Type	TLS-V8/VP-R C160

Preliminary Specifications

Side Mounted

Without ice TIA-222-G

Height AGL(a)	720 ft (219.5 m)
Basic Wind Speed	85 mih (136.8 km/h)
Structure Class	IV
Exposure Category	C
Topography Category	1

Mechanical Specifications

Height	H2	48.3 ft (14.7m)	
Height of Center of Radiation	H3	24.2 ft (7.4m)	
Effective Projected Area	$(EPA)_A$	96.5 ft² (9m²)	Mounts Excluded
Weight	W	1550 lb (C.ft)	Mounts Excluded

Antenna designed in accordance with AISC specifications for design of structural steel as prescribed by TIA-222-G

Prepared by: JBC **Date:** 23-Feb-18 **ME:** **EE:**

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5706.3106 8 ANTENNA REFERENCE Z

Dielectric

Antenna Model: DCRQ4C50

Proposal Number:	C-71146-2
Date:	2-Jan-18
Customer:	Sutro Tower Inc.
Location:	San Francisco, CA

Electrical Specifications

Polarization:	Circular				
Azimuth Pattern:	Omni				
Antenna Input:	3-1/8"	50 Ohm	EIA/DCA		
VSWR:	Channel	1.10 : 1		Band	1.10 : 1
Bandwidth:	12 MHz				
Rated Input Power:	30 kW	(14.77 dBk)	Maximum combined average power		

Mechanical Specifications

Mounting:	Side Mounted			
Environmental Protection:	Feed Point			
Height:	23.4 ft (7.1m)			
Weight:	1000 lb (0.5t)	Excludes Mounts		
Effective Projected Area:	42 ft² (3.9m²)	TIA-222-G	Basic Wind Speed:	85 m/h (136.8 km/h)

Channel Specifications

	Call	CH	Freq	Hpol ERP	Vpol ERP	TPO	RMS Main Lobe Hpol Gain	RMS Main Lobe Vpol Gain	RMS at Horizontal Hpol Gain	RMS at Horizontal Vpol Gain
1	TBA	3	63 MHz	18.0 kW (12.55 dBk)	18.0 kW (12.55 dBk)	17.7 kW (12.48 dBk)	1.28 (1.06dB)	1.28 (1.06dB)	1.28 (1.06dB)	1.28 (1.06dB)
2	TBA	4	69 MHz	18.0 kW (12.55 dBk)	18.0 kW (12.55 dBk)	16.9 kW (12.28 dBk)	1.35 (1.30dB)	1.35 (1.30dB)	1.35 (1.30dB)	1.35 (1.30dB)

Andre J Skalinu
I have reviewed this document
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5706.3106 16 ANTENNA REFERENCE AA

Dielectric

Antenna Model: DCRQ4C50

Proposal Number:	C-71146-2
Date:	2-Jan-18
Customer:	Sutro Tower Inc.
Location:	San Francisco, CA

Electrical Specifications

Polarization:	Circular				
Azimuth Pattern:	Omni				
Antenna Input:	3-1/8"	50 Ohm	EIA/DCA		
VSWR:	Channel	1.10 : 1		Band	1.10 : 1
Bandwidth:	12 MHz				
Rated Input Power:	30 kW	(14.77 dBk)	Maximum combined average power		

Mechanical Specifications

Mounting:	Side Mounted			
Environmental Protection:	Feed Point			
Height:	23.4 ft (7.1m)			
Weight:	1000 lb (0.5t)	Excludes Mounts		
Effective Projected Area:	42 ft² (3.9m²)	TIA-222-G	Basic Wind Speed:	85 m/h (136.8 km/h)

Channel Specifications

	Call	CH	Freq	Hpol ERP	Vpol ERP	TPO	RMS Main Lobe Hpol Gain	RMS Main Lobe Vpol Gain	RMS at Horizontal Hpol Gain	RMS at Horizontal Vpol Gain
1	TBA	3	63 MHz	18.0 kW (12.55 dBk)	18.0 kW (12.55 dBk)	17.7 kW (12.48 dBk)	1.28 (1.06dB)	1.28 (1.06dB)	1.28 (1.06dB)	1.28 (1.06dB)
2	TBA	4	69 MHz	18.0 kW (12.55 dBk)	18.0 kW (12.55 dBk)	16.9 kW (12.28 dBk)	1.35 (1.30dB)	1.35 (1.30dB)	1.35 (1.30dB)	1.35 (1.30dB)

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5706.3106 18 ANTENNA REFERENCE AC

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No.	Date	Description	By
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	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

BROADCAST CHANNEL REPACKING PROJECT

**1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA**

Project

ANTENNA REFERENCES

Drawing Title

Commission 067199.24	Checked BW	Date 09/06/17
Drawn GPN	Approved ROH	Scale N.T.S.

REGISTERED PROFESSIONAL ENGINEER RONALD O. HAMBURGER No. 2951 STRUCTURAL STATE OF CALIFORNIA

Seal

Drawing No. **S1.6**

Date Signed: 5/22/19

1 VIEW OF TOWER BEFORE REPACK

2 VIEW OF TOWER AFTER REPACK

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No.	Date	Description	By
0	5/22/19	ISSUED FOR PERMIT	ROH
	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

BROADCAST CHANNEL REPACKING PROJECT

**1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA**

Project

VIEW OF TOWER BEFORE AND AFTER REPACK

Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	NONE

Drawing No.

S1.7

REGISTERED PROFESSIONAL ENGINEER RONALD O. HAMBURGER No. 2951 STATE OF CALIFORNIA

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Engineering of Structures and Building Enclosures

SHEET NO.
PROJECT NO. 067199.24
DATE 5/22/19
BY RJW
CLIENT Sutro Tower
SUBJECT Digital Repack Lateral Load Calculation
CHECKED BY ROH

To determine whether any local member or connection strengthening is required by the Stack B replacement, we used our SAP2000 Model to compare the demand to capacity ratio between the pre and post repack configurations. The new Stack B mast and antenna weighs 35% more, and has a 16% larger projected area, than the existing Stack B mast and antenna. Our SAP2000 model includes the new configuration, weight, and wind load for Stack B. We modified the member self-weights and applied wind loads by the ratio of the Stack B member self-weight (0.74) and projected area (0.86) pre-repack and post-repack. To determine the percent increase in member demands from the pre-repack configuration we analyzed the tower for two conditions (three load cases):

1. Gravity loading, using the following load combination:
   - 1.4D
2. Wind loading, using the following load combinations:
   - 0.9D+W
   - 1.2D+W

We analyzed the tower for both conditions, ran post processing spreadsheets for every member in the tower, and compared the DCR's associated with capacities computed in accordance with the San Francisco Building Code (SFBC). For wind loading, we determined DCR's for each load combination as well as an envelope load combination.

Under the SFBC, a local retrofit is required if the following conditions are met:

1. Gravity loading
   - The DCR in the post-repack configuration is greater than 1.0, and
   - The ratio of DCR's post-repack to pre-repack is greater than 1.05
2. Wind Loading
   - The DCR in the post-repack configuration is greater than 1.0, and
   - The ratio of DCR's post-repack to pre-repack is greater than 1.10

Our analyses showed that no local mandatory retrofits are required. The max increase in DCR's due to gravity loading is 1.03. The max increase in envelope DCR's due to wind loading is 1.08.

We also evaluated the Tower's response to MCE_R ground motion in the new configuration and found that all the members and connections are adequate to resist the MCE_R demands in the new configuration without modification.

See below for Tables 1 and 2, which report the maximum increase in the envelope DCR by element type for Wind and Gravity Loading, respectively.

SIMPSON GUMPERTZ & HEGER
Engineering of Structures and Building Enclosures

SHEET NO.
PROJECT NO. 067199.24
DATE 5/22/19
BY RJW
CLIENT Sutro Tower
SUBJECT Digital Repack Lateral Load Calculation
CHECKED BY ROH

Element Type	Element ID	MAX DCR_{new}/DCR_{old} if $DCR_{new}>1$
Wide Flange - Truss	65064	1.08
Wide Flange - Leg	7131	1.03
Stack Solid Round	-	-
Steel Cable	80029	1.02
Kevlar Cable	-	-
Double Angle - Truss	40415	1.02
Double Angle - Stack	-	-
Double Angle - Leg	5576	1.05
Double Angle	6275	1.05

Table 1 - Maximum Envelope DCR Increase for Wind Loading

Element Type	Element ID	MAX DCR_{new}/DCR_{old} if $DCR_{new}>1$
Wide Flange - Truss	61001	0.96
Wide Flange - Leg	-	-
Stack Solid Round	-	-
Steel Cable	-	-
Kevlar Cable	-	-
Double Angle - Truss	-	-
Double Angle - Stack	-	-
Double Angle - Leg	-	-
Double Angle	836	1.03

Table 2 – Maximum DCR Increase for Gravity Loading

6 CALCULATION SUMMARY

SIMPSON GUMPERTZ & HEGER
Engineering of Structures and Building Enclosures

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	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

BROADCAST CHANNEL REPACKING PROJECT

**1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA**

Project

ANALYSIS SUMMARY

Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	N.T.S.

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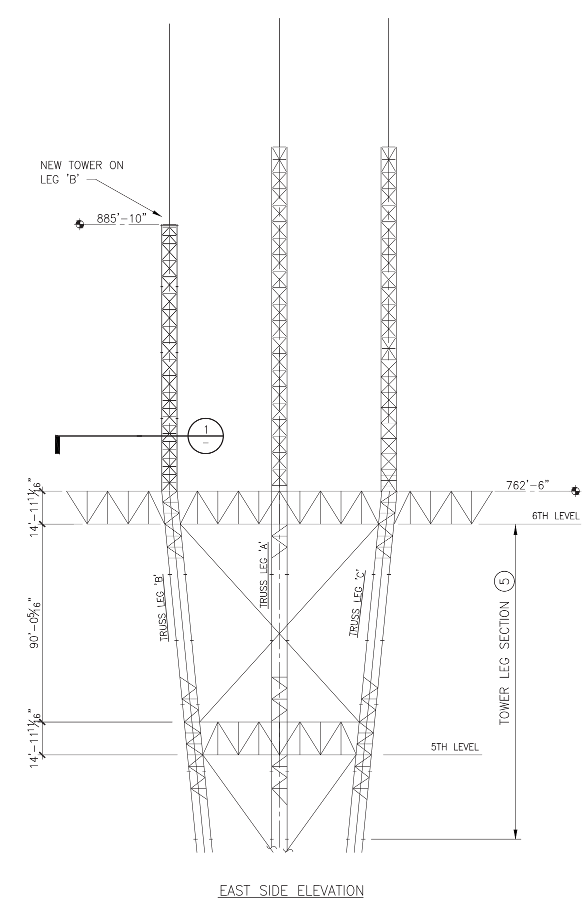
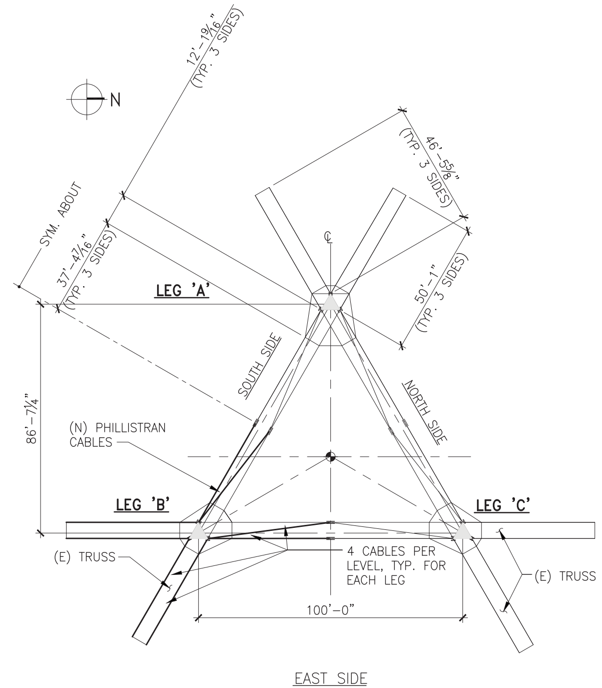
Drawing No. **S1.8**

Date Signed: 5/23/19

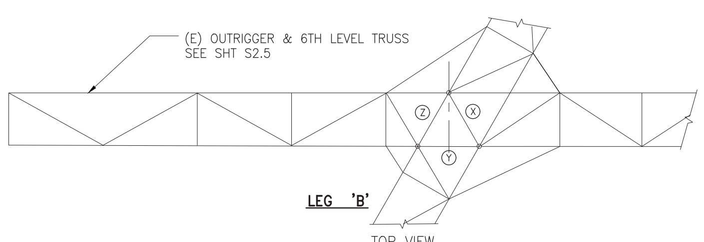


TOWER WORK POINT ELEVATION

SCALE: 1/32" = 1'-0"

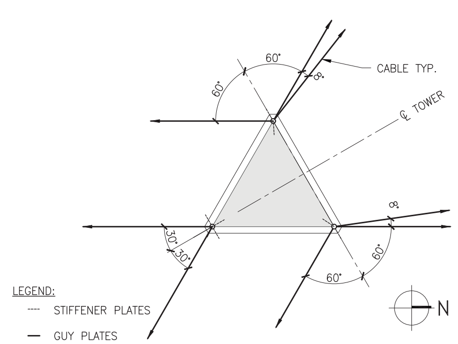


TYPICAL GUY CABLES LAYOUT PLAN



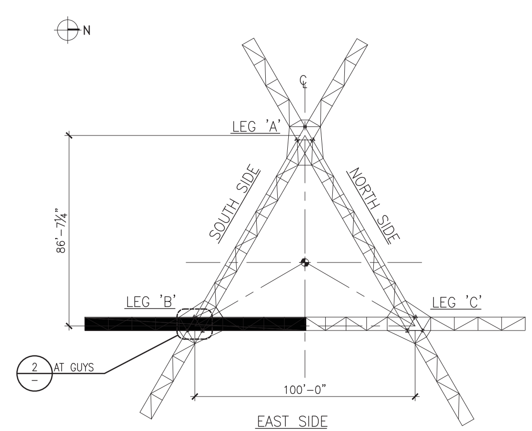
1 SECTION

SCALE: 1/8"=1'-0"

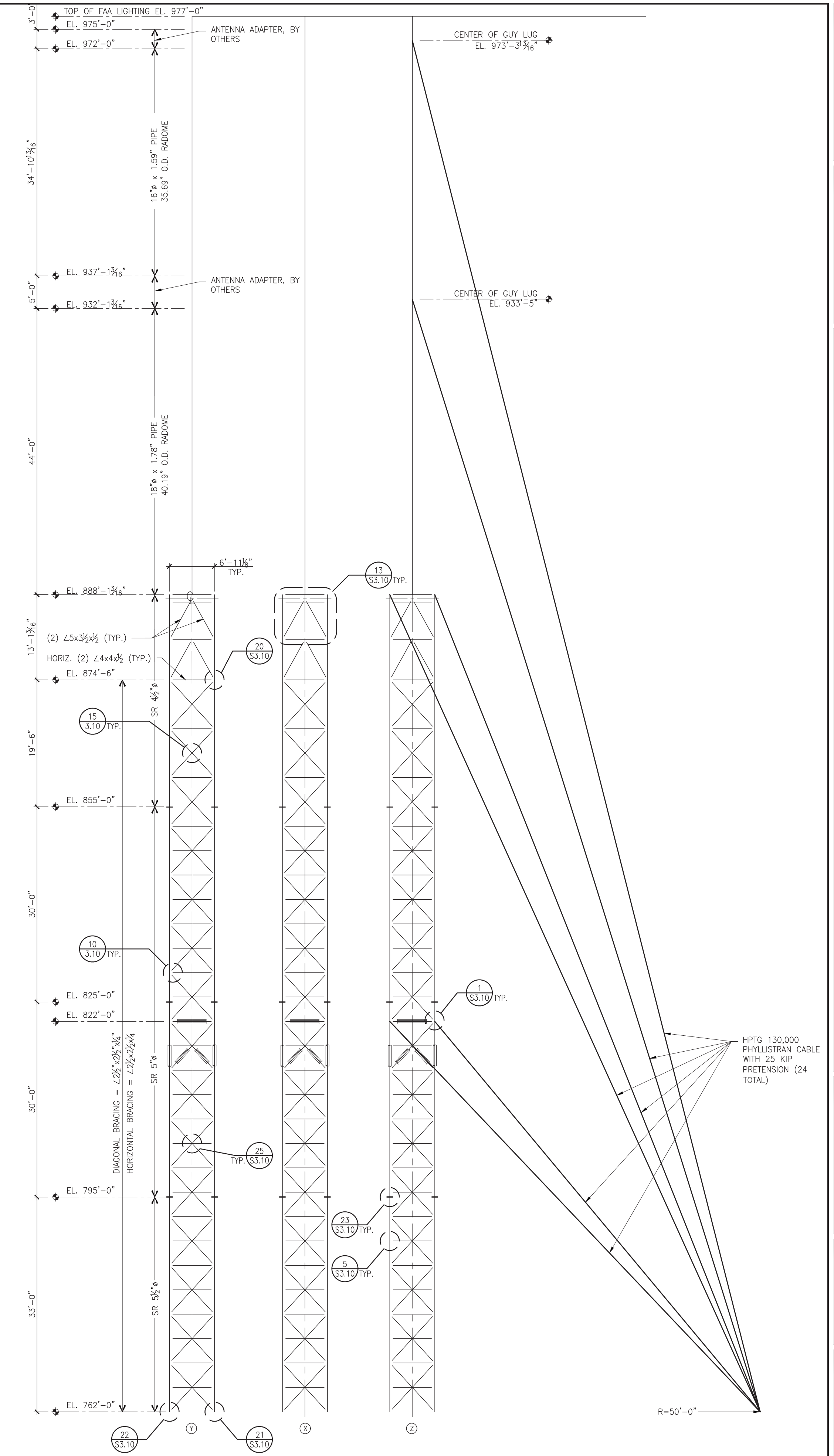


2 KEY PLAN - CABLES & GUY PLATES ORIENTATION

SCALE: 1/4"=1'-0"



KEY PLAN - 6TH LEVEL



LEG 'B' ELEVATION

SCALE: 1/8" = 1'-0"

ANTENNA STACK SUPPORTS

SIMPSON GUMPERTZ & HEGER
Engineering of Structures and Building Enclosures
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1. S.R. INDICATE SOLID ROUND CONFORMING TO ASTM A572-GR.50
2. HEAVY LINES REPRESENT NEW ELEMENTS

No.	Date	Description	By
0	5/22/19	ISSUED FOR PERMIT	ROH
	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

BROADCAST CHANNEL REPACKING PROJECT

1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

ANTENNA STACK SUPPORTS LEG B

Drawing Title

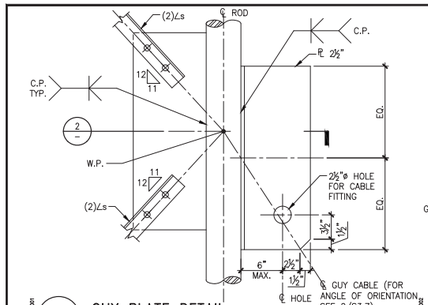
Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	AS NOTED

Drawing No. S3.8

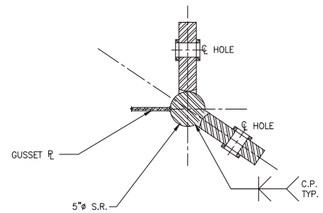
Seal: REGISTERED PROFESSIONAL ENGINEER RONALD O. HAMBURGER No. 2951 STRUCTURAL STATE OF CALIFORNIA

Date Signed: 5/22/19

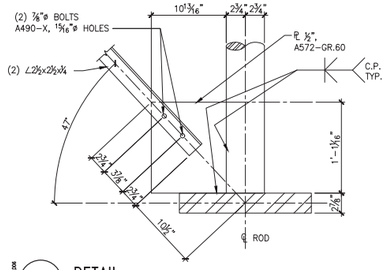
I:\SF\Projects\2006\067199.24-STKB\Drawings\Working_Set - Mandatory Retrofit\STKB_S308.dwg



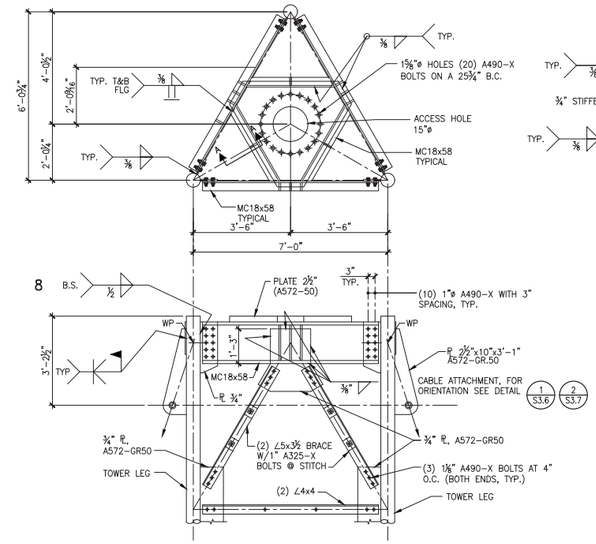
STKB_S310_001 1 GUY PLATE DETAIL
SCALE: 1 1/2"=1'-0"



STKB_S310_002 2 DETAIL
SCALE: 1 1/2"=1'-0"



STKB_S310_004 6 DETAIL
SCALE: 1 1/2"=1'-0"



8

STKB_S310_003 13 ANTENNA BASE CONFIGURATION
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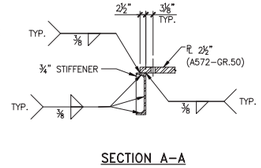
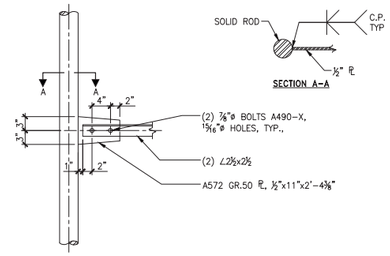
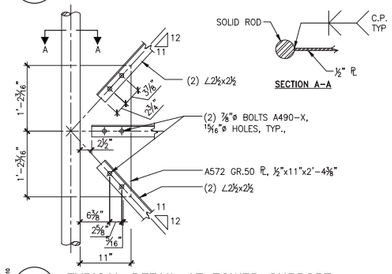


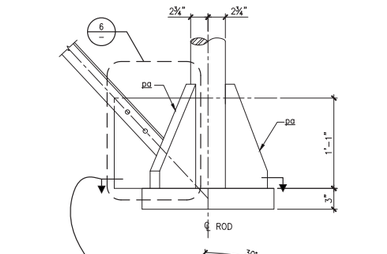
SECTION A-A

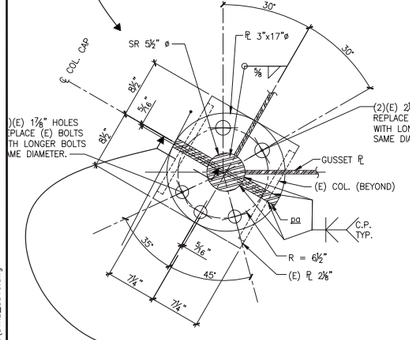


STKB_S310_005 5 TYPICAL DETAIL AT TOWER SUPPORT
SCALE: 1"=1'-0"

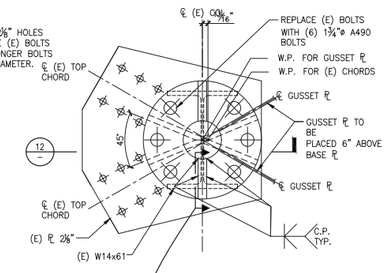


STKB_S310_010 10 TYPICAL DETAIL AT TOWER SUPPORT
SCALE: 1"=1'-0"

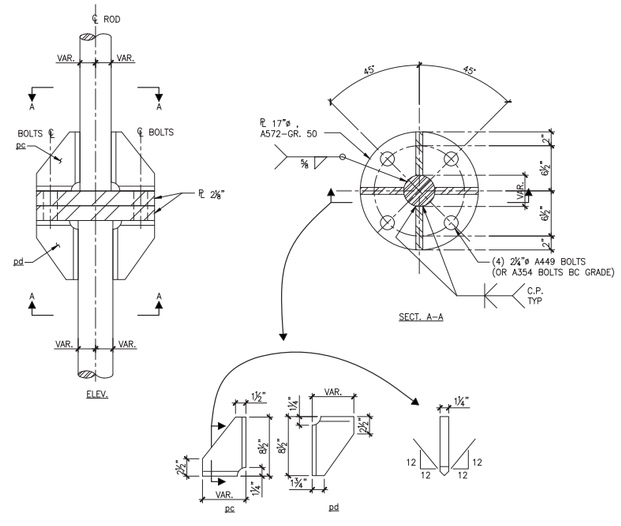




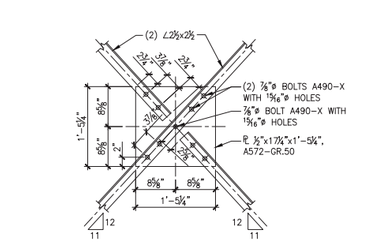
STKB_S310_021 21 BASE PLATE AT STRONG COLUMN
SCALE: 1 1/2"=1'-0"



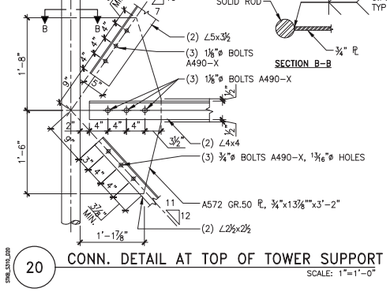
STKB_S310_022 22 BASE PLATE AT WEAK COLUMN
SCALE: 1 1/2"=1'-0"



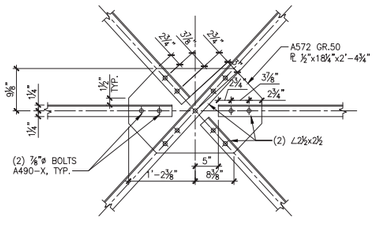
STKB_S310_023 23 TYPICAL SPLICE BEARING PLATE
SCALE: 1 1/2"=1'-0"



STKB_S310_025 25 CONNECTING PLATE DETAIL AT TOWER SUPPORT
SCALE: 1"=1'-0"



STKB_S310_020 20 CONN. DETAIL AT TOP OF TOWER SUPPORT
SCALE: 1"=1'-0"



STKB_S310_024 24 BRACE CONNECTING PLATE DETAIL AT TOWER SUPPORT
SCALE: 1"=1'-0"

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NOTE:

1. ALL PLATES ARE ASTM A572 GR.50 U.O.N.

No.	Date	Description	By
0	5/22/19	ISSUED FOR PERMIT	ROH
	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

BROADCAST CHANNEL REPACKING PROJECT

1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

DETAILS FOR STACK B

Drawing Title

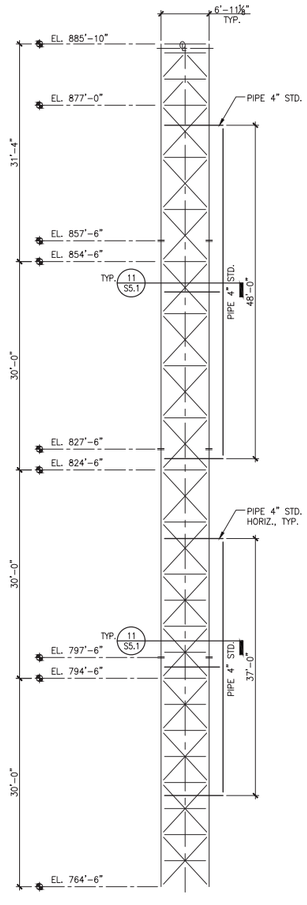
Commission	Checked	Date
067199.24	EW	09/06/17
Drawn	Approved	Scale
GPN	ROH	AS NOTED

REGISTERED PROFESSIONAL ENGINEER RONALD O. HAMBURGER No. 2951 STRUCTURAL STATE OF CALIFORNIA

Seal

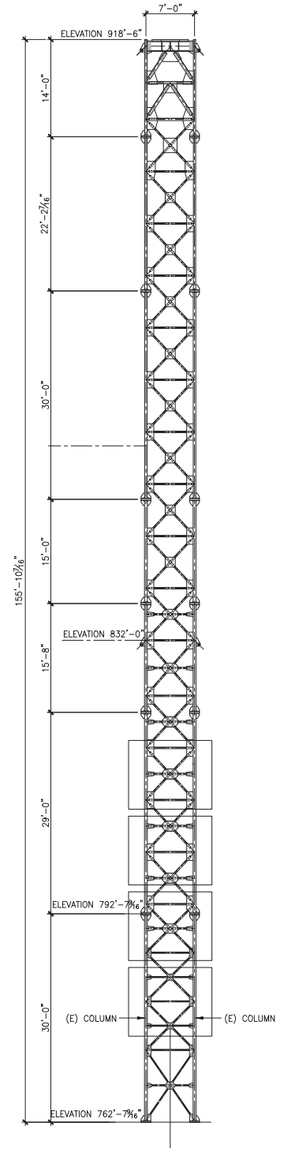
Drawing No. **S3.10**

Date Signed: 5/22/19



23 ANTENNA MOUNT STACK "B"

SCALE: 1/8"=1'-0"



25 ANTENNA MOUNT STACK "C"

SCALE: 1/8"=1'-0"

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BROADCAST CHANNEL REPACKING PROJECT

**1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA**

Project

ANTENNA MOUNT STACKS

Drawing Title

Commission	Checked	Date
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GPN	ROH	AS NOTED

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Drawing No.

S3.12

Date Signed: 5/22/19

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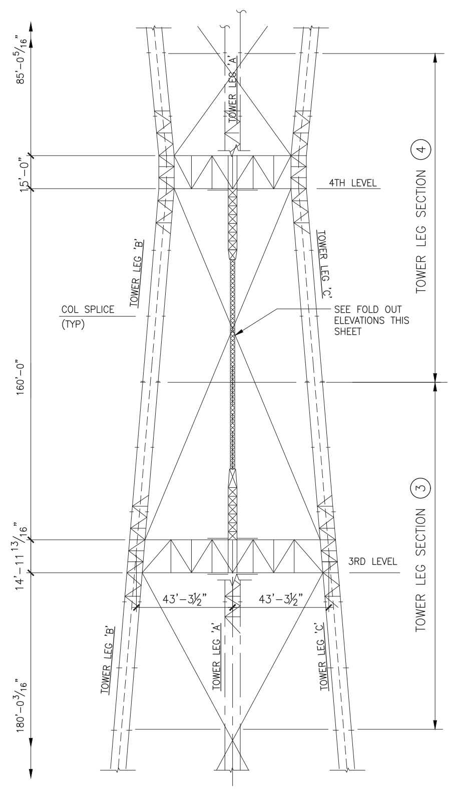
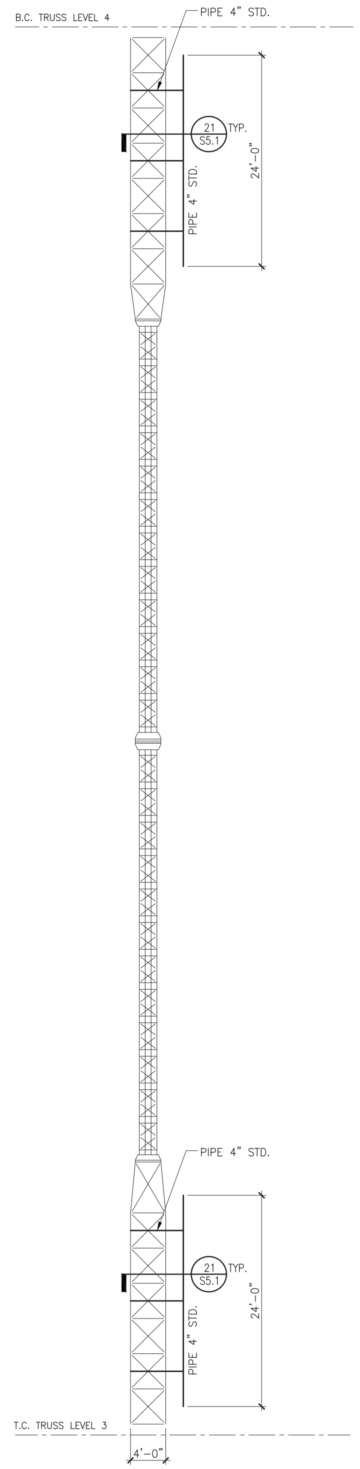
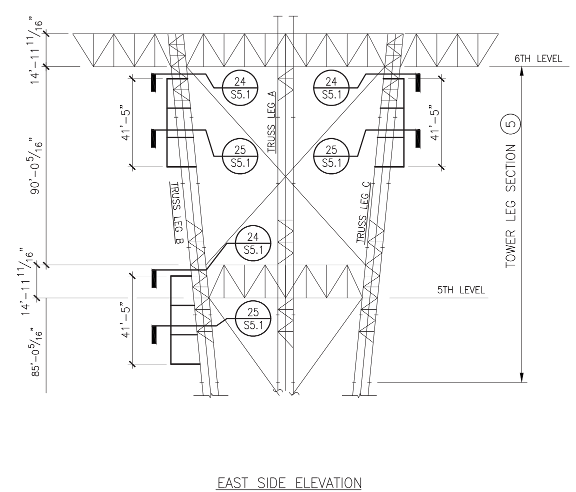


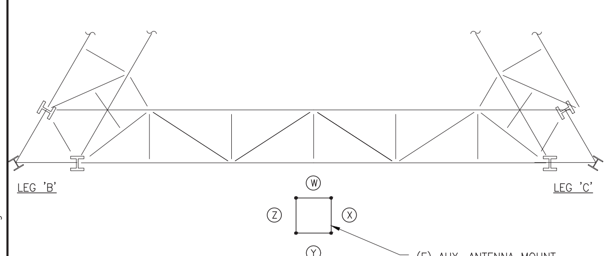
11 TOWER WORK POINT ELEVATION
SCALE: 1/32"=1'-0"



17 AUXILIARY ANTENNA ELEVATION
SCALE: 1/8"=1'-0"



13 TOWER WORK POINT ELEVATION
SCALE: 1/32"=1'-0"



16 AUXILIARY ANTENNA LOCATION
SCALE: 1/8"=1'-0"

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	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

BROADCAST CHANNEL REPACKING PROJECT

1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

NDTV
AUXILIARY ANTENNA ELEVATION & SECTIONS

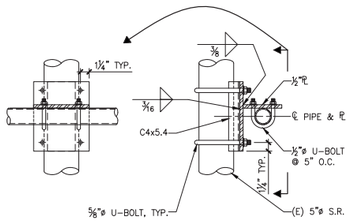
Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	AS NOTED

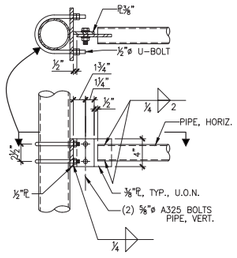
Seal

Date Signed: 5/22/19

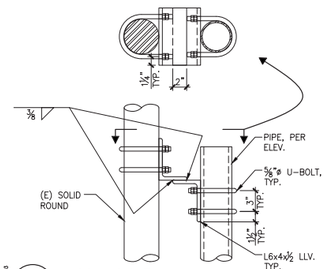
Drawing No.
S3.13



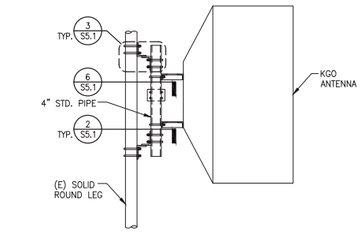
STKB_S501_001 1 KGO MOUNT SCALE: 1 1/2"=1'-0"



STKB_S501_002 2 DETAIL SCALE: 1 1/2"=1'-0"



STKB_S501_003 3 KGO MOUNT SCALE: 1 1/2"=1'-0"



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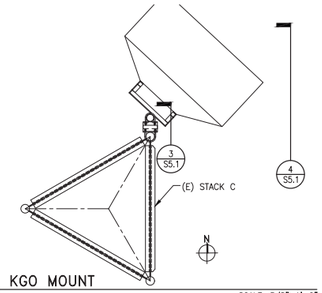
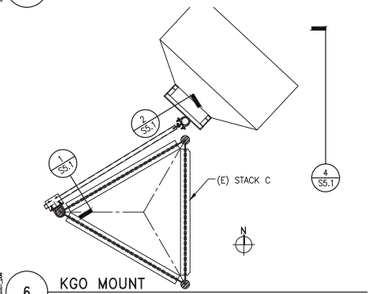


STKB_S501_005 5 KGO MOUNT SCALE: 3/8"=1'-0"



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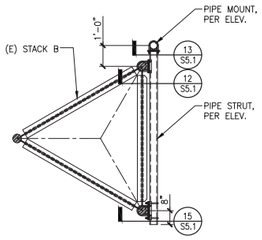
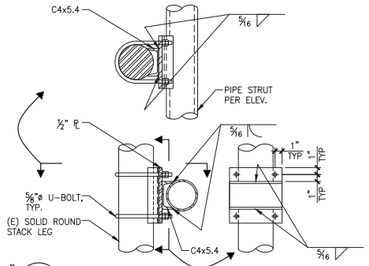


STKB_S501_011 11 KQED AUX MOUNT SCALE: 3/8"=1'-0"



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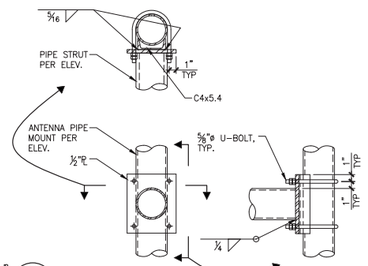

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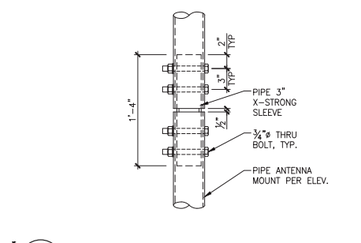
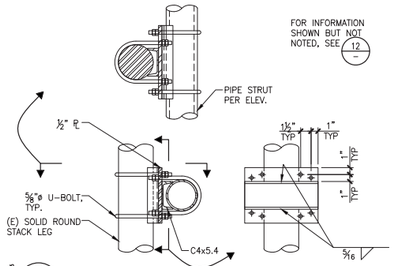
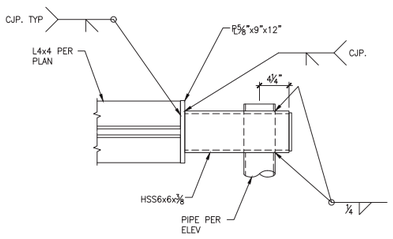


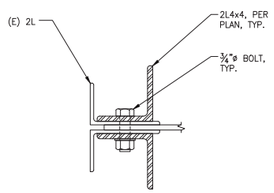
STKB_S501_014 14 KQED AUX MOUNT SPLICE SCALE: 1 1/2"=1'-0"



STKB_S501_015 15 KQED AUX MOUNT SCALE: 1 1/2"=1'-0"



STKB_S501_016 16 DETAIL SCALE: 1 1/2"=1'-0"



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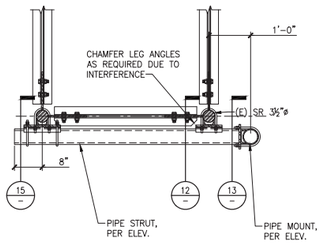
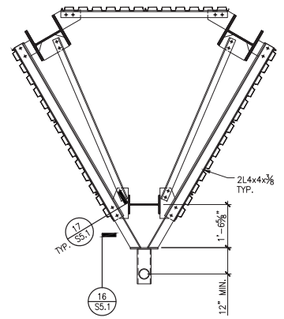
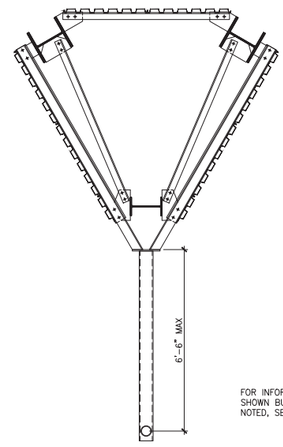


STKB_S501_021 21 DETAIL SCALE: 3/4"=1'-0"



STKB_S501_024 24 DETAIL SCALE: 1/2"=1'-0"



STKB_S501_025 25 DETAIL SCALE: 1/2"=1'-0"

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BROADCAST CHANNEL REPACKING PROJECT

1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

DETAILS

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Drawn	Approved	Scale
GPN	ROH	AS NOTED

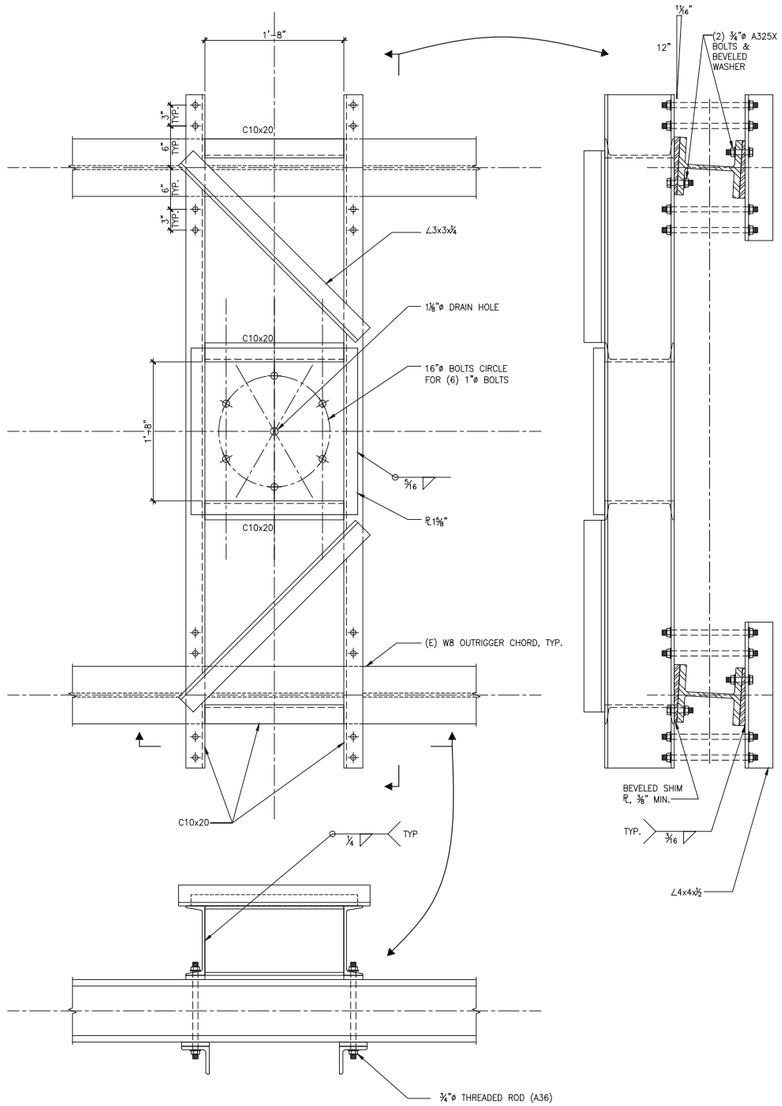
REGISTERED PROFESSIONAL ENGINEER RONALD O. HAMBURGER No. 2951 STRUCTURAL STATE OF CALIFORNIA

Seal

Date Signed: 5/22/19

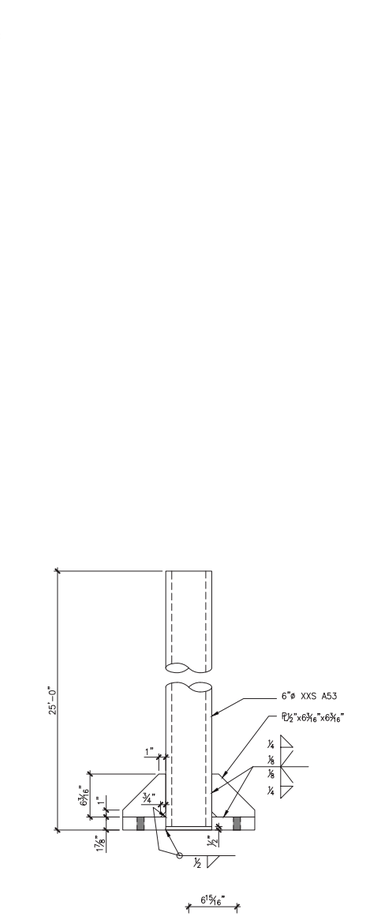
Drawing No.

S5.1



21 ANTENNA MOUNT

SCALE: 1 1/2"=1'-0"



23 ANTENNA MOUNT

SCALE: 1 1/2"=1'-0"

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BROADCAST CHANNEL REPACKING PROJECT

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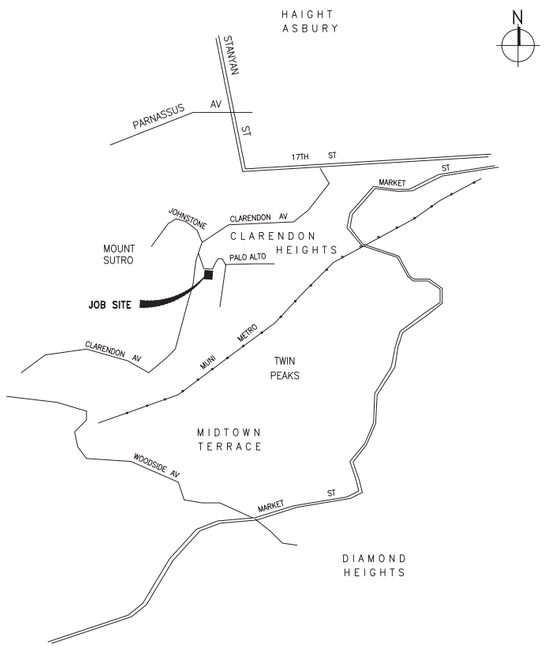
Date Signed: 5/22/19

Drawing No.

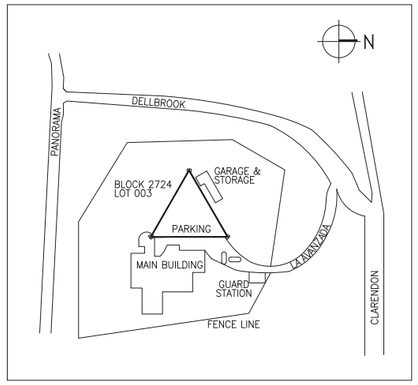
S5.2

SUTRO TOWER
1 LA AVANZADA STREET
SAN FRANCISCO, CALIFORNIA
MAINTENANCE PERMIT
TEMPORARY CLADDING REMOVAL

VICINITY MAP



SITE MAP



LIST OF DRAWINGS

SCOPE OF WORK

REMOVE CLADDING FROM TOWER LEGS ABOVE LEVEL 4 TO FACILITATE INSTALLATION OF BROADCAST REPACKING PROJECT.

SIMPSON GUMPERTZ & HEGER

Engineering of Structures and Building Enclosures

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Consultant

No.	Date	Description	By
	4/22/19	PERMIT SUBMITTAL	ROH

SUTRO TOWER
CLADDING
MAINTENANCE REMOVAL
1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

TITLE SHEET
VICINITY MAP
&
LIST OF DRAWINGS

Drawing Title

Commission	Checked	Date
067199.22		07/12/2018
Drawn	Approved	Scale
GPN		AS NOTED

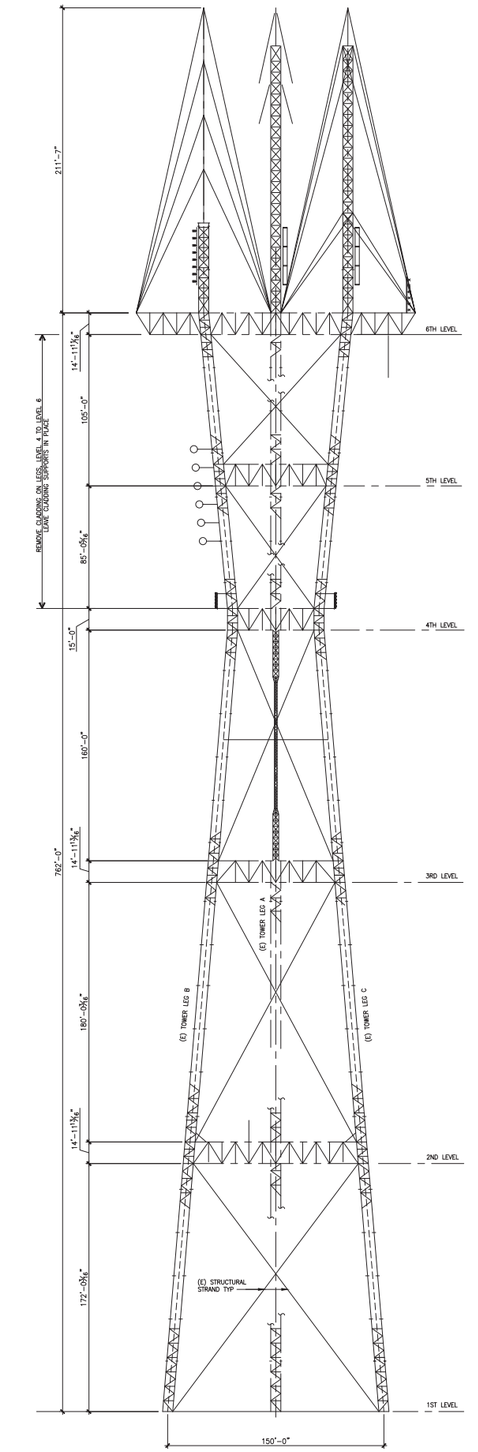
REGISTERED PROFESSIONAL ENGINEER
RONALD D. HAMBURGER
No. 2951
STRUCTURAL
STATE OF CALIFORNIA

Seal

Drawing No.

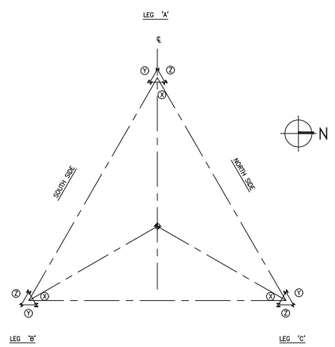
S0.0

6/24/19



EAST SIDE ELEVATION
(OTHER ELEVATIONS SIMILAR)

TOWER REFERENCE ELEVATION
(SHOWING (N) ITEMS TO BE INSTALLED)



EAST SIDE

REFERENCE PLAN

SIMPSON GUMPERTZ & HEGER

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NOTES:

REMOVE CLADDING FROM LEGS BETWEEN LEVELS 4 AND 6 AS NOTED ON THIS SHEET. STORE CLADDING ON SITE AS DIRECTED BY OWNER FOR RE-INSTALLATION. CLADDING PANELS TO BE REMOVED FOR THE DURATION OF THE REPACK PROJECT AND VOLUNTARY STRUCTURAL RETROFIT. THE ESTIMATED TIMELINE FOR RE-INSTALLING THE PANELS IS WITHIN 6 MONTHS FROM THE COMPLETION OF THE REPACK AND STRUCTURAL RETROFIT PROJECTS. CLADDING PANELS ARE TO BE RE-INSTALLED TO THE EXISTING CLADDING SUPPORT POINTS (SPACED @ 10'-0" O.C.) WITH STAINLESS STEEL #12 SELF-TAPPING SCREWS AT EACH RIB ON EACH SUPPORT POINT ALONG THE LENGTH OF THE PANEL. FASTEN SIDELAPS WITH STAINLESS STEEL #10 SELF-TAPPING SCREWS @ 12" O.C.

No.	Date	Description	By
1	6/24/19	REVISED AND REISSUED FOR PERMIT	ROH
	4/22/19	PERMIT SUBMITTAL	ROH

SUTRO TOWER
CLADDING
MAINTENANCE REMOVAL
1 LA AVANZADA ST.
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TOWER REFERENCE PLAN ELEVATION & SECTIONS

Drawing Title

Commission	Checked	Date
067199.22		07/12/2018
Drawn	Approved	Scale
CPN		N.T.S.

REGISTERED PROFESSIONAL ENGINEER
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6/24/19

Drawing No.

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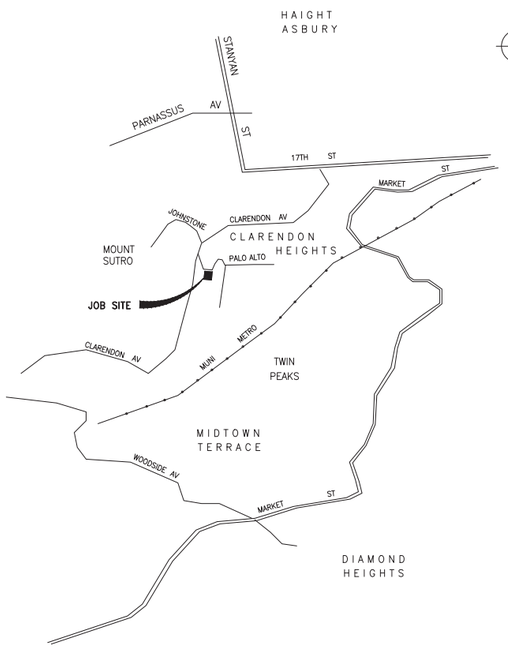
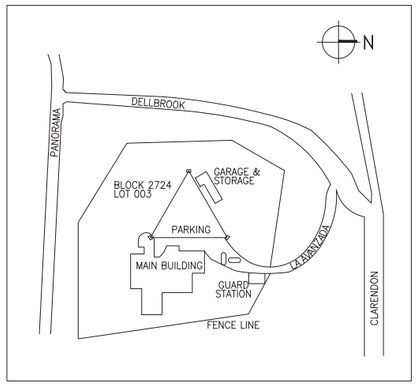
VOLUNTARY
STRUCTURAL RETROFIT
SUTRO TOWER
1 LA AVANZADA STREET
SAN FRANCISCO, CALIFORNIA

VICINITY MAP



SITE MAP



LIST OF DRAWINGS

SCOPE OF WORK

1 Structural upgrade in accordance with Section 403.9 of the San Francisco Code for Existing Buildings with the criteria to meet the wind and seismic criteria of ASCE 7-16 with eventual removal of cladding on Tower Legs. Note: Cladding removal is not included in the scope of this permit.

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0	5/30/19	ISSUED FOR PERMIT	ROH
	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

VOLUNTARY STRUCTURAL RETROFIT

**1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA**

Project

**TITLE SHEET
VICINITY MAP
&
LIST OF DRAWINGS**

Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn: GPN	Approved: ROH	Scale: AS NOTED

REGISTERED PROFESSIONAL ENGINEER
REINHOLD G. HAMBURGER
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Seal

6/24/2019

Drawing No.

S0.0

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GENERAL

1. General notes and typical details apply to all structural features, unless otherwise indicated.
2. If certain features are not fully shown or called out on the drawings or in the specifications, their construction shall be of the same character as for similar conditions.
3. Codes and standards noted in the contract documents shall be of the latest edition, unless otherwise noted.
4. Dimensions shall not be scaled off of the drawings.
5. All work shall conform to minimum standards of the 2016 San Francisco Building Code, of any codes listed in the drawings or specifications and of any regulating agencies which have authority over any portion of the work, including the State of California Division of Industrial Safety.
6. Non-structural features not fully shown or noted on the structural drawings may include but are not limited to:

   A. Architectural features

   - size and location of all door and window openings
   - size and location of all non-bearing partitions
   - size and location of all concrete curbs, floor drains, slopes and depressed areas
   - changes in level, chamfers, grooves, inserts, etc.
   - size and location of all floor and roof openings
   - stair framing and details

   B. Mechanical, plumbing and electrical features

   - pipe runs, sleeves, hangers, trenches, wall, roof and floor openings, etc.
   - electrical conduit runs, boxes, outlets in walls and slabs
   - anchorage and bracing for electrical, mechanical or plumbing equipment
   - anchor bolts for motor mounts
   - size and location of machine and equipment bases
7. Openings, pockets, etc. shall not be placed in structural members unless specifically detailed on the structural drawings. Notify the structural engineer when work requires openings, pockets, etc. in structural members not shown on the structural drawings.
8. The contractor shall be responsible for coordinating the work of all trades and shall check all dimensions and holes and openings required in structural members. All discrepancies shall be called to the attention of the structural engineer and shall be resolved before proceeding with the work.
9. The contract documents represent the finished structure. They do not indicate the method of construction. The contractor shall provide all measures necessary to protect life and property during construction. Such measures shall include, but are not limited to, bracing and shoring for loads due to construction equipment and materials. Observation visits to the site by the structural engineer shall not include inspection of the above items.
10. Construction materials shall be spread out if placed on framed floors or roofs. Load shall not exceed the design live load per square foot. Provide adequate shoring where overload is anticipated.
11. The contractor shall use extreme caution to protect all conduits, pipes, ducts, architectural finishes and utilities not indicated as being removed from damage during construction and shall restore all damaged or otherwise affected elements to their preconstruction condition, unless otherwise noted.
12. The Sutro Tower transmission facilities must remain in operation at all times during the construction period. Contractor shall submit a written work plan indicating the proposed sequence and schedule of work and specific operations to be conducted, to Sutro Tower for review, prior to performing any work on site. The work plan shall be revised and resubmitted on a weekly basis to alert Sutro Tower as to the progress of work accomplished to date and current schedule for performing additional work.
13. Sutro Tower is a radio transmission facility and emits high energy radio waves. The contractor shall be responsible for determining and implementing appropriate protective measures for personnel working on site.
14. The contractor shall maintain a fire watch and employ the necessary protective measures when welding near flammable materials.

TOWER STRUCTURE

Seismic design of tower and appurtenances has been conducted to provide equivalent performance capability to that required of essential structures under 2016 CBC. A project-specific criteria that incorporates non-linear dynamic analysis, site specific spectra and ground motions scaled to the 2475 year hazard level have been employed. A total of 11 pairs of ground motions were used for the analysis at four conditioning periods, 0.9s, 1.5s, and 3.0s. Maximum response quantities were compared against the following criteria: Tensile yielding of members – max strain $10E_y$ compressive yielding of braces – max strain $3E_y$ columns and connections are designed to remain elastic. Wind analysis is based on a site specific wind hazard study and wind tunnel test conducted by RWDI, and dated December 2017. Wind loads were combined with dead loads and live loads in accordance with ASCE 7-10. Steel design is in accordance with AISC 360-10. Wind and seismic upgrade are designed under the San Francisco Code for Existing Buildings Section 403.9, assuming cladding on legs will be removed.

EXISTING CONSTRUCTION

1. Work shown is new unless noted as existing: (E).
2. Existing construction shown on these drawings was obtained from site investigation and can be used for bidding purposes. The contractor shall verify all existing job conditions, review all drawings and verify dimensions prior to construction. The contractor shall notify the Engineer of all discrepancies and exceptions before proceeding with the work.
3. The removal, cutting, drilling, etc. of existing work shall be performed with care in order not to jeopardize the structural integrity of the structure. If structural members or mechanical, electrical or architectural features not indicated for removal interferes with the new work, the Engineer shall be notified immediately and prior approval shall be obtained before removal of members.
4. The contractor shall safely shore existing construction wherever existing supports are removed for the new work.
5. The contractor shall perform the work with minimal inconvenience to the owner and without interruption of day-to-day work operations. The contractor shall ensure safe travel of persons around areas of construction and shall coordinate all operations with the owner or the owner's agent.
6. The contractor shall promptly repair any damage caused during operations, using materials and workmanship similar to that which was damaged.
7. All removed items, materials and debris, unless otherwise noted, shall be removed promptly from the site and disposed of in a legal manner.

STRUCTURAL STEEL & MISC. METALS

1. Fabrication and erection of structural steel shall be in accordance with the "Code of Standard Practice for Steel Buildings and Bridges" AISC 303-16.
2. Materials:

A.	W shapes & MC channels:	ASTM A992 (fy = 50 ksi)
B.	Structural steel & angles:	ASTM A36 (fy = 36 ksi)
C.	All other shapes & plates:	ASTM A572 grade 50 u.o.n.
D.	Structural steel tubes:	ASTM A500 grade B (fy = 46 ksi)
E.	Structural steel pipes:	ASTM A53 grade B (fy = 35 ksi)

3. Bolts are High-strength (ASTM A490-X), unless otherwise noted on drawings:

A.	Machine bolts:	ASTM A307

4. Bolt holes in steel shall be $\frac{1}{16}$ inch larger diameter than nominal size of bolt used, unless otherwise noted.
5. For bolted connections, provide 1½ inch edge and end distance, unless otherwise noted.
6. All welds shall be prequalified or qualified by test in conformance with the "Structural Welding Code – Steel" (AWS D1.1-04) of the American Welding Society. Minimum tensile strength of weld metal shall be 70 ksi typical, unless otherwise noted. Welding electrodes shall be as recommended by their manufacturer for the position and other conditions of actual use. Weld filler metal shall have minimum Charpy V-notch toughness of 20 ft-lbs at 0°F.
7. Weld symbols shown on the drawings do not necessarily differentiate between shop weld and field welds. When field welds are necessary due to construction procedure or sequence, welds shall be provided and be inspected per specifications. All welds shown as field welds shall be done in the field as indicated.
8. All structural steel, miscellaneous metal and connectors exposed to weather shall be hot-dip galvanized after fabrication. Finish paint shall be in accordance with owner's specification. Galvanizing of ASTM A490 bolts shall conform to ASTM F1136 Grade 3.
9. No penetrations through structural steel columns, beams or girders are allowed except as indicated on the structural drawings.
10. The structural steel fabricator shall furnish shop drawings of all steel for the engineer's review before fabrication.
11. A welding procedure specification (W.P.S.) per A.W.S. D1.1 shall be developed by the fabricator/erector and approved by the engineer of record or his designee. The W.P.S. shall include the welding parameters recommended by the electrode manufacturer.
12. All complete joint penetration groove welds shall be inspected and tested per City of San Francisco requirements.
13. Inspectors are to be S.F. City deputy inspectors and A.W.S. Q.C.I. Certified (a C.W. Inspector), reference A.W.S. D1.1-10, Section 6.1.3.1.
14. All bolted connections shall be installed as required for Slip-Critical (SC) joints including the preparation of faying surfaces and tensioning.
15. All faying surfaces for friction-bolted connections of galvanized members shall be roughened by means of hand wire brushing after galvanizing and before erection

STRUCTURAL STEEL WELDING: INSPECTION AND NON-DESTRUCTIVE TESTING (NDT) REQUIREMENTS

1. GENERAL: Testing and inspection shall conform to Appendix Q of AISC "Seismic Provisions for Structural Steel Buildings" (AISC 341-05), unless specifically noted otherwise.
2. INSPECTION: The following inspection items are required for all welding:

   A. Confirm that applicable and approved Welding Procedure Specifications (WPS) are available for all welds to be performed.
   B. Confirm that filler metal selection conforms to the requirements of the approved WPS.
   C. Inspection of materials handling and storage
   D. Inspection of profile soundness of finished welds

   In addition, continuous inspection of the following items is required, except for shop welds performed in approved shops per CBC 1704.2.2 and single-pass fillet welds not exceeding $\frac{5}{16}$" weld size:

   E. Inspection of joint fit-up and preparation
   F. Inspection of welding machine settings
   G. Verification of application of preheat
   H. Verification of interpass temperature control
   I. Verification that all applicable requirements of the approved WPS are followed

3. NON-DESTRUCTIVE TESTING: There are three categories of welds. Non-destructive testing requirements for each weld category are indicated below:

   A. Demand Critical welds (indicated "DC" in the tail of the weld symbol)

   Magnetic Particle Testing (MT) and Ultrasonic Testing (UT) of 100% of joints, full length.

   B. Other welds that are part of the Seismic Load-Resisting System.

   CJP welds: MT of 100% of joints, 50% of length and UT of 100% of joints, 50% of length. The rate of UT may be reduced to 25% after 40 welds, if an individual welder's reject rate is less than 5%. If the welder's reject rate increases above 5%, the 100% rate of UT shall be resumed.

   PJP welds and fillet welds (throat $\frac{5}{16}$" or greater): MT of 25% of joints, full length.

   PJP welds and fillet welds (throat less than $\frac{5}{16}$"): No requirements for non-destructive testing.

   C. Welds that are not part of the Seismic Load-Resisting System

   No requirements for non-destructive testing, unless specifically noted otherwise.

STRUCTURAL INSPECTION, OBSERVATION AND TESTING

1. Special Inspection and Testing are required by Chapter 17 of the CBC. The "Statement of Special Inspections," submitted with the permit application, indicates the specific inspections and tests that are required, as well as the persons or firms responsible for this work.
2. All tests and inspections shall be performed by a certified Special Inspector from an independent testing agency who is employed by the Owner (or agent of the Owner) and not the Contractor.

   A. The Special Inspector shall observe the work assigned for conformance with the approved design drawings and specifications.

   B. The Special Inspector shall furnish inspection reports to the building official, the Architect, Structural Engineer and other designated persons. All discrepancies shall be brought to the immediate attention of the Contractor for correction, then, if uncorrected, to the proper design authority and to the building official.

   C. The Special Inspector shall submit a final signed report stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance with the approved plans and specifications and applicable standards of quality and workmanship of the CBC.

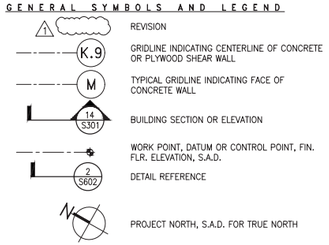
3. The contractor shall hold a pre-construction meeting involving Structural Engineer and the Special Inspector in order to discuss the specific requirements of this project.
4. Material testing requirements are indicated in the specifications and/or general notes.
5. Structural Observation is required by Chapter 17 of the CBC. Types of work listed in the following table and indicated as requiring "structural observation" shall be observed during periodic site visits by the Structural Engineer. Contractor is responsible for notifying structural engineer 48 hours before work is ready for observation. These visits do not constitute Special Inspection.
6. The following types of work are included in this project:

Portions of Structure	Types of Work	Work Included In This Project	Structural Observation Required
Structural Steel	Shop Welding	X	
	Field Welding	X	X
	High-strength bolting	X	X
	Field applied welded headed studs		
	Metal Deck	X	

ABBREVIATIONS

&	And	JST.	Joist
@	At		
A.B.	Anchor bolt	K	Kips
ADD'L	Additional	KSI	Kips per Square Inch
AISC	American Institute of Steel Construction	LBS.	Pounds
ALT.	Alternate	LL	Live Load
ARCH.	Architect	L.L.H.	Long Leg Horizontal
ASD	Allowable Strength Design	L.L.V.	Long Leg Vertical
ASTM	American Society for Testing and Materials	LTWT	Lightweight
A.W.P.A.	American Wood Preservers Assoc.	L.V.L.	Laminated Veneer Lumber
AWS	American Welding Society	MAX.	Maximum
		M.B.	Machine Bolt
BLKG.	Blocking	MECH.	Mechanical
BM.	Beam	MFR.	Manufacturer
B.N.	Boundary Nail	M.I.	Malleable Iron
BOCA	Building Officials and Code Administrators International, Inc.	MIL.	Millimeter
		MIN.	Minimum
		MISC.	Miscellaneous
BOTT.	Bottom		
BRG.	Bearing	(N)	New
B.S.	Both Sides	NO.,#	Number
BTWN.	Between	N.S.	Near Side
		N.T.S.	Not to Scale
CBC	California Building Code	NWT	Normalweight
C.C.	Center to Center		
CCR	California Code of Regulations	O.C.	On Center
		O.D.	Outside Diameter
C.J.	Control Joint	O.H.	Opposite Hand
C.I.P.	Cast-in-place	OPNG.	Opening
C.L.,℄	Center Line	OPP.	Opposite
CLG.	Ceiling	OSHPD	Office of Statewide Health Planning and Development
CLR.	Clear		
CMU	Concrete Masonry Unit		
COL.	Column		
CONC.	Concrete	P.A.F.	Powder-Actuated Fasteners
CONN.	Connection		
CONT.	Continuous	PART.	Partial
C.P.	Complete Penetration	PCF	Pounds per Cubic Foot
CSK	Countersink	PL.,℄	Plate
CTBR.	Counterbore	PLY.	Plywood
CTR.	Center	P.P.	Partial Penetration
		PSF	Pounds per Square Foot
DBA	Deformed Bar Anchor	PSI	Pounds per Square Inch
DBL.	Double	PWJ	Plywood Web Joists
DC	Demand Critical (Weld)		
DET., DETL.	Detail	RAD.	Radius
DF	Douglas Fir	R.D.	Roof Drain
DIA.,ø	Diameter	REINF.	Reinforcing
DIAG.	Diagonal	REQ.	Required
DL	Dead Load	RF.	Roof
DN	Down	R.O.	Rough Opening
DO	Ditto	RND.	Round
DSA	Division of the State Architect	R.R.	Remove & Replace
DWG(S).	Drawing(s)	S.A.D.	See Architectural Drawings
(E)	Existing	SCHED.	Schedule
EA.	Each	SFRS	Seismic Force-Resisting System
E.F.	Each Face		
E.J.	Expansion Joint	SHT.	Sheet
ELEV.,EL.	Elevation	SHTG.	Sheathing
EMB.,EMBED.	Embedment	SIM.	Similar
E.N.	Edge Nail	S.M.D.	See Mechanical Drawings
EQ.	Equal	S.O.G.	Slab on Grade
EQUIP.	Equipment	S.P.	Southern Pine
E.W.	Each Way	SSTL.	Stainless Steel
		STAGG'D.	Staggered
FDN.	Foundation	STD.	Standard
F.F.	Finish Floor	STIFF.	Stiffener
F.G.	Finish Grade	STL.	Steel
FIN.	Finish	STRUCT.	Structural
F.O.C.	Face of Concrete	SYMM.,SYM	Symmetrical
F.O.M.	Face of Masonry		
F.O.S.	Face of Stud	T&B	Top and Bottom
FRMG.	Framing	T&G	Tongue & Groove
F.S.	Far Side	T.N.	Toe Nail
FTG.	Footing	T.O.C.	Top of Concrete
		T.O.S.	Top of Steel
GA.	Gage	T.O.W.	Top of Wall
GALV.	Galvanized	TS	Tube Steel
G.L.	Grid Line	TYP.	Typical
GLB	Glue-Laminated Beam		
GR.	Grade	UBC	Uniform Building Code
		U.O.N.	Unless Otherwise Noted
HDG.	Hot-dip Galvanized		
HGR.	Hanger	VERT.	Vertical
HK.	Hook	V.I.F., ±	Verify in Field
HORIZ.	Horizontal		
H.S.B.	High Strength Bolt	W/	With
HSS	Hollow Structural Sections	W/O	Without
		WCLIB	West Coast Lumber Inspection Bureau
HT.	Height		
		W.P.	Working Point
ICBO	International Council of Building Officials	W.H.S.	Welded Headed Stud
		W.T.S.	Welded Threaded Stud
ICC	International Code Council	W.W.F.	Welded Wire Fabric
INT.	Interior	WWPA	Western Wood Products Association
INV.	Inverted		

GENERAL SYMBOLS AND LEGEND



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VOLUNTARY STRUCTURAL RETROFIT

1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

GENERAL NOTES ABBREVIATIONS & LEGEND

Drawing Title

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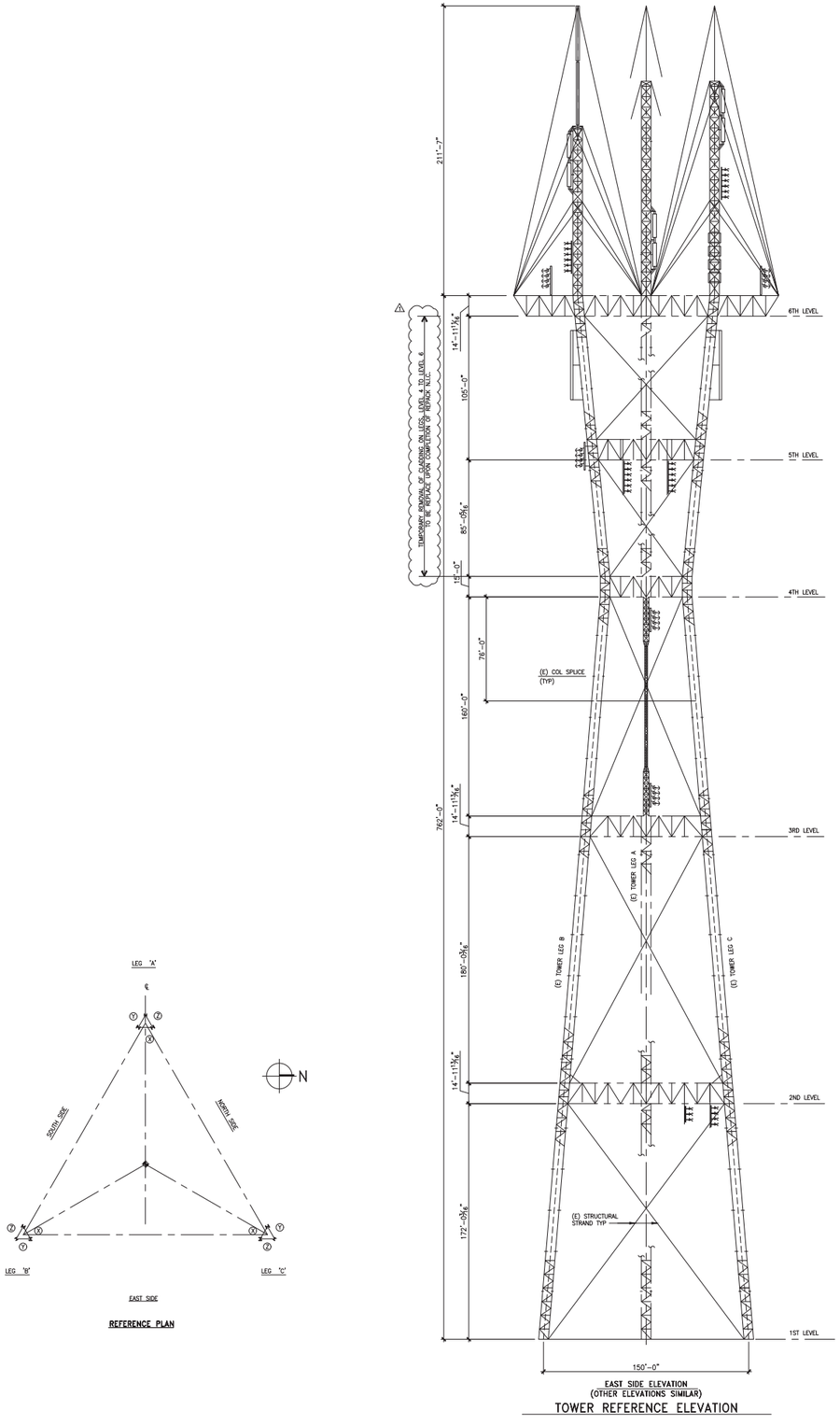
Drawn	Approved	Scale
GPN	ROH	AS NOTED

REGISTERED PROFESSIONAL ENGINEER RONALD O. HAMBURGER No. 2951 STRUCTURAL STATE OF CALIFORNIA
6/24/19
Seal

Drawing No.
S0.1



EAST SIDE ELEVATION
(OTHER ELEVATIONS SIMILAR)

TOWER REFERENCE ELEVATION

EAST SIDE

REFERENCE PLAN

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TOWER REFERENCE PLAN & ELEVATION

Drawing Title

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Drawn	Approved	Scale
GPN	ROH	N.T.S.

Drawing No.

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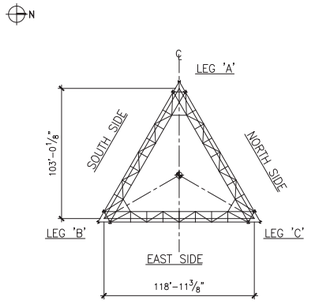
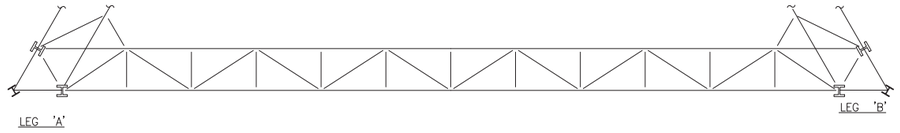
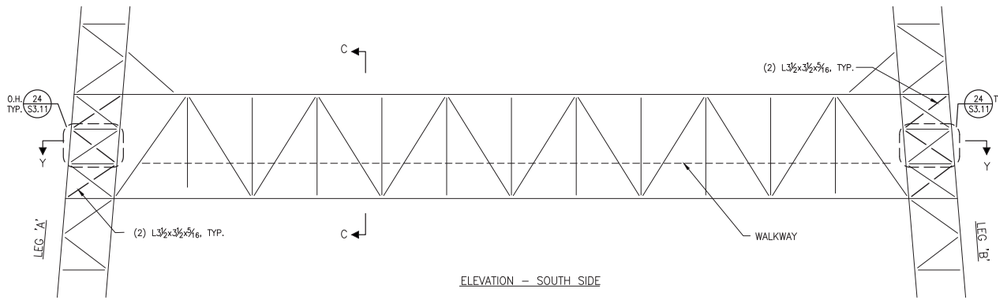


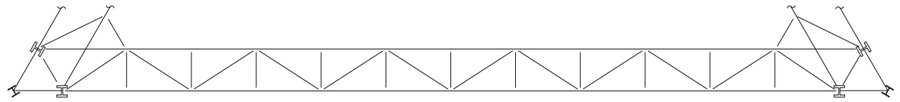
KEY PLAN – 2ND LEVEL



TOP VIEW



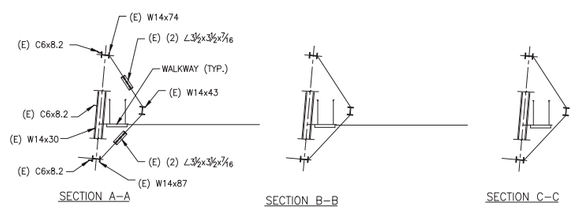
ELEVATION – SOUTH SIDE

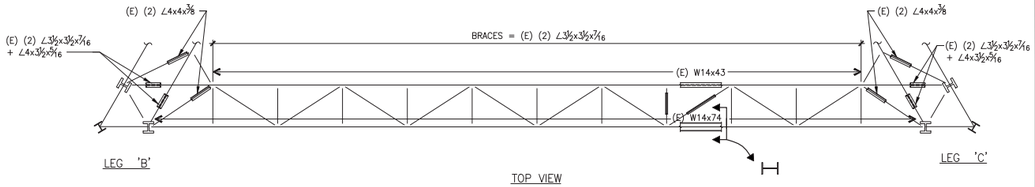


SECTION Y–Y

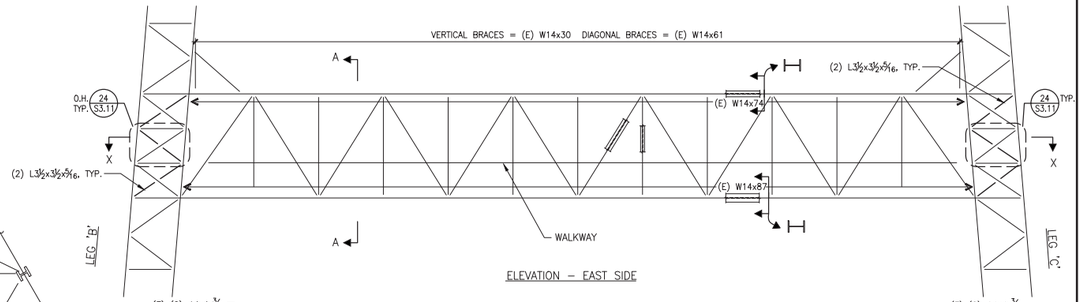
2ND LEVEL – SOUTH SIDE

* NOTE:
SEE EAST SIDE FOR MEMBER SHAPES.

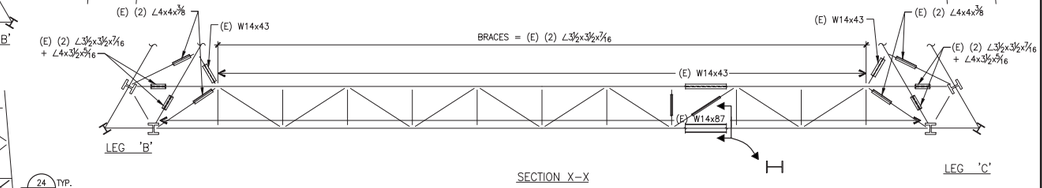




TOP VIEW



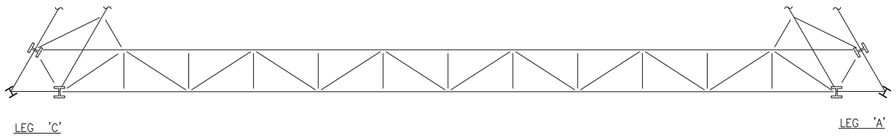
ELEVATION – EAST SIDE



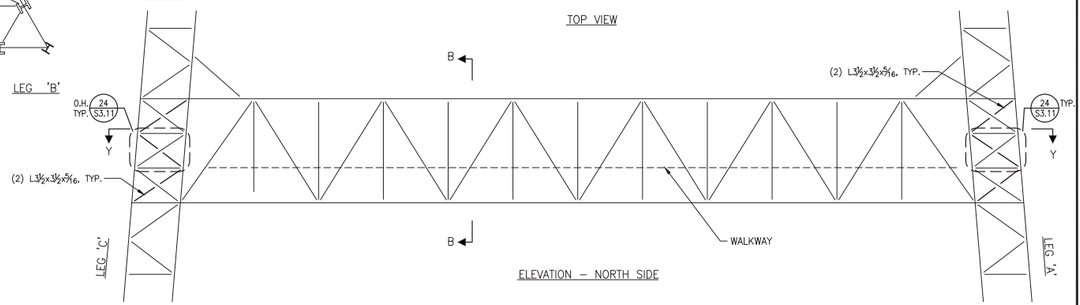
SECTION X–X

2ND LEVEL – EAST SIDE

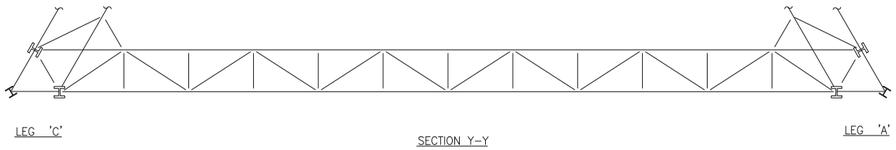
* NOTE:
MEMBER SHAPES ARE THE SAME FOR NORTH AND SOUTH SIDE



TOP VIEW



ELEVATION – NORTH SIDE



SECTION Y–Y

2ND LEVEL – NORTH SIDE

* NOTE:
SEE EAST SIDE FOR MEMBER SHAPES.

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0	5/30/19	ISSUED FOR PERMIT	ROH
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VOLUNTARY STRUCTURAL RETROFIT

1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

2ND LEVEL FRAMING

Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	1/8"=1'-0"

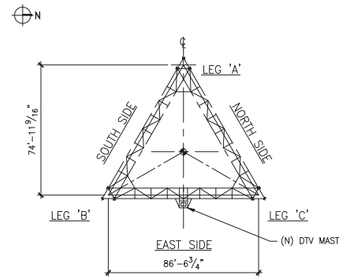
REGISTERED PROFESSIONAL ENGINEER RONALD O. HAMBURGER No. 2951 STRUCTURAL STATE OF CALIFORNIA

Seal

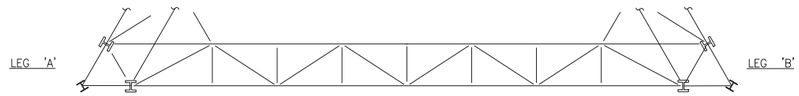
6/24/19

Drawing No.

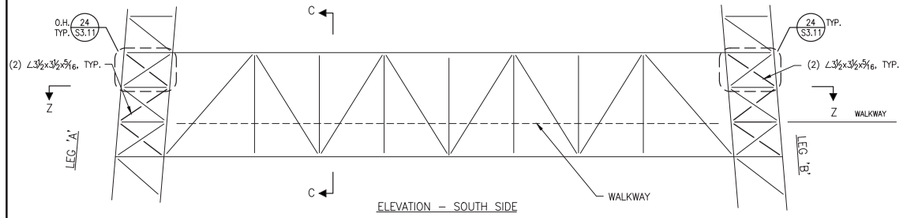
S2.1



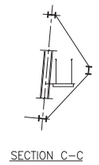
KEY PLAN – 3RD LEVEL



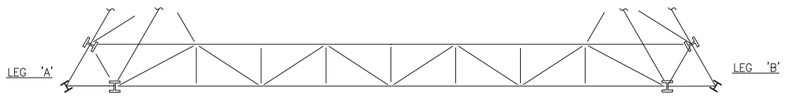
TOP VIEW



ELEVATION – SOUTH SIDE



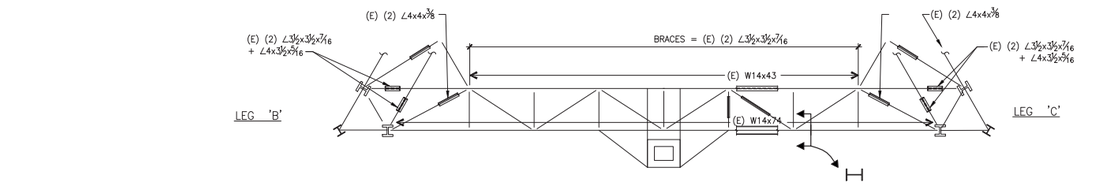
SECTION C–C



SECTION Z–Z

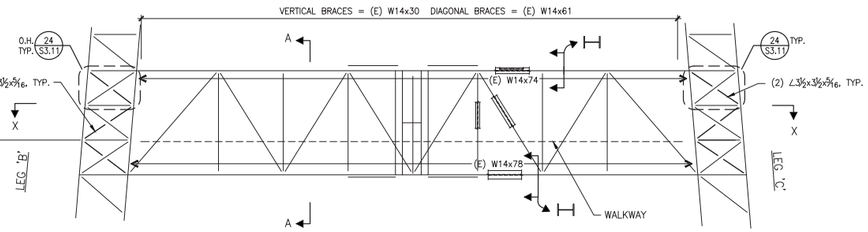
3RD LEVEL – SOUTH SIDE

* NOTE:
SEE EAST SIDE FOR MEMBER SHAPES.

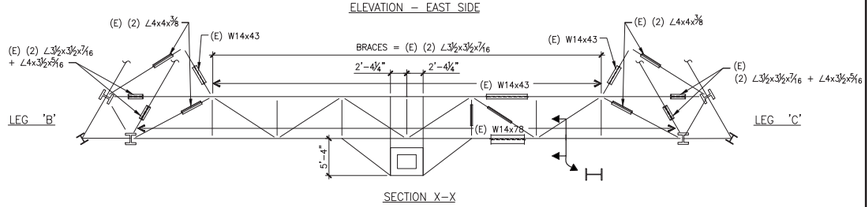


SECTION A–A

TOP VIEW



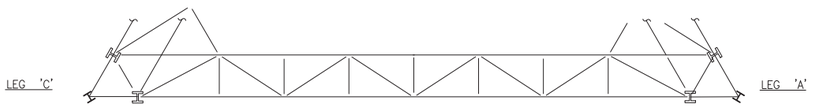
ELEVATION – EAST SIDE



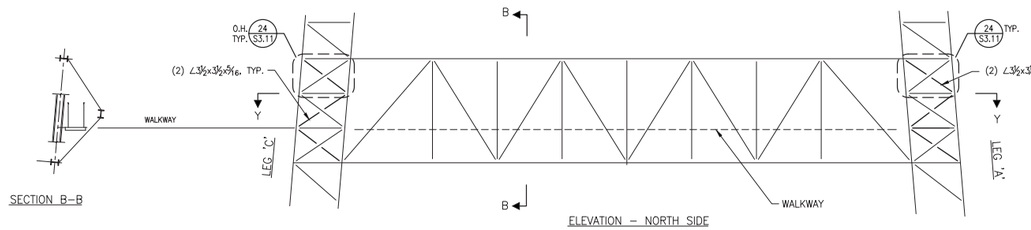
SECTION X–X

3RD LEVEL – EAST SIDE

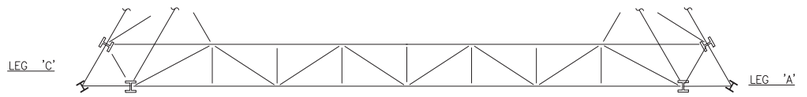
* NOTE:
MEMBER SHAPES ARE THE SAME
FOR NORTH AND SOUTH SIDE



TOP VIEW



ELEVATION – NORTH SIDE



SECTION Y–Y

3RD LEVEL – NORTH SIDE

* NOTE:
SEE EAST SIDE FOR MEMBER SHAPES.

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VOLUNTARY STRUCTURAL RETROFIT

1 LA AVANZADA ST.
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CALIFORNIA

Project

3RD LEVEL FRAMING

Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	1/8"=1'–0"

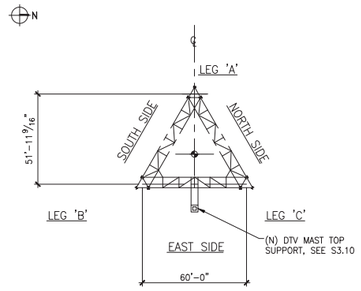
REGISTERED PROFESSIONAL ENGINEER
RONALD O. HAMBURGER
No. 2951
STRUCTURAL
STATE OF CALIFORNIA

Seal

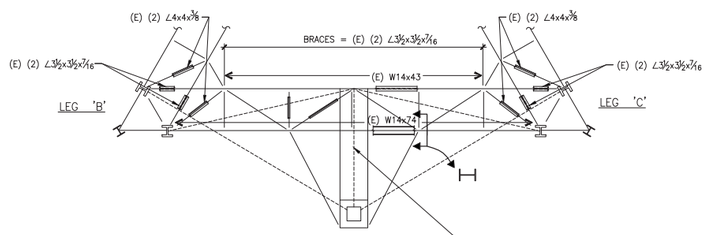
6/24/19

Drawing No.

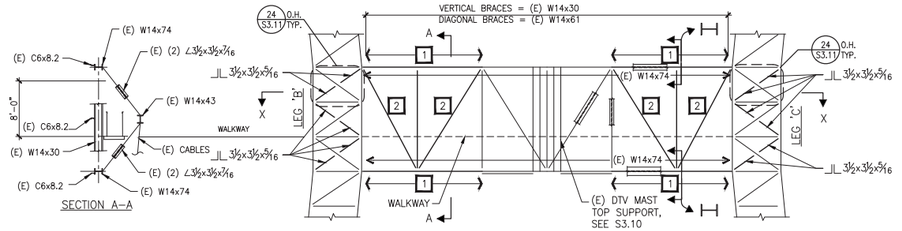
S2.2



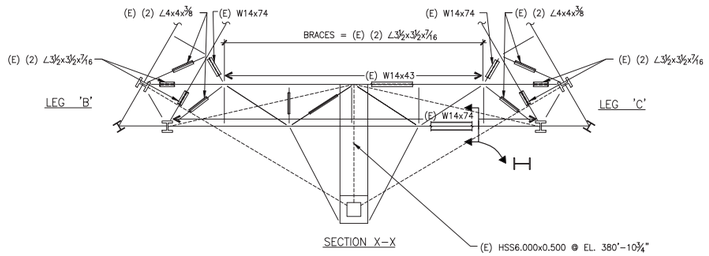
KEY PLAN – 4TH LEVEL



TOP VIEW



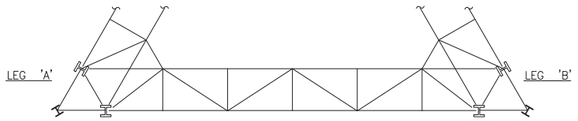
ELEVATION – EAST SIDE



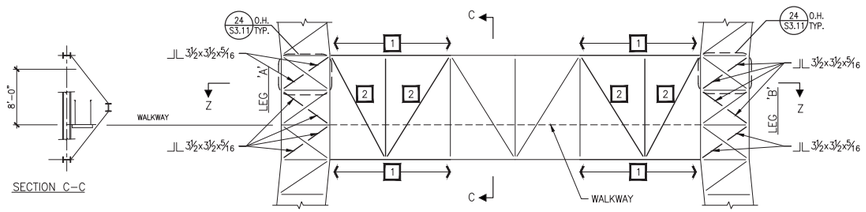
SECTION X–X

4TH LEVEL – EAST SIDE

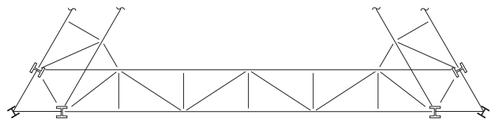
* NOTE:
MEMBER SHAPES ARE THE SAME FOR NORTH AND SOUTH SIDE



TOP VIEW



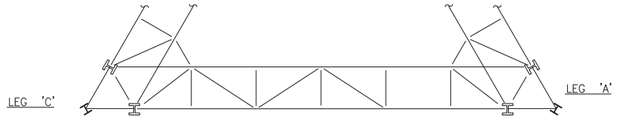
ELEVATION – SOUTH SIDE



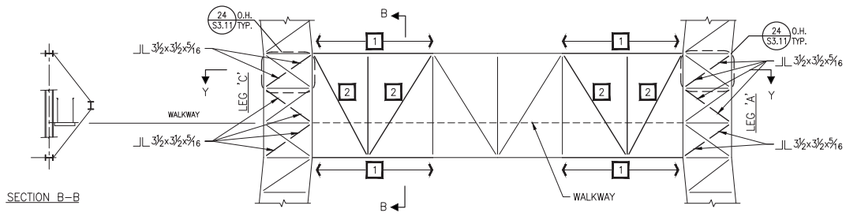
SECTION Z–Z

4TH LEVEL – SOUTH SIDE

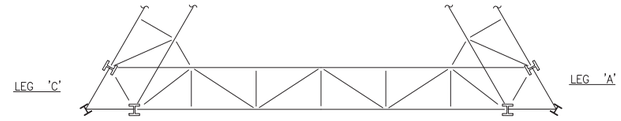
* NOTE:
SEE EAST SIDE FOR MEMBER SHAPES.



TOP VIEW



ELEVATION – NORTH SIDE



SECTION Y–Y

4TH LEVEL – NORTH SIDE

* NOTE:
SEE EAST SIDE FOR MEMBER SHAPES.

KEYNOTE:

1 STRENGTHEN (E) W14x74 PER 16/S3.14, TYP.

2 STRENGTHEN (E) W14x61 PER 17/S3.14, TYP.

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VOLUNTARY STRUCTURAL RETROFIT

1 LA AVANZADA ST.
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CALIFORNIA

Project

4TH LEVEL FRAMING

Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	1/8"=1'-0"

Drawing No.

S2.3

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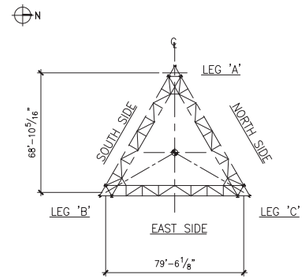
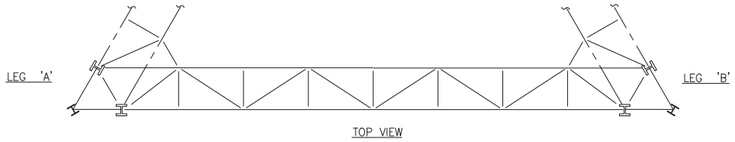
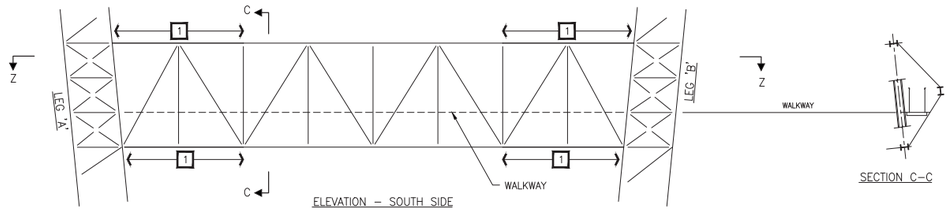
Seal 6/24/19



KEY PLAN – 5TH LEVEL

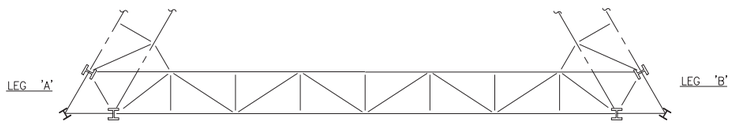


TOP VIEW



ELEVATION – SOUTH SIDE

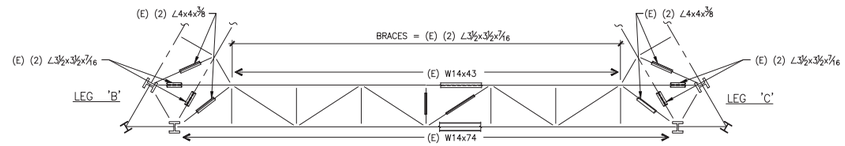
SECTION C–C



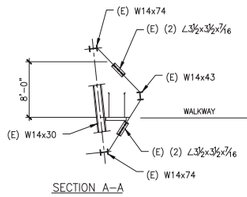
SECTION Z–Z

5TH LEVEL – SOUTH SIDE

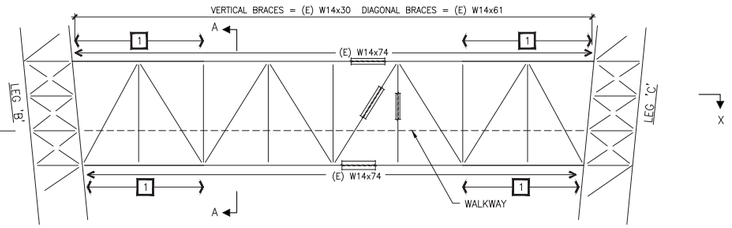
* NOTE:
SEE EAST SIDE FOR MEMBER SHAPES.



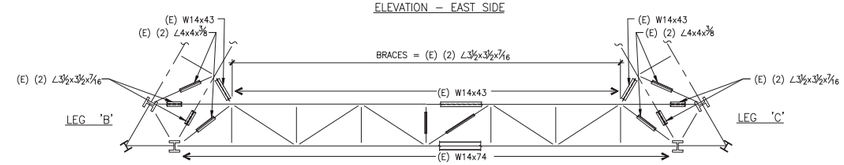
TOP VIEW



SECTION A–A



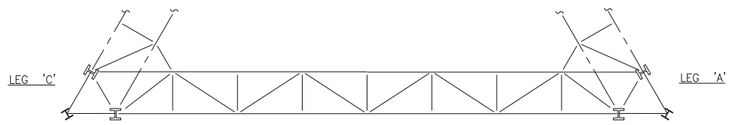
ELEVATION – EAST SIDE



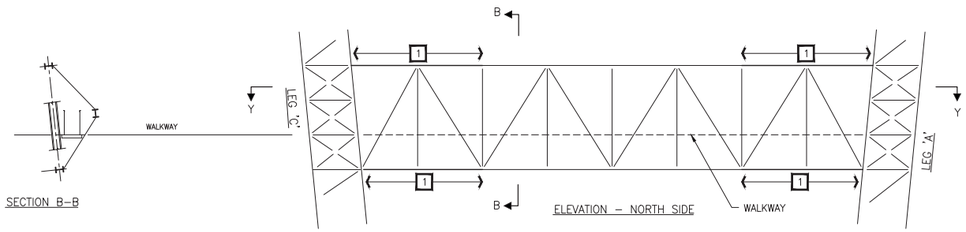
SECTION X–X

5TH LEVEL – EAST SIDE

* NOTE:
MEMBER SHAPES ARE THE SAME FOR NORTH AND SOUTH SIDE

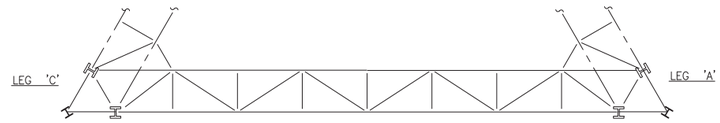


TOP VIEW



ELEVATION – NORTH SIDE

SECTION B–B



SECTION Y–Y

5TH LEVEL – NORTH SIDE

* NOTE:
SEE EAST SIDE FOR MEMBER SHAPES.

KEYNOTE:

1 STRENGTHEN (E) W14x74 PER 16/S3.14, TYP.

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VOLUNTARY STRUCTURAL RETROFIT

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CALIFORNIA

Project

5TH LEVEL FRAMING

Drawing Title

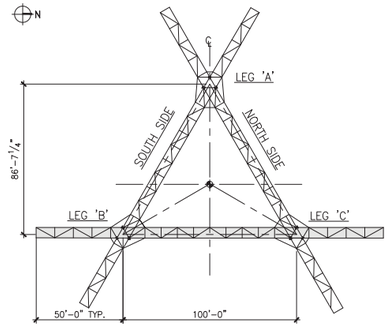
Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	1/8"=1'-0"

REGISTERED PROFESSIONAL ENGINEER
RONALD O. HAMBURGER
No. 2951
STRUCTURAL
STATE OF CALIFORNIA

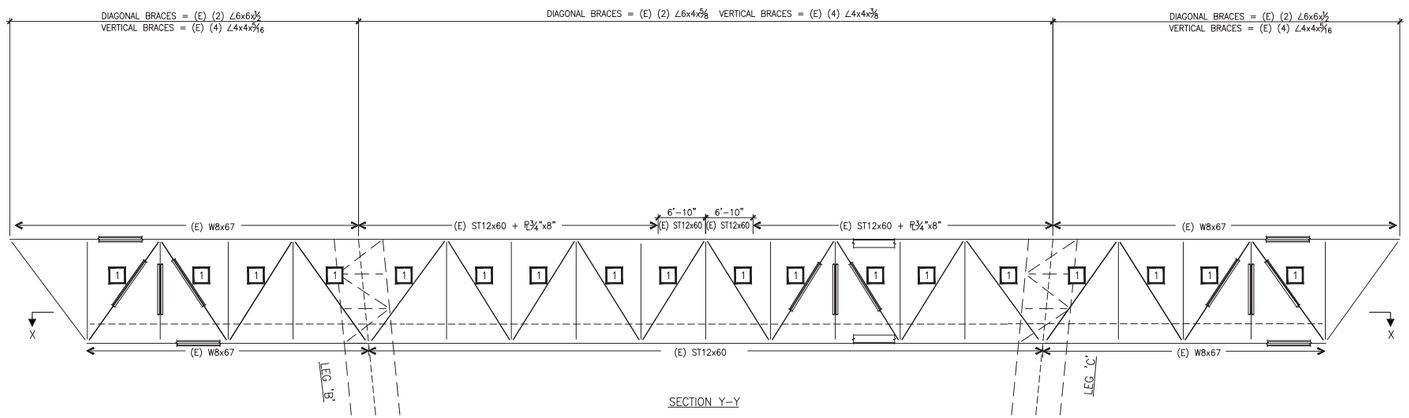
Seal 6/24/19

Drawing No.

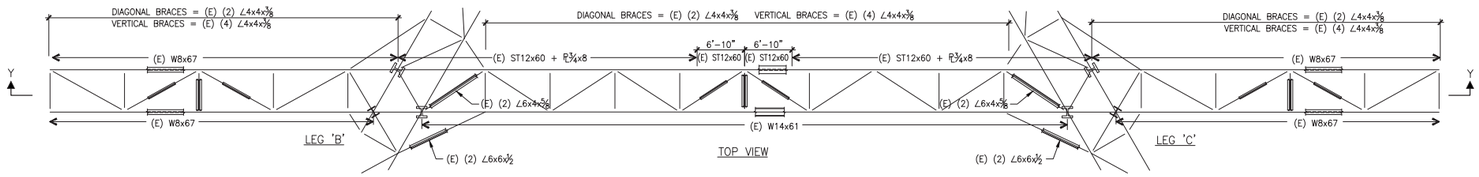
S2.4



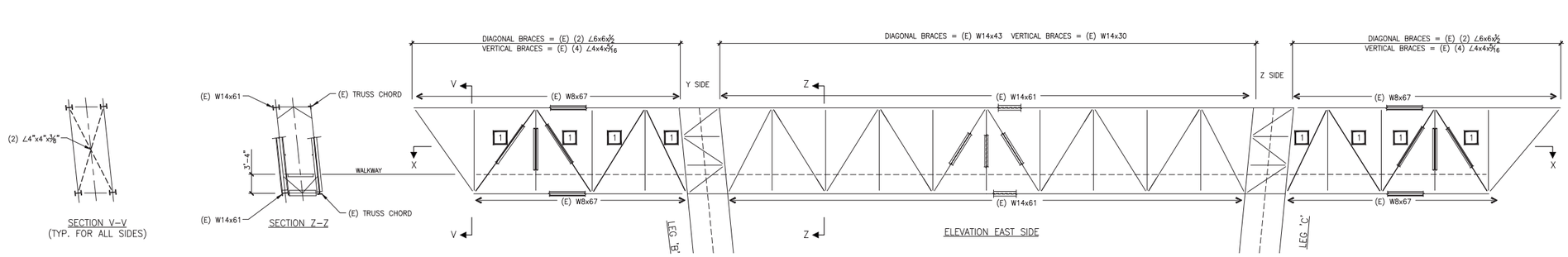
KEY PLAN – 6TH LEVEL

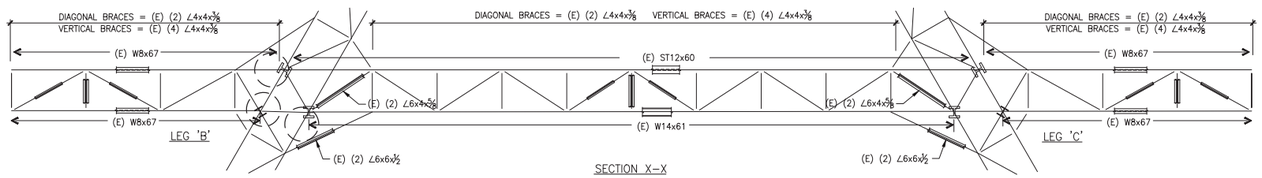


SECTION Y–Y



TOP VIEW





SECTION X–X

6TH LEVEL – EAST SIDE

* NOTE:
MEMBER SHAPES ARE THE SAME FOR NORTH AND SOUTH SIDE

KEYNOTE:

1 STRENGTHEN (E) L6x6 BRACES PER 13/S3.11, TYP.

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No.	Date	Description	By
0	5/30/19	ISSUED FOR PERMIT	ROH
	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

VOLUNTARY STRUCTURAL RETROFIT

**1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA**

Project

6TH LEVEL FRAMING EAST SIDE

Drawing Title

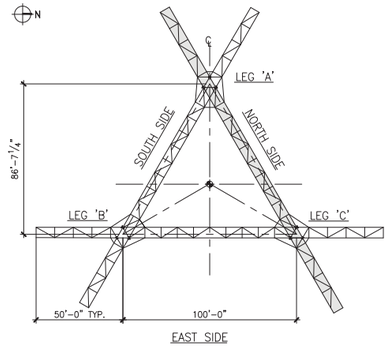
Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	1/8"=1'-0"

REGISTERED PROFESSIONAL ENGINEER RONALD O. HAMBURGER No. 2951 STRUCTURAL STATE OF CALIFORNIA

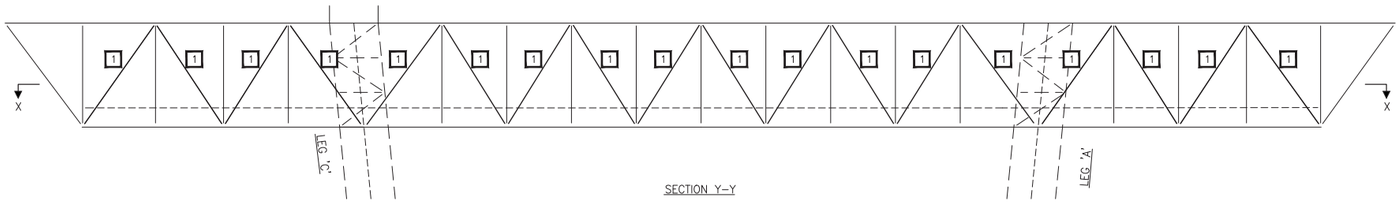
Seal 6/24/19

Drawing No. **S2.5**

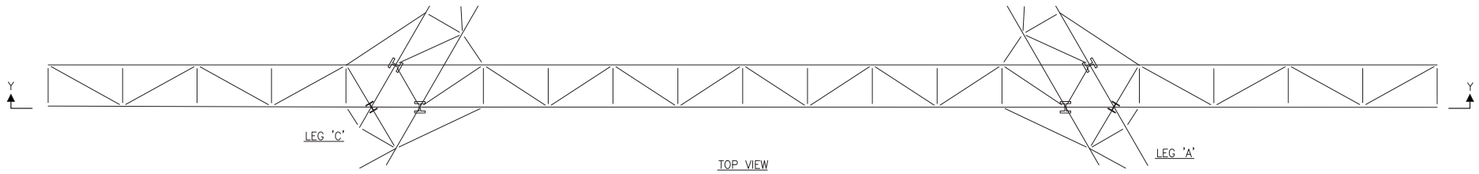
I:\SF\Projects\2006\067199.24-STKB\Drawings\Working_Set - Voluntary Retrofit\STKB_S205.dwg



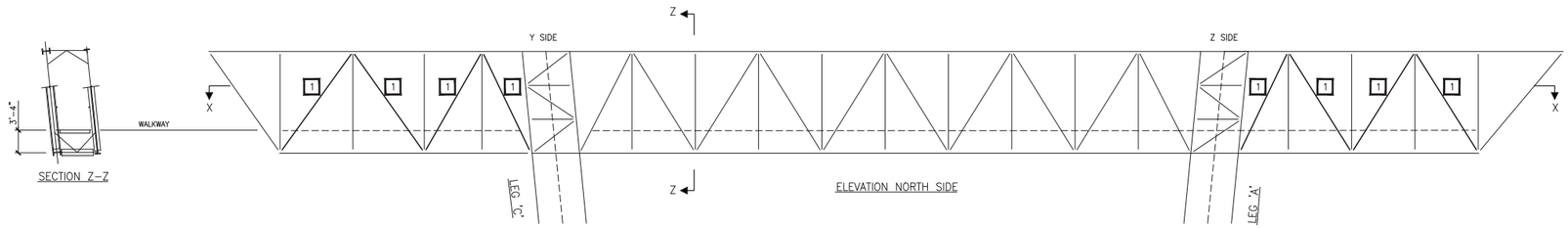
KEY PLAN – 6TH LEVEL



SECTION Y–Y

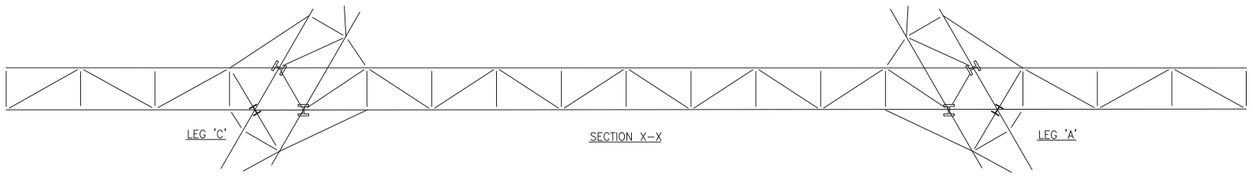


TOP VIEW



SECTION Z–Z

ELEVATION NORTH SIDE



SECTION X–X

6TH LEVEL – NORTH SIDE

* NOTE:
MEMBER SHAPES ARE THE SAME AS EAST SIDE. SEE DRAWING S2.5

KEYNOTE:

1 STRENGTHEN (E) L6x6 BRACES PER 13/S3.11, TYP.

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VOLUNTARY STRUCTURAL RETROFIT

1 LA AVANZADA ST.
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Project

6TH LEVEL FRAMING NORTH SIDE

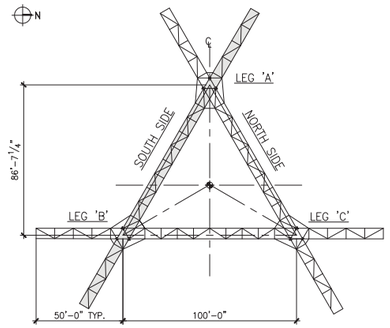
Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	1/8"=1'-0"

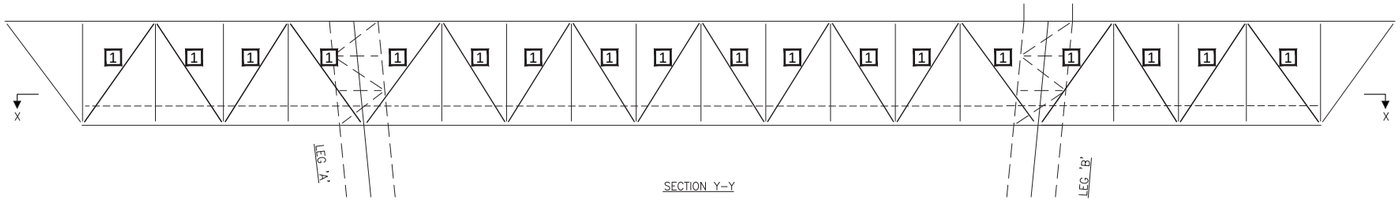
REGISTERED PROFESSIONAL ENGINEER
RONALD O. HAMBURGER
No. 2951
STATE OF CALIFORNIA
STRUCTURAL

Seal 6/24/19

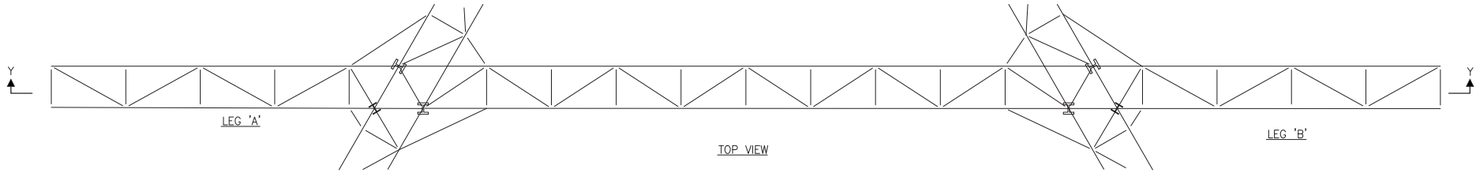
Drawing No.
S2.6



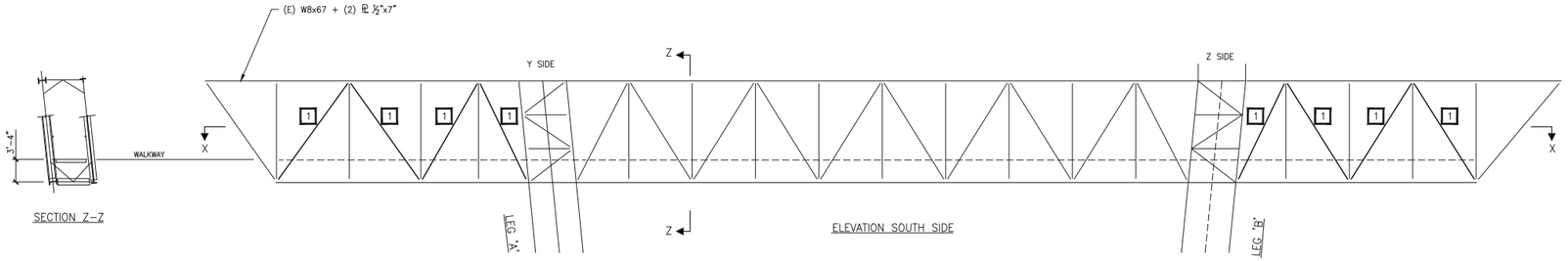
KEY PLAN – 6TH LEVEL



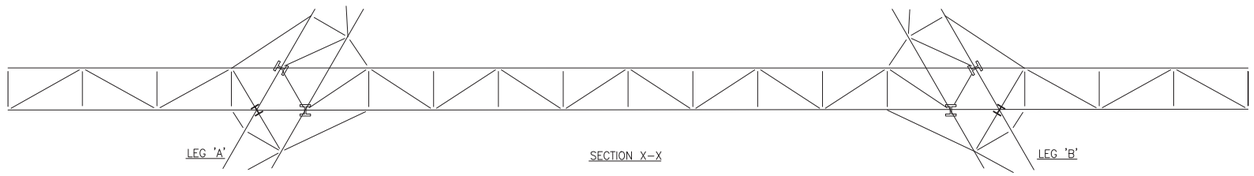
SECTION Y–Y



TOP VIEW



ELEVATION SOUTH SIDE



SECTION X–X

6TH LEVEL – SOUTH SIDE

* NOTE:
MEMBER SHAPES ARE THE SAME AS EAST SIDE. SEE DRAWING S2.5

KEYNOTE:

1 STRENGTHEN (E) L6x6 BRACES PER (13 / S3.11), TYP.

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	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

VOLUNTARY STRUCTURAL RETROFIT

**1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA**

Project

6TH LEVEL FRAMING SOUTH SIDE

Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	1/8"=1'-0"

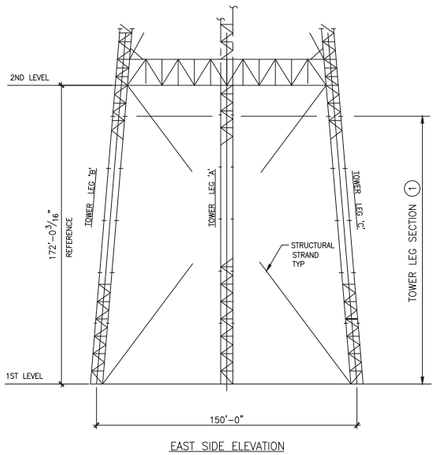
Drawing No.

S2.7

REGISTERED PROFESSIONAL ENGINEER RONALD O. HAMBURGER No. 29511 STATE OF CALIFORNIA

Seal

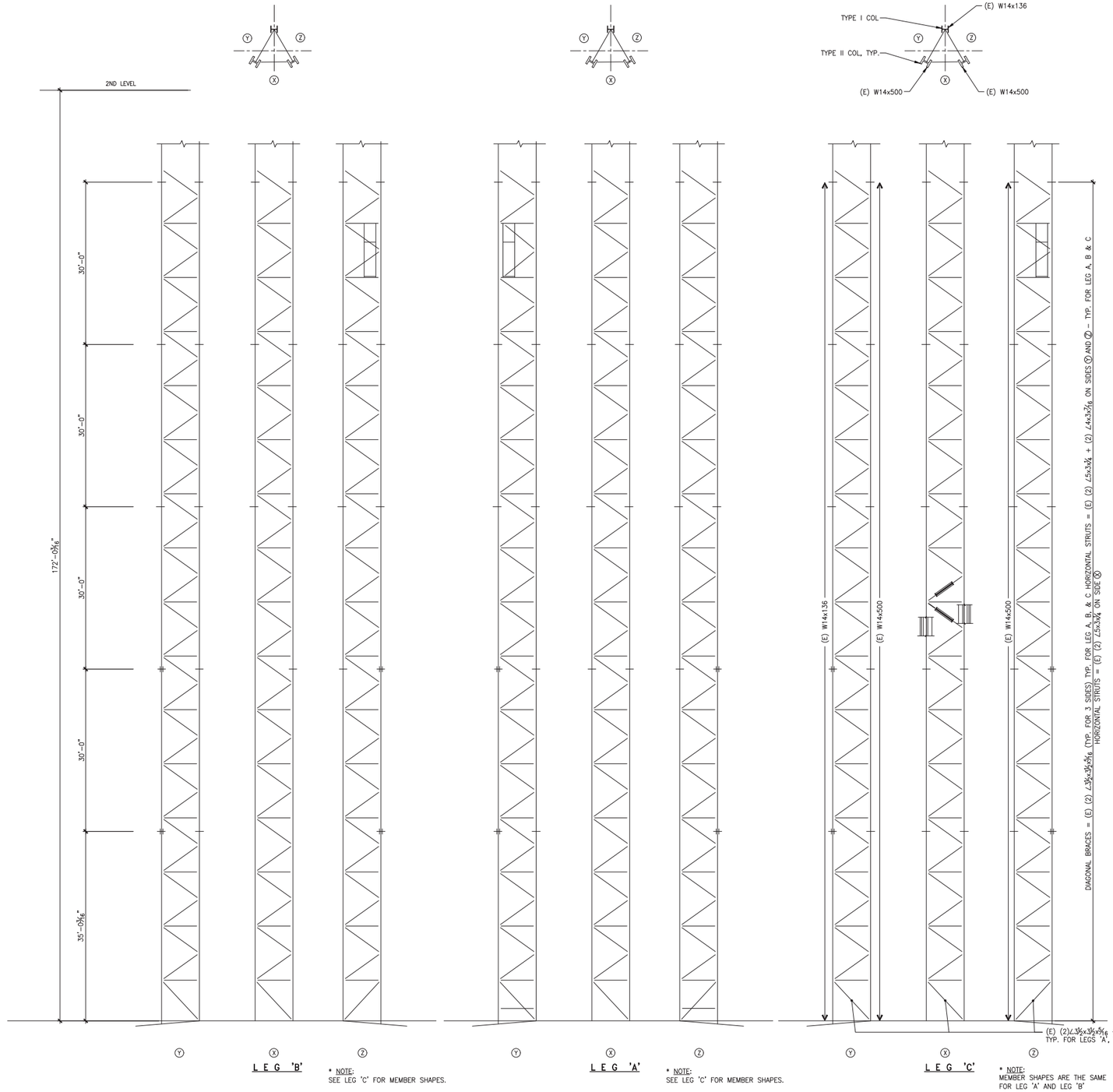
6/28/19



EAST SIDE ELEVATION

TOWER WORK POINT ELEVATION

SCALE: 1/32" = 1'-0"



1 TOWER LEGS SECTION

SCALE: 1/8"=1'-0"

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SHEET NOTES:

1. THIS DRAWING IS FOR RECORD ONLY. NO WORK REQUIRED FOR THIS SHEET.

No.	Date	Description	By
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VOLUNTARY STRUCTURAL RETROFIT

**1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA**

Project

**TOWER SECTION - 1
LEG FRAMING
LEVEL 1 TO LEVEL 2**

Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	AS NOTED

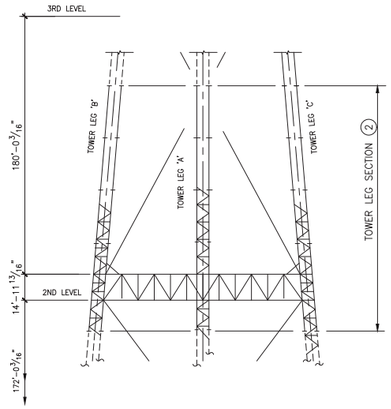
REGISTERED PROFESSIONAL ENGINEER — RONALD O. HAMBURGER — No. 2951 — STRUCTURAL — STATE OF CALIFORNIA

Seal

6/24/19

Drawing No.

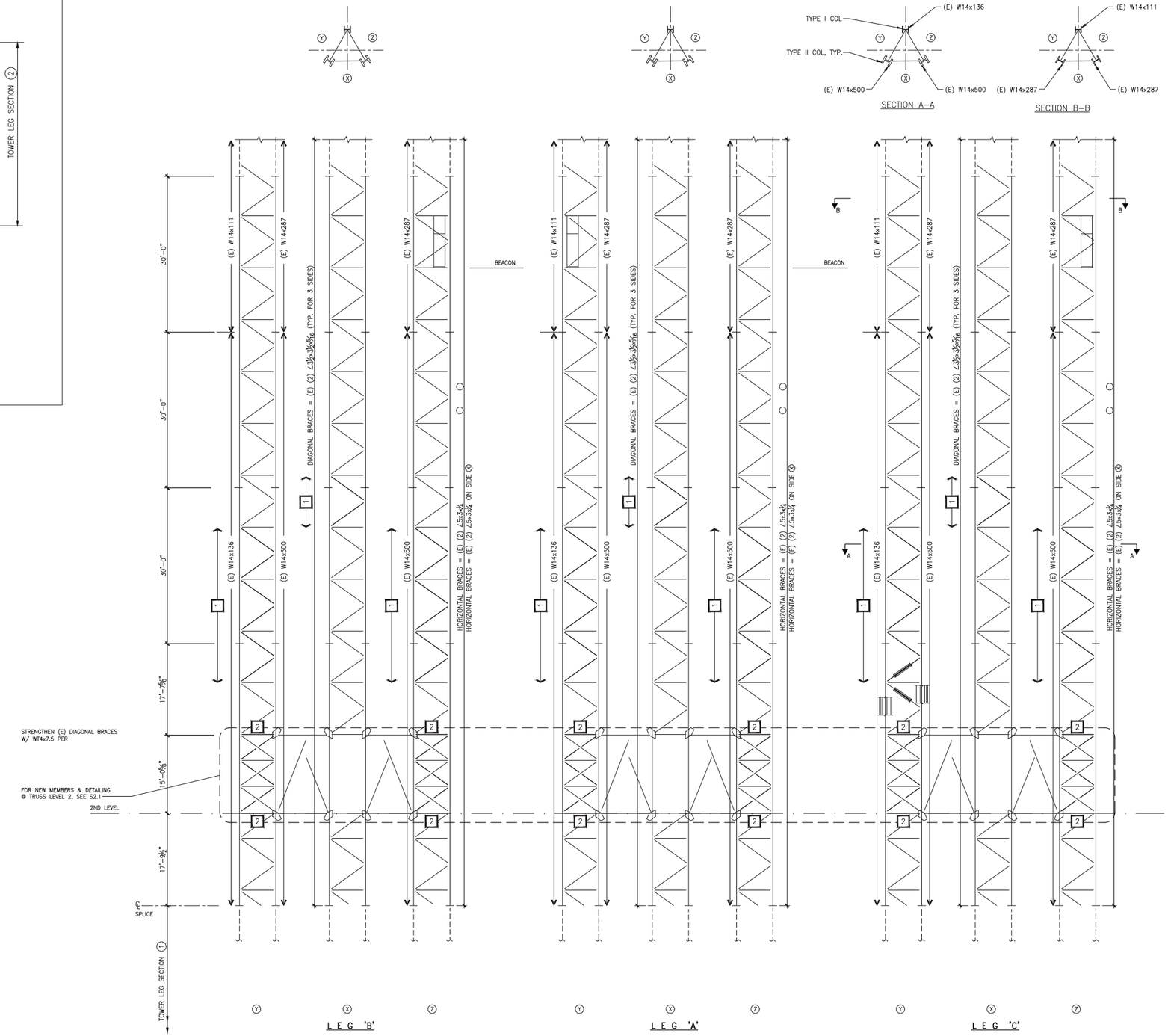
S3.1



EAST SIDE ELEVATION

TOWER WORK POINT ELEVATION

SCALE: 1/32" = 1'-0"



KEYNOTE:

1. STRENGTHEN (E) DIAGONAL BRACES W/ WT4x20 PER (6/S3.14), TYP.
2. STRENGTHEN (E) HORIZ. BRACES W/ WT4x20 PER (19/S3.14), TYP.

2 TOWER LEGS SECTION

SCALE: 1/8"=1'-0"

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VOLUNTARY STRUCTURAL RETROFIT

1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

TOWER SECTION - 2 LEG FRAMING LEVEL 2 TO LEVEL 3

Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	AS NOTED

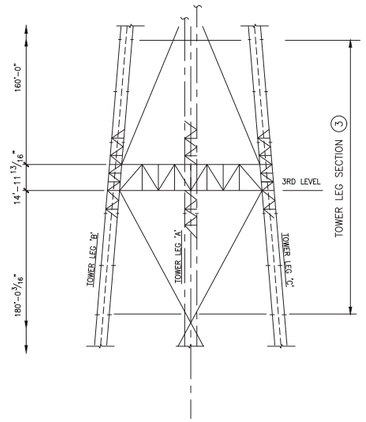
REGISTERED PROFESSIONAL ENGINEER — RONALD O. HAMBURGER — No. 2951 — STRUCTURAL — STATE OF CALIFORNIA

Seal 6/24/19

Drawing No.

S3.2

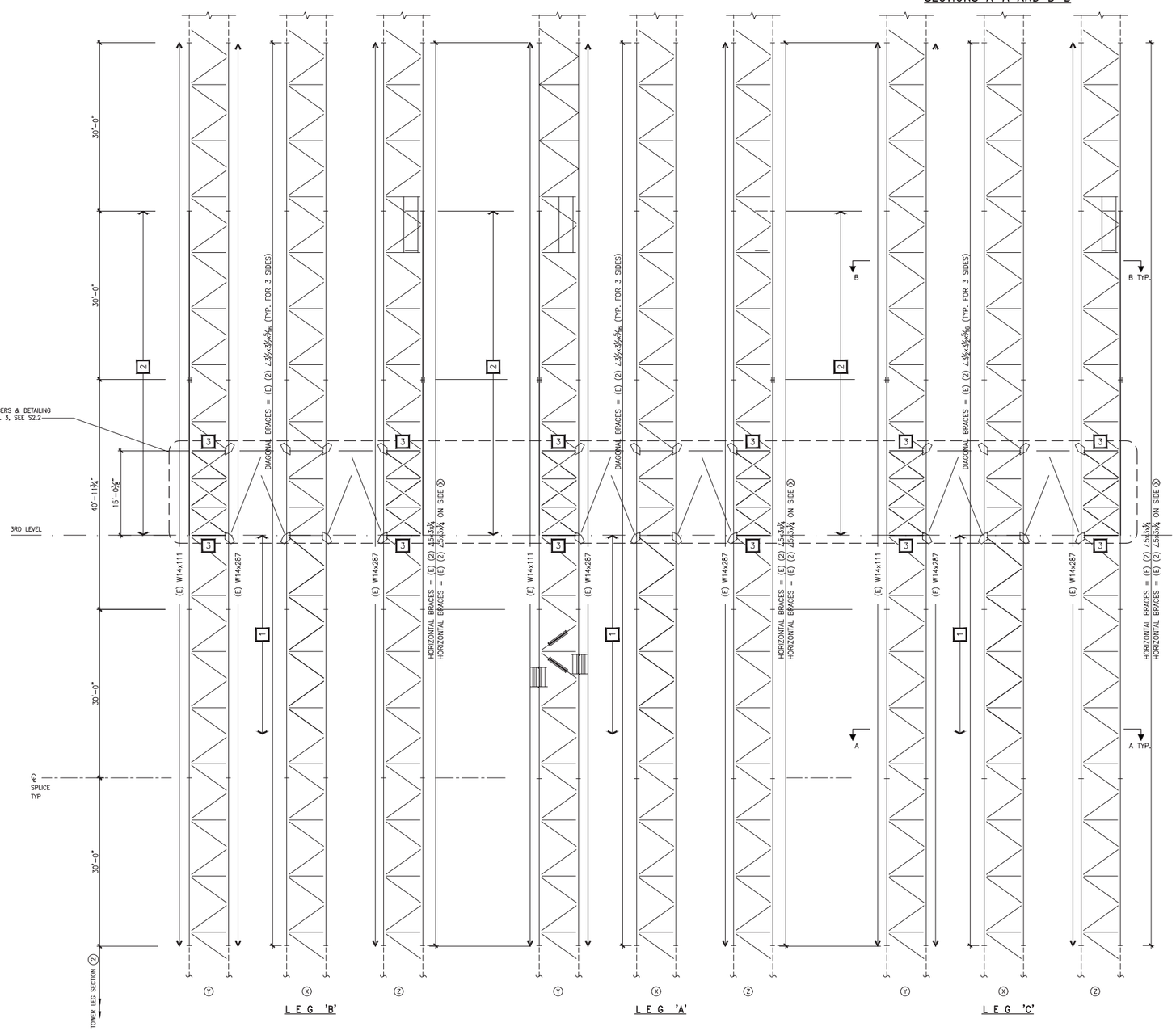
I:\SFV Projects\2006\067199.24 - STKB\Drawings\Working_Set - Voluntary Retrofit\STKB_S302.dwg

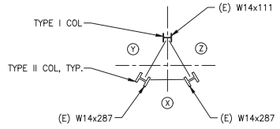


EAST SIDE ELEVATION

TOWER WORK POINT ELEVATION

SCALE: 1/32" = 1'-0"





SECTIONS A–A AND B–B

KEYNOTE:

1. STRENGTHEN (E) DIAGONAL BRACES W/ WT4x20 PER (6/S3.14), TYP.
2. STRENGTHEN (E) W14x111 PER (7/S3.11), TYP.
3. STRENGTHEN (E) HORIZ. BRACES W/ WT4x20 PER (19/S3.14), TYP.

3 TOWER LEGS SECTION

SCALE: 1/8"=1'-0"

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	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

VOLUNTARY STRUCTURAL RETROFIT

1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

TOWER SECTION - 3 LEG FRAMING LEVEL 3 TO LEVEL 4

Drawing Title

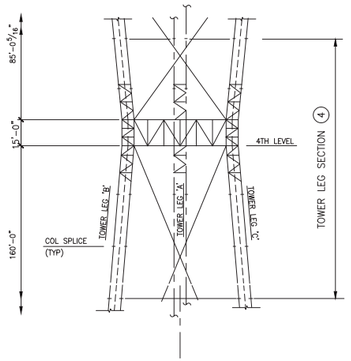
Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	AS NOTED

REGISTERED PROFESSIONAL ENGINEER RONALD O. HAMBURGER No. 2951 STRUCTURAL STATE OF CALIFORNIA

Seal 6/24/19

Drawing No.

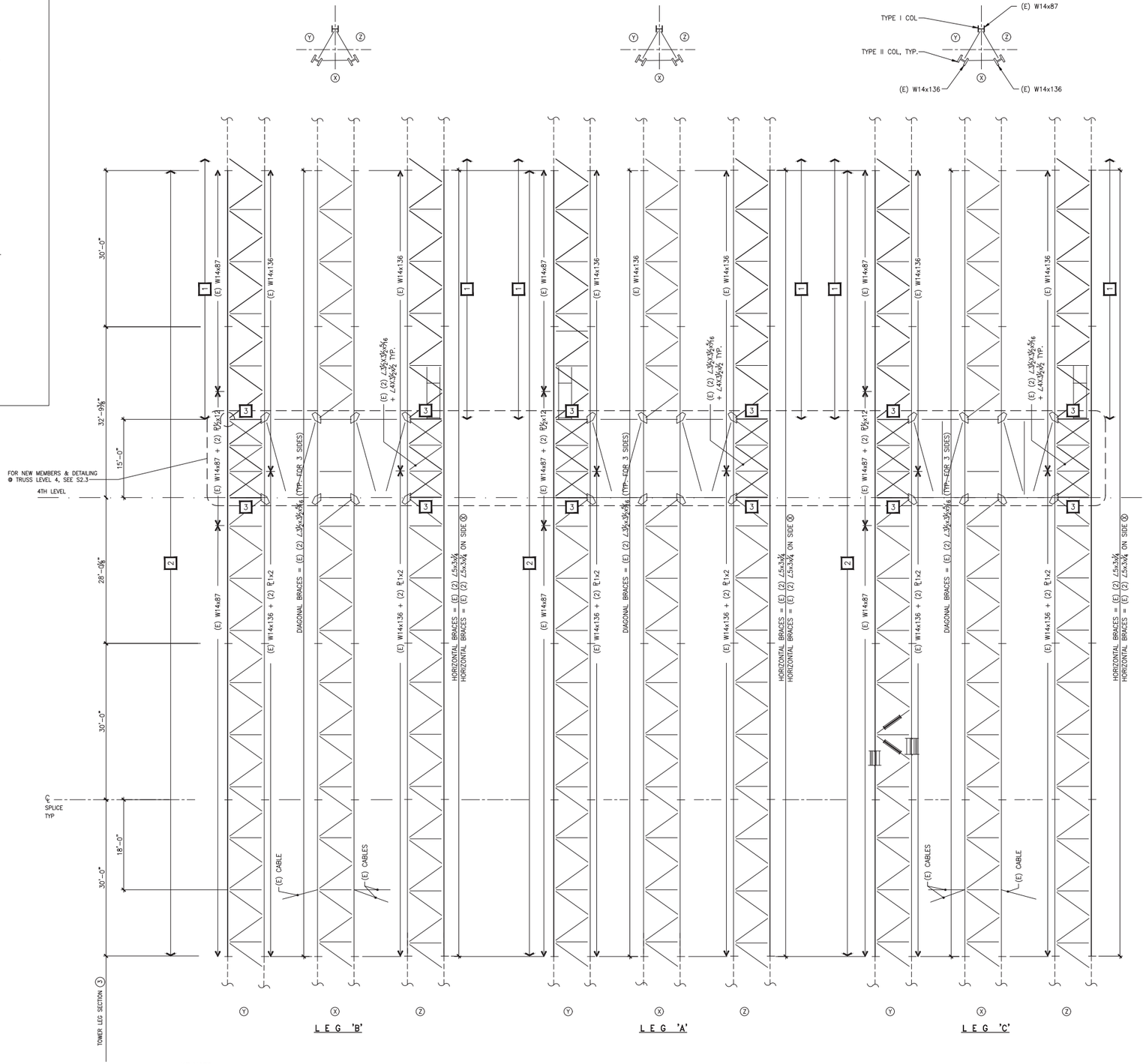
S3.3



EAST SIDE ELEVATION

TOWER WORK POINT ELEVATION

SCALE: 1/32" = 1'-0"



KEYNOTE:

1. STRENGTHEN (E) DIAGONAL BRACES W/ WT4x20 PER (6 / S3.14), TYP.
2. STRENGTHEN (E) W14x87 PER (12 / S3.11), TYP.
3. STRENGTHEN (E) HORIZ. BRACES W/ WT4x20 PER (19 / S3.14), TYP.

4 TOWER LEGS SECTION

SCALE: 1/8"=1'-0"

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VOLUNTARY STRUCTURAL RETROFIT

1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

TOWER SECTION - 4 LEG FRAMING LEVEL 4 TO LEVEL 5

Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	AS NOTED

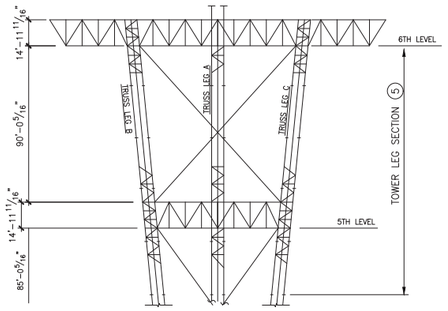
Drawing No.

S3.4

Seal

REGISTERED PROFESSIONAL ENGINEER — RONALD O. HAMBURGER — No. 2951 — STATE OF CALIFORNIA

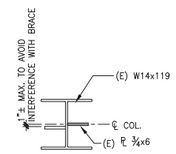
6/24/19



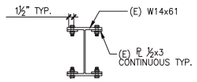
EAST SIDE ELEVATION

TOWER WORK POINT ELEVATION

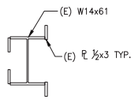
SCALE: 1/32" = 1'-0"



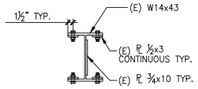
SECTION C–C
(TYPICAL FOR ALL LEGS)



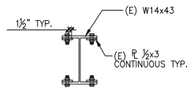
SECTION D–D
(TYPICAL FOR ALL LEGS)



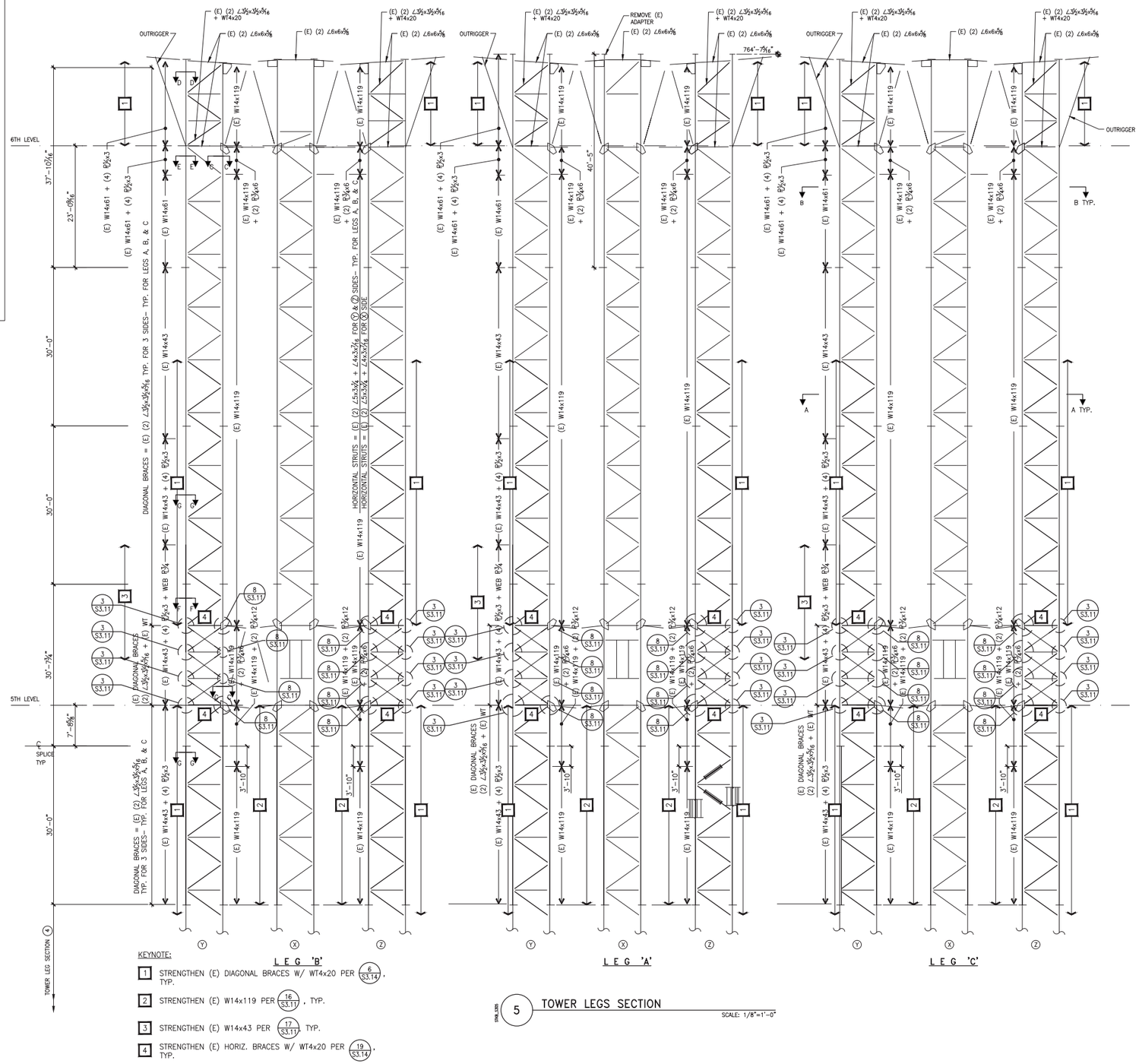
SECTION E–E
(TYPICAL FOR ALL LEGS)



SECTION F–F
(TYPICAL FOR ALL LEGS)



SECTION G–G
(TYPICAL FOR ALL LEGS)

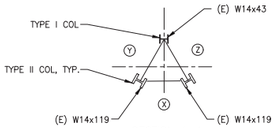


KEYNOTE:

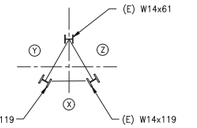
1. STRENGTHEN (E) DIAGONAL BRACES W/ WT4x20 PER (6 / S3.14), TYP.
2. STRENGTHEN (E) W14x119 PER (16 / S3.11), TYP.
3. STRENGTHEN (E) W14x43 PER (17 / S3.11) TYP.
4. STRENGTHEN (E) HORIZ. BRACES W/ WT4x20 PER (19 / S3.14), TYP.

S3.05 5 TOWER LEGS SECTION

SCALE: 1/8"=1'-0"



SECTION A–A



SECTION B–B

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	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

VOLUNTARY STRUCTURAL RETROFIT

1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

TOWER SECTION - 5 LEG FRAMING LEVEL 5 TO LEVEL 6

Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	AS NOTED

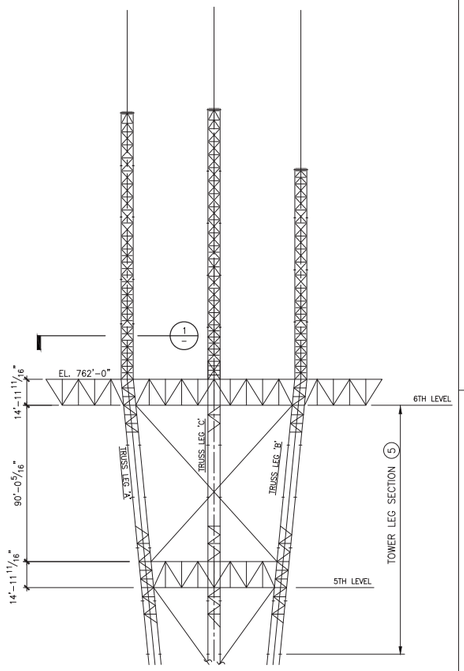
Drawing No.

S3.5

REGISTERED PROFESSIONAL ENGINEER RONALD O. HAMBURGER No. 2951 STRUCTURAL STATE OF CALIFORNIA

Seal

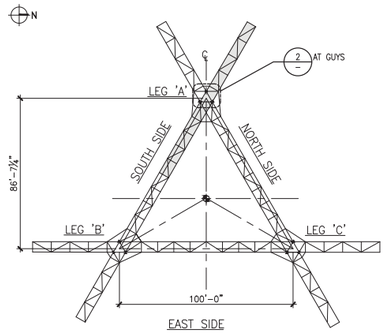
6/24/19



SOUTH SIDE ELEVATION

TOWER WORK POINT ELEVATION

SCALE: 1/32" = 1'-0"



EAST SIDE

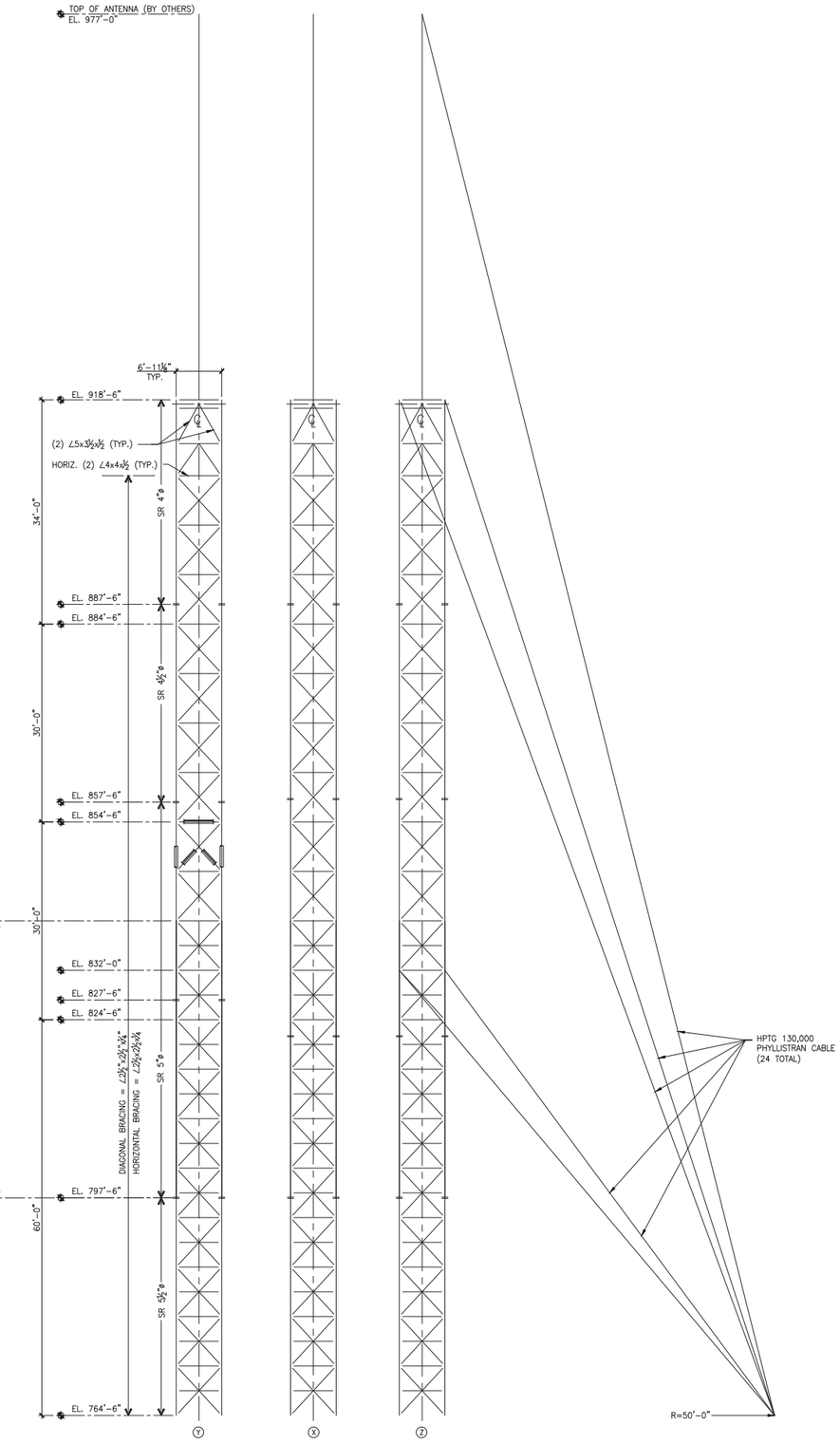
KEY PLAN – 6TH LEVEL

LEG 'A'

TOP VIEW

1 SECTION

SCALE: 1/8"=1'-0"



LEG 'A'

ANTENNA STACK SUPPORT

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NOTES:

1. S.R. – INDICATES SOLID ROUND CONFORMING TO ASTM 572–GR50 (2)
2. ALL CONSTRUCTION ON THIS SHEET IS NEW

No.	Date	Description	By
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	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

VOLUNTARY STRUCTURAL RETROFIT

1 LA AVANZADA ST.
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CALIFORNIA

Project

ANTENNA STACK SUPPORTS LEG A

Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	AS NOTED

Drawing No.

S3.7

REGISTERED PROFESSIONAL ENGINEER RONALD O. HAMBURGER No. 2951 STATE OF CALIFORNIA

Seal 6/24/19

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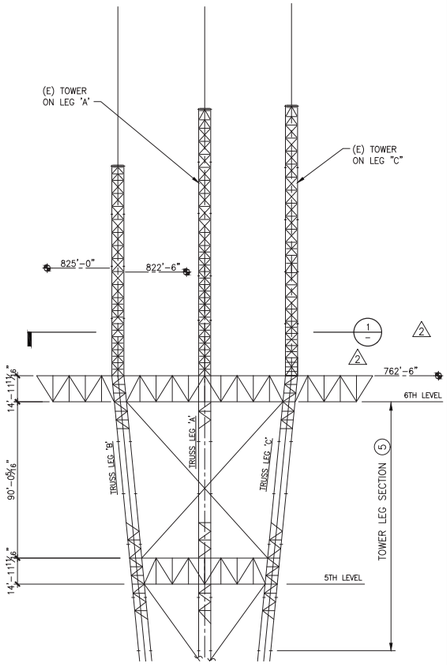
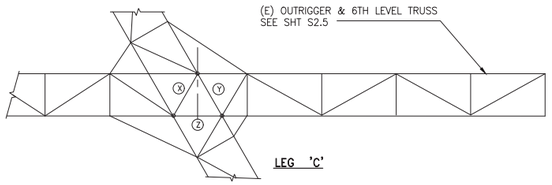


EAST SIDE ELEVATION

TOWER WORK POINT ELEVATION

SCALE: 1/32" = 1'-0"

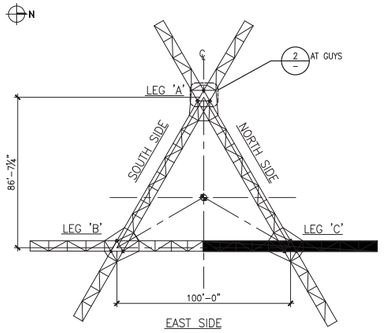


LEG 'C'

TOP VIEW

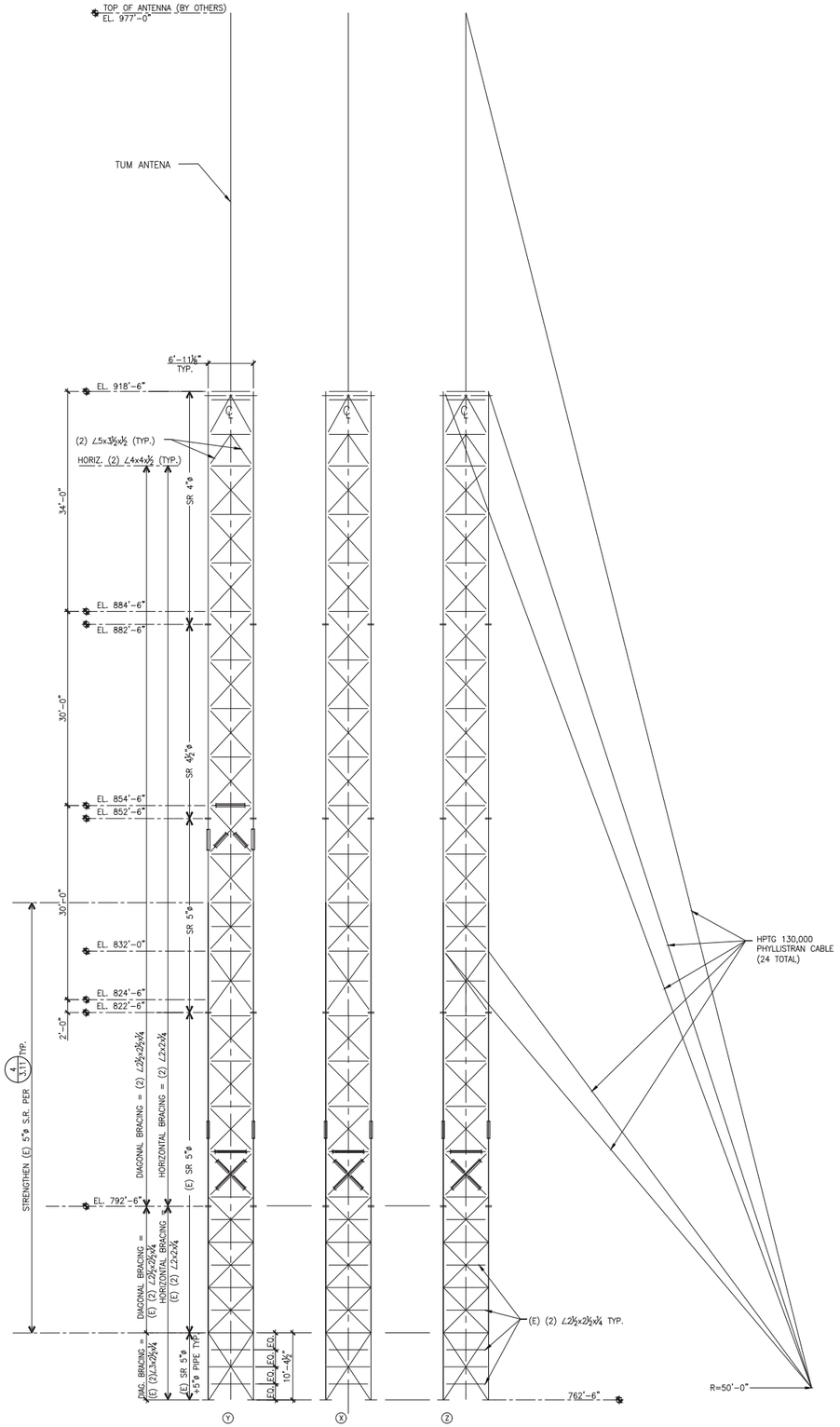
1 SECTION

SCALE: 1/8"=1'-0"



EAST SIDE

KEY PLAN – 6TH LEVEL



LEG 'C' ELEVATION

SCALE: 1/8" = 1'-0"

ANTENNA STACK SUPPORTS

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1. S.R. INDICATE SOLID ROUND CONFORMING TO ASTM A572-GR.50 (2)
2. HEAVY LINES REPRESENT NEW ELEMENTS
3. STACK B LEG ELEVATION: REMAINS UNCHANGED

No.	Date	Description	By
2	12/16/08	PLAN CHECK	ROH
0	5/30/19	ISSUED FOR PERMIT	ROH
	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

VOLUNTARY STRUCTURAL RETROFIT

1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

ANTENNA STACK SUPPORTS LEG C

Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn: GPN	Approved: ROH	Scale: AS NOTED

REGISTERED PROFESSIONAL ENGINEER
RONALD O. HAMBURGER
No. 2951
STRUCTURAL
STATE OF CALIFORNIA

Seal

6/24/19

Drawing No.

S3.9

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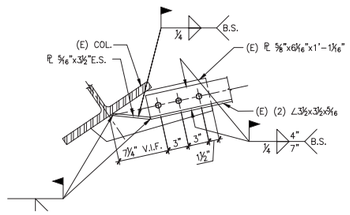
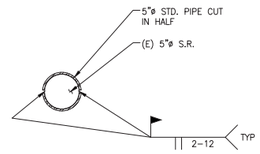


3 CONNECTION STRENGTHENING

SCALE: 1 1/2"=1'-0"



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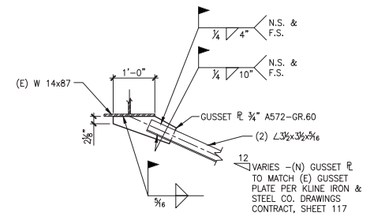
SCALE: 1 1/2"=1'-0"



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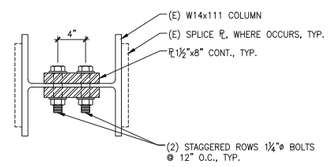
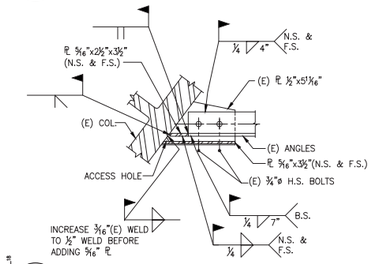
SCALE: 3/4"=1'-0"



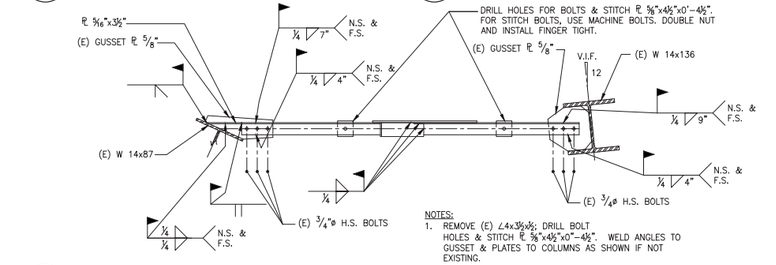
7 TYPE I COLUMN STRENGTHENING

SCALE: 1 1/2"=1'-0"



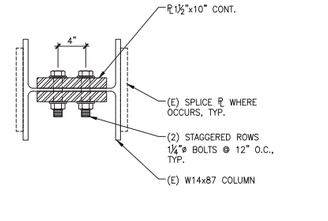
8 CONNECTION STRENGTHENING

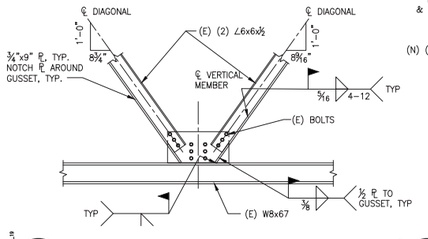
SCALE: 1 1/2"=1'-0"

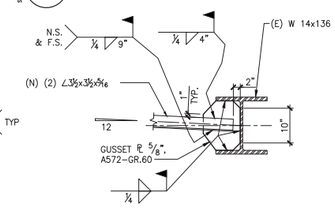


9 DIAGONAL BRACE STRENGTHENING

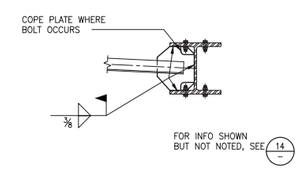
SCALE: 3/4"=1'-0"





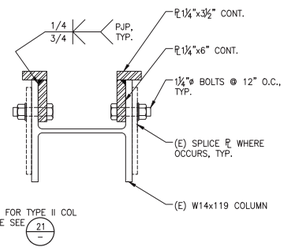


NOTE : GUSSET ℄ TO MATCH (E) GUSSET ℄ PER KLINE IRON STEEL CO. DRAWINGS CONTRACT 3018, SHEETS 129 AND 152, FOR LEVEL 2, SHEETS 135 & 158 FOR LEVEL 3, & SHEETS 140 & 163 FOR LEVEL 4



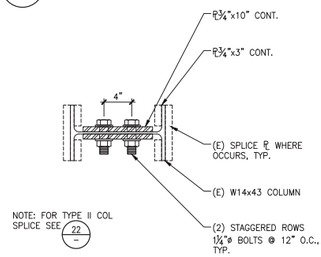
12 TYPE I COLUMN STRENGTHENING

SCALE: 1 1/2"=1'-0"



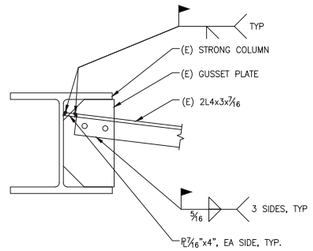
13 CONNECTION STRENGTHENING

SCALE: 1/2"=1'-0"



14 CONNECTION STRENGTHENING

SCALE: 3/4"=1'-0"



15 CONNECTION STRENGTHENING

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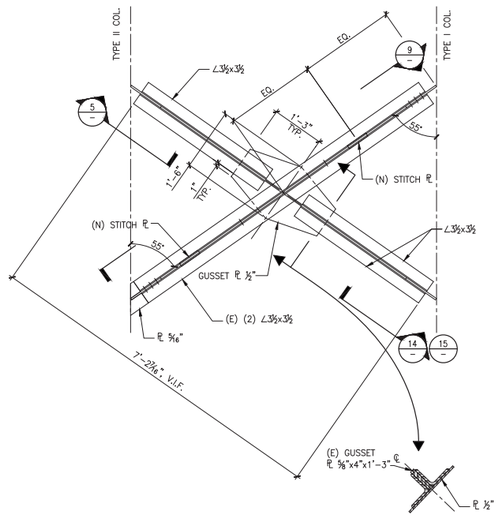

16 TYPE II COLUMN STRENGTHENING

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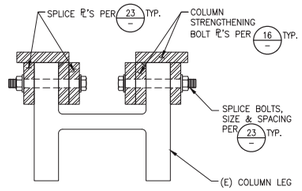

17 TYPE I COLUMN STRENGTHENING

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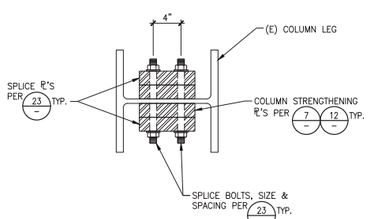

18 CONNECTION STRENGTHENING

SCALE: 1 1/2"=1'-0"

STRONG COLUMN SPLICE PER 21

COLUMN SIZE	SPLICE ℄ SIZE	SPLICE ℄ LENGTH	SPLICE BOLTS SIZE	SPLICE BOLTS SPACING	# BOLTS EA. SIDE OF SPLICE
W14x119	1"x6"	48"	1"ø	4"	6

WEAK COLUMN SPLICE PER 22

COLUMN SIZE	SPLICE ℄ SIZE	SPLICE ℄ LENGTH	SPLICE BOLTS SIZE	SPLICE BOLTS SPACING	# ROWS EA. SIDE OF SPLICE
W14x111	1½"x8"	32"	1⅛"ø	4"	4
W14x87	1½"x10"	32"	1"ø	4"	4
W14x43	¾"x10"	24"	1"ø	4"	3

21 TYPE II COLUMN STRENGTHENING SPLICE

SCALE: 1 1/2"=1'-0"

22 TYPE I COLUMN STRENGTHENING SPLICE

SCALE: 1 1/2"=1'-0"

23 SPLICE SCHEDULE

SCALE: FULL SCALE

24 DIAGONAL BRACE STRENGTHENING

SCALE: 3/4"=1'-0"

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Los Angeles
New York
San Francisco
Washington, DC

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NOTE:

1. ALL PLATES ARE ASTM A572 GR.50 U.O.N.

No.	Date	Description	By
0	5/30/19	ISSUED FOR PERMIT	ROH
	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

VOLUNTARY STRUCTURAL RETROFIT

1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

DETAILS FOR MEMBER STRENGTHENING

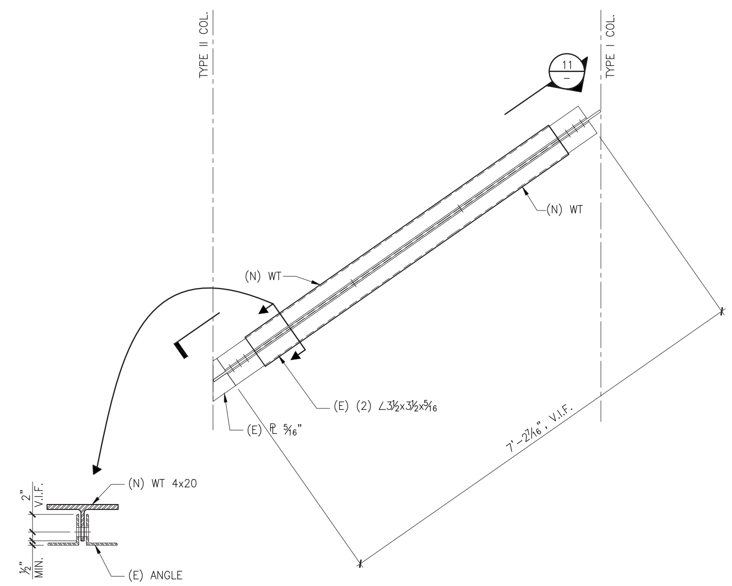
Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	Approved	Scale
GPN	ROH	AS NOTED

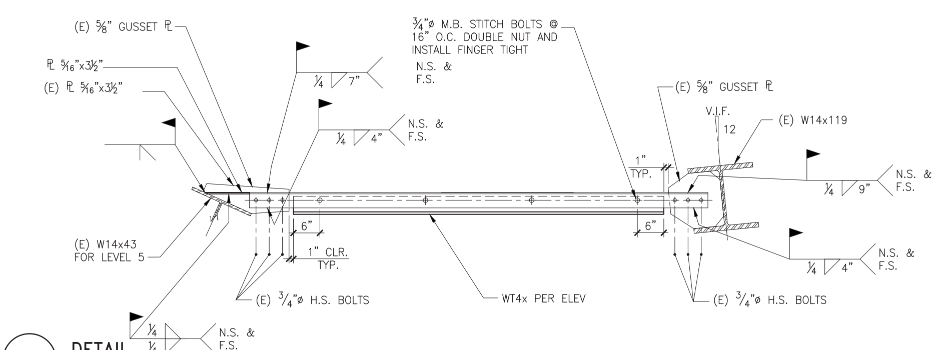
REGISTERED PROFESSIONAL ENGINEER RONALD O. HAMBURGER No. 2951 STRUCTURAL STATE OF CALIFORNIA

Seal 6/24/19

Drawing No. **S3.11**



STKB_S314_D06
6 DETAIL
SCALE: 3/4"=1'-0"



SDTV_S312_D13
11 DETAIL
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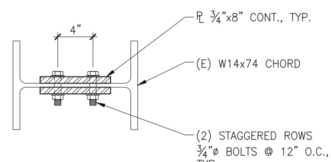

STKB_S314_D16
16 CHORD STRENGTHENING
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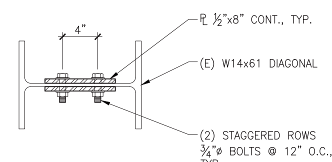

STKB_S314_D17
17 DIAGONAL STRENGTHENING
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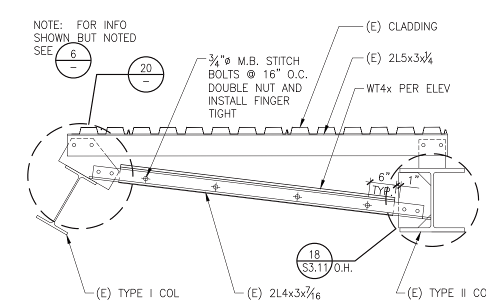
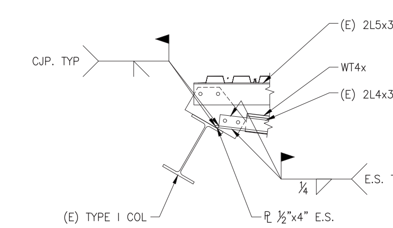


STKB_S314_D19
19 DETAIL
SCALE: 3/4"=1'-0"



STKB_S314_D20
20 DETAIL
SCALE: 3/4"=1'-0"

I:\SF\Projects\2006\067199.24-STKB\Drawings\Working_Set - Voluntary Retrofit\STKB_S314.dwg

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No.	Date	Description	By
0	5/30/19	ISSUED FOR PERMIT	ROH
	9/21/17	ISSUED FOR PLANNING REVIEW	ROH

VOLUNTARY STRUCTURAL RETROFIT

1 LA AVANZADA ST.
SAN FRANCISCO
CALIFORNIA

Project

DETAILS FOR MEMBER STRENGTHENING

Drawing Title

Commission	Checked	Date
067199.24	BW	09/06/17
Drawn	**Approved**	**Scale**
GPN	ROH	AS NOTED

Seal: REGISTERED PROFESSIONAL ENGINEER RONALD O. HAMBURGER No. 2951 STRUCTURAL STATE OF CALIFORNIA
6/24/19

Drawing No.
S3.14

HAMMETT & EDISON, INC.
CONSULTING ENGINEERS
BROADCAST & WIRELESS

WILLIAM F. HAMMETT, P.E.
RAJAT MATHUR, P.E.
ROBERT P. SMITH, JR.
ANDREA L. BRIGHT, P.E.
NEIL J. OLIJ, P.E.
BRIAN F. PALMER
MANAS REDDY
M. DANIEL RO

ROBERT L. HAMMETT, P.E.
1920-2002
EDWARD EDISON, P.E.
1920-2009

DANE E. ERICKSEN, P.E.
CONSULTANT

BY EMAIL ERICD@SUTROTOWER.COM

March 8, 2019

Mr. Eric Dausman
Sutro Tower, Inc.
1 La Avanzada Street
San Francisco, California 94131

Dear Eric:

As you requested, we have compared our radio frequency ("RF") exposure calculations at Sutro Tower for the analog to digital conversion of TV stations in 2008, with the calculations in our report, dated December 28, 2018, for the post-repack facilities, in order to explain the differences in calculated RF exposures. It is important to emphasize that these are differences in *calculated* RF exposure levels, not actual measured exposure levels. We anticipate that actual measured RF exposure levels will be similar to prior levels.

In 2008, we calculated a maximum RF exposure level at ground of 8.4% of the FCC public limit for the final digital facilities. Due to the worst-case assumptions made in these calculations, the calculated exposure levels were expected to be higher than actual levels measured at the site. The maximum RF exposure level we measured, during our several subsequent measurements of the actual RF exposure levels at ground from those facilities, has been between 6% and 7% of the public limit.

We typically see a greater difference between our calculated RF exposure levels and actual measurements than the difference at Sutro Tower for the 2008 modifications. One likely reason for this is that the low points ("nulls") in the manufacturers' calculated antenna patterns are not being realized because of reflections from the spires atop the Tower. Our 2018 exposure calculations attempt to account for this by assuming that the nulls of the individual stations' antenna patterns are, in fact, not as deep.

This more conservative assumption has resulted in an increase in calculated RF exposure levels, from 8.4% in 2008 to 14% in 2018. It is important to note, though, that this is just a change in our calculations, and that the structure of the Tower and spires is not changing, so we expect that actual RF exposure levels will be similar to those previously measured.

I hope that this helps explain the difference between our 2008 and 2018 calculations. We appreciate the opportunity to be of service and would welcome any questions on this material.

Sincerely,

Rajat Mathur

Rajat Mathur, P.E.

dm

cc: Ms. Kristen Thall Peters – BY E-MAIL KTPETERS@CWCLAW.COM

Sutro Tower, Inc. • San Francisco, California
Ground Level RF Exposure Conditions

Statement of Hammett & Edison, Inc., Consulting Engineers

The firm of Hammett & Edison, Inc., Consulting Engineers, has been retained by Sutro Tower, Inc., to evaluate the radio frequency ("RF") exposure conditions at Sutro Tower in San Francisco, California, for compliance with appropriate guidelines limiting human exposure to RF electromagnetic fields.

Prevailing Electromagnetic Field Exposure Standard

The U.S. Congress requires that the Federal Communications Commission ("FCC") evaluate its actions for possible significant impact on the environment. In Docket 93-62, effective October 15, 1997, the FCC adopted the human exposure limits for field strength and power density recommended in Report No. 86, "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," published in 1986 by the Congressionally chartered National Council on Radiation Protection ("NCRP"). Separate limits apply for occupational and public exposure conditions, with the latter limits generally five times more restrictive. The more recent standard, developed by the Institute of Electrical and Electronics Engineers and approved as American National Standard ANSI/IEEE C95.1-2006, "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," includes similar exposure limits. A summary of the FCC's exposure limits is shown in Figure 1. These limits apply for continuous exposures and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health.

Site Description

Sutro Tower is located near Mt. Sutro in San Francisco, California, and currently supports nine DTV and four FM stations. As part of the ongoing FCC repack of TV stations, there are several changes proposed to the DTV stations at Sutro Tower:

TV Station	Existing Condition	Proposed Condition
KURK-LD	Not at site	D03
KRCB(TV)	Not at site	D05
KRON-TV	D38	D07
KGO-TV	D07	D12
KQTA-LD	Not at site	D14
KPJK(TV)	D43	D27
KBCW	D45	D28
KPIX-TV	D29	No change
KQED (TV)	D30	No change
KTVU(TV)	D44	D31
KCNS(TV)	D39	D32
KFSF-DT	D34	No change
KOFY-TV	D19	Ceased operations
KMTP-TV	D33	Ceased operations
KEMO-TV	D32	Ceased operations

In addition to the DTV and FM stations, Sutro Tower also supports approximately 177 additional smaller-scale antennas and accessory equipment on the tower, on the building rooftop, and in a few instances, within the grounds of the secured Sutro Tower site. Due to the low effective radiated power ("ERP") and, in many cases, considerable height above ground of the smaller-scale antenna operations, individual or cumulative RF contributions from these 177 facilities are too low to meaningfully affect cumulative RF levels at ground level, and this report addresses only the RF exposure conditions for existing and proposed television and radio antennas.

The Sutro Tower Communications Site is entirely encompassed by a chain-link fence, with access into the area controlled by a locked gate. Figure 2 shows a plan view of the site, while Figure 3 provides a summary of the proposed broadcast facilities.

Computer Modeling Method

The FCC provides direction for determining compliance in its Office of Engineering and Technology Bulletin No. 65, "Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radio Frequency Radiation," dated August 1997. Figure 4 attached describes the calculation methodologies, reflecting the facts that a directional antenna's radiation pattern is not fully formed at locations very close by (the "near-field" effect) and that at greater distances, in the far-field of the antenna where the pattern is formed, the power level from an energy source decreases with the square of the distance from it (the "inverse square law"). This methodology is an industry standard for evaluating exposure conditions and has been demonstrated through numerous field tests to be a conservative prediction of field strength levels. For all calculations near Sutro Tower, a ground elevation data file was used incorporating USGS 10-meter terrain data.

RF Exposure Levels from Proposed Post-Repack Operation

For a person anywhere at ground, the maximum cumulative RF exposure level due to the *normal* operation of all the broadcast facilities on Sutro Tower is 0.049 mW/cm^2, which is 14% of the applicable public exposure limit. For a person anywhere at ground, the maximum cumulative RF exposure level due to the *auxiliary* (backup) operation of all the broadcast facilities on Sutro Tower is 0.090 mW/cm^2, which is 26% of the applicable public exposure limit. It should be noted that these results include several "worst-case" assumptions and therefore are expected to overstate actual power density levels from the proposed operations.

Conclusion

Based on the information and analysis above, it is the undersigned's professional opinion that RF exposure levels at ground from the proposed post-repack operation from Sutro Tower will comply with the prevailing standards for limiting public exposure to radio frequency energy. The highest calculated level in publicly accessible areas is much less than the prevailing standards allow for exposures of unlimited duration.

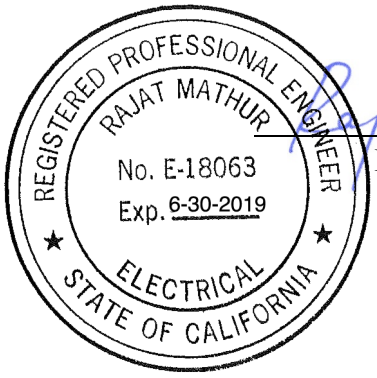
List of Figures

In carrying out these engineering studies, the following attached figures were prepared under my direct supervision:

1. FCC exposure limits
2. Site map showing approximate location of tower and transmitter building
3. Summary of broadcast station operating parameters
4. RFR.CALC™ calculation methodology

Authorship

The undersigned author of this statement is a qualified Professional Engineer, holding California Registration No. E-18063, which expires on June 30, 2019. This work has been carried out by him or under his direction, and all statements are true and correct of his own knowledge except, where noted, when data has been supplied by others, which data he believes to be correct.



Rajat Mathur, P.E.
707/996-5200

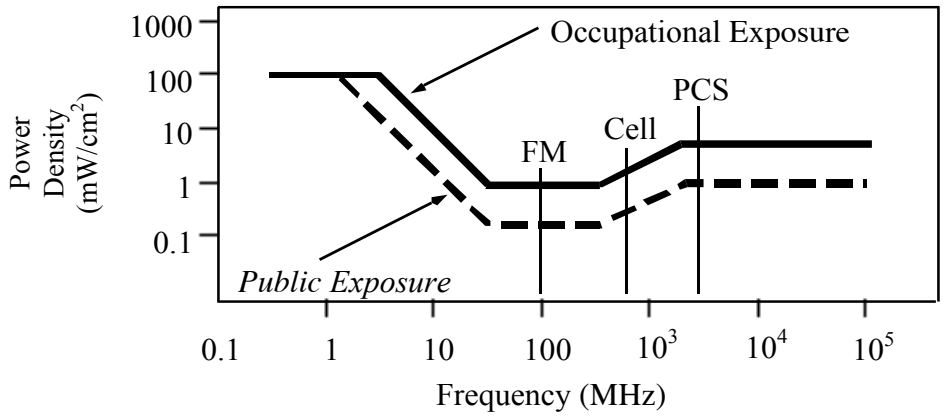
December 28, 2018

FCC Radio Frequency Protection Guide

The U.S. Congress required (1996 Telecom Act) the Federal Communications Commission ("FCC") to adopt a nationwide human exposure standard to ensure that its licensees do not, cumulatively, have a significant impact on the environment. The FCC adopted the limits from Report No. 86, "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," published in 1986 by the Congressionally chartered National Council on Radiation Protection and Measurements ("NCRP"). Separate limits apply for occupational and public exposure conditions, with the latter limits generally five times more restrictive. The more recent standard, developed by the Institute of Electrical and Electronics Engineers and approved as American National Standard ANSI/IEEE C95.1-2006, "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," includes similar limits. These limits apply for continuous exposures from all sources and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health.

As shown in the table and chart below, separate limits apply for occupational and public exposure conditions, with the latter limits (in *italics* and/or dashed) up to five times more restrictive:

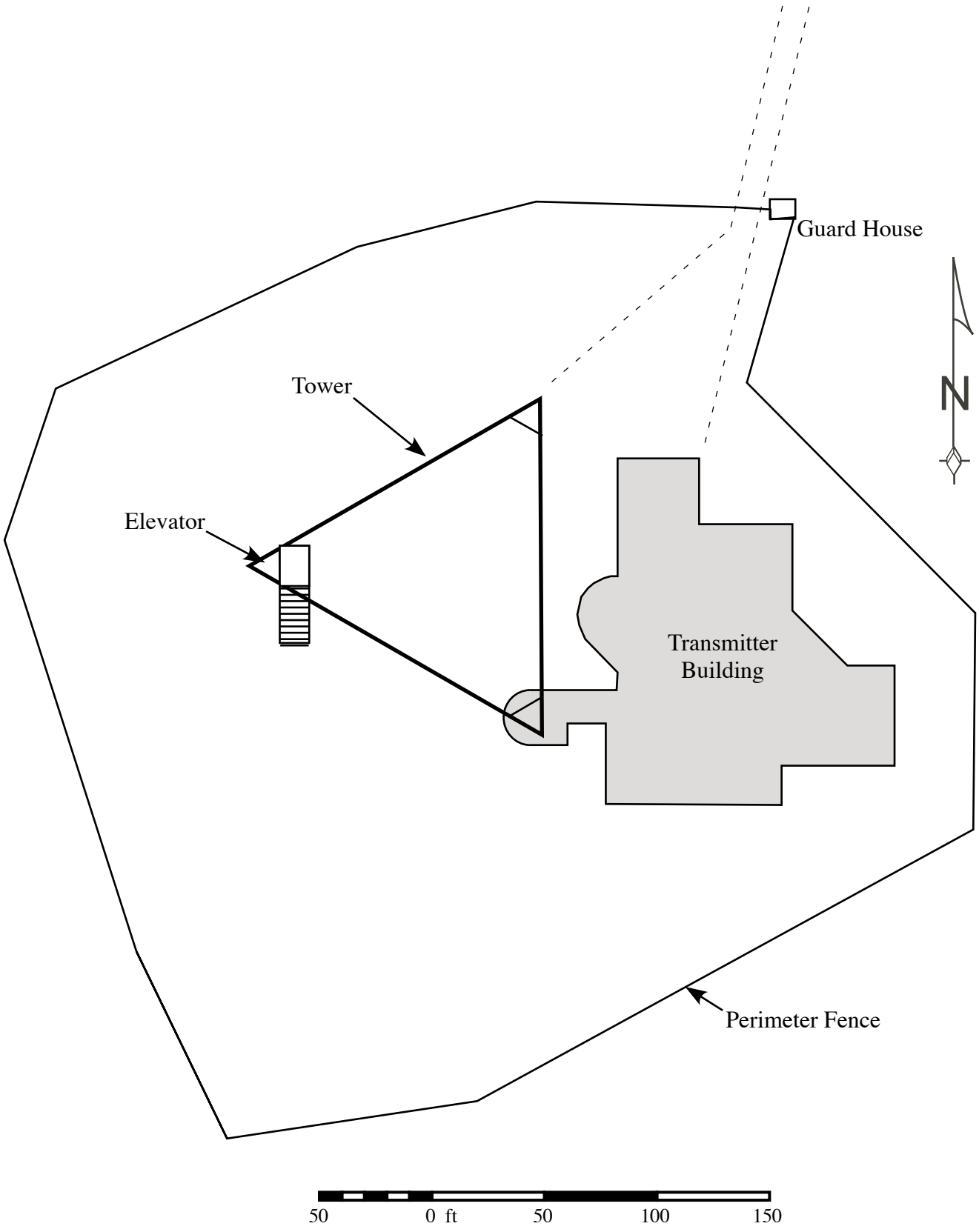
Frequency	Electromagnetic Fields (f is frequency of emission in MHz)					
Applicable Range (MHz)	Electric Field Strength (V/m)		Magnetic Field Strength (A/m)		Equivalent Far-Field Power Density (mW/cm^2)	
0.3 – 1.34	614	*614*	1.63	*1.63*	100	*100*
1.34 – 3.0	614	*823.8/ f*	1.63	*2.19/ f*	100	*180/ f^2*
3.0 – 30	1842/ f	*823.8/ f*	4.89/ f	*2.19/ f*	900/ f^2	*180/ f^2*
30 – 300	61.4	*27.5*	0.163	*0.0729*	1.0	*0.2*
300 – 1,500	$3.54\sqrt{f}$	*$1.59\sqrt{f}$*	$\sqrt{f}/106$	*$\sqrt{f}/238$*	f/300	*f/1500*
1,500 – 100,000	137	*61.4*	0.364	*0.163*	5.0	*1.0*



Higher levels are allowed for short periods of time, such that total exposure levels averaged over six or thirty minutes, for occupational or public settings, respectively, do not exceed the limits, and higher levels also are allowed for exposures to small areas, such that the spatially averaged levels do not exceed the limits. However, neither of these allowances is incorporated in the conservative calculation formulas in the FCC Office of Engineering and Technology Bulletin No. 65 (August 1997) for projecting field levels. Hammett & Edison has built those formulas into a proprietary program that calculates, at each location on an arbitrary rectangular grid, the total expected power density from any number of individual radio sources. The program allows for the description of buildings and uneven terrain, if required to obtain more accurate projections.

Sutro Tower, Inc. • San Francisco, California

Site Plan



HAMMETT & EDISON, INC.
CONSULTING ENGINEERS
SAN FRANCISCO

Sutro520 Sutro508
Figure 2 Figure 2

Sutro Tower, Inc. • San Francisco, California

Summary of Broadcast Station Operating Parameters

Normal Operating Condition

Station	Channel	Effective Radiated Power	Antenna Make & Model	Center Height Above Sea Level
KURK-LD	D03	3 kW	Dielectric DCRQ450	493.1 m
KRCB(TV)	D05	18.6	Dielectric CBR-C2-04MBA/8H-1	496.2
KRON-TV	D07	50	Dielectric THV-6A7/VP-R 4C160	531.6
KGO-TV	D12	47	Dielectric THV-6A12/CP-R 4C160	545.5
KQTA-LD	D14	15	Dielectric TFU-16WB C160	498.1
KPJK(TV)	D27	465	Dielectric TUM-C5SP-14/60H-2-T-R	542.6
KPIX-TV	D29	1,000		
KTVU(TV)	D31	1,000		
KBCW(TV)	D28	1,000	Dielectric TFU-24DSC/VP-R C140 DC	516.9
KQED(TV)	D30	1,000	Dielectric TUM-C5SP-14/60H-2-T-R	542.6
KCNS(TV)	D32	1,000		
KFSF-DT	D34	850	Dielectric TFU-26DSC/VP-R P190	523.7
KOIT(FM)	243	24	ERI MPX-6C-HW	511.2
KSOL(FM)	255	6.1	ERI LPX-3E-SP	440.2
KOSF(FM)	279	10	ERI LPX-4E-HW	492.6
KFOG(FM)	283	7.1	ERI 4-bay half-wave spaced	490.2

Auxiliary Operating Condition

Station	Channel	Effective Radiated Power	Antenna Make & Model	Center Height Above Sea Level
KURK-LD	D03	3 kW	Dielectric DCRQ450	375.5 m
KRCB(TV)	D05	12.5	Dielectric DCRQ450	414.5
KRON-TV	D07	70	Dielectric TLS-V8/VP-R C160	469.7
KGO-TV	D12	70	Dielectric TLS-V8/VP-R C160	469.7
KQTA-LD	D14	15	Dielectric TUA-C4SP-12/40U-1-S	402.3
KPJK(TV)	D27	250		
KPIX-TV	D29	500		
KTVU(TV)	D31	427.9		
KBCW(TV)	D28	500	Dielectric TUA-C4SP-12/40U-1-S	387.8
KQED(TV)	D30	500		
KCNS(TV)	D32	500		
KFSF-DT	D34	185		
KQED-FM	203	58	Dielectric DCRS8D50PF10	492.6
KOIT(FM)	243	36	ERI SHP-6AC-HW	443.2
KSOL(FM)	255	6.1	Shively 6813-NP	302.1
KOSF(FM)	279	10	ERI LPX-4E-HW	302.2
KFOG(FM)	283	13.5	ERI MPX-4C-W	451.1

RFR.CALC™ Calculation Methodology

Assessment by Calculation of Compliance with FCC Exposure Guidelines

The U.S. Congress required (1996 Telecom Act) the Federal Communications Commission ("FCC") to adopt a nationwide human exposure standard to ensure that its licensees do not, cumulatively, have a significant impact on the environment. The maximum permissible exposure limits adopted by the FCC (see Figure 1) apply for continuous exposures from all sources and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health. Higher levels are allowed for short periods of time, such that total exposure levels averaged over six or thirty minutes, for occupational or public settings, respectively, do not exceed the limits.

Near Field.

Prediction methods have been developed for the near field zone of panel (directional) and whip (omnidirectional) antennas, typical at wireless telecommunications base stations, as well as dish (aperture) antennas, typically used for microwave links. The antenna patterns are not fully formed in the near field at these antennas, and the FCC Office of Engineering and Technology Bulletin No. 65 (August 1997) gives suitable formulas for calculating power density within such zones.

For a panel or whip antenna, power density $S = \frac{180}{\theta_{BW}} \times \frac{0.1 \times P_{net}}{\pi \times D \times h}$, in mW/cm^2,

and for an aperture antenna, maximum power density $S_{max} = \frac{0.1 \times 16 \times \eta \times P_{net}}{\pi \times h^2}$, in mW/cm^2,

where θ_{BW} = half-power beamwidth of the antenna, in degrees, and
P_{net} = net power input to the antenna, in watts,
D = distance from antenna, in meters,
h = aperture height of the antenna, in meters, and
η = aperture efficiency (unitless, typically 0.5-0.8).

The factor of 0.1 in the numerators converts to the desired units of power density.

Far Field.

OET-65 gives this formula for calculating power density in the far field of an individual RF source:

power density $S = \frac{2.56 \times 1.64 \times 100 \times RFF^2 \times ERP}{4 \times \pi \times D^2}$, in mW/cm^2,

where ERP = total ERP (all polarizations), in kilowatts,
RFF = relative field factor at the direction to the actual point of calculation, and
D = distance from the center of radiation to the point of calculation, in meters.

The factor of 2.56 accounts for the increase in power density due to ground reflection, assuming a reflection coefficient of 1.6 (1.6 x 1.6 = 2.56). The factor of 1.64 is the gain of a half-wave dipole relative to an isotropic radiator. The factor of 100 in the numerator converts to the desired units of power density. This formula has been built into a proprietary program that calculates, at each location on an arbitrary rectangular grid, the total expected power density from any number of individual radiation sources. The program also allows for the description of uneven terrain in the vicinity, to obtain more accurate projections.

City and County of San Francisco
DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL HEALTH SECTION Stephanie Cushing, MSPH, CHMM, REHS, Director of EH

London N. Breed, Mayor
Grant Colfax, MD, Director of Health

June 20, 2019

TO: Sutro Tower Inc. Attn: Kristen Thall Peters, Esq.

FROM: Arthur Duque, Dept. Of Public Health, Environmental Health Services

RE: Sutro Tower, Inc. RF Report Review

As requested, I have reviewed the documentation that you and Sutro Tower, INC have provided to me regarding the ground level RF exposure conditions at Sutro Tower located in the City and County of San Francisco.

This review includes December 28, 2018 radio frequency energy report prepared by Hammett and Edison Inc. for this site. The maximum cumulative RF exposure level due to the normal operation of all broadcast facilities at Sutro Tower was measured at 0.049 mW/cm^2, which is 14% of the FCC public exposure standard. The maximum cumulative RF exposure level at ground level of all broadcast facilities at Sutro Tower was measured at 0.090 mW/cm^2, which is 26% of the FCC public exposure standard.

Based on the information provided in the Hammett and Edison report, I would agree that the broadcast stations at Sutro Tower are in compliance with the FCC standards and will not produce radio frequency energy exceeding the FCC public exposure limits.

Sincerely,

Arthur Duque

Arthur Duque, REHS

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Phone 252-3800, Fax 252-3894