PREPARING FOR AN ARIZONA OF 10 MILLION PEOPLE — MEETING THE INFRASTRUCTURE CHALLENGES OF GROWTH — BACKGROUND REPORT

October 2008

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P3 | PRODUCTIVITY AND PROSPERITY PROJECT

ASU W. P. CAREY SCHOOL of BUSINESS
ARIZONA STATE UNIVERSITY

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A Report from the Productivity and Prosperity Project (P3), Supported by the Office of the University Economist

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PREFACE

A landmark assessment of infrastructure needs in Arizona was produced by the L. William Seidman Research Institute in May 2008 for the Arizona Investment Council (AIC): *Infrastructure Needs and Funding Alternatives for Arizona: 2008-2032*, available online at www.arizonaic.org. The AIC report addressed infrastructure needs in four categories: energy, telecommunications, transportation, and water and wastewater.

The information from the AIC report is a major input to the report that follows. Other types of infrastructure — most notably education, health care, and public safety — also are analyzed here to provide a more complete picture of infrastructure needs in Arizona. A shorter version of this report was distributed at an infrastructure conference held November 17, 2008 at Arizona State University in Tempe, Arizona. Both reports are available online at wpcarey.asu.edu/research/competitiveness-prosperity-research.

The goals of this report are to place Arizona's infrastructure needs into national and historical contexts, to identify the changing conditions in infrastructure provision that make building Arizona's infrastructure in the future a more problematic proposition than in the past, and to provide projections of the possible costs of providing infrastructure in Arizona over the next quarter century. Options for funding the state's infrastructure are not addressed in this report, but will be the topic of an upcoming report.

ACKNOWLEDGEMENTS

The Arizona Investment Council and its president, Gary Yaquinto, with the support and encouragement of William Post, CEO of Pinnacle West Capital Corporation, and other industry leaders, recognized the significance of infrastructure in Arizona. They provided the funding to bring the importance of infrastructure to light.

Arizona State University President Michael M. Crow also foresaw the coming needs for infrastructure in Arizona and directed the Office of the University Economist to extend the analysis undertaken by the AIC. Dr. Crow also proposed holding a conference to discuss the issue.

A number of people associated with the L. William Seidman Research Institute in the W. P. Carey School of Business contributed to the AIC report and/or to this report:

- Tim James directed the AIC project.
- Matthew Croucher was an author of the AIC report and contributed to this report.
- Molly Castelazo was an author of the AIC report and contributed to this report, in part by writing Appendix I.
- Kent Hill authored a portion of the AIC report.
- Eva Madly produced literature reviews and analyses for both projects.
- Tracy Clark and Liz Farquhar contributed to the AIC project.
- Angela Phillips provided support for both projects.
- Students Jessica Pullen and Emil Robles provided research assistance for this report.

Experts from around the state lent their expertise to the AIC project. These individuals are listed in the AIC report.

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EXECUTIVE SUMMARY

Arizona faces tremendous infrastructure needs:

- Arizona's public-sector infrastructure — particularly the transportation system — has not kept pace with the state's growth over the last 15 years, resulting in a need to "catch up."
- Arizona's existing public-sector physical infrastructure — especially the water infrastructure — is aging, leading to an increasing need for renovation.
- Arizona continues to grow rapidly, creating a substantial demand from new residents and new businesses for public-sector and private-sector infrastructure.

The condition of Arizona's infrastructure has a direct impact on economic productivity and quality of life. As economic competition expands domestically and globally, and as the knowledge economy evolves, the importance of a strong infrastructure increases. Education, in particular, is of growing importance.

The federal government played a significant role in the provision of Arizona's infrastructure through much of the 20th century. More recently, however, the federal government has been expending less on infrastructure, placing more of the burden on state and local governments in Arizona.

Most of the nation's infrastructure currently is provided by state and local governments. So, while federal assistance can be expected, and while certain types of infrastructure are planned and funded primarily by the private sector, the key responsibility for planning and developing Arizona's infrastructure falls on nonfederal public-sector policymakers.

State and local government policymakers, and indeed all Arizonans, will be deciding the future of Arizona in the next few years. Arizona has the opportunity to expand its significance as an economic center and to promote economic growth and prosperity. But it must be willing to invest in the state to reach these goals.

An unwillingness to invest in infrastructure and to confront the challenges posed by Arizona's projected growth will lower the quality of life of Arizonans, negatively impact the state's economy, limit the state's opportunity to become one of the region's leading economic centers, and eventually stifle growth itself.

The costs of rehabilitating existing physical infrastructure and providing new infrastructure to meet the demands of a growing population are significant. With costs increasing faster than the overall inflation rate in recent years, the provision of physical infrastructure will be relatively more expensive. Adding in the need to catch up for low spending in the last 15 years, the increasing need to repair or replace existing physical infrastructure, and the state's high population growth, the result is a need for infrastructure spending greater than in the past.

While a precise projection of the cost of infrastructure needs in Arizona cannot be made, each of several alternative methods of projecting the gap between needs and existing revenue streams have resulted in a figure of billions of dollars per year — over and above existing spending. This projection is based on a broad definition of infrastructure that includes operations costs as well as physical infrastructure costs. Currently, infrastructure expenses account for about 25 percent of

the state's gross domestic product. This proportion may need to rise to around 30 percent over the next 25 years.

While the overall gap will be shared across the private sector, the federal government, and state and local governments, the state and local government share still will be approximately $11 billion per year beyond the operations expenditures and capital outlays already being made. Even with this additional spending, Arizona's per capita state and local government expenditures would be barely above the middle of the states — up from near the bottom currently.

While the public-sector needs are great, some of the expense can be spread over a long time frame through the use of debt financing. Long-term debt is the appropriate way to fund investments in physical infrastructure that will last for decades, helping to ease the burden on current taxpayers and matching the long-run benefits of physical infrastructure investments to their overall costs.

Private-sector needs also are considerable. Consumers likely will have to pay higher prices for electricity, health care, and other privately provided services. This presents a challenge to regulated utilities, which must receive approval for higher rates from the Arizona Corporation Commission.

INTRODUCTION TO INFRASTRUCTURE

Infrastructure is defined as "the basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communications systems, power plants, and schools" by the American Heritage Dictionary.

The physical infrastructure is a key aspect of the overall infrastructure. Physical assets — buildings, equipment, and land — are typically costly to construct or purchase, but are intended to have a long useful life. In public accounting, expenditures for physical infrastructure are classified as capital outlays. The cost of the physical infrastructure is generally financed through long-term debt, thereby matching the term of the financing to the long-term uses of the infrastructure.

A complete picture of infrastructure includes services as well as the physical infrastructure. A broad view of infrastructure based on the concept of the infrastructure services expected in a modern society is shown in Table 1. The provision of most of these services requires a substantial physical infrastructure.

While the physical infrastructure receives special attention in this report, the focus of this report is the overall infrastructure. Services and physical infrastructure are intertwined. If expenditures for current operations are inadequate, the value and usefulness of the physical infrastructure decreases. For example, public buildings have been constructed but left vacant for a year or more because of a lack of current operations funding. Expenditures for services are categorized as current operations spending in public accounting.

Eight categories of infrastructure are presented in Table 1 and are used throughout this report: (1) education, (2) energy, (3) health care, (4) public safety, (5) telecommunications, (6) transportation, (7) water, and (8) other. Other organizations that have studied the nation's infrastructure have used somewhat different categorizations (see Table 2), demonstrating that no generally accepted list or categorization of infrastructure exists.

Publicly Versus Privately Provided Infrastructure

The entity — private sector, federal government, state government, or local government — responsible for the provision of infrastructure varies by type of infrastructure and by community. State and local governments provide much of the infrastructure for schools, public safety, transportation, water, and miscellaneous smaller categories. The federal government contributes to most of these infrastructure types, with primary responsibility for interstate highways and post offices. The private sector is primarily responsible for some types of infrastructure, particularly energy, communications, and health care. Overall, the public sector provides approximately 55 percent of the capital spending for physical infrastructure nationally.

As Table 1 demonstrates, few infrastructure services are wholly the responsibility of either the public sector or the private sector. Instead, in some categories the consumer has a choice. In other cases, the service may be a public responsibility, but may be subcontracted to a private-sector company. A service that may be publicly provided in one community may be available only from the private sector in another community. Finally, some infrastructure services are the primary responsibility of the private sector, but are regulated by the public sector.

Because of this mixture of responsibilities and service provision, this report examines infrastructure broadly defined to include categories primarily provided by the private sector. It is in the public interest to understand the totality of infrastructure needs, even in those cases where the private sector is primarily responsible for its provision.

TABLE 1
COMMON INFRASTRUCTURE SERVICES

Infrastructure Service	Provider (Private Sector versus Public Sector)
Education:	More than 75 percent of the infrastructure spending nationally is by the public sector, with almost all of the public spending by state and local governments
Prekindergarten and day care	Private
Kindergarten through 12th grade	Mostly public, but private options exist
Higher education	Both public and private alternatives
Libraries	Public
Energy:	The private sector accounts for 88 percent of the infrastructure spending nationally; more than 80 percent of the public spending is by state and local governments
Electricity	Typically private though regulated by public sector
Pipelines	Typically private
Health Care	Mostly private, but indigent health care and certain other services are public
Public Safety (police, fire, prisons, protection & inspection)	Public, though some fire protection and some prisons are private
Telecommunications	The private sector accounts for as much as 95 percent of infrastructure spending nationally; the public sector may regulate
Transportation:	Nationally, close to 90 percent of infrastructure spending is by the public sector, with more than half of the public spending by state and local governments
Roads and transit	Usually public
Other modes (air, rail, water)	A mix of public and private
Water:	In the public sector, 90 percent of spending is by state and local governments
Drinking water	Typically public, but sometimes private (especially in a rural setting)
Wastewater disposal (sewerage)	Public, but this service frequently is not available in rural areas
Other:	
Mail	Public (U.S. Postal Service) and private (couriers and package delivery)
Parks and recreation	Public
Solid waste disposal	Trash collection typically is public, though it may be contracted to private companies and frequently is private in rural areas; landfills may be public or private, with public permits necessary

Source: Compiled by authors.

TABLE 2
CATEGORIZATION OF INFRASTRUCTURE

This Report	American Society of Civil Engineers	Congressional Budget Office
Education	Schools	Schools
Prekindergarten and Day Care		
Primary and Secondary		
Higher		
Libraries		
Energy	Energy	Energy
Electricity		
Pipelines		
Health Care	-	-
Public Safety	Security	
Police		
Fire Protection		
Corrections		Prisons
Inspection and Regulation		
Telecommunications	-	Telecommunications
Transportation		
Roads and Highways (Including Bridges)	Roads	Highways
Transit	Transit	Mass Transit
Rail	Rail	Freight Railroads
		Passenger Rail
Air	Aviation	Aviation
	Bridges	
	Navigable Waterways	Water Transportation
Water		Drinking Water and Wastewater
Drinking Water	Drinking Water	
Wastewater	Wastewater	
	Dams	
Other		
		Postal Facilities
Social Services		
Environment and Housing		
Natural Resources		Water and Other Natural Resources
Parks and Recreation	Public Parks and Recreation	
Housing and Community Development		
Solid Waste Disposal	Solid Waste	Pollution Control and Waste Disposal
	Hazardous Waste	
Government Administration		
Interest on Debt		
Other		

Source: American Society of Civil Engineers, *2005 Report Card for America's Infrastructure*, and Congressional Budget Office, *Investing in Infrastructure*, July 2008.

Cost-Benefit Analysis

In a modern postindustrial economy — as in the United States — the quality of a community's infrastructure has a direct effect on the quality of life of its residents and on economic productivity. High-quality infrastructure is necessary for a community to be economically competitive with other areas in the United States as well as globally.

Because of the necessity of many types of infrastructure, little need exists for a cost-benefit analysis prior to building the infrastructure. For example, if existing sources of energy were running at capacity and blackouts were occurring, the necessity of additional infrastructure would be obvious.

In other cases, the construction of infrastructure may be intended to improve quality rather than serve an unmet need. Empirically, benefits from such infrastructure projects may be difficult to prove. The analysis of the relationship between quality of life and infrastructure enhancements is hampered by measurement issues. The correlation between economic productivity and infrastructure enhancements varies with the geographic area analyzed. In some kinds of infrastructure projects, the benefits tend to be local in nature. Most analyses in the past have looked at too broad a geographic area to find a significant benefit. Moreover, some projects may benefit a local area at the expense of other areas.

However, well-designed infrastructure projects that meet a demonstrable need and have a broad effect can be assumed to be beneficial on net, even though costly to construct. The Congressional Budget Office has identified tens of billions of dollars of "economically justifiable investment" — each year, for transportation alone.

Data on Infrastructure Expenditures

The primary source of data on public-sector finance across the United States is the state and local government finance series compiled by the U.S. Department of Commerce, Census Bureau. Local governments are defined as counties, cities and towns, school districts, and special districts (such as those created for fire prevention).The annual Census Bureau tabulations present revenue and expenditure figures by state, using a consistent accounting system for all states. The Census Bureau aggregates the data across all state and local governments in the nation to create a national total.

The Census Bureau's state and local government finance data run from fiscal year 1963-64 through fiscal year 2005-06, though data for 2001 and 2003 are limited to national totals. Every five years (in years ending in '2' and '7'), the Census Bureau data come from a census of all governments. In the other years, the Census Bureau collects data from each state government and from a sample of local governments in each state to estimate the government finance figures. Most of the detail reported by the Census Bureau is for the "general" fund, but some information is provided for a few other funds, including a utility fund.

Government accounting separates expenditures into capital outlays and current operations. A capital outlay is defined as a public expenditure for construction, the purchase of land and existing structures, and the purchase of equipment. All other expenditures are current operations. For most expenditure categories, the Census Bureau does not split the spending into current

operations and capital outlays, though over time the number of categories for which capital outlays are separately reported has increased.

Capital outlays generally can be considered to be spending for physical infrastructure. Most current operations spending, in contrast, cannot be considered to be an investment in physical infrastructure. However, some spending related to the physical infrastructure is included in current operations. Thus, the capital outlays category is an imprecise proxy for public physical infrastructure spending.

In order to compare the government finance data of states of widely varying sizes, and to compare data in one state over time as the population changes, the government finance data must be adjusted. If the analysis is performed over time, the finance data must be inflation adjusted; the gross domestic product implicit price deflator was used for this purpose in this analysis. Two measures typically are employed to adjust for size differences: revenues or expenditures per resident ("per capita") and revenues or expenditures relative to a measure of income. In addition to employing the per capita and per income measures to compare data over time and across states, a measure of capital outlays as a share of revenue also is provided in this analysis.

The per capita measure is simple and straightforward, but is criticized for not considering the concept of ability to pay — the same amount of per capita taxes in a poor state will be more of a burden to taxpayers than in a state in which residents have higher incomes. The most common way to account for income differences across states and across time is to divide the revenue or expenditure figure by personal income, usually expressing the result per $1,000 of personal income.

Personal income, calculated by the U.S. Department of Commerce, Bureau of Economic Analysis, is a broader measure than money income. It includes income not available to the recipient to spend at the current time, such as pensions paid by an employer and contributions paid by both the employer and the employee for government social insurance. In contrast, a measure such as household income includes only the money income actually received. Conceptually, money income would be better as an adjustment to reflect ability to pay, but reliable money income estimates are not available annually by state.

Another concern with using the personal income measure in Arizona and in some other states is a possible underestimate or overestimate of personal income relative to money income. For some of the nonmonetary components of personal income, the Bureau of Economic Analysis has only national data. Its allocation of these national data to the states could result in inaccurate estimates by state. For example, median household and per capita money income in Arizona from the 2000 decennial census was not nearly as far below the national average as median per capita personal income from the U.S. Bureau of Economic Analysis for the same year.

In addition, to the extent that some of the costs of capital outlays do not vary that much from state to state (for example, the material costs of constructing a power plant are largely based on a national market), using an income measure to effectively limit the amount of spending in a poor state will equate to a lower quality and/or lesser quantity of infrastructure in that

state relative to other states. In turn, subpar infrastructure could limit the poor state's economic development, perpetuating its status as a poor state.

Thus, while debatable, for the purposes of this report the per capita measure is considered to produce more meaningful results than the personal income measure when comparing government revenue and expenditure figures *for a given year*. Better measures could be constructed for some categories of spending — for example, elementary and secondary school expenditures could be adjusted by the number of students — but developing such measures becomes a major project when comparing a number of states and when comparing government finances over time.

In contrast, when comparing government revenues and expenditures *over time*, it is important to consider gains in inflation-adjusted per capita income. In an increasingly affluent population, government tax collections per capita can increase without the tax burden increasing. Thus, despite its shortcomings, the personal income measure has an edge when comparing data over time.

NATIONAL INFRASTRUCTURE CHALLENGES

Given that it can take years to complete an infrastructure project, particularly the construction of new physical infrastructure, long-range planning is a necessity. If sufficient infrastructure is not in place before an influx in population occurs, quality of life, productivity, and overall competitiveness can suffer. Therefore, it is important to have a proactive approach in terms of assessing, planning, financing, and building the required infrastructure.

While the population of the United States is increasing only 1 percent per year, this equates to numeric growth of nearly 3 million people per year, resulting in a significant need to continually expand the nation's infrastructure. Further, population and economic growth is highly uneven geographically, with certain areas of the country, such as metropolitan Phoenix, growing much faster and therefore disproportionately burdened by the need for new infrastructure.

The United States faces an imminent set of demanding challenges if it is to keep pace with the infrastructure needs of its residents and businesses over the next quarter century. Calls are coming from various organizations for a concerted effort to plan for and fund improvements to the country's essential infrastructure.

The Growing Interest in Infrastructure Investment

The American Society of Civil Engineers (ASCE) periodically assesses the condition and capacity of the nation's infrastructure, with its efforts widely cited by other organizations interested in infrastructure. The latest ACSE *Report Card for America's Infrastructure* was produced in 2005, with prior versions in 2001, 1998, and earlier. While not re-estimating the needs, the ASCE issued an update in 2008. More detail on the ASCE findings is presented in the following subsection "Examples and Costs of Infrastructure Needs."

The Brookings Institution suggests that America's infrastructure has not been a national priority for many years and that there is a need for a concerted effort to rebuild the infrastructure, following the models of rural electrification under President Roosevelt and the interstate highway system under President Eisenhower. Brookings contends that infrastructure currently is approached from a project-by-project perspective in which "pork" and politics are determining factors. They cite the need for infrastructure in the context of global economic competitiveness, though they also note its importance to quality of life.

The Congressional Budget Office (CBO) estimates that the nation (all levels of government and the private sector combined) invests more than $400 billion per year in capital outlays for infrastructure, with about $60 billion funded by the federal government, primarily for highways and other modes of transportation. Yet the CBO describes this spending as 20 percent less than what is needed to maintain the existing infrastructure in its current condition. Further, they note that additional spending of tens of billions of dollars per year on transportation alone could be considered an economically justifiable investment. The CBO report *Investing in Infrastructure* was presented July 10, 2008 to the Committee on Finance of the U.S. Senate.

The CBO's $406 billion estimate of infrastructure spending in 2004 (the most recent year for which they present data) does not include private-sector spending in some categories, and does

not include every category of infrastructure. The breakout is as follows, using the terminology of the CBO:

- Transportation: $106 billion (including $67 billion for highways, $16 billion for mass transit, and $14 billion for aviation)
- Schools: $100 billion
- Energy: $78 billion
- Telecommunications: $73 billion
- Drinking Water and Wastewater: $28 billion
- Water and Other Natural Resources: $11 billion
- Pollution Control and Waste Disposal: $6 billion
- Prisons: $3 billion
- Postal Facilities: $1 billion

In the report *Infrastructure 2007: A Global Perspective*, the Urban Land Institute (ULI) addressed such topics as the competitive imperative of infrastructure, the 50 percent rise in construction and repair costs since 1999, and the limited potential of privatization. (In the United Kingdom, which actively began to pursue public-private partnerships for infrastructure more than a decade ago, only 16 percent of the infrastructure has been privatized.) In the United States, only 10 percent of road projects are forecast to attract public-private partnerships.

Declines in Infrastructure Spending

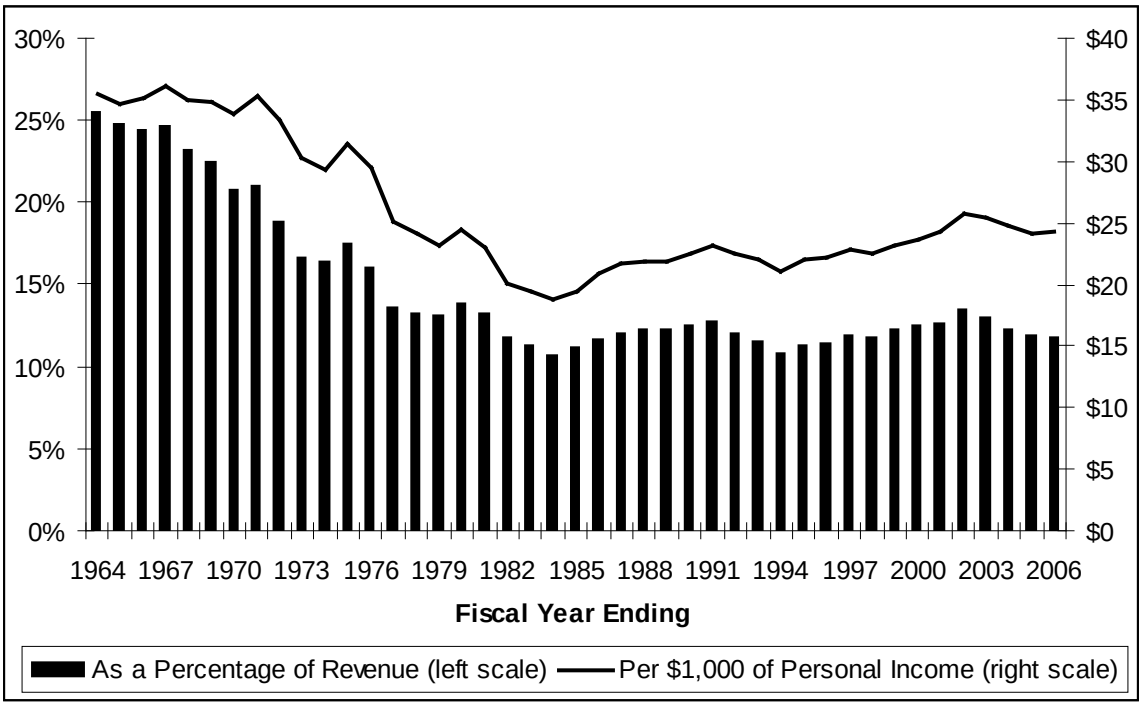
A significant decline in capital outlays for infrastructure relative to economic and population growth has occurred in the United States since 1964, the first year for which data are available. The growing concern about the condition of the nation's infrastructure in recent years likely is a direct result of the reduction in infrastructure investment.

Capital outlays overall and in four categories — primary and secondary education, higher education, highways, and sewerage — are available for the entire Census Bureau state and local government time series for the general fund (back to 1964). Nationally, these four categories have accounted for between 63 and 67 percent of the total capital outlays since the early 1970s. (In Arizona, the share was more than 80 percent in the 1960s, dropping to around 60 percent in recent years.)

Capital outlay data from the utility fund are available only for recent years. Nationally, less than 25 percent of the utility expenditures are for capital outlays. (In Arizona, the share is about 30 percent.)

General fund capital outlays of all state and local governments in the nation combined are displayed in Chart 1. The national average of the amount of state and local government capital outlays as a percentage of the total revenue of state and local governments exceeded 20 percent from fiscal years 1964 through 1971. Since 1977, it has been less than 14 percent in every year, and has averaged around 12 percent in the last three years, among the lowest percentages on record.

CHART 1
GENERAL FUND CAPITAL OUTLAYS
OF STATE AND LOCAL GOVERNMENTS NATIONALLY



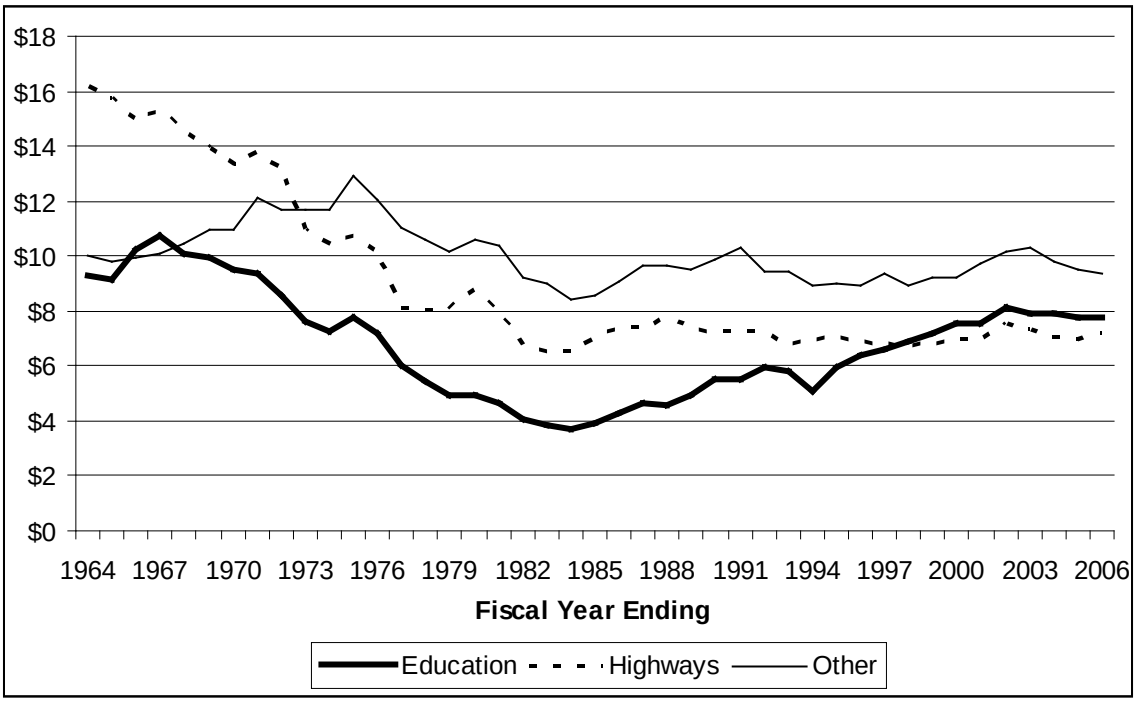
Source: Calculated from U.S. Department of Commerce, Census Bureau, State and Local Government Finances, and personal income from the Bureau of Economic Analysis.

Similarly, capital outlays per $1,000 of personal income exceeded $30 from 1964 through 1973 but the figure has been below $25 in every year since 1978, other than slightly above $25 in 2002 and 2003. In the last three years, the figure has been between $24 and $25.

Education and highways are the two largest uses of general fund capital outlays of state and local governments. As seen in Chart 2, a reduction in capital outlays for highways is primarily responsible for the overall decline seen in Chart 1, but capital outlays for education also fell before partially recovering.

While comparable historical data on capital outlays made by the federal government are not available, the Congressional Budget Office has assembled data on transportation and water infrastructure spending by the federal government. (Since the federal government has little responsibility for education, transportation is the primary use of federal capital outlays). Excluding expenditures on grants and loan subsidies to state and local governments (which are included in the state and local government expenditures), federal capital outlays on transportation and water have shrunk drastically over time. In 1964, the capital outlay per $1,000 of personal income exceeded $17. A steady decline brought this figure down to about $0.75 in 2006.

CHART 2
GENERAL FUND CAPITAL OUTLAYS OF STATE AND LOCAL GOVERNMENTS NATIONALLY BY MAJOR CATEGORY PER $1,000 OF PERSONAL INCOME



Source: Calculated from U.S. Department of Commerce, Census Bureau, State and Local Government Finances, and personal income from the Bureau of Economic Analysis.

Examples and Costs of Infrastructure Needs

The American Society of Civil Engineers assessed the condition and capacity of the nation's infrastructure in its 2005 *Report Card for America's Infrastructure*. The overall grade was D, down marginally from a D+ in 2001. In 2008, the ASCE estimated that $1.6 trillion is needed over a *five-year* period to bring the nation's infrastructure to good condition.

Fifteen categories of infrastructure were assessed by the ASCE, as shown in Table 3. The highest grade is just C+, and some categories were given a D-. Each category was evaluated on the basis of condition and performance, capacity versus need, and funding relative to need.

The costs of rehabilitating existing infrastructure and providing new infrastructure to meet the demands of a growing population are significant. Examples in each of the infrastructure categories follow.

Education

Two estimates of the cost, beyond existing spending, to bring elementary and secondary school facilities into good condition are cited by the ASCE. The U.S. Department of Education in 1999 put the need at $127 billion based on survey data from the National Center for Education Statistics. The National Education Association in 2000 put this figure at a much higher $268 billion. Neither figure has been adjusted for subsequent inflation.

TABLE 3
ASSESSMENT OF THE NATION'S INFRASTRUCTURE

Category	Grade 2005	Grade Change Over Time	Examples of Costs
Education ("Schools")	D	Slight Improvement	In 1999, the federal government estimated $127 billion were needed, other sources put the need at as much as $268 billion
Energy	D	Little Change	
Public Safety ("Security")	I*	New Category	
Transportation:			
Aviation	D+	Worse	$40 billion needed for civil aviation over five years
Bridges	C	Little Change	$9.4 billion per year for 20 years
Rail	C-	New Category	$175-194 billion for freight and $60 billion for passenger rail over 20 years
Roads	D	Little Change	$94 billion to maintain condition, $155 billion to make improvement, compared to current spending of $60 billion — per year
Transit	D+	Little Change	$14.8 billion to maintain condition, $20.6 billion to make improvement, compared to current spending of $12.3 billion — per year
Water:			$1 trillion in drinking water and wastewater over 20 years
Dams	D	No change	$10.1 billion over 12 years just for critical needs
Drinking Water	D-	Little Change	$11 billion per year just for renovation, compared to federal funding of $850 million
Navigable Waterways	D-	Little Change	$125 billion just for a system of locks
Wastewater	D-	Little Change	$390 billion over 20 years
Other:			
Hazardous Waste	D	Little Change	
Parks & Recreation	C-	New Category	$6.1 billion just for deferred maintenance at national parks
Solid Waste	C+	Slight Improvement	

* Incomplete

Source: American Society of Civil Engineers (ASCE), *2005 Report Card for America's Infrastructure.*

Energy

The Brattle Group has determined that growing demand for electric services will require an investment of approximately $1.5 trillion over the 2010-to-2030 period. Absent any changes in carbon policy, distribution costs are estimated at $675 billion, transmission costs at $233 billion, and generation costs at $560 billion. The use of advanced coal technology with carbon capture and storage could add about $200 billion in capital costs.

Health Care

Overall health care expenditures — for services as well as physical infrastructure — are projected to continue to increase rapidly, due in part to much higher inflation in health care and in part to aging of the baby-boom generation. National health expenditures are projected to

nearly double in 10 years to more than $4 trillion annually, according to the Centers for Medicare and Medicaid Services.

Public Safety
America's prison population is expected to continue to rise rapidly during the next few years, according to the Pew Center on the States. Over the next five years alone, the expenditures for new prison construction are projected to be $12.5 billion. Operations costs associated with growth in the prison population are projected to be even greater at $15 billion.

Telecommunications
Nemertes Research suggests internet usage could outstrip network capacity in North America and worldwide in the very near future. They indicate that access infrastructure, specifically in North America, will cease to be adequate for supporting demand within the next three-to-five years. The investment required to bridge the gap between demand and capacity ranges from $42 billion to $55 billion in the United States, primarily to be spent on broadband access capacity. This is in addition to the $72 billion that service providers already are planning to invest.

Transportation
The Congressional Budget Office estimated the nation's spending on transportation infrastructure in 2004 was $106.2 billion: 42 percent by the federal government, 50 percent by state and local governments, and 8 percent by the private sector (mostly in the category of freight railroads). Yet they indicate that $126.5 billion needs to be spent annually just to maintain current levels of service, and suggest that $184.8 billion per year should be spent, including economically justifiable investments. Thus, additional spending would total $78.6 billion per year. This figure is within the range of $40 billion to $125 billion per year that the ASCE estimated is needed in transportation spending beyond the existing spending.

Water and Wastewater
The U.S. Environmental Protection Agency in its 2003 Drinking Water Infrastructure Needs Survey and Assessment indicated that over the 20-year period from 2003 through 2022, the public water system infrastructure needs totaled $276.8 billion. Wastewater infrastructure needs, according to the EPA's 2004 Clean Watersheds Needs Survey, total $202.5 billion from 2004 through 2023.

GROWTH IN ARIZONA AND ITS RELATIONSHIP TO INFRASTRUCTURE NEEDS

Growth and infrastructure are intertwined — after all, infrastructure exists to serve people and businesses. The rapid growth of the population and of businesses in Arizona is the primary driver of infrastructure needs in the state. Arizona's infrastructure needs would be less, and the composition of the needs would be different, if the state's population and economy were not growing so rapidly. In a state with a more stable population, improving the quality of existing infrastructure might be the most important driver of infrastructure needs.

In addition to the sheer growth of the population and economy, other demographic and economic factors play a role in determining the nature of the needed infrastructure investments in Arizona. The geographic location of growth within Arizona, demographic characteristics of the population, the industrial structure of the economy, and land use are among the important considerations.

The location of growth within the state will have a significant impact on infrastructure needs and costs. A number of new planned communities that are remote from existing population centers have been proposed across the state, though it is unclear how many of these ever will be built. The infrastructure needed to serve such communities is very different than the infrastructure needed to serve the same number of new residents and businesses if the growth occurs in an existing developed area (by increasing the density within that area).

The demographic characteristics of residents affect the nature of the infrastructure needed. A retirement community, for example, has different needs from a community with many young adults and their children. The latter will be heavy consumers of schools and roads, while the former will place demands on the health care system.

Similarly, economic characteristics have a large effect on infrastructure requirements. An economy based on tourism, for example, has very different needs than one based on manufacturing.

Land use also affects the types of infrastructure required. For example, a bedroom community that consists primarily of residences and population-supporting employment will have very different infrastructure needs than an industrial center, a business or technology park, or a high-density residential area.

Historical and Projected Growth

Four aspects of growth that have had and will continue to have an impact on the needed infrastructure in Arizona are discussed in this section: the magnitude of population growth, demographic characteristics, economic growth and industrial structure, and geographic location. The population figures cited in this section are those of the resident population. Comparable figures do not exist for tourists or seasonal residents. However, the nonresident population also needs to be considered when determining the need for many types of infrastructure.

Population Growth

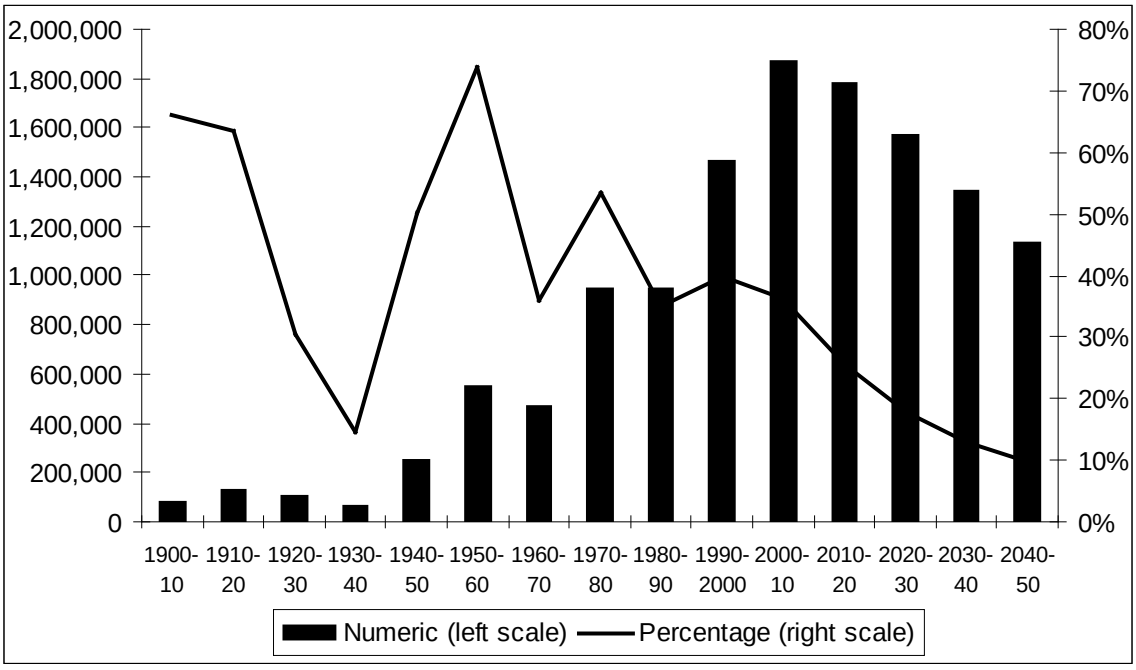
The Census Bureau is the primary source of historical population figures, producing both the decennial census counts and estimates by year by state and county. In Arizona, the Arizona

Department of Commerce is the current source of population estimates and projections, recently taking over this function from the Department of Economic Security (DES), but its time series of historical estimates only goes back to 2001. Until recently, by statute and by executive order, DES was responsible for producing the state's "official" population estimates and projections that are to be used by all state government agencies.

Until after World War II, the *numeric* population change in Arizona was relatively small, averaging less than 10,000 people per year. Because of the small population base, the *percentage* increase in population sometimes was quite high, but during the 1920s and 1930s the percentage gain also was relatively low (see Chart 3). Thus, the demands on infrastructure from a growing population were not particularly significant.

Due to the war effort, the federal government built a considerable amount of infrastructure in Arizona. This enabled growth to accelerate considerably during the late 1940s and 1950s. Numeric gains during the 1950s averaged about 55,000 people per year, and the percentage growth during the decade was the highest of the 20th century. Numeric population gains fell back a little and percentage growth decelerated during the 1960s, somewhat relieving the demand for infrastructure.

CHART 3
HISTORICAL AND PROJECTED POPULATION CHANGE IN ARIZONA BY DECADE



Source: U.S. Census Bureau, decennial censuses (historical) and Arizona Department of Economic Security, Research Administration (projected). (At the end of 2007, Research Administration was transferred to the Arizona Department of Commerce.)

During the 1970s, the numeric increase again jumped (to around 95,000 people per year) and the percentage change accelerated from that of the 1960s. Numeric growth was almost identical during the 1980s, then surged during the 1990s to nearly 150,000 people per year. Even with the much larger population base, the 40 percent gain during the 1990s was higher than in four of the preceding nine decades. Based on population estimates through 2007 and projections through 2010, numeric population growth in the current decade is approximately 40,000 people per year higher than in the 1990s, with the percentage gain not much lower. Thus, around 1970 an extended period of substantial and accelerating population gains began in Arizona. This very high numeric and percentage growth places an enormous burden on providing adequate infrastructure.

After 2010, numeric growth is forecast to gradually decline. However, through 2030 it is expected to remain greater than that of any decade in the 20th century. Due to the ever-expanding population base, percentage growth tapers off. If these projections are accurate, the extreme demands on infrastructure building of the last 15 years will continue for decades longer.

Not only has Arizona's numeric population growth been accelerating, the state's share of the nation's numeric population increase has been rising as well. All else equal, the state's rising share of the nation's population growth suggests that the state's share of the nation's infrastructure spending also should be increasing. As seen in Chart 4, the state's share of the national population gain may be peaking currently, but through 2030 it is projected to remain higher than in any decade in the past.

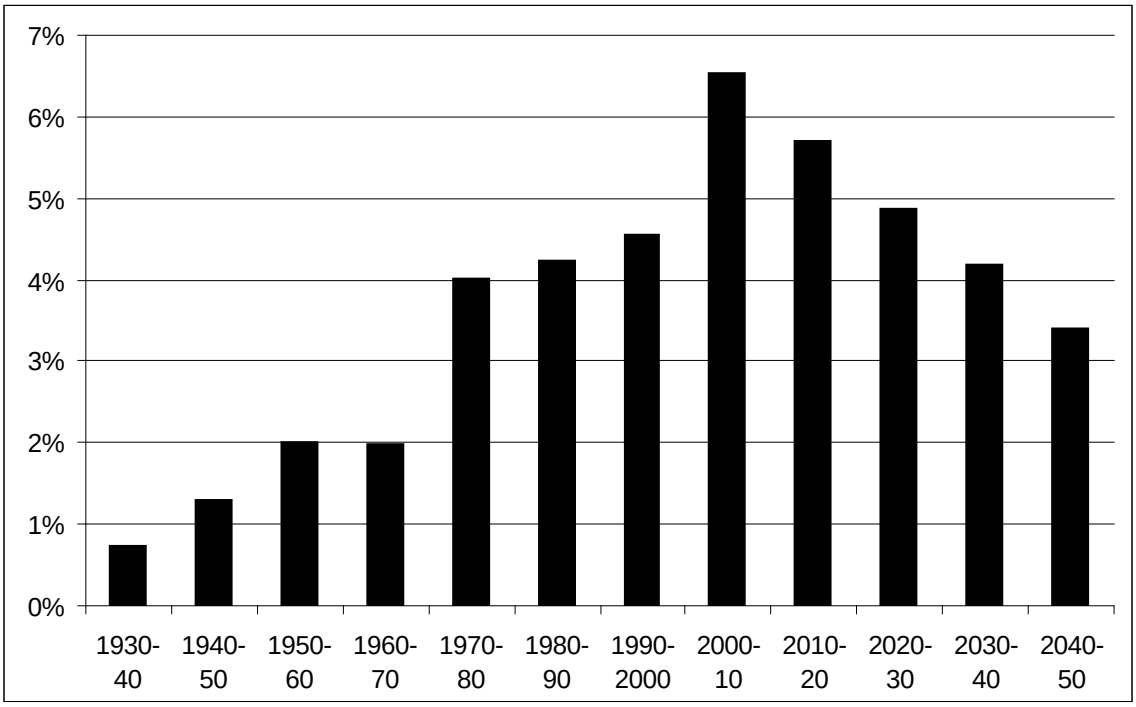
Thus far, this analysis has looked at decadal population changes in the last century and in the coming four decades. The remainder of this subsection focuses on population change over the last 20-to-25 years and on the expected population change over the next 20-to-25 years.

Following a long downturn in the economy in the late 1980s and early 1990s, the state's population growth began to accelerate in 1993. Largely due to an increase in undocumented immigration that resulted from economic difficulties in Mexico and a labor shortage in the United States, growth accelerated further in the mid-1990s to levels never before experienced. In mid-2007, the Arizona population reached 6.5 million, according to the latest DES estimate, but the Census Bureau estimate was less than 6.35 million.

Based on the projections issued in 2006 by DES, the Arizona population will reach 10 million by 2028. The annual gain in the Arizona population is projected to average approximately 172,000 people per year from 2007 through 2028. In comparison, despite the record rise in population over the last 21 years, the annual average during that period was only about 152,000 people.

Other sources have released projections that are much higher than the latest projections issued by DES in 2006. The U.S. Census Bureau released projections by state (but not by county) in 2005. It forecasts 10 million Arizona residents only a year earlier than DES, but in the Census Bureau projections annual growth is much higher during the 2020s than in the DES projections. Moreover, growth is accelerating in the Census Bureau projections, but slowing modestly in the DES forecast. In the fall of 2007, the University of Arizona projected that the Arizona population

CHART 4
HISTORICAL AND PROJECTED POPULATION CHANGE IN ARIZONA BY DECADE AS A PERCENTAGE OF THE NATIONAL POPULATION CHANGE



Source: U.S. Census Bureau (decennial censuses and national projections) and Arizona Department of Economic Security, Research Administration (Arizona projections). (At the end of 2007, Research Administration was transferred to the Arizona Department of Commerce.)

will reach 10 million in 2023 and will be 1.5 million higher in 2028 than in the DES forecast. Like the Census Bureau, the University of Arizona shows annual growth during the 2020s accelerating and far higher than projected by DES.

Growth of the magnitude projected by the Census Bureau and the University of Arizona is possible, but unlikely. However, should numeric growth become that great, infrastructure demands in Arizona will be larger than assumed in this report, which uses the DES population projections in making its projections of infrastructure needs and costs.

Throughout this report, reference is made to an assessment of infrastructure needs produced by the L. William Seidman Research Institute in May 2008 for the Arizona Investment Council (*Infrastructure Needs and Funding Alternatives for Arizona: 2008-2032*, available at www.arizonaic.org). The focus of that study was a 25-year outlook through 2032. Because of the prior existence of this study, infrastructure needs and costs through 2032 rather than 2028, when the state's population is projected to reach 10 million, are estimated in this report.

Based on the DES population projection series, Arizona's population in 2032 will be 10.6 million, an increase of 4.2 million in 25 years, or about 168,000 people per year. In contrast, the Arizona population rose approximately 3.6 million in the last 25 years, or around 144,000 people per year.

Demographic Characteristics

Various demographic characteristics can affect infrastructure needs. The age of the populace has one of the largest effects. Historically, Arizona's population growth disproportionately has consisted of young adults and retirees. Workforce participation rates are highest among young adults, placing a high demand on the transportation system. The education of the children of this age group is a significant and costly demand. In contrast, retirees travel much less and do not place demands on the educational system. However, their health care needs are much greater than those of the younger generations.

In the next 25 years, young adults and retirees are likely to continue to move to Arizona disproportionately. However, the large size of the retiring baby-boom generation means that the relative number of retirees moving to Arizona over the next 15-to-20 years may be higher than in the past. Quality of life is especially important to retirees and infrastructure is an important part of the quality of life.

Incomes, which are highly correlated to educational attainment, also affect infrastructure demands. More affluent members of society tend to consume greater per capita amounts of energy, water, higher education, telecommunications, and transportation. However, the less affluent residents have larger family sizes (putting more demands on primary and secondary education), have less private health insurance (placing more demands on public health care), and place more strain on public safety. The income distribution of the population is not expected to change during the next quarter century.

Household size also affects infrastructure demands. Birthrates in Arizona probably will decline. Some undocumented immigrants, who have more children than most other groups, appear to be leaving the state due to the implementation of the employer sanctions law at the beginning of 2008. As the children of immigrants become adults, they are likely to have smaller families than their parents, as has been the historical pattern of immigrants to the United States. Due to lower birthrates and a larger share of the population being of retirement age, average household size likely will decline, reducing per household consumption of various types of infrastructure.

Economic Growth and Industrial Structure

In a long-term sense, population growth and economic growth (particularly as measured by employment) are interrelated. A history of net in-migration encourages employers that an adequate workforce will be available if a company chooses to relocate to, or expand in, Arizona. Potential working-age migrants are encouraged to move to Arizona because of the history of substantial employment growth. In the short-term, however, most migrants must have a job in order to remain in Arizona.

Much of the employment growth in Arizona occurs in population-serving industries that respond to population growth as it is occurring or with a short lag. Thus, these industries are not responsible for the state's rapid population and economic growth. Instead, the relocation, startup, and expansion of basic industries causes the state's population and economy to grow. A basic activity is one that sells to nonresidents, that is, to residents of other states and nations. Classic examples of basic activities include most types of agriculture, mining, and manufacturing. Out-of-state tourism is another basic activity. Some activities, such as wholesale trade, have a basic

component and a nonbasic component. Some service industries, such as a national call center, also are at least partially basic in nature.

Historically, agriculture and mining were the dominant basic industries in Arizona. Tourism became important during the 20th century, followed by manufacturing after World War II. Since the 1960s, the relative importance of agriculture, mining, and manufacturing has declined, with various service industries becoming more important components of the state's basic economy.

The infrastructure needs of the various basic industries vary widely and the geographic location of basic industries is uneven across the state. In contrast, the variation in infrastructure needs across population-serving industries is less wide, and the geographic distribution of such industries is closely related to the distribution of the population.

The only long-term projection of economic growth in Arizona is produced by the University of Arizona. That projection indicates that the traditional goods-producing industries will continue to experience slow growth over the next 25 years relative to overall employment growth. Many services, especially health services, are expected to continue to grow rapidly.

In general, the expectation is that new and evolving technologies, such as biosciences and nanotechnology, will become more important basic activities in Arizona in the future. These new technologies tend to have specialized infrastructure needs.

Geographic Location

The location of future development is dependent in part on land ownership. The U.S. Department of Agriculture estimates that only 17 percent of the land in Arizona is privately owned. Other than state trust land, the rest cannot be developed. The remaining land either is Indian reservations or set aside for special uses and managed by the federal government, including large tracts managed by the Bureau of Land Management, the Forest Service, the National Park Service, and the military.

The numeric increase in population during the next 25 years is projected by DES to occur largely in Maricopa County. Though numerically only a fourth of the projected growth in Maricopa County, substantial growth is projected for Pinal County during the next 25 years, with its share of the state's population increase more than doubling from the average of the 1980-to-2007 period. The share of the state's numeric population gain is expected to rise in only one other county — Navajo — and only marginally. As seen in Chart 5, the projected numeric change in Pinal County is larger than that of the Tucson metropolitan area (Pima County), larger than the state's other four metro areas combined (Flagstaff, Lake Havasu City-Kingman, Prescott, and Yuma — Coconino, Mohave, Yavapai and Yuma counties), and more than triple the change in the nonmetropolitan portion of the state.

Between 1980 and 2007, the Phoenix metropolitan area (Maricopa and Pinal counties) accounted for 70 percent of the state's numeric population growth, with the Tucson metro area (Pima County) accounting for an additional 12 percent. Despite a projected decline in the Maricopa County share, the Phoenix metro area's share of the state's growth is expected to rise to 74 percent during the 2007-to-2032 period due to the shift in growth to Pinal County; the Tucson

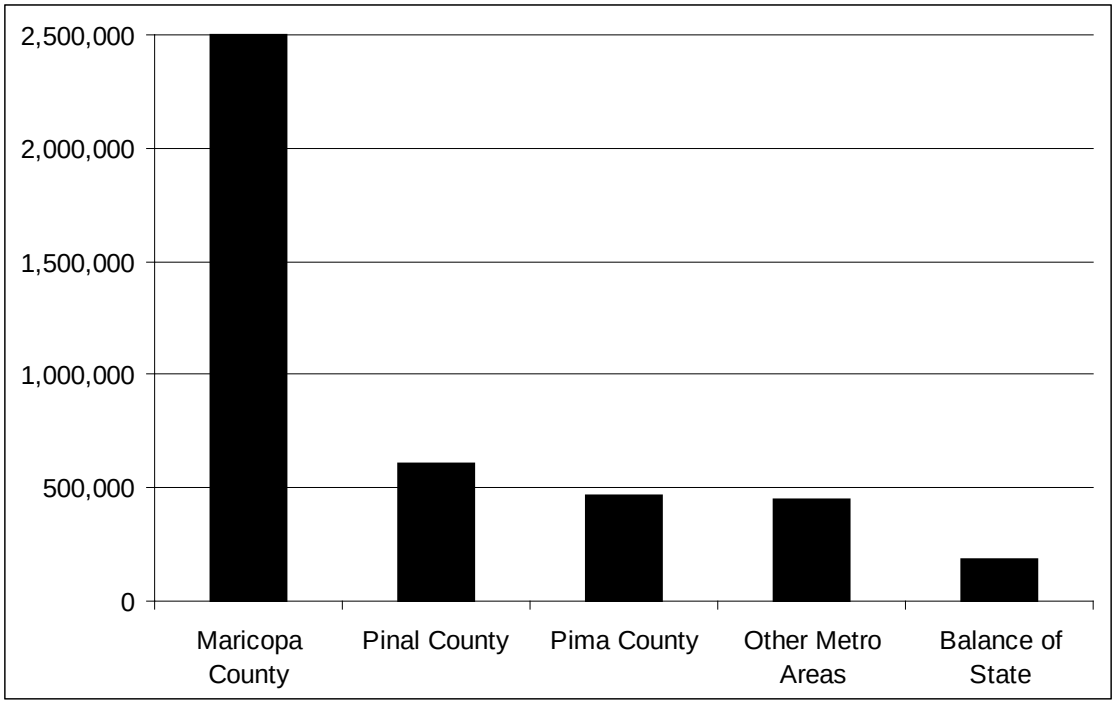
metro area's share is projected to fall slightly. Some believe that a nearly continuous developed area along Interstate 10 will form in these three counties. The three-county megapolitan share of the state's population change is projected to increase from 82 to 85 percent.

In addition to the Phoenix metro area, the Lake Havasu City-Kingman, Prescott, and Yuma metro areas grew faster on a percentage basis than the state between 1980 and 2007. Between 2007 and 2032, the population of these smaller metro areas is expected to rise at about the same pace as the state total, a little less than in the Phoenix metro area but more than in the rest of the state (see Table 4).

Population gains in Pinal County are projected to average 25,200 per year over the next 25 years, compared to 9,200 per year over the last 25 years, or 2.7 times higher. The Pinal County population is expected to reach 900,000 in 2032, or more people than were living in Pima County in 2003.

The expected shift in growth away from Maricopa and Pima counties to Pinal County has important implications for infrastructure. Most of the state's growth over the last 25 years required an expansion of the existing infrastructure in populous Maricopa and Pima counties. A larger share of the growth during the next 25 years will likely occur in Pinal County, which is still a largely rural county consisting of farmland and desert with limited infrastructure.

CHART 5
PROJECTED POPULATION CHANGE IN ARIZONA BY AREA
BETWEEN 2007 AND 2032



Source: Arizona Department of Economic Security, Research Administration. (At the end of 2007, this unit was transferred to the Arizona Department of Commerce.)

TABLE 4
POPULATION CHANGE BY AREA WITHIN ARIZONA

	1980-2007		2007-2032		Share of State	
	Numeric*	Percent	Numeric*	Percent	1980-2007	2007-2032
Arizona	3,762	137%	4,203	65%		
Phoenix-Tucson Megapolitan Area	3,090	144	3,576	69	82.1%	85.1%
Metropolitan Areas:						
Phoenix	2,623	163	3,106	74	69.7	73.9
Maricopa County	2,387	157	2,500	64	63.4	59.5
Pinal County	236	259	606	207	6.3	14.4
Tucson (Pima County)	467	87	470	47	12.4	11.2
Lake Havasu City-Kingman (Mohave Co)	148	262	137	68	3.9	3.3
Prescott (Yavapai County)	151	220	144	65	4.0	3.4
Yuma (Yuma County)**	-	-	123	61	-	2.9
Flagstaff (Coconino County)	59	78	41	31	1.6	1.0
Micropolitan Areas:						
Nogales (Santa Cruz County)	26	129	26	56	0.7	0.6
Sierra Vista-Douglas (Cochise County)	51	59	53	39	1.4	1.3
Payson (Gila County)	20	53	15	27	0.5	0.4
Safford	11	33	9	20	0.3	0.2
Graham County	14	63	9	25	0.4	0.2
Greenlee County	-3	-27	0	1	-0.1	0.0
Other Counties:						
Navajo	46	69	53	46	1.2	1.3
Apache	24	45	19	25	0.6	0.5
La Paz**	-	-	7	31	-	0.2
Yuma and La Paz	131	144	129	58	3.5	3.1

* In thousands
** La Paz and Yuma counties were combined in 1980

Source: Arizona Department of Economic Security, Research Administration. (At the end of 2007, this unit was transferred to the Arizona Department of Commerce.)

Opportunities and Challenges of Growth

Continued population growth in Arizona is inevitable, as least for some number of years more. Such growth will help Arizona expand its significance as an economic center and will give the state more political influence as its number of seats in the U.S. House of Representatives increases.

Growth, however, places a heavy strain on existing public and private infrastructure, requiring constant additions to the existing physical infrastructure and related services. The provision of infrastructure is very expensive. The substantial growth projected in Arizona during the next 25 years will place even greater pressure on the state's infrastructure.

To maintain and improve Arizona's quality of life and economic prosperity over the next 25 years, the state needs to:

- Build cutting-edge telecommunications infrastructure that puts the state on par with world telecommunications leaders like Japan, Korea, and France.

- Realize a forward-thinking energy infrastructure that accounts for rising oil and natural gas prices and an increasing desire to reduce negative environmental impact.
- Lead innovation on water conservation and water supply augmentation, anticipating competition over the West's limited water supplies.
- Build an efficient and safe transportation infrastructure to carry the state's people and goods within, in to, and out of the state.
- Construct and furnish educational facilities, and staff these facilities, to meet the needs of 21st century students and grow a population of highly educated individuals.
- Provide the police and fire protection resources, the judicial system, and the prisons necessary to ensure the safety of the state's residents and visitors.
- Support development of health care research and services.
- Provide high-quality libraries, parks, and a variety of other services expected by an educated and prosperous populace.

The state's expected magnitude of new residents will complicate the construction and provision of the infrastructure necessary to the well-being and economic prosperity of its residents. Thus, the state must decide if it is willing to accommodate the rapid growth forecast to occur. An unwillingness to confront the challenges posed by Arizona's projected growth will lower the quality of life of Arizonans, negatively impact the state's economy, limit the state's opportunity to become one of the region's leading economic centers, and eventually stifle growth itself.

CHANGING CONDITIONS IN INFRASTRUCTURE PROVISION

Changing international, national, and local conditions make the provision of Arizona's infrastructure during the next 25 years different from in the past. Increasing economic competition of a global nature means that Arizona's infrastructure in general, and its education and telecommunications infrastructure in particular, is becoming more important to the state's economic success and to the prosperity of its residents.

In recent years, costs of constructing physical infrastructure, particularly in energy and transportation, have increased faster than the overall inflation rate in the United States. Thus, it will be more costly than in the past to build new physical infrastructure and to rehabilitate existing physical infrastructure.

As Arizona's growth expands geographically away from its dominant cores, this too will add to the cost of building infrastructure. With growth during the last 15 years much greater than ever before and expected to remain historically high, the burden to keep up with growth is significant. Yet, even as Arizona continues to grow rapidly, the increasing age of its early physical infrastructure is rendering more and more of the existing physical infrastructure in need of repair or replacement. Thus, not only must Arizona build new and costly physical infrastructure, as has been the case for some decades, it will increasingly need to refurbish existing physical infrastructure as well.

State and local governments have increasingly become the keys to infrastructure provision. Yet, despite the state's record growth over the last 15 years, capital outlays and current operations by state and local governments in Arizona have fallen significantly relative to the state's size and to the national average. This suggests that Arizona has fallen behind on infrastructure provision, adding to the burden going forward.

Widening Economic Competition

Increasingly, Arizona is competing economically not only against other places in the United States, but against other countries. At the same time as this increase in global competition, an evolution away from an industrial economy to a service- and technology-based economy has been occurring in the United States and in much of the world. The infrastructure required by this new information-based economy is different from that of the industrial economy of the past. Certain types of infrastructure, such as education and telecommunications, are more important now than ever before.

In the past, Arizona competed economically by having a lower cost structure than much of the United States. Low labor costs were most important, but affordable land prices, low taxes, and other competitive business costs also contributed to the state's economic success. However, Arizona no longer can compete on cost when competitors are located in such countries as China and India. The key factor to success in the new economy is the availability of a talented and trained workforce, not low costs.

Increasing Costs

The costs of building physical infrastructure, particularly in the energy and transportation sectors, have increased disproportionately in recent years relative to the overall inflation rate.

Many of the costs associated with more broadly defined infrastructure services have risen rapidly as well. Health care is the most striking example of large cost increases for nonphysical infrastructure, but other costs, such as for higher education, also have climbed more than the overall inflation rate.

Road and highway construction costs have increased an average of 5.5 percent per year over the last 16 years, compared to an overall inflation rate of less than 3 percent per year. In the last four years, road and highway construction costs increased an average of 11.4 percent annually.

Significant increases in the cost of providing energy also have occurred in recent years. Inflation in material prices and construction costs has been higher than the overall inflation rate. Further, the cost of energy generation is increasing with the rising price of natural gas and oil.

Rising Scale of Growth

Numeric population growth in Arizona since the early 1990s has been considerably higher than in the past and percentage growth remains high at nearly 40 percent per decade. Numeric employment gains also are greater than in the past.

Such a rapidly growing population and economy require extensive expansions to the existing infrastructure. This represents an expensive endeavor not present in areas with a more stable population.

Shifting Geographic Growth Patterns

The expected shift in growth to Pinal County has important implications for infrastructure and will require considerable public and private spending for infrastructure building during the next 25 years relative to the last 25 years. Since most of the state's growth during the last 25 years was near Phoenix and Tucson, it required only an expansion of the infrastructure building that had begun decades ago. In contrast, despite a growth boom that began several years ago, Pinal County is still a largely rural county consisting of farmland and desert with limited infrastructure.

In addition to the many developments planned in Pinal County, development plans have been announced for a number of new population centers spread across Arizona, some in areas remote from existing population. To the extent that such communities are built, they will be more costly to serve than if the same number of new residents and businesses moved to an existing developed area and increased the density within that area.

Growing Need for Renovations

In older and less rapidly growing parts of the country, maintaining, repairing, and replacing aging physical infrastructure is a significant share of total infrastructure expenditures. In areas with a growing population, the construction of new physical infrastructure to serve the needs of new residents and businesses is a greater share of the total infrastructure expense.

It is difficult to determine the proportion of the nation's infrastructure expenses that are for the renovation of existing infrastructure. The Federal Highway Administration has split the costs for highways and bridges into three categories: system rehabilitation, system expansion, and system

enhancement. Under a scenario of spending enough to maintain the highway system at current levels of efficiency, 52 percent of the costs were allocated to the system rehabilitation component. Under a scenario to implement all cost-beneficial improvements, the rehabilitation share declines to 46 percent.

Until recently, much of the physical infrastructure in Arizona was relatively new, so extensive refurbishment expenses were not present. Thus, Arizona's substantial need for new physical infrastructure was partially offset by little need to renovate old physical infrastructure. This situation, however, is shifting. At the same time that the need for new infrastructure is greater than ever before due to the state's greater magnitude of growth, an increasing need to maintain, repair, and replace existing physical infrastructure is accompanying the aging of the infrastructure that was developed decades ago.

Evolving Responsibilities

The federal government was a major force in the construction of Arizona's infrastructure during much of the 20th century. The federal involvement coincided with a national interest in developing the West early in the century, with federal actions to spread newer technologies (for example, electricity and telephone service) throughout rural areas of the country during the 1930s, with the World War II effort — in which the federal government actively improved the nation's infrastructure, particularly between the two coastal areas — and with the development of the interstate highway system.

During the last third of the 20th century, however, federal expenditures for the physical infrastructure declined. Thus, it is likely that state and local governments in Arizona will have to cover a greater share of the infrastructure expenses during the next quarter century than during much of the last century.

An overview of the historical development of the Arizona infrastructure is provided in the rest of this subsection. More detail is available in Appendix I.

Long before Arizona became a state, private and public entities were working together to provide the kind of infrastructure that would make the area a suitable place to work and live. The level of public involvement in the provision of infrastructure increased over time in Arizona. In some cases, infrastructure was always a public endeavor or public-private partnership. In other cases, private infrastructure became public over time.

The increase in public involvement in infrastructure was inevitable given the scarcity of government in territorial Arizona in the 1800s. Further, increasing government involvement in the provision of infrastructure in Arizona followed the national trend of general increases in the size of government at all levels — federal, state and local — from the 1800s through the first three quarters of the 20th century. (Since then, however, the relative size of government has declined and a renewed interest in the private provision of infrastructure — for example, toll roads and private prisons — has developed.)

Many public infrastructure issues are placed on ballots to be decided by a vote of the public. These ballot issues may take the form of propositions, bond questions, resolutions, or ordinances,

and are used particularly by cities and towns. However, ballot issues have appeared in state and county government elections as well, and have been used to address a very wide range of infrastructure projects.

Some of the most important infrastructure projects in recent decades have been the result of a public vote. A key example is the increase in the county sales tax to fund the regional transportation plan approved by voters in Maricopa County in 1985 and extended in 2004. According to the 2004 ballot measure, the sales tax will provide for 56 percent of the revenue, with other funding coming from federal transit funds and Arizona highway funds. More than half of the revenues are to be used for freeways and the state highway system within Maricopa County, one third are for public transportation, and 10 percent are for major arterial roads.

Education

While schools run by religious groups and other parties always have been present, the majority of elementary and secondary schools in Arizona are and always have been public. And while there are a number of private institutions of higher education, the state's three primary universities are public (Arizona State University, the University of Arizona, and Northern Arizona University). In fact, since the 1800s, Arizonans have levied general taxes to fund education infrastructure. It is a trend that continues: In 2000, voters approved an increase in the state sales tax to allow for increases in school funding.

While schools have largely been publicly financed and operated, libraries in Arizona have a different history. Most were founded by private groups, financed by donations or membership fees. Over time, though, as cities' ability to levy taxes for public programs grew, most libraries became publicly run endeavors.

Energy

Most of the energy infrastructure in Arizona has always been privately funded and operated. A notable exception is the Salt River Project (SRP), which is a quasigovernmental entity. SRP's initial source of power was hydroelectric generation from its system of dams and canals, for which the federal government — through the Bureau of Reclamation — is largely responsible (for more discussion, see the water subsection following). The Bureau's Hoover and Glen Canyon dams also produce power for Arizona consumers through hydroelectric operations.

Since the 1940s, the SRP has expanded its power system using energy sources other than hydroelectric. On some of these projects, however, the federal government contributed to the funding.

The federal government also played a role in providing power to rural residents through the Rural Electrification Act of 1936. This act provided federal funding for the installation of electrical distribution systems to serve rural residents.

Telecommunications

The telecommunications infrastructure in Arizona has always been primarily private. However, the industry is regulated by the federal government, and the federal government helped spread telephone service through the Communications Act of 1934.

Transportation
Arizona's transportation infrastructure has been funded and operated through a mix of the public sector, public-private partnerships, and the private sector. Railroads always were private enterprises, but were assisted by the federal government through land grants. Airports have been a mixture of public and private operations. The federal government, through military operations during World War II, also played an important role.

Roads have been a state and local government responsibility, with help from the federal government. The federal government has been the major force behind the interstate highway system and is responsible for roads on federal lands, such as the Forest Service.

Public transit initially was provided by private companies. Over time, however, the public sector has assumed responsibility for nearly all operations other than intercity buses. The latest major transit project in Arizona, the light rail system in the Phoenix area, has been partially funded by the federal government, with contributions also coming from county and city taxes.

Water
The earliest water providers in Arizona in the 1800s were private enterprises. Many of these private companies were purchased by municipalities, even before statehood in 1912. Today, drinking water for Arizona residents is supplied by one of more than 400 providers, and wastewater services are administered by more than 100 providers, the large majority of which are public.

In 1902, the Bureau of Reclamation, part of the U.S. Department of the Interior, was created and the federal government began to have a large presence in the water issues of the West. The Bureau of Reclamation played a huge role in creating the 20th century water supply in Arizona through its construction of dams and canals. The federal government provided part of the funding, and also provided loans to local interests. The Salt River Project canals were completed by 1915; some were built by the Bureau of Reclamation and pre-existing canals were purchased by the Bureau. SRP system dams were constructed through the 1930s by the Bureau.

The Bureau of Reclamation continued to play a large role in Arizona even after the SRP system was complete. The Hoover and Glen Canyon dams were constructed in the mid-1900s and the Central Arizona Project canal and associated facilities were built from 1973 through 1992.

Declining Public Spending

Arizona's rapid growth over the last 15 years has not been accompanied by much spending for infrastructure. Capital outlays by state and local governments in Arizona fell significantly over this period relative to the norms of the nation and of other fast-growing states, and also relative to economic gains. Freeway and road building in particular have fallen far behind, with severe traffic congestion afflicting each of the routes into Maricopa County from Pinal County, and with numerous other examples of traffic congestion present around the Phoenix area and in other parts of the state. Capital outlays for elementary and secondary education also lagged.

The relative declines in capital outlays have been matched by relative decreases in current operations expenditures. Thus, not only has the construction and repair of the physical

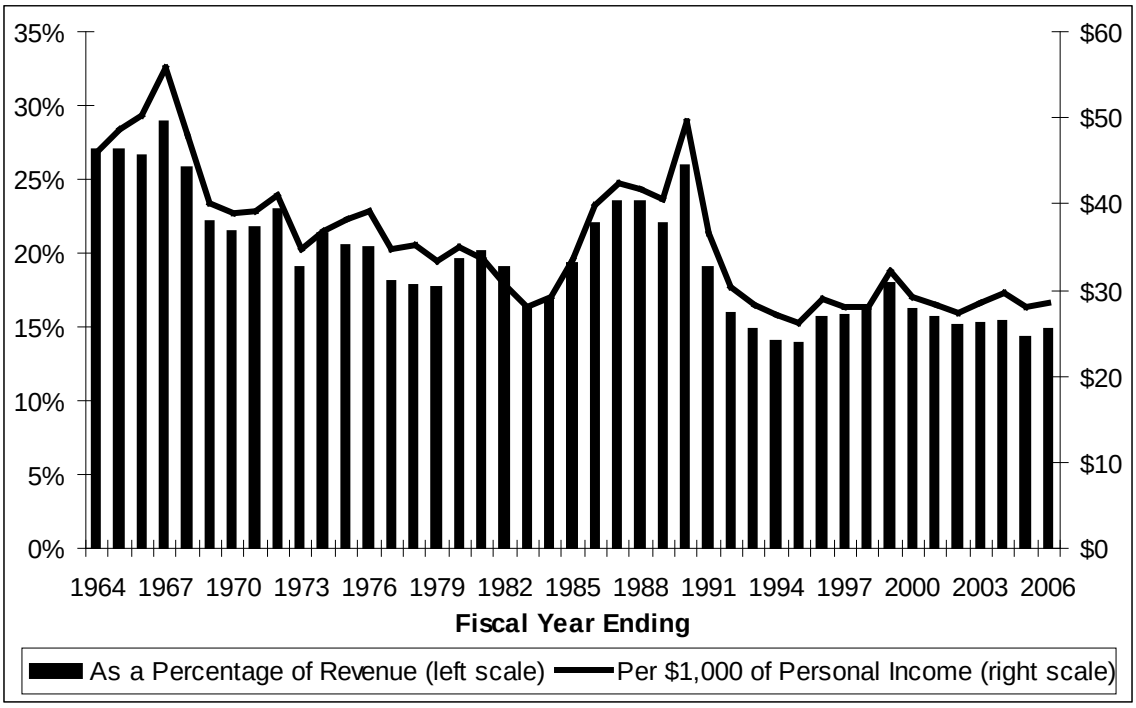
infrastructure been limited, funding for the public services associated with the physical infrastructure also has been restrained.

Capital Outlays Historically in Arizona

According to the state and local government finance data compiled by the Census Bureau, general fund capital outlays made by state and local governments in Arizona as a proportion of revenue exceeded 20 percent in most fiscal years through 1990 and were less than 17.5 percent only twice during the 1964-90 period. Since 1992, in only one year has the share exceeded 17.5 percent, and in five years it has been less than 15 percent, including the two most recent fiscal years of data (2005 and 2006). Capital outlays per $1,000 of personal income have followed a similar pattern, exceeding $40 in the 1960s and late 1980s, but being below $30 in every year but one since 1992 (see Chart 6).

The two major uses of state and local government capital outlays are education and highways. Together, these two uses have accounted for more than half of all capital outlays in every fiscal year since 1964, both nationally and in Arizona.

CHART 6
GENERAL FUND CAPITAL OUTLAYS
OF STATE AND LOCAL GOVERNMENTS IN ARIZONA



Note: Capital outlays and revenue were estimated for 2001 and 2003.

Source: Calculated from U.S. Department of Commerce, Census Bureau, State and Local Government Finances, population estimates of the Census Bureau, and personal income from the Bureau of Economic Analysis.

The decline in capital outlays in Arizona has primarily been due to decreases in highway spending. In the 1960s, at least $19 per $1,000 of personal income was spent each fiscal year on highways. Since then, the value was as high only in 1990. Prior to 1993, only in 1982 and 1983 was the figure below $10, yet it has been less than $10 in every fiscal year since 1993.

Capital outlays per $1,000 of personal income also have occurred in the education category. In each of the last three years, the figure was around $8, compared to $13 or more in most years of the 1960s and early 1970s. In contrast, no downtrend is apparent in other types of capital outlays as an aggregate.

Capital Outlays in Arizona Compared to Other States

Arizona's capital outlays, whether measured on a per capita basis, per $1,000 of personal income, or as a percentage of revenues, have been greater than the national average in most years, as would be expected in a state with a population growth rate consistently much higher than the U.S. average. However, on each of these measures Arizona's outlays as a ratio to the national average have been substantially less since the early 1990s than during the late 1970s and 1980s (see Chart 7). Even during the last 15 years of rapid growth, Arizona's capital outlays have declined on each of these measures.

In 2006, Arizona's capital outlays per capita ranked 17th among the 50 states at 2 percent higher than the national total. On the personal income measure, Arizona's spending relative to the national norm was higher than with the per capita measure, though the rank was not substantially different at 15th.

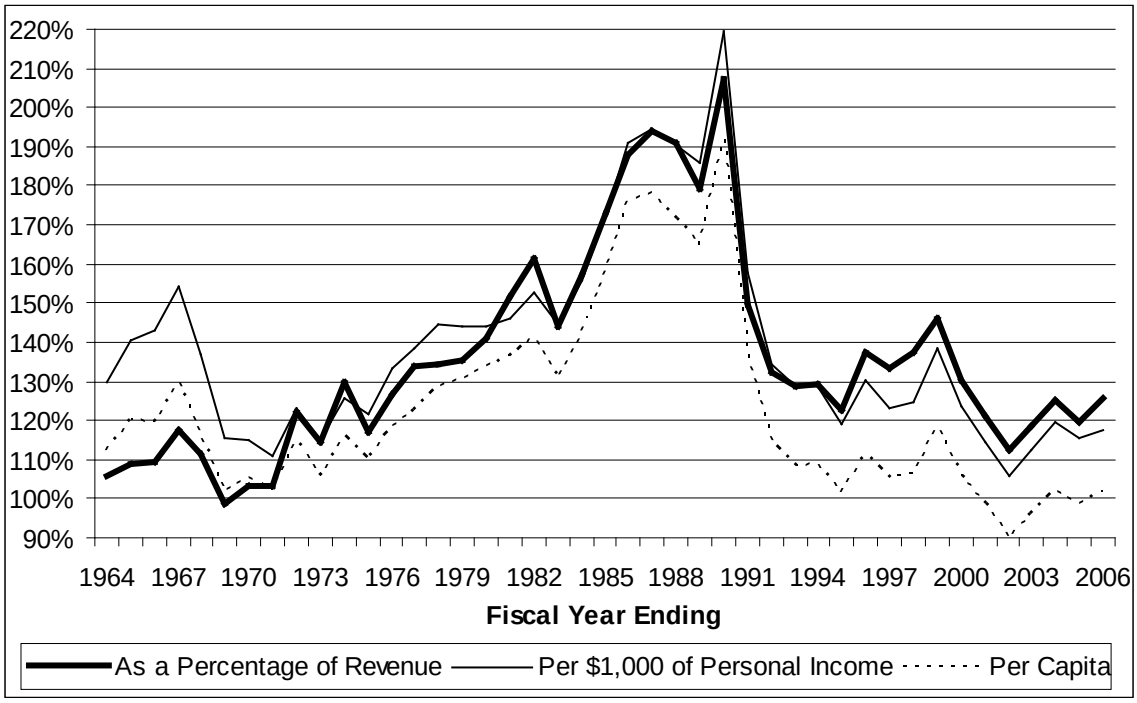
Given the differences in the need for, and nature of, capital outlays in older states with more stable populations compared to fast-growing states, a better comparison is to a smaller set of fast-growing states. The 10 states with the most rapid population growth are Arizona, Florida, Georgia, Idaho, Nevada, North Carolina, Oregon, Texas, Utah, and Washington. (Note: this list is based on the Census Bureau's projections of growth between 2000 and 2030 in order to be consistent with the states used to project infrastructure costs in Arizona, presented in the last section of this report. If population growth between 1992 and 2006 had been used instead, only one change in the list would occur: Colorado would replace Oregon.)

Arizona ranked sixth among the 10 fastest-growing states in 2006 with per capita capital outlays 4 percent below the average of the other nine states. Though a 4 percent differential seems small, Arizona state and local governments would have needed to spend $218 million more than they did to reach the per capita figure of the fastest-growing states.

The shortfall in 2006 was only the latest of the state's annual spending deficits relative to the other fast-growing states. Thus, the cumulative figure over time is much larger.

This $218 million figure understates the additional spending needed to reach the norm in that the sum of the shortfall in education and highways exceeded $625 million. (Capital outlays in the parks and recreation category were far higher per capita in Arizona than the nine-state norm.)

CHART 7
GENERAL FUND CAPITAL OUTLAYS OF STATE AND LOCAL GOVERNMENTS IN ARIZONA AS A RATIO OF THE NATIONAL AVERAGE



Note: Capital outlays were estimated for Arizona for 2001 and 2003.

Source: Calculated from U.S. Department of Commerce, Census Bureau, State and Local Government Finances, population estimates of the Census Bureau, and personal income from the Bureau of Economic Analysis.

Relative to personal income, Arizona ranked fourth among the states in 2006 with capital outlays 5 percent above the total of the other nine fastest-growing states. In contrast, Arizona ranked second on both measures among the 10 states expected to have a population closest to 10 million in 2030 (Arizona, Georgia, Illinois, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Virginia, and Washington). The population of some of these states is hardly rising, reducing the need for infrastructure spending in those states.

A comparison of Arizona to all other states and to selected states in the change in expenditures over time was made for the 1992-to-2006 period. The year 1992 was selected as the comparison year because 1992 was a census year in which no sampling error is present in the state and local government finance data, and because it is immediately *after* the sharp decline in capital outlays relative to the national average, as seen in Chart 7. (A comparison to the prior census year of 1987 would have resulted in a very substantial decline in Arizona's spending relative to the nation.)

On an inflation-adjusted per person basis, capital expenditures in Arizona between 1992 and 2006 rose 25.5 percent between 1992 and 2006, an average of 1.8 percent per year — less

than the national total of 41.1 percent, or 2.9 percent per year. The per capita increase in Arizona was less than the gain in prosperity in the state, as measured by the inflation-adjusted increase in per capita personal income. Thus, spending on capital outlays per $1,000 of personal income *decreased* 6 percent between 1992 and 2006 in Arizona (an average decline of 0.4 percent per year), compared to an increase of 6 percent nationally (0.5 percent per year).

Arizona's change in capital outlays ranked 38th among all states based on the per capita measure and 37th on the personal income measure. Arizona ranked seventh on both measures among the 10 fastest-growing states, and eighth per capita and ninth relative to personal income among the 10 states projected to have a population near 10 million in 2030. Thus, regardless of the measure used or the states compared, Arizona's change in capital outlays between 1992 and 2006 was below average.

Capital Outlays for Education. Relative to the national average, capital outlays for education in Arizona per $1,000 of personal income have been lower since 2000 than at any time since the first year of data in 1964. Despite Arizona's much faster population growth than the national average, Arizona's capital outlays on education per $1,000 of personal income in recent years have been barely above the national average. In contrast, during the late 1970s and 1980s, Arizona's figure was more than double the U.S. average.

In 2006, capital outlays for elementary and secondary education ranked 19th in the nation on a per capita basis and 14th per $1,000 of personal income. The per capita amount was below the national total while the amount relative to personal income was above average. Among the 10 fastest-growing states, Arizona ranked seventh on both measures. Per capita spending was 18 percent below the average of the other nine states and 10 percent lower based on the personal income measure. In order to match the nine-state per capita norm, an additional $249 million in capital outlays for elementary and secondary education would have had to have been expended in Arizona.

Between 1992 and 2006, capital outlays for elementary and secondary education fell in Arizona, both per capita and per $1,000 of personal income. In contrast, the national average increased substantially. Arizona ranked 44th on the change in each measure. Among the fastest-growing states, Arizona was seventh on each measure.

For higher education, Arizona's capital outlays ranked lower: 31st on a per capita basis (19 percent below the average of the 50 states) and 27th relative to personal income (12 percent less than the average of the states). Compared to the 10 fastest-growing states, Arizona ranked fifth per capita (11 percent less than the average of the other nine states) and seventh relative to personal income (2 percent less than the average of the other nine states). To bring the higher education per capita figure equal to the nine-state norm, nearly $50 million more in capital outlays would have had to have been expended in Arizona.

Capital outlays for higher education rose between 1992 and 2006, by a little less than the U.S. average per capita and by a little more relative to personal income. Arizona ranked 26th on both measures. It was fifth on both measures among the fastest-growing states.

Capital Outlays for Highways. Since 2002, Arizona's capital outlays for highways per $1,000 of personal income have been the lowest on record when compared to the U.S. average. The average Arizona figure over those years was only equal to the national average, despite the state's much faster population and economic growth. In the late 1980s, Arizona's figure was more than double the national average.

In 2006, capital outlays for highways ranked 34th in the nation on a per capita basis and 30th per $1,000 of personal income. Among the 10 fastest-growing states, Arizona ranked eighth on both measures: 22 percent less per capita and 15 percent less based on personal income than the norm of the other nine states. The per capita shortfall in capital outlays in Arizona in 2006 equated to $383 million relative to the other fast-growth states.

Between 1992 and 2006, capital outlays for highways fell in Arizona on a per capita basis compared to a moderately large increase nationally. A larger decrease occurred per $1,000 of personal income compared to no change nationally. Arizona ranked 40th per capita and 42nd relative to personal income. Among the fastest-growing states, Arizona was ninth per capita and last relative to personal income.

Capital Outlays Compared to Current Operations in Arizona

Arizona's current operations expenditures as a share of the national total have been below the state's share of population since the late 1960s, as seen in Chart 8. Since the early 1990s, the differential has been significantly larger than in earlier years.

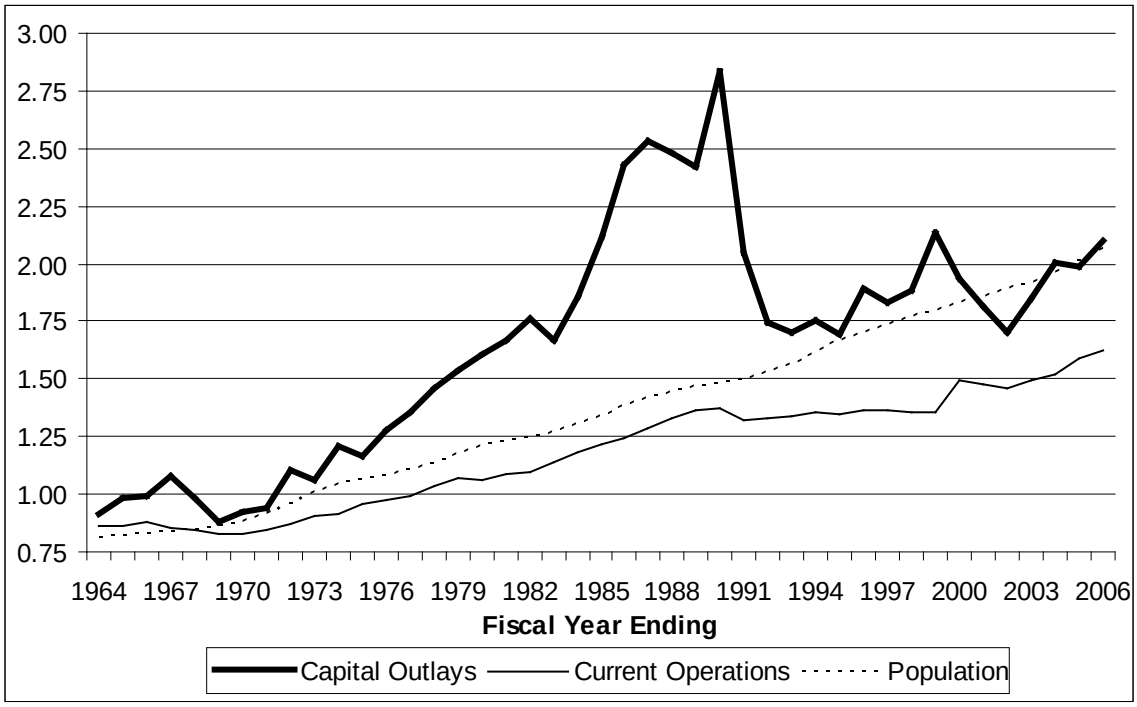
In 2006, per capita spending on current operations in Arizona was the lowest in the country at 21 percent less than the national average. Based on the personal income measure, the state ranked 41st, 9 percent less than the U.S. average. Arizona ranked eighth based on the personal income measure both among the fastest-growing states and among the states with a population near 10 million in 2030. Based on the per capita measure, state and local government spending on current operations in Arizona in 2006 was nearly $3 billion below the norm of the nine fastest-growing states.

The percent change in expenditures for current operations in Arizona between 1992 and 2006 was virtually identical to the percent change in capital outlays. Nationally, the percent increase in current operations was only marginally less than that of capital outlays. Thus, like capital outlays, Arizona's spending on current operations declined relative to personal income while nationally, it rose.

As noted earlier, Arizona's population change as a share of the national population change recently has been much higher than in the past. This suggests that state and local government capital outlays and current operations in Arizona as a share of the national total should be higher now than in the past. As seen in Chart 8, however, this has not occurred.

In the last several years, the state's share of the national capital outlays has been about the same on average as the state's share of the nation's population, despite the fast population growth being experienced in Arizona. Other than in recent years, only briefly around 1970 was the capital outlays share not greater than the population share. During the late 1970s and 1980s, the

CHART 8
GENERAL FUND STATE AND LOCAL GOVERNMENT EXPENDITURES IN ARIZONA AS A SHARE OF THE NATIONAL TOTAL



Note: Capital outlays and current operations were estimated for Arizona for 2001 and 2003.

Source: Calculated from U.S. Department of Commerce, Census Bureau, State and Local Government Finances and population estimates.

capital outlays share was much higher than the population share. Similarly, the current operations share of the national total has gone from about the same as the population share in the 1960s to somewhat lower in the 1970s and 1980s to considerably lower since the early 1990s.

Total State and Local Government Spending in Arizona

In most of the Census Bureau categories, only total spending is available. Arizona ranked 48th among the states in 2006 on total per capita state and local government general fund spending and 35th relative to personal income. Total spending per capita in 2006 was 8 percent less than the norm of the fastest-growing states. With a shortfall of more than $500 per person, total spending by state and local governments in Arizona was nearly $3.2 billion less than the nine-state norm.

Within the general fund, Arizona ranked quite low in per capita spending in some categories. In education, the largest category, Arizona ranked 49th. The state ranked 41st in public welfare and 39th in highways, the next-largest categories. In contrast, Arizona's per capita spending was in the middle of the states in many of the smaller categories, and among the top 12 in police, fire protection, corrections, and parks and recreation.

The comparisons to the other nine fast-growth states are shown in Table 5, for both 2006 and 1992. Not only was Arizona's per capita spending in 2006 below the norm overall and in key categories such as education and highways, but the change in the comparison between 1992 and 2006 is striking. Arizona's per capita spending went from 2 percent above the norm in 1992 to 8 percent below in 2006.

On a per capita basis, the change in total spending in Arizona between 1992 and 2006 was less than the national average in most categories. Arizona ranked last on the change in education spending and had large relative declines in highways and interest on debt. In contrast, the change was greater than the national average in the fire protection, parks and recreation, and sewerage categories.

In the utility fund, Arizona's spending in 2006 ranked among the highest of the 50 states, sixth on a per capita basis and seventh relative to personal income. Within the utility fund, Arizona's per capita ranks in 2006 were fourth in electric supply, seventh in water supply, 13th in transit, and 27th in gas supply.

TABLE 5
PER CAPITA GENERAL FUND EXPENDITURES
OF STATE AND LOCAL GOVERNMENTS IN ARIZONA
RELATIVE TO THE NORM OF NINE FAST-GROWTH STATES

Larger Expenditure Categories	2006 Total	2006 Capital Outlays	2006 Current Operations	1992 Total	1992 Capital Outlays	1992 Current Operations
TOTAL	-8%	-4%	-9%	2%	9%	1%
K-12 Education	-17	-18	-17	-5	36	-11
Higher Education	-7	-11	-7	22	-8	26
Public Welfare	3			11		
Hospitals	-63	-87	-61	-68		
Health	22			12		
Highways	-10	-22	10	14	27	-4
Air Transportation	-19			-11		
Police Protection	12			23		
Fire Protection	21			1		
Correction	13	27	12	7		
Natural Resources	-3			29		
Parks & Recreation	88	296	7	-10		
Housing & Community Development	-31			-9		
Sewerage	-4	30	-24	-27	-29	-26
Solid Waste Management	-25	-26	-24	-37		
Government Administration	11			29		
Interest on Debt	-5			33		
Other	-23			-1		

Note: A blank indicates that the data are not available.

Source: Calculated from U.S. Department of Commerce, Census Bureau.

The change in spending in the utility fund in Arizona between 1992 and 2006 ranked 19th among all states on a per capita basis, with the gain marginally less than the U.S. average. Relative to personal income, the Arizona change ranked 21st, with a marginal decline in Arizona and a small increase nationally. The detail on the utility fund is not available for 1992.

INFRASTRUCTURE NEEDS AND PROJECTED COSTS IN ARIZONA THROUGH 2032

Projecting infrastructure costs over the next 25 years is a highly challenging endeavor. Any type of long-term forecast involves a large number of assumptions and should be considered highly speculative. Thus, the cost figures presented in this section should be viewed only as indicative of Arizona's needs rather than as precise cost projections.

The projected population is the starting point for forecasting infrastructure costs in all categories. Additional data necessary to make projections vary by category of infrastructure. In some cases the desired data are not available. Thus, different methodologies were employed by category and the findings are not consistently comparable across categories.

Forecasts of the infrastructure needs of new residents and businesses represent only part of the total cost. Evaluating the adequacy of the existing infrastructure relative to the size of the population and determining the amount of existing infrastructure that needs to be repaired or replaced during the next 25 years are as challenging as estimating costs for future populations.

A number of basic questions had to be answered in order to make and present the infrastructure cost projections discussed in this section. Some of the questions involve conceptual issues, but others result from data limitations:

- Should total costs be presented, or only those costs unlikely to be covered by existing funding? For a complete picture of the costs of infrastructure, the total costs are presented in the detail for each of the eight infrastructure categories. Clearly, however, the primary purpose of this paper is to project likely future infrastructure costs for which existing funding is inadequate.
- Should the costs be limited to capital outlays, or should they include current operations? Where possible, total costs and capital outlays are identified separately. An adequate infrastructure involves more than just the physical infrastructure, but it is conceptually a challenge to determine which of the current operations costs to include. Practically, detailed data on the nature of the current operations expenses generally do not exist, and in some infrastructure subcategories only total expenses are available. As a result, the focus is a broad definition of infrastructure including current operations as well as capital outlays.
- Should a lump-sum cost figure be presented for the 25-year period, or should the projected costs be displayed annually? Total costs over the 25-year period, and the annual average of these totals, are presented. While an annual projection series clearly would be desirable, in most of the infrastructure categories not enough information existed to make an informed projection of annual costs. Thus, in most categories, the only factor affecting costs by year is projected population growth.
- Should the costs be presented in inflation-adjusted or unadjusted dollars? A case can be made for each. Because of uncertainties in the rate of inflation of infrastructure building in the future and because alternative scenarios based only on different inflation assumptions can be reflected using current dollars, the decision was made to emphasize unadjusted (current) dollars. The primary disadvantage of using unadjusted dollars is that the 25-year funding burden is overstated. Expenditures will be made throughout the 25-

year period, with the funds expended later in the period not being worth as much — assuming that inflation continues. Inflation-adjusted costs are provided in Appendix II.

Methodology

Four separate techniques were employed to make projections of infrastructure costs for this paper. In most of the infrastructure categories, however, only one of these methods could be employed because of data limitations.

1. A rough allocation of Arizona's share of projected national infrastructure costs presented by the American Society of Civil Engineers produced projections for the education, transportation and water categories. In addition, an annual total (excluding health care, public safety, and telecommunications) was projected for the next five years only. For more discussion, see the following subsection "A Crude Projection of Arizona's Costs."

2. The projections for the energy, telecommunications, transportation, and water infrastructures are taken from the detailed analyses in the Arizona Investment Council report. For more information, see *Infrastructure Needs and Funding Alternatives for Arizona: 2008-2032*, available online at www.arizonaic.org.

3. The hospital portion (public and private) of the health care category was projected using data from the American Hospital Association and the Arizona Hospital and Health Care Association. These data are discussed in the "Health Care" subsection.

4. The education, public safety, transportation, and "other" categories, as well as a portion of the health care category, largely consist of services provided by the public sector. Historical data from the Census Bureau government finance series and assumptions about future changes in historical patterns drove a set of simulations of revenues and expenditures. Projecting the costs in the public sector requires a host of assumptions.

State and local governments must balance their budgets annually. Thus, actual expenditures in the future will be constrained by revenues. The difference between the projected revenues and projected expenditures represents the funding gap (or surplus) that is the focus of this analysis. Any adjustments to revenues (for example, a tax cut) in the future will have a significant impact on the projected funding gap.

Most sources of revenue of state and local governments are not tied to a particular use. For example, expenditures for police protection are not drawn from a dedicated fund but instead are allocated from the general fund. Thus, it is not possible to determine a funding gap for each of the categories of public spending. Instead, a gap was determined for the public-sector categories as a whole, with two alternatives employed to provide a sense of the gap by category.

The starting point to projecting revenues and public-sector needs for an Arizona of 10 million people was to employ the historical trends. However, the tax decreases and subsequent declines in revenues that have occurred over the last 15 years have caused Arizona to lag comparison states after adjusting for population and economic growth. It is unreasonable to

assume that this pace of tax cuts will continue for the next 25 years. The simulations assume that current tax rates will be neither increased nor reduced over the coming 25-year period.

Separate assumptions were made for the first few years of the projection period to reflect the current economic downturn and its effect on revenues. The current revenue shortfall was translated into very slow growth (and in some cases declines) in revenue collections and public-sector service provision in the next few years.

In the years following 2010, revenue collections were simulated based on longer-run historical trends, inflation assumptions, and comparisons with the historical trajectories of the revenue collections in other fast-growing states (especially Georgia, North Carolina, and Washington — states expected to be fast growing and of a size comparable to that of Arizona in 2032). The revenue flow is strongly influenced by the projected rapid pace of population growth.

For the purpose of the simulations, expenditure needs after 2010 were based on historical trends, inflation assumptions, unusual cost pressures or demand pressures emanating from Arizona's growing and aging population, and comparisons of spending trajectories in other fast-growing states. The public-service expenditure simulation then is compared to the trajectories of other states out to 2032.

Summary of the Cost Projections

The dollar figures discussed in this subsection are expressed as totals over the next 25 years unless otherwise noted and are for Arizona as a whole. They reflect a broad definition of the infrastructure that includes expenditures for current operations as well as capital outlays. All of the figures presented in this subsection are funding gaps — spending needs not met by current funding. (The later discussions of each infrastructure type include projections of both costs and gaps.)

Due to data limitations and inconsistencies, it is not possible to project a total funding gap inclusive of the private and public sectors. However, each of the alternative methods indicates that the gap will be billions of dollars per year. Spending on the infrastructure categories included in this report currently represent about 25 percent of Arizona's gross domestic product. This proportion may rise to around 30 percent over the next 25 years if infrastructure spending increases to meet the needs.

The focus of this subsection is funding gaps in state and local government finance. A significant shortfall of $288 billion is expected in state and local government revenues relative to the projected needs. Because most government spending is made from revenues that are not specified for a particular purpose, such as the state income tax, it is not possible in most categories to determine a true gap. Two alternative ways of estimating the gap by category were considered.

The first approach distributes the overall percentage difference between projected public-sector revenues and expenditures to the education, health, public safety, transportation, and "other" categories. (The gap determined in the AIC project is used in the water infrastructure and is

included in the $288 billion overall shortfall.) The problem with this approach is that the gap in the transportation category separately estimated in the AIC report is considerably higher than the figure obtained by simplistically distributing the percentage gap evenly to all categories.

The second approach considers that spending in most categories largely is mandated by federal laws or otherwise is viewed as being of high priority (such as public safety and the education of children). In this approach, revenues and expenditures are assumed to balance in the education, health, public safety, and "other" categories. The gap from the AIC study is used for water. The rest of the gap is assumed to be in the transportation category, with alternative projections of the deficit compared.

Total. The gap between state and local government revenues and spending needs over the next 25 years is projected to be $288 billion. (This figure excludes the telecommunications infrastructure in which the public-sector costs are uncertain, though unlikely to amount to more than a few billion dollars.) The average cost per year is $11.5 billion.

In order to provide perspective on the magnitude of this projected funding gap, the annual average deficit over the next 25 years was divided by the annual average Arizona population over the 25 years of 8.72 million. The shortfall is $1,323 per person per year. If per capita spending in 2006 had been $1,323 higher, Arizona's per capita rank among the states would have risen from 48th to 18th, but Arizona's per capita total of $7,121 would have been barely higher than the national average. For comparison, in 1992, Arizona's per capita expenditures ranked 30th at 9 percent less than the national average.

In reality, this $1,323 per capita increase overstates the annual revenue shortfall of meeting the spending needs. Some of the infrastructure spending will use long-term debt, postponing the incidence of the full costs. The use of long-term debt will maintain intergenerational taxpayer equity by matching the costs and benefits of infrastructure over its useful life.

Education. Based on the fourth method described in the methodology subsection, total public-sector education costs are projected to be $873 billion, of which $122 billion are expected to be capital outlays. State and local governments are responsible for nearly all of the public-sector funding for education.

Distributing the total public-sector shortfall of $288 billion across the infrastructure categories, the unfunded capital costs for education would total $10.5 billion — essentially equal to the projection of $10 billion derived from the allocation of projected national needs to Arizona (the first method). The unfunded current operations figure would be $64.5 billion.

Energy. Based on the AIC report, unfunded needs are $109 billion. These should be recovered through higher prices, with no cost to the public sector. The public sector is affected, however, in that the Arizona Corporation Commission may need to modify its process of granting or denying utility rate adjustments.

Health Care. Tremendous increases in health care costs are likely over the next 25 years. Based on the third method, capital outlays for hospitals might total $48 billion to $64 billion and

current operations expenses might rise $755 billion to $862 billion. The total hospital costs of $803 billion to $926 billion represent only a portion of the health care needs since they do not include private-sector expenses of providing services delivered outside of a hospital or nursing home facility.

About $99 billion to $113 billion of the total hospital costs are estimated to be public-sector responsibilities. Other public health costs, based on the fourth method, are projected to be $169 billion, for a total public cost of $268 billion to $282 billion. (The higher projection was used to calculate the $288 billion overall public-sector shortfall.) The federal government is likely to fund an unknown but fairly large share of these costs. Distributing the total public-sector shortfall across the infrastructure categories, the unfunded costs for health care would be $23 billion to $24 billion.

Public Safety. Based on the fourth methodology, public-sector public safety costs are projected to total $296 billion, the vast bulk of which are current operations. The federal government is likely to fund an unknown but relatively small share of these costs. Distributing the total public-sector shortfall across the infrastructure categories, the unfunded costs for public safety would be $1 billion in capital outlays and $25 billion in current operations.

Telecommunications. The AIC report indicates that a total of $1 billion to $2 billion is needed to provide universal access to broadband. If universal access is judged to be desirable, state and local governments will probably need to enter into public-private partnerships and may need to fund most of this cost. An additional $23 billion needed to improve service also will likely require a public-private partnership, but most of the costs probably would be recouped over time from customers.

Transportation. The allocation of projected national transportation needs to Arizona (the first method) results in a capital outlay figure of approximately $117 billion, including payments by the private sector and the federal government. The state and local government share might be $51 billion in currently unfunded capital outlays. Total costs (including current operations) extrapolate to $92 billion.

According to the AIC report (the second method), very significant transportation needs are present, much higher than derived from the first method, amounting to between $253 billion and $311 billion in capital outlays alone. This range includes costs that will be paid by the private sector and the federal government. The state and local government share might be between $122 billion and $151 billion in currently unfunded capital outlays. Most of these needs are in the road and highway component.

In 2006, capital costs nationally were 56 percent of total state and local government spending in the highway category. The Arizona share was nearly identical. Assuming this share holds in the future, then total transportation costs — including operations as well as capital outlays — of state and local governments in Arizona would be between $218 billion and $270 billion.

Based on the fourth method, public-sector costs — including capital outlays and current operations — could be $482 billion. Applying the same assumption about the share of the public-

sector total covered by the federal government as in the other methods, the state and local government share would be approximately $261 billion. Dedicated state and local government funding for transportation is projected to amount to only $111 billion, leaving a shortfall of $150 billion.

The three methods appear to provide considerably different projections of the transportation needs. The projection from the allocation of national costs is lowest at $92 billion in unfunded state and local government needs. This projection likely understates the needs because the methodology did not account for Arizona currently being behind in its provision of the transportation infrastructure. In addition, the simplistic nature of this methodology leaves a wide margin of error.

The difference between the AIC-based projection of $218 billion to $270 billion in state and local government needs and the $150 billion based on the fourth method is a result of the AIC's figure being primarily an assessment of need. If $111 billion in projected transportation revenue had not been subtracted in the fourth method, its projected deficit of $261 billion would have been within the AIC-based range.

Water. The unfunded portion of the water costs will be $30 billion, according to the AIC report. This funding gap is less than that derived from the allocation of projected national needs to Arizona (the first methodology) of $42 billion. State and local governments likely will need to provide the bulk of the AIC-calculated shortfall, perhaps $24 billion.

Other. Based on the fourth methodology, other public-sector costs are projected to total $978 billion, the vast bulk of which are current operations. The federal government is likely to fund an unknown but relatively small share of these costs. Distributing the total public-sector shortfall across the infrastructure categories, the unfunded costs would be $2 billion in capital outlays and $82 billion in current operations.

A Crude Projection of Arizona's Costs

The first method of projecting infrastructure costs in Arizona is to allocate projected national infrastructure costs to Arizona, using the ASCE's projections of national infrastructure needs. The ASCE provides an overall projection of infrastructure needs over a five-year period, and separately identifies detailed costs in some of the infrastructure categories.

The ASCE estimates that $1.6 trillion needs to be spent nationally over five years ($320 billion per year), by the public and private sectors combined, "to remedy America's current and looming problems." This estimate does not include security needs, due to a lack of information. Further, the ASCE does not address the telecommunications or health care infrastructures.

If Arizona's share of the national infrastructure needs is proportionate to its projected population share (currently, 2.1 percent of the nation's population lives in Arizona), then Arizona's costs (public and private sectors combined) would be $7 billion per year. This figure is in addition to current infrastructure spending and it does not include infrastructure costs to serve a growing Arizona population.

The ASCE provides no indication of how the $1.6 trillion figure was derived, or of the costs per category. However, the $7 billion per year projection for Arizona is *less* than the projection made just for the education, transportation, and water categories using the more detailed ASCE data.

Cost figures by infrastructure category and subcategory were gathered from a variety of sources by the ASCE. However, such data are not available for each of the 15 categories. The cost estimates largely are confined to the education, transportation, and water infrastructures. Further, the category and subcategory figures examined by the ASCE are not defined consistently either in terms of content or time period. For example, some projected costs were calculated over a five-year time period, some over 20 years, some on a per-year basis, and some do not have a time frame attached.

For this analysis, all of the figures were adjusted to be on a per-year basis over a 20-year period. (Once the costs were adjusted to a standard 20-year period, they were put on an annual basis and assumed to continue for another five years to be consistent with the 25-year horizon of this paper.) When possible, the figures were adjusted for current levels of spending to represent the gap in funding that needs to be filled (though it is not clear if each of the categorical cost figures truly represent net additional costs needed). Since the cost projections from the various sources were produced at different times, the projections were adjusted to be in consistent 2008 dollars. The result is a national need of roughly $182 billion to $192 billion per year for the next 20 years — only for the education, transportation, and water infrastructures.

Arizona's share of the national costs can be allocated based on either of two techniques: (1) the state's share of the national population, by year, or (2) the state's share of the projected national population *change* over the next 20 years. The first technique is appropriate to allocate renovation costs and other needs to serve the existing population. The second technique is appropriate to allocate the costs related to population growth. Thus, the former understates the needs in Arizona while the latter overstates the needs. A simple average of the figures derived from the two techniques therefore was used.

Using the first technique, the state's share of the nation's annual infrastructure costs would be about $4.5 billion per year. In the second technique, the state's share would be about $10.7 billion per year. The average of the two figures is about $7.6 billion per year. This represents the assumed costs in Arizona of renovating, improving, and expanding the state's education, transportation, and water infrastructures.

Using national data from the Congressional Budget Office, it is possible to estimate the state and local government share of this capital spending. The result is an allocation of the national infrastructure costs to Arizona state and local governments of $4.2 billion per year: $2.1 billion for transportation, $1.7 billion for water, and $0.4 billion for education. Over 25 years, this would amount to $52.5 billion for transportation, $42.5 billion for water, and $10 billion for education.

Education

This discussion of education is limited to public education, which consists of four components: (1) elementary and secondary education, (2) higher education, (3) "other" education (such as

schools for the deaf and blind), and (4) libraries. The growth of Arizona's population over the next 25 years will create a significant demand for expansion of educational services.

The cost of education services, including capital outlays and current operations, is projected to be $873 billion over the next 25 years in Arizona, of which $122 billion is projected to be capital outlays. Nearly all of this expense will be paid by state and local governments.

Discussion

Providing education services, especially K-12 (elementary and secondary) education, historically has primarily been the responsibility of state and local governments in the United States, though the private sector always has played a role. In the last century, most of the new investments in higher education have been undertaken by the public sector. The vast majority of Arizona students pursue their education at a public-sector institution. The projections assume a continuation of current trends of public versus private provision of education. Obviously, if a shift to privately provided education were to occur, the projected public costs would be less, but private costs more or less would offset.

Constitutional provisions in Arizona mandate that instruction at the state's public institutions be provided "as nearly free as possible" while the state has the responsibility to provide for the "maintenance and improvement" of these institutions. Funding for education comes from property taxes collected at the local level and state general fund monies. Universities and community colleges also rely on tuition and fees, philanthropic donations, and sponsored research.

One-third of all state and local government expenditures in Arizona in 2006 were for education. Education's share of capital outlays was 29 percent. Elementary and secondary education accounted for nearly two-thirds of the education total, with higher education accounting for most of the rest.

Public spending on education services in Arizona rank among the lowest in the nation on a per capita or per student basis. The state fell further behind the norms during the last 15 years on both capital outlays and current operations.

Yet the acquisition of knowledge and skills will be one of the most important factors for attaining economic prosperity in the 21st century. Without a quality education infrastructure in Arizona, the standard of living of Arizona residents may lag behind national and international standards.

Costs of Providing Education Through 2032

Education expenses in Arizona likely will increase slightly more than the pace of real economic growth over the next 25 years. Enrollments rising slightly faster than population growth, competitive pressures resulting in increasing costs, as in higher salaries for quality teachers, and "catching up" from the state's low rate of investment in education (on a per capita or per student basis) all will add to future costs.

Infrastructure costs over the next 25 years have been projected for each of the components of education, as seen in Table 6. Capital costs assume the provision of a high-quality education infrastructure through the construction of new facilities as well as renovations and expansions of existing facilities. Projections of current operations expenses — the personnel, maintenance, and operations expenditures required to deliver education services — also are included, though data are not available to divide the overall library cost into capital outlays and current operations.

In the primary and secondary schools component, real per capita growth in expenditures was limited over the last 15 years and considerably less than the national average. This put per capita spending even further below the national average. The student population in Arizona in coming years is expected to rise slightly faster than the rate of overall population growth. Capital costs are projected to be $85 billion over the next 25 years, with current operations expenses of $449 billion.

In the higher education component, Arizona's per capita expenditures also are less than the national average and the comparison states. Real per capita expenditures for higher education rose modestly in Arizona in the last 15 years at less than half the national average rate. This small rise occurred despite the Higher Education Price Index advancing more than the overall inflation rate. University enrollment in Arizona in coming years is predicted to grow at an annual rate approximately one percentage point faster than the rate of population growth, due in part to the relatively large size of the generation reaching college age.

As a result of the higher cost increases, rising enrollment, and need for construction, real per capita spending on higher education is expected to exceed the rate of growth in the real per capita economy over the next 25 years, though the differential should narrow over time. Existing plans for construction projects at the universities of around $7.5 billion in constant dollars through 2020 are incorporated into the nearly $37 billion projection of capital outlays over the next 25 years. Current operations spending is projected to be $255 billion.

"Other" education includes expenditures for vocational training programs and facilities for the blind and handicapped. While growth in real per capita expenditures over the last 15 years was equal to the national average, the level of per capita spending in 2006 was considerably less than in all of the comparison areas. The projections assume that spending growth will match the pace

TABLE 6
PROJECTED PUBLIC EDUCATION INFRASTRUCTURE COSTS
IN ARIZONA THROUGH 2032 IN BILLIONS

	K-12	Higher	Other	Subtotal	Libraries	Total
Total Capital Costs	$84.7	$36.7	$0.7	$122.1	$na	$na
Total Ongoing Costs	449.3	254.8	35.2	739.3	na	na
Total of All Costs	534.0	291.5	35.9	861.4	11.2	872.5

na: not available

Source: Projected by authors using State and Local Government Finance data of the U.S. Department of Commerce, Census Bureau.

of real per capita economic gains. Capital costs over the next 25 years are projected to be less than $1 billion, with current operations costs projected at $35 billion.

Library spending also was well below the comparison areas on a per capita basis in 2006, after declining slightly between 1992 and 2006 on a real per capita basis, compared to an increase nationally. Total costs over the next 25 years are projected to be $11 billion.

The overall cost of education services is projected to be $873 billion in Arizona over the next 25 years. Approximately $122 billion (14 percent) of this expense is projected to be capital outlays.

Energy

The energy infrastructure consists of two components: (1) electricity, including generation, transmission, and distribution, and (2) natural gas, petroleum, and other fuels. The latter component includes refineries, transmission, distribution, and storage, with pipelines a notable feature.

Investments in each component will be necessary over the next 25 years to keep pace with the rapid growth in the Arizona population. In addition, the costs of providing energy will be higher than in the past.

In the next 25 years, the energy sector will likely encounter the need for substantial spending for new infrastructure and related costs given the recent and projected increases in costs and demand for electricity. Assuming no increase in existing electricity prices, the projected funding shortfall — including capital outlays and operations — in the electricity component in Arizona is likely to be around $109 billion over the next 25 years.

Given the private-sector nature of the energy sector, this gap will have to be covered by increases in retail prices. Thus, in coming years frequent requests to adjust retail rates are likely to come before the Arizona Corporation Commission, which regulates the energy sector. Customers, regulators, and politicians will need to adapt to a new environment of rising electricity prices.

Discussion

In the last 10 years alone, electricity demand has increased about 41 percent in Arizona. Most of this increase resulted from the growing population, but per person consumption also rose. While significant gains in appliance efficiencies were realized over this time period, these efficiency gains were more than offset by increased per person usage associated with larger average home size; the increasing popularity of computers, digital TVs, and other information technology devices; and the substitution of electricity for natural gas in new homes.

The state managed through this period of rapid growth by building a large number of natural gas-fired plants — enough to quadruple gas-fired capacity in the state. Relatively low natural gas prices during the late 1980s and 1990s drove the surge in natural-gas plant construction. However, natural gas has become much more expensive since 1999, with prices since 2006 about 2.5 times as high as during the 1987-99 period. This sharp rise in price is not expected to be reversed. Instead, natural gas prices are forecast to rise slightly more than overall inflation through 2030.

Thus, while the capital costs of building a natural gas-powered electricity plant are still projected to be the lowest-cost alternative over the next 25 years, the total cost of gas-fired generation may not be the lowest-cost method of producing electricity.

In addition, as environmental concerns escalate and a collective willingness to take action to reduce carbon emissions emerges, natural gas (and coal) generation are likely to be discouraged (without major technological breakthroughs). Thus, a relative reliance on natural gas-fired plants may not be the best strategy for meeting the challenge of future growth.

Over the next 25 years, electricity demand from the rising population and from continued increases in per capita consumption is likely to increase about 85 percent. Demand for natural gas is projected to nearly double over the forecast period, as will demand for petroleum products, requiring a 33 percent increase in product fuel delivery capacity and storage.

If coal or nuclear generation methods are to be preferred to natural gas — for financial, economic, or environmental reasons — the decision must be made within the next few years if the plants are going to be ready to meet the needs of Arizonans a decade from now. The length of time needed to plan and build a coal or nuclear power plant is eight years or more.

Future needs for natural gas are in part dependent on the source of electricity generation in the future. Arizona currently has no storage facility for natural gas, a limited number of pipelines, and no refineries. In order for Arizona to have a secured supply in the future, it has been assumed in the cost projections that additional pipelines, refineries, and storage facilities will be built in the state during the next 25 years.

Existing energy sources will not be able to provide power to the state's growing population. Therefore, Arizona faces important and difficult decisions about how to meet rapidly growing demands for energy.

Costs of Providing Energy Through 2032

Electricity prices fell substantially after the early 1980s on an inflation-adjusted basis, driven down by declining fuel prices, falling long-term interest rates, and one-time benefits of overinvestment in generation during a flurry of construction of new power plants several years ago. (Wholesale power plants initially were overbuilt, and the excess energy was sold inexpensively to Arizona power suppliers.) In recent years, however, natural gas, petroleum, and other fuel prices have risen significantly, bringing the era of declining electricity prices to an end.

The cost of building new energy infrastructure has risen rapidly in recent years: from 2000 through 2006, nonresidential construction costs rose 56 percent — more than 2.5 times the overall inflation rate. Much above-average inflation in material prices and construction costs has been pushing up costs in all capital-intensive industries, including energy.

Electricity generation is likely to become even more capital intensive than it is now, given that capital costs per unit of power generated are higher for coal and nuclear power than for natural gas generation. In addition, a new mandate from the Arizona Corporation Commission requires

that 15 percent of the state's retail sales of energy production to come from renewable energy sources by 2025. Currently, the cost per unit of power of solar and wind generation is very high.

Thus, the costs of providing energy will be higher than in the past for three reasons: (1) recent increases in construction costs well above the overall inflation rate, (2) a sharp increase in natural gas prices, which takes away the low-cost option for producing electricity, and (3) a recent mandate from the Arizona Corporation Commission to generate energy from renewable sources that currently are not cost competitive.

The total capital investment in electricity infrastructure required to serve Arizona's growing population to 2032 is between $65.0 billion and $77.4 billion depending on the mix of generation technologies employed going forward (see Table 7). Adding approximately $9 billion in capital costs for natural gas, petroleum and other fuels infrastructure brings the total capital cost projection to between $74.0 billion and $86.5 billion. These projections are conservative in that relatively low inflation in construction costs is assumed. Ongoing costs were not explicitly estimated for the energy infrastructure.

In the natural gas, petroleum, and other fuels component, there is no immediately obvious funding gap for pipeline or storage provision. Demand will be met by the private sector, which has historically demonstrated an ability to quickly meet demand with supply, adjusting price as necessary. Thus, the $9 billion in projected capital costs, plus any additional operations costs, are expected to be recovered from customers through higher prices. However, this assumption does not hold if regulated power generators and gas distributors are not able to recover their costs sufficiently to enter into long-term supply contracts with pipeline operators.

TABLE 7
PROJECTED ENERGY INFRASTRUCTURE COSTS IN ARIZONA THROUGH 2032 IN BILLIONS

	Electricity by Primary Source of Power Generation*			Natural Gas, Petroleum, and Other Fuels	Total
	Coal	Natural Gas	Nuclear		
Total Capital Costs	$73.8	$65.0	$77.4	$9.0 - 9.1	$74.0 - 86.5
Generation	44.9	36.1	48.5	N/A	36.1 - 48.5
Refineries	N/A	N/A	N/A	3.6	3.6
Transmission	9.6	9.6	9.6	2.8	12.4
Distribution	19.3	19.3	19.3	2.4	21.7
Storage	N/A	N/A	N/A	0.2 - 0.3	0.2 - 0.3

* In each of the three options, the cost projection assumes that 15 percent of the electricity is solar generated.

N/A: Not applicable

Source: Arizona Investment Council, "Infrastructure Needs and Funding Alternatives for Arizona: 2008-2032."

In the electricity sector, the situation is different. Most providers must receive the permission of the Arizona Corporation Commission to raise prices, a generally lengthy procedure. Considering all costs — operations and maintenance costs (including fuels) as well as capital — and assuming no increase in existing electricity prices, the projected funding shortfall is likely to be around $109 billion over the next 25 years. This gap will have to be covered by increases in retail prices, though the magnitude of the needed price increase will depend on the tradeoff between fuel and capital costs. For example, a shift from gas to nuclear generation would raise capital costs but lower fuel costs.

Given the recent and projected increases in costs and demand for electricity, frequent requests to adjust retail rates are likely in coming years. Customers, regulators, and politicians will need to adapt to a new environment of rising electricity prices.

Health Care

The health care infrastructure in Arizona has been split into three components for this analysis: (1) private-sector hospitals, (2) public-sector hospitals, and (3) other public health. Other private-sector health care services are not addressed.

Health care is one of the fastest-growing segments of the U.S. economy. The demand for quality health care is rising rapidly, driven largely by higher incomes and an aging population, and costs are inflating significantly. Rapid changes in technology in health care result in considerable uncertainty in planning for the future.

The projected hospital expenses — including capital outlays and current operations — are between $803 billion and $926 billion over the next 25 years in Arizona. The public portion is $99 billion to $113 billion. Other public health care costs are projected to be an additional $169 billion. Thus, the total public figure is $268 billion to $282 billion.

Total projected health care costs range from $972 billion to $1,094 billion. As large as these figures may seem, they are not a projected total for the health care sector since they do not include private-sector expenses of providing services delivered outside of a hospital or nursing care facility. Using projections from the Congressional Budget Office, the portion of health care addressed in this analysis accounts for only about a third of the total.

Discussion

Health care is primarily provided by the private sector. The Census Bureau reports governmental health care expenses in two categories: hospitals and other health. Arizona has relatively few public hospitals. Per capita spending of state and local governments in Arizona in 2006 was only $143, compared to the U.S. average of $370. Arizona ranked 41st among the states. Thus, most of the rising demand for hospital services will be met by the private sector in Arizona.

In the other public health component, Arizona was more in line with the rest of the nation, with per capita expenditures in 2006 of $245, slightly above the national average. Expenditures locally and nationally surged in recent years.

Rapid changes in health care technology result in considerable uncertainty in planning for the needs of an Arizona of 10 million people. In addition, the population of the state will age considerably over the next 25 years. The share of people aged 65 and older is projected to rise from about 13 percent today to nearly 16 percent by 2015 and over 22 percent by 2030. This aging population will sustain and may accelerate the demand for new hospital facilities and the personnel that work in hospital facilities over the next 25 years.

Costs of Providing Health Care Through 2032

Projections of the costs of the hospital component are based on surveys taken by the American Hospital Association (AHA) and a separate survey conducted in 2006 by the Arizona Hospital and Health Care Association (AzHHA). The AHA reports that expenses at Arizona hospitals surged from under $5 billion in 2001 to over $8 billion in 2005. Costs per capita generally were lower than in the comparison states, though the gap narrowed over the period as cost inflation in Arizona outstripped that of competitor states. Costs rose more than 9 percent per year on a per capita basis. Net revenues for Arizona's hospitals were nearly $9 billion in 2005.

The AzHHA reports that Arizona hospitals added about 9 percent to the total stock of beds from 2000 to 2006 and plan to add about 20 percent more through 2011 — with costs of more than $3 billion in new hospital construction from 2007 through 2011.

With new facilities comes the need for quality health care staff. The American Hospital Association reports that employment growth in Arizona hospitals increased at a rate exceeding 8 percent per year from 2001 to 2005. The acceleration in capital projects in the next several years likely will generate an even higher rate of growth in the demand for hospital workers, largely highly skilled nurses and technicians.

Expectations are that costs to build and serve hospitals will continue to rise well above the average rates of inflation for the foreseeable future. Costs will be pushed higher by the demand coming from the aging population. Recent trends in the costs of providing these services coupled with expense data reported from the AHA were compiled to produce two projections of hospital infrastructure and service expenses (see Table 8).

TABLE 8
PROJECTED HEALTH CARE INFRASTRUCTURE COSTS* IN ARIZONA THROUGH 2032 IN BILLIONS

	Private Hospitals		Public Hospitals		Other	Total*	
	Low	High	Low	High	Public	Low	High
Total Capital Costs	$42.3	$55.9	$6.0	$7.8	$0.0	$48.3	$63.7
Total Ongoing Costs	661.7	756.4	93.3	105.5	168.6	923.6	1,030.5
Total of All Costs	704.0	812.3	99.3	113.3	168.6	971.9	1,094.2

* Private-sector costs other than hospitals are not included.

Source: Projected by authors using State and Local Government Finance data of the U.S. Department of Commerce, Census Bureau, and data from the American Hospital Association and the Arizona Hospital and Health Care Association.

Projected hospital expenses — including capital outlays and current operations — are between $803 billion and $926 billion over the next 25 years in Arizona. The lower figure assumes that existing trends will continue. The higher figure assumes costs will be higher due to the rapidly expanding elderly population. While unlikely, it is possible that efficiencies in hospital service delivery will offset cost pressures from accommodating the elderly population, keeping the cost trajectory on track with current trends. For perspective, spending at Arizona's hospitals accounted for 4.1 percent of Arizona's gross domestic product by state in 2007, but will surge to between 7.0 and 8.7 percent in 2032 based on these projections.

With private-sector hospital needs projected to be between $704 billion and $812 billion over the next 25 years in Arizona, and public-sector needs expected to reach $268 billion to $282 billion, the total projected costs range from $972 billion to $1,094 billion. As large as these figures may seem, though, they represent only a portion of the total for the health care sector since they do not include private-sector expenses of providing services delivered outside of a hospital facility or nursing care facility. Consumer prices will need to continue to rise rapidly to cover the costs of health care demands.

Public Safety

The public safety infrastructure in Arizona consists of four components: (1) police protection, (2) fire protection, (3) corrections, and (4) protective inspection and regulation. The state's rapid growth will continue to place significant demands on the public safety infrastructure.

Assuming current trends continue, Arizona's state and local governments are projected to spend $296 billion to provide public safety services over the next 25 years. Of this amount, approximately $10 billion will be for the capital cost of correctional facilities.

Discussion

A very high proportion of the public safety infrastructure is provided by the public sector. In some places, though, fire protection is provided by a private-sector company, and some prison inmates are held in privately operated prisons. A large portion of the public safety costs are for current operations.

Per capita spending in 2006 was above the national average and the norm of the fast-growing states in the police protection, fire protection, and corrections components. These were among the small number of expenditure categories in which state and local government spending in Arizona exceeded the national norm as well as the norm of the fast-growing states.

Crime statistics suggest that the majority of crimes are committed by young males. The transient nature of the state's population adds to the crime rate. Additional pressures come from enforcement of undocumented worker laws. Relying on state and local government enforcement agencies to cope with immigration issues undoubtedly will put cost pressures on the system.

Costs of Providing Public Safety Services Through 2032

Of the four components of public safety, police protection is projected to have the highest costs over the next 25 years in Arizona, at $115 billion (see Table 9). The total for corrections is nearly as large at $106 billion, including $10 billion in capital outlays for new prisons. Fire protection costs are projected to be $60 billion, with expenditures in the inspection and regulation

TABLE 9
PROJECTED PUBLIC SAFETY INFRASTRUCTURE COSTS OF PUBLIC SECTOR IN ARIZONA THROUGH 2032 IN BILLIONS

	Police	Fire	Corrections	Regulation	Total
Total Capital Costs	$na	$na	$10.1	$na	$na
Total Ongoing Costs	na	na	95.9	na	na
Total of All Costs	114.9	59.6	106.1	15.5	296.1

na: not available

Source: Projected by authors using State and Local Government Finance data of the U.S. Department of Commerce, Census Bureau.

component only $16 billion. The overall projection of costs over the next 25 years in Arizona for public safety total $296 billion.

Telecommunications

The private sector is the predominant provider of telecommunications services. Telecommunications companies in Arizona will continue to experience increases in demand due to population and business growth and to a rising share of the public using high-speed services.

Two types of telecommunications infrastructure improvements could be made in Arizona, each of which may require the involvement of the public sector: (1) broadband connectivity could be provided to Arizonans living in rural areas without current service, and (2) a statewide fiber-to-the-home (FTTH) network could be created, providing faster service through state-of-the-art connectivity.

In order to provide broadband service to unserved Arizonans, a public-private partnership may be needed. Much of the cost may need to be covered by the public sector. Total costs, including operations as well as capital outlays, are projected to be between $1 billion and $2.2 billion.

For FTTH to become a reality, a public-private partnership also may become necessary. The bulk of the projected cost of $23.1 billion, including operations and capital outlays, likely would be borne by the private sector and recovered from customers.

Discussion

Access to broadband connections is widespread in Arizona, particularly in urbanized areas. However, approximately 200,000 Arizonans (3 percent of the population) lack access to necessary “middle-mile” broadband connectivity (community connection to the cross-country fiber). The unserved areas of Arizona are those communities that are small in population with low population densities and/or are a significant distance away from any telecommunications infrastructure. Private-sector providers have been reluctant to make substantial investments in remote areas where subscriber density is low and the cost of providing service is high.

Though access to broadband connections is widespread in Arizona, access to very high-speed links is limited. Average download speed in the United States is slower than that of many

countries. A FTTH network would give Arizonans the same speed of access as the citizens of countries such as Japan, France and Korea currently enjoy.

Numerous technologies can deliver telecommunications services to residents and businesses. These technologies are changing rapidly, making it difficult to predict the technologies that will be used in the future and to forecast the performance standard of the leading technology. Thus, deciding to provide the best service currently available — fiber-to-the-home, the "gold standard" — offers the greatest likelihood that Arizona's telecommunications infrastructure will remain competitive into the future. However, the upfront costs of providing a FTTH network are considerable, resulting in a lack of interest among private-sector companies to provide this service.

Businesses increasingly rely on access to the telecommunications infrastructure — particularly, access to high-speed data lines — to complete their business activities. As the world becomes more-and-more connected and as markets become more competitive due to increasing access to high-quality telecommunications, the quality of the telecommunications network in Arizona becomes more important to the competitiveness of many Arizona businesses.

Individuals also are increasingly using the telecommunications network — not just for entertainment, but to conduct personal business, such as banking, as well. Thus, the availability and quality of the telecommunications network is increasingly affecting the quality of life of Arizona residents.

Not having a state-of-the-art telecommunications infrastructure increasingly will be seen as a negative factor by businesses and residents contemplating relocation. Thus, access to a high-quality telecommunications infrastructure is vitally important to the Arizona economy.

Costs of Providing Telecommunications Services Through 2032

The cost of expanding telecommunications access to new residents and businesses in areas currently served was not estimated for this report. This service is provided solely by the private sector.

The capital cost of providing broadband connectivity to the currently unserved population of Arizona is projected to be between $0.7 and $1.6 billion. The lower figure assumes aerial deployment of the telecommunications lines, while the higher figure assumes that the lines will be buried. Ongoing costs, which are considerably less than the capital costs, also will vary depending on whether the lines are buried (see Table 10). None of the cost of providing universal access is covered by existing funding mechanisms because it is not cost effective for a private-sector provider to supply this service.

The question of providing telecommunications access to all residents is similar to the issue some decades ago of providing electricity to all residents. In that case, the federal government became involved because of the high cost of providing power to rural residents. In order to provide broadband service to unserved Arizonans, a similar public-private partnership may be needed. A relatively small share of the total cost of between $1 billion and $2.2 billion is likely to be

TABLE 10
PROJECTED TELECOMMUNICATIONS INFRASTRUCTURE COSTS IN ARIZONA THROUGH 2032 IN BILLIONS

	"Middle-Mile" Connectivity*		Fiber-to-the-Home**	Total	
	Low	High		Low	High
Total Capital Costs	$0.7	$1.6	$9.1	$9.8	$10.7
Total Ongoing Costs	0.3	0.6	14.0	14.3	14.6
Total of All Costs	1.0	2.2	23.1	24.1	25.3

* Middle-mile fiber connects communities to the long haul (cross-country) fiber. Costs vary depending on whether the telecommunications line is deployed aerially (typically less expensive) or is buried.
** These costs are in addition to the "middle mile" connectivity costs that also must be spent to provide FTTH.

Source: Arizona Investment Council, "Infrastructure Needs and Funding Alternatives for Arizona: 2008-2032."

recovered from customers. Thus, much of the cost of providing universal access may need to be covered by the public sector.

To provide faster service, creation of a state-of-the-art statewide fiber-to-the-home network is projected to cost an additional $9.1 billion in capital outlays. Ongoing costs would be larger, at $14 billion.

While the costs of providing a FTTH network eventually might be covered by subscribers, companies lack the incentive to move from existing technologies, which involved a substantial investment not long ago, to another technology with such high initial costs. Thus, if internationally competitive service is deemed to be important to Arizona's competitiveness, the public sector may need to become involved. However, the bulk of the projected cost of $23.1 billion, including operations and capital outlays, likely will be recovered over time from customers.

Transportation

The transportation infrastructure in Arizona consists of four components: (1) roads and highways, (2) mass transit, (3) railways, and (4) aviation. The growth in population and businesses will create a need to expand each type of transportation infrastructure over the next 25 years.

In addition, existing traffic congestion and the limited capital outlays for roads and highways over the last 15 years suggest that additional monies will need to be expended in the roads and highways and transit components to bring the existing infrastructure up to standard for existing residents and businesses. Without significant infrastructure investment, declines in performance will adversely affect the quality of life of Arizona residents, economic efficiency, and the state's population and business growth rates.

Most of the projected cost — capital outlays only — of $253 billion to $311 billion over the next 25 years likely will be borne by the public sector, with only a portion of this expense covered by current funding. The state and local government share of the cost may be between $122 billion and $151 billion. Most of this expense will be in the roads and highways component.

Discussion

Traditionally, the transportation infrastructure has been jointly provided by the public and private sectors. Roads and highways primarily have been a public-sector function, though privately run toll roads have been in existence for centuries in the United States. Transit also has been largely a public-sector responsibility, though private companies also have provided such service. In contrast, air and rail service have been largely provided by private-sector companies, though commercial airports are generally operated directly by government entities or government-created airport authorities.

The use of all modes of transportation is likely to increase substantially over the next 25 years as Arizona's population and economy grows. Demand for most types of passenger transportation is expected to approximately double, including passenger vehicle miles travelled on roads and highways, air passenger enplanements, urban bus ridership, and rural bus ridership. Lesser but still substantial gains of 40 percent to 63 percent are expected in general aviation travel, intercity bus transit, and intercity rail boardings. Freight transportation demand also is projected to rise sharply, with air freight tonnages almost tripling, truck vehicle miles more than doubling, and rail freight rising 77 percent.

The state, as well as its counties and cities, currently has limited plans to improve transportation infrastructure in the coming years. Even with these planned improvements in place, burgeoning demand will cause performance levels to decrease on the state's roads, railways, and airports.

Without significant infrastructure investment, the percentage of road passenger travel at an acceptable level of service will fall from 77 percent statewide in 2002 to 38 percent in 2025. Average delay per trip statewide will increase nearly six-fold over the same period.

Such declines in performance would greatly lessen the quality of life of Arizona residents and would adversely affect the economy by decreasing efficiency. Such deterioration in the quality of the transportation infrastructure almost certainly would lower the state's population and business growth rates.

Costs of Providing the Transportation Infrastructure Through 2032

Infrastructure costs were projected in the AIC report for each of the four components. Only capital costs have been projected due to data limitations. The cost projections include costs to complete the transportation infrastructure improvements that already are planned or under construction, as well as those projects that will be necessary to maintain system performance at an acceptable level to 2032.

Relative to the other components, the capital costs projected for the rail component (close to $6 billion) are moderate. With the rail component dominated by the private sector, all or nearly all of its upcoming needs can be considered to be covered by existing funding mechanisms.

Funding needed in the aviation component in the next 25 years also is relatively moderate at around $12 billion. While most of the aviation services are privately provided, 86 percent of the aviation infrastructure is funded by the public sector, based on national figures compiled by the Congressional Budget Office. Thus, the public share of the $12.1 billion projected infrastructure cost is more than $10 billion, with the state and local government share between $5.5 billion and $6 billion. Little of this upcoming expense can be considered to be covered by existing funding.

Transit needs are projected to be higher, with nearly $36 billion in infrastructure costs expected during the next 25 years. In addition to providing service to new residents, this cost figure includes upgrades to the currently limited transit system. While a small portion of the costs are included in the state's existing five-year transportation plan, the vast majority can be considered to be new costs without existing funding. Nationally, all of the transit infrastructure expenses are funded by the public sector, with a little more than half provided by state and local governments. Thus, state and local governments in Arizona are facing a transit need of perhaps $18 billion over the next 25 years.

The projected cost over the next 25 years in the roads and highways component is a staggering $199 billion to $257 billion (see Table 11). The range reflects differing assumptions regarding inflation in road and highway construction. The low estimate assumes road and highway construction inflation will be equal to the overall projected inflation rate of 2.2 percent per year. The high estimate assumes a higher figure of 4 percent per year average construction cost inflation — still lower than the average of the last 16 years, which was affected by the inordinately high inflation of the last four years.

The private sector will play an unknown role in providing the road and highway infrastructure in the future. Existing spending by the private sector in the highways category is unknown, according to the CBO's research. Based in part on the situation in the United Kingdom, the Urban Land Institute forecasts that only 10 percent of road projects will attract public-private partnerships.

Thus, of the $199 billion to $257 billion projected cost of roads and highways, the public sector may need to fund between $179 billion and $231 billion. Based on the state and local government share of 55 percent of the infrastructure capital spending nationally, this results in a

TABLE 11
PROJECTED TRANSPORTATION INFRASTRUCTURE COSTS
IN ARIZONA THROUGH 2032 IN BILLIONS

	Roads		Transit	Rail	Air	Total	
	Low*	High**				Low*	High**
Total Capital Costs	$198.8	$257.0	$35.8	$5.9	$12.1	$252.6	$310.8

* Using 2.2 percent annual inflation for roads and highways.
** Using 4 percent annual inflation for roads and highways.

Source: Arizona Investment Council, "Infrastructure Needs and Funding Alternatives for Arizona: 2008-2032."

state and local government capital outlay need of $98 billion to $127 billion over the next 25 years over and above existing funding sources. This understates the total need since additional operations monies also will be required.

The Arizona Department of Transportation estimates that within seven years Arizona will be in a "preservation only" mode, meaning that incoming revenues will be sufficient only to support operations and maintenance costs; no money will be available to fund new capital projects. Thus, other than the small amount of funding present in the state's current five-year plan, nearly all of the projected cost can be assumed to be unfunded.

Based on the Census Bureau's government finance data, total state and local costs, including current operations as well as capital outlays, could amount to $482 billion over the 25 years. Existing funding dedicated to transportation is projected to total $111 billion, leaving a shortfall of $371 billion. Total state and local government transportation costs could amount to between $218 billion and $270 billion over the 25 years.

Water

The water infrastructure in Arizona can be divided broadly into three categories: (1) water supply infrastructure, which includes dams, reservoirs, canals, and wells; (2) drinking water treatment and distribution infrastructure, which includes drinking water treatment plants and pipelines; and (3) wastewater treatment and conveyance infrastructure, which includes wastewater treatment plants and sewer lines.

Providing water and wastewater services to new residents and businesses will require augmentation of the current water supply. Further, aging water delivery and treatment systems — a substantial portion of Arizona's water and wastewater infrastructure was built several decades ago — will need to be renovated and replaced.

In the next 25 years, considerable spending for capital and operations will be needed to provide water services for new residents and to upgrade existing systems. Costs not currently funded may total nearly $30 billion, with the bulk of these unfunded costs likely to be the responsibility of state and local governments.

Discussion

Water and wastewater systems in urban areas largely are provided by the public sector, though private companies sometimes provide water and wastewater services, even in municipalities. In rural areas, a wastewater system is generally not present, with residents responsible for their own septic tanks. Drinking water in unincorporated areas is usually served either by a private company or by the residents, through wells or trucking in water.

Capital investments will be required to provide water services to new residents and businesses in Arizona, as the infrastructure built several decades ago will not meet the demands of a rapidly growing population. Further, in some parts of the state — particularly Cochise, Coconino, Gila, and Yavapai counties — the current water supply is in need of augmentation. In the populous megapolitan area of Maricopa, Pinal, and Pima counties, augmentation is not expected to be needed by 2032, but likely will be necessary shortly thereafter. However, easy supply

augmentation options no longer are available. As augmentation to existing water supplies is implemented — for example, using water reclamation or desalination — costs will increase.

In addition to capital investments for new systems to serve the state's growth, the water delivery and treatment systems built decades ago are due for replacement in Arizona. Much of the water infrastructure was built several decades ago. The American Water Works Association calls this the "dawn of the replacement era."

Creating and expanding water infrastructure can be a time-consuming process, making planning critical. In some cases, effective planning involves securing new water supplies — which can be very complex legally, institutionally, and financially. In other cases, large-scale capital projects are needed, which take time to plan, finance, and build.

The analysis of the water infrastructure assumes that climatic conditions and water flows in rivers in the future will approximate those of the past. However, climate change could potentially have adverse effects on Arizona's water resources. If so, augmentation in the megapolitan area could be required earlier, and costs might be greater than anticipated.

Costs of Providing Water and Wastewater Services Through 2032

Projections of the capital and ongoing costs of water and wastewater systems are provided in Table 12. Capital costs for the drinking water component are projected to exceed $30 billion. While this includes augmentation costs, the main expense will be the basic infrastructure to provide water for current and future residents. Ongoing costs are expected to exceed capital costs. Costs associated with wastewater systems are projected to be roughly half as much as those for drinking water, with capital projected at $14.2 billion and ongoing costs of $22.1 billion.

Total water and wastewater costs are estimated to be $109.1 billion in Arizona over the next 25 years, including capital costs of $44.9 billion and ongoing costs of $64.2 billion. Revenue from current funding sources is projected to total $79.3 billion, leaving a funding shortfall of $29.8 billion. Existing spending by the private sector is unknown, according to the CBO's research, but it is believed that a high proportion of the capital costs are covered by the public sector. More than 90 percent of the public expenditures are made by state and local governments. Thus, it is likely that the bulk of the $29.8 billion will be paid by state and local governments in Arizona.

The requirement and ability to fund infrastructure needs varies considerably across the state. In areas with impending supply augmentation needs (Cochise, Coconino, Gila, and Yavapai counties), the funding gap will be larger, and the ability to overcome that gap will be limited. The projected total and per capita costs of the supply augmentation projects that will be necessary to support existing and future populations in these counties are shown in Table 13. The figures in this table are based on the assumption that the augmentation planning needs to begin immediately. The per capita costs thus are based on the existing population.

Infrastructure costs in Arizona's other counties are not as dramatic as in these four counties, but the per capita average cost of water and wastewater infrastructure (capital and ongoing costs) across the other 11 counties of the state is about $465 over the 25 years. Beyond this 25-year

TABLE 12
PROJECTED WATER INFRASTRUCTURE COSTS IN ARIZONA THROUGH 2032 IN BILLIONS

	Water	Wastewater*	Total
Total Capital Costs	$30.7	$14.2	$44.9
Drinking Water Infrastructure**	29.1	N/A	29.1
Coconino County Supply Augmentation***	0.7	N/A	0.7
Cochise County Supply Augmentation***	0.2	N/A	0.2
Yavapai County Supply Augmentation***	0.2	N/A	0.2
Gila County Supply Augmentation***	0.0	N/A	0.0
Dam Renovation and Replacement	0.3	N/A	0.3
SRP Well Rehabilitation and Replacement	0.2	N/A	0.2
Wastewater Infrastructure	N/A	14.2	14.2
Total Ongoing Costs	42.1	22.1	64.2
Total of All Costs	72.8	36.3	109.1

* Wastewater capital costs include the rehabilitation and replacement of wastewater and storm water systems to serve existing populations as well as the construction of new systems to serve future populations.
** Drinking water infrastructure costs include the rehabilitation and replacement of drinking water systems to serve existing populations as well as the construction of new systems to serve future populations.
*** Supply augmentation includes projects to provide sustainable sources of water for future populations.

N/A: not applicable

Source: Arizona Investment Council, “Infrastructure Needs and Funding Alternatives for Arizona: 2008-2032.”

TABLE 13
WATER SUPPLY AUGMENTATION COSTS BY COUNTY IN ARIZONA THROUGH 2032

	Total Capital Costs	Per Capita Costs
Coconino County	$652,000,000	$4,752
Cochise County	217,000,000	1,547
Yavapai County	197,000,000	817
Gila County	31,000,000	543

Source: Arizona Investment Council, “Infrastructure Needs and Funding Alternatives for Arizona: 2008-2032.”

horizon, but before 2050, additional water supplies for highly populated central Arizona (Maricopa, Pima, and Pinal counties) will be needed, as the water supply surplus in the megapolitan area is expected to shrink dramatically between 2008 and 2032. Supply augmentation options for the megapolitan area could be just as expensive as the options for Coconino, Cochise, Yavapai, and Gila counties.

Thus, significant infrastructure investments will be required in the next 25 years to provide a sustainable water supply and wastewater services to future populations. The era of “cheap water”

in Arizona has passed: water and wastewater services are going to become much more expensive.

Other

The preceding seven infrastructure categories account for most of the overall infrastructure, particularly the physical infrastructure. Other public-sector expenses can be grouped into five components: (1) social services other than health care, (2) environment and housing, (3) government administration, (4) interest on debt, and (5) not elsewhere classified.

Total state and local government costs in Arizona over the next 25 years in these components are projected to be $978 billion. Only a small portion likely will be capital outlays.

Discussion

Social Services. Excluding health care, the public welfare subcomponent, which accounted for 17 percent of the state and local government expenditures in Arizona in 2006, makes up nearly all of the social services component. Capital outlays are a very small share of the total expenses. Arizona's per capita spending was 21 percent less than the national average, though slightly higher than the norm of the fast-growing states. Though public welfare spending in the last 15 years in Arizona increased substantially, the rise was marginally less than the national average.

Most of the expenditures in the social services category are driven by federal mandates for spending to support low-income individuals and families. A large portion of the expenditures is offset by support from the federal government. Growth in the programs in recent years has been dictated by growth in federal mandates and federal funding support.

Environment and Housing. The environment and housing component consists of four subcomponents: (1) natural resources, (2) parks and recreation, (3) housing and community development, and (4) solid waste (trash collection and disposal). The Census Bureau includes sewerage in this classification, but that service is discussed with the water infrastructure. Capital outlays are a small share of the total expenses, with most of the capital outlays in the parks and recreation subcomponent.

In 2006, Arizona's per capita spending by state and local governments was far above the norms in parks and recreation, near the norms in natural resources, and considerably lower than the norms in the housing and community development (which is supported by an array of federal programs), and solid waste components. The high spending in parks and recreation reflect a large increase in recent years.

Spending in the parks and recreation component in Arizona is currently much higher than in the other components. Costs in this component in particular will be affected by rising land costs, due to availability constraints. The citizens of Arizona likely will continue to demand that state and local governments set aside space for parks and recreation, particularly as the growing population crowds existing facilities and as urban growth expands into natural areas.

Government Administration. The Census Bureau splits government administration into four subcomponents: (1) financial, (2) judicial and legal, (3) public buildings, (4) other

administration. The judicial and legal subcomponent alternatively might be included with the public safety infrastructure. Per capita spending in Arizona for judicial and legal services is above the norms, like the spending in public safety. In contrast, per capita expenditures in the other subcomponents of government administration are less than the national averages, though the figures for the financial and other administration subcomponents are slightly higher than the norms of the fastest-growing states. Capital outlays are a very small share of the total expenses in this component.

The change in per capita spending between 1992 and 2006 in each of the subcomponents was less than the national average. While investments in government administration may help drive efficiencies in other areas of state and local government, it is difficult to measure the benefits.

Interest on Debt and Other. The interest payments on debt presumably result largely from long-term financing taken out in the past to build physical infrastructure. Due to Arizona's rapid growth, capital outlays in the past exceeded the national per capita norm. This suggests that the per capita debt figure should be higher than the national average, but it was 26 percent below the U.S. average in 2006, and slightly less than the norm of the fast-growth states. Per capita debt payments fell substantially between 1992 and 2006 in Arizona, compared to no change nationally. This in part results from the use of general fund monies rather than long-term debt to finance school construction in Arizona.

Arizona's per capita expenditures in 2006 also were below the norms in the subcomponent of expenditures not elsewhere categorized. The change since the early 1990s was about equal to the U.S. average.

Costs of Providing Other Services Through 2032

At current trends, Arizona's state and local governments will spend about $548 billion over the next 25 years on social services programs. A significant amount of this expenditure will come from funds provided to state and local governments from the federal government.

In the environment and housing component, costs are projected to be $206 billion, of which $26 billion would be for capital outlays. Nearly half of the total expense, and most of the capital outlays, is in the parks and recreation subcomponent. The remainder is split among the other three subcomponents.

Government administration costs are projected to be $104.2 billion. Data are not available with which to project capital outlays, but they are expected to be small relative to the total costs.

Payments on debt are projected to be $50 billion. Public services not classified elsewhere are projected to have costs of $70 billion, as shown in Table 14.

Total "other" infrastructure costs are projected to be $978 billion. The capital outlays portion likely will be a little more than $26 billion.

TABLE 14
PROJECTED OTHER INFRASTRUCTURE COSTS OF PUBLIC SECTOR IN ARIZONA THROUGH 2032 IN BILLIONS

	Environment and Housing				
	Natural Resources	**Parks & Recreation**	**Housing & Community Development**	**Solid Waste**	**Subtotal**
Total Capital Costs	$4.0	$20.5	$na	$1.8	$na
Total Ongoing Costs	37.2	81.6	na	33.2	na
Total of All Costs	41.2	102.2	28.0	35.1	206.4

	Social Services		
	Public Welfare	**Other**	**Subtotal**
Total Capital Costs	$na	$na	$na
Total Ongoing Costs	na	na	na
Total of All Costs	545.0	2.5	547.5

	Government Admin-istration	**Interest**	**Other**	**TOTAL**
Total Capital Costs	$na	$0.0	$na	$na
Total Ongoing Costs	na	50.0	na	na
Total of All Costs	104.2	50.0	69.8	977.9

na: not available

Source: Projected by authors using State and Local Government Finance data of the U.S. Department of Commerce, Census Bureau.

APPENDIX I
HISTORICAL DEVELOPMENT OF ARIZONA'S INFRASTRUCTURE

Long before Arizona became a state, private and public entities were working together to provide the kind of infrastructure that would make the area a suitable place to work and live. Perhaps not surprisingly, the level of public involvement in the provision of infrastructure has increased over time. On one hand, it is necessarily so: in 1800s' Arizona, there was not much government around to chip in to build canals, dig wells, run telephone and electricity lines, or build roads. On the other hand, increasing government involvement in the provision of infrastructure has followed alongside the general increases in the size of government (at all levels — federal, state, and local).

In some cases, infrastructure was always a public endeavor or public-private partnership. In other cases, private infrastructure became public over time.

In this appendix, a history of infrastructure provision in Arizona is presented. Certainly the information included is not exhaustive. Instead, the appendix looks at selected infrastructure development over the course of the last 100+ years and asks: Who constructed it? Who financed it? Who operated it? The aim is to offer readers insight into how the provision of infrastructure has changed over time.

Education

Elementary and Secondary Education

Tucson's first schoolhouse in 1867 was a rented saloon in the downtown area. The school teacher resigned after just four months because the city could not afford his wages. Tucson's first public school opened in 1872 and was built on land donated by businessman Estevan Ochoa.[1]

In 1893, the citizens of Flagstaff approved a tax to raise money to construct a public school. During a town meeting, citizens took up a collection and raised $400, enough to pay for the land, legal, and surveying costs.

Phoenix opened its first public school in September 1872 in a county courtroom. The following year a small schoolhouse was completed on Center Street, which is now Central Avenue.

Phoenix established the Union High School in 1895 with four classrooms and 90 enrollees.[2] Construction funds were raised by the sale of Churchill House and six blocks of city land. Union High School remained Phoenix's sole public high school for several years. To accommodate the growing population of children of high school age, North High School was built in 1938. Over the next decade five more schools opened.[3]

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[1] "Tracing our Roots in Pima County," Sewer History.org, 2004, <http://www.sewerhistory.org/indexc.htm>.
[2] Phoenix Union High School District, "District History," 2008, <http://www.phxhs.k12.az.us/education/dept/dept.php?sectionid=1249>.
[3] ibid.

More recently, the Phoenix Union High School District purchased the Franklin School, built in 1926 but vacant for the previous fifteen years, for the price of $10,000. A new specialty high school was planned with a construction cost of about $4 million. The project was financed with 2003 bond funds and contributions from the State Park's Heritage Fund and city grants. The new school would become a four-year fire/EMS school called Franklin Police and Fire High School. It opened its doors to students in 2007.[4]

In January 2001, a unique partnership of businesses and the school district created the Suns-Diamondbacks Academy as an alternative school for at-risk youth.[5] In 2003, a $12 million construction bond was used to build Bioscience High School, a small science- and math-themed school geared towards students seeking a career in medicine and related fields and created to accommodate the fast growing southwest area of Phoenix. Fairfax High School was dedicated in 2007. A list of these selected schools is presented in Table I-1.

Higher Education

The Tempe Normal School opened in 1885 as the first institution of higher learning in the Arizona Territory. When it achieved university status in 1958, it became Arizona State University. In the 1980's, ASU opened a West campus, followed by a Polytechnic campus in 1996, and a Downtown campus in 2006.

In 1885, the City of Tucson appropriated $25,000 to the University of Arizona, the first school to open with university status. The land needed to build the school was donated by two gamblers and a saloon keeper. The first classes of the school met in 1891.

Flagstaff's Northern Arizona Normal School formed in 1899. The school became able to grant bachelor of education degrees in 1925, finally achieving university status in 1966. At that time its name formally changed to Northern Arizona University. Today the school occupies 738 acres, offers 13 residential buildings, and is governed by the Arizona Board of Regents.

Libraries

In 1888, the citizens of Flagstaff joined together to raise money and solicit gifts of books to establish a public library. As a result of their efforts, they accumulated a collection of classics, reference works, and other popular items. Sadly, the library was destroyed by fire in 1893.[6] The National Guard and union veterans tried to fill the city's need by opening several small libraries. By 1910, the Women's Christian Temperance Union had accumulated books from various sources, raised some money, and opened a public reading room.[7]

Another women's group made great strides in establishing a library for Flagstaff in 1914. Two months after the Flagstaff Woman's Club was organized they held a fund-raiser event at the Majestic Opera House. The price of admission was a donation of books or the purchase of

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[4] Pletenik, Craig. "Phoenix Union Buys School from Phoenix Elementary District," 16 Aug. 2004, <http://www.phxhs.k12.az.us/education/components/docmgr/default.php?sectiondetailid=29685&fileitem=1663&catfilter=934>.

[5] Phoenix Union High School District, "District History," 2008, <http://www.phxhs.k12.az.us/education/dept/dept.php?sectionid=1249>.

[6] Cline, Platt. "Mountain Town: Flagstaff's First Century." Flagstaff: 1994, p. 41.

[7] Cline, Platt. "Mountain Town: Flagstaff's First Century." Flagstaff: 1994, pp. 148-9.

TABLE I-1
HISTORICAL PERSPECTIVE ON ARIZONA'S SCHOOLS AND UNIVERSITIES

Infrastructure	Year Built	Constructed By	Source of Financing
City of Tucson's Public Schoolhouse	1872	City of Tucson	Donation by businessman Estevan Ochoa
University of Arizona	1885	City of Tucson	City of Tucson and resident donations
Arizona State University (began as Tempe Normal School)	1885	City of Tempe	City of Tempe
City of Flagstaff's Public Schoolhouse	1893	City of Flagstaff	City tax and resident donations
City of Flagstaff Parochial School	1893	City of Flagstaff	Donation by Gerhard Verkamp
Phoenix Union High School	1895	City of Phoenix	Proceeds from sale of Churchill House
Northern Arizona University (began as Northern Arizona Normal School)	1899	City of Flagstaff	City of Flagstaff
Suns-Diamondbacks Academy	2001	City of Phoenix	Partnership of businesses and school districts
Franklin Police and Fire High School	2006	City of Phoenix	2003 bond funds, city grants, and State Park's Heritage Fund

tickets. The evening's entertainment brought them 160 donated books and $110 in cash. The club soon was able to rent two rooms on the second floor of the Mayflower building and hire a part-time librarian. By the end of 1914, a new library opened with 700 volumes — of which 40 volumes were the Bard's classics donated by the Shakespeare Club — and an excess of 10,000 library patrons.[8] Some of the state's early libraries are listed in Table I-2.

Although the Flagstaff Woman's Club continued to remind citizens of Flagstaff that libraries were supported by taxes in most communities, they continued to be responsible for the library's operation. It was not until 1920 that the Flagstaff City Council began to support the library with tax funds.

In 1937, Flagstaff residents voted to purchase a building at a discounted price in order to establish a new, larger library. It remained in its new location for more than thirty years. By the early 1970s, Flagstaff used sales tax money that had accumulated in the city's public works fund to pay for the purchase and remodeling of Union Hall, the new home to the city's library.[9]

A group of women also established the library system in Phoenix. Fourteen women, known as the Friday Club, started the movement for a library in 1897. This led to the formation of the Library Association in 1899. Members were charged an annual subscription fee of $3, which

[8] ibid.
[9] ibid.

TABLE I-2
HISTORY OF ARIZONA'S LIBRARIES

Infrastructure	Year Built	Constructed By	Source of Financing
Flagstaff Library	1888	Residents of Flagstaff	Donations
Flagstaff Library	1914	Flagstaff Woman's Club	Donations
Phoenix Library	1899	Friday Club	Subscription fees
Phoenix Library	1904	Friday Club	Library tax and Andrew Carnegie
Phoenix Central Library	1952	City of Phoenix	Library tax

provided for the maintenance of the small library that was housed in two upstairs rooms in Fleming Building.

A few years later, in 1901, the Legislature passed a bill allowing a tax to support free libraries. The Phoenix City Council enacted the tax for a public library the following year and appointed a board of trustees. Andrew Carnegie donated $25,000 in 1904 to the city for the building of its library building.

Years later in 1940, Mae Bartlett Heard donated eight acres of land to the city to contain a central library, art museum, theater, and auditorium. Phoenix's Central Library was built on this land and dedicated in 1953. Phoenician Alfred Knight loaned this library his collection of 3,000 rare books, with the provision that the books would become the library's property upon his death.[10] A new Central Library opened in 1995 a few blocks south of the 1953 building.

Energy

Energy infrastructure in Arizona is constructed, funded, and operated mostly by private companies (such as Tucson Electric Power and APS). Historically, most of the energy infrastructure was funded by private companies. The history of power generation and distribution in Tucson highlights an interesting effort to keep the company private.

The notable exception to the primarily private energy infrastructure is the Salt River Project, a quasi-governmental entity, which was funded in large part by the Bureau of Reclamation of the United States Department of the Interior. The Bureau also funded, and currently operates, Glen Canyon and Hoover dams, which are significant hydroelectric power generators.

History of Power Generation in Northern Arizona

In 1893, when Arizona was still a territory, a group of citizens in Prescott asked their city council for an ordinance of authority to install a power plant. It was immediately enacted. An electrical engineer named Thomas Jasper established the Jasper Electric Light Company. Equipment was assembled in an abandoned schoolhouse near the fuel supply of sawmill waste. They had a steam boiler, an engine fueled by scrap and sawdust, and a 35-kilowatt generator. Jasper believed this would generate enough to power between five- and six-hundred light bulbs. Workers of the Electric Light Company strung two miles of wire and by the fall of 1893 the citizens of Prescott

[10] Phoenix Public Library, "History of the Library," 2007, <http://www.phoenixpubliclibrary.org/history.jsp>.

were using light bulbs. Flagstaff had electric lights by October 1895 but the service was only available from dusk until 1 a.m., which was typical for small towns at the time.[11]

Around the same time, a rancher named Lew Turner discovered Fossil Creek and Fossil Springs, located about 86 miles south of Flagstaff. He filed a claim to the land but lacked the finances for development. By 1902, Turner found investors and for four years Fossil Creek and Fossil Springs were studied by engineers. The timing was fortuitous: it was just about the turn of the century that hydroelectric power began to be used throughout the United States. The engineers found that from the springs to the Verde River there was a 1600-foot drop in elevation, enough of a drop to build the necessary velocity for hydroelectric power. In 1907, Turner and his investors formed the Arizona Power Company, raised money through private investors, and by 1908, they started construction on the Childs Power Plant. The plant supplied power to Prescott and Jerome.[12]

Under an agreement between United Verde Copper Company and the Arizona Power Company, the Irving Power Plant was constructed between 1914 and 1916. It also is a hydroelectric plant. A transmission line connected it to the Childs Plant. Though the Childs and Irving Power Plants are small when compared to today's power plants, they fulfilled the electrical needs of all of Yavapai County.[13] These plants remained in operation through 2004, when APS decommissioned both facilities in order to return stream flow to Fossil Creek.

History of Power Generation in Tucson[14]

In the fall of 1892, enterprising Tucsonans formed the Electric Light and Power Company (which would eventually become the enterprise today known as Tucson Electric Power, the principal subsidiary of UniSource Energy Corporation). The Electric Light and Power Company generated power with an electric lighting plant bought from General Electric Company. Soon after, the company took over the Tucson Gas Company in 1896, paying $14,000 for the property, payable over four years.

Facing financial constraints, the founders decided in late 1901 to sell the company to J. J. Henry of Denver, who agreed to a sales price of $35,000 cash and assumption of about $15,000 in debt. Henry obtained a 25-year franchise from the City of Tucson, returned to Denver and sold his newly acquired assets to a new Colorado corporation called Tucson Gas, Electric Light and Power Company for $299,500 in stock and $175,000 in bonds. In 1905, controlling stock in TGEL&P Co. was held by the United States Light and Traction Company of Denver.

As demand quickly outstripped the capacity of the direct current generators, the company pioneered the use of alternating current generators in 1903. It soon was boasted that Tucson had

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[11] Cline, Platt. Mountain Town: Flagstaff's First Century. Flagstaff: 1994, 73-4.

[12] Clark, Bob. Interview. Hydro Electric Power Development in Fossil Creek. 07 Dec. 1979. <http://azmemory.lib.az.us/cdm4/item_viewer.php?CISOROOT=/shmoralhist&CISOPTR=81&CISOBOX=1&REC=16>.

[13] American Society of Mechanical Engineers, The. The Childs-Irving Hydroelectric Project. 10 Apr. 1976. <http://files.asme.org/ASMEORG/Communities/History/Landmarks/5515.pdf>.

[14] The information on the history of power generation in Tucson comes in part from the Tucson Electric Power website, <http://www.tucsonelectric.com/Company/Overview/history.asp>

the finest electrical system available. Carbonized bamboo filament bulbs glowed in more than 300 homes and businesses.

The company kept pace with technical developments and in 1915 began converting to the new diesel systems, which had a lower fuel consumption rate. The company was soon credited for the boom of agriculture around Tucson by providing power for irrigation pumps at low rates.

For several years the city and company had worked to bring natural gas to Tucson. A pipeline bringing gas from Texas was completed in 1933, and the occasion was marked by a big celebration that featured Mayor Henry O. Jaastad using a Roman candle to ignite gas from a pipe near Sentinel Peak that shot a 40-foot flame into the air.

In 1943, the Securities and Exchange Commission ordered Federal Light and Traction Company to make divestiture of its holdings. The Tucson utility was offered to the City of Tucson, and J. R. Snider was sent to Tucson to work out details of the sale.

Negotiations with the city collapsed and in June 1946, a total of 147,000 shares of common stock in Tucson Gas, Electric Light and Power Company were offered to the public. By December, there were 1,927 stockholders from 40 states and the District of Columbia. When TGEL&P Co. became a publicly held company in 1946, board meetings shifted from New York City to Tucson’s Pioneer Hotel.

In 1948, the company announced it would build an $11 million generating station at DeMoss-Petrie Road and the Southern Pacific Railroad tracks, a site now bordered by Interstate 10 and West Grant Road. The plant had an initial capacity of 24 megawatts, which grew to 98 megawatts by 1954.

In 1955, the company announced the Irvington Generating Station would be built on a 280-acre site at South Alvernon Way and East Irvington Road at an initial cost of $25 million. The plant eventually would generate 422 megawatts of power from four units that burned oil or natural gas as fuel. In the 1980s, the largest generator was modified so that it would also burn coal. Today, Unit 4 also burns methane gas that is pumped three miles from the Los Reales Landfill to generate enough electricity for about 5,000 homes.

In 1964, the company ended its status as a “foreign corporation” in Arizona, changing the name and domicile from Tucson Gas, Electric Light and Power Company, a Colorado corporation, to Tucson Gas & Electric Company (TG&E), an Arizona corporation.

Well in advance of anticipated shortages of natural gas and fuel oil for electric generation, the company began to plan to utilize the Southwest's vast coal reserves. The search led in 1965 to formation of a consortium of utilities to build a large coal-fired plant, the Four Corners Project, near Farmington, N. M.

In 1969, plans were announced for additional coal-fired ventures. The company would be a partner in the San Juan Generating Station in northwestern New Mexico and in the Navajo Generating Station near Page, in northern Arizona.

In 1972, the company joined other utilities in plans to build a nuclear generating plant 60 miles west of Phoenix. The operating target date for the first unit was 1981. However, by 1975 it was decided that demand could be met with less expensive coal-fired generation. The company sold its share of what would become the Palo Verde Nuclear Generating Station.

Management decided co-ownership of power plants restricted flexibility of operation, so when demand forecasts projected the need for additional capacity by the late 1980s and early 1990s, the board voted to build a wholly owned, coal-fired plant at Springerville, in east-central Arizona.

In 1979, the gas operations, hampered by moratoriums on gas caused by shortages, were sold to Southwest Gas Corporation of Las Vegas, Nevada. Southwest had greater gas resources available and was able to get the state to lift the restrictions. The company's name changed again — to Tucson Electric Power Company.

A dispute arose in 1979 over construction of the $1.5 billion Springerville station. The company said it chose an open-shop contractor when agreement could not be reached with organized labor. Unions protested, sponsoring a demonstration before the May 13, 1981, annual meeting in which nearly 7,000 marchers participated. The plant was built by the nonunion company.

Sales of assets, which had not been charged to TEP customers, produced more than $200 million in cash in 1983. The company created subsidiaries to invest the capital in securities and varied businesses, including real estate.

In July 1984, the board of directors voted to transfer the basic wholesale power sales business, including ownership in two generating units, to a subsidiary, Alamito Company. Later that year the board authorized a spinoff of Alamito from TEP, approving distribution of a dividend to shareholders consisting of all the common stock of Alamito.

After a series of financial difficulties in the 1990s, UniSource Energy Corporation was formed in 1998 as the new parent company of Tucson Electric Power and its energy-related subsidiaries. A list of selected power-generation facilities is provided in Table I-3.

History of Power Generation in the Phoenix Area[15]

The Salt River Project (SRP) initially was established in 1903 as the Salt River Valley Water Users' Association (the Association) — the nation's first multipurpose reclamation project authorized under the National Reclamation Act. In 1937, the Association created the Salt River Project Agricultural Improvement and Power District (the District) to operate the power generation and distribution system (most of the Association's dams generate hydroelectric power). The District is a political subdivision of the State of Arizona (able to sell municipal bonds). Together, the Association and the District eventually became known as SRP. Today, the company is the nation's third-largest public power utility, providing power to customers throughout a 2,900-square-mile service territory in central Arizona.

[15] The information on the history of power generation in the Valley comes in part from the SRP website, <http://www.srpnet.com/about/history/>.

TABLE I-3
HISTORY OF POWER GENERATION IN ARIZONA

Infrastructure Constructed	Year Built	Who Constructed It	Source of Financing
Prescott Power Plant	1893	Jasper Electric Light Company	Donations
Roosevelt Dam	1905-11	U.S. Bureau of Reclamation	U.S. Bureau of Reclamation
Childs Power Plant	1908	Arizona Power Company	Investors
Cross Cut Power Facility	1914	Bureau of Reclamation	U.S. Department of Interior
Irving Power Plant	1916	United Verde Copper Company	United Verde Copper Co.
Mormon Flat Dam	1923-25	U.S. Bureau of Reclamation	U.S. Bureau of Reclamation
Horse Mesa Dam	1924-27	U.S. Bureau of Reclamation	U.S. Bureau of Reclamation
Stewart Mountain Dam	1928-30	U.S. Bureau of Reclamation	U.S. Bureau of Reclamation
Waddell Dam/New Waddell Dam	1928/1987-92	Private interests (for irrigation)/ U.S. Bureau of Reclamation (Central Arizona Project)	U.S. Bureau of Reclamation
Hoover Dam	1940s	U.S. Bureau of Reclamation	U.S. Bureau of Reclamation
Glen Canyon Dam	1957-64	U.S. Bureau of Reclamation	U.S. Bureau of Reclamation
C.C. Cragin Dam	1965	Phelps Dodge Corp.	Phelps Dodge Corp.
Navajo Coal Generating Station	Mid-1970s	Salt River Project	A consortium of other utilities and the U.S. Department of the Interior
South Con Generating Station	Early 1980s	Salt River Project	U.S. Department of Energy provided partial financing
Palo Verde Nuclear Plant	The plant went on-line in the mid 1980s	Bechtel Power Corporation	Consortium of seven utility companies
Springerville Coal Plant	1980s-ongoing	Tucson Electric Power	Tucson Electric Power

SRP's electricity was first created through hydrogeneration. This electricity initially supported the growing agriculture and mining businesses. Arizona Falls was the site of the first hydroelectric plant in Phoenix, utilizing the flowing water of the canal to produce power. Originally built in 1902, the plant was rebuilt by SRP in 1911, began delivering power again in 1913, and was shut down in 1950. It was reopened in 2003.

In 1909, a hydroelectric generator at the Theodore Roosevelt Dam site was built to run construction facilities, and excess electricity was sold to nearby copper mines and to farms in the Valley. Initially, only 13 customers were served by the small hydroelectric plant.

Later, hydropower was established as the "paying partner" for the construction of the Roosevelt Dam as the first power from the dam was delivered to the Phoenix Light and Power Company. In

1912, SRP signed an agreement with Inspiration Consolidated Copper Company of Miami, Arizona to supply hydroelectric power to the mines, which would ensure the viability of SRP's electric system.

The Bureau of Reclamation began construction on the Cross Cut Power Facility in 1912 as a source of auxiliary power. Its location between the Grand Canal and Arizona Canal was chosen because of the two major electric distribution lines that passed nearby. Water from the Arizona Canal was dropped 112 feet through the Pelton water wheels, which turned Westinghouse generators, generating 11,000 volts of electricity. The plant eventually served parts of Tempe, including its Hayden Flour Mill in the 1920's when the mill was converted from hydropower to electric power. Since the early 1950's the functions of the Cross Cut Power Facility have continued to evolve but the hydro plant continues to provide power in Arizona's summer months.[16]

As the copper industry expanded and the Valley grew, SRP extended its power service. In the 1920s, three more hydroelectric dams were built below Roosevelt Dam: Horse Mesa, Mormon Flat, and Stewart Mountain.

The Salt River Water Users' Association did not begin delivering electricity to residential customers until 1922. By 1928, SRP was stringing a local electric delivery system that resulted in the electrification of the Valley's rural areas nearly 10 years before the National Rural Electrification Act brought power to the rest of rural America. By 1930, 80 percent of those in SRP territory had electric service at a time when only 25 percent of rural America was receiving electricity.[17]

Yet as the company's residential and commercial base rapidly expanded (and demand exceeded supply), the company looked to produce energy from diverse sources in addition to hydrogeneration, including steam and diesel oil. In the late 1940s, SRP committed to system expansion, purchasing new equipment, using new technology and building new substations — essentially creating a new power system.

A diesel plant was constructed at the Crosscut Power Facility that operated until 1949 and a steam portion operated from 1941 to 1974.[18] After World War II, SRP built three steam-generating plants in the Phoenix area to keep pace with growth, and also joined other utilities in a 2,650-mile transmission system across the Southwest that enables delivery of electricity to the Valley from power plants throughout the region.

In the early 1970s, SRP was selected to build and operate the Navajo Generating Station in Page on behalf of a consortium of other utilities and the U.S. Department of the Interior. In 1975, SRP began construction on the Coronado Generating Station in St. Johns, and joined with Arizona Public Service and other utilities in the Palo Verde Nuclear Generating Station west of Phoenix.

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[16] City of Tempe, Arizona. Tempe Historical Museum. Tempe Historic Property Survey. 2008. <http://www.tempe.gov/museum/Tempe_history/properties/hps183.htm>.
[17] Salt River Project. SRP Legacy, The. 2008. <http://www.srpnet.com/about/history/legacy.aspx>.
[18] ibid.

In the early 1980s, the U.S. Department of Energy provided partial financing for the construction of the South Con Generating Station. It was built by SRP in an effort to provide cheaper hydroelectric power to their customers.[19]

The Palo Verde Nuclear Generating System, located about 55 miles west of Phoenix, has been the largest power producer in the United States of any kind since 1992.[20] Bechtel Power Corporation began its construction in 1976 but the last of its three units was not completed until 1988. The total cost to build the plant amounted to $5.9 billion.[21] Today, APS operates the facility and owns 29.1 percent of the Palo Verde plant.[22]

Public Safety

Prior to 1863, Prescott was populated by small camps of miners, mountain men, trappers, cowboys, and farmers. Justice, at the time, was usually meted out with guns or lynchings. In February 1863, President Lincoln and Congress formally established the Territory of Arizona and appointed John N. Goodwin as its first governor. Goodwin and his party headed to Prescott, where the territory's capital was at the time, and organized a territorial government. Prescott's original courthouse also served as the jail, the doors of which were huge logs fastened to the walls with heavy iron straps and two large padlocks. A new courthouse was built on the plaza in 1878.[23]

The Fifth Territorial Legislature in 1868 proposed a bill to build a prison in Phoenix. Although the bill passed, construction could not begin because of the prison's prohibitive cost. The bill was proposed again by the Eighth Territorial Legislature in 1875 but this time the site of the penitentiary was changed to Yuma. The bill was signed by Governor Safford and the territorial prison was to be built in Yuma by resident A. L. Grow, who submitted his construction plans and was awarded $150.

Prisoners labored to build the Yuma prison, which held its first inmates on July 1, 1876. In 1909, the prison closed due to overcrowding and its prisoners were relocated to the prison in Florence, which had been completed a year earlier by prisoners from the Yuma Territorial Prison (who lived in tents during the Florence State Prison's construction). Some of the state's early prisons are listed in Table I-4.

Yavapai County built a jail in Flagstaff in the early 1900s for about $475 but the poorly built structure was cold, damp, filthy, and vulnerable to escape. Atlantic & Pacific Railroad Company offered the county a free building to use as a prison. Again, prison labor was used to construct the prison but this time it was made with steel cells, increasing the cost to $7,630.[24]

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[19] "Canal History." SRP. 2008. <http://www.srpnet.com/water/canals/history.aspx>.
[20] Arizona Public Service. Power Plants. <http://www.aps.com/general_info/AboutAPS_18.html>.
[21] Hedding, Judy. "Palo Verde Nuclear Generation Station." 19 May 2005. <http://phoenix.about.com/cs/utilities/a/paloverde.htm>.
[22] Arizona Public Service. Power Plants. <http://www.aps.com/general_info/AboutAPS_18.html>.
[23] Jakobson, Eino. Interview, 1974, <http://azmemory.lib.az.us/cdm4/item_viewer.php?CISOROOT=/shmoralhist&CISOPTR=72&CISOBOX=1&REC=16>.
[24] Cline, Platt. "Mountain Town: Flagstaff's First Century." Flagstaff: 1994, p. 31.

TABLE I-4
HISTORICAL PERSPECTIVE ON ARIZONA PRISONS

Infrastructure	Year Built	Constructed By	Source of Financing
Yuma Territorial Prison	1876	A.L. Grow and prison laborers	City of Yuma
Flagstaff Jail	1900s	Prison laborers	Yavapai County
Florence State Prison	1908	Prison laborers	Town of Florence
Fort Grant	1912	U.S. Army Cavalry Post	U.S. Government

Fort Grant was built originally as a U.S. Army Cavalry Post, but in 1912 the federal government gave it to the State of Arizona to use as the State Industrial School for Wayward Boys and Girls. In 1968 the State Legislature passed a bill making the school part of the state's correction department, the same year the Arizona Department of Corrections became a state agency. The prison became an all male prison in 1973.[25]

There are now 10 large prison complexes in Arizona, which include Florence, Phoenix, Winslow, Eyman, Douglas, Perryville, Safford, Tucson, Yuma, and Lewis. All of these prisons are operated by the Arizona Department of Corrections.[26]

Telecommunications

Building and financing telecommunications infrastructure always has been a primarily private endeavor. During the late 1800s and early 1900s, telephone companies like Overland and Arizona Telephone, Sunset Telephone Company, and Mountain Bell connected telephone lines across the state to residential and commercial customers.

Tucson had a military telegraph in 1871[27] and in 1874 Phoenix had its own telegraph office. Tucson was the first to open a telephone exchange in 1881, just five years after Alexander Graham Bell received a patent for the telephone.[28] Phoenix got a telephone system in 1891[29] and Kingman got a small line in 1894. Tempe received telephone service in 1900.[30]

The first phones were installed in Flagstaff in1886 though phone service was not public (it was the Ayer Sawmill that installed the original telephones to connect their office to another small mill and a railroad spur five miles away). In 1895, the Sunset Telephone Company of Tucson installed poles and strung wire for public service in Flagstaff. Service began with only 51

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[25] Arizona Department of Corrections, "Early ADC History," 2005, <http://www.azcorrections.gov/adc/history/index.asp>.
[26] Arizona Department of Corrections, "Arizona State Prison Complex: Florence History," 2005, <http://www.azcorrections.gov/adc/prisons/florencehist.asp>.
[27] "Tracing our Roots in Pima County." Sewer History.org. 2004. <http://www.sewerhistory.org/indexc.htm>.
[28] ibid.
[29] City of Phoenix. Out of the Ashes. 2008. <http://www.phoenix.gov/CITYGOV/history.html>.
[30] City of Tempe, Arizona. Tempe History Timeline. 2008. <http://www.tempe.gov/museum/Tempe_history/basics/timeline.htm#FIRST>.

customers, 18 of which were residential. Service extended to Williams and the Grand Canyon in 1901, which led to the installation of a toll phone in the drug store.[31]

By the late 1880s, Mountain States Telephone and Telegraph purchased the operations of Overland and Arizona Telephone companies. As the regional AT&T company, Mountain States was referred to as Mountain Bell and was the face of the telephone company for many people in Arizona until divestiture in 1983. Shortly after divestiture, Mountain States changed its name to US West, which was acquired by Qwest Communications in 2000.[32]

The provision of service is more complicated now than in the past. The divesture of AT&T (of which Mountain Bell was a part) and the Telecommunication Act dramatically changed the industry's rules. Now, the telephone companies that ran service lines (known as incumbent local exchange carriers) are obligated to "interconnect new telecommunications service providers" and to "unbundle" their networks to provide for exchange access, information access, and interconnection to their systems."[33]

Nevertheless, the telecommunications infrastructure has been constructed for the most part with private funds, and continues to be so — with one notable exception. The Communications Act of 1934, signed by President Roosevelt, legislated the idea that telephone service should be universal. A series of programs were created to "encourage and enforce the expectation that basic local and long-distance telephone service be available to all."[34]

The largest of those programs, the Universal Service Fund, provides assistance for construction of telephone infrastructure in high-cost areas (primarily rural, where per-customer cost to build infrastructure is high because potential customers per square mile are few). Funds are collected from major long-distance carriers and are used to extend telephone service to previously unserved areas, help pay for system extensions and to keep basic rates low.[35]

Transportation

Transportation infrastructure has been financed and constructed by a mix of public, public-private partnerships, and private entities. Railroads, for example, were constructed by private companies (in Arizona, Southern Pacific and AT &SF railroads) with help from the federal government (in the form of land grants). The Tucson Airport was the first municipally owned airport in the country; Phoenix Sky Harbor was originally private.

Roads and highways were financed and constructed by counties, cities, and the states, in many cases with help from the federal government (significant help in the case of the interstates). Public transit, interestingly, was historically privately constructed, financed and operated. Today,

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[31] Cline, Platt. Mountain Town: Flagstaff's First Century. Flagstaff: 1994, p. 74.
[32] Arizona Investment Council, "Infrastructure Needs and Funding Alternatives: 2008-2032," May 2008.
[33] Arizona Investment Council, "Infrastructure Needs and Funding Alternatives: 2008-2032," May 2008, p. 175.
[34] Goldstein, M. and Gooding, R., "Universal Service to Universal Access: the Paradigm Shift in Citizens' Use of Telecommunications," International Research Center: State of Arizona, 1995, <http://www.researchedge.com/uss/default.htm>.
[35] ibid.

all public transit is publicly provided, by regional transportation authorities, cities, and, in some cases, the state. However, intercity bus transportation is still provided by private companies.

Railroads

The first railroad in North America began operation in 1827. By 1833, a total of 380 miles of track were in operation in the United States. By 1840, that number had grown to 2,800 miles of track. The golden age of railroads began in 1865, when 35,000 miles of track were in service, and continued until its peak in 1916, when trains operated on 254,000 miles of track throughout the United States. During that period, no other form of transportation rivaled the locomotive.[36]

Railroads always have been privately owned. However, the federal government assisted with financing the construction of the first railroads by granting land to the rail companies.

The first railroad crossed Arizona in 1881 — it was the Southern Pacific (now Union Pacific's East-West Sunset Route), which passes through Cochise, Benson, Tucson, Picacho, Casa Grande, Maricopa, Gila Bend, Wellton, and Yuma. Not long after, in 1883, the Atlantic & Pacific (Santa Fe) Railroad (now BNSF's "Transcon" line) crossed northern Arizona, passing through Sanders, Holbrook, Winslow, Flagstaff, Williams, Seligman, and Kingman. Yet it was not until 1895 that Phoenix was linked by rail to the northern and southern main lines, by what is now known as Union Pacific's North-South mainlines between Phoenix and Nogales.

Airports

Tucson International Airport, the first municipally owned airport in the United States, opened in 1919, though commercial air service did not begin until 1928. During World War II, the airport's runways were shared with the U.S. Air Force. The Tucson Airport Authority was created in 1948 as a nonprofit corporation to oversee operations of the airport. It began international service in 1963.

In 1928, J. Parker Van Zandt helped form Scenic Airways, Inc. with the intention of making a fortune flying tourists to the Grand Canyon and other attractive locations. Scenic Airways' stockholders began financing the construction of Sky Harbor Airport but their plans crashed along with the stock market in 1929. They attempted to sell their endeavor to the City of Phoenix but the city declined because of two previous failed investments in municipal airports. Scenic Airways ultimately found a buyer in Acme Investment Company.[37]

TABLE I-5
HISTORY OF ARIZONA'S MAJOR AIRPORTS

Infrastructure	Year Built	Constructed By	Source of Financing
Tucson International Airport	1919	City of Tucson	City of Tucson
Sky Harbor Airport	1920s	Scenic Airways, Inc.	Scenic Airways, Inc.

[36] Arizona Investment Council, "Infrastructure Needs and Funding Alternatives: 2008-2032," May 2008.
[37] Phoenix Aviation Department. Phoenix Sky Harbor International Airport: The First 50 Years, 1985.

Airmail service came to Arizona in 1930. In an effort to save direct airmail, passenger and express service, the City of Phoenix purchased Sky Harbor Airport from the struggling Acme Investment Company in 1935 for $100,000. Phoenix paid $35,300 in cash and took out $64,700 in mortgages and promissory notes.

In 1940, Phoenix had to commit to several enhancements to the airport in order to be eligible for more than $200,000 in government grants. Ultimately, the City of Phoenix and the U.S. Army entered into a joint occupancy lease. The War Department issued a contract to upgrade the east-west runway and for the construction of a new north-south runway. Voters approved a $1.1 million bond in 1948 to construct a new tower and to reform the old runway. Sky Harbor's Terminal 1 was completed in 1952. Ten years later, Terminal 2 was built for $4.1 million, financed by airport earnings, airport revenue bonds, and federal aid. The expansion of the airport by building Terminal 3 was a $10 million project. The City Aviation Department provided $7 million and the balance was provided by American West and Northwest Orient Airlines.

Roads and Highways

The history of Arizona's roads began in the 1800s with the carving of two rough roads in the north and south part of the territory. Trappers, hunters, and military units utilized the northern route, while the southern route was used by gold-seekers.[38] In 1857 the federal government commissioned Lt. Beale to create a wagon road, which he constructed using the aid of camels, pack mules, and horses. While building the road, Lt. Beale and his crew discovered the springs in Kingman that would become one of the first municipal water sources for the town and eventually bear Beale's name.

Road development was stimulated in 1864 when the First Territorial Legislature authorized toll road companies. Roads created solely by usage were excluded from tolls. The Legislature also authorized counties to levy a road tax for construction. A territorial engineer was appointed in 1909 and the Office of State Engineer was established in 1912, but counties continued to do most of the construction.

Due to the rising popularity of auto travel in the early 1900s, the Territory of Arizona developed a program to create highways and improve existing roads. Inmates provided a cheap solution to labor. In 1913, 75 prisoners were taken by train to Bisbee and by mule-drawn wagons to a prison camp in Tombstone Canyon. The prisoners built the highways over the mountain pass between Tombstone and Bisbee, made improvements on Douglas Highway, and built a bridge over the San Pedro River.[39] The federal government also used prisoners to build Mt. Lemmon Road in the Coronado National Forest near Tucson.[40]

Arizona Territory’s four existing counties joined forces in 1909 to improve and connect county roads.[41] That same year the Arizona Highway Department was organized and began receiving

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[38] Arizona Department of Transportation. About ITD. <http://www.dot.state.az.us/Highways/AboutITD.asp>.
[39] Arizona Department of Corrections. Early ADC History. 2005. <http://www.azcorrections.gov/adc/history/index.asp>.
[40] “Build New Mt. Lemmon Road,” *Tucson Star*, 02 May 1933.
[41] Cline, Platt. Mountain Town: Flagstaff's First Century. Flagstaff: 1994, p. 159.

Federal Aid.[42] The Legislature began levying a tax in 1912 of $250,000 annually to pay for road construction and repair. The state could spend one-fourth of the fund and the remainder was allocated to the counties.[43]

In 1918 the Highway Department was given discretion over significant sums of money from large bond issues carried by the counties to match federal aid with work on state highways within the counties. As a result, the development of state and county highways peaked from 1919 through 1921.[44]

Governor Moeur announced in 1933 that the federal government would pay for the proposed highway over the Catalina Mountains near Tucson at a staggering cost of $1,250,000. The highway would pass over the Catalinas and lead to Phoenix on the north side and to Tucson on the south side. An unintended benefit of the highway was that it opened up extensive recreational areas on the slopes of the mountains.[45]

Plans were announced in 1938 for a massive, half-billion dollar, 10-year project to construct highways and trails in national forests. Forest Service officials said the plan was critical to forest administration and protection. Arizona's estimated share of the expense was in excess of $20 million. Funds were allotted each year and regional foresters prepared programs for the upcoming year.[46]

By the late 1930s, the city of Chandler was experiencing traffic problems related to rapid growth. Drivers of newer, faster cars often did not realize that Arizona Avenue ended at the town plaza, causing them to jump the curb and drive into the park. Trucks making deliveries had difficulty navigating the narrow roads around the plaza. Consequently, the state recognized that Chandler's original design ceased to be practical and safe and in 1940 they aligned Route 87 down Arizona Avenue.[47]

The Arizona Department of Transportation (ADOT) was not formed until 1974. It was organized by combining two existing agencies: the Arizona State Highway Department and the Arizona Department of Aeronautics. The newly formed department was responsible for the construction and maintenance of interstate and state highways as well as providing financial assistance to public airports for development projects.[48]

History of the Interstate System. In the late 1930s, planning began for the Dwight D. Eisenhower National System of Interstate and Defense Highways (more commonly known as the

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[42] McBride, Perle. "The Arizona Highway Department: Past, Present, and Future," *Arizona Highways*, 28 Jan. 1933.
[43] Cline, Platt. Mountain Town: Flagstaff's First Century. Flagstaff: 1994, p. 159.
[44] McBride, Perle. "The Arizona Highway Department: Past, Present, and Future," *Arizona Highways*, 28 Jan. 1933.
[45] "U.S. Will Finance Catalina Tucson-Phoenix Short Road," Republican, 25 Feb. 1933.
[46] "Arizona Forest Road Fund is $20,536,700." 13 Oct. 2008.
[47] "The Story of Chandler, Arizona," 2008. <http://www.chandleraz.gov/default.aspx?pageid=37>.
[48] Arizona Department of Transportation. About ITD.
<http://www.dot.state.az.us/Highways/AboutITD.asp>.

TABLE I-6
HISTORY OF ARIZONA'S ROADS

Infrastructure	Year Built	Constructed By	Source of Financing
Wagon Trail	1857	Lt. Beale	U.S. Government
San Pedro River Bridge, Mountain Pass between Tombstone and Bisbee	1913	Prison laborers	County road tax
State and County Highways	1919-1921	Arizona Highway Department	County road tax
Catalina Mountain Highway	1933	County construction	U.S. Government
National Forest highways and trails	1938	State construction	State of Arizona tax fund
Route 87	1940	State construction	State of Arizona tax fund

interstate system). The Federal Aid Highway Act of 1938 called for the Bureau of Public Roads (BPR), the predecessor to the Federal Highway Administration, to study the feasibility of a toll-financed system of three east-west and three north-south superhighways.

The BPR's report, *Toll Roads and Free Roads*, demonstrated that a toll network would not be self-supporting. Instead, the BPR's report advocated a 26,700-mile interregional highway network.[49]

A similar study commissioned by President Roosevelt in 1941, prepared by the National Interregional Highway Committee and released in 1944, called for a similar system of interconnected highways. Specifically, the report (*Interregional Highways*) advocated a system of 33,900 miles, plus an additional 5,000 miles of auxiliary urban routes.[50]

In the Federal Aid Highway Act of 1944, Congress authorized just such a system, a National System of Interstate Highways, "to include up to 40,000 miles so located, as to connect by routes, direct as practical, the principal metropolitan areas, cities, and industrial centers, to serve the National Defense, and to connect at suitable points, routes of continental importance in the Dominion of Canada and the Republic of Mexico."[51]

On August 2, 1947, Commissioner of Public Roads Thomas H. MacDonald and Federal Works Administrator Philip B. Fleming announced selection of the system's first 37,700 miles. The routes had been proposed by the state highway agencies and reviewed by the Department of Defense. However, neither the 1944 act nor later legislation in the 1940s authorized funds specifically for the interstate system. As a result, progress on construction was slow.[52]

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[49] Federal Highway Administration website, <http://www.fhwa.dot.gov/programadmin/interstate.cfm#interstate_funding>.
[50] ibid.
[51] ibid.
[52] ibid.

Funding for system construction finally came with the Federal Aid Highway Act of 1952, which authorized $25 million per year for 1954 and 1955. Legislation in 1954 authorized an additional $175 million annually for 1956 and 1957.

Yet it was not until the Federal Aid Highway Act of 1956 that the funding issue was truly resolved. That legislation "increased the system's proposed length to 41,000 miles. It also called for nationwide standards for design of the system, authorized an accelerated program, established a new method for apportioning funds among the states, changed the name to the National System of Interstate and Defense Highways, and set the federal government's share of project cost at 90 percent. Title II of the Act (the Highway Revenue Act of 1956) created the Highway Trust Fund as a dedicated source for the interstate system." The 1956 act served as a catalyst for the system's development and, ultimately, its completion.[53]

The highway trust fund was funded with revenue from the federal gas and other motor-vehicle user taxes. The trust fund paid for the federal government's share of interstate and all other federal aid highway projects. The funding system thus "guaranteed construction of all segments on a 'pay-as-you-go' basis, thus satisfying one of President Eisenhower's primary requirements, namely that the program be self-financing without contributing to the federal budget deficit."[54]

Arizona's interstates include:

- **I-40**, which runs east and west, following the AT&SF (now BNSF) railroad tracks from the New Mexico border to the California border. The first Arizona sections of I-40 were opened in 1961; the last were opened 20 years later.[55]
- **I-8**, which runs from the I-10 junction in Casa Grande to the California border. The first Arizona sections of I-8 were opened in 1959; I-8 through Arizona was completed in 1979.[56]
- **I-10**, which runs east and west from the New Mexico border to the California border. "The tale of Interstate 10 through Arizona is a long one, one marked by tensions, realignments, and delays. While portions of the freeway were completed by 1959, the final section was not completed until 1990 – the last section of Interstate 10 completed in the United States."[57]
- **I-17** is one of the two north-south interstate highways in Arizona, connecting Phoenix and Flagstaff, and is one of the two interstate highways entirely within Arizona.[58] The first sections opened in 1958; the last opened 20 years later.[59]
- **I-19** runs north and south between Tucson and Nogales and is the other interstate wholly within Arizona. It was constructed between 1965 and 1978.[60]

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[53] Federal Highway Administration website, <http://www.fhwa.dot.gov/programadmin/interstate.cfm#interstate_funding>.
[54] ibid.
[55] http://www.rockymountainroads.com/i-040_az.html
[56] http://www.rockymountainroads.com/i-008_az.html
[57] http://www.rockymountainroads.com/i-010_az.html
[58] http://www.rockymountainroads.com/i-017_az.html
[59] ibid.
[60] http://www.rockymountainroads.com/i-019_az.html

- **I-15** cuts through the northwestern corner of Arizona. It was constructed between 1961 and 1973.[61]

History of the Phoenix Urban Area Regional Freeway System[62].
In 1985, the Arizona State Legislature passed a law granting citizens the ability to vote on sales tax increases to fund regional improvements. The law also provided for the establishment of the Regional Public Transportation Authority (RPTA). The RPTA's Board of Directors provides guidance to the agencies on how to better service its member communities, who are represented by an elected official.

In October 1985, Maricopa County voters approved Proposition 300, which established a one-half cent transportation excise tax (most commonly known as the one-half cent sales tax) for construction of controlled-access highways in the metropolitan Phoenix area. Funds also were designated to expand regional transit service.

To qualify for funding under Proposition 300, the highway must be listed on the Maricopa Association of Governments' Regional Transportation Plan and the State Highway System. The Arizona Department of Transportation constructs and maintains the highways, using a portion of state highway user revenue funds as well as Proposition 300 funds and some federal funds (on certain segments).

Public Transit
Phoenix. Between 1887 and 1948, a streetcar system operated in Phoenix. Moses Sherman founded the Phoenix Street Railway company and began taking passengers through Phoenix's commercial and residential areas, even as far as Glendale, in streetcars that were drawn by mules. Six years later the company introduced electric streetcars, marking Phoenix as a very modern city.

After the City of Phoenix purchased Phoenix Street Railway from Sherman in the 1920s, the streetcars increased in popularity. However, in the late 1920s and 1930s, demand decreased due to the increasing popularity of automobiles; also, a lack of adequate maintenance on the streetcars led to frequent breakdowns. By the 1930s, service was no longer extended to Glendale and existing routes were shortened or eliminated altogether.

The business saw a brief revitalization during WWII, but it soon experienced problems again with maintenance issues, competition from competing private bus lines and the widespread use of automobiles. In the late 1940s, fire destroyed all but six of the company's streetcars. The city was unwilling and unable to pay to replace the cost of lost equipment and cars, so it ran its last route in 1948.[63]

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[61] http://www.rockymountainroads.com/i-015_az.html
[62] Information in this section is taken, in part, from the Arizona Department of Transportation, <http://www.azdot.gov/Highways/RFS/History.asp>.
[63] Sanzone, Ron. "Streetcars Once Traversed Roads Where Light Rail Will Glide," *The Arizona Republic*, 25 Aug. 2008, <http://www.azcentral.com/community/phoenix/articles/2008/08/25/20080825trolley0825.html>.

In October 1985, Maricopa County voters approved a sales tax increase that would amount to $5 million annually. The money would fund construction of freeways and a portion would be used as seed money for expanding regional transit service.[64]

Valley Metro was created in 1993 by the RPTA Board of Directors as the face for the regional transit system. The purpose was to make all buses more recognizable and unify public transit systems across the region. Members of Valley Metro receive revenues from the national Powerball lottery, known as Local Transportation Assistance Funds. RPTA receives the monies for public transportation; when member agencies apply for funding, RPTA makes the disbursements.[65]

Since the mid-1990s, many cities have voted to increase their sales tax to make improvements on public transportation. Tempe led the way in 1996, increasing its sales tax to expand bus service and to consider other options such as a light rail. Phoenix increased its sales tax by four-tenths of a percent in 2000 to improve local bus service and more. The following year, Glendale voted for a half-cent sales tax increase to fund its transportation improvements, modeling its transit plan after Phoenix's. Peoria voters approved an increase in 2005 to fund transportation projects and services, which is expected to fund more than $200 million in projects.[66]

In 2004 Maricopa County extended the tax originally established in 1985. It allocates over one-third of tax revenues, or $5.8 billion dollars, for transit, including the light rail system.

The planned light rail system is laid on the tracks of Phoenix's old electric streetcar system. Its cost is an estimated $1.4 billion.[67] Funding was received from several sources, including a Federal New Starts grant for $587 million; a Congestion Mitigation and Air Quality grant for $59 million; and contributions from Phoenix and Tempe's sales tax revenues. Phoenix is responsible for paying for the construction of the northwest extension and the City of Glendale passed a sales tax to pay for the future extension to its downtown area.[68]

Tucson. Tucson's Rapid Transit Company got its start in 1905 when it bought out the existing horse-drawn streetcar system. A year later the company introduced its electric streetcar operation. By the 1920s it was clear that the company could not keep up with the city's growth with streetcars alone, so it started running two bus routes. At about the same time, Ray Laos started his own bus service company, Occidental Bus Line, which met with immediate success.[69]

In 1930, a petition was put before the Tucson City Council to end the streetcar service and completely replace it with bus service. The petition won by a narrow vote. A third bus service

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[64] Valley Metro, "History and Local Funding," 2008, <http://www.valleymetro.org/valley_metro/history_and_local_funding/>.
[65] ibid.
[66] ibid.
[67] Maricopa Association of Governments, "Final Regional Transportation Plan Approved," 2008, <http://www.letskeepmoving.com/>.
[68] Valley Metro, "Fast Facts," <http://www.valleymetro.org/images/uploads/lightrail_publications/Fast-Facts.pdf>.
[69] "About Sun Tran," <http://www.suntran.com/about_history.php>.

competitor, Mountain View Bus Line, established service in 1936, but struggled to compete and in 1941 was bought out by Tucson Rapid Transit.[70]

During the gas rationing of World War II, bus ridership skyrocketed. In the years between 1945 and 1947 alone, Tucson's two competing bus companies (Tucson Rapid Transit and Occidental Bus Line) carried an estimated seven million riders. Because of burgeoning demand, Tucson Rapid Transit was able to greatly expand its service and add more modern buses.

Yet, despite the replacement of gas-powered buses with diesel buses, a decline in bus transit began in the early 1950s and continued into the 1960s. The decline can be attributed to labor strikes and competition with the automobile.[71]

By 1969, Tucson Rapid Transit was struggling and the city agreed to assume control of the company. The city restored the health of the bus service company and in 1975 renamed it Sun Tran. Three years later, Sun Tran purchased its only remaining competition, the still-private Occidental Bus Line. Sun Tran is still in operation today with 38 routes and a fleet of more than 200 coaches that serve Tucson and Pima County.[72]

Water

The water infrastructure in Arizona can be divided broadly into three categories: water supply infrastructure, which includes dams, reservoirs, canals, and wells; drinking water treatment and distribution infrastructure, which includes drinking water treatment plants and pipelines; and wastewater treatment and conveyance infrastructure, which includes wastewater treatment plants and sewer lines.

Water Supply Infrastructure

Much of Arizona's water supply infrastructure was constructed with the help of the U.S. Department of the Interior, Bureau of Reclamation, which was created in 1902 to help western states develop water supply infrastructure. The Bureau also has been instrumental in the development of hydroelectric power generation facilities.

It was the Bureau of Reclamation that financed (often through loans) the construction of much of the Salt River Project system of dams and canals, the Central Arizona Project system of dams and canals, as well as Glen Canyon and Hoover dams. The Bureau still is involved in building (and helping finance) water supply infrastructure in the western United States.

Yet the Bureau of Reclamation was not the first to develop water supply infrastructure in Arizona. As early as A.D. 50, the Hohokam had built a system of canals in the Valley. By 600, they had constructed large irrigation systems on both sides of the Salt River. Main canals fed into smaller lateral channels, which fed into the Hohokam's fields. By 1150 to 1450, the Hohokam had more than 300 miles of main canals in the Salt River Valley alone.[73]

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[70] ibid.
[71] "About Sun Tran," <http://www.suntran.com/about_history.php>.
[72] ibid.
[73] Arizona Investment Council, "Infrastructure Needs and Funding Alternatives: 2008-2032," May 2008.

A permanent European settlement did not begin in the Salt River Valley until after the end of the American Civil War in 1865. In September of that year, the U.S. Army established Camp McDowell near the Verde River. The Army started the valley's first canal for the purpose of supplying the soldiers with vegetables.[74]

A gold rush in the 1860s brought an influx of people to the area, including Jack W. Swilling, who believed he could make the ancient Hohokam canals functional again.[75] He and eight other men made water claims and founded the Planters Irrigating Company with a capital stock of $10,000 divided equally into 50 shares worth $200 apiece.[76] Swilling's goal was to capture water from the Salt River via a canal and use it to grow crops to sell to the silver miners in Wickenburg and to the U.S. Cavalry at Fort McDowell. Swilling's company harvested their first crops in March 1868. A few years later the company changed its name to Swilling Irrigating and Canal Company. The success of Swilling's harvest was the catalyst that sparked the canal craze that took place in the area. Most successful projects were the work of private companies and associations that imposed a construction and maintenance fee to its members.[77]

In the 1870s, Tucson vendors sold buckets of water for five cents apiece from wooden carts. The Tucson Water Company was founded in 1882 by Sylvester Watts using the Santa Cruz River as its water source. They laid perforated pipe in the river to collect the water and then conveyed it in four and a half miles of riveted steel pipe to Tucson's downtown area. The water first was delivered in September 1882 and by the following year more than 30 fire hydrants were in place. At the time, there were no water meters in existence and customers were charged a flat fee of $2 per month. Eventually, in 1895 Tucson's Mayor and Council drafted a plan to purchase the privately owned Tucson Water Company and make it a public system.[78]

The Phoenix Area's Canal System. By the early 1900s, many of the Valley's agricultural land owners realized that they would be served best by an integrated system of canals. Furthermore, they understood that they would need to dam the Salt River, which was a very expensive proposition.

So in 1903 land owners formed the Salt River Valley Water Users' Association (Association) and pledged more than 200,000 acres of their land as collateral for a federal government loan for the Bureau of Reclamation to build a system of canals and dams, beginning with the Roosevelt Dam. "That loan was made possible by the National Reclamation Act of 1902, which provided funding for the construction of water storage dams and canals, bringing new hope to those who had struggled to develop the area."[79]

As a part of the Association's agreement with the Bureau of Reclamation, the latter financed and constructed the canals and dams, which the Association operated. In order to create a

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[74] Zarbin, Earl. "Salt River Valley Canals 1867 – 1875." 14 Jan. 1980. Salt River Project Presentation.
[75] "Canal History." SRP. 2008. 28 Aug. 2008. <http://www.srpnet.com/water/canals/history.aspx>.
[76] Zarbin, Earl. "Salt River Valley Canals 1867 – 1875." 14 Jan. 1980. Salt River Project Presentation.
[77] "Canal History." SRP. 2008. 28 Aug. 2008. <http://www.srpnet.com/water/canals/history.aspx>.
[78] "Tracing our Roots in Pima County." Sewer History.org. 2004.
http://www.sewerhistory.org/indexc.htm>.
[79] SRP < http://www.srpnet.com/about/history/water.aspx>.

consolidated canal system, those canals that were constructed privately before the Association was created were bought by the Bureau, which built a number of canals as well.

Table I-7 highlights Arizona's canal system. All of the canals that are now operated by the Salt River Project (the modern extension of the Salt River Valley Water Users Association) were built before 1915. The only canal system to be built later, in fact, was the Central Arizona Project, which was finished less than 20 years ago.

In addition to financing (or purchasing for consolidation) all of the canals that are now part of SRP's system, the Bureau of Reclamation also financed (on loan) and constructed the Central Arizona Project (CAP) canal system. Begun in 1973, the CAP is a 336-mile long system of canals that bring water from the Colorado River to Maricopa, Pinal, and Pima counties. In 1985, the first Colorado River water was delivered through the CAP to the Harquahala Valley Irrigation District. Tucson received its first CAP water delivery in 1992.

Arizona's Dams. Arizona's system of dams not only is a critical part of the water infrastructure, but most of the dams generate hydroelectric power. As is the case with Arizona's canals, most dams were constructed by (and with financing from) the Bureau of Reclamation. Yet while the Bureau financed construction of all of the SRP dams, the SRP is solely responsible for operation

TABLE I-7
ARIZONA'S CANAL SYSTEM

Infrastructure Constructed	Year Built	Who Constructed It	Source of Financing
Tempe Canal	1870	Tempe Irrigation Canal Company	Private; transferred to the Association* when Tempe Canal joined in 1925
Grand Canal	1878	Grand Canal Company	Private; sold to the U.S. Bureau of Reclamation in 1906 for $20,488
Arizona Canal	1883	Arizona Canal Company	Private; sold to the U.S. Bureau of Reclamation after the Association* was formed in 1903
Old Crosscut Canal	1888	Built by pioneers	Private; sold to the U.S. Bureau of Reclamation in 1906 for $15,730; portions have been transferred to City of Phoenix
Consolidated Canal	1891	Consolidated Canal Company	Private; sold to the U.S. Bureau of Reclamation in 1908 for $187,000
Eastern Canal	1909	U.S. Bureau of Reclamation	U.S. Bureau of Reclamation
South Canal	1908	U.S. Bureau of Reclamation	U.S. Bureau of Reclamation
New Crosscut Canal	1912-13	The Association* in contract with U.S. Bureau of Reclamation	U.S. Bureau of Reclamation
Western Canal	1912-13	Western Canal Construction Company	Built under contract between the Association* and U.S. Bureau of Reclamation
CAP Canal System	1973-92	U.S. Bureau of Reclamation	U.S. Bureau of Reclamation

* Salt River Valley Water Users' Association

and maintenance (as is the CAP at the New Waddell Dam). The Bureau operates and maintains Hoover and Glen Canyon dams. Table I-8 highlights some of Arizona's most prominent dams.

Drinking Water and Wastewater Treatment and Distribution/Conveyance
Treatment and distribution of drinking water or conveyance of wastewater is the responsibility of approximately 413 water utility providers and 130 wastewater service providers operating in Arizona.[80] Of those, the large majority are public-sector entities that finance construction of infrastructure by issuing municipal bonds.

TABLE I-8
ARIZONA'S DAMS

Infrastructure Constructed	Year Built	Who Constructed It	Source of Financing
Granite Reef Diversion Dam*	1906-08	U.S. Bureau of Reclamation (for SRP^)	U.S. Bureau of Reclamation
Roosevelt Dam	1905-11	U.S. Bureau of Reclamation (for SRP^)	U.S. Bureau of Reclamation
Mormon Flat Dam	1923-25	U.S. Bureau of Reclamation (for SRP^)	U.S. Bureau of Reclamation
Horse Mesa Dam	1924-27	U.S. Bureau of Reclamation (for SRP^)	U.S. Bureau of Reclamation
Waddell Dam	1928	Private interests (for irrigation)	Private interests
Stewart Mountain Dam	1928-30	U.S. Bureau of Reclamation (for SRP^)	U.S. Bureau of Reclamation
Bartlett Dam*	1936-39	U.S. Bureau of Reclamation (for SRP^)	80% SRP^; 20% Bureau of Indian Affairs
Hoover Dam	1940s	U.S. Bureau of Reclamation	U.S. Bureau of Reclamation
Horseshoe Dam*	1944-46; spillway gates 1949	Phelps Dodge Corp.; City of Phoenix	Paid for by Phelps Dodge Corporation with financing from the federal Defense Plant Corporation
Glen Canyon Dam	1957-64	U.S. Bureau of Reclamation	U.S. Bureau of Reclamation
C.C. Cragin Dam	1965	Phelps Dodge Corp.	Private (Phelps Dodge Corp.); ownership transferred to SRP^ in 2005
New Waddell Dam	1987-92	U.S. Bureau of Reclamation (for CAP#)	U.S. Bureau of Reclamation

*No hydroelectric power generation
^ Salt River Project
# Central Arizona Project

[80] Arizona Investment Council, "Infrastructure Needs and Funding Alternatives: 2008-2032," May 2008.

History of Sewer Development in Tucson. In the 1890s, Tucson residents used outhouses, known as privies, to dispose of sewage. When water pressure was delivered to homes and new indoor plumbing was established in the form of water closets and kitchen drains, they were connected to existing privy vaults or to new cesspools. Residents quickly recognized the vaults and cesspools were ill-equipped to handle the abundance of sewage and a need for sewers became apparent. Consequently, the City of Tucson purchased the privately owned Tucson Water Company and its 720 acres of land from Sylvester Watts for $110,000. In the early 1900s, Tucson's City Water and Sewerage Department was created and the first public sanitary sewers were installed along Main Avenue. The sewers were designed by the New York City firm of Waring, Chapman and Farquhar. Due to rising odor and capacity issues, the first sewer farm was abandoned in 1914 and a larger one was opened.[81]

Continual odor complaints in the 1920s sparked the need for a sewage treatment study and Tucson retained Black & Veatch of Kansas City for the job. A $100,000 construction cost for a primary treatment plant was approved. The first wastewater treatment facility was built in 1928. Almost two decades later, the City of Tucson and Pima County jointly hired a contractor from Salt Lake City to conduct a study for sewering and treatment for the Tucson metropolitan area. Construction of a new wastewater treatment facility was recommended.[82]

The Pima County Sanitary District was formed to address sewerage needs of residents in Pima County and those outside the city of Tucson. Phase one of their project was completed in 1951, routing sewage flow to the new plant. Ten years later the first wastewater treatment lagoon was installed by the District to meet the need for treating sanitary sewage from tributary county areas. Ultimately the District dissolved because it could no longer depend on Tucson's tax base due to its aggressive annexation program. At that time the Pima County government assumed responsibility for the sewerage service. To facilitate this task they created the Pima County District of Sanitation to be responsible for operating the county's sanitary sewerage system and their landfills.[83]

Metropolitan Utilities Management formed in 1974 as a joint county-city agency. Its purpose was to improve facilitation of basinwide planning and the management of the sanitary sewerage system. Within its city limits, Tucson continued to administer its own system while Pima County administered sewerage facilities in the nearby unincorporated areas. The U.S. Environmental Protection Agency held the position that the region would be better served by one single management agency overseeing both systems. After a merger was conceived, sewer connection and user fees were implemented basinwide.[84]

In 1975 the City of Tucson established the Wastewater Reclamation Facility to provide relief for the overloaded sewer lines and to provide effluent irrigation for the Randolph Park Golf Course. Three years later, the Pima County Department of Sanitation was renamed Pima County

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[81] "Tracing our Roots in Pima County." Sewer History.org. 2004. <http://www.sewerhistory.org/indexc.htm>.
[82] ibid.
[83] ibid.
[84] "Tracing our Roots in Pima County." Sewer History.org. 2004. <http://www.sewerhistory.org/indexc.htm>.

TABLE A-9
TUCSON SEWER DEVELOPMENT

Infrastructure	Year Built	Constructed By	Source of Financing
Tucson's Sewer System	1900s	Waring, Chapman and Farquhar	City of Tucson
Wastewater Treatment Facility	1928	Black & Veatch of Kansas City	City of Tucson
Pima County Sewer System	1951	Pima County Sanitary District	City of Tucson
Wastewater Reclamation Facility	1975	Pima County Sanitary District	City of Tucson

Wastewater Management Department. Its formal responsibilities were to operate both of the county's sewerage and solid waste facilities. The “Sewer Management Agreement” of 1979 formed an agreement between Pima County and the City of Tucson. Under the agreement the Pima County Wastewater Management Department assumed responsibility for the operation of all the region’s public sewage facilities, including the service of outlying incorporated areas and those serving the incorporated areas. The agreement included two wastewater treatment facilities and several wastewater pump stations. In addition, the City of Tucson acquired the rights under the agreement to 90 percent of the effluent generated from the metropolitan area wastewater treatment facilities. In April 1984, Tucson put into operation the first phase of a basinwide reclaimed water filtration and distribution system.[85]

Other Infrastructure

Parks

Residents of Flagstaff enjoyed 30 acres of recreational land set aside in 1889 as part of the original town site. In the 1920s, Flagstaff added Clark Ranch to its property and in the 1950s it acquired other large areas suitable for parks from the Forest Service. In 1971, the city bought 40 acres of land for $160,000 and set aside half of the plot for park use.

The community of Flagstaff had been enjoying 150 acres of federal land as part of Thorp Park since 1918, but in 1984 Councilman Christopher J. Bavasi moved for the city to gain the plot’s title. As recreation programs continued to gain popularity, Flagstaff's Urban Trails System (FUTS) was financed by the city's “bed, board, and booze Tax.” FUTS is a citywide interconnecting network of nonmotorized corridors linked with recreation areas.[86]

In 1954, Arizona's Park System formally began preserving mountain areas for the enjoyment of future generations. Maricopa County was allowed to acquire thousands of acres of parkland in 1971 from the Bureau of Land Management at $2.50 an acre.[87]

The Phoenix Parks and Conservation Foundation (PPCF) was founded in 1979 to create and maintain a safe and well-equipped park system for residents and tourists. The PPCF is a nonprofit and tax-exempt agency that is dependent upon contributions of money and materials to

[85] ibid.
[86] Cline, Platt. “Mountain Town: Flagstaff's First Century.” Flagstaff: 1994, pp. 548-9.
[87] Maricopa County Parks and Recreation, 2006, <http://www.maricopa.gov/parks/history.aspx>.

purchase new parks and preserves and to renovate existing parks. It also actively encourages community participation to develop special park projects.[88]

At the turn of the 20th century, most Americans lived in rural areas and small towns. By the year 2000, about 80 percent of the population lived in metropolitan areas without adequate access to parks. Voters continually show their willingness to raise their own taxes to finance new or improved parks.[89]

The Land and Water Conservation Fund (LWCF) Act of 1964 was created to "encourage the provision of greater recreation opportunities for American citizens."[90] Arizona receives annual appropriations from the LWCF which are administered by the Arizona State Parks Board. The Parks Board then funds local and state government-sponsored outdoor recreation projects.

As of 2008, the State Parks Board is recognizing the toll that has been taken on the recreation systems due to increasing population and rapid development. "Communities are expanding ahead of their ability to provide necessary infrastructure and desired amenities, like parks."[91]

The Board's recommended strategy for increasing financing is to take advantage of grants and develop public and private partnerships. The Parks Board further cautions that local communities need to be proactive in planning for future recreational demands.[92]

Landfills

Historically, landfills were not much more than pits or fields on the edges of town where people left their garbage. Rainwater often flushed the garbage into streams and groundwater supplies that were used for drinking, bathing, and washing clothes.

Modern landfills, in contrast, are designed to prevent hazardous wastes from getting into water supplies. Landfills can cost up to $10 million to build and take five years to complete. Before the construction process can begin, the site has to pass stringent legal, environmental, and

TABLE A-10
HISTORICAL PERSPECTIVE ON ARIZONA'S PARKS

Infrastructure	Year Built	Constructed By	Source of Financing
Arizona Falls	1800s	City of Phoenix	City of Phoenix
Flagstaff Recreational Land	1889	City of Flagstaff	City of Flagstaff
Clark Ranch	1920s	City of Flagstaff	City of Flagstaff
Maricopa County Parkland	1971	Maricopa County	Maricopa County

[88] Phoenix Parks and Conservation Center, "Phoenix Parks and Conservation Center – Who We Are," <http://www.phoenixparksfoundation.com/about.html>.
[89] Arizona State Parks, "Statewide Comprehensive Outdoor Recreation Plan," 2008, p. 18. <http://azstateparks.com/publications/downloads/SCORP_2008_Final.pdf>.
[90] ibid. p. xiii.
[91] ibid. p. xv.
[92] ibid.

engineering tests.[93] Today, about 55 percent of Arizona's garbage is packed into sanitary landfills and the rest is burned or recycled.[94]

In 1961, Maricopa County began operating the Hassayampa Landfill as a municipal landfill.[95] In 1967, the City of Tucson built the Los Reales landfill. The Environmental Services Engineering & Technical Support group in 1999 installed a pump-and-treat groundwater remediation system, paid for with 1994 bond funds.[96]

General Government Buildings

Phoenix established its first post office in 1868 with Jack Swilling serving as postmaster. During the same year, Tucson constructed its first courthouse on Ott & Court Avenue.[97] The City of Safford set up its first post office in Bailey's store in March 1875.

The capital of the Territory of Arizona moved from Prescott to Phoenix in 1889. Legislators temporarily met in the chambers of Phoenix City Hall. In 1891, Phoenicians Moses H. Sherman and Marcellus E. Collins donated 10 acres of land for a territorial capitol site. The Capitol building was constructed in 1900 for a cost of $136,000. The Capitol moved to its permanent home in 1901 on another donated, 10-acre lot.

Del Webb moved to Phoenix in 1927 and immediately formed the Del Webb Corporation. Webb made millions of dollars erecting hospitals and government offices with federal grants and loans. During World War II, the Del Webb Corporation built every major military installation in the state of Arizona, except for Tucson's Davis-Monthan Air Force Base. During the Cold War, Webb's business continued to surge when his close ties with the federal government brought more contracts to build veterans' hospitals, air bases, and missile silos. During the 1960s, Webb also built Arizona's retirement community of Sun City.[98]

TABLE A-11
HISTORICAL PERSPECTIVE ON ARIZONA'S GOVERNMENT BUILDINGS

Infrastructure	Year Built	Constructed By	Source of Financing
Capitol Building	1900	City of Phoenix	Moses H. Sherman, Marcellus E. Collins, and City of Phoenix
Hospitals and Government Offices	1930s and 1940s	Del Webb Corporation	Del Webb Corporation

[93] Energy Information Agency, "Yesterday and Today," Sept. 2006, <http://www.eia.doe.gov/kids/energyfacts/saving/recycling/solidwaste/landfiller.html>.
[94] ibid.
[95] United States Environmental Protection Agency, "Hassayampa Landfill," 2008. <http://www.epa.gov/region09/reg9bck.html>.
[96] City of Tucson, "Groundwater Remediation: Los Reales Landfill," <http://www.tucsonaz.gov/ets/Groundwater/Los_Reales/los_reales.html>.
[97] "Tracing our Roots in Pima County," Sewer History.org, 2004, <http://www.sewerhistory.org/indexc.htm>.
[98] Sheridan, Thomas E. "Arizona: A History," Tucson: 1995, p. 270.

APPENDIX II
PROJECTED COSTS IN CONSTANT DOLLARS

The projected costs presented in the last section of the report are converted to constant dollars in this appendix. The adjustment was made using a projected annual average inflation rate based on the Gross Domestic Product implicit price deflator of 2.2 percent per year. This projected rate is slightly less than the historical annual average.

The conversion between nominal and real costs also was affected by assumptions as to when during the next 25 years costs would be incurred. At a minimum, the distribution of the costs over the next 25 years was driven by projected population growth. In some cases, more explicit assumptions were made.

PROJECTED COSTS IN BILLIONS OF 2008 DOLLARS

	EDUCATION					
	K-12	**Higher**	**Other**	**Subtotal**	**Libraries**	**Total**
Total Capital Costs	$62.0	$26.3	$0.5	$88.9	$na	$na
Total Ongoing Costs	312.7	177.9	24.7	515.3	na	na
Total of All Costs	374.8	204.2	25.3	604.2	7.9	612.0

	ENERGY				
	Electricity by Source of Power Generation			**Natural Gas, Petroleum, and**	
	Coal	**Natural Gas**	**Nuclear**	**Other Fuels**	**Total**
Total Capital Costs	$58.1	$51.5	$61.1	$7.8-7.9	$59.3-69.0
Generation	35.7	29.1	38.7	N/A	29.1-38.7
Refineries	N/A	N/A	N/A	3.3	3.3
Transmission	7.6	7.6	7.6	2.5	10.1
Distribution	14.8	14.8	14.8	1.8	16.6
Storage	N/A	N/A	N/A	0.2-0.3	0.2-0.3

	TELECOMMUNICATIONS				
	"Middle-Mile" Connectivity		**Fiber-to-the-Home**	**Total**	
	Low	**High**		**Low**	**High**
Total Capital Costs	$0.6	$1.2	$6.9	$7.5	$8.1
Total Ongoing Costs	0.2	0.4	10.2	10.4	10.6
Total of All Costs	0.7	1.6	17.1	17.9	18.7

	HEALTH CARE						
	Private Hospitals		**Public Hospitals**		**Other**	**Total***	
	Low	**High**	**Low**	**High**	**Public**	**Low**	**High**
Total Capital Costs	$30.7	$40.2	$4.3	$5.7	$0.0	$35.0	$45.9
Total Ongoing Costs	466.7	529.2	65.8	74.6	117.2	649.6	721.0
Total of All Costs	497.4	569.4	70.1	80.2	117.2	684.7	766.9

PUBLIC SAFETY

	Police	Fire	Corrections	Regulation	Total
Total Capital Costs	$na	$na	$10.2	$na	$na
Total Ongoing Costs	na	na	64.5	na	na
Total of All Costs	81.4	41.9	74.7	10.9	208.9

TRANSPORTATION

	Roads	Transit	Rail	Air	Total
Total Capital Costs	$150.0	$27.0	$4.5	$9.8	$191.3

WATER

	Water	Wastewater	Total
Total Capital Costs	$23.8	$10.8	$34.6
Drinking Water Infrastructure	22.3	N/A	22.3
Supply Augmentation	1.1	N/A	1.1
Dam Renovation and Replacement	0.3	N/A	0.3
SRP Well Rehabilitation and Replacement	0.1	N/A	0.1
Wastewater Infrastructure	N/A	10.8	10.8
Total Ongoing Costs	31.7	16.8	48.5
Total of All Costs	55.5	27.6	83.1

OTHER INFRASTRUCTURE

Environment and Housing

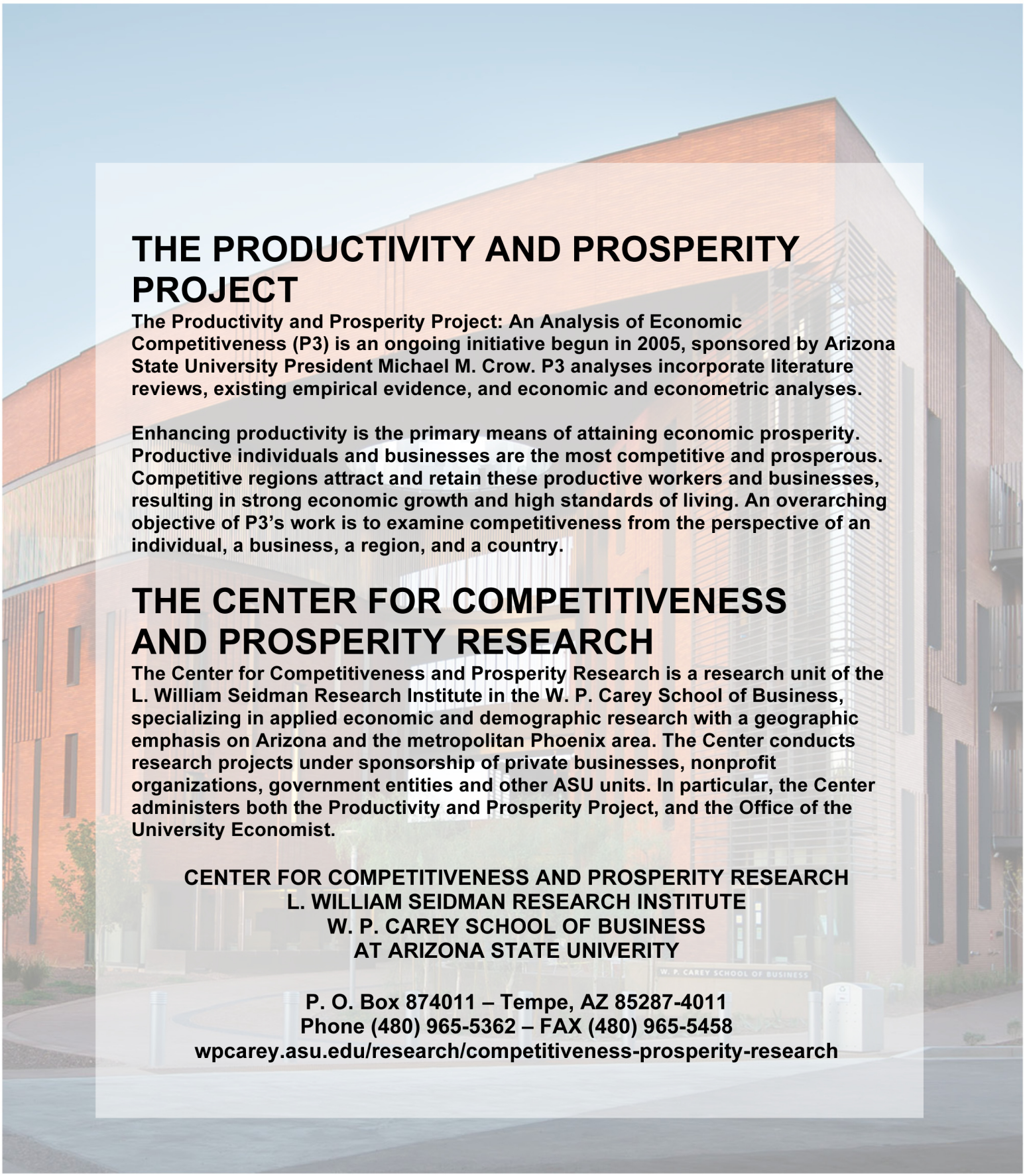
	Natural Resources	Parks & Recreation	Housing & Community Development	Solid Waste	Subtotal
Total Capital Costs	$8.5	$43.8	$na	$3.9	$na
Total Ongoing Costs	20.5	28.0	na	20.5	na
Total of All Costs	29.0	71.8	19.7	24.4	144.8

Social Services

	Public Welfare	Other	Subtotal
Total Capital Costs	$na	$na	$na
Total Ongoing Costs	na	na	na
Total of All Costs	379.8	1.8	381.5

	Government Admin-istration	Interest	Other	TOTAL
Total Capital Costs	$na	$0.0	$na	$na
Total Ongoing Costs	na	36.2	na	na
Total of All Costs	74.3	36.2	49.7	686.5

N/A: Not applicable
na: not available



THE PRODUCTIVITY AND PROSPERITY PROJECT

The Productivity and Prosperity Project: An Analysis of Economic Competitiveness (P3) is an ongoing initiative begun in 2005, sponsored by Arizona State University President Michael M. Crow. P3 analyses incorporate literature reviews, existing empirical evidence, and economic and econometric analyses.

Enhancing productivity is the primary means of attaining economic prosperity. Productive individuals and businesses are the most competitive and prosperous. Competitive regions attract and retain these productive workers and businesses, resulting in strong economic growth and high standards of living. An overarching objective of P3's work is to examine competitiveness from the perspective of an individual, a business, a region, and a country.

THE CENTER FOR COMPETITIVENESS AND PROSPERITY RESEARCH

The Center for Competitiveness and Prosperity Research is a research unit of the L. William Seidman Research Institute in the W. P. Carey School of Business, specializing in applied economic and demographic research with a geographic emphasis on Arizona and the metropolitan Phoenix area. The Center conducts research projects under sponsorship of private businesses, nonprofit organizations, government entities and other ASU units. In particular, the Center administers both the Productivity and Prosperity Project, and the Office of the University Economist.

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