Occasional Papers

Sizing Up the Challenge: California's Infrastructure Needs and Tradeoffs

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CA2025

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Summary

Since the mid-1990s, a number of reports have argued that California is jeopardizing its future by investing too little on basic public infrastructure. We revisit this question, with a focus on three main sectors – schools, water, and transportation. We argue for nuance in characterizing the state's public investment challenges. In many cases, cost-saving innovations and incentives to encourage efficient use of services provide opportunities to meet the needs of a growing population without vast new sums of public spending. In others, recent innovations in funding have enabled us to meet social goals.

In K-12 education, voter support for state and local bonds since 2000 has gone a long way toward redressing a serious backlog of school facilities shortfalls. A key contributing factor was the easing of voter requirements for local school bonds, which now require only a 55 percent majority (down from two-thirds). Recent reforms have also begun to redress inequities across school districts, by focusing more resources on overcrowded schools in low-income neighborhoods. These equity concerns are part of a larger question of how to raise performance in California's public schools, which is especially poor in low-income districts. Higher per student spending levels – now relatively low in California – may be a part of the solution.

In higher education, funding innovations have also helped address the facilities constraints pressing upon the system as the children of the baby boomers reach college age. Thanks to the lower pass rate on local school bonds, the community colleges have generated enough local funds to ensure expansion well into the next decade. If the UC system continues to attract as much outside funding as in the recent past, it too will be in a good position. With limited outside funding, the CSU system is worst placed. Facilities are not the biggest question mark for this sector, however: California's recent budget woes have the potential to reshape some basic tenets of the Master Plan for Higher Education, established in 1960. In particular, proposals now call for additional increases in student fees (already up more than 50 percent since 2001) and for increasing the role of the lower-cost community colleges as feeder schools for the four-year institutions. Demand management through higher fees offers many potential advantages, as long as it is accompanied by means-tested financial aid. This is, nevertheless, a break with the social contract of the Master Plan, which promised low-cost, universal access to California residents. Californians will need to consider the role they want the higher education system to play in the future, in which jobs requiring college training are expected to be an increasing share of all jobs.

Although many raise the specter of impending water shortages as California grows, more efficient use of existing resources, through conservation and reallocation through water marketing, can considerably diminish this challenge. Moreover, municipal water and wastewater utilities, financed through user fees, are making substantial investments to accommodate growth while meeting regulatory goals for clean and safe water. The big questions in this sector therefore concern paying for environmental programs for which no one wants to take ownership. Without continued bond funding for ecosystem restoration and water for aquatic wildlife, urban and agricultural water users will be asked to pay eco-taxes, a prospect farmers consider particularly onerous. Managing polluted runoff is another unfunded environmental mandate. New watershed approaches offer potential to achieve this goal at low

cost; however, local funding sources will also need to be secured, through user fees or local taxes. Raising these funds is considerably more difficult than for utility charges, because it requires a two-thirds voter majority.

Transportation agencies face the challenge of providing mobility and access, managing congestion, and attaining air quality goals in a far different environment from the heyday of freeway expansion in the 1950s and 1960s. Real costs of building highway lanes have more than tripled since then, and the value of traditional roadway user fees – gas taxes – has eroded through inflation and higher fuel efficiency. In today's more built-up environment, the greatest potential lies in strategic investments to relieve bottlenecks and to encourage drivers to carpool, modulate their travel schedules, and use transit alternatives. Over the past decade and a half, roadway investments have focused on these approaches, with the majority of new capacity in high-occupancy vehicle (HOV) lanes. Promising experiments are also under way with the greater use of tolls. Better pricing of road use would also improve ridership on transit systems, many of which go underused. Transportation finance would also greatly benefit from shifting back to user fee support and away from general sales taxes that have progressively replaced the gas tax. Making this move will depend on the public's willingness. The alternative is a future in which we manage demand by default, through longer and longer delays.

In recent years, strategies that aim to achieve multiple goals, by focusing on how and where we build our communities, have increasingly come into the spotlight. Councils of Government in California's four major metropolitan areas have embraced the "smart growth" philosophy in their most recent regional transportation plans, which target more compact, transit-oriented development. A primary aim of these strategies is to increase housing affordability, with more housing and a greater mix of housing types than would occur with a traditional "sprawl" pattern of development (single-family tract developments on the suburban edge). To make these strategies truly "win-win", fiscal and regulatory reforms may be needed to reduce the disincentives to denser development. To succeed, smart growth strategies also depend on the willingness of California's residents to accept more compact living. The public currently appears split on this issue; it is more united in expressing concerns about the effects of growth on housing affordability and air quality. If compact development programs succeed in making housing more affordable, they may win over more converts.

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Acronyms

ASF	Assignable Square Footage
BRT	Bus Rapid Transit
CALFED	Multiagency state and federal program for the San Francisco-San Joaquin Bay Delta
Caltrans	California Department of Transportation
CCC	California Community College
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COG	Councils of Government
CPEC	California Postsecondary Education Commission
CSU	California State University
CTC	California Transportation Commission
DHS	Department of Health Services
DOF	Department of Finance
DWR	Department of Water Resources
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
FTE	Full-Time-Equivalent
HOT	High-Occupancy Toll
HOV	High-Occupancy Vehicle
ISTEA	Intermodal Surface Transportation Efficiency Act
MCL	Maximum Contaminants Level
NCCP	National Communities Conservation Planning
NOX	Nitrous Oxide

PM10	Particulate Matter
ROG	Reactive Organic Gases
RTP	Regional Transportation Plan
RTPA	Regional Transportation Planning Agency
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
TTI	Texas Transportation Institute
UC	University of California

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Introduction

Since the late 1990s, a host of reports by government agencies and independent groups have been sounding a common alarm: Decades of rapid population growth, unmatched by corresponding increases in public investments, are straining the capacity of California's essential public facilities. In this view, the telltale signs of this problem – overcrowding in schools, record rates of traffic congestion, growing vulnerability to drought, and threatened ecosystems – are likely to reach crisis proportions without actions to fix the way we plan for and fund our infrastructure.[1]

The calls for reform have met with some successes. In 1999, the legislature passed AB 1473, a law aimed at improving statewide planning by requiring the governor to prepare an annual five-year infrastructure plan. This reform encourages the state to better identify priorities, compare and evaluate alternatives, and arrive at more cost-effective investment choices.[2]

On the funding side, a major success was the passage of Proposition 39 in November 2000, which lowered the voter threshold for local school bonds from two-thirds to 55 percent in school board elections held concurrently with other state or local elections. This paved the way for considerable increases in local funds for school facilities and for community colleges. At the state level, the initiative process has also generated additional funds for infrastructure. In March 2002, voters approved Proposition 42, which dedicates the state sales tax on gasoline – formerly part of the general fund – to transportation projects. Education bonds passed in November 2002 and March 2004 made a total of $25.35 billion available for K-12 and higher education facilities. Three environmental bonds were passed between 2000 and 2002, making available $5.7 billion for water quality and supply projects and $2.3 billion for the acquisition and improvement of open space and public parks. The only notable ballot-box failure regarding infrastructure finance during these years was the proposal to earmark a share of the general fund for infrastructure projects, in November 2003.

These successes notwithstanding, some core funding questions remain. Local tax or bond finance for some other key sectors, such as transportation, continues to require a two-thirds supermajority.[3] In contrast to the reform of local school finance, the state-level initiatives do not ensure the availability of new sources of revenue to fund infrastructure; Proposition 42 earmarked the use of existing revenues for transportation, and state bonds are

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[1] See California Business Roundtable (1998); California Legislative Analyst's Office (1998c); California State Treasurer (1999); Center for the Continuing Study of the California Economy (1999); Dowall (2001); Neuman and Whittington 2000; Dowall and Whittington (2003).

[2] Governor Schwarzenegger's California Performance Review Commission (2004) calls for broader reforms to promote more efficiency and accountability in state investment and planning. In a companion piece to this report, Barbour and Lewis (2005) discuss the implications of these and other governance reforms for California's public infrastructure policies.

[3] Under the California constitution, local bonds always required a two-thirds vote. The two-thirds threshold was introduced for local special taxes (for particular designated purposes such as transportation) with Proposition 13 in 1978 and reinforced with Proposition 218 in 1996, which also definitively required voter approval for general taxes and fees (de Alth and Rueben, 2005).

repaid through the general fund. As the record budget surpluses of the late 1990s have turned into a record budget crunch, the fragility of these funding sources has been exposed. There has been pressure to cut existing public works programs and reallocate some of the dedicated infrastructure funds to meet state obligations in other areas.

Meanwhile, efforts to raise user fees, a traditional source of funding for some infrastructure services, have been considered "dead on arrival" in the legislature. The per gallon gas tax, a major source of roadway funding, has not been adjusted for inflation since 1994. In May 2004, attempts to include a water user fee to help pay for water for threatened ecosystems were retracted in response to water agency opposition. Among major sectors, only higher education has been successfully targeted for fee increases; since the onset of the budget crisis in 2001, student fees are up by over 50 percent and rising.

Thus, California faces the future with strong voter support for state bond finance or earmarking of investments to specific sectors, but with no clear mandate to raise taxes or fees to support spending increases at the state level, and with high voter thresholds for local spending in areas outside education. In comparison with the late 1990s, when the alarm bells began sounding, unprecedented quantities of bond monies have become available for education facilities, and more modest new funds for other sectors. It is therefore appropriate to revisit a central question posed by the numerous reports on infrastructure: Are we spending too little to secure a sound economic future and quality of life?

Needs and Tradeoffs

The conventional approach to this question is sometimes referred to as "gap analysis." It juxtaposes an assessment of infrastructure "needs" in a specific sector (an estimate of the amount we should be spending) with the levels we actually spend; unfunded needs constitute the "funding gap." Gap analysis often assumes (at least implicitly) that unfunded needs should be met with public subsidies, which requires either raising taxes (and reducing private spending) or shifting public expenditures away from some other sector. It tends to ignore, or discount, the tradeoffs involved in funding public investments.

The problem arises from the way conventional exercises estimate needs. Putting a price tag on public investment needs is, admittedly, less straightforward than for private sector investments. For private goods, the market determines the level of output based on the interaction between supply (the costs of production) and demand (how much people are willing to pay). Market forces are of more limited use in determining the appropriate level of public investments, because it is sometimes either impractical or socially undesirable to fully charge each user for the level of services he or she enjoys. However, economic incentives generally do matter. Conventional needs assessments have largely ignored market analysis and instead followed an engineering approach, gauging needs by matching a targeted per capita level of services to population projections.

Approaches that do not incorporate economic incentives are likely to overstate the level of "needs" in sectors where it would generally be appropriate for users to contribute directly to costs of service. For instance, the volume of new water supplies to accommodate population growth will be lower if we assume that market forces (higher prices) lead people to adopt

conservation policies. Congestion on roadways will be lower (and hence the need for new lanes reduced) with tolls and other incentives to encourage commuters to carpool. The overstatement of needs can be reinforced by the nature of infrastructure finance. If implementing agencies are competing for public funds, they may have incentives to inflate their requirements. (One reason is simply that from an agency's point of view, more is better; another is that they may expect to receive only a share of their requests). The result is a "wish list" of spending priorities that is considerably higher than what society might be willing to pay for, given other demands on its resources.

Over the past ten to 15 years, techniques incorporating willingness to pay have grown in importance. Such approaches, often labeled under the heading "demand management," acknowledge that the demand for public services – and hence the need for public investments – can be altered by the incentives facing individuals. As shown in the examples noted above, the incentives can be based on pricing (e.g., higher water rates to encourage conservation) or other levers (e.g., granting high occupancy vehicles access to faster highway lanes). The appropriateness of demand management techniques varies by sector, depending in part on technical feasibility (because introducing incentives may be costly) and in part on the broader social implications of increasing the costs for individual users. Political opposition can also block greater reliance on user fees, even when they would be appropriate.

In this report, we will refer to approaches incorporating user incentives, or demand, as "modern" approaches to infrastructure needs analysis. Modern approaches to infrastructure planning also include supply-side innovations that reduce the cost of service provision or improve capacity utilization (e.g., the use of electronic signals to relay drivers to less congested roads). Supply-side innovations also include more systematic attention to maintenance, the lack of which can lead to shortened asset life and more expensive repairs. For instance, "life-cycle costing," wherein budgets include the total costs of building, operating, and maintaining a capital asset over its useful life, can generate long-term cost savings and facilitate more stable revenues for maintenance.[4]

In recent years, there has also been greater attention devoted to achieving what economists call "economies of scope." The idea here is that tackling multiple objectives simultaneously can provide services at lower cost or generate a greater number of public benefits for a given cost. Some of these multipurpose, or "integrated" solutions are relatively narrow in range – for instance, moving away from single-purpose school facilities to joint-use facilities. In general, however, integrated approaches hinge on a more complex set of interactions, depending in part on the nature of land-use decisions. One common theme is the link between transportation investments, environmental benefits (especially air quality and open space), and the location of residential and business development. Such approaches are sometimes referred to under the rubric of "smart growth." Another emerging theme is the link between residential and commercial development, water supply, and water quality, under the heading "watershed management." Because they involve alternative land-use scenarios, integrated approaches incorporate private investment decisions in a much more direct manner than the conventional sector-specific approaches.

[4] Life-cycle costing is discussed in Neuman and Whittington (2000); Dowall and Whittington (2003); California Performance Review Commission (2004).

In our evaluation of infrastructure needs and tradeoffs, we will highlight the extent to which infrastructure planning has moved beyond the conventional approach toward these modern approaches, incorporating demand management, supply-side innovations, and economies of scope in service provision. This perspective allows us to go beyond the question posed at the outset. Instead of asking only whether we are spending enough to secure a sound economic future and quality of life, we can also ask whether we are making the most of the public resources that are available.

Sectors in the Spotlight

We address these issues by focusing on the three main areas in which California spends its public investment dollars: education (K-12 and postsecondary), water (supply and quality), and transportation (roads and transit). Together, these sectors represent over 85 percent of proposed state-level spending in the most recent five-year infrastructure plan (Table 1.1). In recent years, they have accounted for 60 percent combined state and local capital spending.

Table 1.1
2003 Infrastructure Plan: Proposed State Spending, 2003-04 to 2007-08
($ billions)

Program Area	Bond Funds	Special Funds	Federal Funds	General Fund	Other	Totals	Per year
Transportation	0.2	14.2	14.1	—	—	28.5	5.7
K-12 schools	10.4	—	—	—	—	10.4	2.08
Higher education	5.4	—	—	—	—	5.4	1.08
Water supply and quality	0.1	—	—	0.2	2.9	3.2	0.64
Natural resources/environmental protection	1.3	0.2	—	0.2	0.1	1.8	0.36
Public safety	0.6	0.2	—	0.3	—	1.1	0.22
Other	1.8	0.3	0.1	1.4	0.2	3.8	0.76
Totals	20.8	14.9	14.2	2.1	3.2	55.2	11.04

SOURCE: California Department of Finance (2003a).

Our focus on infrastructure needs and tradeoffs leads us to concentrate on capital investments – the long-term spending necessary to build and renew capacity to provide public services. The sectors we will examine differ considerably in the role of capital versus operating budgets. In 2002, the ratio of capital to current expenditures was 88 percent for highways versus only 6 percent for higher education (Table 1.2). Whereas facilities are an important issue for higher education, the challenges facing the system's ability to deliver on its social contract over the years to come depend more critically on the availability of operating funds. Both the level and the flexibility of operating funds is, similarly, a fundamental issue for the future of California's primary and secondary education system.

Table 1.2
Public Sector Capital Outlays, 2002

	Capital Spending ($ millions)	Sector Share in Total Capital Outlays	Share of Capital Spent at Local Level c/	Non-capital Spending ($ millions)	Capital to Current Spending Ratio
Higher education	1,224	0.04	0.44	19,152	0.06
Elementary & secondary education	7,021	0.22	1.00	46,181	0.15
Public welfare	162	0.01	0.98	35,397	0.00
Hospitals	761	0.02	0.50	10,638	0.07
Health	165	0.01	0.92	9,628	0.02
Highways a/	5,379	0.17	0.44	6,088	0.88
Police	337	0.01	0.87	9,837	0.03
Fire	187	0.01	1.00	3,944	0.05
Natural resources b/	3,004	0.09	0.72	6,756	0.44
Housing & community development	1,728	0.05	1.00	3,603	0.48
Sewerage d/	1,474	0.05	1.00	2,777	0.53
Sanitation	258	0.01	0.98	2,567	0.10
Water supply d/	2,525	0.08	1.00	6,219	0.41
Electric power	1224	0.04	1.00	13,012	0.09
Gas supply	10.271	0	1.00	84	0.12
Transit	1,346	0.04	1.00	5,276	0.26
Other a/	5,302	0.17	0.89	80,325	0.07
TOTAL	32,106	1.00	0.83	261,485	0.12

SOURCE: de Alth and Rueben (2005) using Census of Governments data.

NOTE: Spending is reported in current dollars.

a/ Highways include all public roadways. "Other" includes public spending on airports and ports.

b/ Natural resources includes some water-related activities (flood control and irrigation districts) as well as resource conservation and parks.

c/ Local spending share is the share of total capital spent by local governments and special districts, irrespective of the source of funding (i.e., it includes grants and transfers from state and federal authorities).

d/ Capital spending in these sectors is likely to be underreported, due to a change in reporting methods for special districts (see de Alth and Rueben, 2005).

The appropriateness of the modern approach to infrastructure planning, and particularly demand management, also varies considerably across these sectors. Because free primary and secondary education is a civil right, and school attendance a legal obligation, the discussions about demand management that have infused other sectors in recent years are not appropriate here. Analysts have instead focused on the potential for achieving supply

economies, through such measures as portable classrooms and multitrack schooling, which increase the throughput of students in a given facility. As we will see, these innovations have largely fallen flat, raising equity concerns without necessarily achieving the desired cost efficiencies.

For higher education, there is more scope for debate on the relative roles of the public and the individual in covering costs. Higher education is a choice, and individuals reap many of the benefits of this training through higher salaries. At the same time, there are wider social benefits from an educated workforce, and public subsidies may contribute to higher overall rates of training than would otherwise occur. The social contract embodied in California's Master Plan for Higher Education, adopted in 1960, guaranteed nearly free, universal access to community colleges, and low-fee access to four-year institutions (the University of California and California State University systems) for the top third of all high school graduates. The recent budget crisis, which led to a sharp student fee increase and a decline in student admissions, has underscored the importance of revisiting the premises of the Master Plan. What is the appropriate role for user fees and other incentives to encourage students to use the system efficiently? If California moves to a system relying more heavily on fees, will it provide the financial support for those students unable to afford the new regime?

California's water sector is currently in the throes of a paradigm shift in the way public investments are planned and paid for. Municipal water services have a strong tradition of direct user-fee finance. Many agricultural users have benefited from federally subsidized projects to develop water supplies. Since the 1980s, there has been a growing recognition, backed by court rulings and legislation, that both sectors have been taking too much water out of the system, at the expense of fish and wildlife habitat. Consequently, some water has been reallocated to instream uses, and environmentalists argue that there are still considerable unmet needs. The modern approach to water planning emphasizes the importance of demand management as a guiding principle for future water investments. In theory, water users have adopted this approach, by agreeing to a "beneficiary pays" principle, whereby users pay for those investments that benefit them directly, and tax dollars pay for public benefits, such as ecosystem restoration. In practice, implementing this policy is proving contentious, especially as public funds are in short supply. Without adequate public support to fund ecosystem restoration and watershed clean-up, California will need to develop mechanisms to ensure that those responsible for the damage (water users and water polluters) pay through user fees; the alternative will be failure to meet environmental goals.

With multiple objectives, including meeting air quality standards, providing mobility, relieving congestion, and providing access to low-income and disabled residents, transportation planning is arguably the most complex of the sectors we examine. Like water, transportation (and particularly highways) has a strong tradition of user fees, where demand management techniques are highly appropriate as long as they are mitigated for the poor. Unlike water, however, the link between user fees and investment has progressively eroded over the past 30 years, as receipts from the primary user fee (the gas tax) have declined and been replaced by other general funding sources, like county sales taxes. Public resistance to greater reliance on user fees presents a considerable obstacle to the adoption of demand management approaches. However, the potential benefits are considerable, especially in conjunction with supply-side innovations drawing on new technologies. Transportation

planning agencies are exploring these options in their modeling exercises, most recently with different land-use scenarios.

Organization of This Report

The core of the report consists of chapters providing an assessment of infrastructure needs and potential funding gaps for each of the targeted sectors, with a focus on the extent to which modern approaches have been successfully incorporated into the planning process. The chapters follow a common format, addressing the following points:

- Who assesses needs? Which agencies are involved in investment needs assessments for the sector, with what frequency, and to what time horizon?

- Indicators of need. What are the key non-financial indicators of service shortcomings within the sector, both now and as projected into the future? To what extent do these indicators reflect an assessment of demand, versus unconstrained needs?

- Financial needs and funding gaps. What is the magnitude of financial needs projected by the main scenarios, what methods are used to generate these scenarios, and how do the levels compare to recent and projected levels of capital spending? If there is a funding gap, are current funding mechanisms adequate for raising additional revenues?

- Alternative scenarios. What is the scope for cost savings or more efficient service delivery through introduction of demand management techniques or alternative supply technologies? What are the obstacles to introducing such alternatives?

A chapter then looks at integrated approaches to infrastructure investment, with a focus on smart growth strategies linking transportation and land use. The report ends with a concluding chapter summarizing major findings and highlighting areas for public discussion and debate.

Source Materials

For the analysis of infrastructure needs, our primary sources are reports by government agencies with implementation and oversight responsibilities, supplemented where relevant by studies by non-governmental groups. For the analysis of the funding gap, we compare these needs estimates with recent and projected expenditure levels, gathered for a companion report in this series entitled, Understanding Infrastructure Finance in California, by de Alth and Rueben (2005). Except where noted, the capital needs and expenditure data are reported net of any financing costs that may be incurred in the course of the associated investment projects.

K-12 Education

California's public education system for kindergarten through high school encompasses over 9,000 schools and over six million students, administered by over 1,000 local school districts (California Department of Education, 2004). School facilities were traditionally a local government responsibility, but the state government became an equal partner after Proposition 13 and other voter measures limited local ability to raise funds.[5] By the 1990s, providing adequate facilities became a major challenge as enrollments expanded steadily, older facilities deteriorated, and class size reduction reforms passed in 1996 increased the need for classroom space.

The California constitution guarantees residents equitable access to primary and secondary school. For this reason, demand management techniques are inappropriate for this sector, and modern approaches to needs assessment focus on containing costs, mobilizing resources, and ensuring their equitable distribution. By the early 2000s, a number of innovations were introduced in the system for financing school construction, including a more equitable system for allocating state funds and easier rules for passing local school bonds. Voters signaled a commitment to improving schools by passing substantial new bond funding at the state and local level, making enough funds available to meet much of the estimated backlog. Experiments with some cost-cutting measures have been less successful. Going forward, questions remain about the reliability of the current funding system, dependent on periodic bond finance, as well as the equity of a system that once again relies heavily on local revenues.

Who Assesses Needs?

The California Department of Finance assesses five-year investment needs as part of the state's Five Year Infrastructure Plan process. Using a somewhat different methodology, the California Department of Education also assesses five-year investment needs, using inputs from local school districts. (The differences are outlined below in the section "Fiscal Needs and Gaps.")

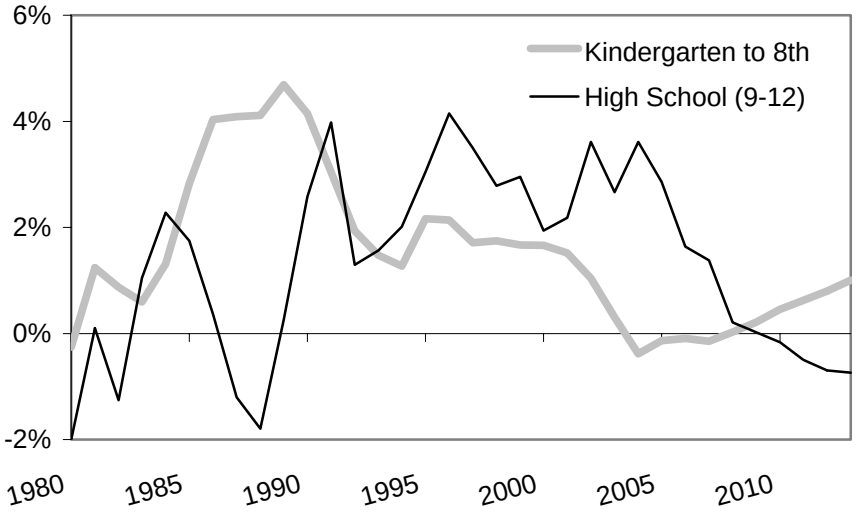
Indicators of Need

The primary driver of school facilities needs is growth of the school-aged population. California experienced high K-12 enrollment growth during the late 1980s and 1990s – generally more than 2 percent annually – placing considerable pressure on school facilities (Figure 2.1). A large part of the growth wave was attributable to the "baby boom echo," as children of baby boomers reached school age. Policies on class size are another driver. Pressure on facilities was

[5] Proposition 13, passed in 1978, limited property taxes – the main source for local school revenue -- to 1 percent of the assessed value of property, and limited growth in assessed value to 2 percent annually. One consequence was to eliminate the ability of local school districts to levy additional special property taxes to pay off debt for the construction of new school facilities through the mid-1980s. In the wake of Proposition 13, the state government took on a greater role in funding school operations and capital improvements. (See Cohen, 1999; Little Hoover Commission, 2000; Brunner and Rueben, 2001; Rueben and Cerdán, 2003.)

heightened in 1996 by passage of class size reduction policies that require no more than 20 children per classroom in grades K through 3.[6]

Figure 2.1
Annual K-12 Enrollment Growth in California
(Actual from 1980-81 to 2002-03, Projected from 2003-04 to 2013-14)



SOURCE: California Department of Education (2004b).

As the "baby boom echo" ages its way through the K-12 system, the high enrollment growth rates of recent years are expected to subside. Projected enrollment growth rates for high school age students will continue to rise until 2005-06 but then subside, even becoming negative by the end of the decade. K-8 enrollment growth, expected to be negative in the short term, is projected to begin climbing again by the end of the 2000s.

Table 2.1 shows the California Department of Education's five-year estimate of classroom space to be newly constructed or modernized from 2003 to 2008. It projects a need for new space to house nearly one million students. The demographic trends discussed above are evident in the figures; in the near term, high school classroom space is a priority, requiring nearly as many new classrooms as the K-6 cohort.

[6] Between 1996/97 and 1998/99, the state provided funding for over 24,000 "teaching stations" made necessary by class size reduction (http://www.cde.ca.gov/ls/cs/k3/facts.asp). See Betts Rueben, and Danenberg (2000) and Jepsen and Rivkin (2002) on the mechanics of class size reduction.

Table 2.1
Statewide Construction Needs for New Construction and Modernization of K-12 Public School Facilities, 2003 to 2008

	New Construction		Modernization	
Grade Level	Projected Unhoused Students	Classrooms Needed	Students in Classrooms over 25 Years Old	Classrooms to Be Modernized
K to 6	373,446	14,938	500,827	20,033
7 to 8	160,184	5,933	223,133	8,264
9 to 12	388,335	14,383	352,394	13,052
Total	921,965	35,253	1,076,354	41,349

SOURCE: California Department of Education (2004).

NOTE: Projected enrollment and facilities needs are from applications determined to be eligible for funding on file with the Office of Public School Construction as of December 10, 2003.

The Department of Education's estimates are based on information from the State Office of Public School Construction's School Facility Program, which provides 50 percent of new construction costs and 60 percent of modernization costs to local school districts that request assistance.[7] Local districts demonstrate eligibility based on existing and projected enrollment within the upcoming five-year period and standardized factors for classroom capacity and age of facilities.[8]

The enrollment projections depicted in Figure 2.1 suggest that the pressure for new facilities experienced in California during the 1990s and early 2000s will ease off somewhat in coming years. However, modernization needs also will become more prevalent as aging buildings deteriorate. The California Department of Education (2004) estimates that 73 percent of classrooms are more than 25 years old.

Although carefully modeled projections of enrollment growth are not available for the period after 2012, population projections provide an indication of expected trends. Figure 2.2 shows projected growth by age cohort from 2000 to 2025 from the California Department of

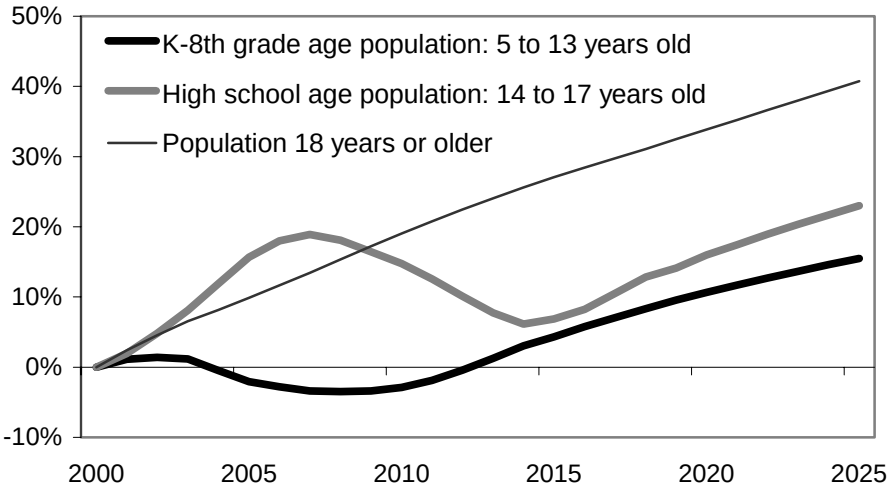
[7] Data on state apportionments and applications awaiting funding for construction and modernization grants are compiled and regularly updated in California Office of Public School Construction (various years).
[8] See California Office of Public School Construction/State Allocation Board (2004).

Finance. From 2011 onward, steady growth in the K-8 age group is expected, at about the same rate as the adult population. The growth rate among high school-aged children will pick up shortly afterward, and is expected to be slightly more rapid than for the other groups starting in 2016. Thus, by the 2010s policymakers will need to gear up again to provide adequate facilities for another wave of school-age children. Much of this growth will occur in inland areas – the Inland Empire, the San Joaquin Valley, and the Sacramento metropolitan region – where existing capacity is likely to be more limited (Johnson, 2005).

Financial Needs and Gaps

The current system for allocating funding reflects a number of recent changes designed to improve equity and increase the incentives for local districts to mobilize resources. Historically, state bond funds have tended to dry up before all demands for local assistance were met, and conflicts erupted over state rules governing eligibility and funding priority (Cohen, 1999).

Figure 2.2
Population Growth Projections by Age Group for California 2000-2025



Source: California Department of Finance (2004a).

The system was simplified in 1998, when voters approved a state bond measure with $6.7 billion for K-12 school facilities, and accompanying state legislation (SB 50) established a new process for allocating the funds. The state government would provide 50 percent of new construction costs and 80 percent of modernization costs (this was later reduced to 60 percent) for districts requesting assistance. State grants were standardized based on average cost factors for per pupil new construction and for modernization of classrooms over 25 years old (or portable classrooms over 20 years old). School impact fees – a major local funding source – were capped at $1.93 per square foot of new residential development (Herdt, 1998).

Continuing controversy over allocation of scarce funds resulted in modifications favoring overcrowded schools (Shigley, 2001). Voters passed two more state bonds in 2002 and 2004 (Propositions 47 and 55), providing $21.4 billion for K-12 facilities – more than the total in school bonds passed during the entire decade of the 1990s. About one-fifth of the funds were directed for "critically overcrowded" schools, mainly located in low-income, urban neighborhoods.[9]

A key reform to the local funding mechanism was the passage in 2000 of Proposition 39, which reduced voting requirements for local school bonds from a two-thirds majority to 55 percent approval in school board elections held concurrently with other state or local elections. The passage rate soared, with local voters approving $20.3 billion in bonds for K-12 facilities by November 2004 (de Alth and Rueben, 2005). Greater local resources relieve some pressure on the state to provide funding (one measure of hardship, preempting local fund match requirements, is inability to pass local bonds), but this will also induce more districts to apply for state matching funds for new projects.

The recent influx of bond funding has gone a long way toward addressing the backlog in school facilities needs, but a funding gap remains. The first column in Table 2.2 shows the Department of Education's five-year estimate of the state's financial obligation for facilities, corresponding to the classroom needs estimates in Table 2.1. Local school districts are responsible for providing nearly the same amount. The estimates reflect the cost of funding the backlog in approved, but unfunded, applications on file and those applications determined eligible for consideration but for which final allocations had not been determined.[10]

The second column in Table 2.2 shows the level of state funding *proposed* for approximately the same period by the California Department of Finance in *California's Five Year Infrastructure Plan 2003*, including the $10 billion in state bonds passed by voters in March 2004 and earlier bonds. These funds are also intended to cover the backlog in approved but unfunded applications, plus the average annual allocation for each type of project needed during the upcoming five-year period.[11] The funding proposal comes to less than two-thirds of the Department of Education's estimate of need. If we assume that the Department of Education's methods for assessing needs are broadly correct, this means that another $5 billion to $6 billion will be required to meet the state's share of eligible local projects.[12] Judging by the overall ratio of local to state bond funds over the past four years ($18.2 billion versus $21.4 billion, respectively), it is likely that a comparable effort will be needed at the local level as well.

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[9] For a description of the current program, see California Office of Public School Construction/State Allocation Board (2004). For a discussion of the overcrowding problem and other equity issues regarding school facilities finance, see Pastor and Reed (2005).

[10] Funding needs for this second group were estimated by multiplying projected enrollment counts by average state allocations per pupil from prior years.

[11] Technically, the Department of Finance proposal covers the backlog as of February 27, 2002, and the period from school year 2003-04 to 2007-08, whereas the Department of Education needs estimate covers the backlog as of December 10, 2003, and the period from 2003 to 2008.

[12] As new applications become eligible and state bonds are drawn down, this funding gap will increase.

Table 2.2
State Share of Funding Needs and Proposed Spending for New Construction and Modernization of K-12 Public School Facilities, 2003-04 to 2007-08 ($ billions)

	Dept. of Education: Projected	Dept. of Finance: Proposed
New Construction	$13.0	$4.6
Modernization	$3.9	$3.4
Hardship a/		$2.4
Total	$16.9	$10.4

SOURCES: California Department of Education (2004); California Department of Finance (2003a).

NOTE: a/The California Department of Education figures include hardship allocations.

Alternative Scenarios for Meeting Needs

A funding gap of this magnitude, despite a major capital influx, raises the question of whether further reforms can either reduce costs, provide a more stable source of funding, or both. In many areas, equity considerations are proving to be a guidepost to what may be feasible or socially desirable.

Cost-cutting Technologies and Management Reforms

As pressure on school facilities increased during the 1990s, proposals were advanced to reduce costs and make fuller use of existing facilities. These include use of lower-cost technology (portable classrooms in particular), a shift to multitrack schooling, and management or organizational reforms ranging from "life cycle" investing to establishing regional construction authorities.

Portable classroom use increased considerably with the introduction of class size reduction policies in 1996. In 2000-2001, almost one-third of the state's K-12 public school classrooms were portable.[13] Advantages of portable classrooms include their low initial cost, fast installation, and portability from school to school. These factors permit greater flexibility in meeting fluctuating enrollment levels. However, concerns have also been raised about their environmental effects (health, aesthetics, loss of playground space) and their durability and

[13] California Air Resources Board and California Department of Health Services (2003).

quality. As few if any districts have been able to decommission portables, their long-term cost-effectiveness is questioned because of higher maintenance and earlier replacement costs.[14]

Multitrack schooling is a system that staggers three or more tracks of students with different schedules throughout the calendar year, thereby increasing the facility's overall student capacity. Since the 1980s, the state has offered incentives to promote multitrack programs in schools with space constraints, and by 2002-2003, one-fifth (22 percent) of K-12 students in California were enrolled in these programs (California Department of Education, 2003). The approach has met with a number of criticisms, however. For one, it may complicate or even prevent other educational reforms such as extension of summer schooling. Additionally, some administrators argue that the multi-track schedules, which include more frequent disruptions than a regular school year, are detrimental for learning and for efforts to improve educational quality in low-performing districts (Little Hoover Commission, 2000).

The remaining cost-savings proposals are still on the drawing board. One proposal would imply an overhaul of the current incentive structure for local districts. The state's current 50-50 state-local partnership system was instituted in 1998 as part of a package of reforms (in SB 50) to simplify the system, enhance local control, and provide incentives for cost savings. The primary incentive is the 50-50 rule. School districts are required to pay 50 percent of construction costs to encourage judicious planning. But districts also are allowed to keep any of the state funds not spent on construction to discourage cost overruns. Some observers argue that although current incentives may help reduce initial costs, a better policy would reward projects that produce long-run savings over the life cycle of buildings in terms of maintenance, operation, and renewal costs in addition to construction costs.[15]

Another proposal argues that scale economies could be achieved by regionalizing the management structure for school facilities. By this line of thinking, the state's approximately 1,000 independent school districts, whose administrators focus only sporadically on construction projects, may not be the best entities to manage facilities construction and renewal. Mistakes are more likely to be repeated, innovations less likely to be transferred, and cost savings more difficult to achieve. New arrangements including joint powers authorities, regional administration, and public benefit corporations are advocated as potentially cost-effective alternatives. Similarly, some advocate consideration of joint-use facilities as a way of achieving economies of scope: Such facilities would enable a range of local agencies to provide a diverse set of services to the community (Metropolitan Forum Project, 1999).

Facilities Funding Reform

Given the unpredictable nature of state bond funding and recent conflicts over the way the state allocates and prioritizes scarce funding among districts, some analysts have called for a more complete overhaul of the school facilities financing system. For example, the California Legislative Analyst's Office (2001) recommends that the state provide capital facilities funding on an annual per pupil basis – similar to the way it funds school operating budgets – after a transition period in which districts are brought to a comparable starting point. This would

[14] California Air Resources Board and California Department of Health Services (2003); EdSource (1998).
[15] Most discussion in this paragraph and the next is based on Little Hoover Commission (2000).

require raising a new source of revenue, however. In recent years, voters have been far more willing to consider bond finance – which gets paid for out of the general fund – than tax increases.

Such a system could help overcome negative consequences of the state's current "boom and bust" approach to school facilities funding. As its stands, cost overruns may occur during periods of high construction demand (following passage of bond measures, for example).[16] Also, conflicts erupt over the criteria for prioritizing district applications because of concerns that bond funds will run dry before all needs are met. Such concerns led to the establishment of the Critically Overcrowded Schools Program, for example.

The Legislative Analyst's proposal also includes an ability-to-pay adjustment to address disparities in local school districts' capacity to raise matching funds. Factors including assessed property values, enrollment growth, and average household income within school districts are associated with substantial differences in per student facilities funding across the state (Rueben and Cerdán, 2003). Capital expenditures are not currently subject to the equity requirements established for school finance equalization. However, as part of a recent legal settlement the state has agreed to channel additional resources and attention to facilities in low-performing schools (Pastor and Reed, 2005).

Other questions about school funding relate to operational budgets, which usually outweigh capital expenditures by nine to one. California spends less per student than many other states, and because of our higher costs of living (requiring higher teacher salaries), these funds do not go as far. California also has relatively low levels of student performance. Performance is lowest in schools in low-income neighborhoods. On average, these schools now receive only a slightly higher share of operating funds from the state than other schools do (Rose et al., 2003). Raising student achievement in our public schools will be a complex task, and money alone will not solve it. However, new funds, creatively used, may need to be part of the solution.

[16] A school district supervisor in Ventura County recently reported that costs of new construction are coming in as high as twice their initial estimates, an increase he attributed to the high demand for specialized contractors and their relatively short supply.

Higher Education

California's system of public higher education is the largest in the nation, with over 2.3 million students enrolled (California Department of Finance, 2003b). It includes the ten campuses of the University of California (UC) system, the 23 campuses of the California State University (CSU) system, and the 109 campuses of the California Community College (CCC) system. The Master Plan for Higher Education, adopted in 1960, charted an ambitious vision for this system, with the promise of low-cost, universal access to all who could benefit from postsecondary education. The needs and policies of the system have been increasingly scrutinized in recent years, as declining state revenues, burgeoning enrollments, rising costs, and a growing backlog of deferred maintenance have raised concerns about how future students would be accommodated and how resources could be used most efficiently.

As is the case for K-12 education, facilities represent only a small share of the total budget in higher education, and many of the challenges now facing the system relate to operating budgets. But to the extent that facilities determine the ability to accommodate students and to provide a certain quality of education, they are a central point in considerations of the system's future.

Under the Master Plan's generous low-fee premise, facilities planning for higher education could proceed in parallel to the system for K-12 education, with population growth as a primary driver of enrollment potential. The financial challenges facing the system are now calling into question this premise, with more explicit consideration of using student fees as a way to raise funds and to manage demand. The modern approach to needs assessment also includes efforts to contain costs through more efficient capacity utilization and, possibly, through shifts in the composition of the three-tiered system, with a greater emphasis on the lower-cost community colleges as feeder schools for the universities. Such changes, while potentially positive, may fundamentally alter both access to and quality of the system. Californians will need to consider the tradeoffs as they revisit the Master Plan.

Who Assesses Needs?

Every year, the three main segments of the state's higher education system (CCC, CSU, and UC) submit five-year capital needs proposals to the Department of Finance (DOF) for inclusion in the state's five-year infrastructure plan. In addition, the California Postsecondary Education Commission (CPEC), responsible for monitoring and coordinating the system, periodically projects long-term needs. Independent agencies or groups, such as the California Legislative Analyst's Office and the California Education Roundtable, also sometimes conduct evaluations or critique existing ones.[17] However, as with K-12 education, projections of enrollment and facilities needs that extend more than ten years into the future are rare.

[17] Shires (1996); California Higher Education Policy Center (1996); Benjamin and Carroll (1997); California Legislative Analyst's Office (1998a); Hayward, et al. (1998).

Indicators of Need

The Master Plan defined the roles of the three segments and established admissions targets for each. The University of California, designated as the state's primary research and doctorate-granting institution, must offer admission to any California resident in the top one-eighth of the state's high school graduates. The California State University has a primary mission to educate through the master's degree level, with emphasis on technical and teaching degrees. CSU must offer admission to the top one-third of the state's high school graduates. The California Community Colleges, charged with providing academic, vocational, and remedial instruction at the lower division levels, must admit any student capable of benefiting from instruction. The Master Plan also established policies for transfers among these institutions. In particular, it encouraged the use of the CCCs as a transfer track to the four-year institutions as a way of containing costs (Barbour and Lewis, 2005). The enrollment goals for the UC system, correspondingly, include a 60:40 ratio between upper and lower division classes.

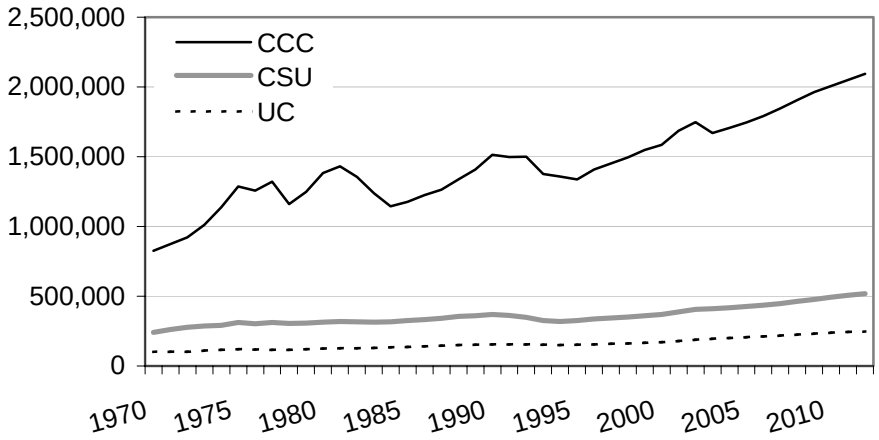
These policy guidelines historically have provided a stable framework for facilities planning, which generally has been based on projections of undergraduate enrollments pegged to K-12 enrollment counts, demographic factors, and college acceptance rates in the state, rather than being dependent on short-term fiscal or political considerations (California Higher Education Policy Center, 1996).

Recent projections signaled alarm about a "tidal wave" of new postsecondary enrollments during the 2000s. DOF expects a 26 percent increase in enrollment from 2003 to 2012, to a total of 2,859,206 students (Figure 3.1). This enrollment surge is explained mainly by two factors. The first, and most important, is the "baby boom echo" – the advancement to college age of the children of baby boomers (that cohort was also labeled a "tidal wave," and so their children are referred to as "Tidal Wave II"). The second factor is projected continuing improvement in college participation rates among 18 to 24 year olds. In 2000, CPEC estimated that 72 percent of the projected increase in number of students prepared to seek enrollment between 1998 and 2010 would reflect population growth and 28 percent the improved college participation rates among 18 to 24 year olds.[18] This implies improvements in participation for members of economically disadvantaged ethnic groups, and particularly Latinos, who are growing as a share of this age cohort.

Private colleges and universities also play an important role in educating Californians. In 1998, there were over 600 independent, non-public institutions in the state, the majority of which were vocational technical institutes. About 200 of these were degree-granting institutions headquartered in California; statewide, they accounted for 24 percent of all undergraduate enrollment at four-year institutions and 57 percent of graduate enrollment (Table 3.1).

[18] DOF and CPEC use different methods to derive enrollment projections, although both rely on estimates of age-cohort population growth rates, participation rates among various socioeconomic and racial/ethnic groups, labor market factors, and policy considerations. (See California Postsecondary Education Commission, 2000, for a comparison of the methods). CPEC's labor-intensive methodology has precluded annual calculation of estimates. See Hayward et al. (1998), for an independent review and comparison of methods used by different state agencies.

Figure 3.1
Public Higher Education Enrollment in California, 1970-2012



SOURCE: California Department of Finance (2003b).

Establishing reliable demand estimates for the independent degree-granting sector is difficult, because the schools are governed independently and because student demand has been more sensitive to changes in economic factors than has been the case in the public sector. Key determinants include net prices in the sector (relative to changes in personal income), the relationship between prices in the public and independent sectors, and the level of student assistance available.

Table 3.1 shows CPEC's estimates of enrollment demand growth from 1998 to 2010 for the 197 independent degree-granting institutions that participate in the federal student aid program as well as enrollment projections for the three public segments. CPEC applied current (late 1990s) and moderately higher participation rates to DOF's population projections by racial-ethnic category for the traditional undergraduate college-going age cohort (18 to 29) to derive the two scenarios for the independent sector. This sector is projected to constitute a larger share of graduate enrollment under both scenarios, but its undergraduate share may change slightly depending on participation rates.

These estimates are now slightly outdated. Calculated in 2000, they project enrollment by 2010 that is about 1 percent lower than DOF's most recent estimate for that year, released in late 2003 (and shown in Figure 3.1). DOF's estimate reflected new information on participation, which had reached a historic high in the fall of 2002. In June 2004, CPEC released updated projections that take these higher participation levels as a starting point and incorporate moderate further increases in participation out to 2013. In comparison to the earlier projections shown in Table 3.1, total undergraduate and graduate enrollment (including part-time students) in 2010 is expected to rise by an additional 4 percent, and the proportion of full-time students by 7 percent, for a net increase in full-time-equivalent (FTE) students of 12 percent.

Table 3.1
Projected Enrollment for Degree-Granting
Higher Education Institutions in California, 1998-2010

	Enrollment		Share of State Enrollment (Undergraduate or Graduate)		Pct. Change
	1998	2010	1998	2010	
Independent Degree-Granting Institutions: a/					
Scenario A: Current Participation Rates					
Undergraduate	176,832	220,060	9%	8%	24%
Graduate	146,705	182,244	57%	58%	24%
Total	323,537	402,304	14%	13%	24%
Scenario B: Moderately Increasing Participation Rate					
Undergraduate	176,832	248,143	9%	9%	40%
Graduate	146,705	205,501	57%	61%	40%
Total	323,537	453,644	14%	14%	40%
Public Institutions:			(Based on Scenario A above)		
CCC	1,475,000	2,003,918	71%	71%	36%
CSU					
Undergraduate	278,597	395,544	14%	14%	42%
Graduate	71,207	83,941	28%	27%	18%
UC					
Undergraduate	132,699	183,456	6%	7%	38%
Graduate	40,871	46268	16%	15%	13%
Total Public	1,998,374	2,713,127	86%	87%	36%
Undergraduate	1,886,296	2,582,918	91%	92%	37%
Graduate	112,078	130,209	43%	42%	16%

SOURCE: California Postsecondary Education Commission (2000).

NOTE: The enrollment figures are headcounts and include part-time students.

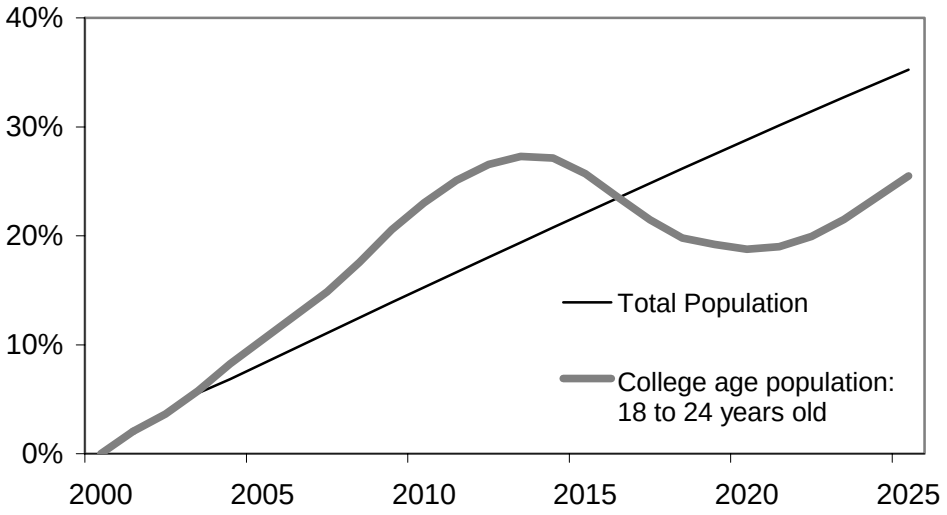
a/Data in the CPEC analysis are from 197 independent degree-granting schools that participate in Title IV Student Financial Aid.

From the standpoint of facilities needs, the increase in FTE is more significant than total enrollment, since it provides a better measure of the intensity of use. Applying standardized space criteria, CPEC estimated in 2000 that the UC system had reached its capacity limits, and that the CCC and CSU systems' remaining excess capacity would also be eliminated within a few years.[19] CPEC predicted a full-time-equivalent capacity shortfall for 344,000 students by 2010 without expansion or more efficient use. In its 2004 update, it adjusted this figure upwards, predicting a shortfall of space for over 686,000 students by 2013, equivalent to one-third of total full-time-equivalent enrollment across the segments. The increase is due mainly to

[19] The amount of space required is calculated based on projected enrollment, the allocation of space for different activities (known as "space standards"), and assumptions about facility use ("utilization standards," i.e., hours of the day and days of the week that the space is used).

the projected increase in enrollment, plus lower-than-expected space expansion in the early 2000s in the CCC and CSU system. Three-quarters of the space shortfall would be experienced by the CCCs and 19 percent by the CSUs. The UC's outlook actually improves in the updated projections thanks to expansion in the early 2000s. In 2000, CPEC also estimated that the state's independent colleges and universities might have capacity to add an additional 35,000 students between 1998 and 2010, clearly not enough to house the projected shortfall in the public system.

Figure 3.2
Projected Growth of California's College-age Population, 2000-2025



Source: California Department of Finance (2004a).

Carefully modeled projections of enrollments beyond 2013 are not available. However, DOF population projections provide an indication of expected trends (Figure 3.2). The presence of the Tidal Wave II generation comes through clearly in the shape of the graph. The college-age population is expected to grow more rapidly than the population as a whole until 2012. Most of the growth will be concentrated in a few counties in Southern California. Barring dramatic shifts in participation rates, the pressure on facilities should then subside as growth in the 18-to-24 year old age group declines and remains negative until 2021. Indeed, if facilities are expanded over the next decade to fully accommodate the projected increases in enrollment, some of California's postsecondary institutions may experience excess capacity between 2015 and 2025.

Financial Needs and Gaps

The assessments of new capacity needs presented above assume that the basic tenets of the Master Plan would be adhered to, in particular, guaranteed access for qualified candidates and low student fees. In its 2004 update, CPEC explicitly assumes that state funding, student fees, and course offerings return to levels observed during the economic boom years of 1996 to

2001. The early 1990s recession had taken a heavy toll on student enrollment, as reduced course offerings, higher fees, and a decline in incomes led to a decline in the demand for higher education. The drop in enrollment was greatest in the community colleges (Figure 3.1). By the early 2000s, higher education again faced a funding crisis, as the state government reeled from a budget deficit of historic proportions.

For the first time in roughly a decade, student fees were increased to help meet the funding shortfall. Between the fall of 2001 and the fall of 2004, undergraduate fees for a full academic year in the UC system were raised from $3,859 to $6,230 (61%), in the CSU system from $1,876 to $2,860 (52%) and in the CCC system from just under $13 to $26 per unit (105%, or for a 26 unit full-time course load, from $330 to $676).[20]

Student fee hikes and course cancellations led to an enrollment decline in the CCC system of about 90,000 students (about 5%) from the fall of 2002 to the fall of 2003. Given a projected growth rate for the same year of 5 percent, the CCC system argued that roughly 10 percent of potential students were "denied access," although the decline was considerably smaller (1.7%) in terms of full-time-equivalent students.[21] In 2004, proposed state budget cuts to UC and CSU would have reduced freshman enrollment by 10 percent. More than 7,000 eligible students were to be denied admission (diverted to community colleges, they were to be guaranteed transfers by junior year). Although funding for most of these diverted students was subsequently restored during state budget negotiations in the summer, this was the first such violation of the access tenets for UC of the state's Master Plan since it was passed in 1960. Continued uncertainties over the state's long-term budget situation leave open the possibility of further cuts or fee increases.

The CCC mission may be especially vulnerable to cuts in funding and student fee hikes. The proportion of students completing two-year terminal degrees has risen over time, and many members of Tidal Wave II will come from families of limited means. Funding cuts have been hardest on the least-prepared students at CCCs, who tend to be first-generation, low-income, and minority (Hayward et al., 2004). In addition, older working adults and students in more expensive vocational programs may have suffered from cuts in evening and weekend classes.

The recent cutbacks were the product of reduced operating budgets, not a lack of facilities. Although the UC system does face immediate capacity constraints on some campuses, space is available to accommodate students on other campuses. Even as operating budgets were cut, the outlook for higher education capital budgets actually improved substantially during the early 2000s, thanks to the passage of state and local bond measures. The two most recent state education bonds (Proposition 47, passed in November 2002, and Proposition 55, passed in March 2004) provided nearly $4 billion for higher education facilities. Like primary and secondary schools, community colleges have also benefited from the lower majority

[20] California Postsecondary Education Commission (2003b); University of California, Office of the President (2004); California State University (2004).

[21] California Legislative Analyst's Office (2004e). LAO also contends that about one-third of the decline was the result of legislative directive to reduce enrollment in low-priority physical education and other classes.

required on local bonds following the passage of Proposition 39 in November 2000. Since then, local bonds totaling about $9.1 billion have been passed for community college facilities.

How far these new funds will go in addressing the projected shortfalls in space depends on a number of factors, including assumptions about requirements for research facilities and institutions' ability to mobilize outside funds. It also depends on how one assesses costs for new instructional facilities for higher education. Although the legislature has imposed space and utilization standards on the segments, each segment uses its own method of cost estimation.

Table 3.2 presents an overview of four recent capital needs estimates for all facilities (including the full spectrum of maintenance and modernization needs, and including research): two self-reported estimates by the segments for inclusion in *California's 2003 Five Year Infrastructure Plan,*[22] and two estimates using CPEC's 2000 and 2004 ten-year enrollment projections. To allow for comparability, the data are presented in annualized form. The data reported by the segments show the annualized amounts requested as well as totals including amounts deferred to future years.[23]

The first CPEC column reports the results of a detailed cost assessment done in conjunction with the 2000 study of projected enrollment and facilities needs to 2010. Although this assessment is a few years older than *California's Five Year Infrastructure Plan for 2003*, it is still a useful benchmark, because it was intended to provide a more objective evaluation than the segments' own requests. CPEC used space standards and typical construction costs to arrive at expansion needs and applied a rule of thumb for maintenance, assuming that one-fortieth of existing inventory should be replaced or overhauled in any given year.[24] The second CPEC column reports our rough estimates of the cost implications of the June 2004 enrollment projections to 2013, which point to greater facilities shortfalls in the CCC and the CSU systems, and slightly lower future needs in the UC.[25] The update raises total annual costs from $1.5

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[22] The methods are described in California Department of Finance (2003a). The 2003 *Five Year Infrastructure Plan* questioned UC's procedure, noting, "the quantification of both space needs and resulting costs involve numerous assumptions that have not been validated" (p.108). The California Legislative Analyst's Office (2002a) also noted that UC's cost estimates for research space were high in comparison with estimates in other states.

[23] UC noted that its total annual estimate did not include the funding required to address a $500 million backlog of deferred maintenance in existing facilities. The CCC Board of Governors identified district needs of $13.8 billion for state supportable infrastructure (62 percent for modernization and 38 percent for new facilities) but requested only $6.6 billion over the next five years, deferring $7.2 billion to future years.

[24] California Postsecondary Education Commission (2000). Regarding maintenance, the report notes, "Unfortunately, there is no detailed analysis available of the condition of higher education's physical plant. While local administrators and planners have a general idea of individual campus renovation or replacement needs, there is no systematic, statewide compilation that can inform the estimate" (p. 91). However, advances in methods are under way. For example, UC has developed a comprehensive model that takes a "systems" approach, "deconstructing" a building into component systems that need to be renewed on a predictable schedule, and establishing life cycles and unit costs for renewing each component (California Department of Finance, 2003a).

[25] To calculate costs, we took each segment's per FTE cost for constructing new facilities to provide for enrollment growth from the 2000 CPEC estimates, and applied it to the new FTE capacity shortfall

billion to $2.1 billion, still 17 percent lower than the segments' own requests for funding, which were based on lower enrollment projections. The discrepancies are greatest for the CCC system.

The right-hand columns of the table present two estimates of available funding: the administration's proposed expenditures in the *Infrastructure Plan* and the cumulative amount of state and local bonds made available since 2001. The Department of Finance proposed to fund only two-fifths of the segments' request and only two-thirds of the CPEC estimates then available. The discrepancies were greatest for the UC, possibly reflecting the fact that a large share of UC capital funds is raised from non-state sources (California Postsecondary Education Commission, 2003a).

Given the continued state budget woes, these funding proposals – which include contributions from the general fund – are somewhat moot. It is therefore useful to assess how far the one sure source of public funding – the bond revenues – will go toward alleviating facilities needs. Table 3.3 summarizes the number of years of capital needs that could be met under the different needs scenarios, assuming the same share of capital outlay funds is contributed from non-state sources for UC and CSU as during the period from 1996-97 through 2000-01 (80 percent for UC, and 21 percent for CSU).[26] It also includes a scenario with lower non-state funding for UC.

The figures highlight the importance of non-state sources in meeting facilities expansion needs in the current era. With limited expectations of outside funding, the CSU system is in the worst position, with enough funds for just two to four years. At current outside funding levels, the UC system appears in relatively good shape, with adequate facilities funds for seven to nine years. This figure is more than halved, however, if outside funding falls from 80 to 50 percent of the total. Moreover, the ability of different campuses and programs to raise external funds varies widely. Older, established campuses and programs are better able to raise funds from alumni and donors, yet newer programs may face more pressing expansion needs. These mismatches could significantly alter the projection of adequate facilities funding.

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estimates. (Reported costs are $14,700 per FTE for CCC, $29,250 for CSU, and $73,500 for UC.) Because this estimate relies on CPEC costs per FTE for new construction, it may overstate costs, because some capacity expansion is possible through modernization and rehabilitation. In constructing our estimate, we carried over annualized maintenance costs from the 2000 CPEC estimate. This lowers the ratio of maintenance to total costs (for enrollment growth and maintenance) from 45 percent to 32 percent systemwide (30 percent for CSU, 24 percent for CCC, and 49 percent for UC). If the amount of maintenance increased in proportion to new construction in the CCC and CSU, this would add another $527 million in costs annually. In the segments' own requests, the ratio of maintenance to facilities expansion varied, ranging from 37 to 39 percent for the UC and the CCC, to 64 percent for the CSU. The higher CSU figure may reflect inclusion of deferred maintenance costs in the segment's request.

[26] The share of capital outlay funds contributed from non-state sources was calculated from data for the period from 1996-97 through 2000-01, from California Postsecondary Education Commission (2003a).

Table 3.2
Needs Estimates (Annualized) and Bond Revenues for California Higher Education
($ millions)

	Self-Reported Needs, 2003-07[1]		CPEC Needs Estimates		Funding Proposed/Available		
	Segment Request to DOF	Request Plus Reported Deferred Needs	1998-2010[2]	2003-2013[3]	DOF Proposed[1]	State Bonds Since 2001 (total)[4]	Local Bonds Since 2001 (total)[5]
UC	$670	$770	$618	$583	$335	$1,098	
CSU	$556	$556	$359	$550	$312	$1,186	
CCC	$1,329	$2,769	$526	$988	$427	$1,666	$9,100
Total	$2,555	$4,095	$1,503	$2,121	$1,074	$3,950	$9,100

SOURCES: 1) California Department of Finance (2003a); 2) California Postsecondary Education Commission (2000); 3) Authors' calculations based on California Postsecondary Education Commission (2004) (see footnote 25); 4) Proposition 47 passed in November 2002, and Proposition 55, passed in March 2004; 5) de Alth and Rueben (2005).

Table 3.3
Years of Capital Costs Covered by Public Bonds and Non-Public Sources

		Self-Reported Needs		CPEC Needs Estimates	
	Projected Share Non-Public Funds	Request to DOF	Request Plus Deferred Needs	2000-2010	2003-2013
UC (1)	80%	8.2	7.1	8.9	9.4
UC (2)	50%	3.3	2.9	3.6	3.8
CSU	21%	2.6	2.6	4.1	1.5
CCC	0%	8.1	3.9	20.5	10.9

SOURCE: Table 3.2.

Overall, the CCC's situation has improved dramatically with the passage of local bonds, which outnumber state bonds for this segment by five to one. Depending on whether future enrollment most closely matches the old or new projections (a factor mainly determined by state policy on fees and course offerings), funds are available to cover anywhere from 11 to 20 years under CPEC cost estimates. Even with the high enrollment scenario, this would potentially cover statewide facilities expansion throughout the period of projected enrollment growth to 2012. Some districts may still face challenges, however, because local bonds are not evenly

distributed across districts. The heavy reliance on local funding means that some communities may choose to offer their residents considerably more spacious and higher quality facilities than the standardized guidelines imply. This view is reinforced by the much higher needs estimates reported by the CCC itself, under which bond funding would be adequate for only four to eight years of investments.

The diversification of funding sources for higher education facilities can be viewed as a positive, entrepreneurial response to infrastructure finance challenges. However, this more decentralized approach to funding also raises the potential for "orphan" campuses and programs, which may provide valuable educational services, but which are less able to raise funds from private donors or the community. In this context, the state may need to play a more strategic role with the resources at its disposal.

Alternative Scenarios for Meeting Needs

These innovations in facilities finance notwithstanding, public higher education in California is at a crossroads. As CPEC noted in 2000, "If a second great surge of students is coming – and Commission analysis…shows clearly that Tidal Wave II is reality -- then business-as-usual will clearly be insufficient." Since the late 1990s, numerous reform proposals have been put forward to reestablish – or reinterpret – the social contract in the Master Plan.[27] Many proponents argue for the need to restore higher and more predictable levels of state funding from the general fund, which has been susceptible to cuts during periods of budget difficulties and has declined as a share of rising real per student costs. However, modern approaches recognizing the limits and tradeoffs involved in public funding are also increasingly common. As with K-12 education, this includes supply-side proposals to improve the system's productivity and cost-effectiveness. Unlike K-12, it also includes explicit consideration of demand management techniques. Some of these proposals have found fertile ground in today's revenue-constrained environment.

Demand Management Options

Well before the recent fee increases, a number of observers had begun to call for greater reliance on user fees.[28] Instituting a long-term policy of higher fees (or tuition) would influence demand for schooling and put a formal end the Master Plan's commitment to low-cost access. The justification for higher fees is that many students would be able to pay a greater share of the costs without undue hardship, thus providing a stable source of funding to the system. Higher fees may also relieve some pressure on enrollment demand in the public sector, by shifting some students to private institutions. By the same token, they can encourage students to finish their degree programs more quickly, thereby freeing up space for new students. (Currently,

[27] For summaries of major reports during the late 1990s, see Breneman (1998) and California Postsecondary Education Commission (1999). Also see Joint Legislative Committee to Develop a Master Plan for Education (2002).

[28] See California Postsecondary Education Commission (1995a and 1995b); California Higher Education Policy Center (1996); Benjamin and Carroll (1997); California Education Roundtable (1998); California Citizens Commission on Higher Education (1999); Joint Legislative Committee to Develop a Master Plan for Education (2002); Dowall and Whittington (2003). Regarding a more predictable approach to fee increases, see California Legislative Analyst's Office (2004a).

four-year degrees typically take five and a half years in the CSU system, for instance).[29] Some observers also advocate varying fees (or prioritizing access) according to the level of education, training, and profession, and to encourage more rapid graduation rates.[30] In order not to limit access, a program to raise fees must be accompanied by increased financial aid for needy students. In spite of the hefty fee increases in recent years, fees for California schools remain low compared with fees in counterpart schools in other states.[31]

Performance and accountability standards are another type of incentive for both learners and institutions. For example, state aid might be geared toward demonstrated achievement of performance goals such as rapid time-to-degree. Such incentives could encourage institutions to facilitate more streamlined course loads for students.

Options for Greater Cost-Efficiencies

However, fee increases alone may not be enough to solve the system's problems. One study determined that to maintain historic levels of access into the next decade, California would need to increase fees well beyond levels envisioned in current debates, unless the system is made far more productive in its use of resources.[32] Proposals for greater cost-effectiveness include providing incentives or mandates for more efficient use of space and other fixed resources, reallocating students from high-cost to lower-cost institutions, realizing economies of scope through regional linkages, and introducing new technologies.

In the area of space utilization, one much-discussed option is to extend summer sessions or even institute full year-round operations. One study by the California Legislative Analyst's Office (1999) suggests that operating year round could increase the number of students accommodated with existing facilities by up to one-third, saving several billions of dollars. These estimates may be overstated, however, because summer usage saves mainly on classroom space, not general space, and may require the hiring of additional faculty with new office and

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[29] Average time to degree in the CSU system is 5.5 years for freshmen and 3.5 years for transfers (California State University, Office of the Chancellor, 2003). In the UC system, the comparable figures are 4.2 years for freshmen and 2.4 years for upper-division transfers from CCCs (University of California, Office of the President, 2003).

[30] California Postsecondary Education Commission (1995b); Benjamin and Carroll (1997); Dowall and Whittington (2003).

[31] According to the California Legislative Analyst's Office (2004a), "In the current year, total UC undergraduate and graduate fees are 20 percent less and 25 percent less, respectively, than the average fees charged by its four public comparison institutions. Total CSU undergraduate and graduate fees are less than half the average fees at its 15 public comparison institutions. Fees at CCC are the most anomalous. The current level of $18 per unit is the lowest in the nation and roughly one-fourth of the national average. Furthermore, students currently are paying a small share of their total education costs. In 2003-04, UC, CSU, and CCC students are paying only 26 percent, 17 percent, and 12 percent, respectively, of their total education costs." After counting the fee hikes established in FY 2004-05, UC undergraduate fees were still 10% below the average fees charged by peer institutions, and CSU fees were 85% below the average.

[32] Park and Lempert (1998). The study found that only with a tripling of fees from levels of the mid-1990s – and only if price sensitivity of students' enrollment decisions is lower than currently estimated in the academic literature – could historic levels of access be preserved to 2014. If price sensitivity is the same or greater than current estimates suggest, fee increases would not make up for adverse funding trends.

research space needs. Year-round operation has been phased in slowly at some UC and CSU campuses. With the exception of a handful of campuses with recognized space constraints, the state provides only very limited support for summer enrollment.[33] Elsewhere, students are generally charged much higher fees. Nor have financial aid programs been restructured to accommodate summer programs. For example, Pell Grants cap aid per year, providing no incentive for accelerated schedules. In this context, many students will pursue summer work instead of schooling.

The call for summer programs is part of a more general push for improved space and utilization standards. The California Legislative Analyst's Office (2002a) has argued, for instance, that some UC campuses do not utilize their classroom space efficiently (CCC and CSU do not report the actual utilization of their classrooms and laboratories, precluding a comparable analysis for these systems). Many administrators also believe that the decades-old space standards should be overhauled. The CSU Chancellor's Office has developed a new process termed "ASF per FTE" (Assignable Square Feet per Full Time Equivalent student). This operates on the principle that space should not be measured solely by activity in on-site classrooms and teaching labs, but across the entire campus, providing a greater incentive for space conservation and sharing (California Postsecondary Education Commission, 2000; Dowall and Whittington, 2003).

The issue of research space has been the subject of recent debate. Estimates of facilities needs for research activities are not directly linked to enrollment projections. At UC, the state's primary research institution, research space was expanded at almost double the rate for instructional space (including laboratories) over the past decade; it now exceeds instructional space by a factor of four to one (California Legislative Analyst's Office, 2004f). The UC has relatively generous space standards for research in comparison with peer universities nationally (about 80 percent of academic space, versus roughly half elsewhere). For the same square footage, research facilities are about twice as expensive to construct as classrooms. The policy debates center less on the costs or standards for these facilities, however, than on the appropriate role of the state in funding them. Arguments in favor of state sponsorship stress the role that research facilities play in the quality of graduate instruction and in the contribution to the regional economy. The Legislative Analyst has taken the position that UC has the potential to fund these facilities through sponsored research, a practice on which it has already embarked.

New facilities management techniques also are advocated to cut costs. For example, a technique implemented for many years by the UC system – design-build contracts – has been advocated for the other higher education segments as well as other state infrastructure sectors (Neuman and Whittington, 2000; California Performance Review Commission, 2004). In design-build, project design and construction occur under one contract, removing an entire bid cycle from the planning process. The CSU system also recently implemented a new capital outlay management process considered a worthy model, under which capital planning has been largely decentralized to campuses and funding made more flexible. At the same time, new accountability measures were instituted for materials cost standards, financial record-keeping,

[33] Fully funded programs within the UC system, this includes Berkeley, Los Angeles, Santa Barbara, and Davis, all of which are close to or at their Long-Range Development Plan population limits. Elsewhere, the state provides only "marginal costs."

certification of project compliance, and performance review. The new process has shortened project delivery cycles by as much as 2.5 years and saved the system millions of dollars each year (Dowall and Whittington, 2003).

In another vein, cost-cutting is advocated through a greater emphasis on CCCs as a feeder institution to the UC and CSU systems. The far lower costs of a CCC education make this a potentially attractive way of cutting costs.[34] Such a shift would probably require altering the admissions criteria in the Master Plan, since most UC- and CSU-eligible students are unlikely to want to voluntarily shift to the community colleges, at least at current prices. To wit, opposition to the administration's budget proposal for 2004-05, which would have diverted thousands of eligible UC and CSU students to the CCCs, led to a reinstatement of places at the four-year institutions.

The proposals that would help achieve economies of scope include greater intra-regional coordination among educational institutions and more joint use of space. Improved linkages to the K–12 system offer the potential for better student preparation for postsecondary education, and more streamlined movement of students through the system. Finally, technological solutions also have been advanced, such as distance-learning technology.

Policy Tradeoffs

To be successful, many of the reforms proposed in the name of cost savings may require additional financial contributions from the state or other sources. Year-round enrollment, for example, may be feasible only if the state provides full financial support. Technological upgrading would require expensive up-front investments even as it promises long-run savings. Furthermore, efforts to reduce the state's financial contribution to higher education, by increasing fees or compressing costs, necessarily involves tradeoffs. The economic rationale for public support to higher education is that the benefits to society of an educated workforce outweigh the benefits for individual students. Attempts to reduce public costs may provoke concerns about loss of quality as well as equity. For instance, diverting some students to CCCs may permit cost savings, but those institutions may also provide a lower-quality education. Raising fees without adequate financial aid will reduce access for those groups least able to afford a higher education.

These choices have consequences not only for individuals but also for the economic health of the state as a whole. In today's more global, competitive, and high-tech-oriented economy, higher education is increasingly the ticket needed to obtain the best jobs. Indeed, economic projections for California predict the greatest job growth in sectors that are relatively skill-intensive, such as business and professional services, education, and health care (Neumark, 2005). Thus, Californians will need to consider the potential costs of not pursuing policies to ensure greater access, quality, and affordability – the major elements enshrined in the Master Plan.

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[34] CPEC estimates that the marginal instructional cost to the state per FTE student is $4,367 for CCC, $8,956 for CSU, and $10,812 for UC (California Postsecondary Education Commission, 2004). For 2003-04, the state provided UC with $9,030 for each additional full-time-equivalent student, compared to $6,594 at CSU and about $4,132 at CCC (California Legislative Analyst's Office, 2004d.)

Water Supply and Quality

California's water resources are expected to meet multiple, potentially competing, objectives: safe, reliable, and affordable drinking water supplies for the growing residential population; reliable, low-cost supplies for water-dependent agricultural and industrial businesses; and clean and adequate supplies to ensure the health of the state's waterways, lakes, and beaches and the wildlife and recreational activities that depend on them.

As we enter the 21st century, there is a general recognition that meeting these objectives has become more challenging and, in all likelihood, more costly. In the last century, the dominant mode for harnessing water supply in California and other western states was through construction of large surface storage and conveyance systems. Environmental and financial considerations have made this option less viable. In today's growing communities, water managers explore a range of options for increasing supply, including tapping non-traditional sources and using existing ones more efficiently. Environmental and public health concerns have also raised the bar for water quality management. Federal and state standards apply to the purity of potable water supplies ("drinking water") and to the control of pollutants entering water bodies ("clean water"). Standards in both areas have been increasing as the science for detecting contaminants improves and as new evidence emerges about the role of some pollutants on water quality. Improving water quality is now often a key to increasing water supply.

Although state and federal agencies play a role in all aspects of water management, the frontline institutions are local utilities and governments. Retail water utilities – a mix of special districts, municipal departments, and private companies – are responsible for meeting drinking water standards; they also have primary responsibility for mobilizing new supplies for residential growth, in many cases together with regional or countywide water wholesalers. Roughly 400 large retailers (population > 10,000) serve most California homes and businesses; over 8,000 additional systems deliver water to smaller communities and public facilities such as parks. Nearly 600 local wastewater utilities – many of which double as water retailers – are responsible for meeting the clean water standards for municipal wastewater discharge, the primary fixed or "point" source of water pollution in California. Over the past decade, municipal and county governments have progressively become responsible for managing a key form of diffused or "non-point" source pollution – stormwater runoff. Finally, hundreds of agricultural water districts manage the water resources for California's farmers. Because they deliver "raw" (untreated) water, they are not subject to drinking water standards, but they are increasingly being targeted to manage agricultural runoff, the other main non-point pollution source. Because agriculture uses about four times more water than all municipal and industrial uses combined, these districts are also key players in the discussions about statewide supply policies.

The water sector provides many examples of modern approaches to investment planning. User fees have traditionally been the main source of investment funds for municipal water utilities, and demand management techniques are now a core strategy for both municipal and agricultural users. There is also considerable attention to achieving economies through

innovations on the supply side, and water users are at the forefront in experimenting with integrated solutions to simultaneously resolve quality and supply problems.

However, major debates remain on the appropriate role of public subsidies versus user fees. California also has a tradition of periodic, substantial subsidies in the water sector, particularly from federal sources. Federal contributions were integral to the development of water storage projects for irrigation in the early to mid 20th century.[35] In the 1970s and 1980s, federal grants provided up to 90 percent of the costs for upgrading wastewater facilities to meet the standards of the Clean Water Act, passed in 1972.

With federal funds now less available, the sector has to face the question of how to pay for water for the environment. This includes not only the additional water quality improvements called for under the Clean Water Act, such as managing urban and agricultural runoff; it also includes new supplies for the environment. Since the 1980s, there has been a growing recognition, backed by court rulings and legislation, that water projects had taken too much out of the system, at the expense of fish and wildlife. Some water has been reallocated to instream uses, and environmentalists argue that there are still considerable unmet needs. As we discuss below, it is possible to make compelling arguments for public subsidies to support these environmental goals but also to argue that water users and water polluters should contribute to the costs.

Rising costs to meet public health and environmental goals have also led to call for taxpayer support to local utilities on equity grounds. Subsidies for low-income households are one way to limit potentially negative equity effects of demand management policies such as user fees. As we will see, however, water and wastewater fees in most California communities are still quite low, suggesting that the need for subsidies is quite limited.

Who Assesses Needs?

For water supply, statutory obligations exist for needs assessment at the state and local level. Every five years, the Department of Water Resources (DWR) prepares an update of the California Water Plan (Bulletin 160), which examines supply and demand conditions 20 to 25 years into the future. Since 1985, all retail and wholesale water utilities serving at least 3,000 customers or delivering at least 3,000 acre-feet of water annually have been required to submit Urban Water Management Plans to DWR at five-year intervals, including 20-year projections of supply and demand and means of addressing projected shortfalls. Although the horizon and the frequency mirror the state efforts, there are no direct links to the California Water Plan. Many utilities engage in other planning exercises, notably by developing water master plans.

For water quality, the statutory requirements ensure more direct linkages between local and statewide needs assessments. Every four years since the mid-1990s, all large drinking water utilities (population > 50,000) and a sample of medium-sized utilities (> 10,000) have been required to submit an assessment of 20-year capital investment needs to the state Department of Health Services (DHS), which in turn submits the survey to the federal Environmental

[35] By contrast, the State Water Project is not a subsidized project; the state facilitated the investment by floating the necessary bonds, but project contractors (municipal and agricultural utilities) are required to cover all costs. (In Kern County, agricultural users are subsidized locally through the sales tax).

Protection Agency (EPA). EPA uses this data to document drinking water infrastructure needs for each state and for the nation. A comparable exercise is conducted for investment needs of wastewater utilities. The most recent survey (2000) also includes some storm-water-related costs. In this case, the responsible state-level agency is the State Water Resources Control Board (SWRCB).

Since the mid-1990s, a multiagency, federal-state partnership known as CALFED has also been a major player in needs assessment. The objective of the CALFED program is to restore the health of the San Francisco-San Joaquin Bay Delta ecosystems, while improving the quality and reliability of supplies for the state's municipal and agricultural water users. Economic and technical analyses done as part of the CALFED effort are a major input into the most recent update of the California Water Plan (Bulletin 160-04), which began in 2001 and will not be finalized until 2005. In contrast to past water plan updates, the preparation of Bulletin 160-04 has involved a great deal of participation by water user and environmental groups and outside analysts. It has also aimed to look at the problem of water resource management in an integrated manner, taking into account potential benefits of different supply strategies in terms of water quality and aquatic wildlife habitat as well as benefits to municipal and agricultural users.

Indicators of Need

Water Supply

California's *water supply* concerns arise because urban demand is growing, traditional supply sources are shrinking, and some sectors are perceived to have unmet needs. In a conventional approach to water supply planning – without demand management – this could imply the need for vast new quantities of water, as can be seen in the following extrapolation exercise, labeled as the "extreme scenario" in Table 4.1. In 2000, a year of "average" or "normal" rainfall, per capita municipal and industrial water use (a category including commercial landscaping but excluding agriculture) was 232 gallons per day, or just over one-quarter acre-foot per year. At this level of per capita consumption, and with a projected population increase of 14 million inhabitants, municipal use would expand by 3.6 million acre-feet between 2000 and 2030, or roughly 120,000 acre-feet per year.

Since the early 1990s, agricultural users have experienced forced supply reductions of over 1 million acre-feet to increase instream flows available for endangered or threatened fish and wildlife.[36] Part of the commitment to the agricultural community under the CALFED process has been no further involuntary cutbacks to support this goal. Despite these measures, environmental groups estimate that another 0.5 to 1 million acre-feet are needed just to meet current regulatory protections. Meanwhile, between now and 2015, California will have to reduce use of Colorado River supplies by about 0.8 million acre-feet, an amount other basin states are reclaiming to support their own population growth. Groundwater basins are being

[36] Although precise estimates of these reallocations to the environment are unavailable, affected water users often cite a total of 2 million acre-feet. Reallocations include up to 1.2 million acre-feet under the 1992 Central Valley Improvement Act and additional flows as part of the 1995 Bay-Delta Water Quality Control Plan. The City of Los Angeles has also reduced its use of groundwater from the southeastern Sierras by about 130,000 acre-feet to mitigate damage to Mono Lake and the Owens Lakebed.

overdrafted on the order of 1 to 2 million acre-feet per year, and the California Water Plan has set a goal of eliminating this practice.

If California were to meet environmental flow requirements, accommodate population growth with existing levels of per capita use, maintain agricultural water use at current levels, replace Colorado River supplies, and restore groundwater use to sustainable levels of pumping, this would require increasing supplies from other sources by 5.9 to 7.4 million acre-feet by 2030, an increase of 7 to 9 percent over 2000 levels.

However, this extreme scenario overstates new supply needs by a considerable amount. For one, California's residential water users can still make large savings through conservation practices. Utilities encourage conservation with price techniques (such as increasing block rates, which charge higher prices for higher levels of use) and non-price techniques (such as education programs). Changes in plumbing codes also mean that new homes, which will accommodate population growth, use more water-efficient appliances. By one recent estimate, if utilities simply continue to implement conservation programs they have already agreed to, average per capita use will fall by nearly 5 percent, implying a drop of 0.5 million acre-feet in new demand compared to the alarmist scenario.[37] We have included this amount in the "moderate scenario" in Table 4.1. In fact, further conservation gains are likely.

Table 4.1
Current and Projected Water Use, Two Scenarios
(millions of acre-feet)

	Use in 2000	Net change to 2030	
		Extreme Scenario	Moderate Scenario
Municipal	8.9	3.6	3.1
Agriculture	34.3	0.0	-3.2
Environment	39.4	0.5–1.0	0.5–1.0
Total use	82.5		
Colorado River surplus	0.8	0.8	0.8
Groundwater overdraft	1.0–2.0	1.0–2.0	1.0–2.0
Total "new" water needed		5.9–7.4	2.2–3.7

SOURCES: 2000 use levels are from California Department of Water Resources (2004a), statewide water use balances. "Extreme" and "moderate scenarios were calculated by the authors using information from this source (see the text) and California Department of Water Resources (2004b).

Economic factors are also likely to reduce agricultural water use. Every year, some farmers sell land for new housing developments. Farmers also have been increasing

[37] This estimate corresponds to the draft Water Plan's "current trends" scenario.

agricultural water use efficiency as they shift to higher value crops. In the moderate scenario, we have assumed a 9 percent reduction in overall agricultural use by 2030. This is more conservative than some projections, which anticipate a decline by as much as 11 percent based on current trends.[38] Water no longer used by agriculture provides the opportunity for transfers to urban and environmental users, reinforcing a trend in water marketing that got under way in the early 1990s (Hanak, 2003). Unused agricultural water can also contribute to reducing groundwater overdraft.

Taken together, these changes in urban and agricultural water use levels – based on fairly conservative assumptions – considerably alter the outlook, more than halving the amount of new supplies needed. As we will see, numerous supply options are available to fill the remaining gap.

Beyond the simple calculus of supply and demand under "business as usual" scenarios, two supply issues that have recently come to the fore suggest the need for new strategies. One of these is the role of the fragile San Francisco-San Joaquin Delta, the hub for sending water from Northern California to points south. The levees, mostly earthen structures, are seismically vulnerable, and their failure could jeopardize drinking water supplies for Southern California and irrigation supplies in the San Joaquin Valley for months, if not years. A levee break in June 2004 has renewed debates on the best strategies for tackling this problem. Some analysts argue that propping up the levee system is an unsustainable strategy, and they call for reconsideration of the decades-old plan to sidestep the Delta with a peripheral canal (Leavenworth, 2004).

The second issue is global warming. Climate forecasts suggest that the effects of global warming on California's water supply will not begin to be felt until somewhat later in the century – beyond 2030. Under some scenarios, California's usable water supply could then decline by nearly 30 percent by 2100. Such shifts will clearly need to be accommodated with changes in management strategies for water storage, but it is not apparent that they will entail a water crisis for the state. According to one modeling exercise, water transfers from agriculture to urban areas could largely alleviate these shortages, without significant economic harm to the agricultural sector (Lund et al., 2003).

Water Quality

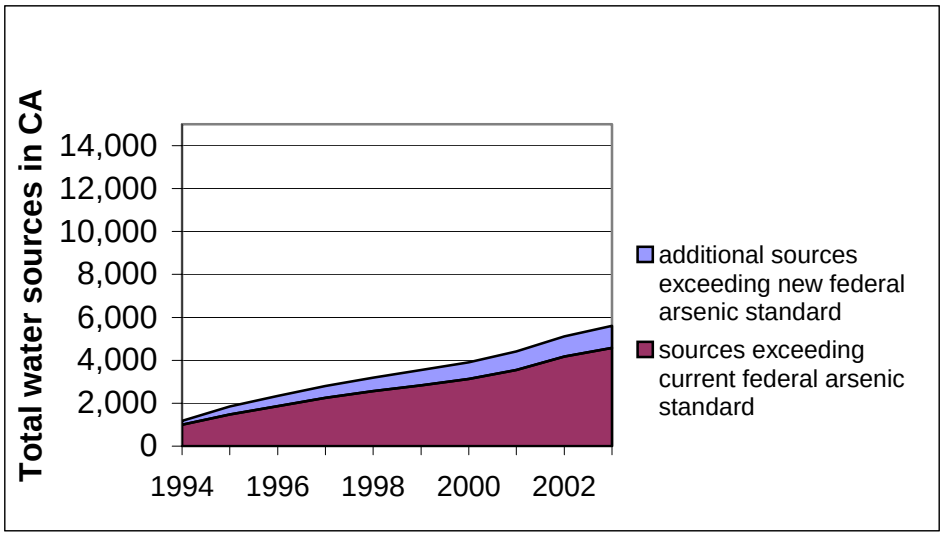
California faces *water quality* concerns with respect to the provision of safe drinking water and the protection of the state's many water bodies and long coastline. For drinking water, which must meet strict regulatory standards for certain contaminants, the problem of source contamination appears to be growing.

Figure 4.1 shows the cumulative number of drinking water sources (groundwater and surface water) that exceeded the maximum contaminants level (MCL) for regulated chemicals since 1994. By 2003, 4,578 sources, or nearly one-third of the state's 15,000 sources, exceeded these MCLs at the current federal standards of 50 µg/L for arsenic, a naturally occurring

[38] The draft Water Plan's "current trend" analysis projects a drop in use by 3.9 million acre-feet, on the assumption of a 10 percent reduction in irrigated crop area and continued gains in agricultural water use efficiency. In Table 4.1, we have included the plan's "resource sustainable" scenario, which assumes some increased multicropping.

contaminant. Over 1,000 additional sources will exceed the revised federal arsenic standard – five times stricter (10 µg/L) – that takes effect in 2006. This number would skyrocket under the even stricter standards California is considering.[39] Figure 4.1 does not include some of the new contaminants for which there are not yet regulatory standards, such as perchlorate, a potentially dangerous chemical found in rocket fuels that has now been found in 563 drinking water wells at 12 locations in the state.[40] Nor does it include cases of microbial contamination, which are considered to present the most acute public health risks. In 2004, drinking water systems reported over 400 investment projects, valued at over $1 billion, to address these risks (California Department of Health Services, 2004a).

Figure 4.1
Drinking Water Sources with a Chemical Contaminant



SOURCE: California Department of Health Services (2004c).

NOTE: The series shows the first year an MCL excedence was reported for a particular source.

Although regulators do have some scope for weighing the costs and benefits, drinking water regulations are chosen to minimize public health risks. Utilities are required to meet these standards, through treatment where possible, and in extreme cases by ceasing to use contaminated sources. Research continues to develop more effective technologies to remove harmful substances, but there is little question that the cost of meeting these standards is rising. Preliminary DHS estimates suggest that the total annual costs for arsenic removal will range

[39] DHS monitoring data from 2000 – 2002 revealed only 70 sources (46 systems in 20 counties) exceeding the 50 µg/L limit; 616 sources (314 systems in 42 counties) exceeding the 10 µg/L limit, and 3,309 sources (1,182 systems in 56 counties) exceeding 2 µg/L, the lowest level among options DHS is now considering for the new MCL. Because of risks of lung and bladder cancer associated with arsenic, the state has set a public health goal of no more than 0.004 µg/L of arsenic in water, but 2 µg/L is the lowest level at which detection is reliable (California Department of Health Services, 2004b)

[40] State Water Resources Control Board and Department of Toxic Substances Control (2004).

from $186 million under the new federal standards, to as much as $1.2 billion under the most stringent state-level regulations being considered.[41] (In light of this finding, it is likely that a less stringent standard will be chosen). Estimated costs of cleaning up contaminants like MTBE (a gasoline additive) and perchlorate lie in the tens to hundreds of millions of dollars for individual groundwater basins. In some cases – as with arsenic – these clean-ups will be necessary just to continue using existing supply sources. However, some other clean-ups involve groundwater basins that are still in reserve and will make new supplies available.

Available data on the quality of water in our rivers, estuaries, lakes and streams does not lend itself to making comparable assessments of trends. Table 4.2 summarizes the most recent statewide inventory of which water bodies are "impaired" or threatened with impairment. Impairment is the state when a water body is too polluted to support one or more designated purposes, such as wildlife habitat or certain recreational activities. Although these assessments do not cover all water bodies – for instance, they cover just over 20 percent of the coastline and 15 percent of rivers and streams – they provide evidence of widespread problems. Fish consumption advisories were in effect for 18 percent of California's lake area in 2002, and there were 437 beach day closures, mostly in Southern California.

Early strategies to remedy these problems targeted point sources, leading to massive investments to upgrade wastewater treatment capacity in the decade or so following the passage of the Clean Water Act. The attention shifted to non-point sources in the late 1980s and early 1990s, initially for construction activities and urban runoff in large municipalities (> 100,000 persons), and since 2003 for runoff from smaller communities (> 50,000).[42] Recent rulings have also increased the number of construction projects covered, set limits on post-construction runoff from new development, and strengthened the requirements for the state Department of Transportation (Caltrans) to manage harmful runoff from the state's highway system.

In contrast to drinking water programs, clean water regulations focused, until recently, on the promotion of technology and management practices designed to improve water quality, without imposing quantitative limits on the discharge of specific pollutants. Since 2000, regulators have begun to address impairment by introducing such limits – known as total maximum daily loads (TMDLs) – for pollutants in "listed" water bodies (listing occurs when a body is designated as impaired) (Table 4.2). TMDLs can address a wide range of problems – chemicals, bio-hazards, sediment, trash, even temperature – alone or in combination. At present, California's regulators have a goal to establish nearly 400 TMDLs, of which roughly two dozen are complete. Although there are debates on the magnitudes, there is no question that TMDLs will increase the cost of managing water quality for local utilities and governments.

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[41] Estimates provided by DHS, August 2, 2004 (unpublished). A considerable portion of these costs concern the disposal of toxic residuals. The greatest cost increment occurs in moving from a 4µg/L limit down to 2 µg/L.

[42] Because these programs involve the issuance of stormwater permits under the National Pollution Discharge Emission System (NPDES), urban runoff is legally identified as a point source, despite its non-point character.

Table 4.2
Impaired, Threatened, and Listed Water Bodies, 2002

	Impaired Area	Threatened Area	Total Bodies Listed	Listed Area
Bays and harbors (acres)	459,881	11,219	43	456,338
Coastal shoreline (miles)	160	0	97	119
Estuaries (acres)	102,118	1,322	36	99,857
Groundwater (sq. miles)	22,971	2,429		
Lakes/reservoirs (acres)	361,128	106,445	68	255,465
Rivers/streams (miles)	27,449	3,602	430	26,545
Saline lakes (acres)	480,585	0	3	291,761
Wetlands, freshwater (acres)	104,110	996	4	73,598
Wetlands, tidal (acres)	80,592	3	4	66,672

SOURCES: Impaired and threatened bodies: State Water Resources Control Board (2003a). Listed water bodies: State Water Resources Control Board (2003b).

NOTE: "Threatened" areas are on the brink of impairment. The surveys focus on site-specific evaluations and monitoring of a sample of polluted and clean water bodies.

Even abstracting from the issue of cost increases from stricter standards and emerging contaminants, utility analysts nationwide and within California have been expressing concern about the condition of water and wastewater utility facilities.[43] Problems of deferred maintenance and aging networks (especially pipes) have led to the conclusion that major investments will be needed over the next two decades simply to keep many utilities operating reliably.

Financial Needs and Gaps

Water-related investments thus concern several distinct areas, with different sets of actors: supply augmentation (done by various water agencies, individually or combined), drinking water treatment and delivery (done by municipal water utilities), wastewater treatment (done by wastewater utilities), and the newer area of non-point source management (potentially done by a wide range of actors, including water agencies, municipalities, transportation authorities, and individual farms, homes, and businesses). In this section, we outline what is known about the costs of these investments over the next 20 years, and compare this with recent levels of expenditure, to get a sense of the areas most susceptible to funding gaps.

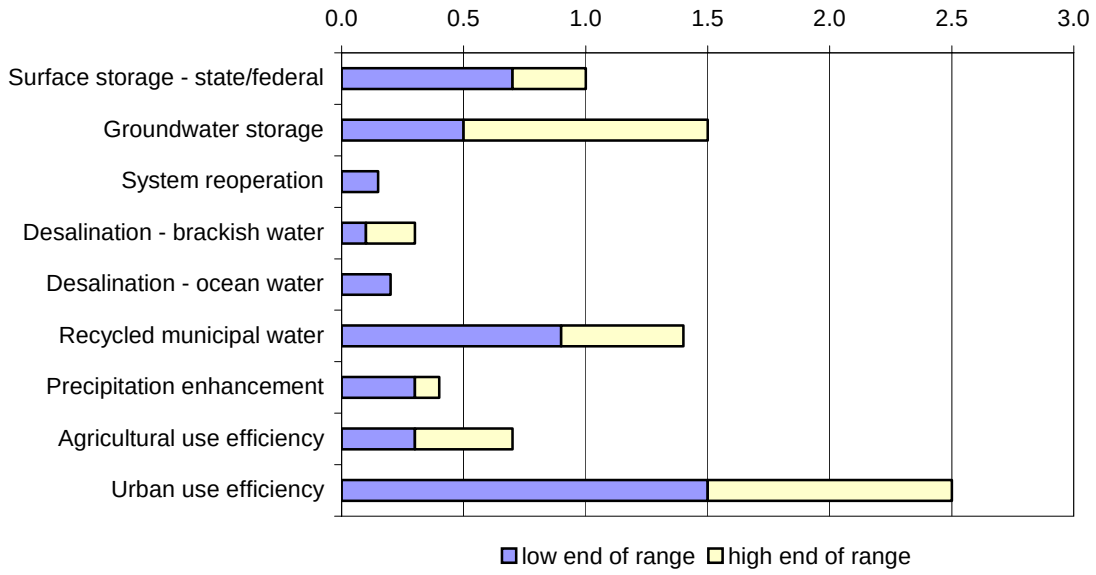
[43] For national studies, see American Water Works Association Water Industry Technical Action Fund (2001); Water Environment Research Foundation (2000); Water Infrastructure Network (2000); U.S. Environmental Protection Agency (2002) (hereinafter *Gap Analysis*); Congressional Budget Office (2002); U.S. General Accounting Office (2002). For commentary on the California situation, see California Rebuild America Coalition (2003).

Water Supply

A major focus of the California Water Plan Update has been to spotlight the potential sources of new water that might be mobilized between now and 2030. The most recent estimates from this exercise, which draws on assorted studies of individual supply sources, are presented in Figure 4.2. The figure highlights the portfolio approach to water management that has gained ground since the early 1990s, combining traditional sources like surface storage with non-traditional sources (storage in underground aquifers, desalination, recycling, precipitation enhancement) and strategies to increase water use efficiency through demand management (conservation).

It is noteworthy that one potentially low-cost strategy is not currently part of the mix: water transfers from voluntary reductions in agricultural water use through land fallowing. Determining the amount potentially available from transfers has been a contentious issue for the Water Plan Update, because some agricultural interests argue that there should be no new net water loss from this sector. Some of the strategies listed (agricultural water use efficiency and conjunctive management) do imply transfer activity, but the table does not incorporate the fact that agricultural water use is likely to decline due to various market forces including residential growth. It is therefore best to view the figure as a list of potential new sources above and beyond what the market can generate.

Figure 4.2
Potential New Supply Sources, 2000 – 2030 (millions of acre-feet)



SOURCE: California Department of Water Resources (2004a).

Simply summing these strategies overstates the potential, because some – for instance surface and groundwater storage – could compete for the same supplies. Globally, however,

they indicate scope for expansion well above the range of expected growth in urban and environmental demand. The optimal mix of supply solutions depends on costs and reliability and will vary by locality and region. Some sources, such as conservation, groundwater banking, and water transfers, can make water available at a very low cost – $100 to $200 per acre-foot or less per year. Others, such as desalination, recycling, and surface storage, require considerable up-front investments as well as high operating costs, bringing annual costs above $600 per acre-foot and in some cases over $1,000.[44]

There are no comprehensive estimates of how much California's water sector would need to invest each year to expand supplies to meet urban and environmental demands. To provide a very rough gauge, we can cost out the increases in net water demand implied under the moderate scenario presented above, which range from 75,000 to 135,000 acre-feet per year. Assuming average development costs in the range of $3,000 to $5,000 per acre-foot, this implies annual investment needs for new water on the order of $220 million to $615 million statewide.[45]

Although these scenarios incorporate meeting additional environmental water needs, they do not include the costs of ecosystem restoration. To restore ecosystems within the San Francisco-San Joaquin Bay Delta, the CALFED program has estimated that additional expenditures on the order of $150 million per year would be required. DWR estimates that statewide needs could account for another $150 million to $300 million.[46] These figures include funds for protection of the Delta levees, for which costs are potentially much higher.

Drinking Water and Wastewater Facilities

The investment costs for water supply development are distinct from those utilities must incur to maintain and expand their delivery systems and treatment facilities. Table 4.3 presents cost estimates for these activities from the most recent set of EPA utility surveys for drinking water and clean water. It also includes prorated estimates for California from recent national studies by the EPA and the Congressional Budget Office.

Although the surveys are intended to document all capital needs eligible for federal loans, the absence of any direct link between the survey and the funding process diminishes the risk of an upward bias. If anything, there is likely to be a downward bias because of non-response by smaller agencies.[47] The EPA "gap analysis" and the CBO study were conducted in response to concerns that the needs surveys also fail to fully capture certain system replacement

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[44] For some comparisons of end-user costs from different supply sources, see CALFED (1999), Table 1.1. For individual source costs, see the studies used by the Water Plan to estimate potential supply.

[45] Average investment costs are based on data presented in California Department of Water Resources, 2004.

[46] California Department of Water Resources (2004a). Planned investments included fish screens, levees, and land acquisition for habitat. CALFED's ten-year finance plan targets funding for levees at $446 million (CALFED, 2004).

[47] For instance, the SWRCB notes that reporting was complete for only roughly two-thirds of wastewater agencies, covering about 85% of outstanding financial needs (State Water Resources Control Board, 2003a.) Technically, drinking water utilities may not include projects whose purpose is to support future growth, although this appears to be a somewhat ambiguous area, since "reasonable" growth of system capacity is allowed.

requirements (particularly aging pipes). In the EPA gap analysis, the high and low estimates reflect different assumptions about infrastructure replacement rates. The CBO scenarios also make different assumptions about savings associated with improved efficiency and the borrowing term (the CBO did not examine scenarios without financing costs).[48] On balance, the estimates suggest that capital expenditure requirements for utility delivery and treatment systems far exceed the costs of developing new supplies. For drinking water, the range is from $1 billion to $2.8 billion per year, and for wastewater $1 billion to $1.8 billion.

Table 4.3
Annual Drinking Water and Clean Watershed Investment Needs
(millions of 2000 $)

	EPA Needs Surveys		EPA Gap Analysis		CBO Estimates	
	CA Total	CA share	Low	High	Low	High
Drinking water	874	12.6%	969	2,806	1,459	2,529
Clean water						
- sewage	663	8.2%	1,355	1,842	1,064	1,711
- stormwater	18	6.3%				
- non-point source	40	5.8%				

SOURCES: U.S. Environmental Protection Agency (2001, 2002, 2003); Congressional Budget Office (2002).

NOTES: All studies report 20-year needs, extending out to 2018 for the drinking water needs survey and to 2019 for others. EPA drinking water needs survey data are in 1999 dollars, all others are in 2000 dollars. California's share of national costs from the EPA gap analysis and the CBO study is prorated based on its share in the needs surveys. The CBO estimates include the costs of financing.

Runoff Management

For stormwater management and control of other non-point source pollution, the only statewide estimate available is from the 2000 needs survey, which reports capital costs of roughly $60 million per year. This relatively modest figure could reflect an undersampling of agencies responsible for these activities. But there are also considerable debates about the overall costs associated with stormwater programs, the relative role for capital expenditures, and the share of public and private costs in the total.

A widely cited study, commissioned by a coalition of cities and builders opposed to the new regulations in Los Angeles County, estimated that they would generate $102 billion in compliance costs (Gordon et al., 2002). The study assumed that all stormwater would be treated to drinking water standards before discharge, requiring the installation of over 100 small

[48] The EPA gap analysis also reports scenarios including financing costs. The data presented in Table 4.5 provide a direct comparison with the needs survey, which also excludes financing costs, as do the data on actual capital expenditures reported in the text.

treatment facilities. Critics have argued that the study exaggerated the level of water purity required and failed to consider lower-cost alternatives to treatment.

Such alternatives include preventive design measures at the time of land development (e.g., natural or artificial capture or drainage devices) and public education programs to reduce harmful practices by individuals and businesses. The land development costs have also been hotly debated, however, with state regulators arguing that they should not exceed 1 to 2 percent of construction costs, and builders arguing that they may run considerably higher.

There is also uncertainty regarding Caltrans' costs for runoff management. Preliminary estimates suggest construction cost increases ranging from 2 to 15 percent for different types of activities and a global cost of $5 billion for compliance with a recent agreement to retrofit existing highways to capture runoff in the Los Angeles region alone (California Department of Finance, 2003c; Weikel, 2004).

Is There a Funding Gap?

How do recent capital expenditures compare with the potential capital costs outlined here? Data are available for 1996/1997 from the Census of Governments and for 1999/2000 from the state controller and state budgets. Although these sources are not strictly comparable, they give a good sense of overall spending by sector. In real terms, water-related capital spending, including both supply augmentation and drinking water facilities, increased from $2.6 billion to $3.3 billion between 1997 and 2000.[49] This lies at the high end of the range of projected annual needs for these activities of $1.2 billion to $3.4 billion. Wastewater spending has been relatively stable at around $1.7 billion per year, well in line with annual capital needs.

These capital spending figures are primarily locally funded through user fees. California's utilities appear well-positioned to cover their investment requirements, both to maintain their existing networks and to expand where growth is occurring. Utilities have a distinct funding advantage over municipal and county governments, because user fees, unlike taxes, are typically not subject to the two-thirds voter threshold requirements. The key funding question, which we address below, is whether some communities may merit subsidies to meet increasing costs for new regulations and contaminants.

There are more general questions for two other areas of the water portfolio. For stormwater there is no good baseline on spending or investment needs, although some estimates suggest potentially high costs. In contrast to water and sewer utilities, funding mechanisms for stormwater programs appear more problematic. There is legal ambiguity over whether charges constitute taxes – requiring two-thirds voter approval – or user fees.[50] This may put local governments in the difficult position of being required to meet regulatory standards, without being given the means to raise funds to cover the costs. By the same token,

[49] de Alth and Rueben (2005). Data are in 2000 dollars to allow comparability with cost estimates in Table 4.3. More recent data for water and sewer are less reliable because of a change in reporting methods for capital investment by special districts. Because of this change, capital spending for these sectors is likely to be underreported in Table 1.2.

[50] Recent court cases have ruled in favor of both sides of this question. See Minan (2003).

Caltrans has no guarantees that it will recover what are likely to be substantial costs for managing runoff.

The estimated costs of environmental water and ecosystem restoration are considerable: At current market prices, supplying an additional 0.5 million to 1 million acre feet of environmental water is likely to cost $65 million to $130 million per year.[51] With ecosystem restoration costs noted above, the total annual environmental bill is on the order of $500 million annually. Many agricultural users hold the view that the environmental price-tag should also include some restoration of supplies returned to instream uses through involuntary cut-backs in the early 1990s.

Alternative Scenarios for Meeting Needs

These potentially unfunded areas raise important questions about the role of public subsidies versus user-fee funding for environmental clean-up. Before turning to these issues, however, we briefly examine the scope for modern approaches to reduce the level of costs. In addition to demand management, which is already a central element in supply planning, the focus is increasingly on achieving cost savings through flexible regulatory approaches and through integrated approaches to water supply and water quality.

The Quantity-Quality Nexus

For water supply, utilities now count on the use of two incentive-based tools – conservation and marketing – to play a role in reducing demand, reallocating supplies, and keeping down costs. Increasingly, conservation is also being recognized as a potential source of savings on utility infrastructure in growing areas, because reductions in per capita use can postpone the need to expand treatment facilities for water and wastewater.

In other respects, the investment requirements of water and wastewater utilities are primarily determined by regulatory standards. Within the industry, much recent attention has focused on the potential benefits of introducing "asset management systems" to improve implementation efficiencies. Such systems aim to help utilities improve financial and physical planning for maintenance and capital improvements; a recent study suggests that their potential to reduce overall costs may be overstated, however (U.S. Government Accountability Office, 2004).

To attain regulatory objectives in the emerging field of stormwater management, there is likely to be considerably more room for cost reduction through a flexible mix of technologies and policies. One recent example comes from San Diego, where local governments worked together to develop a plan for implementing rules to capture runoff on new development. The plan, accepted by regional regulators, allows cities to work with developers to install systems covering entire drainage areas rather than individual projects, thereby reducing per acre costs from $50,000 to $10,000 (Rogers, 2002).

[51] Based on estimated average costs of water purchased by the environmental water account between 2001 and 2003 of $129 per acre-foot.

The search for innovative solutions is also leading to more integrated approaches, linking water quality, water supply, and land use. In the Chino Basin area (San Bernardino County), local governments and water managers are exploring the potential to tie stormwater management programs to aquifer recharge. By reducing impervious surfaces (e.g., curbs, pavement) and directing the flow of runoff, they hope to increase local supplies, while reducing the discharge of pollutants to local rivers and lakes. Even in areas where recharge benefits are not available, the introduction of more drought and pest-tolerant native plants can simultaneously conserve water (a water supply benefit) and reduce pesticide-laden runoff (a water quality benefit). Integrated watershed management approaches are also seen as a way to combat source contamination of drinking water, reducing the need for treatment.

Such approaches need to involve a wide array of players – local governments, utilities, builders, residents, businesses, farmers. Experiences in various parts of the country and elsewhere provide a large toolkit of strategies and techniques, but these must be grafted and molded to fit local conditions (e.g., Arnold and Gibbons, 2001). Although it is early to say which strategies will "pencil out" in California's different regions, it is likely that such approaches will become increasingly viable as pressure mounts on communities to manage water quality as well as supply.

The Role of Public Funds

This brings us to the second question of funding sources. Both nationally and within California, water-quality-related needs have again generated calls for substantial taxpayer support to supplement local resources.[52] Two arguments are made in favor of taxpayer subsidies. The first is an equity argument, because cost increases in some areas are expected to generate hardship for large numbers of households. The second argument emphasizes the public goods aspects of clean and safe water and healthy aquatic ecosystems.

Although some advocates of subsidies may have overstated the affordability problem, required system upgrades could pose real financial difficulties in some low-income communities.[53] The risk is greatest in smaller communities, because there are significant scale economies in most treatment technology. Some existing programs specifically address these concerns. For drinking water systems, the state revolving fund, co-financed by federal and state authorities, gives priority grants and low-interest loans to low-income communities.[54]

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[52] At the national level, this has generated calls for a federal water trust fund. Support has come from both industry groups (mainly public works officials) and environmental groups. See for instance, Water Infrastructure Network (2002); Natural Resources Defense Council (2004).

[53] The Water Infrastructure Network (2000, 2002) has argued that subsidies are needed across a very wide array of communities to alleviate hardship. Congressional Budget Office (2002) provides a critique of this analysis, and discusses options for mitigating increasing costs to low-income households. In communities where most people can afford increases in user fees, an alternative to a general subsidy is to provide subsidized, lifeline services to low-income households. Increasing block rates, a water pricing technique now used by over 40 percent of California's utilities to encourage conservation, provides some protection to low-income households by keeping rates for basic indoor water use low.

[54] Between 1998 and 2000, 35 percent of all drinking water state revolving funds (or $85 million) were allocated to disadvantaged communities (California Department of Health Services, 2004a).

California has a small communities grant program for wastewater systems.[55] U.S. Department of Agriculture financial assistance also targets rural (typically low-income) communities for wastewater and drinking water.

The question arises whether these programs will be adequate in relation to emerging needs, such as treatment for arsenic, which is prevalent in low-income Central Valley communities. By the common metric of affordability – the share of utility fees in median household income – it appears that most of California's communities have a considerable margin before rates become burdensome.[56] In a recent statewide survey of utilities, only 3 percent (covering 2 percent of the sampled population) had charges greater than 1.5 percent of median income, the cutoff for eligibility under targeted drinking water programs (Table 4.4). Another 12 percent of utilities (8 percent of the population) had fees exceeding 1 percent of median income. Regions where water rates are high – such as the Central Coast and some north coast and mountain communities included in the "rest of state" category – appear more vulnerable than the Central Valley, where water rates are generally quite low. This suggests that subsidies for utility investments will continue to be important on equity grounds in a select group of communities, rather than on a regionwide basis.

The public good justification for subsidies raises the classic dilemma of assigning responsibility for reducing negative externalities. Should the parties responsible for causing harm pay for mitigation, or should the general public pay for the benefits of a cleaner water supply and healthier environment? Subsidies are most likely to be warranted, the more general the public benefits, and the more difficult it is to assign responsibility or generate an effective response from those whose actions are causing (or have caused) harm.

In recent years, California policymakers have simultaneously increased the obligations of responsible parties – through TMDLs, stricter stormwater rules, greater protections for aquatic wildlife – and pushed for as much public funding as possible. State-level fund-raising has been highly successful. Since 2000, California voters have approved two major water bonds, and a third with a large water component, making $5.7 billion available to support water projects.[57] Federal support has been less forthcoming.[58]

Substantial portions of the bond funds are available as grants to local agencies and groups, for a wide array of activities. Some areas, such as habitat restoration, lie more squarely in the public domain than others. Programs to support water use efficiency and groundwater storage both involve subsidies to specific groups of water users, even though the results may generate a wider public benefit by augmenting supplies (and reducing pressure on

[55] This program disburses grants of $10 million to $20 million per year and provides the opportunity for these communities to use the state revolving fund loans for additional capital.
[56] For wastewater, SWRCB data suggest that average rates in small systems are only 1 percent of median incomes (State Water Resources Control Board, 2004). According to SWRCB officials, the rule of thumb for affordability of wastewater treatment is 2 percent of median income.
[57] Proposition 13 (2000) committed $1.97 billion and Proposition 50 (2002) $3.4 billion to assorted water projects, and Proposition 40 (2002) $300 million to water quality and restoration. See de Alth and Rueben (2005) for details.
[58] The focus of these efforts has been on federal contributions to the joint federal-state CALFED program. Congress recently agreed to allocate just under $400 million, down from over $2 billion in initial requests.

environmental flows). Although not all of these funds will be used for capital projects, they will clearly raise the state's contribution and possibly overall capital spending on water for several years.

Table 4.4
Water Charges as a Share of Median Household Income, 2003

	Communities in Sample	Average Yearly Water Fees ($)	Water Fees as % of Median Household Income	Fees > 1% of Median Income	Fees > 1.5 % of Median Income
Bay Area	109	$444	0.6%	5%	0%
Southern Coast	176	$385	0.7%	13%	1%
Central Coast	38	$457	0.9%	29%	11%
Inland Empire	60	$322	0.7%	17%	8%
San Joaquin Valley	55	$207	0.5%	5%	0%
Sacramento Metro Area	34	$248	0.5%	3%	0%
Rest of State	64	$344	1.0%	41%	8%
California	536	$363	0.7%	15%	3%

SOURCES: Authors' calculations, using water fees from Black and Veatch (2003) and median household income from the Census 2000, adjusted for inflation with the CPI-U.

NOTES: "Communities" are defined as a pairing between a utility and a local jurisdiction (city or unincorporated area of a county). Some cities/counties have more than one utility, and some utilities operate in more than one local jurisdiction. For jurisdictions with multiple utilities, we have assumed that the distribution of household income is the same across utility service areas.

Looking ahead, it is unclear whether the system will be able to depend on new injections of funds from the general public or will need to return to more heavy reliance on user fees, as in the 1990s. For water and wastewater utilities, local finance appears as a viable option for most investment: Both the recent levels of self-finance and the funding mechanisms appear generally sound. Recent courtroom successes suggest that there will also be some scope for mobilizing private funds for clean-up of contaminated groundwater basins.[59]

Ensuring funding sources for stormwater and other forms of non-point pollution appear more problematic both for local governments and for Caltrans. In both cases, California's residents and businesses are the source of water quality problems – by driving, by littering, by watering their lawns, and by washing their cars in the road – but there is no mechanism in place to ensure they are contributing to the cost of controlling them.

[59] Santa Monica recently won a large settlement with oil companies for the clean-up of the MTBE contamination in the groundwater basin, and deals are now being negotiated with responsible businesses for the clean up of perchlorate in Sacramento and Santa Clara Counties. California congressional representatives have been pressuring the U.S. Defense Department to agree to help clean-up perchlorate in Southern California locations.

The other major area of uncertainty concerns programs to provide water for the environment and ecosystem restoration foreseen under CALFED and other programs. The CALFED program was developed with an expectation that significant state and federal funding would be available to support its environmental goals. To date, bond funds and other temporary monies have been available for these activities.[60] But a long-term funding arrangement remains elusive. Without significant additional public funds, the future of these programs will depend on the outcome of debates on whether and how water users should share the cost.

Environmentalists are now calling for increased user fees (in effect, an environmental tax) to finance the program, a proposal the Administration introduced as part of its 2004-05 budget negotiations (and subsequently withdrew). The most virulent opposition to such proposals comes from farmers, who consider that the water supply promises of CALFED have yet to be met. Because the costs of developing most potential new sources are prohibitive for farmers, public subsidies would be needed to restore the water that they involuntarily ceded to the environment in the early 1990s. To farmers, this would be consistent with CALFED's "beneficiary pays" principle, because the environment, not they, would be the ultimate beneficiary. From the environmentalists' perspective, water users caused harm by overdeveloping the system and could therefore be expected to contribute to the clean-up. With eco-taxes on water, a much higher burden would fall on farmers, as the largest water users.

In the eyes of many observers, CALFED's recently released ten-year finance plan skirts the "beneficiary pays" issue, by continuing to rely heavily on state and federal contributions and failing to demarcate the areas where users should pay (CALFED, 2004). The implication is a funding policy that relies on the continued willingness of California voters to support state water bonds.

[60] For instance, during the first three years of the CALFED stage 1 program, $476 million was spent on ecosystem restoration, and another $180 million is earmarked for 2004 and 2005 from Proposition 50. An average of 300,000 acre-feet per year (at an overall cost of $120 million) has been purchased through the environmental water account (McClurg, 2004).

Transportation

California's transportation system is the most extensive in the nation. The state highway system comprises more than 50,000 roadway miles, and California also has over 8,000 miles of railroad, 250 general aviation and 28 commercial airports, and over 200 public transit systems. As the leading global gateway for Pacific Rim trade, more than one-third of the value of all U.S. and foreign trade passes through California's ports, totaling $200 billion annually. Nationally, more than two million jobs are tied to the ports.[61]

Transportation policy in California faces substantial challenges. As car use and congestion in urban areas continue to rise, debates rage about the relative merits of programs to address multiple and sometimes conflicting goals. Meanwhile goods-related traffic contributes to congestion in urban areas and has replaced cars as the major source of air pollution. Systemic challenges related to transportation finance also pose concerns. Governance arrangements adopted during the 1990s set a framework to consider transportation options in a more integrated fashion at the metropolitan scale, but conflicts persist as planners seek to address growing demands with fewer resources than in the past.

In some respects, the financial constraints and planning quandaries facing this sector have served as a catalyst for integrating modern approaches into the planning process. Solutions combining demand management, innovative funding mechanisms, and new technologies all have the potential to provide considerable benefits, and California has been successfully experimenting with many of them. However, the current transportation finance system exhibits some fundamental disconnects between user incentives and investment decisions, which work against efforts to increase efficient resource use in this sector. User fees (particularly the gas tax) have progressively given way to other sources of funding, like county sales taxes. Broad-based solutions incorporating higher user fees could provide the sector with a more stable source of funding while modulating demand and relieving congestion. But such approaches remain politically unpalatable.

Who Assesses Needs?

Transportation planning is a hybrid of federal, state, regional, and local roles and responsibilities. At the state level, short-term needs are assessed within the constraint of expected revenues. Every two years, the State Department of Transportation (Caltrans) prepares an estimate of all federal and state transportation funds projected to be available during the next five-year period, which provides the basis for investments during that time frame. The funds are first used to cover non-capital expenditures, including administration and highway maintenance. Remaining funds are then allocated to local assistance and capital outlay (California Legislative Analyst's Office, 2000b).

During the 1990s, federal and state policies pushed programming responsibility to the regional level (Barbour and Lewis, 2005). Today, regional transportation planning agencies in California (RTPAs) are responsible for programming 75 percent of funds from state and federal

[61] California Department of Finance (2003a); California Department of Transportation (2003a); Haveman and Hummels (2004).

sources designated for transportation capital improvements. The remaining 25 percent is allocated for projects of inter-regional significance chosen by Caltrans.

The most concerted long-range planning is done by regional transportation planning agencies in urban areas with a population of 50,000 or more, which are required by federal law to produce 20-year regional transportation investment plans (RTPs), updated every three years. RTPs must address multiple goals, including conformity with air quality standards, mobility, access, congestion relief, equity, energy efficiency, and safety. Since the early 1990s, regional agencies have greater latitude in allocating funds across different transportation modes.

Indicators of Need

Following a period of rapid expansion in the post-war years, highway building slowed in the 1970s, and a significant share of investment shifted toward transit projects. Increasing car and truck use and disappointing transit ridership levels have sparked debates about the appropriate balance between investments in these two parts of the transportation portfolio. After examining these trends and debates, we address two common indicators of transportation needs that have generated much attention both in popular discussions and among public works officials: congestion and the state of California's roadways.

A Persistent Trend: Rising Car Use

The most predominant transportation trend in California is rising car use. Annual vehicle miles traveled on state freeways grew almost three times faster than population from 1967 to 1997, and car use is projected to continue outpacing population growth in the future (Figure 5.1). Factors that account for the dramatic increase in car use in recent decades included a rise in two-earner households as women entered the workforce and a continuing shift of jobs and residents to less densely developed suburban and "edge city" locations. The sharpest rise in median commute lengths during the late 1980s and early 1990s was among first-time homebuyers – many who purchased homes at the urban fringe because of rising home prices in central locations (Landis et al., 2000).

Although Californians may be known for their "love affair with the automobile," increasing car use is not unique to the state. In 2002, daily vehicle miles traveled per capita for the Los Angeles-Long Beach, San Diego, and San Jose urbanized areas were slightly above the nationwide average among urbanized areas with a population greater than 1 million. For the San Francisco-Oakland, Riverside-San Bernardino, and Sacramento areas, the rates were slightly below the average.[62]

Goods-related traffic has also contributed to the rapid increase in road use, especially in Southern California. California roads and highways carry more truck traffic than any other state in the nation – more than a billion tons of freight annually (The Road Information Project, 2004). In 2002, trucks accounted for 29 percent of total vehicle miles traveled in the state (California Department of Transportation, 2003b).

[62] Federal Highway Administration (2002, Table HM-71).

Transit Expansion as an Alternative to More Highways

The rise in car use occurred in spite of a policy shift since the 1970s to promote mass transit as an alternative. Transit was advocated to address growing concerns about the consequences of highway building, including community opposition to invasive highway projects, rising traffic congestion, environmental concerns such as air pollution, and the deterioration of downtown business centers (Fielding, 1995). The argument that transit might help alleviate traffic congestion was buttressed by research on "induced demand," suggesting that as long as drivers desire more mobility than can be accommodated by an existing roadway system, increases in capacity may be quickly consumed as travelers shift from alternative modes, routes, or schedules, and as land development responds to new road supply.[63] Highways had begun to experience such demand pressure by the 1970s as expansion was curtailed in the face of a "cost-revenue squeeze."

The "cost-revenue squeeze" was the result of a combination of rising costs and declining growth in user fees for highways. Costs rose substantially for rights-of-way, labor and materials, high design standards, and to address community and environmental concerns (Taylor, 1992). The average ratio of annual inflation-adjusted capital outlay expenditures to each new road mile added in the U.S. was more than three times higher during the 1990s than during the early 1960s.[64]

Revenues did not keep pace with rising costs because the main source of dedicated revenue – the excise tax collected on gasoline – was not indexed to inflation, which was especially high in the late 1960s and 1970s. Gains in fuel efficiency (some mandated by law) also contributed to the erosion of gas tax receipts. In real terms, California fuel tax revenue per vehicle mile traveled is worth approximately 36 percent of what drivers paid in 1970; the federal fuel tax, used to fund federal transportation grants, exhibited a similar decline. The drop in revenues contributed to a precipitous decline in capital outlays on highways during the high inflation years (Figure 5.1). Although total spending recovered beginning in the mid-1980s, it has stayed flat when measured in terms of vehicle miles traveled.[65] The result has been a substantial slowdown in highway expansion. From 1980 to 2000, the state added only about 6 percent to its stock of state highway lane miles.

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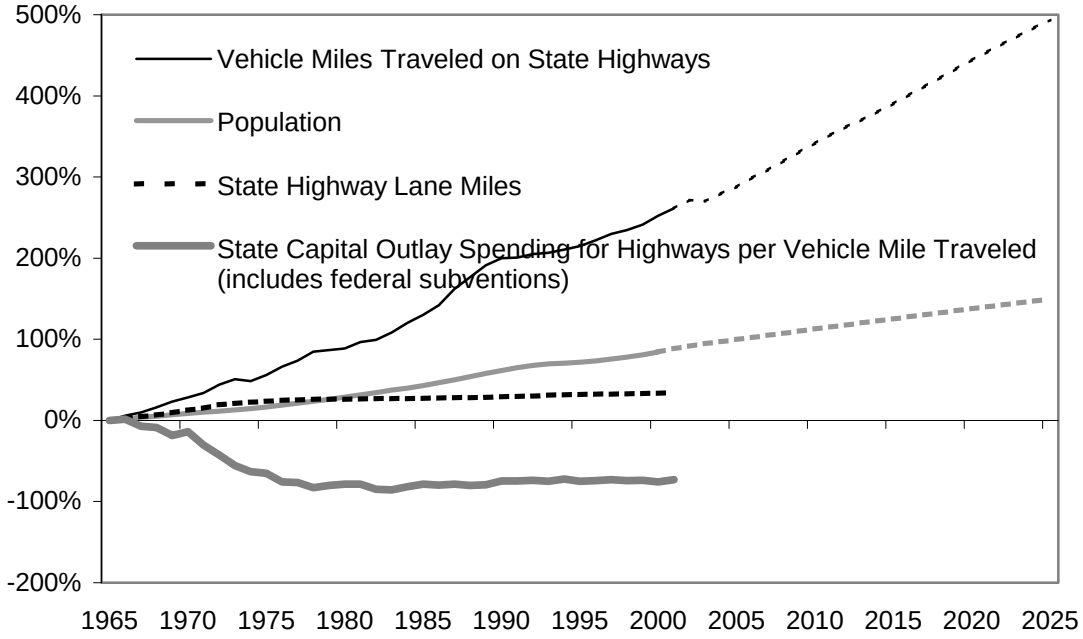
[63] For a critical review of research on this issue, see Bernick and Cervero (1997) and Cervero (2003). Taylor (2002) notes that *any* strategy to increase capacity – from new transit service to operational improvement such as coordinated signal timing or ramp metering – is just as susceptible to induced demand.

[64] Authors' calculations, with data from the Federal Highway Administration (annual reports, Tables HF-10 and HM-10), following the method used by Taylor (1992). The estimate is calculated as the ratio of total real annual expenditure on capital outlay for "highways" (all public roads) to the net annual increment in lane miles, based on three-year moving averages. Spending is adjusted for inflation with the Producer Price Index for Materials and Components for Construction. Capital outlay includes expenditures for rights-of-way, engineering, and construction, and includes improvements to existing highways (rehabilitation) as well as new construction. For recent estimates of current construction costs, which vary widely, see Washington State Department of Transportation (2002, 2003).

[65] The measure shown is the ratio of state expenditure on capital outlay for highways (which includes federal subventions) to vehicle miles traveled on state highways. A small portion of this category of expenditure (4 percent in 1999 and 2000) actually went to local streets and roads.

Figure 5.1
Growth in Key Highway-Related Indicators in California, 1965-2025



SOURCES: For vehicle miles traveled: Caltrans (2003b) (historical estimates to 2002, estimated to 2025); for population: California Department of Finance, for 1965 to 1999 from I 47-69, I 70-79, I 80-89, I 90-00: July Intercensal Estimates of Total Population for California Counties, and for data from 2000 to 2025, California Department of Finance (2004); for highway lane miles: Caltrans (2004); and 4) for state and federal capital outlay spending for highways: Federal Highway Administration (1965 to 1994, Table SF-202C, State Government Capital Outlay for Highways, by State, 1921 - 1995, and from 1995 to 2001, annual reports, Table SF-2, adjusted for inflation using the Producer Price Index, Materials and Components for Construction.

The erosion of highway funds was reinforced by a shift toward spending on transit. In per capita terms, transit capital expenditure in California more than doubled between 1972 and 1997.[66] Four of California's major cities – San Diego, Los Angeles, San Jose, and Sacramento – opened new rail systems during the 1980s and 1990s. In recent years, transit has accounted for 20 to 40 percent of the combined capital outlay for transit, highways, and roads.[67] Because transit systems

[66] Census of Governments data, as reported in de Alth and Rueben (2005).

[67] There are some discrepancies among data sources on capital expenditures for transportation in California. The Federal Highway Administration (FHWA) reports significantly higher spending on highways (a category including all public roads) for 1997 (representing fiscal year 1996-97) than either the Census of Governments (fiscal year 1996-97) or the California State Controller's and state budget data (fiscal year 1996-97) (FHWA data are from Federal Highway Administration, (annual reports); details for these latter two sources are reported in de Alth and Rueben 2005). In nominal dollars, FHWA reports capital outlay of $4.6 billion on highways and $1.2 billion on transit; the Census of Governments reports $2.8 billion on highways and $1.3 on transit; and the state sources report $3.3 billion on highways and only $0.9 billion

generate higher public operating expenses than roadways (Table 1.2), their share in total spending is considerably higher.

The substantial investments in transit did not turn the tide of increasing car use in California, however. Although ridership increased more rapidly than population growth in most of the state's major urban areas from 1990 to 2000, and increased marginally as a share of all travel, the overall share remained very low – generally under 1.5 percent.[68] Transit does play a greater role for trips to work, which occur during peak periods. Across five metropolitan areas, the share in 2000 was 5.6 percent (Table 5.1). However, this represented just a marginal increase (+0.1 percent) in combined transit use (subway, rail, bus, and streetcar) since 1990. Carpool trips declined slightly. Single-occupancy vehicle travel remains by far the most popular means of travel, even to work.

Only in terms of reducing vehicular congestion during peak periods, and in providing mobility in the state's most densely settled, central areas, can transit claim to be very effective (Fielding, 1995). Transit carried 38 percent of all trips on the San Francisco Bay Bridge Corridor, 30 percent of all trips into central Los Angeles, and 18 percent of trips to downtown San Diego in 1999.[69] According to one estimate, hours of delay in the state's largest urban areas would increase by 23 percent if transit service were eliminated and by 50 percent for the Bay Area (Texas Transportation Institute, 2003).

Environmental benefits of transit may be negligible with low ridership. When buses and trains are filled, transit saves energy and reduces air pollution. However, at current average rates of bus usage, cars with more than three occupants and vans with ten are more energy-efficient, so ridesharing strategies may produce comparable energy savings. Rail transit can produce energy savings, but the energy resources required for initial construction may take decades to recoup (Fielding, 1995).

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on transit. For 2000 (fiscal year 1999/2000), FHWA reports $4.8 billion on highways and $1.5 billion on transit, whereas the state sources report $3.7 billion on highways and $2.6 billion on transit. According to Susan Clarkson at Caltrans (interview, 6-15-2004), higher expenditures in the FHWA data than in the state budget are due, at least in part, to the inclusion of additional categories: capital outlay under the jurisdiction of state departments other than Caltrans (e.g., California Highway Patrol, state forestry and parks departments, Office of Traffic Safety), salary and benefits for employees not directly involved in projects; equipment maintenance; field investigations; and legal costs.

[68] O'Toole (2004). The exception was the San Francisco Bay Area, where transit's share of total passenger miles was 4.3 percent in 2000 (a slight decrease from 1990).

[69] California Transit Association and California Association for Coordinated Transportation (1999).

Table 5.1
Means of Transportation to Work in Major California Metropolitan Areas

Mode of Travel to Work	Los Angeles	San Francisco	San Diego	Sacramento	Total
Percent Drove Alone					
In 2000	72.4	68.1	73.9	75.3	71.5
Pct. Pt. Change 1990-2000	0.1	-0.2	3.0	0.1	0.3
Percent Carpool					
In 2000	15.2	12.9	13.0	13.5	14.2
Pct. Pt. Change 1990-2000	-0.3	-0.1	-0.7	-0.1	-0.3
Percent Bus/Streetcar					
In 2000	4.3	5.7	3.1	2.4	4.4
Pct. Pt. Change 1990-2000	-0.2	-0.5	-0.1	0.3	-0.3
Percent Subway/Rail					
In 2000	0.3	3.5	0.2	0.3	1.2
Pct. Pt. Change 1990-2000	0.3	0.6	0.2	0.0	0.4
Percent Worked at Home					
In 2000	3.6	4.1	4.4	4.0	3.8
Pct. Pt. Change 1990-2000	0.8	0.6	-0.6	0.9	0.6
Percent Other Means					
In 2000	4.2	5.7	5.4	4.5	4.8
Pct. Pt. Change 1990-2000	-0.7	-0.4	-1.8	-1.2	-0.8

SOURCE: Authors' calculations using data from the U.S. Census.

NOTES: The data are for metropolitan statistical areas, which comprised counties and include undeveloped areas within them. In contrast, the data discussed in the text on the transit share of all travel includes urbanized areas only.

Cost overruns for many projects, disappointing ridership levels, and high levels of operating subsidies led to serious critiques of rail strategies by the 1990s (Kain, 1999; Fielding, 1995; O'Toole, 2004). In response, transit advocates have argued that transit cannot be expected to compete effectively with car use as long as drivers are not required to absorb the full social costs of driving. This includes various "externalities" such as congestion costs in time and fuel imposed on other drivers, damage to health and vegetation from air pollution, climate change, water pollution, noise effects, fatalities and injuries from crashes, and waste from scrapped vehicles and oil. Transit advocates also contend that under-pricing car use encourages land-use choices that reinforce the pattern of rising car use, in particular, "sprawl" development instead of denser, more compact land use.

Table 5.2
Estimated Costs and Subsidies for Transportation in 1990 Cents per Passenger Mile Traveled

Study*	Conditions	Government Facilities and Service	Externalities**	Total Cost	User Payments	Net Subsidy
Automobile						
WRI	All times, all roads	3.4	5.9	9.3	1.0	8.3
NRDC	All times, all roads	3.1 to 3.7	10.2 to 19.2	13.3 to 22.9	0.7	12.6 to 22.2
CLF	Off-peak, expressway	4.3	14.4	18.7	3.0	15.7
CLF	Peak, expressway	4.3	17.7	22.0	3.0	18.8
Litman	Off-peak, urban	4.8	19.5	24.3	1.5	22.8
Litman	Peak, urban	7.1	50.2	57.3	2.0	55.3
Litman	Rural	2.6	10.4	13.0	0.9	12.1
Bus						
NRDC	Urban	50.1	2.5 to 7.4	52.6 to 57.5	14.0	38.6 to 43.5
CLF	Off-peak	80.1	3.0	83.1	14.8	68.3
CLF	Peak	191.8	5.9	197.7	14.8	182.9
Litman	Urban, peak	52.8	12.0	64.8	19.1	45.7
Rail Transit						
NRDC	Urban	44.1	2.7 to 7.1	46.8 to 51.2	14.0	32.8 to 38.2
CLF	Off-peak	78.2	1.1	79.3	37.0	42.3
CLF	Peak	120.3	1.5	121.8	37.0	84.8

SOURCE: Gomez-Ibanez (1997). Studies: WRI: MacKenzie, Dower, and Chen (1992); NRDC: Miller and Moffett (1993); CLF: Apogee Research (1994); Litman: Litman (1995).

NOTE:

* All studies are for travel in the U.S. except CLF, which is for trips in medium-density portions of the Boston metro area.

** Some or all of the following: congestion, air pollution, climate change, noise pollution, water pollution, solid waste, accidents, energy, parking.

Comparative estimates of the full costs (including many externalities) suggest that transit is usually at a disadvantage at current ridership levels, however. Table 5.2 presents estimates of average total costs per passenger mile traveled under current usage conditions by mode from some national studies.[70] Although the methods and estimates vary, they agree on a few points. Public construction and operating costs are much higher for transit, and subsidies to transit users also tend to be higher. Transit externalities are lower, however, and the difference is most evident

[70] For transportation investment decisions, one would need to compare alternatives in any particular location. Also, the results might change under different usage, such as transit at full capacity.

during peak (typically congested) urban expressway conditions. The results suggest that only in peak, urban conditions does transit even begin to compete with cars in terms of full social costs. In other situations, car use is more cost-effective for most trips. These results imply that full cost pricing of *both* cars and transit use – taking into account the full set of financial and non-financial costs – would generally favor car use in low- and medium-density urban environments (see also DeLucchi, 2000).

Transit advocates also note that cost efficiency (even including environmental and health costs) is not the only standard that transit systems have been expected to meet. Unlike cars, transit must meet social equity goals – in particular the provision of low-cost transportation on a ubiquitous basis to the carless (largely the poor and elderly) (Litman and Greenberg, 2000). Thus, minimum service levels are maintained even for less cost-effective routes, such as in suburban areas.[71]

However, the pattern of transit investments suggests that such equity considerations have not been the main factor driving the high cost of transit. Instead, in an attempt to gain middle-class ridership and support for transit investment, transit resources in recent years have been devoted disproportionately to building and operating high-cost, suburban commuter-oriented service – especially rail (Wachs, 1997; Garrett and Taylor, 1999). With the erosion of the state and federal gas taxes, transportation agencies have progressively shifted to local revenue sources, often through voter-approved initiatives. Ballot initiatives include packages of transportation improvements assembled to appeal to suburban voters, often favoring "glitzier" – but less cost-effective – projects (Taylor et al., 2001; Wachs, 2003a).

Federal and state funding allocations have contributed to this spending bias. Federal categorical expenditure has favored new transit capital investment over operating subsidies, and rail over bus service. Also, federal and state spending is allocated by formulas based on track or vehicle mileage, or population, rather than ridership. As a consequence, suburban systems (rail and bus) tend to receive much deeper subsidies per transit rider than central city systems (Taylor, 1991; Wachs, 1997; Garrett and Taylor, 1999). The governance system for ratifying regional transportation plans also plays a role. The one-government, one-vote system used by most metropolitan area Councils of Government (COGs) – entities that often coincide with regional transportation planning authorities -- works against identifying priorities that are truly regional in focus, for example to maximize regional cost-efficiency or ridership-based equity in transit investment.[72]

These critiques do not necessarily imply that California is spending too much on transit, but rather that by a number of criteria it could be spending transit resources better.

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[71] In 1996, central cities were home to only 20 percent of all workers but accounted for 69 percent of all transit use. In contrast, suburbs were home to half of all workers but generated only 29 percent of transit trips. Most commutes were within suburbs or central cities, not between them (Pisarski, 1996).

[72] See Barbour (2002), for more on the governing structures, jurisdictions, and responsibilities of regional planning agencies in the state.

Congestion: How Big a Problem Is It?

By some oft-cited statistics from the Texas Transportation Institute (TTI), the Los Angeles metropolitan area has been the nation's most congested for more than a decade, and the San Francisco, San Diego, and Sacramento metropolitan areas rank among the nation's ten worst. In public opinion surveys, Californians living in these areas routinely identify traffic congestion as a major problem (Baldassare, 2002, 2004).

The basic idea is straightforward: Delays in travel time occur when too many vehicles are trying to use the roadways at the same time or when incidents such as accidents or stalled vehicles cause back-ups. The steady rise in vehicle miles traveled, coupled with limited capacity expansion, means that Californians have been using their roadways more intensively over the past few decades. Traffic delays, especially at peak periods, are a natural outcome of this process.

However, measuring congestion is difficult. Two ideal measures would be the changes in *average* travel time over a specified distance at specified periods of the day and changes in the *variability* of those trips, which is a key consideration for many drivers. Unfortunately, few such statistics are compiled systematically. Census data on travel time to work provide one indication of long-term trends in average travel time, although they do not control for the fact that the distance traveled may also have changed. Between 1990 and 2000, average travel time to work increased by two to five minutes for residents of California's major metropolitan areas, or 7 to 19 percent (Table 5.3). Although the data confirm an upward trend, the magnitude is not as alarming as one might have expected.

Table 5.3
Travel Time to Work for California Residents, 1990 and 2000 (minutes)

County of Residence	1990	2000	Increase (minutes)	% Change
Los Angeles	26.5	29.4	2.9	11%
Orange	25.5	27.2	1.7	7%
San Bernardino	27.4	31.0	3.6	13%
Riverside	28.2	31.2	3.0	11%
San Diego	22.2	25.3	3.1	14%
San Francisco	26.9	30.7	3.8	14%
Santa Clara	23.3	26.1	2.8	12%
Alameda	25.8	30.8	5.0	19%
Contra Costa	29.3	34.4	5.1	17%
Sacramento	21.7	25.4	3.7	17%

SOURCE: Authors' calculations, using U.S. Census, 1990, and 2000 STF3.

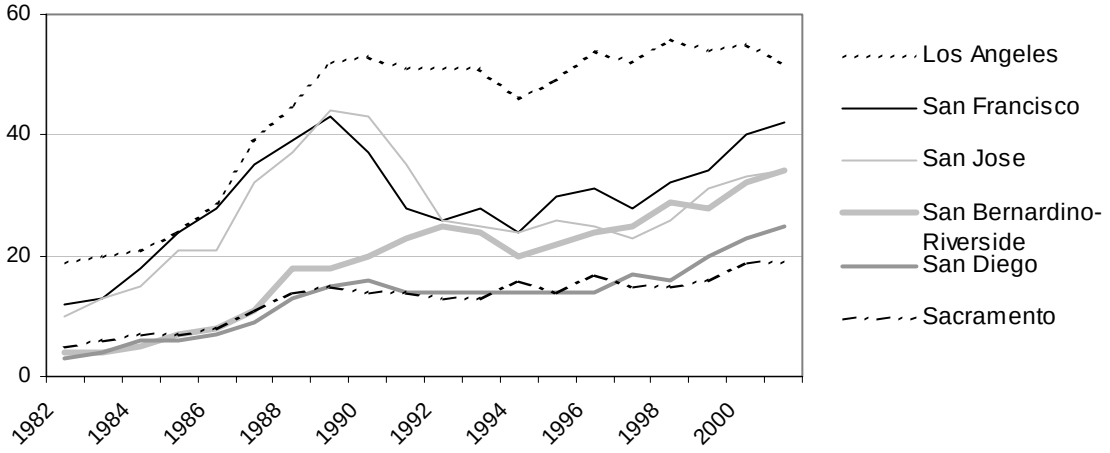
NOTE: Workers are all workers 16 years or older who did not work at home.

An alternative measure of travel delays is provided by TTI's annual *Urban Mobility Study*, which estimates annual hours of delay as a function of daily traffic volume on highways and

major arterial roads.[73] To provide a basis for comparison across regions, Figure 5.2 presents this indicator in per capita terms over a 20-year period. Because some members of the public have much lower than average vehicle use, this measure understates delays for typical drivers and passengers. However, it gives a sense both of trends and of the relative magnitudes across metropolitan areas.

For coastal regions (Los Angeles, San Francisco, San Jose), the sharpest increases in congestion occurred during the 1980s; the 1990s were characterized either by a flattening out (Los Angeles) or actual declines (Bay Area). Congestion continued to rise in San Diego and in fast-growing inland areas (Inland Empire and Sacramento) during the 1990s. In 2001, annual average hours of delay per capita ranged from 19 in Sacramento to 52 in Los Angeles, or one hour per week.

Figure 5.2
Annual Hours of Delay per Person on Highways and Major Arterials for California Metropolitan Areas, 1982-2001



SOURCE: Texas Transportation Institute (2003).

NOTE: Delay is measured per capita (not per driver or passenger) for freeways and major arterials as the difference in time required to travel peak-period vehicle miles at average speeds and at free-flow speeds.

[73] TTI's method assumes that half of all daily travel occurs during peak periods, standardized nationally at seven hours per day (6:00 to 9:30 A.M. and 3:30 to 7:00 P.M.). As such, it overstates delays in metropolitan areas where road use is more spread out over the day.

These time delays and the associated extra fuel costs have been used to generate very large estimates of the costs of congestion to California's economy – in 2001, $20.4 billion.[74] To provide some perspective, this price-tag is roughly 40 percent higher than total annual public spending on transportation in the state as a whole.[75] Cost estimates of this type imply that Californians might be willing to pay substantial sums to alleviate congestion – in the Los Angeles area, just over $1,000 per year for every man, woman, and child. However, it is likely that this measure exaggerates the value of time lost. Studies suggest that there is substantial heterogeneity in commuters' valuation of time, with some – especially long-distance commuters – not valuing it highly (Calfee and Winston, 1998; Small et al., 2002).

A more general critique is that broad measures of congestion are not the best indicators of transportation system needs. In the conventional view of the problem, congestion signals a need to build more road capacity. However, congestion can also be viewed as a sign that we are making greater use of our roadway investments, albeit with social costs in terms of delay, pollution, and other factors. From society's standpoint, building enough capacity to eliminate delays in peak travel periods hardly makes sense, because this would mean creating considerable excess capacity into the system for the rest of the day. A modern approach to infrastructure planning recognizes these tradeoffs.

Moreover, congestion is amenable to strategic interventions aimed at relieving the worst bottlenecks, rather than just building more roadway capacity. Congestion tends to be highly localized at choke-points, and its effects are non-linear – an additional car slows traffic considerably more during peak periods than during off-peak periods. In addition to enhancing transit on heavily congested corridors, modern techniques include implementing "smart" technology to regulate traffic flow and higher user fees during peak hours (Wachs, 2002; Taylor, 2002). Some analysts suggest that higher user fees have the most immediate potential to reduce congestion. For example, a modeling exercise for the San Francisco Bay Bridge suggested that by raising the (then) one-dollar toll to three during the morning rush hour, delay could be reduced by 40 percent (Frick et al., 1996). However, higher user fees are unpopular with voters. As one analyst observed, "the political debates over the issue indicate that we actually prefer the problem to the solution" (Wachs, 2002, p. 43).

Maintenance and Rehabilitation: How Much Is Enough?

In recent years, public works officials have increasingly stressed the need for more funds for maintenance and rehabilitation of existing transportation facilities, as many are now aging past their design life. The following statistics serve as examples: About one-fifth of the pavement on state highways is considered in need of rehabilitation or major reconstruction, and more than half the state's bridges are over 30 years old and require rehabilitation or replacement (California Department of Transportation, 2003a). California's roadway system has been characterized as the second roughest in the nation. As highways have aged, maintenance and rehabilitation work has

[74] Texas Transportation Institute (2003). The calculation is for the state's seven largest metropolitan areas, for highways and major arterial roads. TTI valued time in all metropolitan areas at $13.25 per hour, roughly two-thirds of average hourly California wages (California Employment Development Department, 2004).
[75] According to state budget and controller data, total transportation expenditures (capital and operations) were $14.6 billion in 1999/2000.

consumed increasing shares of spending.[76] But there is a significant backlog; deferred maintenance for state highways alone is estimated to cost more than $587 million, and major rehabilitation and reconstruction needed to halve the number of state highway lane-miles that need this type of work at about $2.2 billion annually for a decade.[77] In arguing for more funds, officials commonly appeal to a long-term cost savings argument put forth by the Federal Highway Administration: that one dollar spent on preventive maintenance can save up to six dollars in future costs, by extending the time before expensive rehabilitation is required.

Here again, however, there are problems with the way needs indicators are measured and questions about their use as a guideline for spending.[78] Often, measures of road or bridge conditions are done with periodic spot visual checks, not a good basis for assessing maintenance or rehabilitation needs. Also, the implication that the entire roadway system should be maintained to the same high standard is problematic. Given the competing objectives for public funds, it makes more sense to prioritize expenditures based on usage. Lightly used rural roadways and even city streets with low speed limits can bear lower maintenance standards than heavily used highways and expressways, for instance. Modern approaches to this problem also emphasize the potential for new technology – such as sensors – to help conduct more accurate assessments of conditions. Demand management approaches can also help: Heavy trucks, which pay less than half their share of highway costs, cause the worst damage (Federal Highway Administration, 1997).

Projections of Future Trends

In coming decades, car use among Californians is expected to rise steadily. The volume of goods moving by all modes within the state is expected to double by 2020, and many of the state's major airports will soon reach capacity (California Department of Transportation, 2003a). In the greater Los Angeles area, air passenger travel is expected to double before 2030, with suburban airports forced to accommodate much of the increasing demand (Southern California Association of Governments, 2004).

A study recently completed for Caltrans projected future road and transit travel demand to 2025 as a function of various demographic and land-use variables, assuming transportation infrastructure is provided at similar levels as today.[79] The findings suggest that car use will continue to be the predominant mode of travel, and traffic congestion will worsen since most population growth in absolute terms will occur in urban centers. Time spent traveling is projected

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[76] From 1957 to 1967, the ratio of capital outlay expenditure to maintenance expenditure for highways and roads in California was nearly four-and-a-half to one. In the 1999 and 2000 fiscal years, the ratio was closer to one-and-a-half to one (Federal Highway Administration, *Highway Statistics* annual reports and Summary to 1995, Tables HF202C, HF202M, and HF2).

[77] California Legislative Analyst's Office (2004b). LAO notes that the projected average annual funding over the next five years for rehabilitation and reconstruction is about $1.65 billion, leaving an annual shortfall of about $550 million.

[78] This section draws on a discussion with Martin Wachs, Institute of Transportation Studies, UC Berkeley, June 22, 2004.

[79] Crane et al. (2002). The researchers projected travel demand based on a recent Bay Area survey of travel behavior. An important assumption was that differences by age and race/ethnicity (controlling for other factors like income) would remain constant over time.

to rise by 48 percent. Jobs and residences will continue to suburbanize. The largest percentage increases in population and travel will occur in the Central Valley and peripheral edge cities and on the highway corridors linking these areas. Transit trips will rise at a substantially faster rate than car trips but will remain a small share (less than 10 percent) of overall trips in most areas.

Financial Needs and Gaps

As part of the federal Intermodal Surface Transportation Efficiency Act of 1991, regional transportation plans were required to be "fiscally constrained" – to contain only projects with secured funding sources. This step was taken to help promote more strategic planning across projects and modes and to ensure that long-range transportation plans would actually conform to long-range air quality plans (rather than contain "wish lists" of projects that might never actually be implemented). However, the fiscal constraint requirement also hampers the ability of state and regional agencies to evaluate potential benefits from greater or lesser levels of investment.

As a result, few careful studies have been conducted of future investment needs, statewide, that are not limited by expected revenues. The California Transportation Commission's (CTC) 1999 study is the most extensive recent source of this type. It provides results from an extensive survey of state, regional, and local transportation agencies regarding their *unfunded* (i.e. uncommitted in long-range plans) ten-year needs for system rehabilitation, operations, and high-priority expansion projects. The combined total of reported needs, as demonstrated in Table 5.4, was between $107 billion and $117 billion, with 72 percent geared for system expansion (of which 40% for rail and bus). Nearly one-quarter of reported unfunded needs was for rehabilitation or retrofit of existing assets.

The projects included are above and beyond those already programmed, based on long-range estimates of secured funding sources. If we take 1999 and 2000 capital expenditure levels of roughly $6 billion per year as an indicator of this funded baseline, total annualized spending needs would amount to roughly $16 billion to $17 billion. To cover all needs, including the CTC survey estimates, spending would have to be more than two-and-a-half times the amount actually expended in these years, a time of budget surpluses.

The CTC estimate has substantial drawbacks as a measure of investment needs, however. Although the official state and regional estimates of investment needs are likely to be low because they are budget-constrained, the CTC measure is likely to be too high, reflecting a "wish list" of all desirable projects from the transportation agency survey respondents. Neither the administration's budget-constrained approach nor the CTC's survey-based approach calculates and balances needs in relation to clearly defined standards for system performance. Caltrans and the regional agencies have been working to develop system performance measures during recent years to permit cost-benefit comparisons across different modes and projects, but the progress has been slow, as the endeavor is both technically and politically demanding.

Table 5.4
Reported Ten-Year Unfunded Needs for State, Regional, and Local Transportation Improvements and Operations

Category	Unfunded Needs			
	Billions of dollars			%
System Expansion				
Regional Agency Expansion Projects			53.6	45.9%
Highways			19.6	16.8%
Arterials			13.1	11.2%
Urban and Commuter Rail			19.6	16.8%
Bicycle and Pedestrian			1.3	1.1%
State Highways				
Interregional Improvements in Rural Areas, Native American Reservations			6.0	5.1%
Safety and Operational Improvements			3.8	3.3%
Bus and Rail Transit:				
Rolling Stock	0.7	to	2.4	2.1%
Capital Improvements	1.0	to	6.2	5.3%
American Disabilities Act (ADA) Capital Improvements			0.1	0.1%
Intercity Passenger Rail Service (expansion and rehab)			3.1	2.7%
Los Angeles Basin Rail Consolidation & Grade Separation			2.3	2.0%
North American Free Trade Agreement Transportation Infrastructure			0.4	0.3%
California Alliance for Advanced Transportation Systems			2.0	1.7%
Airports: Ground Access Improvements			2.9	2.5%
Seaports: Ground Access Improvements			1.1	0.9%
Paratransit			0.1	0.1%
Total Expansion	77.3	to	84.2	72.0%
System Rehabilitation and Retrofit				
Local Streets and Roads: Pavement Rehabilitation			10.5	9.0%
Local Bridge Rehabilitation and Replacement			0.6	0.5%
State Highways				
Bridge and Highway Rehabilitation			5.5	4.7%
Recurrent Problems			4.3	3.7%
Storm Drainage Retrofit and Retrofit Soundwalls			6.6	5.6%
Total Rehabilitation and Retrofit			27.5	23.5%
Operations				
Bus and Rail Transit				
Operating Shortfall	0.7	to	3.8	3.3%
ADA Operations	0.1	to	0.2	0.2%
Intercity Passenger Rail Service			1.1	0.9%
Total Operations	1.9	to	5.1	4.4%
Total	106.7	to	116.9	100%

SOURCE: California Transportation Commission (1999).

The State of Texas provides a possible model for California to consider. Legislation enacted in 2003 (HB 3588) requires that the statewide transportation plan include performance measures for relieving congestion and other goals, and this component *cannot* be fiscally constrained. Instead of letting budget constraints provide a parameter for planning – a framework within which alternatives are compared in relation to their performance – the Texas plan establishes quantifiable performance targets. Alternative scenarios for meeting the objectives then may be identified and the costs and benefits compared (Poole, 2004; Texas Department of Transportation, 2002). The system may particularly have merit in allowing explicit public consideration of different options that can be pursued at different price tags.

Some regional transportation agencies in California have begun to explore this approach as part of their long-range planning. In its most recent RTP, the planning agency for the San Francisco Bay Area projected a reasonable level of expected revenue to be $87.4 billion, but unfunded needs were pegged at $33 billion higher (Metropolitan Transportation Commission, 2001). The Los Angeles area agency estimated a financially constrained revenue forecast at $120 billion, assuming only that projects currently committed for funding would be completed and current land use practices would continue. The RTP then detailed an additional $31 billion of unfunded public investments needed for the region and a further $60 billion in projects to be funded from private sources (Southern California Association of Governments, 2004). The San Diego area agency projected constrained revenue at $29.6 billion, reasonably expected revenue at $41.9 billion, and unconstrained system investment needs at $67 billion (San Diego Association of Governments, 2003).

Few regional agencies explicitly model performance analysis of program scenarios that exceed expected revenue limits, however. An exception is the San Francisco Bay Area agency's latest RTP, which compares projected performance of programming scenarios that include revenue-unconstrained alternatives to expand transit capacity. This permits an examination of potential gains if funding were increased for the preferred RTP projects.[80] The preferred scenario (Blueprint II) provides more transit capacity, increasing transit trips by 2 percent, reducing daily vehicle miles traveled by more than one million, and making more than 70,000 additional jobs accessible by transit, as compared to the proposed project using available funds (Table 5.5).

Transportation Finance Challenges

During the late 1990s, the state legislature and voters responded to perceived shortfalls in transportation funding by enacting measures to provide a large influx of new funds. In 2000 the legislature passed the Transportation Congestion Relief Program, a six-year program to direct $7.6 billion in state general funds for specific congestion relief projects around the state. In 2002, voters passed Proposition 42, which permanently dedicated state sales tax revenue on gasoline toward transportation improvements.[81]

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[80] Prior to this evaluation, the preferred "Blueprint" package of revenue-unconstrained projects was itself developed using performance analysis of alternatives (Metropolitan Transportation Commission, 2000).
[81] The sales tax on gasoline, introduced in 1972, had been principally destined to the general fund, as is the case for other state sales taxes. This tax should not be confused with the per gallon gasoline tax, considered a user fee, which has always been dedicated to transportation funding.

However, these actions were rapidly undone by the state's growing budget crisis. Starting in 2001, some transportation funds were loaned or permanently transferred to the state's general fund to cover other obligations. By 2003, Proposition 42 had been partially suspended. Loans and transfers from transportation from 2001 to 2004 total more than $3 billion (California Legislative Analyst's Office, 2004g). To make matters worse, annual federal transportation funds to the state are expected to contract by more than $600 million in upcoming years as the result of mandated conversion to ethanol-blended fuel, which is taxed at a lower rate than fuel with no ethanol content (Transportation California, n.d.).

These cutbacks and deferrals highlight the vulnerability of transportation funding during budget crises. Effective transportation planning relies on long-term funding predictability, because projects take many years to complete. Many analysts raise more systemic concerns about transportation finance. The issues relate closely to needs determination because different means for raising revenue are not neutral in their impacts on the demand for transportation services.

The traditional approach to raising transportation revenue was through user fees – specifically state and federal gas taxes. Not indexed to inflation, gas taxes were raised regularly by the Congress and the state legislature during the 1950s. However, since 1963, the state gas tax has been raised again only twice, the last time (1990) after a public referendum on the matter.[82] The federal tax is similar in magnitude (currently $0.184 per gallon versus $0.18 for the state tax), and has moved largely in parallel to the state tax. Declining real per gallon values and increases in fuel efficiency have resulted in a revenue base worth one-third its 1970 value in terms of vehicle miles traveled.

As this funding source declined, new local revenue sources were sought. In California, this included providing counties with authority to adopt half-cent sales tax increases for packages of transportation programs to be placed on county ballots for voter approval. Measures have passed in twenty counties, and by the late 1990s this source accounted for one-third of local funding for transportation (California Legislative Analyst's Office, 2000b; de Alth and Rueben, 2005). Last year, general sales taxes from counties and four transit districts generated as much revenue as the state gasoline tax.[83]

[82] The referendum allowed 1 percent annual increases until 1994.

[83] In 2003-04 the county sales taxes raised roughly $2.3 billion and the four transit district sales taxes raised $450 million, for a total of $2.75 billion. The state gas tax raised roughly $2.8 billion. (From Martin Wachs, personal communication, June 22, 2004.)

Table 5.5
Selected Results of Performance Analysis of Alternative Transportation Program Scenarios at Varying Funding Levels for the San Francisco Bay Area to 2025

		Alternatives			
	No Project	Proposed Project	System Management	Blueprint 1	Blueprint 2
	Abs. Value	Change from No Project			
Supply					
Roadway Supply (Lane Miles)	20,000	2%	2%	3%	3%
Transit Supply (Seat Miles per Hour)	3,700,500	8%	7%	39%	108%
Outcomes					
Daily Vehicle Miles of Travel (1,000s)	191,768	-1,181	-1,792	-1,605	-2,377
Daily Vehicle Hours of Delay (1,000s)	959	-104	-96	-120	-123
Avg Delay per Vehicle Trip (Minutes)	3.5	-0.4	-0.4	-0.5	-0.5
Daily Person Trips by Mode (1,000s)					
Auto	21,597	-0.1%	-0.2%	-0.3%	-0.3%
Transit	1,585	2.1%	2.8%	4.2%	4.1%
Bike	346	-0.9%	-0.9%	-1.2%	-1.2%
Walk	2,699	0.0%	-0.1%	-0.1%	-0.1%
Number of Total Jobs Accessible					
By Auto Within 45 Minutes (1,000s)	876	81	57	85	105
By Transit Within 45 Minutes (1,000s)	269	22	22	53	93
Percent of Total Jobs Accessible					
By Auto Within 45 Minutes (1,000s)	17.9%	1.7%	1.2%	1.7%	2.1%
By Transit Within 45 Minutes (1,000s)	3.2%	0.1%	0.1%	0.2%	0.6%
Percent of Total Jobs Accessible for Residents of Low-Income Communities					
By Auto Within 45 Minutes (1,000s)	21.0%	1.9%	1.3%	1.9%	2.4%
By Transit Within 45 Minutes (1,000s)	6.1%	0.2%	0.1%	0.3%	0.9%
Total Annual Time Saved (1,000s of hrs)		89,200	101,100	111,600	148,900
Total Annual Value of Time Saved ($1,000s)		$1,663,100	$1,897,500	$2,117,900	$2,931,400
Annual Out-of-Pocket Cost Savings		$108,300	-$249,500	$112,700	$110,400
Annual User Benefits ($1,000s)		$1,771,400	$1,648,000	$2,230,600	$3,041,800
Vehicle Emissions (Tons/Day)					
CO	795.3	-16.0	-21.1	-18.9	-21.6
ROG	49.3	-2.5	-2.9	-2.8	-3
NOX	146.5	-0.2	-0.6	0.7	0.2
PM10	92	0.6	0.9	0.9	1.3
CO2	687.5	-15.7	-21.1	-18.4	-21

SOURCE: Metropolitan Transportation Commission, Regional Transportation Plan (2001).

2001 Regional Transportation Plan Alternatives

No Project Alternative (Baseline for purposes of Environmental Impact Report) Projects that are reasonably foreseeable primarily based on current funding commitments. These projects are identified in the federally required 2001 Transportation Improvement Program (TIP) and include fully funded sales tax projects authorized by voters in Alameda and Santa Clara Counties during the November 2000 election.

Proposed "Project" Alternative (Financially constrained) The financially constrained RTP proposed for Commission adoption in November 2001. Projects are based on MTC's regional priorities (e.g., filling transit operator shortfalls, pavement shortfalls on the metropolitan transportation system (MTS), and system management programs) and the county congestion management agency (CMA) adopted project lists.

System Management Alternative (Financially constrained) Includes projects to address corridor mobility that are primarily operational in nature, such as more express bus service, reversible carpool lanes, and a better connected HOV and transit system. Provides more funding for streets and roads pavement shortfalls. Freeway ramp metering is assumed for the most congested corridors. Congestion pricing is assumed on the Bay Bridges to generate additional revenues, including transit operating revenues, and some highway projects are deferred to provide additional capital funding.

Blueprint 1 Alternative (Not financially constrained) The 2001 RTP plus "Blueprint" projects that could be funded if new revenue sources are developed. These represent extensions of existing funding sources, higher levels, or legislative authorization to pursue a particular fund source. Potential sources of new revenue include up to a ten-cent Regional Gas Tax, bridge tolls, new and extended sales taxes in various counties, BART bonds, and continuation of higher state transportation funding levels as provided in the Governor's 2000 Transportation Congestion Relief Program.

Blueprint 2 Alternative (Not financially constrained) Includes many projects considered in MTC's 2000 Transportation Blueprint for the 21st Century, including expanded ferry service, a California High Speed Rail system, and other long-term highway and transit improvements. For many of these projects a funding source has not yet been identified. This alternative is in addition to projects in Blueprint 1 and therefore provides the most extensive set of transportation projects that could be funded with the most optimistic assumptions about future revenues.

The shift to county sales taxes is problematic from several standpoints. One issue is funding stability. As most of the measures are set to expire in the next few years, the future of this funding source is not secure. Since the passage of Proposition 218 in 1996, renewal now requires a two-thirds vote. As noted earlier, projects funded by county ballot measures may reflect local voter preferences but not necessarily the optimal resource allocation from a regional standpoint. A case in point is the bias toward high-cost suburban commuter transit projects. Because they often require matching funds, the ballot measures also tend to skew all state and regional funding toward their inflexible packages of improvements (Taylor, Weinstein, and Wachs, 2001; Wachs, 2003a, 2003b).

Finally, a basic flaw in using the general sales tax to fund transportation investments is the absence of direct links to transportation use. Pricing transportation so that users pay a greater share of the costs of driving would encourage more efficient use of resources. Integrating concerns about predictability, long-term growth potential, and effects on behavior, many policy analysts have called for restructuring the state's transportation finance system so it is based on growth-indexed user fees. For example, the California Legislative Analyst's Office recommends

that voters be asked to repeal Proposition 42, to increase the gas tax to replace the lost funding, and to index the gas tax to inflation (California Legislative Analyst's Office, 2004c; Taylor et al., 2001).

Fully efficient transportation pricing would entail more than an increase in the gas tax. User fees based on vehicle miles traveled, fuel consumed, or a similar metric are geared to recover some portion of the *average* cost of road use, but they do not take account of *marginal* costs under different conditions. One study of federal highways estimated that these costs were roughly four times greater on urban interstates for all vehicle classes (Federal Highway Administration, 1997). Marginal (or "congestion") cost pricing could help with cost recovery, and it could also help shift driver incentives to use roadways in non-peak periods. In the past, introducing marginal cost pricing would have been prohibitively expensive in terms of administrative costs. With the advent of electronic toll technology, however, it becomes much easier, from a technical and administrative standpoint, to vary tolls by location and by time of day.

A user-fee approach to efficient pricing of automobile use would also need to take account of the cost of parking. Approximately 95 percent of automobile commuters in California receive free parking at work, a benefit that is income-tax-exempt.[84] To a large extent, the availability of so much free parking is a function of local planning codes. Local governments impose minimum off-street parking requirements on new development, generally pegged to peak levels of demand (Shoup, 1997, 1999a). Although detailed studies have not been conducted on the value of the implicit subsidy provided for parking through these policies, evidence suggests it is quite high.[85] Studies have shown that solo driving and car use generally are reduced substantially when workers must pay to park.[86]

In general, a greater reliance on user fees would open up the opportunity for the transportation sector to use revenue bonds, a potential source of funding stability. Revenue bonds – a form of long-term borrowing in which the debt obligation is secured by a project revenue stream – have been an important source of local infrastructure finance in the water and wastewater area. Unlike general obligation bonds, these bonds do not require voter approval. Some of California's local transportation authorities with fee revenues have begun exploring this route.

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[84] Based on U.S. Census data, cited in California Legislative Analyst's Office (2002b).

[85] For solo drivers receiving employer-paid parking in downtown Los Angeles, the value of employer-paid parking per mile driven to work amounts to 16 times more than the value of the federal gas tax paid for their commute (Shoup, 1993). A survey of parking impact fees imposed on developers in central business districts of 17 U.S. cities (imposed to capture the cost of providing parking) revealed an average fee more than four times higher than the average fees on office space for all other purposes combined (for roads, sewers, water, parks, and other amenities) (Shoup, 1999b).

[86] California Legislative Analyst's Office (2002b). One study cited uses San Francisco Bay Area data (RIDES for Bay Area Commuters, 2000). It found that 77 percent of commuters provided with free parking drove alone, versus only 39 percent of commuters required to pay for parking. The corresponding figures for transit use were 4.8 percent and 42 percent, respectively. In their review of factors influencing transit ridership, Taylor and Fink (2003) also stress the central role of parking availability.

Alternative Scenarios for Meeting Needs

As this review has already shown, many of the pathways for maximizing the effectiveness of transportation spending center on modern approaches: demand management policies such as user fees to encourage more efficient use of existing systems and improve cost recovery; supply-side innovations to provide services more cost-effectively and enable greater capacity utilization. Some of the greatest potential lies in combinations of both demand and supply-side policies.[87] Here we provide an overview of the experiences to date, and highlight some of the challenges going forward. We reserve discussion of a third set of policies, aimed at achieving economies of scope by integrating transportation and land use, for the following chapter.

Supply-Side Innovations

Advances in information technology offer many possibilities for improving the way we manage and use our transportation system. Smart technologies are already helping with congestion relief and have considerable untapped potential. Already, strategies such as traffic signalization and ramp metering are being used to reduce congestion at bottlenecks and reroute drivers to less congested roads in the event of back-ups. The use of traffic sensors at key locations allows for "smart" traffic lights, which can adjust signaling according to traffic conditions. Electronic toll collection at bridges is reducing administrative costs while allowing traffic to flow more smoothly. As more and more cars are equipped with on-board navigation systems that rely on global positioning systems, these too will be able to be used to redirect traffic. These congestion relief technologies also have air quality benefits, because they reduce the amount of time spent idling and in low gear.

Sensors also have potential to improve the precision of road and bridge quality assessments for maintenance scheduling. Unlike highway automation, which is still some time off, these technologies are currently available. Some analysts argue that more could be done to support the adoption of smart technologies (Deakin, 2002). One constraint to more rapid investments in technologies like sensors is that regional spending plans are tied down many years in advance by the programs agreed to in county sales tax ballot measures, leaving little room for flexibility to respond to new opportunities.

In the area of transit, planners are also looking to less costly alternatives to light rail. One strategy gaining adherents is bus rapid transit (BRT), which involves operating buses on exclusive bus highways, HOV lanes, or busy urban routes. BRT also often includes technological or street design improvements such as traffic signal prioritization, better stations, enhanced boarding procedures, fewer stops, faster service, and cleaner, quieter vehicles. Average capital costs per mile for BRT projects have been less than half the cost for light rail, although operating costs have been variable (U.S. General Accounting Office, 2001a). Lower capital costs often reflect the fact that new rights-of-way and construction are unnecessary in implementing BRT. California urban areas implementing BRT include San Diego, San Jose, and Los Angeles. It is important to note, however, that to be cost-effective, BRT requires a level of density above that currently found in

[87] See Rodier and Johnston (1997) for a study of synergistic effects of pricing, land-use, and capacity-enhancing strategies.

many of California's metropolitan areas. In many places, expansion of regular bus capacity, with access to HOV lanes, would be a better option.

Although they do not address the objective of congestion relief, some technological advances also may mitigate associated air quality problems. Electric, hydrogen, or hybrid electric-gas vehicles eventually may gain sufficient market share to reduce emissions significantly. Such vehicles may also have water quality benefits, by reducing polluted runoff. Adoption of these new technologies as stores of petroleum decline over coming decades will spell the eventual demise not just of the gas-burning engine but the gas tax. However, technological advances in electronic toll collection pave the way toward new techniques for collecting user fees.

Demand Management Techniques

To date, the most widely implemented demand management technique to mitigate congestion relies on a non-price strategy: the designation of HOV lanes, reserved for carpoolers and mass transit users. The advantage of this technique, from a political perspective, is that it imposes no out-of-pocket costs on drivers but instead encourages them to group their travel to save time and (sometimes) tolls.

When coupled with new highway lane construction, this technique combines supply-side and demand-side strategies. State and federal mandates require consideration of HOV expansion in all highway expansion planning. In particular, HOV capacity can be used to demonstrate regional transportation planning compliance with air quality standards. As a result, the majority of new capacity added to the state highway system over the last 15 years has been for HOV lanes. By 2000, 925 lane miles of California state highway had been designated as HOV lanes (2 percent of state highway lane miles). About 70 percent were in Southern California (California Legislative Analyst's Office, 2000a).

In 2000, the state's HOV lanes carried about 57 percent more people per hour during peak congestion periods than mixed-use lanes. HOV lanes were especially efficient in cases where complementary efforts to promote bus service and/or carpooling had been implemented.[88] Statewide about two-thirds of total maximum HOV capacity was being used, suggesting that some of these lanes still have room to accommodate users. Strategies to promote carpooling and bus service are appropriate in such contexts.

The financial alternative to HOV lanes is a toll. Five toll roads opened in Southern California in recent years, generating much attention for this potential new source of local revenue for highway expansion. In at least two cases, the tolls have been used in conjunction with HOV access, a hybrid known as a HOT (high-occupancy toll) lane. Of the five, two have also implemented congestion pricing, varying the price of access depending on the level of traffic (Taylor et al., 2001). Long considered politically infeasible, congestion pricing has been boosted by recent advances in electronic toll collection. For example, on a stretch of Interstate 15 in San

[88] For example, the El Monte Busway on Route 10 (the San Bernardino freeway) carried 49 percent of people during peak hours, but only 15 percent of vehicles. Aided by "casual" carpooling arrangements at East Bay transit stops, the four HOV lanes at the San Francisco Bay Bridge toll plaza carried 63 percent of all people crossing during the morning commute, while 18 mixed-flow lanes carried the remaining 36 percent (California Legislative Analyst's Office, 2000a).

Diego, single occupant vehicles can choose to purchase an electronic transponder that permits them to use carpool lanes by paying a toll, which varies based on the rate of congestion in the cost-free lanes. Revenues in 2000 averaged about $5,000 per month and were used to finance transit service on the corridor (California Legislative Analyst's Office, 2000a). A similar HOT lane was designated on State Route 91 in Orange County.

Route 91 has been connected to another innovative local financing and management tool – public-private partnerships for planning, constructing, and managing transportation routes. Pursuant to legislation passed in 1989, Caltrans entered into four demonstration projects for constructing toll roads, to be financed by the private sector.[89] The ten miles of new toll lanes constructed in the median of State Route 91 in Orange County was the first of these projects to be completed.

The introduction of toll roads has not occurred without teething pains. By 2004, one toll road – the San Joaquin Hills turnpike in Orange County – faced bankruptcy, underscoring that profitability conditions are not always present. Also, in 2002, the Orange County Transportation Authority bought back the toll lanes of State Route 91 from the private firm operating them, because it deemed that the terms of the 35-year "no compete" clause were too onerous – in effect preventing expansion of adjoining public highway space (Shigley, 2003). The Route 91 project has been running successfully since then, with funds earned on tolls going to improvements in other capacity. This experience is likely to lead to more sophisticated competition clauses in future contracts with private operators; it may also shed light on conditions when public ownership of a toll road is more appropriate.

A recent study of Southern California toll roads concluded that they are likely to be most successful in heavily congested corridors in rapidly growing areas with few alternative routes (Boarnet et al., 2002). Public support depends on the perception that tolled lanes provide relief even to non-users by relieving congestion on other nearby routes. This is particularly important in relation to the debates about the equity implications of tolls. Tolls have raised equity concerns because they are generally applied across the board, regardless of a driver's ability to pay. Some research suggests that these effects may be small, however. Also, there are a number of policies that could be used to mitigate the effects for poor households.[90] Equity implications are also much less of a concern if toll roads are introduced within a portfolio of route options, for instance alongside non-paying lanes.

As noted, parking charges are another pricing mechanism to discourage solo driving. In 1992, California passed a parking cash-out law requiring certain employers to offer cash in lieu of parking. Although the program was found to be quite effective in reducing solo driving and increasing transit use, its scope was very limited, applying only to employers who lease, rather than own, parking space (California Legislative Analyst's Office, 2002b). Other options being

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[89] Taylor et al. (2001). Under the program, a firm builds the facility and leases it from Caltrans for up to 35 years. All revenue beyond construction costs, debt payment, and a specified profit margin revert to the state.

[90] For a discussion of research, see Taylor et al. (2001). The California Legislative Analyst's Office (1998b) suggested possible policy measures to address equity concerns. For example, welfare recipients and other low-income drivers could be provided a monthly transportation subsidy in the form of toll credits or "lifeline" toll rates, similar to the reduced lifeline telephone and energy rates.

tested by California cities include in-lieu parking fees for developers (in lieu of the requirement for providing free off-street parking space), employer-paid transit passes, and curb parking fees with revenue targeted for improvements to the specific neighborhood (to help overcome public opposition to higher parking fees) (Shoup, 1993, 1997, 1999b).

Innovations for Goods-Movement

Goods-related traffic – by road and rail – plays a major role in congestion, particularly in Southern California. Increasingly, transportation planners are seeking innovations that exploit the fact that the industry itself has much to gain financially by enhanced mobility. This allows the application of demand management principles, including user fees and private sector contribution to construction costs. To date, the flagship project of this type is the Alameda Corridor project, a public-private partnership that has reduced rail and road congestion through grade separation between the Long Beach ports and the City of Los Angeles (see Haveman and Hummels, 2004). Revenue bonds are the main funding source for the project, to be repaid with charges to the railroad and port shippers. It may be more difficult to encourage such partnerships in inland areas, such as San Bernardino County, where the lack of grade separation poses a major problem for road congestion, but where the railways themselves do not stand to gain as much from the improvements.[91] In the Los Angeles region, plans are also under consideration for the construction of dedicated truck toll lanes.

Management Techniques

Other approaches to efficient provision of transportation services relate to project management. Management is a particular concern in this sector, given the extent of inter-governmental collaboration and the long gestation for project completion. Caltrans has been criticized for slow project delivery (Dowall and Whittington, 2003; California Performance Review Commission, 2004). Promising techniques include decentralizing project management to regional offices and simultaneously consolidating functions under a single manager (called "one-hat" management). Other potential techniques include performance-base contracting with private firms, for example using life-cycle costing and warranty specifications as a basis for contracting out work for pavement maintenance.

[91] In the Alameda Corridor project, the railways stood to gain from straightening the tracks, a problem they do not face in the inland areas. Because they have the right of way, they are not encumbered by road traffic (personal communication, Norman King, June 24, 2004).

Integrated Strategies and Smart Growth

As various infrastructure sectors faced pressure during the 1990s from population growth, higher costs, and environmental and fiscal constraints, strategies emerged to better coordinate planning across sectors. Coordination was seen as the key to using existing facilities more efficiently and to addressing growing conflicts among planning goals – in particular, between environmental protection and economic development.[92] These new approaches emphasize planning at the regional scale and often rely on "stakeholder" decision-making processes to integrate planning among different levels of government and different policy areas. They also emphasize better coordination between sectoral investment strategies and local land-use planning. The latter, a prerogative of cities and, for unincorporated areas, county governments, shapes the location and footprint of residential and commercial development through zoning, subdivision approval, and other measures.

Although many of the ideas behind coordination go back decades, a major impetus for this change was a shift in thinking about environmental regulation. By the late 1980s, the conventional approach, which relied on centralized, bureaucratic regulation of specific, separate "point" sources of major pollutants or other hazards, had come under attack. As remaining threats to environmental quality were increasingly traced to diffuse "non-point" sources – in particular urban dwellers, farms, and automobiles – it appeared that further gains would depend on changes in local land-use and transportation policies (Mazmanian and Kraft, 1999). Furthermore, growing conflicts between environmental and economic uses for land and water made coordination desirable to avoid piecemeal battles.

Transportation was the first sector to be systematically targeted by this integrated approach. Amendments to the Clean Air Act in 1990 strengthened enforcement of non-point air pollution, by threatening the withholding of federal transportation funds for areas out of attainment. A series of programs – the state's Congestion Management Program, established in 1989, the federal Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, and SB 45, state legislation passed in 1997 – created a new framework in which metropolitan planning agencies take the lead in developing transportation improvement plans, which must now conform to regional air quality plans in addition to a range of other policy goals.

Environmental regulations regarding water quality and the protection of endangered species have similarly influenced approaches in the water arena. The CALFED process, established in 1995 to help resolve water conflicts in the San Joaquin-Bay Delta region, has become a centerpiece of the state's effort to integrate investment in new supplies, increases in water use efficiency, and ecosystem restoration in support of endangered wildlife. Recent regulatory changes in the area of stormwater management are creating new incentives for local governments to take regional, watershed approaches to water quality management. Since January 2002, local governments have also been required to explicitly consider the water supply implications of land-use; SB 610 and SB 221, passed in 2001, require the demonstration of adequate water supplies prior to approval of large new residential development projects (more than 500 units).

[92] For a discussion of the shift in planning approaches from the early post-war years to the present, see Barbour and Lewis (2005).

Another example of the integrated approach is in the area of habitat preservation. The Natural Communities Conservation Planning (NCCP) program was established in 1991 to integrate long-range land development plans with multispecies habitat conservation at a bioregional scale. This was seen as a more effective (less piecemeal) response to the Endangered Species Act, which many local governments and developers felt was leading to unreasonable obstacles to new development, and which many environmentalists criticized for failing to ensure species survival. The initial focus of the program has been Southern California (Murphy, 1999; Pollak, 2001a , 2001b; Rempel et al., 1999).

As we have seen, the trend toward promoting regional, integrated approaches to planning and development is also evident in education. Current proposals for higher education reform often advocate greater intra-regional coordination among educational institutions, and more joint use of space with other agencies. Similarly, in K-12 planning, new regional arrangements for managing facilities construction and renewal are advocated. Efforts are also under way to promote joint use of facilities among different community agencies (including schools), and to plan for schools as "centers" of community development.[93]

Alongside these developments, a movement promoting "smart growth" emerged in the 1990s. Smart growth is a popular term for integrated land-use, infrastructure, and environmental planning. Smart growth explicitly incorporates the goal of achieving socially equitable outcomes from these planning processes. Proponents claim that current fiscal and regulatory incentives promote inefficient and environmentally unsound "sprawl" land development patterns, low levels of affordable housing production, disinvestment in inner city areas, and uncoordinated planning at the regional scale. In a smart growth approach, a key to more affordable housing is more compact development, with more multifamily units. Transit-oriented development is often a focus of smart growth strategies, on the grounds that it may favor these housing options while lessening pressure on the environment (air quality and open space).[94]

Smart growth scenarios are now an integral part of regional transportation planning in many of the state's metropolitan areas; in the San Francisco Bay, San Diego, Sacramento, and Los Angeles regions, these principles have been integrated in the most recent plans. In practice, this means that the city and county governments adopting and ratifying the plans have committed themselves to implementing the plans' transit-oriented, compact land-use policies.

Propelled by these developments, policies to promote more coordinated planning have also emerged at the state level.[95] As noted in the introductory chapter, a new requirement was established in 1999 for the governor to submit an annual five-year infrastructure plan to the legislature, intended to promote more strategic investment and planning. AB 857, passed in

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[93] See New Schools, Better Neighborhoods website, www.nsbn.org.

[94] Other equity-related smart growth strategies include reinvesting in inner city areas (particularly in public schools) to encourage more families to live there instead of in the suburbs. The equity effects of such policies are hard to predict, however, as the strategy could promote gentrification and displacement of low-income residents.

[95] See California Business Roundtable (1998); California Legislative Analyst's Office (1998c); California State Treasurer (1999); Center for the Continuing Study of the California Economy (1999); Neuman and Whittington (2000); Dowall (2001).

2002, established three main state planning priorities that reflect smart growth principles – to promote infill development and equity, to protect environmental and agricultural resources, and to encourage efficient development patterns. Beginning in 2005, any proposal for funding in the state's five-year plan is required to be consistent with these goals. However, observers within and outside state government acknowledge that it will be difficult to establish concrete guidelines for implementing this smart growth requirement.

Indeed, among the areas where integrated approaches are being proposed, the smart-growth, transportation, and land-use nexus may be generating the greatest debate. At issue are both the claims of smart-growth advocates concerning the benefits of compact, transit-oriented development, and questions about the policy and financial incentives needed to encourage more communities and regions to put smart growth plans into action. For this reason, we focus more heavily on the debates and challenges concerning the implementation of smart growth, although we also address broader questions on the role of public support to integrated approaches.

Modeling Smart Growth Outcomes in California

Thanks to the involvement of the regional transportation agencies, smart growth strategies have benefited from a considerable amount of modeling of potential outcomes. Extensive work is being done in the San Francisco Bay, Los Angeles, San Diego, and Sacramento regions. In contrast to earlier transportation models, which take land-use patterns as given, these models examine alternative land-use scenarios, varying the density and location of development. They project outcomes in relation to environmental, mobility, economic (cost-benefit), and equity objectives. In response to growing concerns about a housing affordability crisis, especially in metropolitan coastal areas, the most recent models also explicitly integrate assumptions about housing affordability.

Table 6.1 shows selected results from smart growth scenario modeling for the San Francisco Bay Area. The three alternative land-use scenarios were developed after a year-long series of public workshops to gain input on desired and feasible policy shifts.[96] Implementation of the land-use objectives embodied in the smart growth scenarios (including the availability of affordable housing) was assumed to require enhanced incentives and regulatory reforms affecting local governments and developers.

[96] The Smart Growth Initiative was a joint effort by the five major regional planning agencies (for water quality and supply, transportation, local governments and land-use, bay management, and air quality management) and about 45 business, labor, environmental, community, and governmental groups. The project had three goals: to create a smart growth land use vision for the Bay Area, to identify and obtain the regulatory changes and incentives needed to implement it, and to develop 20-year land-use and transportation projections based on the vision to guide infrastructure investments (www.abag.ca.gov/planning/smartgrowth).

Table 6.1
Selected Modeled Performance Outcomes for Different Land-Use Scenarios for San Francisco Bay Area in 2020

	1998 Base Year	2020 Baseline	Central Cities Alternative	Network of Neighborhoods Alternative	Smarter Suburbs Alternative
Total Households	2,394,800	2,839,600	3,105,400	3,109,200	3,113,600
Mean Household Income	$60,500	$78,600	$77,600	$77,800	$78,000
Greenfield development within region (acres converted)		83,000	0	4,000	34,000
Land outside region to be developed (devoted) to housing		45,000	0	0	0
In-commuters from other regions		265,000	0	0	0
% Zero-Vehicle Households	9.3%	7.6%	11.4%	9.5%	8.5%
Vehicles per Household	1.82	1.91	1.83	1.83	1.88
% Transit Trips	5.6%	6.1%	8.6%	6.8%	6.2%
% Walk Trips	9.2%	10.4%	11.5%	10.8%	10.9%
% In-Auto Trips	83.9%	82.2%	78.4%	81.0%	81.5%
Transit access (walking distance)					
Housing		23%	60%	46%	25%
Jobs		35%	67%	59%	35%
Avg. Trip Length (Miles)	7.03	7.37	7.04	7.06	7.18
Avg. Trip Duration (Minutes)	18.2	18.4	18.3	17.9	18.2
Daily Vehicle Miles Traveled (1,000s)	128,373	174,695	166,652	171,635	176,140
Daily Vehicle Trips (1,000s)	13,103	16,477	16,229	17,016	17,161
Avg. Vehicle Trip Length (Miles)	9.8	10.6	10.3	10.1	10.3
ROG	178.4	42.3	40.4	41.9	43.3
NOX	251.4	137.3	134.2	137.0	140.5
CO2	473.1	608.6	579.9	598.8	616.3
CO	2044.4	716.9	694.2	715.1	733.9
Total Housing Units		401,500	668,100	672,800	676,700
% Very Low Income		8%	27%	27%	26%
% Low Income		8%	16%	16%	17%
% Moderate Income		22%	24%	24%	24%
% Above Moderate Income		62%	33%	33%	33%
Percent of Population in Analysis Areas with Acceptable Jobs/Housing Balance*		57%	71%	50%	85%
Percent of New Households in Analysis Areas with Acceptable New Jobs/New Housing Match**		9%	76%	64%	29%

SOURCE: Smart Growth Strategy Regional Livability Footprint Project (2002a and 2002b).

The Three Smart Growth Alternatives and the Base Case

Alternative 1, "**Central Cities**," locates compact, walkable, mixed-use, and mixed-income development in the region's urban cores (San Francisco, Oakland, and San Jose) and in each county's largest city or cities. It also emphasizes growth around existing public transit stations and avoids development in outlying areas by concentrating growth.

Alternative 2, "**Network of Neighborhoods**," calls for development in many of the same locations as the first alternative but at lower densities. Additional compact, walkable, mixed-use, and mixed-income development would take place in other existing communities, along an expanded public transit network and on major corridors. This alternative envisions a rail renaissance, with new and old stations surrounded by a range of diverse types of housing, jobs, and services.

Alternative 3, "**Smarter Suburbs**," proposes compact, walkable, mixed-use, and mixed income development in many of the same places as the first and second alternatives but at still lower densities. Additional growth would occur at the region's edges at higher densities but with a better balance of jobs and housing than are typical of existing or planned new suburbs.

The "**Current Trends Base Case**" is a term coined to describe the region's future growth if nothing is done to chart a new course. The Base Case fails to provide sufficient housing for an increased population and workforce, resulting in continued growth in outlying areas, increased long-distance commuting, and further environmental degradation. It envisions development in edge communities, with residential areas largely segregated from other uses and continued reliance on the automobile as the primary mode of travel.

* Fifteen overlapping commute areas were analyzed, each centering on an existing job center and extending to include housing within about a half-hour commute or less. An acceptable jobs-housing balance is defined as a sufficient number of jobs within the area for at least 85% of households.

** Jobs-housing match assesses the match of pay scales and housing costs for new employment and new housing development only.

The differences in projected outcomes between the baseline case and the smart growth alternatives are marginal with respect to a number of transportation outcomes (average daily vehicle trips and trip length, air pollution indicators). However, the smart growth alternatives project a significantly higher number of households to be accommodated within the region, a reduction in the acres of greenfields converted to housing, a rise in transit access, and an improvement in the regional jobs-housing balance. The scenario ultimately adopted as the basis for the RTP was closest to the "Network of Neighborhoods" alternative.

Which Integrated Activities Merit Public Financial Support?

Integrated strategies are usually proposed as "win-win" approaches to public investment, at least when viewed in terms of costs and benefits at the state and regional scales. Coordination across sectors and linkages with local land-use decisions should generate economies of scope, making investment dollars go further for a wider set of benefits. By implication, integrated approaches should not necessarily generate additional costs in comparison with traditional sector-specific approaches. However, the shift toward integration

may require incentives to change the way governments and agencies interact and make decisions.

A key impetus for introducing more integrated strategies has been to avoid the negative financial incentive associated with failure to comply with environmental regulations: the monetary hammer of losing federal highway funding, of having building projects delayed because of questions regarding habitat for endangered species, and most recently of being fined for stormwater runoff. But positive incentives may also be appropriate, especially if there are institutional or regulatory barriers to adopting an integrated strategy. For example, incentives may be required to overcome local opposition to policies to promote the "regional good" that entail adverse consequences when viewed from the perspective of certain localities.

In the area of regional resource management, for instance, there will frequently be a need to create new institutions corresponding to the dimensions of the resource itself. This would justify public support, for instance, for the formation of groundwater basin or watershed management groups, consisting of the range of governments, agencies, and other interested parties that operate within the area. Seed money to help launch these new collaborative forms, and to support the technical investigations they need to begin their work, may be necessary to facilitate the attainment of goals not being met by the traditional model, such as management of non-point sources of pollution.

For linking transportation and housing, it may also be appropriate to provide local governments with carrots in the form of financial assistance to promote more infill, for instance by rezoning for higher-density, mixed-use, transit-oriented development.[97] The premise is that such developments are more difficult to generate through market forces alone within the current fiscal and regulatory context.

To date, financial support for integrated approaches has been most substantial in water-related areas. The funds available to local entities through the state water bonds passed in 2000 and 2002 include programs specifically geared to institutional development (groundwater basin management and watershed management) and give priority to proposals developed jointly by multiple institutions. By providing incentives to local agencies to work collaboratively, the new programs encourage the development of regional approaches.

Positive financial incentives have been relatively scarce for smart growth strategies, especially at the state level. The state's affordable housing programs – one potential source – were boosted in 2002 by passage of a $2.1 billion bond measure (Proposition 46). However, only a small amount of funding was allocated specifically to programs linking housing and transportation objectives. For example, $25 million was awarded in 2003 for Jobs-Housing Balance Incentive Grants to localities demonstrating recent increases in residential building permits, with awards weighted for high, medium, or low employment demand areas.

[97] Sometimes competition for the location of a new transit station or hub may be appropriate, whereby jurisdictions put forth proposals for the best land-use plans. A potential drawback is that competition may discourage the losers from moving toward more appropriate zoning. Also, regional transportation objectives may dictate outcomes that limit the scope for a competitive approach to financial incentives.

In the San Francisco Bay and San Diego regions, some regional transportation funds have been committed to assist in implementing regional smart-growth policies. In San Diego's case, the decision to include incentives was based on the limited implementation success for the region's earlier smart-growth strategy.[98] The level of funds committed by the regions is relatively limited in absolute terms although it represents a substantial share of discretionary funds.[99]

Market and Regulatory Barriers to Smart Growth

Smart growth advocates promote compact development for a host of reasons, from reducing automobile use and congestion, to promoting efficiency in energy use and public services, to the preservation of open space and potential health benefits of more walking (Litman, 2003). However, many of the claims are challenged in a continuing debate among academics, policymakers, and smart growth advocates concerning the costs and benefits of sprawl versus compact development (Burchell et al., 1998).

For example, smart growth advocates call for compact development, and in particular "infill" development near transit stops, as a means for encouraging transit usage. This strategy rests on a substantial body of research demonstrating an inverse relationship between residential density and vehicle miles traveled, and a positive relationship between density and transit use.[100] However, few smart growth advocates have acknowledged that one cost of compact growth is likely to be *more* traffic congestion, not less. Sprawl can exacerbate congestion under certain circumstances – for example when rapid outward population growth is not accommodated by new roadway investment, or when outlying commercial and employment centers locate near freeways, concentrating traffic on congested corridors (Burchell et al., 1998; Taylor, 2002). But more generally, it is compact growth not sprawl that is likely to do so (Taylor, 2002; Wachs, 2002). Indeed, increasing congestion is the mechanism by which

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[98] The Council of Governments ratified the Regional Growth Management Strategy in 1993. By 2000, land-use plans and policies were still generally inconsistent with the plan because of the low density of planned development (San Diego Association of Governments, 1998, 1999, 2000).

[99] In the San Diego area, the recently adopted Regional Comprehensive Plan commits $25 million in transportation funds over five years for localities that adopt supportive land-use policies. The half-cent sales tax for transportation passed in November 2004 includes $250 million over 40 years for local infrastructure improvements integrating land-use and transportation objectives and $850 million for environmental mitigation including acquiring and maintaining regional natural habitat preserves. The Sacramento area regional transportation plan commits $500 million over 23 years for smart growth community grants, while in the San Francisco Bay Area, the Metropolitan Transportation Commission established the Transportation for Livable Communities and Housing Incentives Programs to fund projects integrating transportation and land use (streetscapes, improved transit access, bike and pedestrian improvements) or encouraging high-density housing near transit. The 2001 RTP funded these programs at $27 million annually. Regional agencies have only limited discretionary funding available for a given RTP. In MTC's case, $8.6 billion of the total $87.4 billion in funding for the entire 24-year plan was identified as discretionary (in other words, not already committed by previous plans). The smart growth programs represent 7.5% of discretionary funds on an annualized basis – a fair amount considering the wide range of needs competing for the scarce funds. In addition, MTC promotes a Location Efficient Mortgage Program which provides assistance to homebuyers in compact communities.

[100] For extensive reviews, see Parsons Brinkerhoff Quade and Douglas, Inc. (1996); Ewing and Cervero (2001); Crane et al. (2002).

higher density may encourage more walking and transit use and less car use. If the goal is to reduce automobile congestion, appropriate policies are those that directly aim to reduce the utility of driving – such as congestion pricing, higher gas taxes, or parking cash-out programs.

Other costs and benefits of compact versus traditional development patterns should be weighed in the equation along with congestion relief. However, this does suggest that smart growth policies should not be oversold as a means to mitigate congestion. It also suggests that policies to encourage compact development could benefit by linkages to strategies to reduce car use.

Smart growth advocates must also face questions about the marketability of denser development. In response to the smart growth critique of sprawling development on the urban fringe, developers and builders may point out that they are building in response to what consumers want to buy – single-family detached homes with yards (and less congestion). Public opinion polling data suggests, in fact, that Californians are quite split on this issue, with about half preferring to live in such homes, even if it means long commutes, and the other half preferring an option involving higher-density living with easier access to work (Baldassare, 2002).

Developers also point out that they could provide more housing consistent with transit-oriented development goals if they did not face considerable obstacles to doing so. Some of these obstacles relate to the fiscal and legal disincentives for building multifamily housing: Federal tax code changes in the mid-1980s eliminated key incentives for building affordable multifamily units, and liability insurance has been higher for this type of housing as well.[101] Another legal constraint is the requirement under the California Environmental Quality Act for environmental review at the level of individual development projects, which may deter the feasibility of infill development on small, scattered sites. Other obstacles reflect local resistance to denser development. Local governments may face certain disincentives to building multiunit housing that relate to the fiscal system and cap on property taxes introduced by Proposition 13.[102] In addition, existing residents may resist growth for reasons including congestion, making it more difficult to gain approval for infill projects.[103]

In this context, the results of a recent, comprehensive national study on the costs and benefits of sprawl are instructive for California. The study compared current projected growth

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[101] Little Hoover Commission (2002). A lawsuit decided in 2001, and new legislation passed in 2002, aided developers in their fight to lessen condominium construction defect liability, which may help in increasing production of multifamily structures (California Planning and Development Report, 2001, 2002.)

[102] According to this argument, voter initiatives to limit local revenue – Proposition 13 in particular – have led to a greater "fiscalization" of land use choices, using zoning and other policy levers to favor development that maximizes revenue, in particular retail development, while disfavoring less remunerative land uses, in particular multiunit housing. Proposition 13 is also credited with an increase in the use of impact fees to support the infrastructure and services associated with new growth, thereby adding to housing prices.

[103] In a recent survey of city planners in California, Lewis and Neiman (2002) found that local conditions, such as commute times and jobs-housing balances, help determine cities' orientations toward housing and growth: "It is the real consequences of growth 'on the ground,' rather than merely local snobbery, that provoke citizen opposition" (p. 72)

patterns to 2025 (the sprawl scenario) with a controlled-growth scenario (simulated by the imposition of regional growth boundaries) for 3,091 U.S. counties within extended metropolitan areas (Burchell et al., 2002). Under the controlled-growth scenario, only 11 percent of households and 6 percent of jobs are redirected, but this substantially reduces sprawl (to 75 percent or less of the threshold) in more than half the counties projected to experience it. This results in savings in land conversion, public infrastructure (roads and sewers), per-capita public service costs, and housing and personal travel costs. The study also demonstrates the benefits of sprawl, however, including congestion management, cheaper family housing at the periphery with larger lots, and variety in community settings. Many of the benefits accrue to individuals, while more of the costs are spread across communities or regions. The authors conclude that sprawl's "critics and proponents are probably both right…there appear to be more costs than benefits, though the magnitude of these costs is not nearly what has been chronicled in the popular press…While sprawl is not the villain it has been portrayed to be, it is without question an unnecessary and increasing drain on natural resources."

Conclusion

At the outset of this exercise, we set the goal of shedding light on two central questions for public investment in California. First, are we spending enough to secure a sound economic future and quality of life? And second, are we making the most of the public resources available? Our review of three major sectors – education, water, and transportation – provides ample evidence that there is no single answer to the first question, because there is no objective measure of "needs." Whenever it is appropriate for those who use public services to contribute to their cost, the demand for those services – and hence the level of investment needed – depends in part on how much users are willing to pay. Even for those services considered basic public goods, for which users should not be charged, the costs may vary depending on standards adopted and technologies employed.

Public subsidies involve tradeoffs, shifting funds away from other programs or raising taxes. Recognizing the scope for cost-saving innovations and developing suitable user incentives are pathways to spending public resources judiciously. This is the essence of what we have termed a "modern approach" to infrastructure planning. California's public investment planners have been moving in this direction over the past ten to fifteen years, experimenting with different ways of providing and paying for services. Here we highlight the lessons emerging and the challenges remaining. These challenges include striking the right balance between efficiency and equity goals and setting up appropriate funding mechanisms.

K-12 Education: Building for Equitable Access

Years of high enrollment growth and low levels of spending put California's public education system in a major facilities crunch by the mid-1990s. With nearly $42 billion in state and local bonds since 2000, voters have provided enough funds to address much of the backlog and accommodate new growth. To fund projects meeting strict eligibility criteria, another $5 billion to $6 billion in state funds and a comparable local effort are still required. This cycle will need to resume early in the next decade, when enrollment is again slated to rise.

Public primary and secondary education is the one area where it may not be too far of a stretch to think in terms of an objective level of facilities needs. Because free primary and secondary education is a civil right, and school attendance a legal obligation, demand management is not appropriate here. Moreover, the scope for cost compression through portable facilities and year-round schooling has proven limited, and such measures have raised other problems, including potentially negative associations with student performance and health.

Tackling the facilities problem, therefore, has required innovations in the funding system. Proposition 39, lowering the voting requirements for school bonds from two-thirds majority to 55 percent, has generally made it far easier for communities to raise the local share. Recent reforms have also significantly improved the state's financing and planning system – streamlining the application process, targeting funds for overcrowded schools. These reforms have gone a long way toward addressing problems of inequity across school districts; overcrowding is greatest in low-income areas.

Going forward, policy debates will continue to focus on equitable access. In the wake of Proposition 39, one issue is the appropriate local match for state contributions. Property tax limitations put lower-wealth communities at a disadvantage because their ability to raise funds is lower. This has led to calls for ability-to-pay adjustments to state contributions.

Periodic bond financing can relieve shortfalls in school facilities, because they are relatively straightforward construction projects. Compared to sectors like transportation and water, the associated environmental reviews are less likely to cause long delays. The recent wave of spending has also revealed some shortcomings in this system, however, prompting a rush to "get in line" and possibly also generating cost increases because of a spike in demand for contractors. To bring schools out of the boom-bust cycle, some have proposed dedicating regular budget funds to school facilities finance. Under such a shift, the state could allocate facilities funds to schools in a manner similar to operational budgets, on a per pupil annual basis. This would require raising a new source of revenue, however. In recent years, voters have been far more willing to consider state bond finance – which ultimately gets paid for out of the general fund – than new taxes.

Other questions about school funding relate to operational budgets, which in most years outweigh capital expenditures by nine to one. California spends less per student than many other states, and because of our higher costs of living (requiring higher teacher salaries), these funds do not go as far. California also has relatively low levels of student performance. Performance is lowest in schools in low-income neighborhoods. On average, these schools now receive slightly more operating funds from the state than other schools do. Raising student achievement in our public schools will be a complex task, and money alone will not solve it. But new funds, creatively used, may need to be part of the solution.

Higher Education: Revisiting the Master Plan

Rising college participation rates and the coming of age of the "Tidal Wave II" generation (children of the baby boomers) has also generated pressure on California's system of public higher education. Overall, a 50 percent increase in capacity will be needed between now and 2013 to accommodate all students projected by the most recent enrollment forecasts. Three-fourths of this growth is in the community college system. The tidal wave will crest at about this time, and growth in the college-age population will remain negative for roughly a decade.

Although higher education also benefited from the two most recent state education bonds, these sums can cover only a small share of projected capacity expansion. However, non-state funding – from local or outside sources (benefactors and sponsored research) – may enable both the CCCs and UC to cover facilities rehabilitation, upgrade, and expansion well into the next decade, throughout the period of enrollment growth. The effect is most striking for the CCCs, which have benefited from Proposition 39. Recent local bonds outweigh state bond funds by a factor of five to one, potentially covering expansion for 11 years or more. For UC, there was a similar ratio of outside funds to state funds for capital in the late 1990s. At this rate, UC can potentially cover expansion for seven to nine years. With limited expectations of outside funding, the California State University system is in the worst position, with enough funds for at most four years.

The diversification of funding for higher education facilities can be viewed as a positive, entrepreneurial response to infrastructure finance challenges. In this new context, state funding will need to play a more strategic role in sponsoring orphan campuses and programs, which may provide valuable educational services but which are less able to raise funds from private donors or the community.

With full expansion of facilities to accommodate projected increases in enrollment, some of California's postsecondary institutions may experience excess capacity between 2015 and 2025. This underscores the importance of strategies to increase capacity utilization of existing space, for instance with incentives to expand summer enrollment, to encourage faster graduation, and to explore new technologies for distance learning.

For higher education, there is also scope for debate on the relative roles of the public and the individual in covering costs. Higher education is a choice, and individuals reap many of the benefits of this training through higher salaries. At the same time, there are wider social benefits of an educated workforce, and public subsidies may contribute to higher overall rates of training than would otherwise occur. The social contract embodied in California's Master Plan for Higher Education, adopted in 1960, guaranteed nearly free, universal access to community colleges, and low-fee access to four-year institutions (UC and CSU) for the top third of all high school graduates. The recent bonds have allayed many of the concerns regarding the system's physical capacity to accommodate the growing pool of applicants implied by this social contract. However, the state's budget woes have exposed a potentially far greater constraint relating to operating funds.

The immediate response has been an increase in student fees by more than 50 percent and a cut in some classes and programs. The CCCs, for whom enrollment is particularly price-sensitive, argue that these policies have already led to absolute declines in a period when enrollment was expected to increase. During recent budget negotiations, one proposal would have required the UC and CSU systems to reject thousands of qualified applicants for the entering class in fall 2004. Although this funding was ultimately restored, the episode has opened the door to altering the basic tenets of the Master Plan.

One proposal under consideration is to cut costs by increasing the feeder-school role of the CCCs, where per student costs to the state are lower than at the four-year institutions. Lower costs could come at a price of lower quality. The other main proposal is to increase reliance on student fees, which are still low by national standards. Higher student fees offer a number of potential advantages: as a source of funding autonomy, as a way of encouraging students to finish their degrees more quickly, and as a way of shifting some demand to private sector institutions. To avoid excluding eligible students who cannot afford to pay, fee increases would need to be accompanied by increased availability of means-tested student aid. Financial aid policies are likely to be increasingly important, as the college-age cohort shifts toward economically disadvantaged ethnic and racial groups.

These changes may offer the potential for financial solvency without significant increases in public subsidies, but they also imply a potentially profound reshaping of our system of higher education. California would be remiss to dismiss the social contract embodied in the Master Plan without a broad public discussion of the appropriateness of that contract as

we move into the 21st century, in which a highly educated workforce will be key to maintaining a strong economy.

Water: Paying for the Environment

Until recently, water planners associated growth with a specter of impending shortages and correspondingly vast public investment needs. While some still hold this view, there is increasing recognition that the amount of new water we need to support growth depends greatly on the extent to which we allow economic incentives to guide our decisions. Major savings are possible with more efficient use of existing resources, through conservation and through water marketing. Some of this transition will occur naturally as growth puts upward pressure on water prices and as some farmland is converted to residential development. In 2000, agriculture – a sector that now represents a small share of the California economy – still used roughly four times more water than all residential, commercial, and industrial uses combined. Small shifts out of agriculture can therefore generate large proportional increases for urban use.

At the heart of the debates about how much water we need is who will pay for it. Although there is a strong tradition of direct-user fee finance for municipal water agencies, many farmers have benefited from federal subsidies. Since the early 1990s, environmental water demands, to support aquatic wildlife, have entered the mix. Initially, these demands were met with involuntary, uncompensated reductions in water to other users, mainly farmers. Since then, there has been a presumption that taxpayers should pay for environmental water under the "beneficiary pays" principle of CALFED, a multiagency, multistakeholder process that aims to restore fragile Bay-Delta ecosystems while securing supplies for other users. Farmers have taken the view that the environmental water bill should include restoration of their lost supplies. Because the costs of developing most new sources are prohibitive for farmers, public subsidies would be needed to make them whole.

Many observers stress that managing water quality is at least as great a challenge as securing new supplies. New public health evidence on drinking water contaminants is raising the bar for water utilities, and new environmental regulations on polluted runoff are reshaping the way we will need to manage a wide range of activities. Some public works advocates have also argued that insufficient investment by drinking water and wastewater utilities is leading to an impending water quality crisis. In calling for public subsidies, they hearken back to the 1970s, when the federal government provided massive subsidies to upgrade wastewater treatment. They also point to the equity implications of rising costs.

However, our analysis suggests that California's municipal water and wastewater utilities are largely on track to meet regulatory demands and accommodate growth with the current funding system, which again relies mainly on user fees. This healthy state of affairs is due, in no small part, to utilities' straightforward system for raising revenues. Generally, they need only a simple majority vote from their governing board to raise fees. Current user fees are low as a share of household income, suggesting scope for fee increases without causing across-the-board hardship. Some communities may have difficulties meeting new regulations on emerging contaminants. But this should be fairly easy to do by expanding the state's targeted

assistance programs, which currently account for a small share of total state and federal support in this sector.

Thus, major questions on the table relate to potential areas of "unfunded" needs for the environment and for agriculture. Since 2001, environmental water needs and ecosystem restoration programs – including the seismically fragile Delta levees – have been funded with state bonds, and there is enough money available to cover another two to three years. The presumption behind CALFED's tentative peace accord between water users and environmentalists was that public funds would continue to be available for these activities. With no assured long-term funding, environmentalists are now calling for increased user fees (in effect, an environmental tax) to finance the program.

The most virulent opposition to such proposals comes from farmers, who consider that the water supply promises of CALFED have yet to be met. Given the likelihood that federal contributions will remain minimal, Californians will no doubt be asked to make ballot-box decisions on whether to devote substantial new bond funds to support ecosystem restoration, and, potentially, to help fund new supply development. Because state bonds are repaid through the general fund, bond finance amounts to subsidies from the general taxpaying public. Under the alternative of eco-taxes on water, a much higher burden would fall on farmers, as the largest water users.

The other unresolved environmental water issue concerns the management of polluted runoff. New regulations are clamping down on the construction industry, municipalities, transportation authorities, and farmers. Those leery of the costs consider this yet another "unfunded mandate." Although some cost estimates may be excessive, there are clearly challenges to paying for the management of runoff. Private construction activities are the only ones with a direct mechanism for recouping costs, through higher sales prices. Under the current legal system, stormwater fees may be considered taxes, requiring a two-thirds popular vote. In this sense, the "unfunded mandate" critique rings true: Municipalities and transportation agencies are given responsibility for implementing regulations but without the authority to generate the necessary funds.

Transportation: Smart Investments and Better Incentives

The complexity of the transportation system – with networks of roadways and different types of transit – makes it particularly difficult to assess whether we are spending enough in this sector. In the early 1990s, transportation agencies were required to move away from a conventional "wish list" approach to assessing needs, toward revenue-constrained planning. This new system has the advantage of forcing planners to consider tradeoffs among different investment options in meeting goals such as mobility and congestion relief, while meeting air quality requirements. However, there is currently no system in place for gauging potential benefits of additional investments. One recent unconstrained needs assessment suggests that capital spending would have to more than double to cover all desirable investments. But because this exercise did not weigh the costs and benefits, it is not a reliable guide to what we should be spending.

What is certain is that we are now investing less in roadways, on real per capita basis, than in the heyday of freeway building in the 1950s and 1960s. Moreover, the higher costs for rights-of-way, environmental mitigation, and modern design standards mean that these dollars do not go as far as they once did. Even after adjusting for inflation, it costs over three times more to build a highway lane mile now than it did in 1960. Slower roadway expansion, coupled with rapidly increasing car and truck use, has meant that vehicle miles traveled per lane mile have nearly tripled since the mid-1960s. Traffic congestion is a feature of life in California's metropolitan areas, and judging by public opinion polls, a source of daily consternation.

Given the costs, building enough roadway capacity to eliminate delays in peak travel periods would not be a good use of scarce public resources. Instead, it makes sense to manage congestion by investing strategically to tackle bottlenecks and by managing demand. Demand management can include encouraging drivers to carpool, to spread out their travel across the day, and to use transit alternatives during peak periods.

California's transportation agencies have been funneling roadway investments in these directions. Most significantly, the majority of new highway lane miles built in the last fifteen years have been HOV lanes, which favor carpooling and bus use. Promising experiments are now under way with the use of toll lanes, alone or in conjunction with carpooling (the so-called HOT lanes). Managed well, toll lanes also provide benefits to those in the regular lanes by alleviating congestion, and they can generate funds for other roadway improvements. Special toll lanes for goods traffic can provide similar benefits. A host of smart technologies – including electronic transponders for toll collection and traffic sensors – promises to enable further improvements in traffic flow, enhancing both mobility and air quality.

Since the 1970s, the other trend in transportation investment has been the rise in transit, which now accounts for between 20 and 40 percent of annual capital expenditures and a much larger share of the total transportation budget. Transit serves multiple goals, including mobility and access for low-income, disabled, and elderly residents without cars. However, an important motivation for shifting investment toward transit was to provide an alternative to road use to alleviate congestion during peak periods.

Progress toward attainment of this goal has been less than stellar. Between 1990 and 2000, transit use for trips to work in five major metropolitan areas barely increased, moving from 5.5 to 5.6 percent. The recent numbers are somewhat better for densely traveled corridors – 38 percent of trips along the San Francisco Bay Bridge corridor, 30 percent to downtown Los Angeles, 18 percent to downtown San Diego. But it is difficult to dismiss the critique that overall, these investments are not living up to expectations, with costs – including high operating subsidies – that far outweigh the benefits. Often, we have been making the wrong transit investments, favoring glitzy suburban light-rail systems that may never pencil out over more flexible bus systems and selective rail investments in densely populated areas. Recently, transportation authorities have been exploring some lower cost alternatives to rail, such as bus rapid transit. But as long as our funding system remains biased toward capital-intensive projects, progress toward smart transit investments is likely to remain halting.

Of all the sectors we examined, transportation is the one where the finance system is most broken. Roadways have a strong tradition of user fees, notably through state and federal taxes on gasoline, introduced in the 1920s. But rising fuel efficiency and failures to adjust this

tax for inflation have progressively eroded this revenue source. In real terms, gas taxes now raise about one-third the amount per vehicle mile traveled raised in 1970. User fees have progressively been replaced with general sales taxes. County sales taxes – voted upon as ballot measures – are a problematic source of funds from several standpoints: They reduce flexibility by committing transportation authorities to spending on a specified set of projects; they favor showcase (but not necessarily cost-effective) projects that appeal to suburban voters; they are geared to meet needs defined at the county, not the regional, level; and they frequently lock in state and federal matching funds for the same projects. In many counties, these funds risk non-renewal under the two-thirds voter threshold introduced with Proposition 218 in 1996. Finally, unlike the gas tax, sales taxes provide no incentives to drivers to modulate car use.

Although some progress can be made in managing congestion and air quality through a continued focus on HOV lanes, incorporating more user fees would provide dual benefits to California's transportation system – generating a more stable source of revenues, while encouraging drivers to team up and to use more transit. Potential sources include not only a higher gas tax but also tolls and even parking charges. The advent of electronic toll collection raises the possibility for much more efficient pricing of road use than the gas tax could ever achieve, because tolls can be varied according to the type of road and time of day.

Moving to more user-fee-based systems will depend on the public's willingness. When surveyed, Californians routinely cite traffic as one of their biggest problems. Yet they have been loath to increase transportation funding, except through local sales taxes. Legislators have not dared increase the gas tax since the early 1990s. And tolls, while promising, continue to meet with public skepticism. The alternative is a future in which we manage demand by default, through longer and longer delays.

Compact Development: Time for Growing Smarter?

California's rapid growth has exposed a fundamental tension between environmental protection and economic development. Transportation systems pollute our air and water. Expanding water supplies can harm aquatic wildlife. Construction of all types contributes to water and air pollution and can endanger critical natural habitats. Since the early 1990s, planners and environmental and community activists have increasingly sought to craft solutions to these problems through integrated approaches. These approaches emphasize planning at the regional scale and aim to break down the walls across sectors and across levels of government. Rather than taking land-use decisions as given, integrated approaches aim to shape these decisions. By influencing how and where we build, proponents see the potential not only to improve environmental outcomes but also to generate other social benefits, including more affordable housing, healthier lifestyles (more walking and biking), greater community development, and more cost-effective use of transportation facilities.

California's four major metropolitan areas have officially embraced this philosophy in their most recent regional transportation plans, which target more compact, transit-oriented development. A primary aim of these strategies is to increase housing affordability, with more housing and a greater mix of housing types than would occur with the single-family tract developments envisioned in the "business as usual" scenarios. Legislation passed in 2002 also calls for the state to embrace this "smart growth" approach by investing strategically to support

infill development, efficient development at the urban fringe, and the preservation of open space.

The explicit adoption of smart growth goals by regional councils of government, through processes involving substantial citizen input, is significant. It suggests elected officials are buying into the idea that concerted planning is the best way to ensure that growth is accompanied by wider social benefits. Moving from planning to execution of these goals will be challenging, however. Many of the benefits of linking public investment to private land-use decisions will accrue at the regional scale, through more housing opportunities, more open space, better air quality, better source water protection, and potentially also improvements in social equity. Some of the costs, meanwhile, are concentrated at the local level, with those who have to implement or accept changes in land use (local governments, developers, homeowners).

To make these strategies truly "win-win," fiscal and legal reforms may be needed to reduce the disincentives to denser development. To succeed, however, smart growth strategies also depend on the willingness of California's residents to accept more compact living. When surveyed, a strong majority expresses the view that growth will make the state a less desirable place to live; housing affordability and air quality are listed as the primary concerns (Baldassare, 2001, 2004). Californians appear more split on the type of tradeoffs they want to make in terms of housing and location, however – with about half preferring the traditional "sprawl" pattern of development (single-family homes, even if it means long commutes), and the other half preferring denser living and easier access to work (Baldassare, 2002). This suggests that there is already a potential market for compact, transit-oriented development. If compact development programs succeed in making housing more affordable, they may win over more converts.

Paying for the Future We Choose

The message that emerges across all sectors is that Californians have choices about the future we want to build. One part of the choice is deciding what level of public services we want to provide. Another part is deciding how we want to pay for them. The more we link payments to the use of facilities, the better we encourage individuals and businesses to use them efficiently. As the examples of water and wastewater show, user fees offer the potential to be robust, stable funding sources. To be sure, it is important to be aware of the equity implications of more reliance on user fees. But equity should not be used as a pretext for subsidizing those who can pay; there are many ways to provide safety nets to protect those unable to afford basic services. When general public subsidies are appropriate, the experience also shows the importance of devising funding mechanisms that enable us to meet our social goals. As a case in point, lowering of voting requirements from a two-thirds majority to 55 percent for local school bonds was crucial for putting our schools and community colleges in a position to accommodate the students of the coming decade.

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