


RAMP METERING DESIGN MANUAL



 California Department of Transportation
Division of Traffic Operations

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Book Descriptions:

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HIGHWAY DESIGN MANUAL	
	May 7, 2012
FOREWORD	
Purpose <p>This manual was prepared for the California Department of Transportation (Department) by the Division of Design for use on the California State highway system. This manual establishes uniform policies and procedures to carry out the State highway design functions of the Department. It is neither intended as, nor does it establish, a legal standard for these functions.</p> <p>The standards, procedures, and requirements established and discussed herein are for the information and guidance of the officers and employees of the Department.</p> <p>Many of the instructions given herein are subject to amendment as conditions and experience warrant. Special situations may call for deviation from policies and procedures, subject to Division of Design approval, or such other approval as may be specifically provided for in the text of this manual.</p> <p>It is not intended that any standard of conduct or duty toward the public shall be created or imposed by the publication of this manual. Statements as to the duties and responsibilities of any given classification of officers or employees mentioned herein refer solely to duties or responsibilities owed by these in such classification to their superiors. However, in their official contacts, each employee should recognize the necessity for good relations with the public.</p>	<p>and made available on-line on the Department Design website: http://www.dot.ca.gov/hq/oppd/hdm/hdmtoctoc.htm. The new instructions or updates may consist of additional sheets or new sheets to be substituted for those superseded. Users of this manual are encouraged to utilize the most recent version available on-line on the Department Design website.</p> <p>Organization of the Manual</p> <p>A decimal numbering system is used which permits identification by chapter, topic, and index, each of which is a subdivision of the preceding classification. For example:</p> <p>Chapter 40 Federal-Aid Topic 42 Federal-Aid System Index 42.2 Interstate</p> <p>The upper corner of each page shows the page number and the date of issue.</p>
Scope <p>This manual is not a textbook or a substitute for engineering knowledge, experience, or judgment. It includes techniques as well as graphs and tables not ordinarily found in textbooks. These are intended as aids in the quick solutions of field and office problems. Except for new developments, no attempt is made to detail basic engineering techniques; for these, standard textbooks should be used.</p>	<p>Use the Table of Contents</p> <p>The Table of Contents gives the index number and page number for each topical paragraph together with corresponding dates of issue. If the holder of the manual chooses to maintain a paper copy, the holder is responsible for keeping the paper copy up to date and current. Revised Table of Contents will be issued on the Department Design website as the need arises.</p> <p>Use of the English and Metric Editions of the Highway Design Manual</p> <p>This Sixth Edition of the Highway Design Manual is in U.S. Customary (English) units. Departmental policy established by Director's Policy 15-R1 and Deputy Directive Number 12-R1, both effective October 2006, state that the Department has adopted the use of the U.S. Customary (English) units as its preferred system of units and measures. All projects designed and constructed in English units shall follow the standards in this manual.</p> <p>The Metric standards contained in the Fifth Edition of the Highway Design Manual, and related publications, are to continue to be used if the specific project was granted an exception to</p>
Form <p>The loose-leaf form was chosen because it facilitates change and expansion. New instructions or updates will be issued as sheets in the format of this manual</p>	

Image Transportation for America Adetokunbo Toks Omishakin comes from the Tennessee Department of Transportation, where he directs its Bureau of Environment and Planning. He has also served on the board of directors for American Walks, and as vice chair of the AASHTO Council on Active Transportation, where biking and walking advocates say he has provided thoughtful leadership. The state dedicates funding to biking and walking under the Active Transportation Program; it has rewritten pieces of the California Design Manual; Caltrans has already adopted a somewhat toothless Complete Streets policy. Dave Snyder, Executive Director of the California Bicycle Coalition, told Streetsblog that "we've had other directors talk the talk, but none have walked the walk by putting their energy to promote active transportation in a difficult environment the way Toks has. We are really looking forward to working with him." At the time, just getting a single bike lane built was cause for a major celebration. Things have changed, he said, in large part because of the active engagement of advocates, who have pushed government agencies to do better. But first they talk about transit and funding. It's gotta be convenient for people. It's gotta be affordable." The column geometry should be Bosch Captive Column,, the ultimate highstrengthtoweighratio structure. I'm working toward getting an engineering guide written by an earthquake engineer. That would be poetic, because the founder of earthquake engineering, Bob Mast of Abam Engineers, did a lot of the early analysis. Credit where credit is due to Newsom for a bold choice, and best of luck to Omishakin. Fingers crossed. Long an independent department, Caltrans had just been put under the control of the new California State Transportation Agency, CalSTA, which had promptly commissioned an outside report on its strengths and weaknesses. <http://cgsafe.com/upFile/image/20200921/digital-thermometer-user-manual.xml>

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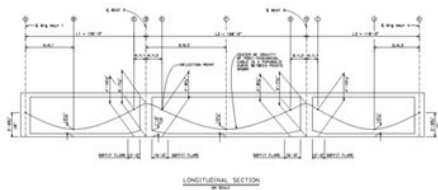
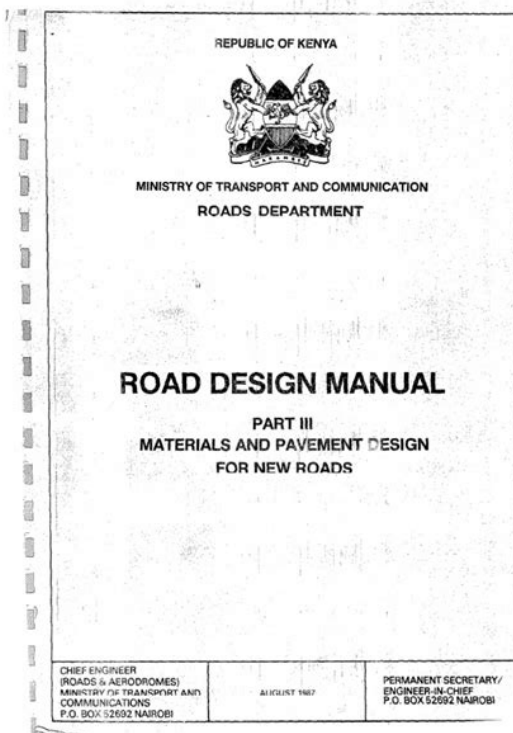


Figure 7.12.6-7 Final Cable Path as it would Appear on the Plans

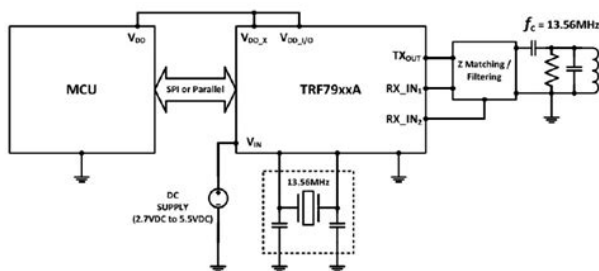
In addition to some very hard conversations about equity and diversity in bike advocacy—a subject that needs its own report—there were more plannery presentations about ontheground bike issues. TELECOMMUNICATIONS Wireless LICENSING PROGRAM. These procedures to license property to Telecommunications Wireless Carriers are a supplement to the Caltrans Right of Way Manual, Airspace Chapter, and are designed to assist District staff in licensing sites for Telecommunications Wireless Facilities and do not supplant the requirements identified in the Department’s Airspace Development policies and procedures. PLEASE BE ADVISED the information in this manual is updated on a regular basis; for the most current information, contact the appropriate department. CALTRANS’ MISSION The mission of Caltrans is to Provide the people of California with a safe, efficient and effective intermodal transportation system; Plan, develop, maintain, and manage interregional transportation systems; Assist and guide delivery of local and regional transportation services; Provide leadership for California’s transportation future by conducting research and development, and by formulating plans, programs, guidelines and standards; and Be a good steward of its resources. To perform its mission, Caltrans has under its control and management property located throughout the State of California that is used for the safe and effective operation of its transportation systems. Caltrans shall maximize public and private multiple use of property held for transportation purposes, including rights of way, in concert with community needs and good land use planning, when it is deemed safe to do so. Many of the properties are capable of accommodating a secondary use without interfering with the operation and future expansion of the transportation corridor. <http://safe-international.com/userfiles/digital-timer-model-9159-manual.xml>



This includes making property available for an unmanned telecommunications wireless facility under the terms of a nonexclusive license agreement when the licensing of a site benefits the public and is consistent with the State's transportation programs and needs. MISSION of TELECOMMUNICATIONS WIRELESS LICENSING PROGRAM The purpose of the licensing program is to increase the mobility of voice and data information through an improved telecommunications infrastructure and to provide Caltrans with more efficient communications systems. The mission of the Telecommunications Wireless Licensing Program is to Provide an efficient method to transport data that will improve the public's ability to communicate. Utilize Caltrans'owned assets to satisfy internal needs to establish a high tech network for communications. Generate revenue by licensing the site for a wireless facility when there are no negative impacts to operations. This mission statement is in concert with Executive Order W1891 issued by the Governor in October 1991, mandating that state agencies seek new opportunities to involve the private sector in maximizing the value of its real estate, and is supported by the Federal Highway Administration FHWA, which finds this program to be consistent with the Federal Telecommunications Act of 1996 and the need to develop the future Intelligent Transportation System ITS. A license may be granted for sites identified in the above listed properties when it is found safe, does not interfere with traffic or other transportation uses, and is visually unobtrusive. The Master License Agreement MLA approved by the California Transportation Commission CTC on May 1, 1997 must be executed by any cellular or Personal Communications Services PCS carrier interested in licensing a site.

The agreement standardizes the terms and conditions that will apply to all specific sites licensed to a carrier, with a Site License Agreement SLA describing the specific use and restrictions for each site. See Appendix D. The full implementation of the licensing program includes a continuous review and evaluation of the policy, process, and agreements used to license a site, and of the market rates received as a result of the installation and operation of the Facility. All Caltrans programs in the districts and in Headquarters, and Carrier staff, including brokers and consultants, are encouraged to provide input as to the effectiveness of the licensing program. AIRSPACE AUTHORITY Caltrans has the legal authority to lease its property held for transportation purposes for a secondary use if such use does not interfere with the operation of the highway. Prior to entering into any lease, Caltrans shall determine that the proposed use is not in conflict with the zoning regulation of the

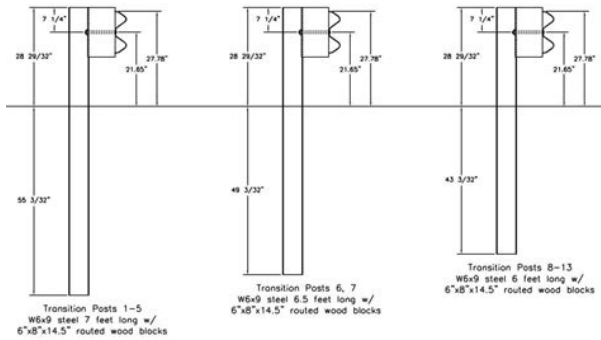
local government concerned. The process outlined below ensures that the licensing of sites for a Facility is consistent, fair, and equitable for all parties involved, and establishes a streamlined program that reduces costs and expedites the process of reviews and approvals. This program cannot license sites on conventional highways, which are under the jurisdiction of the District Permits Office. The licensing of the properties requires independent access for the installation, maintenance, and operation of such facility. Exceptions may be granted if they do not interfere with Caltrans' internal operations or impact the safety of the traveling public. The process to get an exception is established by the Design and Local Programs Program DLPP, and is initiated at the District's Permits Office. It is important to note that there is no listing of all real property owned within access control e.g. interchanges, light poles, directional signs, overcrossings.



<https://www.interactivelearnings.com/forum/selenium-using-c/topic/13954/3sgte-engine-manual>

California State Highway Map identifies all the state highways that are under Caltrans' control, and is available through the District Public Affairs office or attached to the Master License Agreement May 1997 as Exhibit B but not included as an exhibit in this guidebook. Maps are available from each District Public Affairs office. Other sources available include Caltrans web site on the Internet. The address to view location maps is Specific parcel or site maps should be available on the Internet in mid1998. Caltrans will advertise the need for a system by way of a Request for Proposals. Responsible Program Traffic Operations Note Refer to "Implementation of the Licensing Program" for a description of the types of property held for transportation purposes that may be available for license. Carriers respond directly to Airspace with their interest in licensing the site for a telecommunications use. If it is determined that the site can accommodate a secondary use, the site will be made available for licensing. 2. Carriers locate a site suitable for their needs that is either identified as property compatible for a secondary use per the inventory of Caltrans owned properties, or not yet identified as a property compatible for a secondary use but which the Carrier believes could be compatible. The interested Carrier submits a letter to Airspace identifying the site and expressing an interest in installing a Facility, briefly describing the purpose and type of Facility. The DARC is convened to determine any potential interference with Caltrans operations and communications, and, if none, determines if Caltrans wants to exercise its right to share space on the tower subject to the provisions in the MLA. If it is determined that the site can accommodate a secondary use, the site will be made available for licensing.

<https://datavoiz.com/images/brondi-fx-100-twin-manuale.pdf>



6 TELECOMMUNICATIONS WIRELESS FACILITIES For purposes of this licensing program, telecommunications wireless facilities Facility are specifically for cellular transmission and Personal Communications Services PCS. It is anticipated that agreements with cell site developers will be available in the near future. Proposals for Enhanced Specialized Mobile Radio ESMR and paging facilities are currently handled by the Traffic Operations Program since these facilities will be allowed through a separate process. There are restrictions on the use of batteries and generators that could create a hazardous condition for the traveling public and to the real property. Additionally, all proposals to use property underneath an elevated highway must include a Project Study Report PSR that evaluates the impact of the improvements on operations and safety. ROLES AND RESPONSIBILITIES OF CALTRANS PROGRAMS Since the approval of a Facility requires input from all impacted Caltrans programs, district and headquarters staff have a critical role in the review of all proposals submitted by Carriers. Whether staff are participating in the DARC or developing siting guidelines, their responsibility is to ensure that all program concerns and needs are addressed when approval for the installation and operation of a Facility is granted. Traffic Operations Program Traffic Ops In addition to being the Project Manager for all shared resources in connection with multiple sites for a Caltrans network, Traffic Ops is a core member of the DARC, with responsibility to ensure the proposed Facility will not interfere with traffic flow nor adversely impact the safety of the traveling public. All requests to use the controlled access way for ingress and egress to the site for testing, installation, or maintenance must include Traffic Ops review and approval.

<https://www.davidpipe.com/images/brondi-fx-400-user-manual.pdf>

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Traffic Ops is also responsible for coordinating and developing the regional and statewide list of communication needs in relation to maintenance operations, traffic operations, and the Intelligent Transportation System ITS. In some cases, District Airspace will take the lead in leasing property outside of access control. The Caltrans Right of Way Manual's Airspace Chapter provides the basis for the policies and processes incorporated herein. District Airspace Managers Airspace Responsible for reviewing and coordinating approval of the proposals submitted by Carrier, ensuring that the siting guidelines established by all impacted Programs within Caltrans are considered before a site is approved. In addition, Airspace will assist all Carriers in arranging for radio frequency and soil

tests through the District Permits Office or other district programs. All reviews will ensure the proposal does not have a negative impact on the operation of the transportation system or affect the safety of the traveling public. Consists of all district representatives whose program is impacted by the proposed use, i.e. Traffic Operations, Project Development, Environmental, and Maintenance. The Maintenance Telecommunications Engineer is also a part of the team. Office of Radio Communications Engineers Telecom Engr Headquarters based unit comprised of engineers that work in the districts with the responsibility to develop and manage all radio systems for Caltrans' internal communication needs. As a core member of the DARC, the Telecom Engr will review the potential impact on Caltrans' existing and planned telecommunications systems and other users in the area. There may be times when other concerns arise e.g. FCC rules compliance but for the most part the review will focus on these three areas 1. Does the proposal pose an interference concern to any of Caltrans' present or future planned communications systems 2.

Does Caltrans have any present or future communications needs at the proposed site 3. Does the proposal pose an interference concern to other users in the area state agencies in particular. If so, the Department of General Services Telecommunications Division will also need to review the proposal. The Telecom Engr works directly with Traffic Operations in reviewing and updating Caltrans' needs on a district, regional, or statewide basis. The Telecom Engr will conduct any necessary intermodulation studies, which may include the need to involve Department of General Services Telecommunications Division DGS, if the site is within interference range of a multiuse state system. Additional charges for DGS review will be billed directly to the Carrier and are not part of the administration fee. Landscape Architects also review and approve Facilities on State Roadside Rest Areas SRRA. 8 Environmental Program The District Environmental Planners review the proposed Facility to determine whether the project could cause significant impacts to the environment species habitat, cultural resources, water quality, historical landmarks, etc.. In making their independent assessment of project impacts, they ensure the information submitted addresses all California Environmental Quality Act CEQA and National Environmental Protection Act NEPA requirements. Permits Office Permits District Permit Engineers are responsible for issuing all permits to use properties within access control and other properties as their policy dictates. They are the lead on all proposals to use conventional highways for a Facility. Permits maintains a file on all Facilities within access control for future maintenance and project development reference. Permits in Headquarters sets the policies and procedures for the issuance of encroachment permits to test, install and maintain Facilities.

<https://www.birdandwildlifeteam.com/wp-content/plugins/formcraft/file-upload/server/content/files/1627010b68d0a5--boss-chromatic-tuner-tu-2-owners-manual.pdf>

Design and Local Programs Program DLPP Responsible for the development of siting guidelines and future use of properties held for transportation purposes. Requests to obtain an Encroachment Permit by Exception are processed through Permits in accordance with policies and procedures established by the DLPP. Note See Appendix C for Caltrans representatives and phone numbers. 9 LICENSING PROCESS LICENSING PROCESS BASIC LICENSING REQUIREMENTS It is the Carrier's responsibility to certify that all installations or construction meets or exceeds any applicable design criteria. All improvements constructed on Caltrans property are considered to be the property of the State after the term of the license has expired, or upon abandonment, unless specifically stated in documentation as being otherwise. Caltrans reserves the right to require the primary Carrier to remove all improvements at the expiration of the lease. Independent access from the highway is required for all licenses. Carrier is responsible for the clean up of hazardous materials introduced to the site during the term of the Site License Agreement SLA. Caltrans is responsible for the clean up of preexisting conditions, but may elect not to do so because of funding constraints, and as such the site will not be licensed. Road rights on property other than State

owned lands are not guaranteed. The Carrier must acquire their own easement rights where needed. No project shall proceed to construction without the written approval of the FHWA, Office of Radio Communications Engineers TelecomEngr and the District Airspace Review Committee DARC. Airspace will transmit such approval to the Carrier. For all properties within access control, an Encroachment Permit will be required prior to construction and an annual maintenance permit will be maintained in order to conduct any repairs or make modifications to any equipment within the access control.

Telecom Engr and the Department of General Services DGS Telecommunications Division establish standards to ensure the integrity of all communications facilities and minimize interference with State agency communications. In addition to technical specifications, these standards may restrict the number of facilities allowed within range of state systems or other licensed facilities. A proposal can be refused based on the number of telecommunications facilities existing at the location. On an annual basis, every carrier who has executed the MLA will provide proof of liability insurance coverage and submit for review a financial statement in accordance with the provisions of the MLA. PROPOSAL REVIEW All requests to license property held by Caltrans, whether in response to the District's marketing of a site or the Carrier's transmission study, must be submitted in writing to the District Airspace Manager Airspace. The review and approval of all requests is conducted in three stages conceptual, preliminary and final. 10 Conceptual Determination of the proposal's compatibility with existing uses, and a review of the proposed installation, operation and maintenance's impact on safety and internal issues. Requires a simple narrative by the Carrier describing the proposed use and location, depicted on a simple diagram and map. Preliminary In-depth review of the proposal considering access, security, construction, maintenance, installation, interference, safety and other issues raised during the conceptual review. Requires preliminary blue prints depicting size and height of the facility, square footage of the area to be "licensed", square footage of the area to be used during construction, and specifics on access, fencing, and utility hookups. Final In-depth review and approval of the proposed construction, along with verification of all reviews and required approvals of governing entities.

Requires final construction plans depicting all excavations and trenching, approved use and building permit by the local entity, approved environmental document, and resolution of all issues raised during preliminary review. See Exhibits 1-4 for flowcharts depicting the above process. Any modifications to existing systems or property that exceed required upgrades or additional services and improvements to the transportation system must be preapproved by the Airspace Advisory Committee AAC. The DARC is comprised of District representatives from programs impacted by the proposed facility. The "Core" team will always consist of program representatives from Traffic Operations, Maintenance Operations, Environmental, and the TelecomEngr. The lead for the DARC is the District Right of Way Airspace Manager who is responsible for ensuring all proposals receive the appropriate level of review prior to entering into a SLA. If the proposed facility is within access control, in addition to the Core Team, the DARC will include a representative from Facilities Administration. Airspace may request representatives from any other program impacted by the proposal. Additionally, District Asset Management will be advised of all conceptual and preliminary reviews. It is strongly recommended that each program select one permanent representative to serve on the DARC meetings to ensure consistency in application of the siting guidelines and review process. 11 The DARC will review all requests for additional equipment, any collocation and all extensions to the ten-year SLA term. The review will ensure the requests or extensions are compatible with Caltrans intended use at the site and do not interfere with the safety or operations of the public and of Caltrans. The DARC representatives should be at the highest level in order to make a final decision. It is recommended that each member has the full support from upper management to determine the feasibility of the proposal.

The DARC can and should restrict the height, exact location, access, and security to protect Caltrans interest and assets. In the formal response to the Carrier, the DARC's determination should clearly identify the issues and the reasons, and allow the Carrier to mitigate. LICENSING AGREEMENTS Documents are used to grant the Carrier the right to construct, install, operate and maintain their personal property on Caltrans owned real estate. As such, the Carrier has no real property rights and cannot encumber the property in order to obtain a loan to construct. Master License Agreement MLA The primary licensing document, with standard terms and conditions that are not site specific i.e. insurance, liability, hazardous materials, that apply to all Carriers prior to entering into a Site License Agreement SLA. See Exhibit 9 for a summary of the major terms and conditions. Site License Agreement SLA A secondary document for a site approved by the DARC at the agreement phase. It identifies the specific terms and conditions for the proposed Facility; i.e., base license fee, specific type of facility, terms and options, access, contact information, hazardous materials, description of the facility, square footage of the site, maintenance, and includes restrictions regarding the use of sites on or near Caltrans structures e.g. columns, signs, buildings. If Caltrans will jointly use the facility, the identification of Caltrans equipment must be shown on the final plans, along with an agreement on its installation. Instead, each Carrier is entitled to a six month "local permitting period" that grants time to obtain all necessary reviews, approvals and all permits. A total of four three month extensions 12 months can be granted under extenuating circumstances if the Carrier has diligently pursued approval but the delay is beyond their control.

Full payment is required for all extensions, unless Caltrans did not respond to a preliminary or final proposal within the 45 day review period. Though the Carrier is required to pay full rent beyond the six month local permitting period, extensions allow them to cancel the SLA at any time prior to the issuance of an encroachment permit without being subject to all the termination and cancellation penalties in the MLA. RATES and FEES Annual Base License Fee Annual payment for the site using the pricing matrix in the MLA, to establish a rate based on geographical location and type of equipment number of antennas and square footage of enclosed area. Annual payment is paid in advance at the time the Encroachment Permit to construct is issued; and thereafter every July 1st. The fee covers staff costs associated with the review and approval of the preliminary and final documents, and includes a six month permitting period. Payment All fees permit, administration, license, collocation must be paid in advance to the Caltrans accounting office identified in the SLA, the billing statement or other appropriate notification. The extension of the SLA can be held up if the Carrier is in arrears. Security Deposit There is no security deposit as the MLA requires advance annual payments. Permit Fees See "Permit" Section. Recommendations to continue with the MLA will require Airspace Advisory Committee AAC and California Transportation Commission CTC approval. The terms and conditions of the SLAs executed during the first five years will remain unchanged during the life of the SLA. The SLAs are for ten years with three additional periods options of five years each. The SLA term can be modified to match specific Carrier or Caltrans needs since a future project may require Caltrans to license the site for only three years. At the end of each term, the SLA can be extended for an additional term; however, the Carrier must provide advance notice if it intends to extend.

Airspace must coordinate a review by the DARC to ensure there are no immediate needs or potential interference by continuing to license the site. Caltrans can require the Carrier to remove or relocate the Carrier's equipment at the termination or cancellation of the SLA. The Carrier may be compensated for early termination of the SLA during the first ten year period based on the amount of unamortized improvements. PRICING MATRIX The base license fee is determined by the greater of the number of antennas; or the square footage of the enclosed area. Category 2 All other urbanized areas on the "map" e.g. Sacramento and Fresno. Category 3 Remaining areas on the "map" shown in white. Should the proposal require only part of the Facility be located on Caltrans property e.g. the vault is located outside the right of way on private property, the license fee will be

based on the number of antennas whether mounted on the Carrier's structure or Caltrans structure on Caltrans property. Any Carrier requesting a facility with more than 16 antennas or a fenced area exceeding 2,500 square feet must pay a higher rate than the pricing matrix dictates. If the same site were in an Urban area, it would be treated as a Macrocell, Category 3 not Category 2. Headquarters will determine the rate for any proposals larger than a Macrocell in a Prime Urban area after receiving a district recommendation. The proposal will be reviewed to determine if the Carrier is in need of all the space and antennas for their facility or whether they are adding the extra space and antennas for a potential collocatee. 14 COLOCATION The MLA is nonexclusive and requires collocation with all other interested Carriers if it is physically possible, without interfering with the Carrier's current use. This includes requests by Caltrans to share facilities at a later date. Each collocatee will be required to have a separate SLA subject to the MLA, and the term must run coterminous all expiring on the same date.

There are two types of collocation per the MLA, SubUser and DirectUser. A SubUser collocatee is a carrier that uses the licensee's antenna mount and equipment area to mount their antennas and house their equipment. A DirectUser collocatee is a carrier that only uses the licensee's antenna mount and has their own equipment area. The base license fee for a SubUser is 50% of the licensee's annual payment, or 50% of the payment the collocatee pays the Carrier, whichever is higher. However, if the collocation is submitted as one proposal with the primary facility, only one administration fee for the entire review will be required. See Exhibit 11 for a description of different collocation scenarios and license fees. CALTRANS RADIO NEEDS The MLA specifies what Caltrans can receive in the way of "space" on the facility, in addition to the full base license fee, as follows 1. Space to mount one 800 MHz omniantenna approximately 44" long, 1.5" in diameter, with a weight not to exceed twenty pounds, to be mounted not less than 20' high, as designated by the Carrier. 2. Space for radio equipment in a 2' x 2' x 7' area within the shelter or on a concrete pad. 3. Conduit or cable tray for transmission from equipment area to antenna. 4. Cable access to phone and power lines. Requests for additional trades or in kind services are not allowed. Any additional space or construction required must be funded by the program and paid directly to the Carrier. As such, any work done by the Carrier for Caltrans in connection with the installation or repair of Caltrans' communications equipment must be paid directly by Traffic Operations or the appropriate program. The SLA must identify who will install Caltrans' equipment, and if the carrier installs it, the SLA must establish the cost, payment method, time schedule and installation standard. No rental offsets or credits are allowed.

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