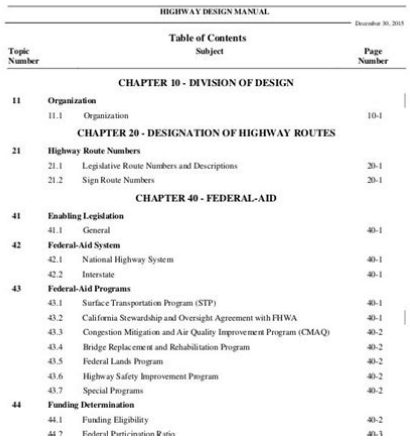

HIGHWAY DESIGN MANUAL

December 30, 2015

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File Name: California highway design manual chapter 1000.pdf
Size: 4497 KB
Type: PDF, ePub, eBook
Category: Book
Uploaded: 17 May 2019, 21:10 PM
Rating: 4.6/5 from 803 votes.

Book Descriptions:

California highway design manual chapter 1000

Explore the policy documents listed below to better understand Caltrans guiding principles for making streets safer for people walking and rolling. Do you know of a Caltrans policy promoting safe active travel not listed here.The manual is continuously updated to reflect changes in policy and procedures. See Chapter 31 for information about Nonmotorized Transportation Facilities. Provides enhanced guidance for twoway separated bikeways, added guidance for transit stops, additional guidance for separated bikeways adjacent to street parking, and discussion of maintenance using Caltrans equipment. Design guidelines for Class IV bikeways is provided in DIB 89. The guide is continuously updated to reflect changes in policy and design best practices. It is the first statewide active transportation plan for the State and intended to be applied in conjunction with local and regional policies and actions. Intended for Caltrans employees. This document presents design concepts to make these streets more walkable and livable and to keep them compatible with community values while assuring safe and efficient operations for vehicles, pedestrians, bicyclists and highway workers. The document complements Pedestrian Accessibility Guidelines for Highway Projects, which provides accessible design guidance for roads and sidewalks along State highways. It is intended for Caltrans planners and engineers, but local agency staff and the general public may also find it useful. These solutions use innovative and inclusive approaches that integrate and balance community, aesthetic, historic, and environmental values with transportation safety, maintenance, and performance goals. Context sensitive solutions are reached through a collaborative, interdisciplinary approach involving all stakeholders. This is in direct contrast to ordinary city streets.http://www.aloeverajuice.cz/files/digital-adidas-watch-manual.xml

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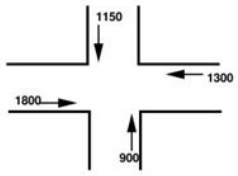


Figure 34:8: Traffic flow in the intersection

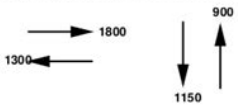
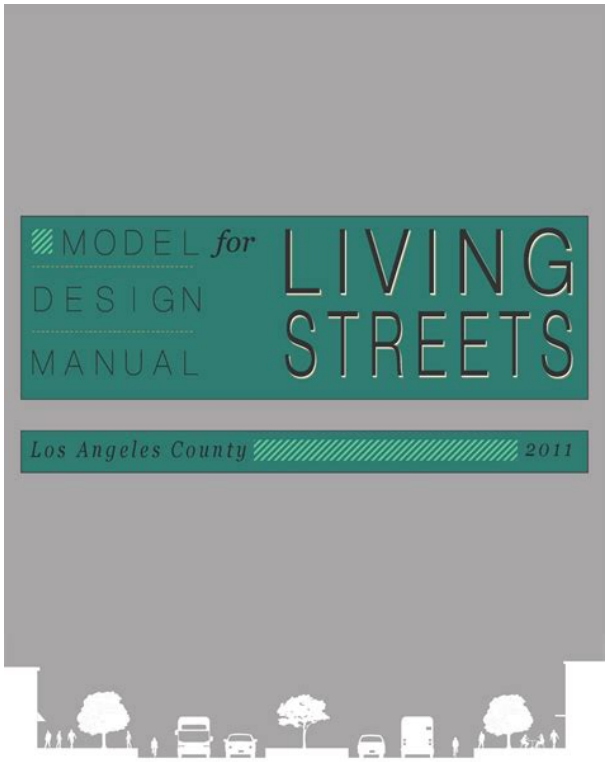


Figure 34:9: One way of providing phases

Solution

1. If we assign two phases as shown below figure 34:9, then the critical volume for the first phase which is the maximum of the flows in that phase = 1150 vph. Similarly critical volume for the second phase = 1800 vph. Therefore, total critical volume for the two signal phases = 1150+1800 = 2950 vph.
2. Saturation flow rate for the intersection can be found out from the equation as $s_i = \frac{3600}{2.3}$ = 1565.2 vph. This means, that the intersection can handle only 1565.2 vph. However, the critical volume is 2950 vph . Hence the critical lane volume should be reduced and one simple option is to split the major traffic into two lanes. So the resulting phase plan is as shown in figure 34:10.
3. Here we are dividing the lanes in East-West direction into two, the critical volume in the first phase is 1150 vph and in the second phase it is 900 vph. The total critical volume for the signal phases is 2050 vph which is again greater than the saturation flow rate and hence we have to again reduce the critical lane volumes.

The westernmost extension of this bicycle path is via roads in Marina Del Rey and Playa del Rey, connecting to the Dockweiler State Beach bicycle path, which is part of the 22mile coastal Marvin Braude Bike Trail. The citymaintained portion runs from.03 miles west of Vermont Avenue to West 190th Street along Dominguez Channel in Gardena. The west path section runs from White Oak Avenue to the Canoga Metro station in Canoga Park. Bike Path ID 41. Mileage 4.66. The east path section runs from Haskell Avenue to Leghorn Avenue. Bike Path ID 52. Mileage 0.41. Phase 1 runs from Roxford Street to Hubbard Street in the northeastern San Fernando Valley. Bike Path ID 56. Mileage 0.52. Los Angeles Department of Transportation. Archived from the original on 15 April 2013. Retrieved 27 April 2013. Retrieved 27 April 2013. City of Long Beach. Retrieved 28 April 2013. Retrieved 13 May 2013. Retrieved 14 May 2013. Retrieved 14 May 2013. Retrieved 30 April 2013. Archived from the original PDF on 1 April 2013. Retrieved 28 April 2013. Retrieved 13 May 2013. Retrieved 13 May 2013. Scott Hendison. Retrieved 28 April 2013. Retrieved 1 May 2013. Retrieved 13 May 2013. By using this site, you agree to the Terms of Use and Privacy Policy. These guidelines allow much more flexibility and are tailored to the urban and suburban challenges we see in our region. Check out Caltrans' 2017 guide to accommodating bicyclists and pedestrians on California's transportation system, which features some of the newer bike designs. Often, this takes the form of multiuse trails. The defining aspect is that they are not on streets shared with vehicles, but separate places for bikes and other recreational uses. California's Highway Design Manual says that the minimum width of travel way for a twoway bike path shall be 8 feet, 10foot preferred. Where heavy bike or pedestrian traffic is expected, the Highway Design Manual recommends 12 feet or more.http://martinsnegocios.com.br/zeturin/www/admin/mod_galeria_eventos/arquivos/digital-alarm-system-manual.xml



The construction and future improvements of such facilities should also consider where the offroad path intersects with streets and other bike facilities and create good connections to these trails. This may require traffic signals or other devices to prevent conflicts. For reference on design standards, please see VTA's Bicycle Technical Guidelines. Width and other characteristics can vary.Class IV protected bike lanes below provide the most protection and comfort for people on bikes and do the most to encourage a broad range of users. These are shared facilities with vehicles and other road users. They are often marked by signs appointing them as such and often include sharrows see below. This can entail grade separation, flexible bollards or permanent barriers. California State Assembly Bill 1193 created this new class of bikeway facilities in 2014. Protected bike lanes provide the most protection and comfort for people on bikes and do the most to encourage a broad range of users. See Caltrans' Class IV Bikeway Guidance for more information on specifications and our Protected Bike Lanes factsheet for the benefits of these facilities. They are used to designate that vehicles and bicycles should share roadway space. They can also specify where in the roadway a bicyclist is expected to ride. This is achieved through a number of trafficcalming strategies. They are typically lowtraffic, residential streets with low motorized traffic speeds. Bicycle boulevards are usually signed and facilitate bike travel. The first bicycle boulevard in the nation was in Palo Alto Bryant Street. Other cities quickly followed suit. These are a great way to make streets more accommodating for bicyclists without creating separate bike lanes. Bicycle boulevards are best when on a grid network prioritizing one through route for bicycle travel. They should be more than a few blocks long.

This provides a safe waiting area for bicyclists when stopped at a red light in which bicyclists are more visible to cars. This is a solution to the potential for "right hooks" when a vehicle is turning right across a bike lane. It can also allow a bicyclist to move from a right side bike lane to the left side of the traffic lanes in order to turn left. This permits the person biking to stay in the bike lane and other bike facilities rather than cross one or more lanes of car traffic to turn left. It also makes it easier to turn left from a protected bike lane. The developer shall obtain the approval of the Director of said plans, profiles and specifications prior to commencing any construction. Sec. 1024 Where no Standard Specified Requirements to be Prescribed by Director Where the requirements for street improvements are not specified in these standards, or the documents referenced in these standards,

the requirements shall be established by the Director. Such requirements shall conform to accepted engineering standards. Sec. 1025 Payment for Improvement 1025.01 All improvements required by these standards shall be constructed and installed by the developer at his expense unless expressly agreed by the Board of Supervisors that the County will bear the expense or any portion of the expense. 1025.02 Arterial or Collector Highway Alignment in Development In case of an arterial or collector highway alignment lying within the development, improvement thereof shall be subject to the following provisions If it appears to the Board that the County may within a reasonable period, not exceeding five 5 years, undertake construction of an arterial or collector highway along such alignment, it may make an order requiring the Developer to contribute to and deposit with the County an amount equal to the cost of construction as determined by the Board. Such contribution shall be filed with the County Road Fund through the Director.

Consistency with adopted General Plans, Specific Plans, and other plan routes where appropriate. Expanded intersections as may be required at arterial and collector highway intersections as shown on the County General Plan or Specific Plans, or as required by the Director. Bike Lanes shall be designed and constructed in conformance with Caltrans Highway Design Manual, Chapter 1000, Bikeway Planning and Design. Sec. 1029 Utilities, Design and Installation All utilities shall be designed, constructed, and installed by the Developer in accordance with all applicable County requirements and State laws. Underground utilities including services to be located within street rightofway shall be installed prior to surfacing the streets. Underground utility construction shall be in accordance with the provisions of Public Utility Commission General Order 95. Any aboveground cabinets or facilities located within the road rightofway shall be permitted only upon approval by the Director. Compliance with this requirement may result in the need to create public utility easements outside of the rightofway. For Phased Improvements by parcel or lot size, see Appendix B of the Land Division Ordinance. The minimum asphalt concrete thickness shall be 0.20 foot. For details, see Plate R32 and Chapter IV. Arterial and collector highways TI to be designated by the Director. For details see Plate R32 and Chapter IV. The minimum asphalt concrete thickness shall be 0.20 foot. For Phase Improvements by parcel or lot size, see Appendix B of the Land Division Ordinance. Maximum grade of roads shall be fifteen percent 15%. Roads shall be traversable by a standard passenger car. When private streets are approved for use, an acceptable entity shall be formed for street and drainage maintenance prior to recording.

The following notes shall be placed on the street improvement plans before the Director signs them The Subdividers engineer shall be responsible for inspection of all improvements outside of County road rightofways and certify such to the County. No changes shall be made to these plans without the approval of the Director. Subdivider shall obtain the necessary building, grading, and encroachment permits prior to starting any work required by these plans. Private streets shall comply with all requirements of the Kern County Fire Department and Land Division Ordinance. Also, private streets located within the State Responsibility Area SRA shall comply with all requirements of the California Department of Forestry and Fire Protection. Sec. 1034 Pedestrian Accessibility Guidelines Federal and state regulations require that each facility or part thereof shall be designed 11 and constructed in such a manner that the facility is readily accessible to and usable by individuals with disabilities. If it is found that an accessibility design standard can not be fully incorporated in a design, an accessibility design exception will be required, subject to the Director’s approval. Limited exceptions to the above minimums may be approved by the Director when topography or other conditions warrant within the following limits Arterial and collector highways not less than 300 feet. In mountainous areas, minimum local streets radii may be reduced to 100 feet or as approved by the Director. Curve widening to provide adequate sight distance shall be determined by the Director. 1041.02 Intersections Streets shall intersect at right angles where practicable. When topography or other physical feature makes this requirement impracticable, a Limited Exception may be granted by the Director. A knuckle shall be considered an intersection for skew angles.

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Where the angle of intersection is acute, or where a sight distance problem may be anticipated, an increased property line cutoff may be required by the Director. All streets entering upon any given street shall have their center lines directly opposite each other or separated by at least 150 feet, see plate R48 thru R50. Tangent distance between end of horizontal curve and intersection centerline shall be a minimum of 150 feet. 1041.03 Deadend streets in excess of 150 feet in length shall be constructed to permit vehicles to turn around at the end. The director may increase the length to 200 providing no access is provided by the road. The maximum length of a deadend street, including all deadend streets accessed from that deadend street shall not exceed the following cumulative lengths, regardless of the number of parcels served Parcels zoned for less than one acre 800 feet Parcels zoned for 1 acre to 4.99 acres 1320 feet Parcels zoned for 5 acres to 19.99 acres 2640 feet Parcels zoned for 20 acres or larger 5280 feet Where a deadend street serves areas in which several different length limits could apply because of several different parcel sizes, the shortest allowable length shall apply. Sec. 1042 Gradient 1042.01 Minimum grade on any street or alley shall be 0.5%. Where concrete curb and gutter or gutter in the case of an alley, is constructed, minimum grade shall be 0.2%. 1042.02 The maximum grade on any street or alley shall be as follows Arterial and Collector Highways 6%. Local streets and residential culdesac streets including street turning area 8%. All classes of industrial and commercial streets 8%. Alleys 8%.13 Exceptions to the maximum or minimum grades may be granted by the Director as follows Arterial and Collector Highway 8% maximum. Local and culdesac streets excluding street turning area 15% maximum. All classes of industrial or commercial streets 8% maximum. No exceptions allowed. Alleys 15% maximum. 1042.

03 Superelevation shall be provided for all streets where required by the Director. 1042.04 Vertical curves shall be as follows Residential and industrial streets shall be designed to provide a minimum stopping sightdistance corresponding to a design speed of 25 MPH. Arterial and Collector highways shall be designed to accommodate minimum vehicle speeds of 65 MPH. An exception may be granted by the Director to reduce the vertical curve design speed. Vertical curves shall be used when change in grade exceeds 0.50% and shall have a minimum length of 50 feet. Alleys shall be designed for 20 MPH stopping sight distance. Roadmixed asphalt surfacing may be used, in lieu of asphalt concrete, in those areas of the County more than 50 miles along the shortest practical route from a commercial asphalt concrete plant. Roadmixed asphalt surfacing RMAS shall conform to design mix approved by the Director. Minimum thickness of a roadmixed asphalt surfacing shall be 0.25 of a foot. Alleys Surfacing shall be of asphalt concrete or roadmixed asphalt surfacing, whichever is used in the streets of the development. The minimum thickness of aggregate base or aggregate subbase shall be 0.35 foot. 1044.03 Aggregate Bases In addition to the specified RValue for aggregate bases, the RValue at 150 psi exudation pressure shall be 90% of the RValue at 300 psi

exudation pressure. Sec. 1045 Utility Placement Within Streets Underground utilities including services to be installed in streets shall be installed prior to surfacing of the streets. The Department will entertain the use of lower wattage bulbs, such as light emitting diode LED and solar street lights. The developers are encouraged to utilize new technology in order to reduce carbon foot print and reduce energy cost. All material and work shall conform to the requirements of the California Electrical Code, National Electrical Code, and other pertinent codes and regulations. 1046.

01 Residential Areas Street lights shall be located at intersections, at midblock with blocks greater than 600 feet between intersections, at ends of culdesacs greater than 150 feet in length, and on curved streets as required by the Director. Street lights on arterial and collector streets or intersections with an arterial street shall be 9,500 lumen. Street lights on local streets shall be 5,800 lumen. Lumin output and light sources may vary depending on new technology. Street lights shall have an acceptable maintenance entity formed and be energized prior to acceptance of the improvements. Street light construction shall be in accordance with Plate R75 unless approved otherwise by the Director. 1046.02 Commercial and Industrial Areas Street lights shall be located at intersections and ends of culdesacs greater than 150 feet in length. Luminaires shall be as provided in the above paragraph. 16 On all streets, the pull box shall be installed and the light wired from the pull box at the pole per plate R76. Electrical service shall be provided to the street light from the adjacent parcel on either side of the street as it is developed. Electrical service easements shall be granted as required. Luminaire shall be full cutoff optics. 1046.07 Street light location plan and general plan details shall be submitted for review and approval by the engineer. The plans shall show and identify all street lights to be installed, distance between poles, height of poles, wattage of lamps, lumens, type of luminaire, irrigation pedestals and all other pertinent information. Also, all existing street lights within 400 feet of the project shall be clearly identified and shown on the plans. Chapter V. Access Sec. 1051 State Highways Access to state highways, is regulated by Caltrans. Requests for access and changes to existing access shall be coordinated with Caltrans. Encroachment permits for access to state highways shall be obtained from Caltrans. Sec.

1052 City Streets Access to city streets, is regulated by the incorporated city who has jurisdiction. Requests for access and changes to existing access shall be coordinated with the respective incorporated city. Collector streets operate at approximately 40% to 60% either way. Local street's function is to provide nearly 100% access to abutting properties and should be designed to eliminate through traffic. Driveway access on arterials shall be kept to a minimum as determined by safety, topography, zoning and prior parcelization constraints or other special circumstances. Waivers of access on subdivisions shall be provided along major streets except where driveway access is permitted. 1053.01 Minimum full access intersection spacing on arterials shall be limited to onethird mile. Closer spacing may be permitted if a traffic signal synchronization study is approved which demonstrates the location to be feasible for a signal. The signal, if allowed, shall be funded and installed by the developer. 1053.02 Minimum spacing and type of local street access along arterial and collector streets shall conform to details in Plates R49 and R50. Access points along arterial streets shall be restricted to right turn in and right turn out movements only. Full access median openings or openings limited to allow left turn in with no left turn out may be permitted where an approved traffic study provides justification for said access. Analysis for and development of full access openings must also meet the signalization requirements of Section 1053.03. The design of limited access openings shall conform to applicable details in Plates R42 through R50. 1053.03 For purposed development of no more than 200 residential dwelling units, circulation may be developed with only one access available. Development beyond 200 units will be required to provide a second

means of access.

Access points on collectors within 300 feet of the curb return at an arterial intersection shall be limited to right turn in and right turn out movements. The design, number and location of driveway approaches must comply with the standards and policies contained herein and must be approved by the County. 1054.01 Driveway approaches will not be permitted for parking or loading areas which would require backing into county roads with the exception of single family R1 residences. 1054.02 Driveway approaches constructed along arterial streets shall be restricted to right turn in and right turn out movements only. Full access median openings or openings limited to allowing left turn in with no left turn out may be permitted where an approved traffic study 18 provides justification for said access. Analysis for and development of full access openings must also meet the signalization requirements of Section 1053.03. The design of limited access openings shall conform to applicable details in Plates R42 through R50. Driveway approaches constructed along collector streets within 300 feet of the curb return at an arterial intersection shall be limited to right turn in and right turn out movements. 1054.03 Only one driveway approach per property per street is permitted for single family R1 lots excepted on local streets. Additional driveway approaches may be permitted where an approved traffic study is provided which demonstrates that more than one access is required to adequately handle driveway volumes, and will not adversely affect traffic flow on county roads. Where a property has access to more than one street, at a double frontage location, access will be limited to the lower classification street to minimize the impact upon traffic flow, except as allowed herein. Access to only the higher classification street will be required in the case of incompatible land uses, i.e.

, the lower classification street serves residential development and the access is to serve commercial or industrial development. Addition of access to the higher classification street may be allowed provided an approved traffic study provides sufficient justification. During construction all such activities will be the responsibility of the permittee. 1054.05 Arrangements must be made by the developer or permittee, for the necessary removal or relocation of any public utilities, structures, trees or plants with the person or entity having ownership or control prior to commencing work. Right turn storage lanes are required at all streets and access points where one of the following criteria is met The 85th percentile speed is less than 45 MPH and the peak hour turning volume is over 200. The 85th percentile speed is 45 MPH or greater, the arterial is shown ultimately having 6 lanes and the peak hour turning volume is 25. 1055.02 Collector Streets Left and right turn storage lanes are required on all collector streets at arterial street intersections. Striping for left turn channelization shall be provided for any access leading to a development, which, at build out, generates more than 50 peak trips. 1055.03 Design of left and right turn storage lanes shall comply with the applicable requirements of details in these standards. Bay tapers for turn lanes shall be 90 feet in length for single turn lanes and 120 feet in length for dual turn lanes. 60 bay tapers will be permitted on streets where the 85th percentile speed is 40 MPH or less, provided the turn lane is accessing either a driveway or a local street. 1055.04 In the absence of turning volume data showing the need for greater storage, the following minimum lengths shall be used Dual left and single right turn storage lanes from arterial street into another arterial street shall be designed for a minimum length of 200 feet measured from end of taper to limit line.

Left and right turn storage into local streets or major private entrances shall be 150 feet minimum. Left and right turn storage into minor private entrances shall be 100 feet minimum on collector streets and 150 feet minimum on arterial streets. 1055.05 Upon subdivision or other development which accesses onto an arterial or collector street, the following minimum improvements will be required to provide left turn channelization, where insufficient width would otherwise be available due to existing or proposed street improvements. On and off site road improvements are required from any collector or arterial street to provide left turn channelization into each street or access

point within the subdivision or development. Design shall be based upon standards contained in Plates R66. Chapter VI. Site Access Design Sec. 1061 Introduction This chapter is intended to serve as a standard for the placement, size and configuration of site access improvements. Sec. 1062 Access Widths and Spacing Access widths and spacing shall be designed per Plate R56. Sec. 1063 Alignment Access drive or road must intersect a public street at 90 degrees or as close as possible to 90 degrees or minus a maximum deviation of 15 degrees on local streets. Minimum sight distance shall be provided at all access points in accordance with the provisions of this Division and Chapter 5 of Division Nine. Design loading shall be H20S1644 with alternate. Bridge width shall equal the approach roadway width plus one pedestrian walkway in accordance with the standard typical crosssections included. Plans for such crossings shall be submitted to the Director for review and approval. Where special design or variation from standards is necessary for any drainage facility, crossing a street or highway, said design shall be subject to the approval of the Director.

Improvements shall be in accordance with State of California Business and Transportation Agency Department of Transportation Standard Specifications, current edition, as modified and determined applicable by the Director. All streets have been designed in accordance with the Traffic Index as shown on the typical crosssections. If approved in writing by the Director, an alternate pavement design using Class III Aggregate Base and a thicker A.C. section may be used. Any work which affects any existing County maintained road or the traffic thereon shall be completed within 20 working days from start of work. Elevations and grades shown on the profiles are gutter flowlines inverts. All concrete shall have all exposed surfaces treated with a white pigmented curing compound see Section 907.01B of the Std. Specs. after finishing. Permanent traffic control signing and other safety devices not shown on these plans shall be installed per plans approved by the Engineer. Street lighting shall be installed and a means provided to contract for public utility services and maintenance. Prior to start of any earthwork, the Subdivider shall obtain a Grading Permit as required by Kern County Code of Building Regulations and Grading Ordinance. Wheelchair ramps shall be constructed at all curb returns per plate R60 of the Kern County Development Standards and as directed by the engineer. All existing facilities, including but not limited to structures, poles, pipelines, conducts, canals, and appurtenances, which are considered to be obstructions by the County Engineer, shall be relocated at the expense of the Subdivider. New streets shall be extended at intersections as directed by the County Engineer in order to provide a safe connection to the existing street pavement.

Storm drainage sump shall not be allowed to accept water until secured by permanent fencing or in the case of shallow unfenced sumps not until compliance with depth and side slope criteria as set by the Kern County Development Standards, Division Four. Pavement grinding in accordance with Section 42 of the Standard Specifications shall be provided as directed by the Engineer where new pavement meets existing pavement. All frames and covers within the roadway shall be raised to finish grade per Plate R69.24 Underground utilities including services to be located within rightofway shall be installed prior to surfacing the streets. When bike lanes are required along a highway, the curb line shall be extended three 3 feet and the parkway area reduced three 3 feet. Street sweeping, walls, drainage, street lights, etc. NOTE Any additional notes, not required by the Engineer, will be listed under a heading of “The Engineer of Record’s Notes” and will not be considered to be a part of the County approval. Table of Contents Standards for Streets Chapter I. Introduction Chapter II. Street Improvement Requirements Chapter IV. Landscaping Chapter IX. Temporary Street Closures Chapter X. Subdivision Street Improvement Plan Notes Kern County Public Works Department Mission Statement To provide public infrastructure, facilitate development, and deliver services that protect and enhance the lives of the people of Kern County. Discover everything Scribd has to offer, including books and audiobooks from major publishers. Start Free Trial Cancel anytime. Report this Document Download Now save Save Caltrans Highway Design Manual 2016 For Later 0 ratings 0% found this document useful 0 votes 31 views 838 pages

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