Standard Values: Change in Urban Arterial Street Design

by

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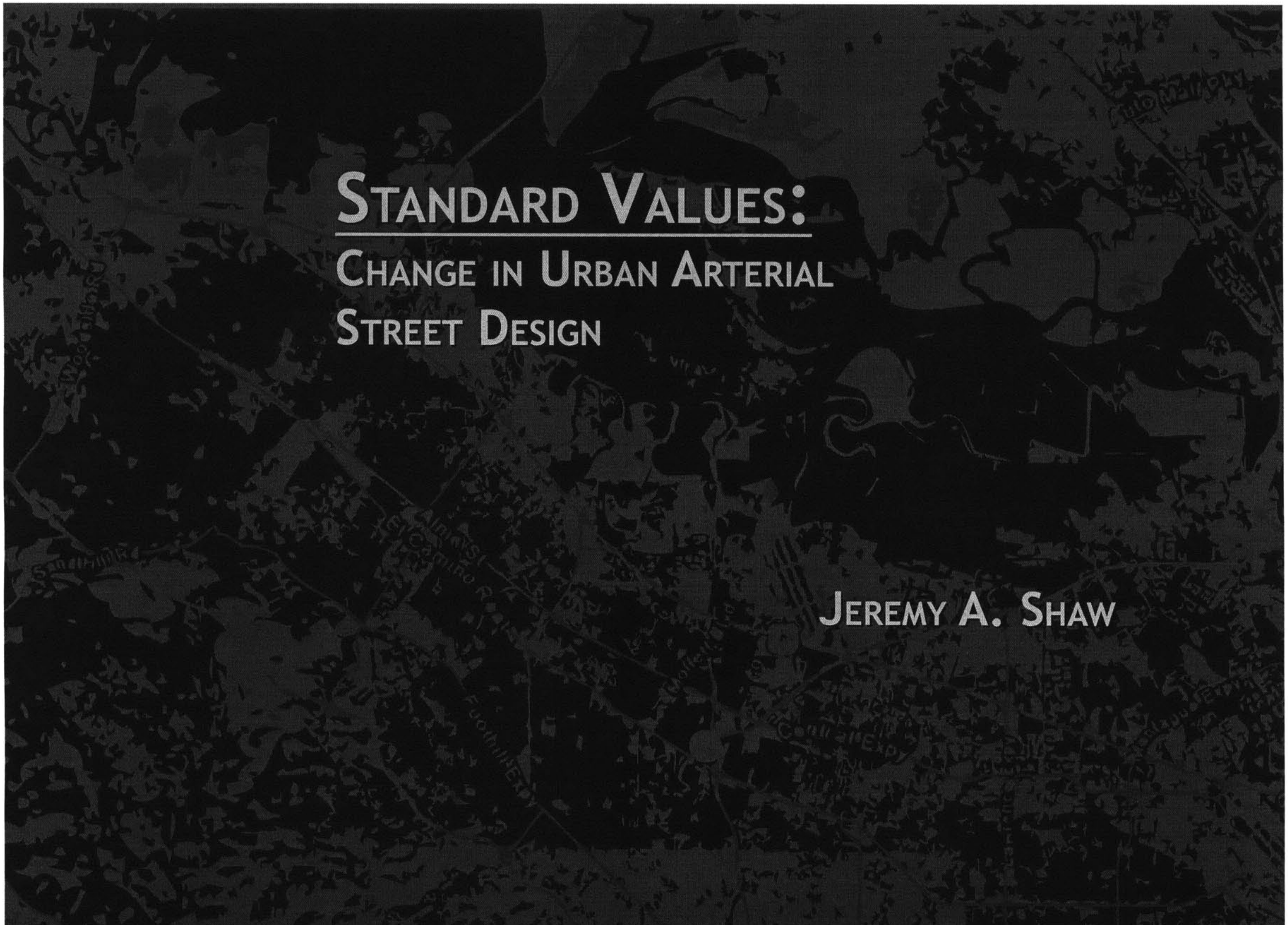

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ABSTRACT

The highway-building industry and highway governance was born in the minds of progressive engineers bent on ushering in a new era of efficiency, progress and modern transport. Governance and standards in California heavily influenced other state highway organizations.

This research traces the evolution of values in urban arterial street design and standards in the United States and California. For nearly 100 years, the design criteria of geometric street standards have been based on increasing automobility, as if without end. Since the 1960s, liability concerns have guided significant changes in design standards, mostly based on passive driver safety design. Since then, legal action has given rise to bicycle and ADA-based design standards. Right-of-way constraints have lowered minimum widths and "flexibility" has impacted design philosophy and process. However, these latter forces are not driving fundamental or enforceable change to design standards. Change to mandatory standards remains driven by automobility and liability concerns.

Despite conventional standards, unconventional values manifest in the design and planning of streets. Using the case of El Camino Real in Palo Alto, this research explores the difficulty of implementing unconventional street design through the process of changing standards. It then draws on the case of Santa Monica Boulevard in Los Angeles to demonstrate that individual projects under local jurisdiction are more likely to impact the design of streets. Further research is warranted on state highway relinquishment, the philosophy of context-sensitive design, and methods of selecting design speed.

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CONTENTS

To mend High-ways, loe Here the way is shown;
No better way than This, Shall e're be known:
A firm and Certain way, of no great Cost;
In all wayes else their Labour's wholly lost.
The Old way ne're could do't, 'twas neer Deceit,
As may be prov'd, it was a very Cheat.

From *A Short Rational Discourse, Presented to His Majesty, Concerning the High-ways of England*, 1675.
Found in *The Road* by Hilaire Belloc.

INTRODUCTION

I. Why streets?

> *...the boulevards do more than establish an organizational pattern. They constitute, I believe, the irreducible armature of city's public space, and as such are charged with a social and political significance that we can hardly ignore.*
>
> \- Douglas Suisman

Streets have long shaped the places and ways in which we live. They define our neighborhoods and structure our cities. But beyond structure, streets are one of the few places that can provide truly democratic space. They are "the irreducible armature of the city's *public space*, and as such are charged with a social and political significance that we can hardly ignore," (Suisman 1989). The activity, utility and design in streets guide our daily experience and shape perceptions of the world around us (Lynch 1960). Streets serve essential economic functions as well. They are the primary means of the mobility of people and goods. They also provide access to places and destinations.

As people and places change, so do our streets. They typically begin as a means to get places or as a divider between them. Santa Monica Boulevard was once a boundary, the interstice, between pre-Los Angeles ranchos. Now it is a major vehicle thoroughfare for the west side of the city. Or consider that the Champs-Elysees was once the bulwark from which Parisians defended their city. Now it is a monumental corridor, linear park and shopping mall - while serving tens of thousands of vehicles and pedestrians everyday. Once-meek paths have been transformed into grand arteries, like Wilshire Boulevard in Los Angeles. At the same time celebrated routes have become run-of-the-mill suburban strips, like El Camino Real throughout California. The function, shape and stature of these linear elements have changed dramatically. But generally they have maintained some degree of mobility and of accessibility.

Streets also evolve from ways into places of their own right. Consider the Ponte Vecchio: once a bridge into Central Florence, later an extension of Florentine markets, and now its own market and tourist attraction. Washington Street was once a road that led to the old city and port of Boston. As that destination grew, so did the demands on the approaching street and street network that grew around it. The approach lands were filled, platted, and developed. Street grids that grew around roads like Washington expanded local industry, while creating neighborhoods for the increasing number of immigrants employed there. Many of those commercial expansion areas and neighborhoods became urban commercial, office or public places in their own right (e.g. Boston's Back Bay, San Francisco's North Beach, Paris's Bercy).

II. Why arterial streets? A Brief History.

In the United States, "arterials" occupy the pinnacle of our planned metropolitan road networks. "Arterial" is derived from the Latin *arteria*, meaning windpipe or artery, and the Greek *aorte*, or aorta. The etymology of our principal roads is thus rooted in the movement or flow of essential inputs, namely oxygen, blood cells or, in a more modern sense, automobiles. Arterials include interstate freeways, limited-access expressways and conventional highways (surface streets). Basing freeways on arterial flow makes sense: freeways are designed to maximize vehicle mobility and offer few roadside destinations to stop and access.

But classifying major surface streets as arterials presents a conflict. Arterial surface streets, or arterial streets,[1] are intended to prioritize mobility similar to the way freeways do; but unlike freeways, arterial streets also provide direct access

1 From herein denoted as arterial streets.

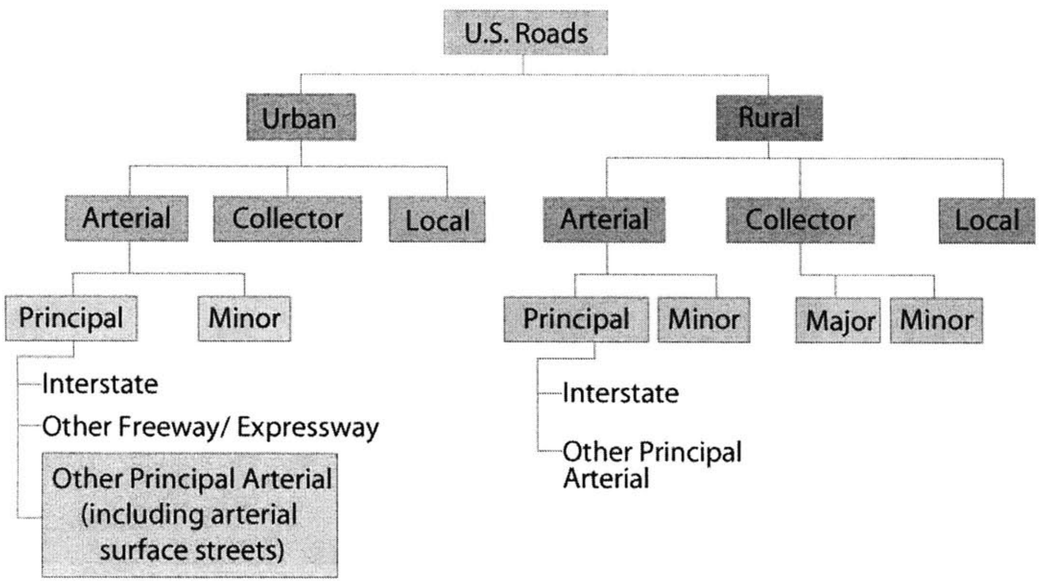


Figure 1-1: Functional Classification of Highways. Subject of this thesis highlighted in yellow (based on FHWA 1989)

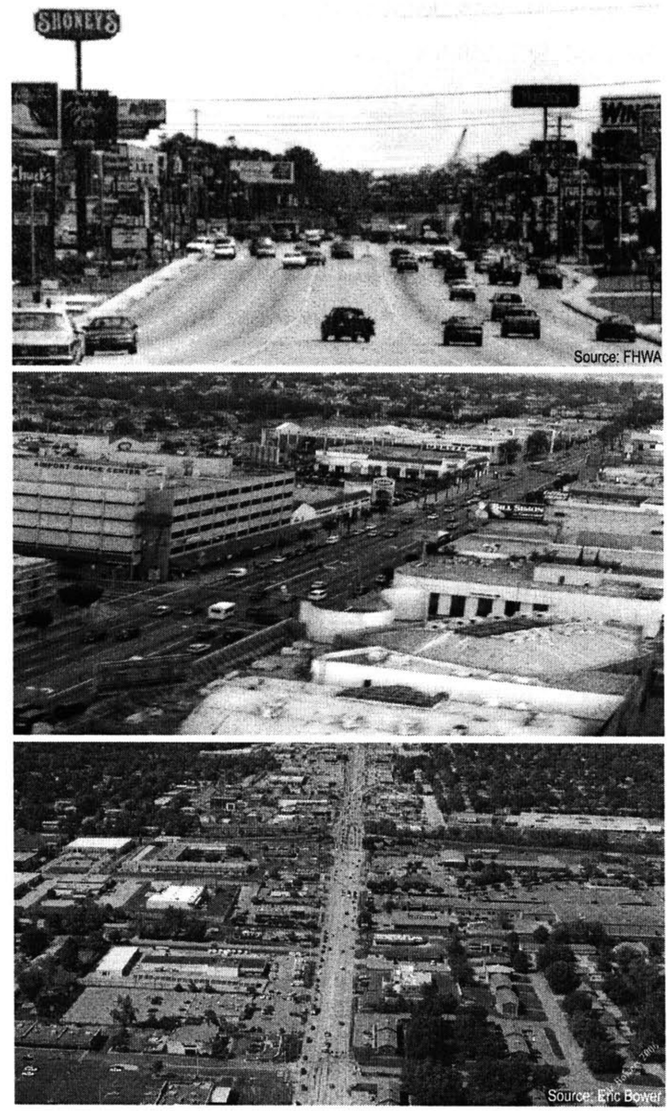


Figure 1-2: Typical urban arterial streets. (middle - Sepulveda Blvd in Los Angeles; bottom - Kansas City, KS)

to destinations. Unlike freeways, arterials are lined with roadside attractions, cross streets, sidewalks, signs – things the driver is meant to slow down for, see or read. And unlike freeways, people on foot, driving trucks, in buses, and riding bicycles constantly negotiate with drivers for space, way and access. Nevertheless, arterial streets have long been designed to maximize vehicle mobility, often without consideration of mobility for other modes, accessibility and the other purposes arterial streets serve.

Arterial streets also structure our urban form and growth. Most of today's suburban arterial streets began as country roads between town centers. Some were main streets, others intersected with them. Urban arterials in older cities often carried streetcar lines. In most cases, the roads served as spines for development, central strips for business, and major paths for travel.

Figure 1-3: Structuring arterial streets. Los Angeles, California.

Arterial streets are integral to cities and suburbs everywhere. They are the primary travelways of our daily lives. Composing only 10% of road miles in the country, nearly 45% of vehicle miles traveled (VMT) take place on arterial streets. They provide more accessibility, mobility, experience and place than any other street type. There are small town, suburban and urban arterial streets, each with different dimensions, attributes and land use context. But all of them have to balance the dual purposes of mobility and accessibility.

Since the 1920s, most arterial street designs have favored vehicle mobility – decreasing the livability of the streets and accessibility of their development. Main streets have lost their walkability, real estate values and centrality either by becoming auto-oriented throughways or vacant anachronisms in the shadows of a bypass.

Though suburbs have been around as long as cities, the ease and reach of the automobile fueled farther, faster suburban de-

Figure 1-4: Suburban arterial structure, without street frontage.

velopment than ever before. By the mid-20th century, arterial street design in suburbs began to favor driver needs, and major streets became inhospitable to living, walking or developing frontage along. Mid-century street design standards were all about maximizing automobility: lowering congestion and increasing the efficiency of movement. In suburban areas, residences rarely fronted on arterials. Arterials were meant for moving, not living. Setbacks from the street increased to accommodate parked vehicles, signs grew to be visible at high speeds, and land uses became far too separated for walking. Many arterials were designed without frontage at all, lined by walls, the backs of homes or parking lots they were intended to serve.

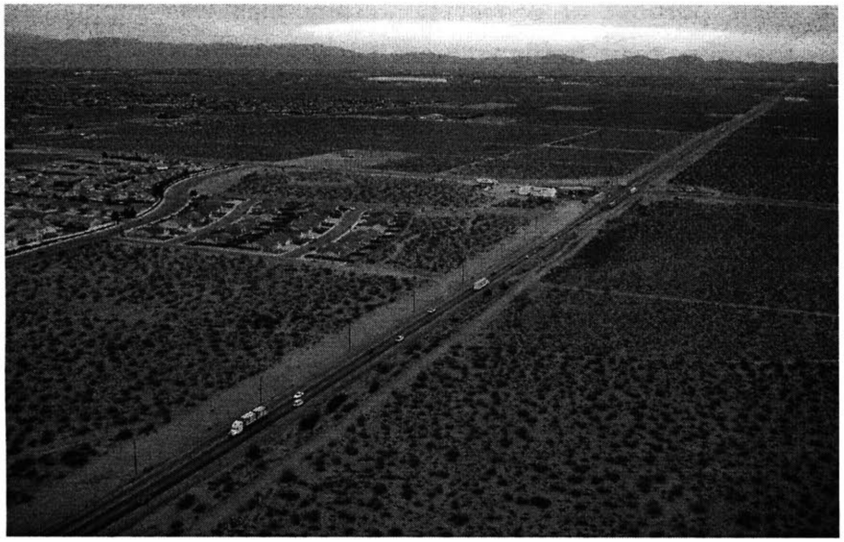


Figure 1-5: Latter 20th century arterial streets, often begin as a rural highway (top) and develop with ample setbacks, parking and big box retail (bottom).

Figure 1-6: Often the streetscapes are left unplanned or degenerate into unappealing conditions for the pedestrian and transit-rider.

In the latter half of the 20th century, as the suburban fringe pushed farther from city centers, urban arterials corridors lost residents, commercialized or fell into disrepair (Jacobs). Streets like East 14th in Oakland, Crenshaw and Adams in Los Angeles, or Mountain Avenue in Ontario succumbed to disinvestment. These streets were designed for automobility – often at the expense of accessibility, experience and place-making. But as their purpose of conveying automobiles was supplanted by freeways, their traffic volumes fell below capacity (Jacobs).

Figure 1-7: Older urban arterials often fall into decay. Ontario, California.

III. Opportunity and Change

The poor condition, under-utilization and tremendous opportunity of urban arterial roads[2], has not gone unnoticed in recent years. In California, cities are regenerating the public realm on arterials with the intent of facilitating better public transit, urban re-investment, and pedestrian safety features. 3rd street in San Francisco is being revitalized by investment in tandem with a light rail extension. Ventura, Santa Monica and other Southern California cities are initiating "corridor" plans, which address land use, design and transportation along linear strips of urban development. East 14th Street in San Leandro was redesigned to better accommodate pedestrians and reinvigorate investment around the BART station. The list goes on.

The literature is also seeking to understand the urban arterial condition in new ways. From the 1930s through the '80s, research, surveys and literature of urban arterial streets were often aimed at facilitating automobile movement (APWA 1969; Bishop 1989; Box and ITE 1984; Malcher 1935). Since the 1960s, "passive" safety design for the worst possible auto accident scenarios dominated arterial designs at the expense of pedestrian needs, right-of-way

2 Arterials in cities and suburbs qualify as urban, according to the FHWA. Rural arterials are without significant roadside development.

constraints and public transit. Today, practitioners and academics are reevaluating the utilization of urban arterial street width (Harwood 1990; Jacobs, Macdonald et al. 1994; Jacobs, Macdonald et al. 2002; Daisa and ITE 2006), mobility-based street design (West 2000), the paradigm of passive safety design (Hauer 1999; Dumbaugh 2005) and the threat of pedestrian amenities to driver safety (Nadero 2003). The public sector is engaging context-based design or context-sensitive solutions (CSS). The tenets of CSS vary according to whom is asked. Generally, it can be characterized as a method of designing streets that are more appropriate to their land use and transportation context than "one-size-fits-all" standard street designs based on automobility.

But if academics are seeking to incorporate values other than automobility and driver safety into street design, are they succeeding? How are these alternative values translating into unconventional street designs? And how are street standards changing to better include alternative values such as urban design amenity, walkability or transit mobility?

Figure 1-8: Cities are now redesigning the travelway, streetscape and land use of older arterials, which often double as main streets. Brea, California. (City of Brea)

This thesis seeks to answer these questions. It first shows that the qualitative design values[3] behind standards have not changed significantly throughout the 20th century. Though street-standards texts have changed to incorporate considerations like multimodality and right-of-way constraints, automobility and passive driver safety continue to dominate standards. It then uses the cases of El Camino Real in Palo Alto, California and Santa Monica Boulevard in Los Angeles, California to illustrate how alternative design values are being incorporated into arterial street design today. This research suggests that standards are not the best venue for changing the paradigm of arterial street design. Rather, local, project-based design initiatives are. While standards are being revised to better incorporate context-sensitive solutions and public process, local projects are better suited for the context-sensitive approach. This paper focuses on arterial surface streets in California's urbanized areas: streets that have the dual purposes of serving through traffic as well as being a destination in their own right.

3 *Values* are defined henceforth as unique qualities of a street that can be considered desirable or of merit by those who hold them; e.g. efficient automobile traffic, pedestrian accessibility, pervious surface cover, or consistent cross section design.

After the Methodology chapter, the thesis first summarizes essential background: the rise of United States street design governance in parallel with the rise of the automobile. The following chapter traces the driving values of arterial street design standards throughout the 20th century. The fifth chapter explores alternative theories that respond to the automobility-oriented and "passive" safety designs of arterial streets. Chapter Six contains two case studies to illustrate how alternative values are being incorporated into street design today. The first case, El Camino Real in Palo Alto, illustrates the difficulty in changing arterial street design by amending state standards. The case of Santa Monica Boulevard in Los Angeles shows that local jurisdiction, political will and project-specific needs can better facilitate arterial street design change. The final chapter suggests possible avenues of further research.

METHODOLOGY

The two methodological elements of this research paper correspond to the paper's two major components: historical standards research and case study investigation. Both relied heavily on personal interviews.

I. Standards Research

For the historical review of standards, I first attempted to find secondary sources on the subject matter of standards and standards change. Secondary information on standards was mostly found in FHWA historical reviews (Cron 1975; Weingroff 1993; Weingroff 2003; Weingroff 2006), conference proceedings (Hadden 1944) or conceptual design framework proposals (ARTISTS 2004; Burden 1999; City of Palo Alto 2003; Daisa and ITE 2006; Freedman, Tung and Bottomley 2006; Jacobs, Macdonald and Rofé 2002). Academic research on the history and change of street standards exists and seems to be increasing (Dumbaugh 2005; Fambro 2000; Hauer 1999; Jacobs *et al* 1997; Southworth and Ben-Joseph 2003). The original impetus of the study was to compare cities' street standards; to this end I investigated APWA's 1969 *A Survey of Urban Arterial Design Standards*, which included the Cities of Los Angeles, Pasadena and Glendale. I reviewed the ample primary sources of arterial street standards – the policies, guidelines and manuals themselves. For this research, I reviewed AASHO/AASHTO geometric design policies from the 1940s through 2004. I reviewed California Department of Transportation (Caltrans) *Planning Manual of Instructions* from 1952 and 1959, as well as *Highway Design Manual* (*HDM*) from 1995, 2001 and 2006. The Caltrans research was a combination of library, online and Caltrans archive research. The investigation also included online searches of the California Streets and Highways Code as well as the online policies and standards of the Cities of Los Angeles, Pasadena, Glendale.

Finally, several planners, highway designers and design reviewers were interviewed on person or over the phone. These included Caltrans district design reviewers (Clark 2006; DeLuca 2006; Steele 2006; Thomas 2006), the *HDM* editor (Clark 2006), Caltrans landscape architects (Dudley 2006; Oehler 2006). I interviewed other practitioners and experts in the field, including a highway designer writing the Institute for Transportation Engineers (ITE) *Draft Context Sensitive Solutions for Major Urban Thoroughfares in Walkable Communities* (Bochner 2006), American Public Works Association standards writers and engineers (Ellison 2006; LaPlante 2006), a Congress for the New Urbanism (CNU) researcher and writer (Greenberg 2006), urban designers in the field (Macdonald 2006; Greenberg 2006; Tung 2006; Switzky and Varat 2005, Moore 2006, Ross 2006, Erickson 2006). As my original research was studying the standards of *cities*, I also interviewed or emailed with several city transportation engineers

(Conger and Sarkis 2006; Oishi and Lee 2006; Fleck 2006; Perlstein 2006), transportation planners (Bent 2006; Bowin 2006; Charlton 2006; Hiatt 2006; Lieberman 2006) and the former head of the Los Angeles Department of Transportation on the subject of city street design standards and values change (Rifkin 2006).

II. Case Studies

The case study research also relied heavily on personal communication and interviews. Several of the standards research interviewees above also discussed case studies. The El Camino Real case study in Palo Alto, California was largely based on interviews with involved parties, including the Palo Alto City Planner on the project (Warheit 2006), the contracted urban designer on the *El Camino Real Master Design Plan* (Erickson 2006), the landscape architect involved in the negotiation process (Oehler 2006) and the Caltrans design reviewer (Thomas 2006).

The Santa Monica Boulevard Case Study in Los Angeles also utilized interviewees. These included the concept urban designer (Carbrey 2006), the landscape architect (Oishi 2006), transportation engineers (Conger and Sarkis 2006) and the Caltrans design reviewer (DeLuca 2006) on the project. It also included email communication with the former project manager (Ganaja 2006).

In addition to interviews, I conducted site visits to both streets, took several photos and approximate measurements, reviewed relevant plans (City of Palo Alto 2003; City of Los Angeles 2004; City of Los Angeles 2006), reviewed project memoranda (Oehler 2003) and conducted online news searches about the projects.

INSTITUTIONAL HISTORY

*In every field of industry,
new problems have presented themselves and new
tools have been created
capable of resolving them.
If this new fact be sent
against the past, then you
have revolution.*

- Le Corbusier

Chapter Summary: *The institutional underpinnings of road building in the United States are instrumental to understanding design, standards and change on urban arterial streets. The highway-building industry and highway governance was born in the minds of progressive engineers bent on ushering in a new era of efficiency, progress and modern transport. Their triumvirate legacy of state planning and design control, federal funding, and third-party guidance has lasted to this day. With powerful automobile constituencies and expansive territory to develop, California (particularly Los Angeles) heavily influenced highway planning and design governance. Interstate highway planning ushered in an unprecedented degree of federal involvement in road networks.*

Street standards are not a modern enterprise. In the fifth century B.C., the Roman Empire was the first to standardize the classification, design and construction of roads. The empire legally defined roads based on their permitted modes of travel (Cron 1974). Pedestrian paths were one-foot wide, horse and pedestrian paths were three. Single carriage roadways were four feet wide and two-lane vias 8. The Romans also standardized methods of road construction (Southworth and Ben-Joseph 2003).

Standards do not change often either. The construction standards put in place by the Romans more than 2000 years ago bare a strong resemblance to their successors. The conventional raised sidewalk design on western streets were designed by the Romans in the first century B.C. (Southworth and Ben-Joseph 2003). The Roman construction technique of layering paving stones and then mortar on roman military routes also lasted well into the 19th century (Hulbert 1901; Southworth and Ben-Joseph 2003). It may not be surprising then to hear that little changed throughout the 20th century either.

Considering the change in technology and development patterns throughout the 20th century, one would still expect that street standards to advance. Indeed, arterial street standards have not significantly changed since the birth of the profession of highway engineering.

I. Progressive Highway Institutional Formation

The earliest standardization of highways in the United States the author could find was in the congressional and executive acts regulating the National (or Cumberland) Road, in 1806 (Hulbert 1901; Eddy 1999). But by 1838, federal hesitation over its power to levy tolls led to the turning of the National Road over to the states' jurisdiction. Throughout the 19th century and until the New Deal, the federal government shied away from standardizing or constructing roads (FHWA 2005). Road engineering and related sciences were generally left to the states (Hadden 1944; Alkire 2006).

The advent of the bicycle in the late 19th century united urban advocates into the Good Roads movement. "The speed and individual mobility afforded by the bicycle created a nationwide craze -- complete with bicycle clubs, clothes, races, and touring guides -- for what appeared to be the next important mode of transportation," (Weingroff 1993). While they were mostly urban, the bicyclists' biggest problem was the impassability of the nation's roads outside of cities (Levinson 2004). Escaping the congestion of urban areas was not an option. Bicycles associations tried and failed to form alliances with farmer associations to fix rural roads. With the introduction of the "safety" bicycle (two wheels of the same size) and pneumatic tires 10 years after the first (large-wheel) bicycle, "the craze became an economic, political, and social force" (Weingroff 1993) in its own right.

Out of this movement arose the Civil War hero General Roy Stone. Stone would lay the foundation of the institutions responsible for highways and transportation in the U.S. today. He was hired to head the first Office of Road Inquiry (ORI, the progenitor of the FHWA) within the Department of Agriculture in 1893. The Secretary of Agriculture issued instructions that Stone's work "will need to be of gradual growth, conducted at all times economically . . . [with] no considerable expenditure for the present," (Weingroff 1993). Highway construction costs were to be borne by the states only.

With his engineering background, little money, and a progressive can-do outlook, Stone wrote state governors, congressmen, railroad officials and geologists inquiring of highway laws, deposits of road-building materials and freight rates throughout the states. He tested road materials, wrote legislation, and spoke at conventions. One of Stone's greatest successes was the object lesson road program:

> The idea, borrowed from Massachusetts, was to build short stretches of road to educate local engineers and, on the theory that "seeing is believing," create support for increasing funding for road improvements. Federal engineers or part-time special agents directed the work, but equipment was donated and most of the remaining cost was paid by the sponsors. The program was one of the ORI's most popular, with demand far exceeding the agency's resources (Weingroff 1993).

Stone's legacy is best summed by Seely:

> In the end, he pioneered three enduring patterns of activity for the ORI: build a reputation for technical knowledge, promote the gospel of good roads, and utilize cooperation to reach those goals (Seely 1987).

These patterns thrived under Loren Page, the Director of the Office of Public Roads Inquiry (OPRI – ORI, renamed) beginning in 1905. Like Stone, Page believed in collaborating with, rather than dictating to, the states and highway-related industries (Weingroff 1993). He expanded the object lesson road program, testing laboratories and the "good roads" train used to deliver these ideas. He also built experimental roads to test materials and methods, increased the agency's public exposure and made OPRI engineers available to inspect proposed Rural Free Delivery routes for the Post Office Department. A 1913 bill appropriated $500,000 to an experimental post road program, to be administered by the OPRI. While the program's success was limited, the OPRI quickly learned from this experience that collaborating with the nation's 3,000 counties would be a lot more taxing than working with 48 states (Weingroff 1993).

Figure 3-1: Federal Highway Administrations

Federal Highway and Road Institutions	Years
Office of Road Inquiry	1893-1898
Office of Public Road Inquiries	1899-1905
Office of Public Roads	1905-1915
Office of Public Roads and Rural Engineering	1915-1918
Bureau of Public Roads	1918-1939
Public Roads Administration	1939-1949
Bureau of Public Roads	1949-1967
Federal Highway Administration	1967- present

By Page's time, the mass production and consumption of the automobile had overtaken the bicycle's popularity. The good roads movement retained its base of urbanites. But it was now led by automobile associations more than bicycle organizations (Weingroff 1993; FHWA 2005; California State Automobile Association 2006).

The 1916 Federal Aid Road Act appropriated $75 million to state highway agencies for road projects along any road used by the US postal service. The Act was as much an economic and expansionist policy as a transportation one. Two-thirds of the roads were located in parts of the country "where the pioneering work required to open up new territory yet remains to be done," (Weingroff 2005). The Road Act did little to delineate physical standards for the roads to be funded (Cron 1974). With the country's entry into the First World War, labor and capital were limited. By the war's end only 17.6 miles of federal aid projects had been built (Weingroff 1993).

II. Highway Industry Growth

The highway engineering industry was rapidly growing from the tireless efforts of growing numbers of engineers, road builders, and highway officials. State standards, federal funds and professional capital were well intertwined in establishing the institutional framework of contemporary street design.

The 1921 Federal Aid Road Act solidified the future of highway and transportation planning in the United States. With the 1921 Act, the Bureau of Public Roads (BPR – the former OPRI) regained the resources to reinstate the spirit of the 1916 Act, smooth over its controversies and implement it. The legislation satisfied supporters

Figure 3-2: Organizations and associations in the U.S. with an interest in highway design

Highway Design Organizations and Agencies	
Federal Highway Administration (FHWA)	Part of the Department of Transportation that oversees Federal-Aid Highway Program, funding Interstate Routes, US Highways and State Highways; publishes Manual on Uniform Traffic Control Devices (MUTCD); performs research on highway capacity, safety, design and construction. (see above table).
State Departments of Transportation (e.g. Caltrans in California)	The organizations that establish transportation and highway policies, procedures and standards; manage federal-aid, federal transportation and state transportation funding; plan, construct, maintain and design state roads and highways; and conduct other transportation programs which vary by state.
American Association of Highway and Transportation Officials (AASHTO, formerly AASHO)	The association of state officials which researches and creates policy and guidance for geometric design of streets and highways, roadside features and other transportation infrastructure. AASHTO does not establish federal or state policy, but it is a recognized authority whose policies are often adopted by state officials and the FHWA. Founded in 1914
Transportation Research Board	A division of the National Research Council, the TRB serves as an independent advisor to the government and promoter of innovation through research on transportation issues. It publishes the Highway Capacity Manual. It includes the National Highway, Transportation and Airport Cooperative Research Programs whose research is often incorporated into AASHTO Policy and FHWA regulation.
Institute of Transportation Engineers	A professional association that researches and educates about safety and mobility issues. Founded in 1930.

of the principle of federal-aid to states as well as those committed to a national, interstate system. The statute included the requirement that all paved surfaces should be at least 18 feet wide – the first federal geometric standard of the century (Weingroff 1993).

The State Highway Departments filled the void of the remaining standardization. By 1914 they had already formed the American Association of State Highway Officials (AASHO, later AASHTO), with Page's full support. AASHO ratified the 1916 Federal-Aid bill before going to congress and it helped draft the 1921 Act.

With federal funding and state highway planning capacity, counties and local associations lobbied for resources with studies of traffic volumes and driving trends. Traffic studies were initiated often to systematize road maintenance and construction (Maine 1924, California 1920, Cook County 1924). Los Angeles County sought to quantify the economic values of road mileage for the purposes of maintenance budgeting. These were often conducted by contractors, professional associations and pavement companies.

This was only the beginning of a road-building boom that never caught up to the growth in automobile use and ownership. From 1921 to 1931, vehicle registrations increased 250% from 10.4 million to 26 million (Weingroff 1993). The immediate impact of mass automobile ownership on streets, networks and cities ill-suited for them was, naturally, congestion. Urban populations reacted with vigor, demanding uncongested streets.

An entire generation of associations, clubs and committees dedicated themselves to unclogging urban streets. Local Automobile Clubs, the Institute of Transportation Engineers (ITE), regional planning associations, public administrations devoted to highway design were just a few. Master architects forsook their original venues of city design to design new cities around the vehicle. Frederick Law Olmsted, Jr. undertook a regional thoroughfare plan designed to facilitate automobility in Los Angeles – with consideration for, but little elucidation of, architecture, design and alternative uses of public space (Olmsted 1924). Le Corbusier embraced the automobile's efficiency with city plans structured around free-flowing highways and interchanges. Prestigious universities and academics soon committed themselves to the science and professions of automobility often in and around Los Angeles (Malcher 1935; Behrens 1998).

California set the precedent for federal-state cooperative highway planning. The California State Automobile Association (CSAA) heavily lobbied and wrote the funding formula for federal aid – effectively increasing federal aid based on a state's proportion of public land (CSAA 1996-2006). The 1920 California Highway Study, set the standard for future studies by examining subgrades, routing and traffic surveys (Cron 1974). California also happened to have the greatest rates of automobile ownership and vehicle miles traveled in the nation (Bottles 1987).

Other states followed suit, by copying others' more than creating their own design standards. Even at the industry's incipience, warnings were sounded of "a grave danger attendant on the use of standards of any kind. The temptation is to neglect the detailed study of local conditions and use a standard structure. This often resulted not only in an unwarranted increase in ... cost, but may result in a type of construction which fits but poorly to the location where used," (ASCE 1918 in Cron 1974).

III. Caltrans: A Legacy of Highways

Today, the California Department of Transportation (Caltrans) is responsible for planning and maintaining the State's system of interstate highways, state highways and rights-of-way. Caltrans is concerned with the long-distance (regional, statewide and national) flow of goods and people along arterial highways from and to every port, farm, workplace, city, market and home.

The California Department of Transportation was originally the California Bureau of Highways, in 1895. The Bureau has survived several incarnations as its own Department of Highways, as a Division of Highways in various other Departments and as the Highway Transportation Agency. Its overseeing commissions have changed with even more frequency.

The California Department of Highways was created in 1897 after the three-member California Highway Commission recommended a state system of highways. Its early years were marked by corruption. By 1907, it was replaced by the Division of Highways within the Department of Engineering (Forsyth, Hagwood et al. 1996). The Division broke ground on El Camino Real south of San Francisco, its first construction project, in 1912.

The Department of Engineering became the Department of Public Works in 1921. But the Division of Highways remained in tact for five decades. A high degree of autonomy enabled the Division to plan, implement and construct interstates and highways without much public opposition. Cities did have a high degree of leverage in the planning of highways. But the Division did not have to answer to the legislature; it had its own source of guaranteed funding (the gas tax); and, in the words of one highway designer, it "did what was right," (Thomas 2006). Many design decision makers in Caltrans have experience in the autonomous days of the Department's former incarnations. Some regret the loss of such autonomy, the meddling of politicians and the freedom to design without negotiating values.

Figure 3-3: California highway standards milestones

Year	Milestone
1895	Original California Bureau of Highways Created
1952	Planning Manual of Instructions, 1st ed. created
1959	Planning Manual of Instruction (2nd ed.)
1964	Highway Design Manual (3rd ed.)
1972	California Department of Transportation created
1975	Bicycle standards incorporated into change orders for highway design manual
1987	Highway Design Manual (4th ed.)
1995	Highway Design Manual (5th ed.)
2005	Main Streets: Flexibility in Design and Operations
2006	Highway Design Manual, 6th ed.

A series of substantive institutional changes took place in the 1960s and 1970s. In 1961, the Department of Motor Vehicles, Highway Patrol and Department of Public Works were combined to form the Highway Transportation Agency. (Four years later it was renamed the Transportation Agency.) In 1972 the legislature folded in the Departments of Public Works and Aeronautics to form the Department of Transportation. It was in this era that state transportation officials became responsible to the legislature – a pivotal moment in the autonomy and fluidity with which the Department could plan, design and construct highways. Since then, the Department has consisted of the Divisions of Mass Transportation, Transportation Planning, Highways, Aeronautics; Administrative Services and Legal Services. This was the watershed moment that enabled many of the changes to the California Highway Design Manual that are discussed in the following chapters.

IV. Nationalization

Despite deference to state power for the 19th and early 20th centuries, elements of highway planning began to nationalize after Franklin Roosevelt became president. Initiatives for a national system of defense highways were begun in the 1930s and culminated in the Federal Highway Act of 1956. In 1939, the Bureau of Public Roads called for a "system of direct interregional highways, with all necessary connections through and around cities, designed to meet the requirement of the national defense in time of war and the needs of a growing peacetime traffic of longer range," (Cron 1974). In the 1930s, President Roosevelt reportedly drew six lines across the continent, three east-west and three north-south. And thus began the interstate highway system. By December 1944, 40,000 miles of interstates had been planned based on decades of previous research. It was not until the 1956 Federal Highway Act that these plans could be implemented.

AUTOMOBILITY, SAFETY & VALUES CHANGE

We must aim at the fixing of standards in order to face the problem of perfection. .. Standards are a matter of logic, analysis and minute study; they are based on a problem which has been well "stated." A standard is definitely established by experiment.
- Le Corbusier

Their personal characteristics have nothing to do with what follows. That's the point of a systemic analysis – to take apart the institutions that are larger than the personalities who inhabit them.
- Doug Henwood

This chapter traces the core values behind American and California urban arterial street standards.[1]

Automobility concerns have long determined typologies of streets and geometric design standards.

The functional classification of streets is the primary determinant of the automobility-based designs of arterial streets.

For more than 50 years, the design criteria of street geometric designs have been based on increasing automobility, as if without end. Since the 1960s, liability concerns have guided significant changes in design standards, mostly based on passive driver safety design. Legal action has also brought about bicycle and ADA-based design standards. Right-of-way constraints have lowered minimum design values and "flexibility" has changed design philosophy and process. However, these latter forces are not driving fundamental or enforceable change to design standards. Change to mandatory standards remains driven by automobility and liability concerns.

1 Though many standards were based in road construction methods and materials, this research focuses on design classifications and design standards only.

I. A Primer on Current Street Standards

Authoritative guidance on street design is published by the American Association of State Highway Transportation Officials (AASHTO), the Federal Highway Administration and State Departments of Transportation.

AASHTO's *A Policy on the Geometric Design of Highways and Streets* (the *Green Book*) is *the* national authority on geometric design. Yet it is not law. It offers a wide range of acceptable values and often uses the words "may" or "should" with reference to particular design values. The *Green Book* includes policy on the functional classification of highways, design criteria (e.g. design vehicles, driver performance, highway capacity, access control, pedestrians and bicycle facilities), the elements of design (sight distance, horizontal alignment and vertical alignment), cross section elements (e.g. pavement, lane widths, shoulders, horizontal clearance, curbs) and the recommended quantitative values for each as they apply to freeways, urban and rural arterial streets, collector streets, local streets and intersections (AASHTO 2004). AASHTO also publishes street design guidance, such as the *Roadside Design Guide* and the *Guide for the Development of Bicycle Facilities*. Portions of guides have been incorporated and referenced in the *Green Book*.

The FHWA also publishes guidance, such as a *Guide to Flexibility in Highway Design* (FHWA 1997). This is a primary example of how the FHWA charts the course for progressive road design at the national level. After the publication of *Guide to Flexibility*, the FHWA sponsored a workshop on flexibility and context sensitive design, culminating in 5 state pilot programs. AASHTO's published *Flexible Highway Design* seven years later in 2004.

The FHWA does not publish its own standards. It typically adopts *Green Book* policy with some exceptions (FHWA 2005; Lee and Oishi 2006). FHWA policy and adopted standards apply only to roads on the National Highway System.

However, roads receiving Federal-Aid or other federal funding must comply with state standards. State standards also govern state highways and roads within state rights-of-way. The degree to which state standards are regulatory depends on the state. The California Highway Design Manual (HDM) is a mixture of mandatory standards ("shall") and advisory ("should") or permissible ("may") guidelines. Since it is not a formal statute, ordinance or regulation pursuant to the Administrative Procedures Act, the HDM does not have the force of law. The California Vehicle Code (CVC) does have the force of the law (Gowan 1998). The HDM contains most geometric design considerations, not the CVC.

Both AASHTO policies and the California HDM can be used in court as standards of care (Gowan 1998). The HDM "represents the public entity's own determination of what standards of performance apply in a given design situation," (Gowan 1998). While the AASHTO polices are "a widely recognized authority and comprise the official standards in many states," (Gowan 1998). A failure to meet the standard of care can be used as evidence of negligence. Deviations from these standards of care are permissible, but they "can be the bane of any defense lawyer unless there is a well-documented process established which demonstrates that their adoption results from an exercise of discretion and is based on sound engineering judgment," (Gowan 1998). This process is called the design exception process. The design exception process must be rigorously documented and the design well researched and tested. For these reasons, States are often not inclined to make the exception process simple and cities often do not have the resources to complete the process.

II. Classifications for Standardization

While this research focuses on the design standards of urban arterial streets, understanding the overall highway classification system provides insight into the values behind the standards. For example, Napoleon foreran functional classification systems with street standards based on a road's imperial relevance. That is, he designed roads based on their placement in an imperial road network, not on their geographical, land use or traffic conditions. Roads from Paris to large cities were of one size, from Paris to small cities another, and between cities were yet another size. While it is probable that the intensity of large cities justified larger delivery roads than that of smaller cities, was it certain that roads between cities other than Paris would not carry heavy traffic? Could not roads between "large cities" carry more traffic than roads between small cities? In Napoleon's scheme, such roads would be of the same width. Environmental or traffic conditions did not guide a road's design, its relation to Paris did.

A. Early Context Classification

During the formative period of United States road governance near the turn of the 20th century, classifications of roads were limited. The only apparent distinction was based on land use context, between rural farm-to-market roads and urban or interstate highways (Weingroff 2005). And even then, these distinctions had less to do with design and geometrics than they did with location, apportionment and patrons served.

As roads expanded into the varying topographies of the country, design speed was added to AASHO's standards (AASHO 1941). According to Cron (1976), "the design speed was an indirect recognition of the influence of topography on highway design." Sight distance, vertical curvature and horizontal curvature – the three determinants of geometric design and critical factors for safety - are all influenced by design speed. "By selecting a lower design speed the designer automatically adjusted his design to rougher topography," (Cron 1976). This was the first mention of manipulating the design speed of a road to better approximate its context. In 1945, AASHO took these context concerns one step further. It categorized roads and ranges of design speed by "flat, rolling and mountainous" topographies.

Only topographical context impacted design. And it only impacted design with respect to three automobile-related design criteria: sight distance, vertical curvature and horizontal curvature.

The current or planned adjacent land use, urban design qualities, and alternative modes of travel were not accounted for in a street's designation. In an urbanized (typically flat) area, AASHO effectively based geometric design decisions on the number of lanes. The number of lanes, in turn, was based on presumed traffic density (average daily travel or ADT). Since traffic data were not readily available, the designer of roads was to use "tentative capacities," (AASHO 1940). The legacy of not knowing the exact or desired capacity is of critical import in the design of urban conventional highways.

B. Early Road Classification

The earliest definition of road types (as opposed to context types) in the United States the author could find was in a 1918 edition of Transactions of the American Society of Civil Engineers (ASCE). Among a host of definitions of road construction materials sit the definitions of "street" and "highway."

It is telling that "highway" and "street" both refer to the entire right-of-way devoted to travel. They only differ in their land use context. Despite the different needs and travel patterns between urban and non-urban contexts, a "street" is still considered a subset of highway. The sub-classification of "street" may simply seem to be a semantic debate. But the contemporary connota-

Highway	The entire right of way devoted to public travel, including the sidewalks and other public spaces.
Street	A highway in a urban district

Figure 4-1: Early Classifications (ASCE 1918)

Boulevard	An important street of extraordinary width (not less than 120 ft wide) with ample provisions for shade trees or ornamental planting. A boulevard is not intended for trucking but is readily available and attractive to pleasure traffic, and adjacent to property that may be peculiarly adapted to furnishing imposing settings for public buildings or for the highest type of private residences. In its design ample or generous provisions are made for pedestrians, for restful recreation, or contemplation, and for ornamentation.
Freeway	A highway to which there is no vehicular access from abutting properties
Arterial Highway	A highway for vehicular traffic that is a main channel, with many tributaries, and the roadway of which is required, by traffic frequency, to be not less than four travel lanes wide"
Express Roadway	A roadway for fast minimum-stop traffic, with separated opposite-direction free-traffic lanes, and without grade crossings.
Express traffic	Non-stop fast traffic with distantly separated origin and destination
Major Highway	A highway forming an essential part of a highway system for a region, such as a state, and the row which not less than 100 ft wide
Super highway	A highway to accommodate mass passenger transportation on rails, in addition to all other highway functions, including local service to abutting properties.
Road	A highway outside an urban district (sometimes meandering street discordant with general street plan)
Street Thoroughfare	A street carrying thorough traffic from and to other than the abutting properties

Figure 4-2: Further classifications of streets (ASCE1923)

tion of "highway" as a roadway with high automobile traffic begins to explain why streets in the United States also tend to be automobility-oriented. The ASCE Committee on Street Thoroughfares (1923) later defines arterial highways, major highways, freeways and streets.

These classifications may have been too specific in category, while imprecise in definition for officials to commit to. It was years before any of these terms became official standards or design policy.

Class	Traffic Volume (ADT)
A	4,000 or more
B	750 to 4,000
C	300-750
D	300 maximum
E	200 maximum

Figure 4-3: First classification of roads by AASHO (1931)

AASHO based its first classification of roads on traffic volume. As Cron notes (Cron 1976), "Most engineers acknowledge that traffic is the primary determinant for road standards, overriding all others." In 1931, AASHO established desirable practices for right-of-way width, pavement, shoulders and bridges, gradient limits, pavement type and minimum radius of curvature for the five classes of road in Figure 4-7. By 1936, Classes F (100 max) and G (50 max) were added to the classification (AASHO 1940).

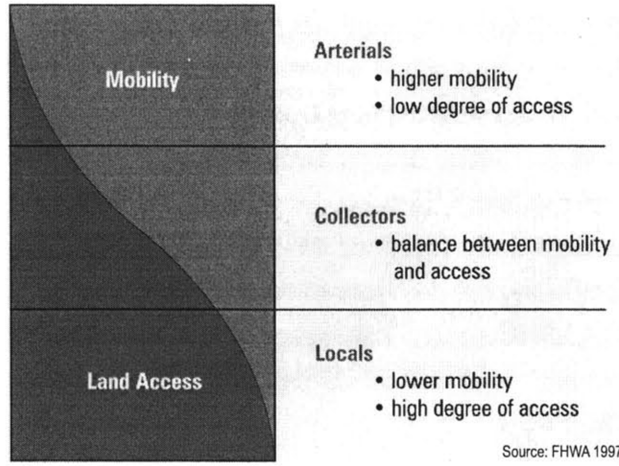


Figure 4-4: The basic criteria for the functional classification of roads

C. Contemporary Functional Classification

Functional classifications in the U.S. have long been based on their relevance to regional mobility, rather than to Paris in Napoleonic France. In a metropolitan region, certain roads are presumed to provide a particular character of service to drivers. The character of service is defined by the balanced provision of access (the ability to reach a desired good or service) versus mobility (physical movement). As shown in the figure, arterials are more heavily depended on for mobility than they are for accessing adjacent land use. Functional classifications of roads are determined by state transportation agencies and typically follow the FHWA model (see figure I-1).

1. Rural vs. Urban

Broadly classifying roads as either urban or rural has long been convention in the United States. While the distinction was made in the early 20th century mostly for policy reasons (see above), it continues to be the basic distinction of roads (FHWA 1989; AASHTO 2004; Caltrans 2006).

Rural areas are defined by the FHWA as areas of population under 5,000 (FHWA 1989). AASHTO and Caltrans follow the same principle (AASHTO 2004; Caltrans 2006). The rural principal arterial network is defined as a system of routes which connects all urbanized areas greater than 50,000 people. The urban-rural distinction, while perhaps ill-defined, is of seemingly little debate or import. It can be assumed that rural highways are without significant roadside development. What is worthy of note is that these unsubtle definitions indicate the degree to which land-use context typically impacts design.

The upshot of this lack of nuance is that, for decades, street design standards have been biased towards rural conditions. Standards were originally conceived for, and carry the legacy of, undeveloped areas where road building was unconstrained and automobility encouraged. Urban conditions, in which walking and riding transit are more practicable, were typically ignored or avoided.

2. Functional class

The second and more significant part of U.S. functional classification has more to do with a road's function. In the figure above, the words "street" or "highway" are conspicuously absent from the classification. "Freeway" only appears as a subset of "Principal Arterials." Basic design types are not included because the classification is based on a road's mobility function, not its design. According to the FHWA:

> Most travel involves movement through a network of roads. It becomes necessary then to determine how this travel can be channelized within the network in a logical and efficient manner. Functional classification defines the nature of this channelization process by defining the part that any particular road or street should play in serving the flow of trips through a highway network (FHWA 1989).

Thus, the functional classification system is oriented around a means of transportation (automobile), a particular network (highways), made up of 3 basic components (arterial, collector and local roads) in order to expedite access to and from land uses primarily along local roads. It is based on the presumed logic of the rational driver flowing through a hierarchical network providing a level of service as planned.

This model of functional classification has driven street design for more than 50 years.

The first step in the design process is to define the functional that the facility is to serve. The level of service needed to fulfill this function for the anticipated volume and composition of traffic provides a rational and cost-effective basis for the selection of design speed and geometric criteria within the ranges of values available to the designer (AASHTO 2004: 13).

The model is very powerful in its clear systematic planning and usefulness to forecasting and analysis. Roads are not isolated segments; indeed they are part of a larger network and need to be planned as such. Yet, it is not without its detractors. In particular, Cron complains:

> for most roads such a system (based on importance of the road, rather than present or forecasted traffic) is inadequate for classifying road standards because it does not recognize the great variations in traffic volume that occur from place to place on the same road. The same can be said of the functional systems such as primary and secondary and feeder; nevertheless, function is probably still the most widely used basis or classifying road standards (Cron 1974).

The responding argument from AASHTO (2004) is as follows:

> in the past, geometric design criteria and capacity levels have traditionally been based on a classification of traffic volume ranges. Under such a system, highways with comparable traffic volumes are constructed to the same criteria and provide identical levels of service, although there may be considerable difference in the functions they serve.

Under a functional classification system, design criteria and level of service vary according to the function of the highway facility. Volumes serve to further refine the design criteria for each class (AASHTO 2004).

So, if two roads have identical traffic volumes, they should not be designed the same if one is meant to provide access while the other is meant to provide mobility. Both Cron and AASHTO are right.

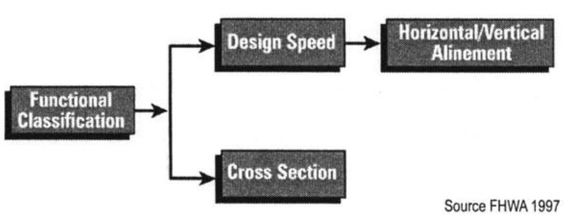


Figure 4-5: Functional class establishes the basic cross section in terms of lane, shoulder and median width, and other major design features.

Functional classification is of concern to Cron because different segments on the same road can vary in traffic volume, yet still be considered the same class.

The functional classification is also of concern because it determines a street's design. That is, the design of a street is based on its relevance to a regional road network (remember Napoleon). Arterials are intended to provide a high level of mobility for the majority of long-distance, often linear, through traffic. An arterial may be either a grade-separated, limited access freeway or a conventional highway (surface street) – roads of profoundly different design qualities. A freeway is an arterial highway to which abutting land owners have no right of access and with grade separated intersections (Caltrans 2006). A conventional highway is also an arterial highway, yet without access control. Because conventional highways are often considered arterials, local access, place-making, pedestrian experience and other functions they serve are outweighed by designs for its mobility function. This conflation of dramatically different designs into one category is of greater concern to arterial street design than the vagueness of the urban-rural classification. Even senior Caltrans designers have questioned the lack of subtlety of this distinction (Thomas 2006).

As systematic as the functional classification system is, it excludes a great many other systems, characteristics of roads and values. It fails to consider local, pedestrian and urban design features. Before a street's cross section is even designed, its classification biases it towards automobility. Nevertheless, functional classification has a valid role in regional mobility planning, and it continues to drive the design of arterial streets.

III. Mid-Century Standards for Automobility

A road is defined by its functional class. It is designed in terms of automobility: control of access, grade separation, traffic control, "through traffic on a continuous route," "separated roadbeds for traffic in opposing directions," are the primary determinations of highway type in California's HDM. They have been since 1952. The automobility bias has existed since the beginning of the highway engineering industry.

This is not to say that urban arterial street standards Caltrans and the Highway Design Manual are static. Since 1952, six editions of the Highway Design Manual (or its progenitor) have been published. Similarly, AASHTO has updated its Policy in various publications, most recently in the 2004 edition of the Green Book. Chapters of policy have been amplified, supplanted or refined as the field has advanced. But these changes are generally modifications of the early 20th century paradigm intended to increase automobility.

A. Mid-Century Philosophies

Until the Federal Aid Road Act of 1921, federal government efforts consisted largely of road-building research, technology transfer and funding. During the inter-war period the government focused on creating a national network of priority defense and freight routes. Though this research does not examine these eras, they were formative in shaping the values behind highway standards and planning today.

The 1950s were prolific years for standards-producing bodies. In 1950, AASHO bundled several of its policies from the previous ten years into *Policies on Geometric Highway Design*. It included policies on highway classification, geometric types, sight distance, passing zones, intersections and grade separations. AASHO added one policy in 1950 to its collection: A Policy on Design Standards – Interstate, Primary and Secondary Systems. These formative policies focused on high-speed and rural design features more than the typical land uses, urban frontage or modal mixture unique to urban conditions. Many of their calculations and policies have remained unchanged for over 50 years (AASHO 1940; Hauer 1999; AASHTO 2004).

Early California design guidance, like that of the federal *Highway Capacity Manual* and AASHO policies, displays a clear bias towards high-speed and rural highways. The California Division of Highways Planning Manual of Instruction codifies the federal funding bias towards freeways, high-speed highways and roads in small towns and suburbs over those in urban areas (California. Division of Highways. 1952; California. Division of Highways. 1959). The "Basic Design Policies" of the Manual are design speed, highway capacity, design designation, access control, pedestrian facilities, stage construction and roadside installations – factors relating mostly to automobile flow. Two are related to construction. Another, "pedestrian facilities," doesn't leave much hope for the pedestrian on state highways. It begins with:

> Sidewalks shall not be constructed except as a replacement in kind. Where existing sidewalks are to be disturbed by highway construction, the replacement shall apply only to the frontage involved and no other sidewalk construction, such as closing existing gaps in sidewalks, shall be authorized. Land owners or local agencies may construct a sidewalk under permit. (California. Division of Highways. 1952)

Despite the early definitions of "streets" as a distinct urban category of "highway," policies like these are what gave the word "highway" its automobile orientation.

The four primary basic policies – design speed, highway capacity, design designation, and access control – also display the automobility bias.

According to the Manual, the "choice of the design speed is influenced primarily by the character of terrain, type of highway, traffic volumes and economic considerations," (California. Division of Highways. 1959). Drivers are said to be more apt to accept lower design speeds where a "difficult location is more obvious." The acknowledgement of the driver control and behavior in street design conflicts sharply with passive safety design paradigm and general resistance to context-sensitive design (see Dumbaugh 2005). This issue will be revisited later. For now, it is telling that the Manual codifies design guidance that acknowledges a driver's ability to react to changing context – in this case, only geographic or topographic context. The Manual doesn't hold the same regard for the development context or for factors unrelated to automobile flow. Design speed for flat terrain, typical to urban areas, was 60 – 70 mph in the early Manuals.

The diction alone of access control conveys the importance placed on vehicle flow. Control is precisely to protect vehicle flow from interrupting vehicles entering from access roads.

The design designation is defined as "a simple, concise expression of the basic factors controlling the design of a given highway," (California. Division of Highways. 1959). While more of a list than an expression, the controlling design factors relate to vehicle design speed, vehicle capacity and quality of traffic.

The target year is typically 20 years out and the methods of predicting daily traffic capacity are ill-defined and usually just assume a factor of growth trends. After 20 years, the calculation is applied again and so on, so that the design of all new facilities assumes the perpetual growth of vehicle traffic.

Figure 4-6: Design designation expression (Cal Div. of Hwys. 1959)

V =	The design speed in miles per hour.
ADT(y) =	Average daily traffic, in number of vehicles, for the current year.
ADT (y+20) =	Average daily traffic, in number of vehicles, for the target year.
DHV =	The two-way design hourly volume, in number of vehicles.
D =	The percentage of the DHV in the direction of heavier flow.
T =	The truck increment as percent of the DHV.

The Geometric Design and Structure Standards chapter of the Manual consists of a road's primary features based on design speed: vertical curvature, horizontal curvature, sight distance and grade.

In 1954, AASHO published A Policy on Geometric Design of Rural Highways, based largely on its various policies of the previous decade. The 1954 Policy was the foundation for every subsequent AASHO policy. Two years later, AASHO published A Policy on Arterial Highways in Urban Areas (more akin to the subject matter of this thesis). Even specifically urban policies heavily rely on the assumptions and guidance in the 1954 Rural Highways.

The 1956 Policy on Arterial Highways considers "major streets" as the lowest order of arterial, serving a mix of regional and local traffic (AASHO 1956). The degree to which automobile flow reigns supreme and unfettered seemed to be the primary measure of a street. "Major streets" were never considered as focal points of urban activity. Indeed, the notion of a street relating to its surroundings was antithetical to AASHO's assumptions. "City planning emphasizes self contained neighborhoods. Urban arterial highways desirably should be located in the bands or wedges of relatively unused land between such neighborhoods," (AASHO 1956). This type of design "promotes safety in that residents satisfy their needs within the neighborhood where traffic is local and slow," (AASHO 1956).

The idea of capacity as the primary measure of mobility and basis for street design was entrenched in the 1950s. The first concise piece of guidance in the 1956 Policy on Arterial Highways in Urban Areas sets the tone for the remainder of the book:

> Control of access increases efficiency of operation, reduces accidents and avoids the experience of needing to provide new parallel highways as capacity drops on existing ones due to roadside interference...Unless an arterial is protected from the stifling effects of roadside development, capacity will constantly decrease and hazards increase. (AASHO 1956:3)

Also, streetcar lines were undesirable (AASHO 1956: 200). If a streetcar was unavoidable, then medians were preferred – not for the safety or pedestrian refuge they may provide, but in order to facilitate greater automobile capacity. Separate roadways for the two modes of traffic could also have other benefits. But when other values such as streetcar mobility, walkability and urban design are without advocates, resources or institutional backing – they are bound to get lost as a street is designed.

This type of automobility-oriented major street conditions can be imagined in heavily urbanized areas. After all, even in dense urban areas with effective mass transit, some streets must prioritize automobile traffic. But what of urbanizing, suburban or rural towns? The 1957 AASHO Policy states:

> in many communities of small to intermediate size, a major street may well represent the optimum type that can or should be developed...also major streets may be initial improvements toward the later development of expressways (AASHO 1956).

If a suburban town's main street is a major street, then the AASHO Policy was effectively re-designing small main streets to maximize automobility. If competition from local traffic was inevitable, then separate roadways were preferred in the form of frontage roads. At one point in time, the separation into multiple roadways was not to the exclusive benefit of automobility. Local traffic, in addition to pedestrians and adjacent land use, could benefit just as much as regional traffic from a multi-way road (Jacobs 2002). But all too often, the local traffic, pedestrian amenity or needs of adjacent land uses are overlooked or designed out of the street.

The mid-century documents are not to be criticized wholesale for catering outright to automobility. They prioritize automobility over other modes and values. This in itself is not a problem. The problem has been an absence of support for other modes and values by any other institution, public resource or advocate. With public resources, professional organization and political clout behind it, AASHTO has long been well positioned to follow through with its own guidance. The same cannot be said for the interests of pedestrian amenity, human scale urban design, pedestrian safety or transit mobility.

B. The Persisting Basis of Automobility

The value of automobility has remained embedded and prioritized in urban arterial street standards since 1940 (Hauer 1999). The Caltrans Highway Design Manual has been, in the words of a wise Caltrans designer, "pretty much the same back to the [19]60's," (Thomas 2006). The AASHTO Green Book has not changed policy significantly since its first set of policies in the 1940s (Fambro, Collings et al. 2000).

Generally speaking, standards and policies today seek the most immediate ways to maximize automobility. Design speed, capacity and access control are still "basic" design policies. According to the California Highway Design Manual (2006), "every effort should be made to avoid decreasing the design speed of a local facility," and as "high a design speed as feasible should be used" on all state facilities. The design speed is then used to determine the minimum horizontal and vertical alignments and sight distances. In the case of urban arterials with extensive development, the acceptable range of design speed is now 30-40 mph rather than the 60-70 mph in the 1959 Manual. Several advisory basic design policies have been added since the 1950s as well: sidewalks must be a minimum of 5 feet wide, two curb ramps should be installed at new corners and driveways should not be located within 300 feet of a median opening if not directly opposite of it. Also added are instructions for coordinating with other agencies, scenic values in planning and design, and special considerations like heavy hauling equipment, construction-period considerations for water, air and wetlands pollution, earthquake considerations, safety reviews, and materials conservation. Yet none of these additions are mandatory, or even advisory, standards.

Most of the mandatory and basic design policies endure from the original 1952 document. The target year capacity for new facilities is still based on the 20-year forecast. Safety and operational improvements for existing facilities are supposed to be made on existing ADT. So even if current ADT exceeds the designed ADT of 20 years prior, improvements have to be made to accommodate the additional traffic at the predetermined level of service. The built-in bias of building for more and more automobiles remains.

In the Geometric Design and Structure Standards chapter as well, many elements have been added, specific conditions have been raised, and ranges of values refined. But the core factors based on design speed still dominate the surface street design elements of the chapter: horizontal and vertical curvature, sight distance and superelevation. Much has been learned about these factors and they are critical to road safety. But their dependence on design speed and the high design speed's insensitivity to various urban conditions maintain the original mid-century bias towards rural and high-speed highways.

IV. Liability is force of change since the 1960s

Perhaps the most influential changes to design standards since the 1940s resulted from the fear of liability. Caltrans serves as a striking example. Legal action has sent Caltrans (and many other departments) reeling from fear of time-consuming and expensive lawsuits. 35% of Caltrans highway tort cases were related to design in the 1996-97 fiscal year, seeking $440 million (Gowan 1998). Whether the lawsuits are a phenomenon of our litigious culture, a unique opportunity to tap the supposed deep pockets of state governments or an unwillingness of highway-users to accept responsibility is a matter of debate. Some assert that Caltrans' "deep pockets" is simply a myth and perception of the litigants (Thomas 2006). Either way, there is little debate that liability drives a conservatism in street design and change to standards today.

The paradigm of liability is rooted in the highway safety movement which accelerated under President Eisenhower and the increasingly accident-wary automobile industries of the 1950s (Weingroff 2003). It gained popular momentum in the mid-1960s with the Ralph Nader-led campaign against highway designers. In addition to excoriating the automobile industry, Nader's *Unsafe at Any Speed* (1965) and associated campaign criticized highway designers and design governance for avoidable hazards which led to roadside accidents. The 1960s transportation safety movement resulted in the National Transportation Safety Act (1965), the National Highway Safety Act (1966) and the National Highway traffic safety administration (1970), crash testing, the development of air bags and other driver safety features.

Notable figures like Nader and epidemiologist William Haddon applied the principles of epidemiology to transportation safety. Epidemiology's significant reliance on data-driven analysis over human behavioral modifications was translated into transportation safety science (Dumbaugh 2005). Rather than relying on driving behavior, Haddon relied upon a "passive" approach to transportation safety design. The objective, he believed, was "to enable a 'crash without injury' by physically engineering safety features into vehicles and their environments" (Gladwell 2001 in Dumbaugh 2005). After Nader took these ideas and generated a public outcry at the "designed-in" dangers of our transportation systems, AASHO and congress held several hearings and reformulated the way streets are designed.

The result was a fearful culture of highway design seeking to "design out" any potential hazards in road design. The inherent assumption was to design for the worst possible scenario or least-competent driver. AASHO identified a large number of fatalities associated with "single-vehicle, run-off-roadway crashes," (Dumbaugh 2005). These conclusions led to the sort of design philosophy that can best be summed up by the General Motors' crash "proving grounds" designer and spokesman Kenneth Stonex, "What we must do is to operate the 90% or more of our surfaces streets just as we do our freeways... [converting] the surface highway and street network to freeway and Proving Ground road and roadside conditions," (Dumbaugh 2005). One of the Stonex's key findings on GM's Proving Grounds was that most cars came to a stop within 30 feet of leaving the roadway. The congressional committee therefore concluded that "eliminating fixed objects within 30 feet of the travelway would eliminate more fixed-object crashes and, in a conjectural leap, that the roadway would therefore be safer as a result," (Dumbaugh 2005). AASHO incorporated the 30-foot clear zone into policy in 1967 and 1973 and it remains in the Roadside Design Guide (AASHTO 1973, AASHTO 2002; McLean 2002 in Dumbaugh 2005; Weingroff 2003). Hence began the "passive safety" paradigm. Arterial streets and standards included expansive clear zones free of fixed objects, unlimited access control, shallow curvature, wide lanes and shoulders and the avoidance of pedestrian features that threaten driver safety or automobile flow.

A. Liability at Caltrans

Liability and responsibility to legislators have been increasingly influencing California design standards since the 1965 safety campaigns. When Caltrans was reorganized in 1972, it became responsible to the state legislature. It then lost much of the autonomy that enabled the Division of Highways to plan and "do what was right." Politically-laden legislative battles seemed to be determining design standards decisions, not engineering principles, sound judgment or facts. Safety and mobility remain Caltrans' top priorities (Caltrans 2003). But liability is becoming a more immediate factor and driver of change in design standards than concern for safety.

Since the 1960s, lawsuits have increasingly bogged down the resource of the Department. 416 design-related cases were filed in the 1996-97 fiscal year alone (Gowan 1998). Tort cases and liability are often the cause of much departmental consternation. The recent debate on median trees in urban arterials is one example. It was finally brought into a negotiated settlement only at the urging of the Transportation Committee chair in the State Assembly (see El Camino Real case study).

Caltrans is very conservative to change in their design manual. Even if evidence asserts that a particular design is safe, the proof must be absolutely incontrovertible before the Department even considers the possibility of change. As long as debate remains about a design, Caltrans will not entertain change. But research exists that casts as much doubt upon long-held assumed truths by DOTs and AASHTO as upon research showing unconventional designs as unsafe (Dumbaugh 2005; Ewing 2005). Even when the Department did change the letter of the law regarding median trees, the conditions placed in the law prevent actual design change in Palo Alto, where the debate was raised and most pertinent.

These assertions are not intended to accuse the Department of greed or neglecting driver safety. Most of the changes it makes are rooted in a genuine concern for driver safety and change the design of actual streets for the better. For example, in the last 50 years, the use of median buttons has been discouraged and two-way left turn lanes, wider and planted medians have been encouraged. The recommendations have materialized. In a comparison of contemporary urban arterial street designs to their condition in 1969, the few changes that occurred made the roads much safer. Pasadena replaced many segments of excessively wide streets and barren medians with two-way left turn lane (TWLTL) segments, alternating left-turn pockets or planted medians. Los Angeles improved crossing conditions, painted crosswalks and added countdown signals on urban arterials, especially near schools, churches and at major transit intersections.

Nevertheless, the practicality of self defense against losing millions of dollars in lawsuits and potential legislative appropriations seems to be driving the change of standards more than pure safety concerns.

B. A Note on Relinquishment

The combination of liability risk, maintenance costs and design exception requests from Cities has led Caltrans to relinquish several surface streets. It is practically unofficial policy that Caltrans relinquish surface streets which run parallel to freeway/expressways or serve little regional purpose. In the last 9 years, Caltrans has relinquished 21 road segments in District 7 (Los Angeles and Orange Counties) alone. Most of these streets are town or suburban main streets. Another 33 are pending.

But each relinquishment needs a willing partner. The local jurisdictions negotiate unique agreements with Caltrans to obtain jurisdiction of these streets. If Caltrans relinquishes the street in substandard condition then it typically negotiates a payment to the city to pay for improvements, in addition to an agreed plan for phasing out state maintenance of the road. (The Santa Monica Boulevard agreement included $10m from Caltrans for routine maintenance and bringing the street up to standard condition.)

At least two critical conclusions can be drawn from Caltrans massive thrust to relinquish. One is that the Department is forced to be more concerned with its own resources and budget than with the safety of actual streets. Caltrans often relinquishes streets to a City eager to make changes in the design. (Why else would a City want control of the street and its maintenance costs?). Such designs are typically forbidden by the State HDM based on safety reasons. Yet, Caltrans has no problem allowing the designs to materialize. It simply does not want to be responsible for them. So is the Department's concern driver safety or simply the responsibility for driver safety?

The second conclusion is that the Department considers regional needs only as far as its own highways. Local impacts are of little concern. While the Department works painstakingly to plan for regional arterial traffic on its arterial routes, as soon as a route is deemed unnecessary to the Department (due to route redundancy or low traffic), the Department is willing to relinquish the various segments of the street to any in the patchwork of jurisdictions it may run through. For example, as the State relinquishes bits and pieces of Highway 1 running along California's coast, it leaves each city with little obligation to coordinate with neighboring cities.

V. Multimodal planning since the 1970s

Since the 1970s, multimodal planning is the most apparent change to the California Highway Design Manual. Is also the most popular response from designers when questioned where the most change has taken place (many of whom began working for the Department in the late 1970s). Design standards for two critical modes – bicycles and wheelchairs – appeared after they were legally required to do so by the California legislature (California 2006) or the Federal Government (Caltrans 1973) in the mid 1970s.

Chapter 1000, planning for Bicycle Facilities, comprised the most substantive multimodal design changes to the California HDM. The California Vehicle Code gives the State of California governance over traffic, including bicycles. It was only after the bicycle lobby's pressure that the obvious contradictions in policy towards bicycles became apparent. The Bicycle Facilities Committee was then created in 1973. The result was a new addition and revision of the Highway Design Manual in 1975. Since the HDM is only revised when necessary, it could be deduced that the need to include Chapter 1000 in the 1975 was urgent enough to make a new revision necessary.

Transit, despite the creation of the Department's Division of Mass Transportation, was not immediately served or addressed in the new Highway Design Manual of 1975. Though Caltrans designers continue to assert that they do not "prioritize one mode above another," the institutions and legal legacy that were set in place in the earlier part of the century ensure that the automobile is the primary object of the Highway Design Manual (Thomas 2006). This seems appropriate, considering that the majority of land area was rural or developing at low-densities which made the automobile the most capable source of transport. But in urban areas and urbanizing suburbs, the appropriateness of the automobility bias is questionable.

AASHO went through a similar transition in the 1970s. In the early 1970's the organization changed its name to the American Association of State Highway and Transportation Officials (AASHTO). The reformulated *Green Book* contains basic guidance from the 1954 Policy as well as urban street publications (AASHO 1956; AASHO 1973) Like the Caltrans HDM, the current AASHTO *Green Book* uses language and structure that embrace multimodal transportation planning more so than the literature of the 1950s and 1960s.

VI. Right-of-Way Limitations

Design policy and guidance also began to reflect limitations of right-of-way more typical of urban settings. One can imagine that in the early part of the century, when the science of highway engineering was developing, the country was vast and full of development opportunity (especially California). The provenance of the rural bias in highway design is not difficult to discern. There was room, so why not use it? This is how rural-style highways with 30-foot clear zones were standardized in all land-use contexts (AASHO 1973; Dumbaugh 2005). But beginning in the 1970s, there seems to have been a growing awareness of right-of-way constraints in language and permissiveness, if not in explicit design.

For one basic example, "major streets" in the 1956 AASHO *Policy* were considered to be 6-8 lanes, while the 2004 considered them 4-8. Since the 1956 edition, the lower limits of lane widths have also been decreasing. Roads with significant truck traffic were once 12 – 14 feet; in 2004 they were 10-14. Minimum widths decreased from 10' to 9', and maximum widths for typical travel lanes were reduced from 14 to 12 feet. "Right-of-way constraints" included in the Green Book since the 1970s were never mentioned in the 1957 or earlier Policies either. Maximum

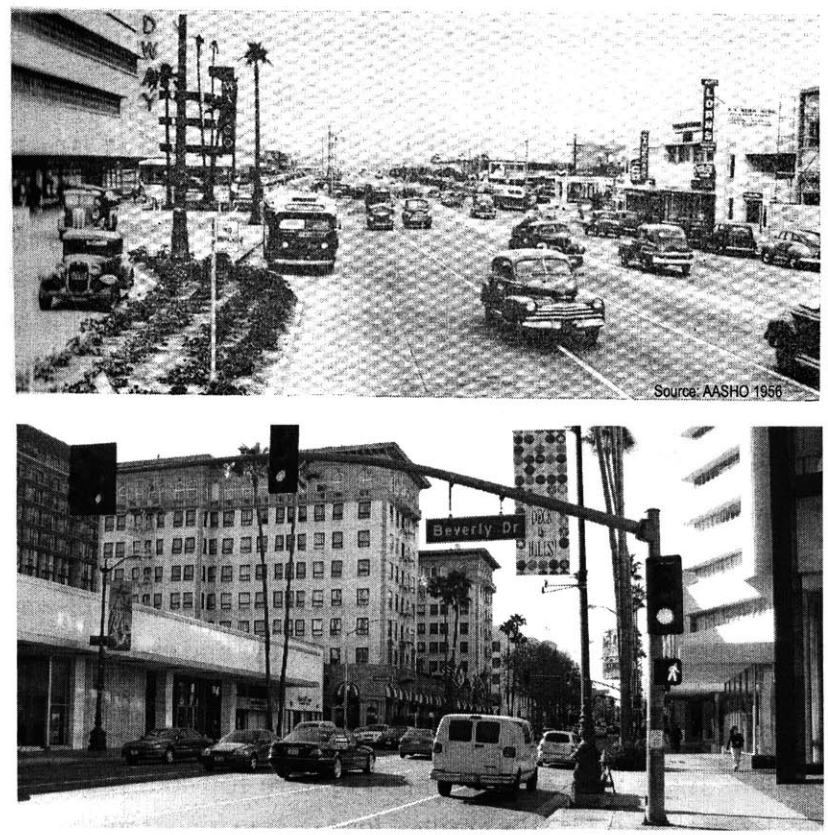


Figure 4-7: A multiple-way Wilshire Boulevard in Los Angeles in the 1950s (above). Today, the median-separated side lanes have been eradicated, and the entire right-of-way is devoted for through travel (below).

median widths in the urban condition have been reduced from 25' to 16' since 1956. Similarly, up to 3.5' right-side clear zones were required on Major Streets in the 1956 Policy. Though clear zones are still a contentious issue, 18" is now the norm (this is also related to today's near ubiquitous use of curbs, which were rarer in the 1950s). Requirements for shoulders and clear zones have also been reduced since the mid-century.

Because of these constraints, street designs and research now seek to squeeze as much through-traffic capacity out of streets as possible. The 1956 AASHO *Policy* also included designs for multiple-way boulevards, with local-access lanes separated by medians from through-access lanes. Such designs necessitated wide rights-of-way and dedicated street space to local traffic at the expense of through traffic. By 2004, this street design was nowhere to be found in the Policy. Multiple way boulevards are no longer common in the *Policy* nor in American cities.

The mid-century California guidance also betrayed a rural bias among right-of-way considerations. Urban conditions never seemed to be considered. Recommendations for right-of-way widths were generally made for rural highways and expressways; constraints were limited at cost, topographic features and plans for expansion (Division of Highways 1952, see index 703-6.1). Two-lane roads were recommended to have 100-foot rights-of-way. Exceptions were only granted for extreme topographic conditions – not a problem for a typical urban major thoroughfare or main street (Division of Highways 1952, see index 703-8.2). Turning radii were designed along the outside radius (i.e. conservatively) for trucks traveling at 20 mph (Division of Highways 1952, see index 704-5) – again, hardly an urban intersection condition. Intersections were designed like off-ramps more than a typical urban intersection (*ibid.*).

The Manual did, however, dedicate a paragraph to city streets:

> Due to the many variable conditions encountered in the design of curbed city street connections, it is impractical to establish a standard city-street curb return. In each case the radius should be as large as practical. In all cases it should accommodate the commercial design vehicle, taking into account any shoulder or parking strip being provided. *(Division of Highways 1952, see index 7-405.9)*

It is true, city street conditions are variable and difficult to standardize. But the lack of detail and attention to the urban condition in Index 7-405 betrays the bias of the Division of Highways for the rural, expansive and high-speed automobile conditions over constrained, multimodal, urban low-speed environments.

Contemporary policy and research better acknowledge the urban condition and right-of-way constraints. In research sponsored by the Transportation Research Board, Harwood weighs the effectiveness of various strategies for reallocating the use of street width on urban arterials without changing the total curb-to-curb width (Harwood 1990). In particular, he shows that narrower lanes do not affect mid-block accident rates (though intersection accident rates increase when the number of lanes is increased). He takes into account vehicle operational and safety performance, as well as qualitative impacts on abutting businesses, pedestrians and bicycles. Harwood implicitly recognizes

Figure 4-8: Major interventions in American highway design and governance

Year	Milestone	Gov't Instit. Report, or Law	Concept Introduced	Policy or Normative Standard	Significance to urban arterial street design
1893	Federal Office of Road Inquiry, Department of Agriculture Formed	X			First federal institution dedicated to road; based on research and science of road construction.
1914	AASHO Formed	X			Organization formed by state heads of transportation to exchange findings, best practices and standards. Originally dedicated to road construction, later included traffic engineering and geometric design.
1916	Federal Aid Highway Act	X			Allocated $75 million to states for postal road projects. WWI delayed fund application.
1921	Federal Aid Highway Act	X			Federal aid paradigm established: federal-aid provided to states for no more than 7% of highway miles in state; First geometric standard of century: roads must be 18 ft wide
1931	First Road Classification by ADT (AASHO)		X		Based on traffic counts.
1938-1944	First AASHO Geometric Design Policies			X	Policies on Geometric Design, Highway Types and Sight Distances; First application of Design Speed in highway design
1950	First Highway Capacity Manual by the Transportation Research Board		X		Manual for estimating the hourly capacity of single points on specific highway types. Based on assumption that functionality of highway system is sum of functionality of its parts.
1954	White House Conference on Highway Safety and Presidential Action Committee for Traffic Safety established	X			"The first continuing action group ever created by Presidential appointment." Provided a direct coordination between White House and corporate, labor, state and local traffic safety efforts.
	A policy on the Geometric Design of Rural Highways (AASHO)			X	First consolidated, comprehensive policy by AASHO.

Figure 4-8 (continued)

Year	Milestone	Gov't Instit. Report, or Law	Concept Introduced	Policy or Normative Standard	Significance to urban arterial street design
1956	A Policy on Arterial Highways in Urban Areas (AASHO)			X	Considerations for urban conditions not addressed in 1954 policy. Many calculations and principles based on 1954 policy
	Federal-Aid Highway Act and Highway Revenue Act of 1956	X			Creates the Highway Trust Fund and providing a mechanism for financing Interstate System.
1961	Death and Life of Great American Cities written by Jane Jacobs		X		A non-professional protest of modern, technocratic planning, in particular its ignorance of the import of street, street life and pedestrian-scaled planning to city life.
1963	Traffic in Towns by Colin Buchanan for British Ministry of Transport	X	X	X	Concept of Environmental Areas; Measures streets in terms of noise, pollution, social activity and pedestrianization.
1965	Unsafe at any Speed written by Ralph Nader		X		Spawned the automobile industry and road designers to "design out" the possibility of accidents with "worse case scenario" street design.
	Level of Service concept introduced		X		The LOS concept provided a way to categorize congestion and provide congestion targets for street designers
1966	Highway Safety Act of 1966	X			Response to pandemic of highway-related deaths, provided federal funds for state highway safety programs. Creates National Highway Safety Administrations
1968	Federal Aid Highway Act	X			Established need to identify national functional classification system
1973	AASHO changed to AASHTO	X			Name change made among a growing awareness and need to plan for transportation modes other than automobiles.

Figure 4-8 (continued)

Year	Milestone	Gov't Instit. Report, or Law	Concept Introduced	Policy or Normative Standard	Significance to urban arterial street design
1981	Livable Street written by Donald Appleyard		X		Documented and analyzed the impacts of traffic and auto-oriented streets on the sociability, marketability, perception, design and general livability of urban streets in San Francisco.
1984	A policy on the geometric design of highways and streets, 1st ed.			X	Combined separate AASHTO policies on urban and rural roads into one policy, The Green Book.
1997	Flexibility in Highway Design	X	X		Significantly addressed the need for context sensitivity and elucidated possibilities for CSD within existing guidelines.
1998	Thinking Beyond the Pavement		X		National Workshop on Integrating Highway Development with Communities and the Environment While Maintaining Safety and Performance.
	State CSD pilot programs (CT, KY, MD, MN, UT)	X	X		The resultant pilot programming of Thinking Beyond the Pavement
1999	Main Street: When a Highway Runs Through IT	X	X	X	The first state document to provide alternative design standards for "in-town" segments of state highways
2001	A policy on the geometric design of highways and streets, 4th ed.			X	Changed criteria and assumptions for stopping sight distance, design speeds, bicycles; made pedestrian controls consistent with ADA, added roundabout discussion and driver behavior.
2004	A guide for achieving flexibility in highway design	X			Follow-up to FHWA's literature on CSD. More consistent with Green Book than FHWA.
	ARTISTS: Arterial Streets Towards Sustainability sponsored by the European Commission		X		European Commission exploration of opportunities for making arterial roads into more livable streets while maintaining vehicle mobility.
2005-2007	Context Sensitive Solutions for Major Urban Thoroughfares in Walkable Communities		X	DRAFT	ITE's flexible design solutions for major streets to better accommodate pedestrians and human-scale urban design while maintaining mobility.

that urban arterial streets are operating more often within limited rights-of-way – a conclusion that AASHTO and Caltrans design guidance accept also.

Recognizing that highways and streets cannot be expanded ad infinitum, transportation planners and engineers are turning to transportation demand management, land use planning and arterial systems planning to better utilize street space (Levinson 2004; Tumlin and CA 2005).

But these considerations are hardly the driving values behind design policy and standards change. They are mere modifications of early, entrenched standards. For the most part, considerations of right-of-way have lowered the minimum values of acceptable ranges of widths. But the basic design policies of design speed, capacity and access control remain.

Understanding national and state geometric design standards in terms of their legacy, of the values of mobility and safety, and of liability risk helps explain the types of change and resistance to change in general. It is easy to see why precedent prevails. Most designers have been part of an organization that has established, decades-old standards and has been repeatedly sued for what seem the most minor or unpredictable roadway hazards. Most design decisions are left to the engineer's individual judgment, to commonly accepted practice or to the AASHTO *Green Book*. But the *Green Book* is a vague policy, not a set of standards. Deferring to AASHTO thus means deferring to individual judgment or commonly accepted practice. And what agency wants to risk a lawsuit on an engineer's unconventional judgment, uncommon practice or unproven safety features?

ALTERNATIVE RESPONSES TO THE AUTOMOBILITY PARADIGM

Since the 1960s, several academics and practitioners have responded to the automobility-oriented street design paradigm with critiques and alternatives. Though their conceptual frameworks overlap often, the responses can be classified based on their central focus. The first section, *Considerations of Impacts on the Livability of Streets*, includes several wake-up calls regarding the negative impacts of automobility-based street design on urban space and urban experiences other than driving, most notably those of Buchanan, Appleyard, Jane Jacobs and Allan Jacobs and Elizabeth Macdonald. Dumbaugh critiques the dominance of "passive" safety designs which make streets "unlivable," while Hauer questions the scientific basis of such passive safety designs. Recent approaches and alternatives to the urban design of arterial streets reconsider streets as places in their own right. Finally, context-sensitive solutions (CSS), is a popular paradigm defined by locally-specific design, participatory process and a flexible, multifaceted product.

I. Considerations of the Livability of Streets

Since Jane Jacobs, academics have flocked to the subject of the automobile and its impacts on city building and public space.

Colin Buchanan's 1963 report for the British Ministry of Transport, *Traffic in Towns*, is a seminal departure from the conventional way of perceiving streets and street types. It puts forth the concept of environmental areas within which through-traffic should be excluded; and it measures streets not only in terms of capacity, but also noise, pollution, social activity, pedestrianization and aesthetics (Buchanan et al. 1964). This book establishes a basis from which much of the contemporary context-based design literature has sprung. It provides a valuable counterpoint and context to the prevailing framework and discourse out of which most modern standards have been written. Most important for this research, *Traffic in Towns* provides alternative criteria by which to evaluate arterial roads and their impacts. At the same time, it upholds the functional class hierarchy of roads. According to Buchanan, environmental areas are to be divided by high-traffic arterial roads and only traversed by collector roads. The theory leaves little room for planning or designing arterial roads as urban places in their own right.

In the 1970s and early 1980s, Donald Appleyard forced a sea change in how streets are studied and for whom they are designed. *Livable Streets* is an exhaustive analysis of what it is like for San Franciscans to live with urban traffic. He categorizes streets based on levels of traffic flow. But he does not measure them or make recommendations based on automobile needs. He discusses congestion's impacts on the social networks, perceptions and activities of the people who live on those streets – rather than the impacts on those who drive through them. Appleyard proclaims the need for design, legislation, education and law enforcement that protect neighborhood streets as a sanctuary for children, activity and residential space (Appleyard 1981). Like Jane Jacobs' *Death and Life of Great American Cities*, Appleyard's book is instrumental to understanding and designing streets based on alternative values to those of modern city planners. His resident interviews, accident measures, and analysis of safety and perceived safety along urban streets demonstrate the automobile's detrimental impacts on livability and helped propel a street design paradigm, not to mention a new locution.

In *Streets and the Shaping of Towns and Cities*, Southworth and Ben-Joseph (2003) investigate how the history of residential street standards has shaped the land use, environment, and daily assumptions we make in suburban communities. The book's chronicle of roads, of the entrenchment of excessive auto-based standards and suggestions for change serve as models for the structure of this research.

Jacobs and Macdonald have researched the design and functions of urban arterial streets with more focus and intent than most other designers and academics. In "The Uses and Reuses of Major Urban Arterials," they profess that urban arterial corridors, "once main streets in 'gray' areas or working class districts, then widened to increase auto flow, often before freeway construction, can be used to revitalize" their gray context as multifunctional roadways (Jacobs, Macdonald et al. 1997). In the literal sense, their later research demonstrates the valid use, function and appeal of multiple-roadway boulevards that efficiently convey through traffic while creating a safe "pedestrian realm" for pedestrians, residents and slow-moving local access traffic. More figuratively, they summarize the functions beyond automobility that urban arterials can provide – functions such as urban revitalization, pedestrian access and placemaking.

II. Reconsiderations of the Passive Safety Paradigm

In the 1990s and 2000s, street designers and engineers have questioned the "passive safety" designs that dominate geometric street design standards and policy.

Dumbaugh (2005) traces the origins of "passive safety" design philosophy from the transportation safety movement of the 1960s (see chapter 4). He shows that passive safety designs seek to enhance safety by accommodating worst possible, high-speed and extreme driver scenarios. The drawback is that the philosophy "assumes that drivers who already drive safely will continue to do so when forgiving design values are used, thereby enhancing the overall safety of a roadway by making it safe for not only average drivers, but also extreme drivers," (Dumbaugh 2005).

In an empirical analysis of comparable streets in Florida, he suggests that passive "forgiving design values" such as wide lanes and expansive clear zones were actually more dangerous than "livable" street designs like street frontage abutting the sidewalks, narrower lane widths, on-street parking and pedestrian-buffering roadside objects. His research shows an ambiguous relationship between passive designs and safety. He suggests a theory of positive design based on modifying driver expectations. The suggestion overlaps with context-sensitive theories of street design in many ways. He also cites other research that suggests that livable street designs may enhance driver awareness and reduce the number and severity of accidents

Hauer's most relevant major point is that measurable limit standards for vertical curves, lane width and horizontal curves which have lasted for more than 50 years of AASHTO policy were often based on conjecture. Though from 1940s to 1994 AASHTO declared that no feature has more impact on safety than pavement width, it never empirically linked crash frequency or severity to pavement width (Hauer 1999). Rather, the calculations were based on a 1944 paper which based safety on a driver's tendency to shift to the right within the lane, rather than on crash data. Sight distance calculations for vertical curves were originally based on an object of four inches in height not because that proved to be the height of dangerous objects but because it was more economical to construct curves. The height was changed to six inches in 1965 because of the lower design of cars, not because of any measurable data relating it to crash frequency or severity. Hauer's conversation relates mostly to two-lane rural roads, rather than the multi-lane urban arterial streets discussed in this paper. However, AASHO policy on the former has long been the primary basis for calculations and designs of the latter.

III. Streets as Places

Many progressive designers and practitioners focus exclusively on the urban design potential of major urban arteries and boulevards. Though they do not explicitly use context-sensitive terminology, their concepts overlap with the CSS movement. They all seek to address the inadequacy of auto-based street standards on streets that serve other users and purposes.

Arterial Streets Toward Sustainability, or ARTISTS, is a European Commission project that is compiling case studies and guidance for designing and managing arterial streets based on the needs of the people that use them, not simply the people inside of motor vehicles (ARTISTS Project: Arterial Streets Towards Sustainability 2004). Like the subject of this research, the ARTISTS project seeks to address both the through traffic and urban place functions of an arterial street. It prioritizes public participation in the planning, design and management of streets. It also seeks to create a functional classification system based on the two independent dimensions of "link status" and "place status."

The Livable Boulevards initiative of the Westside Cities Council of Governments in the Los Angeles basin also exemplifies a growing awareness in California of the opportunity and need to plan, design and manage urban arterial streets as places in their own right. A livable boulevard is defined as

> An arterial thoroughfare with a mix of land use, design and mobility characteristics, including clearly defined neighborhood-oriented segments with housing and mixed-use development offering comfort, convenience and safety, as well as multimodal accessibility to local and regional destinations. These neighborhood-oriented segments are complemented by other parts of the boulevard which emphasize business, cultural or visitor serving uses in order to achieve a sustainable mix of economic activities in a highly accessible environment.

As the initiative's white paper states, "the central challenge of planning for Livable Boulevards is simultaneously addressing the mobility functions of the arterial street, and the way the street functions as a local place," (Freedman Tung and Bottomley 2006). In order to rise to the challenge, the paper focuses on advancing accessibility, sustainability and livability in "neighborhood-oriented segments" of arterial corridors. It details the neighborhood-supporting land uses, multimodally-accessible street frontage and public right-of-way designs that best advance the three themes.

Jacobs, Macdonald and Rofè also explore the potential beauty, functionality and walkability of urban streets in *The Boulevard Book*. The culmination of years of research into major streets, street design and the impacts of multiple-roadway boulevards, this book exposes some of the limitations of the functional classification of streets. Though they have long espoused the design virtues and pedestrian amenities of multi-way boulevards, Jacobs *et al* address the sources of resistance to the multi-way road design: increased number of conflict points, greater risk for accidents, lower vehicle mobility, excessive right of way and others. By providing through lanes for long-distance traffic and side access lanes for local traffic, they claim that the multi-way boulevard design provides one possible solution to congestion and auto-dominated design on arterials (Jacobs *et al* 2002). More importantly, the book shows that modern street standards do not allow for the multiway boulevard design despite its apparent advantages to pedestrians, cyclists, local traffic and design features.

The literature often addresses implementation as well (Garrick and Wang 2005). Most of the above references include substantial portions dedicated to process, advance planning, consensus-seeking and the perceived immutability of some standards (ARTISTS 2004; FTB 2006). Of particular relevance to California and Caltrans is *Civilizing Downtown Highways* (Congress for the New Urbanism, Local Government Commission *et al* 2002). The publication is essentially a guide to redesigning auto-oriented arterial "main streets" into walkable and attractive places. It is written mainly for California cities, but also for Caltrans in the hope of fostering collaboration. It uses case studies and cites legal references to exhibit how small towns and cities can proactively re-design and manage streets that are under Caltrans jurisdiction.

IV. Context Sensitivity and Flexibility

Context-sensitivity can be considered a new paradigm of approaching transportation facility and street design. Many argue that *context-sensitive solutions* (CSS) describe the appropriate *process* for engaging the community and integrating alternative values in the planning and design of a facility (Caltrans 2005; Dudley 2006). Public process is a critical component to most context-sensitive design guidance (AASHTO 2004; Caltrans 2005; Caltrans 2006; Daisa and ITE 2006; FHWA 1997). Con-

Figure 5-1: The CSS Product: Qualities of Excellence in Transportation Design

The "Qualities that Characterize Excellence in Transportation Design" - that is, of the physical end product of the CSS process - are:

- The project satisfies the purpose and needs as agreed to by a full range of stakeholders. This agreement is forged in the earliest phase of the project and amended as warranted as the project develops.
- The project is a safe facility for both the user and the community.
- The project is in harmony with the community, and it preserves environmental, scenic, aesthetic, historic, and natural resource values of the area, i.e., exhibits context sensitive design.
- The project exceeds the expectations of both designers and stakeholders and achieves a level of excellence in people's minds.
- The project involves efficient and effective use of the resources (time, budget, community) of all involved parties.
- The project is designed and built with minimal disruption to the community.
- The project is seen as having added lasting value to the community.

Source: www.contextsensitivesolutions.org 2006

Figure 5-2: Characteristics of the CSS Process That Yield Excellence

"The Characteristics of the Process that will Yield Excellence in Transportation Design" are:

- Communication with all stakeholders is open, honest, early, and continuous.
- A multidisciplinary team is established early, with disciplines based on the needs of the specific project, and with the inclusion of the public.
- A full range of stakeholders is involved with transportation officials in the scoping phase. The purposes of the project are clearly defined, and consensus on the scope is forged before proceeding.
- The highway development process is tailored to meet the circumstances. This process should examine multiple alternatives that will result in a consensus of approach methods.
- A commitment to the process from top agency officials and local leaders is secured.
- The public involvement process, which includes informal meetings, is tailored to the project.
- The landscape, the community, and valued resources are understood before engineering design is started. A full range of tools for communication about project alternatives is used (e.g., visualization).

Source: www.contextsensitivesolutions.org 2006

text Sensitive Solutions.org, an online resource created for the FHWA by the non-profit organizations Project for Public Spaces and Scenic America[1], identifies CSS by qualities of the CSS planning *process* and *product* (see Figures 5-1 and 5-2).

The core principles of context-sensitive *design* (see Figure 5-3) are less prominent on the website and more debatable in general (CSS.org 2005; Bochner 2006). In essence the only design elements of the principles are the fourth (lower the design speed) and the fifth (maintain existing geometry and cross section).

1 In partnership with the Federal Transit Administration, AASHTO, ITE, National Association of City Transportation Officials (NACTO) and the National Park Service

Figure 5-3: The core principles of CSS design

The core principles of CSS design:

- Use the flexibility within the standards adopted for each State.
- Recognize that design exceptions may be optional where environmental consequences are great.
- Be prepared to reevaluate decisions made in the planning phase.
- Lower the design speed when appropriate.
- Maintain the road's existing horizontal and vertical geometry and cross section and undertake only resurfacing, restoration, and rehabilitation (3R) improvements.
- Consider developing alternative standards for each State, especially for scenic roads.
- Recognize the safety and operational impact of various design features and modifications.

Source: www.contextsensitivesolutions.org 2006

The most contentious issue in the flexibility debates remains that most critical of "basic design" policies: design speed (Bochner 2006). Experts debate the idea of lowering design speed to decrease operating speeds (and therefore increasing pedestrian safety). And, assuming, the lowering of design speed is desirable, the designs by which to do so are also debated (Bochner 2006; Steele 2006). Nevertheless, much of the guidance uses the term "context-sensitive *design*," even when context-sensitivity is largely about *process*.

The FHWA has aggressively pushed flexibility and context-sensitive highway designs, understanding that the one-size fits all attitude of the 1960s is not apt (FHWA 1997). *Flexibility in Highway Design* illustrates the good design, sound public process, and context sensitivity that are possible within current standards and accepted practices. It affirms that the AASHTO Green Book is the definitive source of design guidance and that all case studies are merely creative designs within the parameters of the Green Book. The guide "encourages highway designers to expand their consideration in applying the Green Book criteria. It shows that having a process that is open, includes good public involvement, and fosters creative thinking is an essential part of achieving good design," (FHWA 1997).

Flexibility includes a lot of the non-technical, pre-design planning and process guidance that is left out of the AASHTO *Green Book*: problem definition, project definition, definition of the terminal of the project, project concept development, aesthetic treatment of surfaces, design within appropriate context, and landscape development. It also outlines how to determine a street's functional classification and that determination's role in the design and design process.

AASHTO followed suit with its own *Guide to Achieving Flexibility in Highway Design* (AASHTO 2004). *Achieving Flexibility* more fully embraces CSS. It is more technical and structured like the *Green Book*. Like *Flexibility* it is a guide for process and design that functions within the permissible parameters of the *Green Book*, without challenging it. Like most CSS literature, it dedicates much of its content to process. "This guide is intended to promote the incorporation of sensitive community and environmental issues into the design of highway facilities. It is organized to provide an overview and summary of key aspects of the highway project development process from initial planning through completion of construction plans," (AASHTO 2004).

The ITE has taken a different approach. By no means usurping the AASHTO *Green Book*, the ITE seeks to better address the design of particular streets in particular urban conditions. The title of their draft recommended practice speaks for itself: *Context-Sensitive Solutions for Major Urban Thoroughfares in Walkable Communities* (Daisa and ITE 2006). Their contention is that urban arterial street design standards were based on rural-style arterials whose intent was to maximize automobile flow. While these standards are appropriate for arterial streets in many contexts, there are particular contexts in which they do not apply. These are mainly the walkable districts of urbanized areas. *Major Urban Thoroughfares* argues the design of these streets should better match the land use and urban design context, the needs of its users and the placemaking potential of walkable town centers. It is a striking departure from earlier ITE literature and from AASHTO convention in that it accepts the need to design for values other than maximizing automobility and passive driver safety (ITE 1983; AASHTO 2004). It is, however, still a draft recommended practice.

Caltrans similarly addresses flexibility on smaller city and town main streets. In *Main Streets: Flexibility in Design and Operations* (Caltrans 2005), Caltrans presents design and process resolutions to the conflict between regional mobility and local livability interests. Main streets are of serious concern to Caltrans: many happen to be state roads, their maintenance is expensive, and local demands on Caltrans are only increasing as more cities revitalize their main streets (Padilla 2006, Perlstein 2006, Thomas 2006).

Flexibility has made major inroads into design philosophy. The design philosophy chapter (80) of the *HDM*, the Caltrans Project Development Procedures Manual, the AASHTO *Green Book* and street designers' rhetoric have become more context sensitive in the last ten years (Caltrans 2006, Steele 2006, Thomas 2006). The FHWA has sponsored pilot programs in CSS training for the Connecticut, Kentucky, Maryland, Minnesota and Utah DOTs and many other states have pursued their own procedures and training programs (CSS.org 2006; Dudley 2006; NJDOT 2006)

Oregon and Massachusetts have taken context-sensitive *design* policy the farthest. For segments of state highways that serve as a community main street, Oregon created Special Transportation Areas (STAs). STAs are ODOT's way of "formally recognizing certain segments of state highways where through traffic movement will be balanced with the needs for local access and circulation." STAs allow the state to apply different design and mobility standards to the street segments that run through the middle of a town. The Massachusetts Highway Department Design Guidebook was recently honored for its best practices in CSS (VHB 2006; http://www.vhb.com/mhdGuide/mhd_Guidebook.asp).

But for the most part context-sensitivity has yet to be enshrined into design standards. Both the FHWA and AASHTO publications remain guides, not design policy. The five pilot states and many others focus on process. In California, the *HDM* still rules. Any variation from it is required to go through the design exception process (Caltrans 2005; Thomas 2006).

In 2000 the California legislature proposed changing "in-town," urban arterial standards, much like Oregon's STAs. The resolution would have addressed the many shades of gray of "urban" and the perennial conflict between rural-based standards in urban environments. The resolution was vetoed by Governor Davis under what appeared as pressure from the Department of Transportation (Warheit 2006). The resultant compromise was a set of 10 demonstration grants and the creation of the Office of Community Planning, both of which could address contextual design and process issues, including alternatives designs for the "in-town" urban arterials. The first of these demonstration grants was designed for California's oldest road: El Camino Real.

CASE STUDIES:
Values Change in Arterial Street Design Today

Standards are a matter of logic, analysis and minute study: they are based on a problem which has been well "stated." A standard is definitely established by experiment.
- Le Corbusier

Regulations can continue to accumulate, piling up ever more uniform rules as government and professional inertia carries them onward – or they can evolve, causing a shift in emphasis toward site-specific and localized physical design.
- Eran Ben-Joseph

I. Introduction to Case Studies

How do values other than automobility and driver safety manifest in urban arterial street design? The answer is that typically they do not, as many urban arterial streets are the jurisdiction of Caltrans. Caltrans is more accountable to statewide budget and regional traffic flow than to local design values. But with the ascendancy of CSS and livable street design initiatives, alternative design values are inspiring the redesign of urban arterial streets. The following two case studies illustrate two ways in which this is taking place. Proposed changes on El Camino Real in Palo Alto have been slow because they require a change to the state Highway Design Manual. Change on Santa Monica Boulevard in Los Angeles has taken place largely because the street was relinquished to the City of Los Angeles.

Since many urban arterial streets are or were once under the jurisdiction of Caltrans in California, the status quo for the design of these streets is the least expensive way of complying with the *Highway Design Manual (HDM)*. Caltrans is under no obligation to landscape their arterial surface streets (Oehler 2006). And cities' attempts to landscape, permit awnings or allow for otherwise non-standard roadside features must be approved through the encroachment permit process. Unconventional geometric designs to the street itself must be approved by the lengthy, and often onerous, design exceptions process. Most cities do not have the political will or financial resources to apply for design exceptions (Congress for the New Urbanism, Local Government Commission *et al.* 2002; Erickson 2006; Perlstein 2006; Thomas 2006; Warheit 2006). For this reason, the typical answer is that the *HDM*, with all the values it embodies, rules. Though Palo Alto has the political and financial resources to change El Camino Real, the following case study shows just how difficult change is on California's urban arterial streets.

II. Slowly, Through Standards Change: The Case of El Camino Real in Palo Alto

At the heart of this research is the difficulty of institutional change. None exemplifies this challenge better than the case of El Camino Real in Palo Alto, California. It is an epitomic venue for the conflict between regional mobility and local livability goals on an urban arterial street. The tension in this conflict is heightened by the fact that only a change to the California *HDM* can enable the livability-based re-designs in question. While the conflict's initial negotiation process is one to be emulated, the resultant change to the *HDM* was a compromise with a caveat which solidified the status quo along El Camino Real. However, the negotiation process eventually led to funding for the a comprehensive corridor plan and the possibility of future change.

Figure 6-1: Comparison of case study existing conditions.

Case	Jurisdiction	Segment Length	Major Trip Attractions	Average Daily Traffic	ROW	Pre-Project Characteristics
El Camino Real Palo Alto, CA	Caltrans	4.25 miles	Stanford University, Stanford Shopping Mall, Stanford Hospital, Downtown Palo Alto	45,000 vehicles	120'	6 12' lanes, 4'-12' median, Turn pockets, 8' street parking
Santa Monica Blvd Los Angeles, CA	Caltrans relinquishment to City of L.A.	2.5 miles	Century City Office Park, I-405 freeway	50,000+ vehicles	Varies	**Big SMB:** 4 12' lanes, Turn Pockets **Little SMB:** 2 lanes, Parallel Parking

A. Introduction to Palo Alto

Palo Alto is a city of more than 60,000 (City of Palo Alto 2006) situated 30 miles southeast of San Francisco on the base of the peninsula that forms San Francisco Bay. It sits 14 miles north of San Jose, in the northern notch of the Silicon Valley. It is connected to each of these regional hubs by two limited-access freeways (Interstate 280, U.S. 101), the Caltrain commuter line, and one urban arterial: State Route 82 or El Camino Real. El Camino Real connects the entire peninsula with downtown Palo Alto as well as Stanford Shopping Center, Hospital & Clinics and University – with approximately 20,000 students (Stanford University 2006). 98,000 people work in Palo Alto (City of Palo Alto 2006).

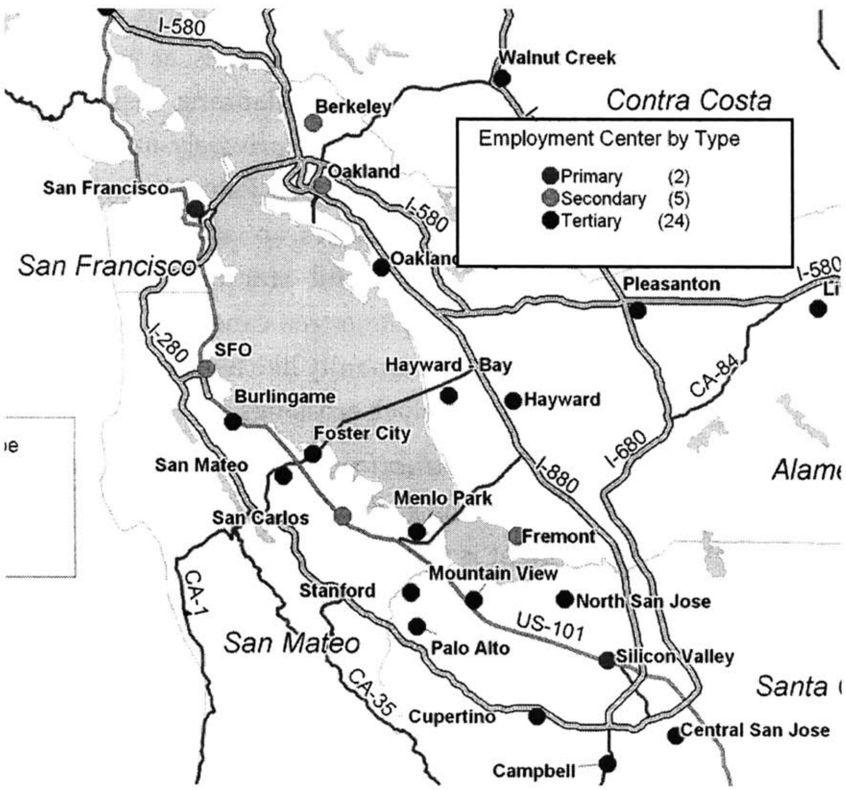


Figure 6-2: Palo Alto contains two regional employment centers

Palo Alto has made significant strides to design its streets for purposes other than automobility. It is well known for its bicycle planning and urban forestry initiatives. The City has created over 37 miles of bicycle lanes and paths is one of only four cities in the country that has received the designation of bicycle friendly city at the gold level. As of 1990, 5.8% of Palo Alto residents ride to work – compared to 0.4% for Santa Clara county overall (and, incidentally, the City of Boston).

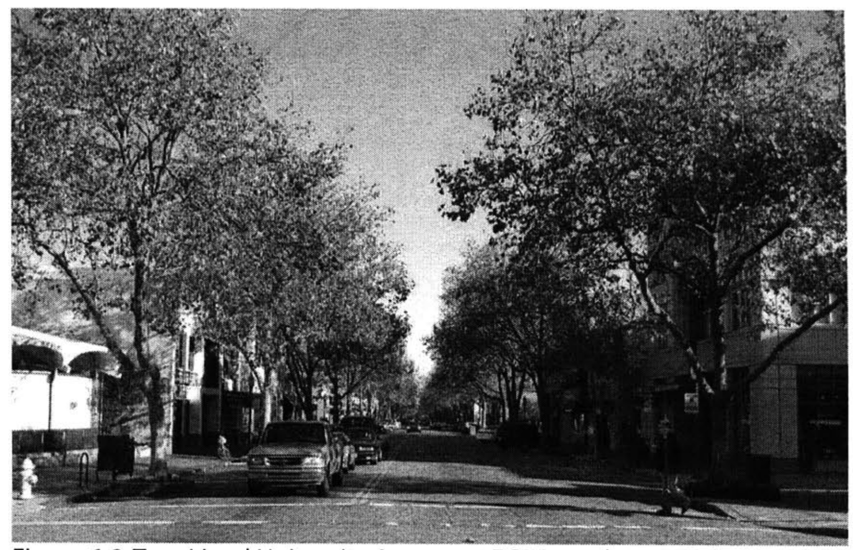


Figure 6-3: Tree-Lined University Avenue at ECR interchange, Palo Alto

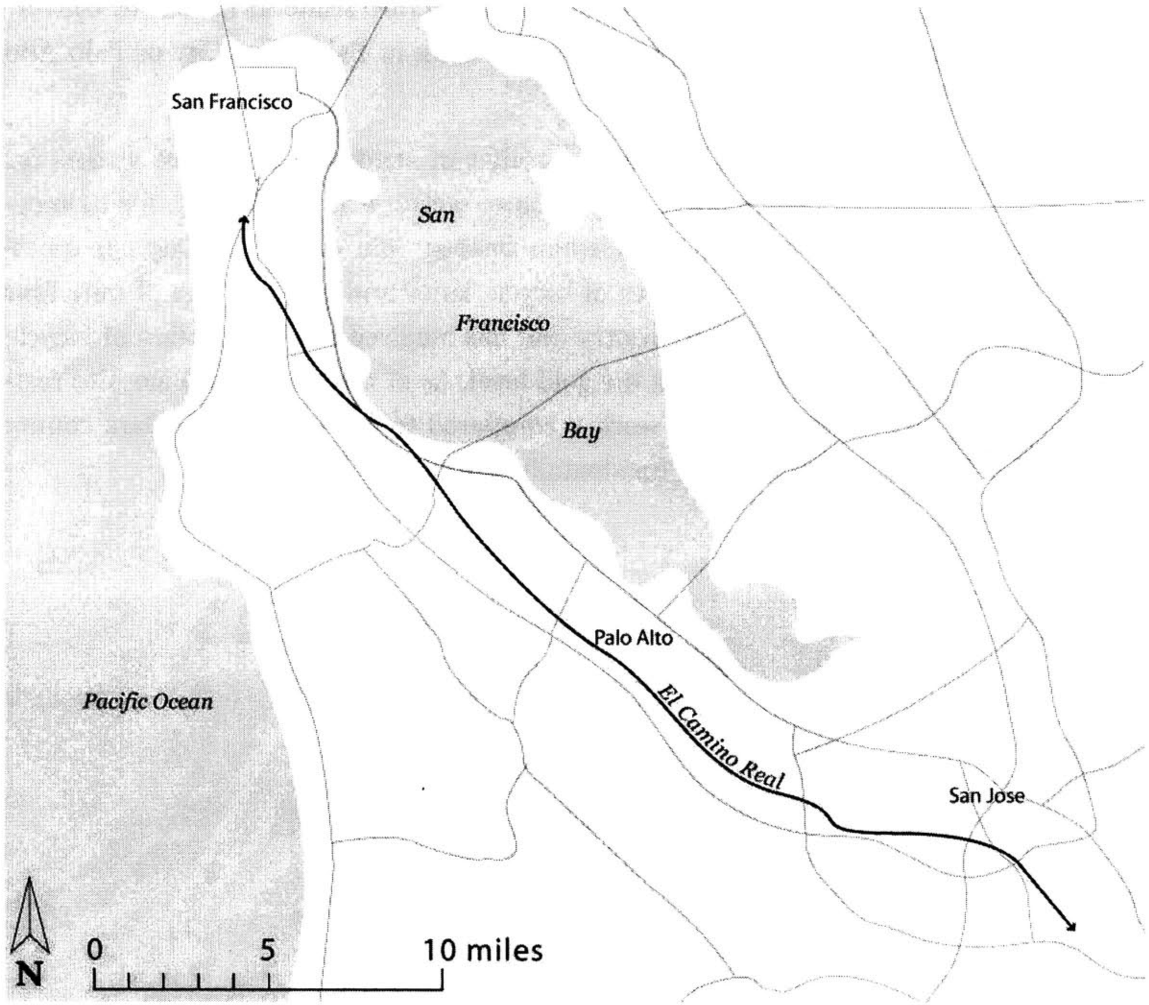


Figure 6-4: Context of El Camino Real on the San Francisco peninsula

Palo Alto is proactively maximizing tree coverage throughout the city, on private and public property. For 15 straight years the city has been recognized as Tree City USA by the National Arbor Day Foundation (City of Palo Alto 2001). The city has an extensive ordinance governing the protection and maintenance of public and private trees, an award-winning technical manual that contains standards and procedures for preserving trees, as well as arborists among the planning department staff committed to privately-owned tree programs. Downtown Palo Alto and University-area streets are shaped by small blocks of colorful stuccoed storefronts, shaded by plane tree canopies and full of pedestrian amenity like benches, bulbouts and mid-block crossings.

B. Introduction to El Camino Real

Achieving such a lush pedestrian environment is more of a challenge on El Camino Real. Also California route 82, El Camino Real carries more than 50,000 cars per day to and from the Stanford complex, Sand Hill Road and other epicenters of Silicon Valley high technology. The Palo

Alto segment of the road is just a 4-mile stretch of the original 600-mile California mission trail established by the Spanish priest Junipero Serra in 1769. The road connects each 18th and 19th century downtown from Sonoma south through San Jose, Los Angeles and San Diego...as well as all of the strip commerce in between. It is the former surface routing of US highway 101. The 101 bypass was established in 1964, at which point this route became signed state route 82. In the Bay Area, it serves as or intersects with the main streets of more than 20 cities. Despite its length, El Camino Real serves mostly local trips (JVSV 2004). Because of its historical importance and relevance to so many cities in San Mateo and Santa Clara counties, 15 of the 20 cities have embarked on projects dedicated to re-imagining the street (JVSV 2004). The civic and regional collaborative Joint Venture Silicon Valley (JVSV) is currently spearheading an effort to coordinate planning along the "Grand Boulevard" of El Camino Real with all 20 cities, 5 transportation agencies and both counties. As the City of Palo Alto has done (2003), most cities are attempting to change El Camino Real into an attractive boulevard, designed for mobility beyond the automobile, and with more intensive land uses.

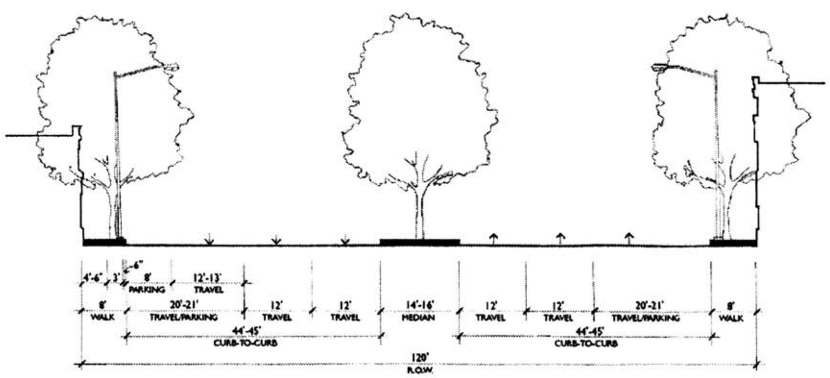
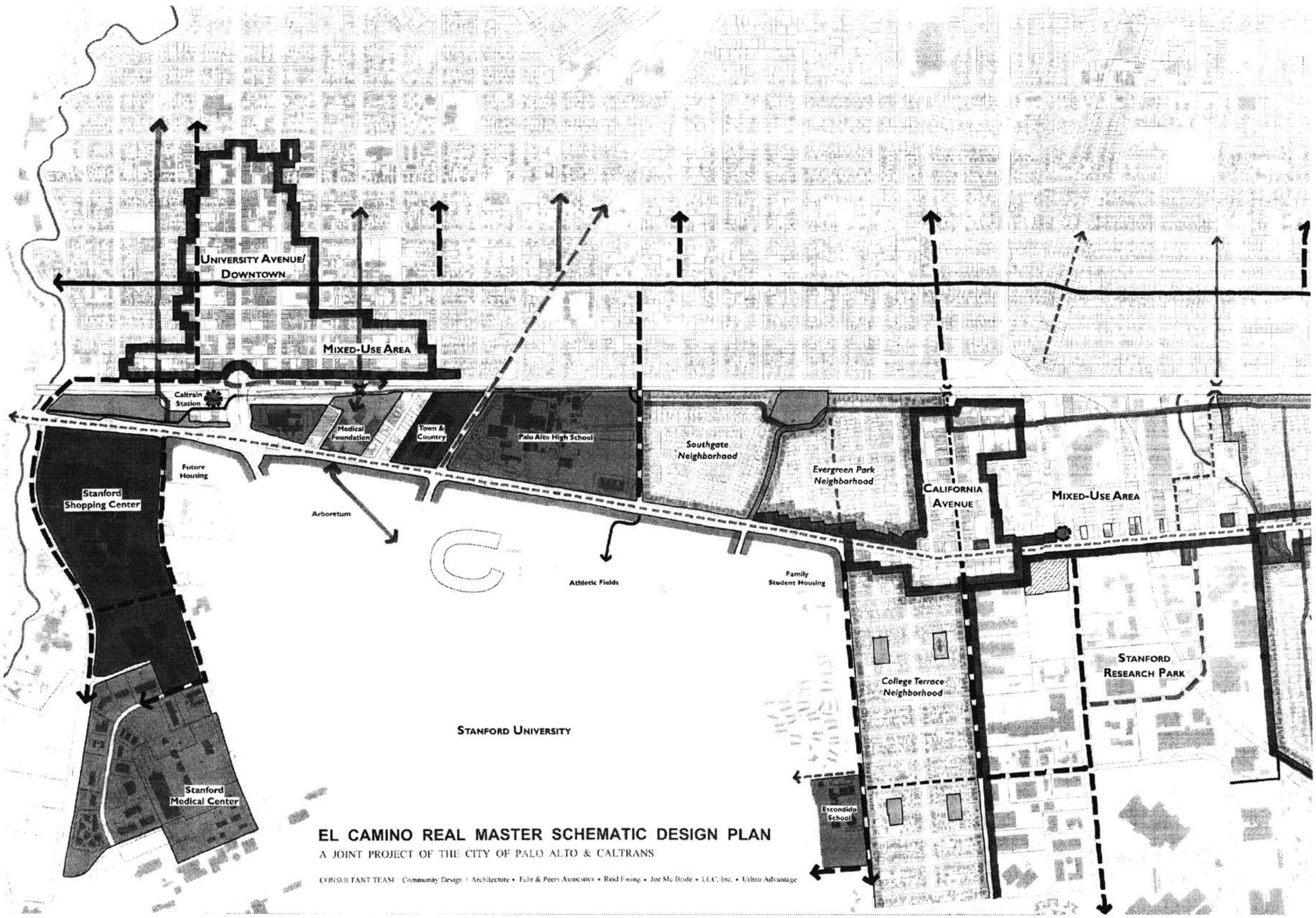


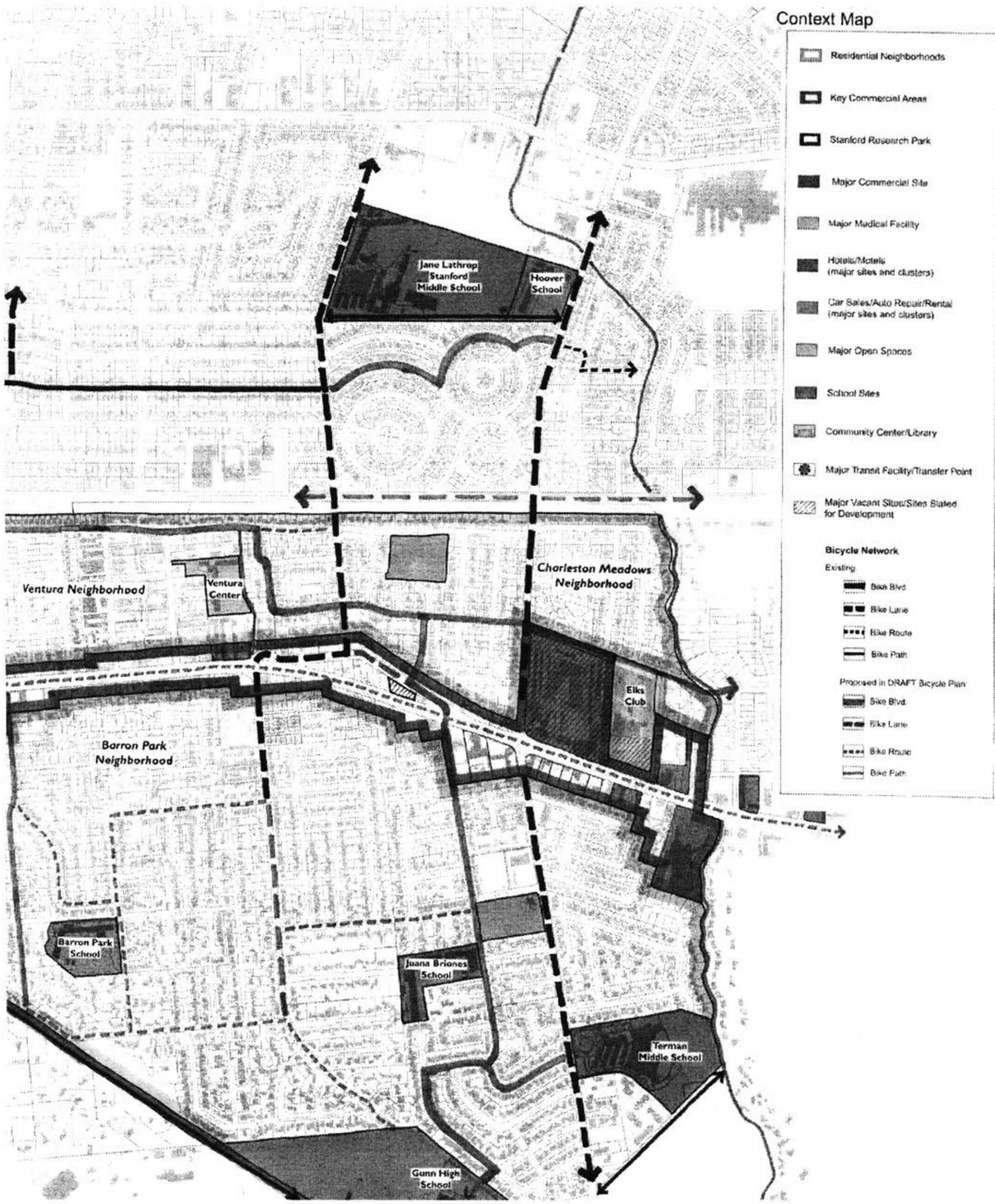
Figure 6-5: Typical cross section of El Camino Real (Source: CD+A)

Bus ridership along this corridor represents more than 21% of bus ridership in the Silicon Valley. The recent addition of rapid bus measures along the corridor has lowered travel times and increased ridership by 15% (Valley Transportation Authority 2006). At least 200 cyclists ride the road daily (City of Palo Alto 2003).

For the first half of the 20th century, El Camino Real was a country road dotted with dispersed farm houses. There had always been talk about improving the road, but it was not until 1968 that the funds were allocated. At that point, the right of way was widened to 120 feet in Palo Alto. Sidewalks were seven feet wide, breakdown lanes 20, and each lane 12. The median was also 12 feet wide, in case it was needed to accommodate traffic in the future. Italian stove pine and canary island pine were planted along the centerline of this 12-foot median. The six 12-foot lanes of through traffic and rest of the 1968 design remain to this day.

El Camino Real has been the object of review in several comprehensive planning efforts, most of which identify the 1968 design's bias towards automobility (JVSV 2004; City of Palo Alto 1998, 2004). Redwood City's and Menlo Park's tree interests,


University Avenue/
Downtown
Mixed-Use Area
Caltrain Station
Medical Foundation
Town & Country
Palo Alto High School
Southgate Neighborhood
Evergreen Park Neighborhood
California Avenue
Mixed-Use Area
Future Housing
Stanford Shopping Center
Arboretum
Athletic Fields
Family Student Housing
Stanford Research Park
College Terrace Neighborhood
Stanford University
Stanford Medical Center
Escondido School
EL CAMINO REAL MASTER SCHEMATIC DESIGN PLAN
A JOINT PROJECT OF THE CITY OF PALO ALTO & CALTRANS



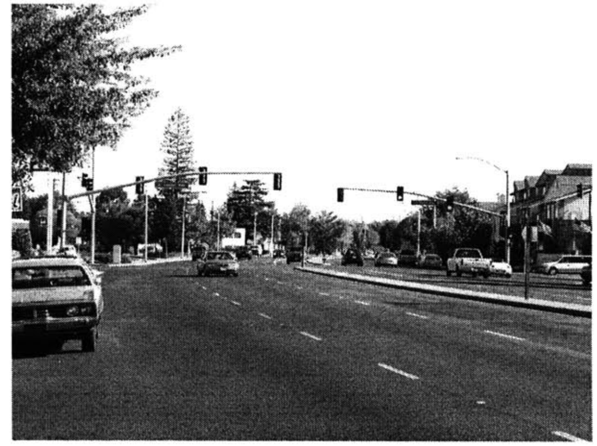


Figure 6-7: (left) The land use context of El Camino Real (Source: CD+A)

Figure 6-8: (top) El Camino Real's auto-oriented streetscape (Source: CD+A)

Figure 6-9: (bottom) El Camino Real underpass at the crossroads of main street University Avenue, the Caltrain depot and Stanford University - not the most hospitable of intersections to pedestrians.

the JVSV effort and the Valley Transportation Authority's (VTA) rapid bus improvements are just a few. The 1998 Palo Alto Comprehensive Plan identifies El Camino Real as the City's most "recalcitrant community design problem." The 2004 Master Schematic Design Plan identifies the bereft pedestrian environment, the dangerous cycling conditions, inconsistent and narrow sidewalk designs, and lengthy distances between signalized crossings (City of Palo Alto 2004). Despite the Caltrain Station, several major employment destinations (Stanford University, Shopping Center and Research Park), and a high school, the street frontage is remarkably insensitive to pedestrians accessing these destinations.

C. The El Camino Real Debate

The El Camino Real design debate began with a feature close to the heart of the Palo Alto planning department: street trees. In 1999, Palo Alto citizens organized to plant street trees in the sidewalks and medians of El Camino Real. The City coordinated street tree planning with Menlo Park and Redwood City to the north. To demonstrate commitment, Palo Alto committed funds to redesigning the median and to establishing a non-profit organization, Trees for El Camino, to organize the planting.

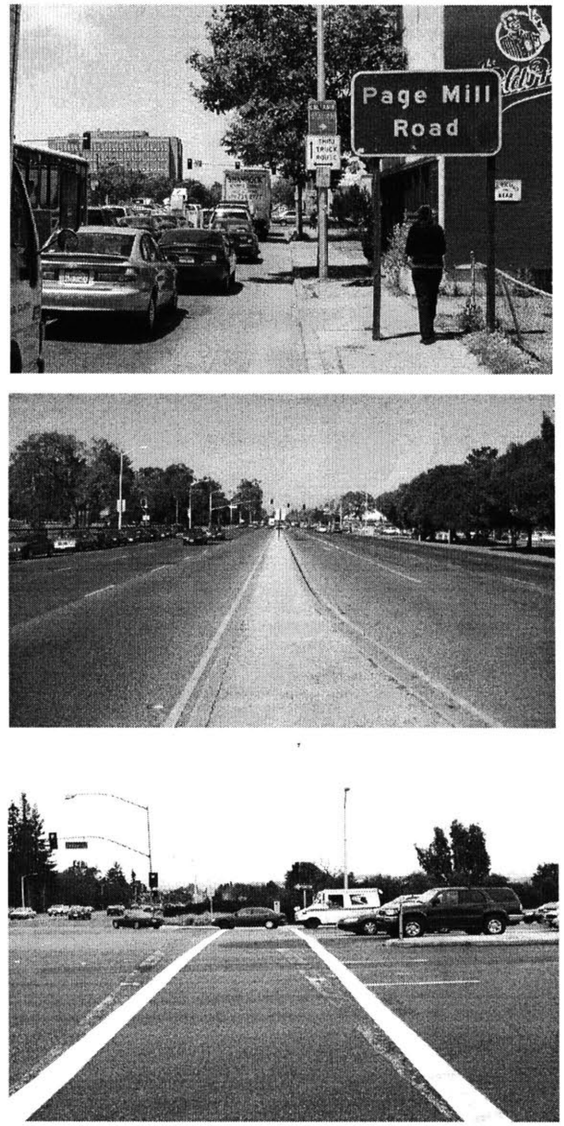


Figure 6-6: Poor pedestrian conditions, wide expanses of pavement without trees are of particular concern to Palo Alto (Source: CD+A)

Among other design features, the City of Palo Alto was interested in planting additional trees (to those from 1968) in the medians to be consistent with the City's lush tree coverage, to create shade and to provide features more amenable to the pedestrian eye. Palo Alto thought it would befit a street of such local, historical and pedestrian importance to make it more amenable to alternative modes of transportation while distinguishing it from other, automobile-based arterial streets. In 1999, the Cities of Palo Alto, Redwood City and Menlo Park applied for permission from Caltrans to plant trees in the medians, many of which were between 4 and 12 feet.

The median street tree debate was controversial enough to Caltrans to stall change on El Camino Real. Caltrans' major concern is the clear zone between the median curb and the trunk of the tree. The Department has been adamant that there must be six feet of clear zone between the face of the tree (at maturity) and the face of the curb. The 12-foot and narrower medians on El Camino Real in Palo Alto were therefore not ample enough to plant new trees. Caltrans was not wiling to jeopardize a mode of travel for the benefits, however quantifiable, of median street trees.

Prior to El Camino Real, the median tree clear zone had not been a cause for such consternation. The trees originally planted on El Camino Real in 1968 clearly violate current guidance. Each *Highway Design Manual* though the 1995 edition barely mentions limitations on median trees. Permission for them was granted by "encroachment permits," the same category of design permission needed for awnings, sidewalk improvements and plantings (Caltrans 1995). Jurisdiction over median tree planting was granted to the Caltrans landscape architect, not design reviewers or highway engineers (Caltrans 1995).

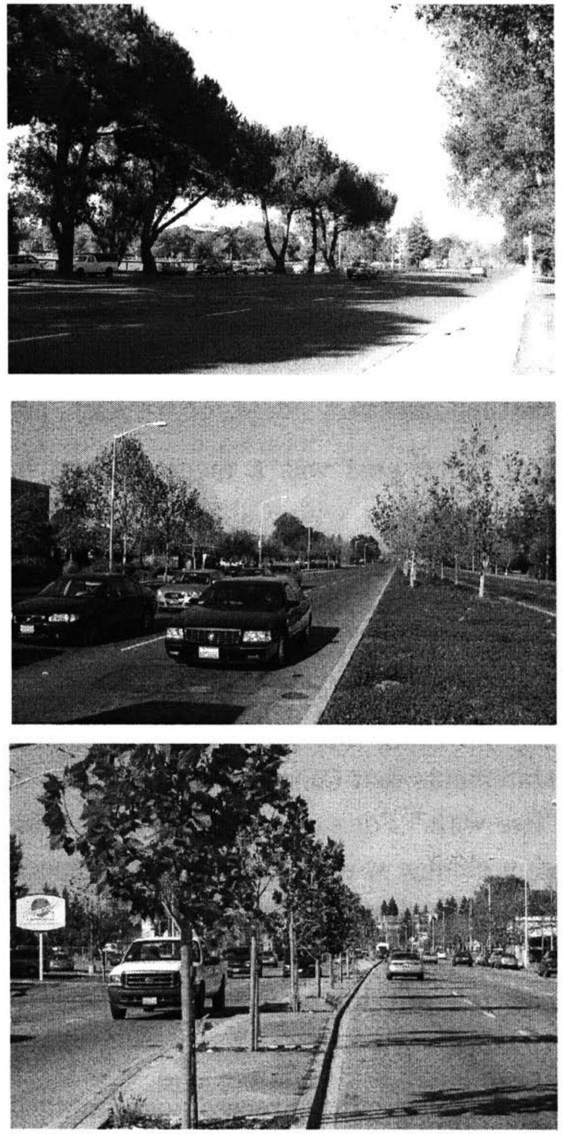


Figure 6-10: Median trees from 1968 (top), Median trees planted at minimum permitted clear zone (middle), violating the clear zone minimum in Menlo Park (bottom).

But beginning in 2000, state highway officials became much more conservative with respect to median clearances. AASHTO had become concerned with the clear zones buffering median street trees (Warheit 2006). In response to the Cities' request to plant median trees, Caltrans commissioned Dr. Edward Sullivan at Cal Poly San Luis Obispo to investigate the safety of such narrow clearances from median street trees on urban conventional highways (Sullivan 2003).

In parallel, the Department had quietly proposed to increase the minimum size of medians to 12-14 feet in the Highway Design Manual. For trees in narrower medians, the Department was proposing requiring barriers. It had gone as far as contracting the designs for the required barriers. When word leaked of the proposed HDM changes, there was an outcry from local interests. The changes did not go forward.

Rather than broil in an antagonistic standstill, the factions in the debate around El Camino Real and median tree clear zones were pressured into a rare opportunity. Local State Assemblyman Joe Simitian happened to be on the Transportation committee. His position provided the bully pulpit from which to pressure Caltrans into engaging Palo Alto, Menlo Park, Redwood City and alternative design solutions for El Camino Real and, consequently, the HDM (Erickson 2006; Warheit 2006). The result was a negotiation process in which factions rarely have the opportunity to engage. The district landscape architect, design reviewer, city planning department, contracted urban designers and consultants were all brought together to resolve the issue at the behest of Assemblyman Simitian.

By being forced to come to the table and communicate their values, factions in the design debate were better able to understand each other (Oehler 2006; Warheit 2006). Despite Caltrans' reputation for recalcitrance, the Caltrans Design Reviewer for the district asserted that "a lot of good will was created" in the negotiation process (Thomas 2006). Designers came out of the process with an understanding of the immense pressure and responsibility Caltrans designers have to shoulder, having witnessed or been liable for the worst of vehicle accidents (Oehler 2006). The city's proposals were in good standing because they were embedded in a larger, planning study and were consistent with existing context in Palo Alto (Erickson 2006, Oehler 2006, Thomas 2006, Warheit 2006).

The cities' goal was a memorandum of understanding with Caltrans that when projects go forward, the design exception will be granted "on the merits of the City," (Oehler 2003; Oehler 2006). This would include median re-design, trees in five-foot medians and a series of conditional statements that Caltrans would be able to "live with." For example, a particular design change would be allowed if a speed zone with slower traffic were studied. Another design exception was supposedly easy to grant: the reduction of 12' lanes to 11' lanes.

Nevertheless, the process lost political steam, the City budget constricted and

Figure 6-11: Timeline of Critical Events on El Camino Real in Palo Alto

1998	Palo Alto Comprehensive Plan identifies El Camino Real as recalcitrant community design problem
1999	City passes resolution prioritizing the planting of shade trees. Allocates funds for median renovation and establishing nonprofit, Trees for El Camino Real
	Requests encroachment permit from Caltrans.
	Encroachment permit denied
	Requests pilot project with trees in 5-foot medians
2000	Palo Alto and Stanford encounter difficulties of redesigning El Camino Real in Stanford Shopping Center frontage project.
2000	Office of Community Planning and Demonstration Grants established
2001	Highway Design Manual changed
July 2001	Office of Community Planning Demonstration Grant awarded to Palo Alto for feasibility study and master schematic design plan for El Camino Real right-of-way.
Nov 2001	Design directive #22, encourages CSS
Jan 2002	El Camino Real Master Plan Project begins
2003	Pilot Project initiated

the MOU "didn't quite get done," (Oehler 2006). The commissioned report was finalized and, though the results are still debated, convinced Caltrans that the tree plantings requested by the three cities were more unsafe to motorists than if the medians were kept clear (Warheit 2006; Thomas 2006). The street was likely to remain the same.

While the design negotiation process brought a lot of good will, the act of independently funding experts to study the issue and seeking changes to the HDM effectively killed any advantage that good will may have provided. Though the Sullivan report is still disputed, the fact that it is written and published was grounds enough for Caltrans to defend their original claims. The debate has since gone back and forth between dueling experts (Ewing 2005). But until they are brought to the same table to negotiate values and identify common goals, the debate will advance very little towards positive change.

In the mean time, Caltrans has cemented its point of view in the HDM. Index 902.3 (4)(a), in the Landscape Architecture chapter of the HDM changed. For posted speeds above 35 mph, the debated median tree standard went forward: six-foot clear zones were required in the median from the face of mature trees to the face of the curb. (Despite clear zones of only 1.5 feet on the right side.) Anything less required a significant concrete barrier. The concession to the Cities was a lowering of the required median clear zones at speeds posted 35 mph and below. They are now allowed to be less than six feet. However, the speed limit on El Camino Real is 40 mph. The change in standard therefore had no impact on the design of the street in Palo Alto, Menlo Park or Redwood City. (Nevertheless, Menlo Park simply went ahead and planted the trees without permission.)

Since the MOU imploded in Palo Alto, the City used a Caltrans grant to push forward with the El Camino Real Master Schematic Design Plan. It incorporated many of city's desires related to median trees. But, more importantly, it discussed the corridor holistically and comprehensively. Land uses, pedestrian design, transit, median design, automobile traffic congestion, speeds, accidents and level of service were all considered. The report was completed in 2003 and the overall initiative for El Camino Real has since been stalled, with the city's political attention being paid elsewhere. But now that Joint Venture Silicon Valley has grand ambitions for boulevard designs along El Camino Real, it is more likely that the El Camino Real master plan will be revisited and revived.

After years of debate and the comprehensiveness of Palo Alto's study and design plan, the outgoing director of Caltrans permitted a pilot project to plant trees within medians smaller than 12 feet on El Camino Real. Though the standard has not been changed, the pilot project has allowed Palo Alto, Menlo Park and Redwood City to go forward with the desired plantings. As a pilot project, the designs are being monitored for accidents and continue to be prohibited elsewhere in the state. The plantings were to recent to show anything conclusive just yet (Yee 2007).

The median designs and other unconventional designs in the Design Plan have not been proposed to the extent required in the design exceptions process. Exceptions are not likely at this juncture.

D. Lessons from El Camino Real

The resultant changes to the HDM are significant in three ways. First, the geometric street design standard of median clear zones was not changed. It was conditionally parsed. This is the type of refinement that represents many of the changes to the HDM as well as to the AASHTO Green book in the last several decades. Rather than significantly changing, the HDM and Policy have simply become thicker with more specific conditions and possibilities as highway designers collectively learn more from research and practice. In this most recent example of median trees, the conditions were a mere political compromise than a change willingly made based on endorsed research. Nevertheless, the change did not affect actual street design – it simply entrenched the risk-averse opinion of the Department.

Second, at the same time that the design standard was changed for 35 mph streets, Caltrans removed jurisdiction of median trees from the landscape architect and granted it to the highway designer – effectively making what the city perceived as an urban design decision into a safety decision (Caltrans 2006: Index 902.3 (4)(e)). The intent was to preclude a similar situation to El Camino Real's, in which a landscape architect seeks to plant trees deemed unsafe to highway designers, from arising again. As it is more typical of the designer to make decisions based on safety, this move is indicative of the Department's consistent self-defense against liability risk.

Finally, the resultant compromise hinges on the condition of speed. This brings the question back to operating speed and design speed, that most basic of design policies. It has long been accepted that highway design speed should be maximized (see Chapter 4). But Dumbaugh, Nadero and others assert that there is not a reliable causal connection between roadside factors or high design speed and safety – especially on urban streets. The ITE is also pressing this issue by suggesting (in their draft) that design speeds should be lowered and closer to posted speeds in urban areas with high pedestrian activity (Daisa and ITE 2006). So, in the case of Palo Alto's El Camino Real, perhaps the issue is not the clear zone from median trees but that design speeds should be lowered.

With the pilot project, Palo Alto and Menlo Park have taken one step in the direction of change. The Design Plan is also a significant and powerful planning document. Yet, the negotiation compromise could have provided more direction in moving forward. Instead, the HDM changes solidify standards that were already in place. Under immense pressure, the outgoing director had to order a pilot project, outside the scope of standards, to provide a chance for change. In the mean time, the director of Caltrans has changed, the District 4 landscape architect left and city politics have shifted course.

The story of El Camino Real and the median tree clearance debate illustrates the difficulty inherent to standards change on state conventional highways. Standards change slowly, only with political pressure and often parse existing standards rather than change the fundamental values behind them.

This is not to say that Caltrans does not make concessions. For example, in Eureka 11 foot lane widths were permitted through design exception where 12 feet are required (Steele 2006). In this particular case, the ADT was low enough and the geometrics safe enough to allow for narrower lanes. Like all unconventional designs on California highways, Eureka's was left up to the design reviewer and the engineer's sound judgment. One can imagine that, after years upon years of accumulating design exceptions and conditional parsing, standards eventually change. They do. But it is a protracted process of ad hoc change made by default, not guided or planned. The values behind the standards remain the same. Designers have little reason to risk safety, liability and mobility for an unconventional, unproven design. And as decades accumulate, the design standards stay more or less the same. Or, as for the design of streets like El Camino Real, exactly the same.

III. Locally, on a Project Basis: The Case of Santa Monica Boulevard in Los Angeles

Assuming that standards change only with difficulty and when political pressure mounts, it may not be surprising that innovation springs up beyond their reach. Standards effectively cement a design in writing and therefore need to be legally watertight. Writing any standard puts the writer at risk. This is why the *Green Book* is a recommended policy, and a vague one at that. This risk is also why the Caltrans HDM is a set of guidelines for design decisions which, in the end, must be made by sound engineering judgment – not a book. This risk is also why instead of changing the HDM in an effective way, Caltrans compromised with conditional standards and tighter control.

This risk is also why unconventional designs are rare. Conventional arterial streets are designed for driver safety and automobility. Standards have ensured these design values for decades. Though standards evolve, it remains difficult to insert alternative design values into them. El Camino Real serves as a case in point. But values do change and arterial street designs are beginning to reflect these changes.

Santa Monica Boulevard in Los Angeles exhibits the three qualities necessary for unconventional design based on alternative design values. They are: (1) on an individual project basis, (2) under local jurisdiction, and (3) in a place with the resources and political will for design change beyond conventional design values.

A. Introduction to Los Angeles

Los Angeles bucks convention in many ways. This section focuses on just one: the fact that it has its own street standards. Cities rarely have the resources to do so. They typically use AASHTO, California's HDM or, in the case of Southern California, the local chapter of APWA standard plans. The accumulated expertise of such larger organizations is a sound base from which to make design decisions. It also has the benefit of sheltering the City from liability risk.

Los Angeles, with its vast resources and automobile dependency, has long collaborated with professional associations to create its own set of design standards. The Southern California Automobile Association began proposing standards to the City of Los Angeles as early as the 1920s. The Southern California chapter of APWA and the City of Los Angeles have long kept their standard specifications and standard plans in step with one another (Ellison and Updyke 2006). Engineers employed by the City were also the APWA members that wrote the APWA standard plans (Oishi and Lee 2006). After the 1990s recession and successive budget reductions, they effectively combined efforts to the point that their standard plans are now one and the same.

While the City of Los Angeles is still liable for geometric design it does not operate with the fear of risk or perceived risk with which Caltrans does. Caltrans operates higher-speed and higher-risk facilities than most cities, so it is liable more often in wrongful death suits compared to mostly property damage suits at the

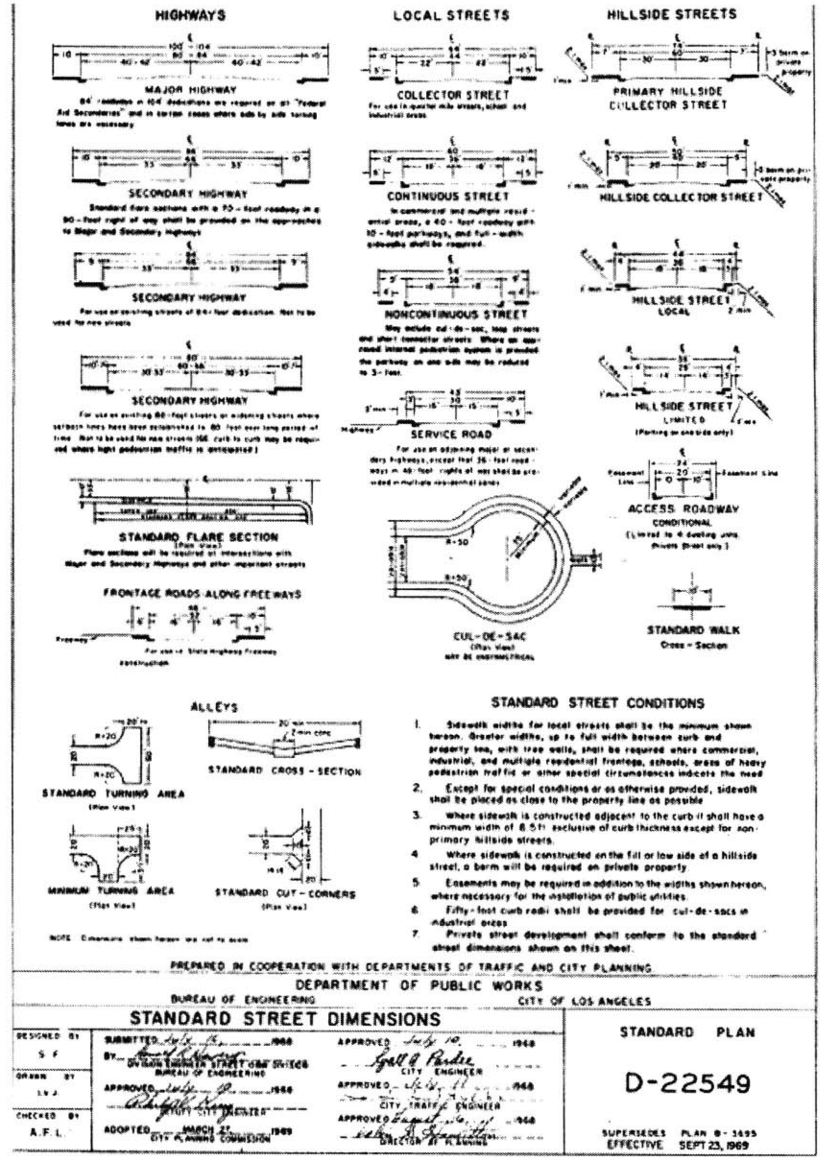


Figure 6-12: Street Standards in entirety, Los Angeles, 1966

city level. City engineers of course use sound judgment and design for safety. But without being responsible to hundreds of other cities, like the California HDM or AASHTO *Green Book*, Los Angeles has much more latitude in the standards it creates.

But that latitude is more evident in the actual design of streets rather than in the standards. Unlike the street designer's tome, the AASHTO Green Book, Los Angeles standards are two pages long. The City has other manuals for standard plans and procedures. But for 33 years the only geometric design content in their standards was a basic classification of streets and their desired cross sections (Los Angeles 1966). By 1999, they had added 10-foot sidewalk requirements in designated zones to better accommodate pedestrians.

Los Angeles Standards are actually the jurisdiction of City Planning. This is relevant in two ways. One, standards cannot change in a vacuum of mobility-based decision making. The Director of City Planning must approve any change to them, in addition to the Bureau of Engineering Director. A certain sensitivity to planning context is thus built into the bureaucracy around standards. Second, where as public works standards typically apply only to the public domain, L.A.'s, being under planning jurisdiction, are enforceable on private land as well. Since most of Los Angeles is built-out, the standards are typically used for dedications on the redevelopment of old, out-of-compliant street frontage rather than newly constructed streets.

Los Angeles is more open to addressing context and accepting variation than the State. The sentiment from several Bureau and Department engineers seemed to be they were open to seeing "what works." Some streets have long had double left-turn lanes of only nine feet, even after resurfacing provided the opportunity to re-stripe them (Conger and Sarkis 2006). While this is unheard of on comparable state highways, a lack of accidents is sufficient enough for the Department of Transportation to maintain it (Conger and Sarkis 2006). More importantly, the City has embarked on a Downtown Street Standards Project as part of a larger Central City Community Plan. The City has initiated another street standards project in downtown Hollywood (Rifkin 2006). Both are being conducted within larger, land use planning and urban design initiatives. The fact that two distinct conversations about street standards particular to two discrete downtown areas reflects the City's recognition that exist-

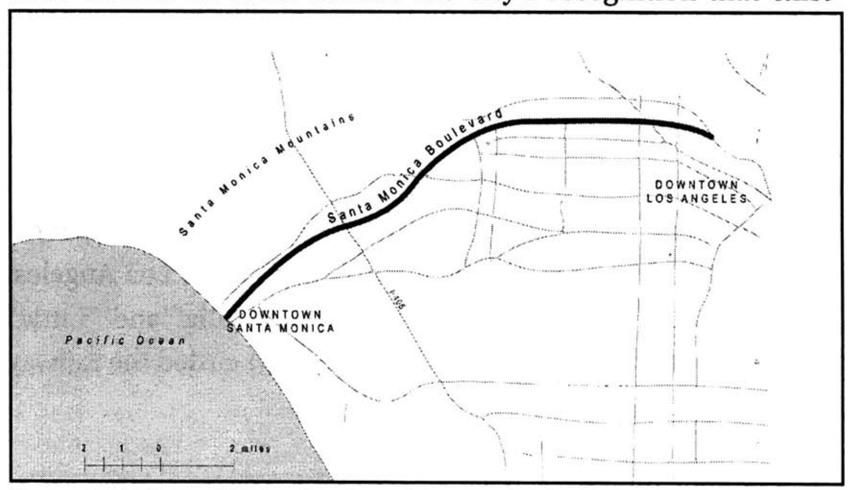


Figure 6-13: Santa Monica Boulevard context in the L.A. Basin

ing street standards are not appropriate for everywhere; nor is one set of alternative "downtown" street standards appropriate to every downtown context in the City.

Los Angeles is thus ripe for innovation in street design. The City has the resources and ability to plan. Its standards guide designs, but do not limit them. And, even so, multiple sets of new, context-sensitive standards are being created.

B. Introduction to Santa Monica Boulevard

Santa Monica Boulevard runs for 15 miles from West Sunset Boulevard in the Silverlake district of Los Angeles to the City of Santa Monica's Pacific Ocean beachfront. Santa Monica Boulevard helped establish the armature of the new, auto-sized grid along which Los Angeles expanded westward in the early 20th century. No one had yet conceived of the possibility of creating an urban boulevard stretching across the entire basin. (Wilshire Boulevard's ascendancy into that role did not take place until 1930.) At the time, an interurban train ran along Santa Monica Boulevard, linking the wealthy enclave of Beverly Hills and the distant downtown Santa Monica with Los Angeles' own. The Boulevard and tracks shared the same right-of-way for nearly the entire 15-mile stretch. From Holloway Drive (currently in West Hollywood) to Sepulveda Boulevard in Los Angeles, a right-of-way was dedicated to the railway. "Big" and "Little" Santa Monica Boulevards (both bidirectional) girded the railway right-of-way.

By 1933, Santa Monica Boulevard had been incorporated into the state highway system as State Route 2. Four years later, it was designated the western segment of US Route 66, "Main Street of the USA." It remained so until 1964. According to a 1965 Division of Highways map, Santa Monica Boulevard was slated to be a freeway from US 101 to Interstate 405. Beverly Hills opposition to the freeway eventually killed the idea in 1975. Santa Monica Boulevard remained wholly State Route 2 until 1998. At that point, Caltrans relinquished the portions within Santa Monica (Route 1 to Centinela Avenue) and West Hollywood (Doheny Drive to La Brea Avenue) to the respective cities. By 2002 the segment of interest in Los Angeles (I-405 to Moreno Drive) had been relinquished.

Figure 6-14: Century City, a regional employment center and impetus for improving automobility on Santa Monica Boulevard (enters at left middle)

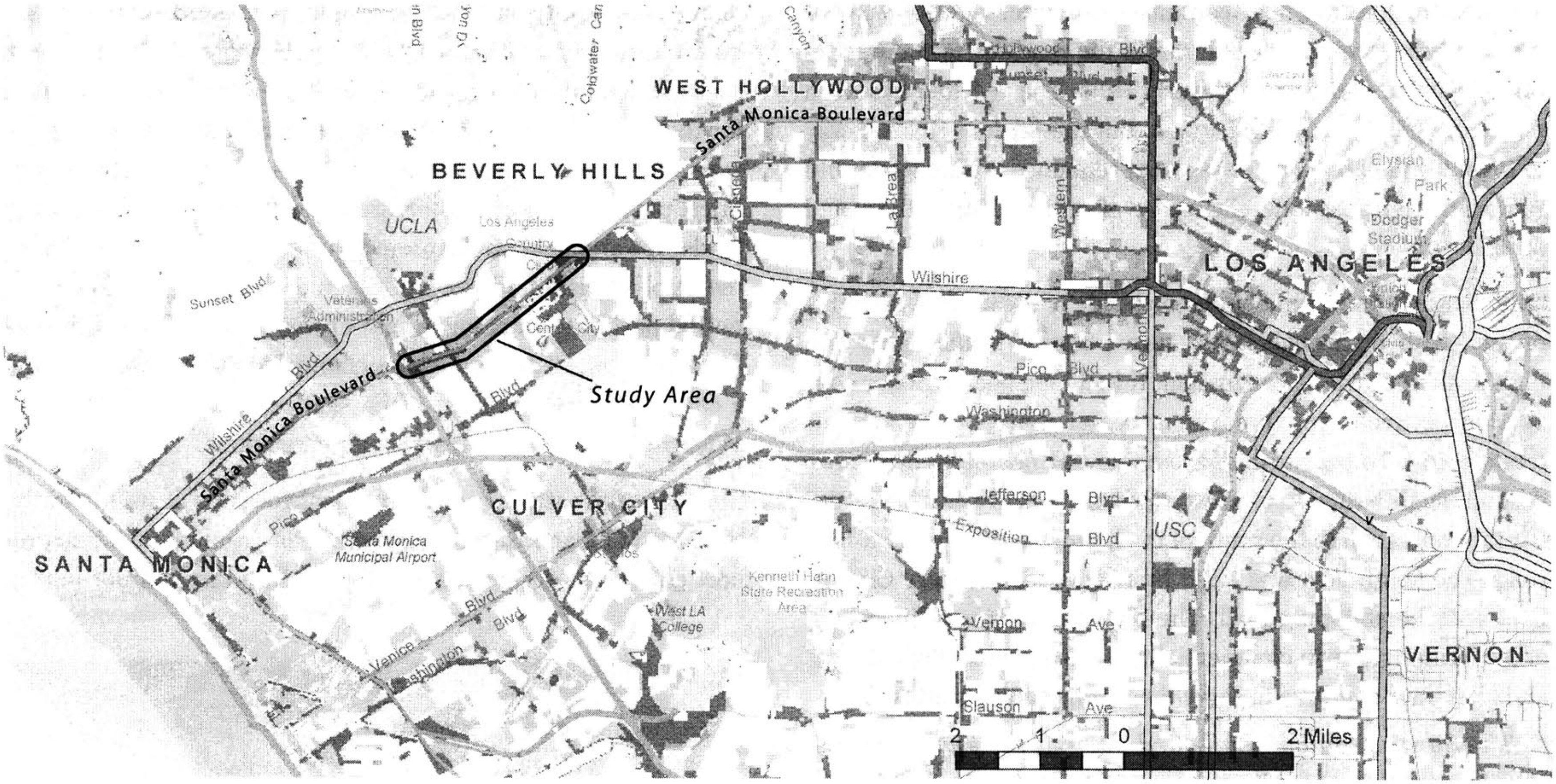
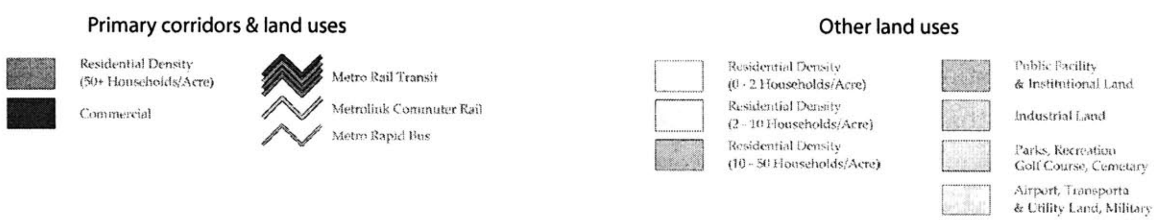


Figure 6-15: Santa Monica Boulevard Context Map (Calthorpe Associates)



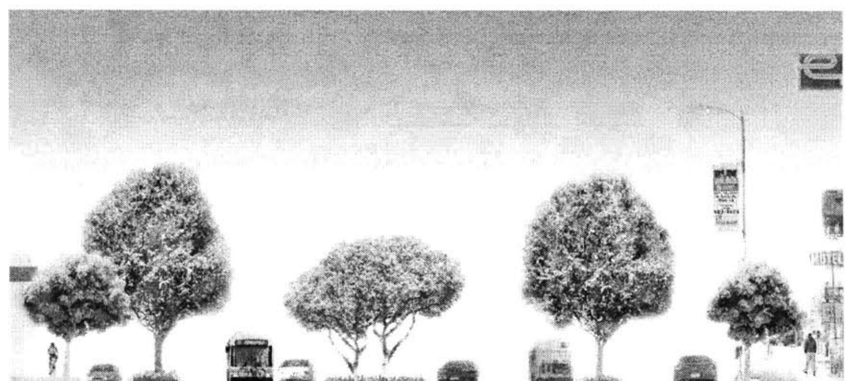
The Los Angeles segment contained off-street right-of-way for the Red Line streetcar, which ran in the roadway to the west in Santa Monica and east in Beverly Hills. The red line has been discontinued since the mid 1950s. But the 80-foot right-of-way in the 2.2-mile Los Angeles segment remained as storage for old trains and, later, as a derelict space of refuse, illicit activity and parked cars.

"Big" Santa Monica ran on the north side of the interstitial right-of-way, with 6 through lanes, turn pockets, traffic lights and high peak hour traffic congestion. It had long been a major connection between the employment center Century City and Interstate 405. To the north of the boulevard lay the well-off residential neighborhoods of Westwood and Beverly Hills. "Little" Santa Monica ran to the south of the interstice. It was a two-lane road. The south side was lined by residences, Century City offices and the shopping mall. The big boulevard was lined with office buildings, strip commercial and gas stations. Parking lots and alleyways continue to serve these commercial spaces.

C. The Santa Monica Boulevard Transit Parkway project

Los Angeles has long discussed a re-design of Santa Monica Boulevard. The initial design concept process was facilitated by the LA Metropolitan Transportation Authority (MTA) – the City transit operator and county congestion management agency – in the 1980s with the understanding that Caltrans would eventually relinquish the highway. Caltrans would not have been interested in or open to the re-designs being discussed for the entire Santa Monica right-of-way. The MTA hired Gruen Associates to conduct a community outreach and input campaign and to channel its findings into a design concept. Public workshops were held, associations formed and public debate centered on possibilities for the new Santa Monica Boulevard. In addition to providing a venue for public input, Gruen Associates served a valuable political purpose that can otherwise derail a public project. As one landscape architect on the project put it, "they took the hit" from the public (Oishi and Lee 2006). In a wealthy, politically connected part of town along a right of way long plagued with traffic congestion, Gruen Associates channeled public comment into a coherent design concept while sheltering the City, State and MTA from potentially negative public relations.

The State and City were well into the throes of a recession by the time the MTA and Gruen finished the environmental impact report (EIR) and design concept report. The City did not pursue


Source: City of Los Angeles
Figure 6-16: Section of re-designed boulevard at Malcolm Avenue

relinquishment and the highway remained Caltrans jurisdiction until the economy shifted.

Los Angeles picked up momentum with the project in the late 1990s. An engineer drastically reduced the estimated cost by more than $50 million! The new estimate was apparently too good to pass up, despite departmental doubt about the new esti-

Figure 6-17: Wilshire Boulevard (with towers) running parallel to Santa Monica Boulevard (in foreground). The view from the air suggests the inferiority and typical, auto-oriented strip nature of Santa Monica Boulevard relative to its parallel. UCLA can be seen in the rear left.

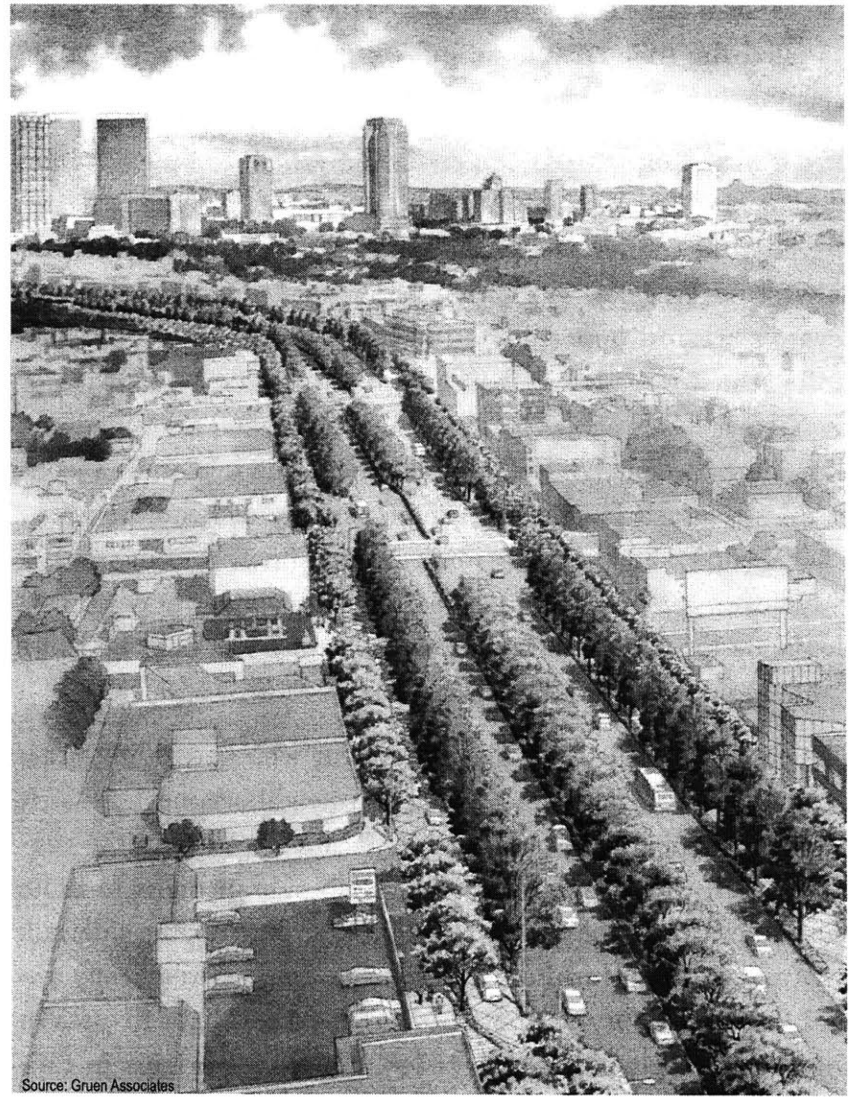


Figure 6-18: A rendering of the original design concept for the Santa Monica Boulevard Transit Parkway.

mate (Oishi and Lee 2006). MTA and the City liked the estimate, pursued the relinquishment and commenced the construction documents on their own.

The design concept was centered on a grand, multiway boulevard from Beverly Hills to I-405, reinvigorating the walking, driving and commercial experiences along a defining corridor in west Los Angeles. The Gruen design availed itself of the boulevard's greatest opportunity: the vast right-of-way. The design united the two roads and their interstice to create a 6-lane major throughway, side access lanes for local traffic and tree-lined medians in between. While this design has been explored (Jacobs et al), discussed in other jurisdictions (City of Beaufort 2004; CD&A 2004), and recently implemented (in San Francisco), it is typically perceived as an expensive 19th century atavism that demands too much ROW. Yet, right-of-way was the one thing Santa Monica Boulevard had.

The concept recalled European grandeur while providing practical congestion relief and protecting neighborhood access. It originally called for processions of Jacaranda trees in the center median with London Planes in both side medians to unite the boulevard. As the western terminus of route 66, the sidewalk treatments, street furniture and signage would symbolically unfold the entire story of Route 66; oak trees and light fixtures in the eastern segment were to reflect the route's origins in Chicago. The streetscape would progress through species and elements representative of the cities through which the route trav-

Figure 6-19: Santa Monica Boulevard at Westwood Avenue: A typical intersection with "Little" Santa Monica at left, "Big" Santa Monica at right and old interurban right-of-way in between.

Figure 6-20: A rendering of the re-designed intersection.

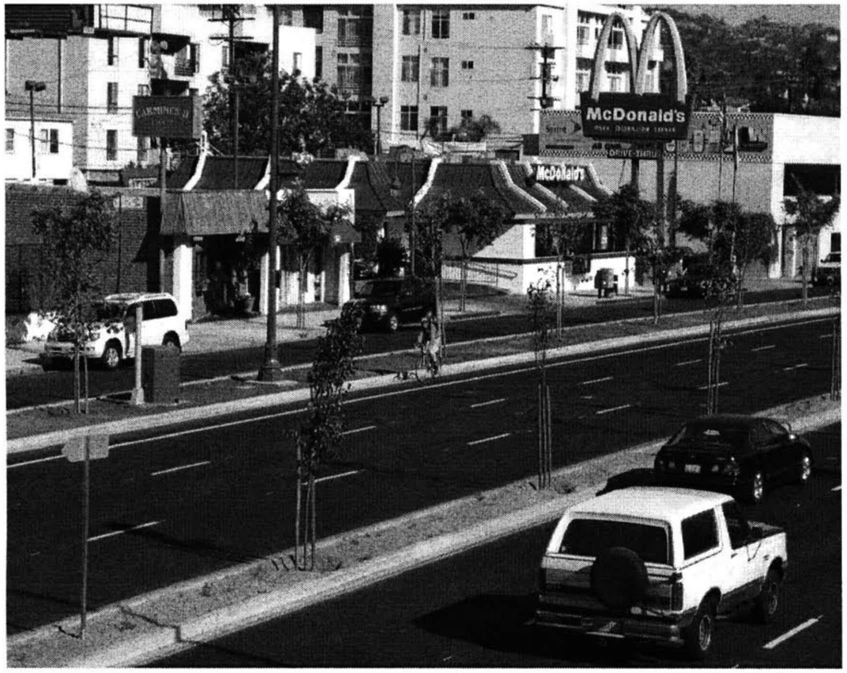


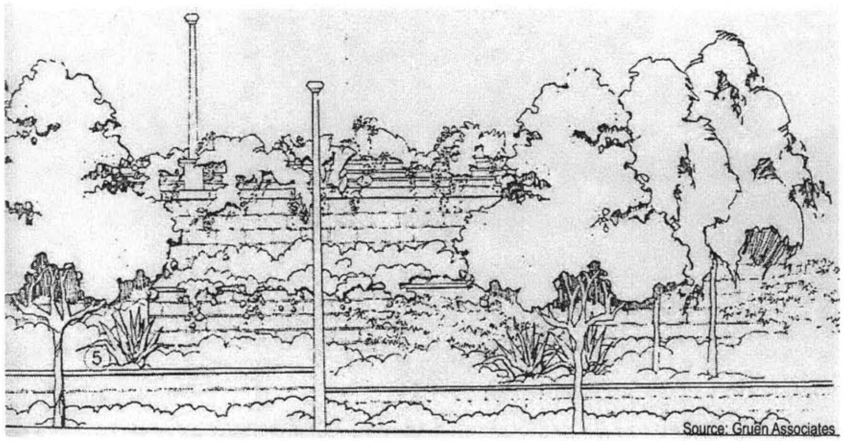
Figure 6-21: The re-designed boulevard, near Thayer Avenue

els. The western segment of the Boulevard, while united to the east by the Jacarandas and Planes, would contain sidewalks with blue hues, wave designs and Palm trees to evoke the route's Pacific terminus.

It provided a poignant and elegant counter weight to a defining structural element of the LA basin: Wilshire Boulevard. Just three-fourths of a mile to its north and running the same course from Santa Monica to downtown Los Angeles, Wilshire Boulevard was designed for fame, grandeur and excess – fitting, for Los Angeles. It is now the serpentine source from which wealthy


Figure 6-22 : Sidewalk treatments on the new boulevard.

apartment towers, hotels and financial services spring towards the heavens in a freak occurrence of skyscraping urbanity amongst the wealthy Westside. From the air it is one of the most striking and identifying features in the Westside, yet distinctly un-L.A. At the same time, it provides citywide access for thousands of cars and transit riders everyday. While light rail was once hoped for along Wilshire, the boulevard is now the route for the original and one of the most successful bus rapid transit lines in California.



Figures 6-23 and 6-24: The design concept (above) for the retaining wall was re-worked after engineering review and some cost cutting measures, as shown in photo of boulevard at Thayer Avenue (right)

The Santa Monica Boulevard design concept took a cue from Wilshire's unlikely fame, if not its design. While an additional rapid transit line has yet to be planned for the boulevard, the re-design does include a bus-only lane and is titled the "Santa Monica *Transit* Parkway." Wilshire's grandeur stems from its wealthy residents, sinuous sweep across the west of L.A. and connection to local institutions like UCLA and Beverly Hills. The Santa Monica Boulevard re-design embraces L.A. particulars – freeway-bound traffic and congestion, strip commercial shopping, and a desolate pedestrian environment – with a grand, unifying statement of walkable, urban design. The side access lanes provide the buffer and width to accommodate a safer and friendlier pedestrian experience. The street continues to function as an auto-oriented strip in many parts, but the improve-

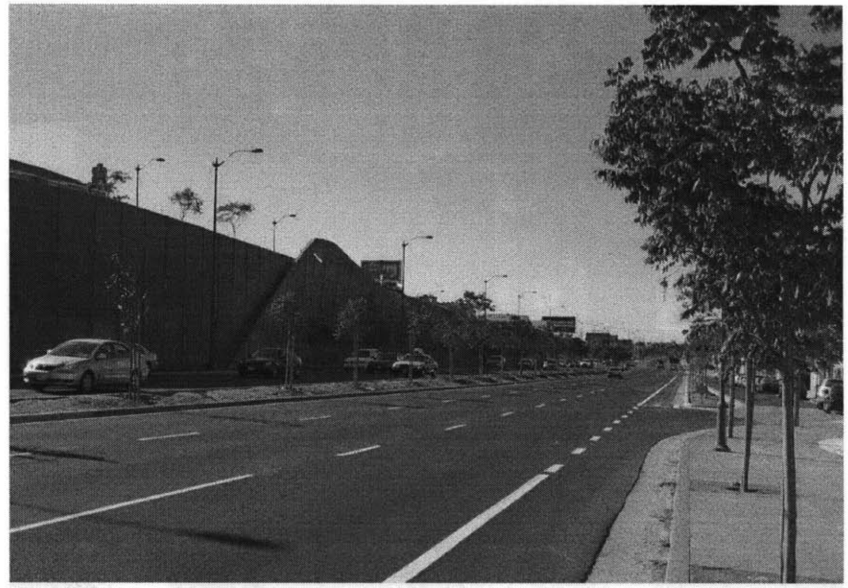


Figure 6-25: Section of re-designed Santa Monica Boulevard at Holmby Ave

more than the previous design. Through signal timing and increased capacity, the Boulevard facilitates once 20-minute trips to Interstate 405 now in 5 minutes (Oishi and Lee 2006).

The original design concept was elegant, but a number of details did not pass muster with the Los Angeles Department of Transportation (DOT) and Bureau of Engineering (BOE). Median grades were too steep, trees too close to intersections and connectors for pedestrians of disability inadequate (Oishi 2006).

Los Angeles was thus forced to deviate from the original concept. Medians were redesigned. The most apparent difference is in the retaining wall at Thayer Avenue between the through traffic lanes and the south side access road. The ultimate design of

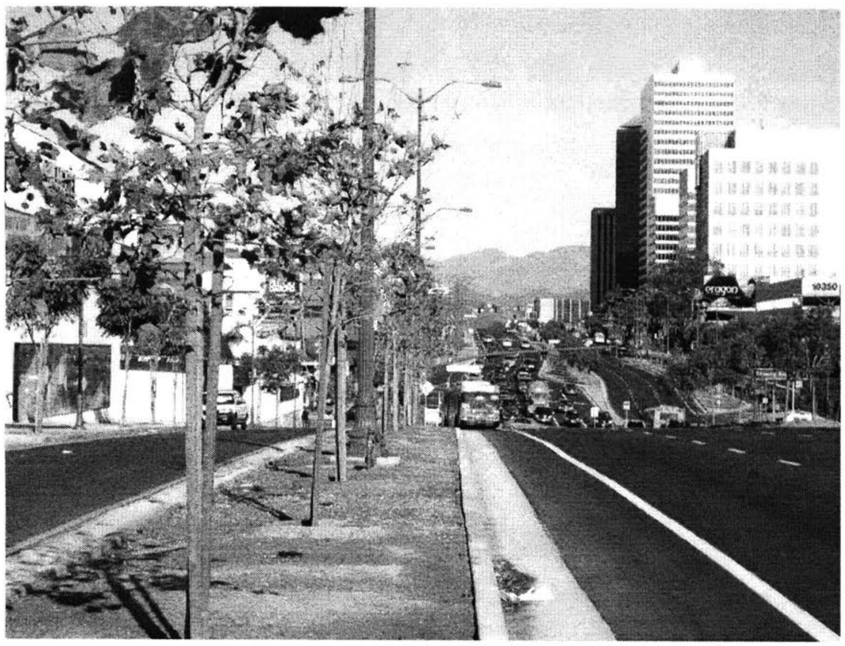
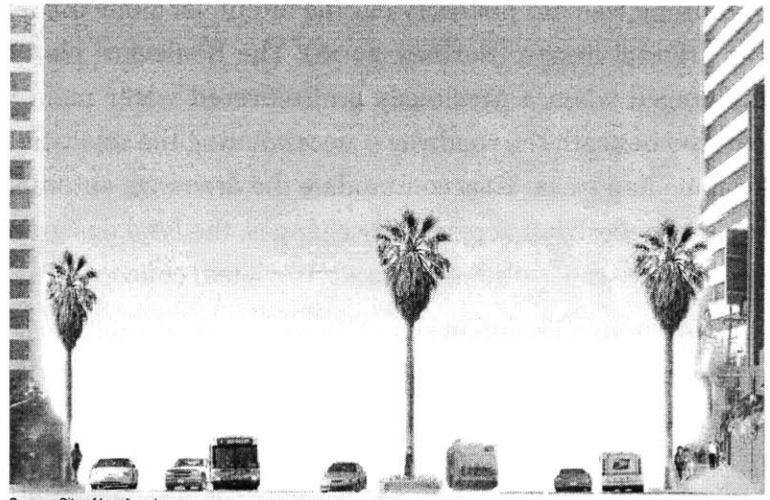


Figure 6-26: Some of the more unconventional designs on Santa Monica Boulevard: narrow medians with trees, side access lanes for local traffic, six-foot bicycle lanes (looking east); Century City is in right background



Source: City of Los Angeles

Source: City of Los Angeles

Figure 6-27 and VI-28: Section of re-designed boulevard at Sepulveda Boulevard (above) and at Century City (below), both looking west.

the retaining wall did not carry out the intent, let alone the form, of the original design (Carbrey 2006). The Boulevard plan was also changed when a previously undiscovered water main was uncovered beneath the roadway – necessitating the relocation of several median trees. To accommodate the drainage, automobile safety and pedestrian accessibility changes, the final design contained 800 trees – 300 fewer than the original concept.

D. Criticism of the Project

The project is not without its critics. Some believe it is just a reincarnation of the original Santa Monica freeway at-grade (Carbrey 2006; Perlstein 2006). Its width, design speed and signal timing do little to convince otherwise. The tremendous retaining wall continuing the grade-separation of parts of Little Santa Monica is redolent of high-speed highways more than an urban street. Yet the original retaining wall design was out of compliance, so alternatives were limited.

Some also wonder what happened to the "transit" in the Transitway Project. The exclusive bus lane is stunted at best, only spanning from Moreno Drive to the Avenue of the Stars. Otherwise the buses still travel in mixed traffic, albeit faster moving traffic. Considering that the MTA, Los Angeles' transit operator, footed the bill for much of the project some wonder if it got its money's worth. In the end, most critics concede that this stretch of Santa Monica Boulevard was intended to facilitate traffic quickly to the high concentration of employment in Century City. Westwood neighbors to the north also chronically complained of the traffic. The side access lanes seemed to mollify local commerce and

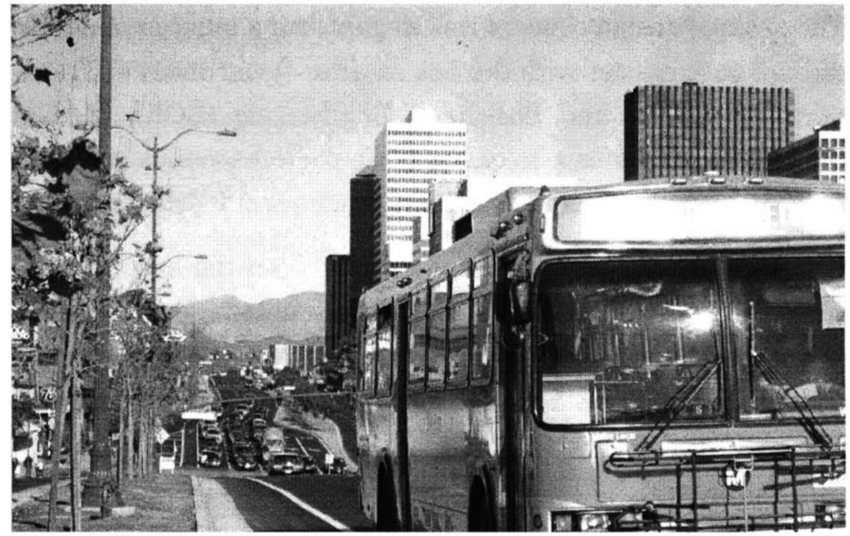


Figure 6-29: Bus in mixed traffic lane on re-designed Santa Monica Boulevard

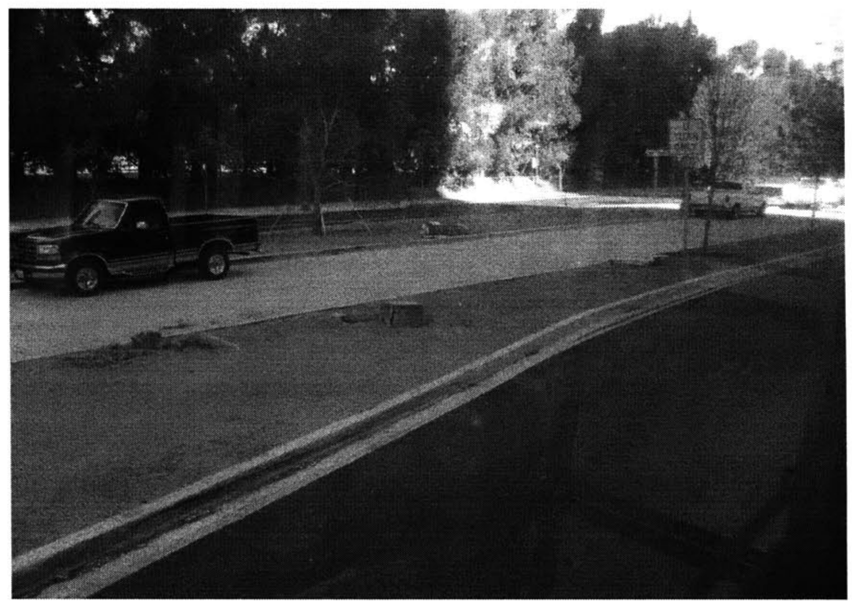


Figure 6-30: The dedicated busway is short & not operational yet.

resident concerns about noise and fast-moving traffic, yet critics often seem to overlook this design while fixating on the tremendous width of the entire roadway.

E. Conclusions

The Santa Monica Boulevard Transit Parkway Project provides an example of innovation in street design that is very difficult to initiate from changing the state highway design manual.

First, innovation occurred because of a tangible need on a particular street. While Los Angeles' standards are unique, the unconventional design of Santa Monica Boulevard did not spring from them or from an attempt to change them. Considering that the last change street design standards took 33 years, changing standards was convincingly not the venue for addressing Santa Monica Boulevard. More to the point: the standards did not have to change to allow for such an unconventional design (unlike El Camino Real).

Second, the process took place under local jurisdiction. While Caltrans is concerned with regional mobility, they were not in a position to address the complexity of Santa Monica Boulevard – an atypical urban arterial street with the all-too-typical confluence of challenges: pedestrian, local access, regional mobility, urban design, bicycle access, transit mobility and conflicting community concerns. A congestion management agency and transit operator thus took it upon itself to redesign a street! The City agreed to obtain jurisdiction. Local agencies also had the resources and experience to conduct a successful public engagement process – the linchpin, according to some designers, of any context-sensitive solution. It could also be argued that successful public engagement, combined with sound engineering

Figure 6-31: Summary table of case study projects

Case	Initiator	Main Stimuli	Main Challenges	Design Proposal	Process	Costs	Outcome
El Camino Real Palo Alto, CA	City of Palo Alto	Street trees, Walkability	Proposals prohibited by Caltrans Highway Design Manual	Median Trees, Sidewalk trees	Negotiation with Caltrans to change HDM or reach MOU w/out design exception	not available	Pilot Project for Median Trees; Grant for ECR Master Design Plan
Santa Monica Boulevard Los Angeles, CA	Metropolitan Transportation Authority & City of Los Angeles	Traffic Congestion	Cost, Public Opinion, Relinquishment	Re-grade, combine rights-of-way into one boulevard, signal timing, add bus lane, improve sidewalk and street fixtures.	Relinquish to City of Los Angeles, Joint funding by MTA, FHWA, Caltrans, City of LA	$68,000,000	New boulevard with increased capacity and ROW, Exclusive bus lane, Side access lanes, Timed signals.

judgment and political accountability, is the linchpin to defense against liability risk.

Caltrans never would have had the budget for this sort of campaign. While it is currently emphasizing the importance of increasing outreach, community input and budgets for the early planning phases of its projects, funding is still short for these activities (Dudley 2006). This was an understatement during the recession of the early 1990s especially.

Finally, the local agencies are more politically accountable to local constituents. So of course the will, power and resources to address the boulevard were more readily available to the MTA and the City of LA than Caltrans. This is especially the case for a road that thousands of wealthy lawyers and citizens drive up and down every day to and from their homes, Century City, Interstate 405 and Beverly Hills. Caltrans is not as accountable to these constituencies as elected members of the City Council or appointed members of the MTA and other local agencies.

The local problem, jurisdiction and political accountability of the project enabled basic design elements that would have been extremely difficult under Caltrans jurisdiction. Encroachment permits would have been required for the sidewalk treatments, the light fixtures and street furniture. The medians separating the throughway from the side access lanes are inadequate according to the HDM and would have almost certainly been denied a design exception. The project has explicit landscape themes in the trees and sidewalk treatment to reflect its historical significance – for which Caltrans approval would have been difficult.

The travelway is also full of unconventional design values. The through roadway medians are too narrow for trees to be planted according to HDM guidelines. The HDM requires tree-free clear zones for 100 feet from intersections, where as Los Angeles' standards are 50. 200 fewer feet of trees per block would have had a significant impact on a design which was already 300 trees short of the original concept. 11-foot through lanes are consistent throughout the boulevard, as are 6 foot bicycle lanes – not standard designs on state highways. The bus-only lane and obliquely-angled intersection at the boulevard's eastern end also deviate from Caltrans standards.

Yet the design maintained, even improved, the street's automobility. The design provides landscape continuity to the street in a way that is appealing to drivers and pedestrian alike. It is also safer and more amenable to pedestrians, local traffic and abutting property owners. As one designer has put it, the multi-way boulevard is a street "for all seasons," (Bochner 2006). With the available right-of-way, the Santa Monica Boulevard Transitway Project is able to provide street space and design features to satisfy nearly every user of the street – at least in design.

F. Lessons from Southern California

These lessons hold for innovation in street design elsewhere. In fact, Cities have been obtaining and redesigning portions of Santa Monica Boulevard for years. Santa Monica and West Hollywood were the first cities to negotiate a relinquishment agreement with Caltrans for Santa Monica Boulevard in 1998. After their redesign, West Hollywood's portion of the Boulevard still maintains the 45,000+ ADT and major bus lines it has traditionally carried. But it now also has bulb-outs, mid-block crossings wider sidewalks and street furniture- all design elements that were either anathema to or subject to a rigorous design exception process under the State's jurisdiction. West Hollywood's redesign of Santa Monica Boulevard actually defies conventional standards to a much greater degree than Los Angeles'.

And West Hollywood did not reinvent its standards to redesign Santa Monica Boulevard. Its simple redesigns, reconstructions and rehabilitation of the street were within APWA's standard plans (Perlstein 2006). Obtaining jurisdiction over the Boulevard easily allowed businesses to install awnings, apply for sidewalk seating and accoutrements, and other simple improvements for which obtaining Caltrans permission was onerous and, often, not worthwhile.

Cities beyond Los Angeles are also re-designing their streets outside of Caltrans jurisdiction. Cathedral City, in the Coachella Valley, negotiated a relinquishment to redesign a state highway into a multiple-roadway boulevard at the City's re-designed civic and commercial center. Smaller cities throughout the state are adding bike lanes, narrowing through traffic lanes, or adding trees to their main streets without the burden of Caltrans encroachment permits, design exceptions or prohibitions. More and more unconventional street design is taking place outside of the jurisdiction of Caltrans. Perhaps this fact speaks to the rigor of the design exceptions process more than the Department would like to acknowledge.

These innovations and those along Santa Monica Boulevard are not taking place in standards. They are happening on actual, asphalt and concrete streets. Cities are not codifying unconventional street designs. Rather, they are relying on the sound judgment of their designers, engineers and planners to redesign streets uniquely fit to their context. The California Highway Design Manual and the AASHTO Green Book state that professional judgment is the ultimate arbiter of design speed and, therefore, geometric design (AASHTO 2004; Caltrans 2006, see Index 101.1). But it seems that Caltrans is much more reluctant to trust professionals' judgment than local jurisdictions are.

CONCLUSION

> *The construction, entrance, and the whole character of the Road change with new social needs and habits, with the facilities of natural science, their rise and decline. But this perpetual change, which affects the Road as it does architecture and every other work of man, is epically marked by certain critical phases, one of which...we have now entered. There are moments in the history of the Road in any society where the whole use of it, the construction of it, and its character have to be transformed.*
> - Hilaire Belloc

Palo Alto has yet to see the design of El Camino Real change significantly. The City has the resources and political will, it has a particular street and objective to fulfill, but it does not have jurisdiction over the street. On the other hand, with respect to Santa Monica Boulevard, Los Angeles has all of the above. Political and fiscal resources were behind the project beginning in the 1980s, the objective was clear and particular to just one segment of just one street, and the project did not proceed without the understanding that Caltrans would relinquish the segment to local jurisdiction.

Considering the decades of standards based on automobility and driver safety and the entrenchment of these values into a very large and conservative bureaucracy, the change seen on Santa Monica Boulevard, and even the planning initiative along El Camino Real, can be viewed as positive change.

While documenting a lack of change and automobility-based design can be interpreted as critical, the truth is that street standards have succeeded in their objectives. They are rooted in a commitment to the freedom of movement and personal safety. They are systematic, comprehensive and efficient. Additionally, the whole point of standards is to establish an immutable guide or norm. Change – or even flexibility – is antithetical to the idea of standards. What's more, from the perspective of automobility and driver safety, standards have improved. Streets have gotten safer and have improved automobile movement. The slowness of contemporary change is due to risk of liability more so than an inherent unwillingness to change.

Nevertheless, the mid-20th century objectives of arterial street standards were limited. While standards may have succeeded with respect to the driver and automobility, other users and functions of the street have been slighted. Automobility-based values are not inherently wrong. But the infrastructure, standards and systems that rose from the reification of automobility values have out-competed several other values that are equally valid.

California is changing and so are its needs. Alternative values of street design and standards are coming to bare. The pressure for entrenched standards to change is just one example. Planning initiatives like Palo Alto's and Joint Venture Silicon Valley's are two more. The design of Santa Monica Boulevard in Los Angeles and West Hollywood are as well. The list could go on. The relinquishments, the multiway boulevards, the main streets – are all physical manifestations of values in street design that have been unrepresented for decades: values like walkability, urban design amenity, multimodality are just a few.

The faster alternative values are represented, on equal playing field with automobility and driver safety, the more likely future streets will cater to those who actually use them. Main streets can be regenerated, central property values will be reinvigorated, and environmental benefits will be reaped.

But there must be pressure and representation of these values. This is why the Palo Alto negotiation process can be viewed as a success – despite the failure to liberalize the HDM. Without the pressure of Assemblyman Simitian forcing diverse factions to the table, alternative points of view and values would not have been heard by the diverse parties. There is an inherent, cultural mistrust of others in these political venues for street design. But when parties are forced to the table, in the words of the Bay Area Caltrans Design Reviewer, "a lot of good will is created" (Thomas 2006). Seemingly opposing factions begin to understand others' values and, more importantly, begin to seek shared solutions that improve upon the status quo.

The failure of the Palo Alto process is that it has ceased. Trust was lost over the disagreement between factionalized experts and the changes to the HDM (Caltrans 2006; Ewing 2005; Sullivan 2003). And the political pressure that convened the table to begin with has dissipated. As some negotiation experts would put it, "No one is taking responsibility for making proposals substantially better, in the sense of making larger numbers of people comfortable with these" (Susskind and Cruikshank 1987).

The continued success around Palo Alto is that Joint Venture Silicon Valley is stepping up to the plate. Less encumbered by electoral politics, JVSV is embracing arterial street design change. And just as large urban and suburban arterials transcend political boundaries, JVSV is taking a regional approach to fixing the problem. By "embracing a regional approach to making the roadway design compatible with the uses along the roadway itself," JVSV hopes to turn an unsatisfactory suburban arterial running through 20 cities into a grand boulevard that increases affordable housing, transportation service, design amenity and pedestrian appeal (Joint Venture Silicon Valley Network 2004).

While the Santa Monica Boulevard case demonstrates that local jurisdiction is critical to change, it is not a panacea. Rather, it provides a more level playing field upon which more voices can be represented. The State's voice is equally important. And so is the more comprehensive, regional voice for livability that JVSV is providing. And they are not unique. The Westside Cities Council of Governments in LA County (representing Beverly Hills, Santa Monica and West Hollywood) has begun their Livable Boulevards project. Like the downtown LA street standards project, it comprehensibly embraces streets as public space, means of transportation and units of land use. But it is addressing them beyond the city scale, at the regional or subregional scale that is more appropriate for the arterial street.

After decades of designing arterial streets as major transportation links in a metropolitan automobility network, new bodies of planners, designers, engineers and politicians are addressing them in the ways that arterial streets have always served but have never been officially recognized. Streets are being planned as places, addressed regionally and locally, and designed for diverse users. The street designers of the early 20th century embraced a future of freedom through automobility by creating new designs, industries and institutions. In the same way, cities and regional organizations are forging the basis of a future based on new freedoms, choices and values that have been absent from arterial street design for nearly 100 years.

Future Directions

This thesis is a mere scratch on the surface of the subject of arterial street design, standards and change. It is more of an introduction to the many directions in which research on the subject could follow. While these directions are legion, I would like to focus on several of interest.

First is the further study of these particular case streets. That is, ample opportunity remains for the better understanding the process of change on arterial streets. Further investigation of Santa Monica Boulevard in West Hollywood, Santa Monica and the City of Los Angeles as well as experiences along El Camino Real in Redwood City, Menlo Park and other cities are warranted. Redwood City and Menlo Park are particularly relevant because they applied for the original design exception to median trees together with Palo Alto. The post-relinquishment, redesign of the Santa Monica Boulevard in West Hollywood embraces its "main street" designation while facilitating more than 40,000 cars per day and three of the most heavily used bus lines in the Los Angeles basin (Perlstein 2006). This case would support the basic thesis that alternative design values are not detrimentally impacting automobility and driver safety. Further research should engage this issue.

A second direction is that of relinquishment. To better understand its impacts and, perhaps, the impacts of decades of Caltrans jurisdiction, comparative analyses of streets before and after relinquishment should be carried out. Does local control mean a loss of automobility? Without the constraint of the HDM and the design exception process, do relinquished-street designs end up violating the tenets of the HDM or Caltrans? Streets like Octavia Boulevard in San Francisco and Palm Canyon Drive suggest not. But perhaps this is a function of their role in the regional automobility network or a result of comprehensive network planning. These issues related to relinquished streets should be investigated.

The realm of arterial street design is worth pursuing further – namely, context-sensitive design, design speed management and accident risk factors. As a general approach, Context-Sensitive Designs and Solutions warrant further investigation. This thesis suggests that standards are inherently difficult to change and that particular street projects are more amenable to unconventional design. So does codifying flexibility make sense? How can a standardized manual be context-sensitive, without an understanding of the locale or neighborhood to which it is to be applied? Perhaps as a heuristic tool such manuals do make sense. But for actual street design change, a cultural shift towards context-sensitive and easing the exceptions process is just as critical as new sets of standards and exemplary studies.

Also, the issue of design speed is one that can hardly be covered in a paper such as this. It is certainly one of the greatest debates in CSD and, particularly, in the issue of designing "major urban thoroughfares." As the El Camino Real case suggested, passive safety designs seem to be more flexible at lower speeds. Otherwise, why would Caltrans have permitted narrower clear zones for 35 mph than for 45 mph? Some research demonstrates that lower speeds can maintain higher traffic volumes and increased level of service (LOS). So can El Camino Real have its cake and eat it too, by lowering the design speed while maintaining LOS through timed signalization? Is it even possible to lower design speed without topographic changes or decreasing sight distance? Do we want to decrease sight distance? And will such signalization compete with pedestrian needs? Such issues warrant investigation.

Finally, the issue of risk should be investigated. Pertaining to the street tree issue, some research suggests that accident risk is sometimes so low, that the appeal, amenity and walkability gained from "livable" designs may be worth it (Bratton and Wolf 2005). Caltrans would undoubtedly disagree, considering that their money (and, ultimately, the taxpayers') is on the line. Nevertheless, if a scientific risk analysis can demonstrate the value of street trees or other streetscape fixtures – perhaps some street designers will be open to it. This is yet another avenue down which research has begun and should continue as it pertains to urban arterial streets.

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