

Preparing for an Arizona of 10 Million People

Meeting the Infrastructure Challenges of Growth



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Acknowledgments

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. Their interest resulted in the report *Infrastructure Needs and Funding Alternatives for Arizona: 2008-2032*, which was produced by the L. William Seidman Research Institute in the W. P. Carey School of Business in May 2008. See www.arizonaic.org for the publication.

Many people associated with the L. William Seidman Research Institute in the W. P. Carey School of Business worked on infrastructure issues over the past year. The significant contributions and achievements of Tim James, Matthew Croucher, Molly Castelazo, Kent Hill, Eva Madly, Tracy Clark, Liz Farquhar, and Angela Phillips are acknowledged gratefully. Students Jessica Pullen and Emil Robles provided research assistance for this report.

See wpcarey.asu.edu/seid/ccpr for a background report for *Preparing for an Arizona of 10 Million People: Meeting the Infrastructure Challenges of Growth*.

Experts from throughout the state also lent their expertise to this work. Their knowledge and willingness to share it are appreciated.

Preparing for an Arizona of 10 Million People

Meeting the Infrastructure Challenges of Growth

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Infrastructure for Arizona's Future

A Foreword from Michael M. Crow

When President Teddy Roosevelt spoke from the steps of Arizona State University's Old Main in March 1911, a few days after the dedication of the dam on the Salt River that would bear his name, he predicted that with adequate irrigation projects the population of the Valley could some day reach 75,000 – or maybe even 100,000. No one then could have foreseen the demographic trends that would lead within a century to the transformation of a region dominated by ranching and mining into one of the fastest growing states in the nation. With projections today suggesting the likelihood that within the next quarter-century more than 10 million Americans will call our state home, Arizona must confront unprecedented challenges as it becomes larger than New Jersey, Michigan, Illinois, and probably Pennsylvania. The future can be considered from many perspectives. *Preparing for an Arizona of 10 Million People: Meeting the Infrastructure Challenges of Growth* examines the next 25 years from the standpoint of infrastructure: those basic facilities and services and systems that allow us to remain competitive as a region.

Not only is Arizona one of the fastest growing states in the union, at its heart an emerging “megapolitan” region comprised of multiple interdependent jurisdictions – the Sun Corridor – will stretch from the Prescott region of Yavapai County south to Mexico. Eight of 10 million Arizonans will call the Sun Corridor home. This vast urban agglomeration promises to power our innovation and foster socioeconomic gains as we engage competition from throughout the global knowledge economy. But our success is contingent on an optimal infrastructure, including roads, transit, electricity, drinking water, telecommunications, and also healthcare, public safety, and our public schools and the three state universities.

While Arizonans enjoy matchless natural capital and an egalitarian culture that bolsters free enterprise, we are behind the curve in developing infrastructure commensurate with projections for our future. Our topography has discouraged the integrated regional planning essential for such critical issues as land use, open space, and transportation. For example, consider the failure thus far to construct adequate connectivity between metropolitan Phoenix and Tucson. The dilemma is further exacerbated by Arizona's traditional reliance solely on market forces rather than market and policy planning together.



The historic inadequacies of planning at scale underscore the need to think regionally to plan and build what could become the world's first sustainable region. Sustainable development means balancing economic growth and wealth generation with enhanced natural and social capital. The achievement of sustainability through innovative market-driven designs would provide Arizonans with unparalleled quality of life and position the Sun Corridor as a leading center for technological innovation and economic development.

A century ago Arizona witnessed the construction of an infrastructure project – Roosevelt Dam – that sparked the state's development and growth. As we approach the Arizona centennial, the imperative for a more advanced infrastructure will not be met with single showcase projects. The complexity of the challenge is unprecedented and our preparations for 10 million residents, in a state that as recently as 1960 had less than 1 million, must be informed by a mindset that embraces the needs of the present and the possibilities of tomorrow. Arizona must begin thinking and acting like a region or even like a republic – lowercase “r” – and less like a cluster of combative jurisdictions or a standard-issue American state. This report provides the foundation for informed decisions that should enhance the future for all Arizonans.

A handwritten signature in black ink that reads "Michael Crow". The signature is fluid and cursive, with the first letters of the first and last names being capitalized.

Michael M. Crow
President, Arizona State University

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 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 has 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% of the state’s gross domestic product. This proportion may need to rise to around 30% over the next 25 years.

The overall gap will be shared across the private sector, the federal government, and state and local governments, with the state and local government share 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 barely be 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 period 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.

Arizona’s infrastructure challenges will require commitment and creativity to meet the needs and potential of 10 million people and to ensure a positive future for the state.

Preparing for an Arizona of 10 Million People

Meeting the Infrastructure Challenges of Growth



Even if Arizona were not still growing, infrastructure would be a big issue for the state. From the youngest to the oldest, each of Arizona's more than 6 million residents every day in some way uses the state's infrastructure. Except perhaps during a traffic jam or in the aftermath of a monsoon storm, few Arizonans ever think in detail about what makes our communities livable and how those services are designed and paid for. Nearly everyone simply assumes that the systems required to support life as we know it will work. The same is most likely true for thousands of businesses. Many in the private sector are very knowledgeable and concerned about infrastructure, but others know only that they have what they need to operate. Yet, to deal with the problems left from the past and prepare for the positive future Arizonans have said they want, everyone is a stakeholder in infrastructure and will play a role as voters, investors, decision makers, and planners.

The recent emphasis on sustainability and "smart growth" – plus the realization that business as usual will not continue to deliver a vibrant economy and high quality of life – have prompted a new look at infrastructure. In May 2008, the L. William Seidman Research Institute in the W. P. Carey School of Business at Arizona State University published a landmark assessment of the state's infrastructure on behalf of the Arizona Investment Council (AIC). For perhaps the first time, the study integrated research on energy, telecommunications, water and wastewater, and transportation needs over the next 25 years. *Infrastructure Needs and Funding Alternatives for Arizona: 2008-2032*, available at www.arizonaaic.org, provides the foundation for *Preparing for an Arizona of 10 Million People: Meeting the Infrastructure Challenges of Growth*.

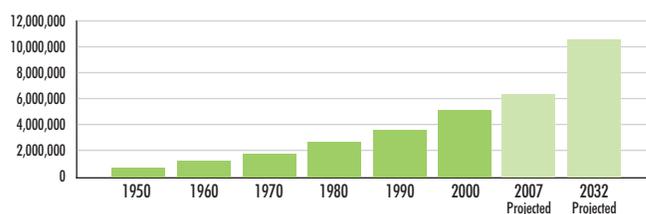
Presented at a statewide infrastructure conference in November 2008, *Preparing for an Arizona of 10 Million People: Meeting the Infrastructure Challenges of Growth* places Arizona's infrastructure needs into context, identifies the conditions affecting its development, and supplies cost projections for infrastructure in the coming years. It expands on the report done for AIC by considering additional types of infrastructure. A background report is available online at wpcarey.asu.edu/seid/ccpr. Options for funding the state's infrastructure will be the topic of another report.

This report is organized around the questions that policymakers, business leaders, and residents often ask about infrastructure. Eight categories of infrastructure are discussed in this report:

- Education
- Energy
- Health care
- Public safety
- Telecommunications
- Transportation
- Water
- Other (social and environmental services)

ARIZONA MAY REACH 10 MILLION RESIDENTS

POPULATION ESTIMATES AND PROJECTIONS IN ARIZONA AS OF JULY 1



Source: Arizona Department of Economic Security (2007 and 2032) and U.S. Department of Commerce, Census Bureau (1980, 1990 and 2000), L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University, May 2008.

Some observers have said that Arizona's infrastructure is in better shape than various other states because some of it is relatively new. This is small consolation when the challenges, as will be shown in this report, are daunting and will take years of building and billions of dollars to meet. As Arizona Investment Council President Gary Yaquinto noted: "If we don't start moving now, we're going to end up in a situation where growth in our economy will stagnate and our quality of life will deteriorate." *Preparing for an Arizona of 10 Million: Meeting the Infrastructure Challenges of Growth* is intended as a "heads up" on infrastructure and a catalyst for serious discussion of and decisions about the state's future.

What is Infrastructure?

The tangible things that make places work

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.”¹ While the physical infrastructure of buildings, equipment, and land is a key aspect of the overall infrastructure, services and physical infrastructure are intertwined. If expenditures for operations are inadequate, the value and usefulness of the physical infrastructure soon decrease. For example, public buildings have been constructed, but left vacant for a time because of a lack of operating funds. As a result, the facility’s purpose goes unmet.

Physical assets typically are costly to construct or purchase, but are intended to have a long, useful life. Physical infrastructure costs generally are financed through long-term debt. Such expenditures are called “capital outlays.”

¹ American Heritage Dictionary.

The quality of a community’s “facilities, services, and installations” has direct effects on residents’ lives and on economic productivity. High quality infrastructure is necessary for communities and states to be economically competitive with other areas in the U.S. and around the globe.

Few infrastructure services are only the responsibility of either the public or the private sectors. Who provides and pays for infrastructure – businesses, nonprofit institutions, and federal, state, and local governments – varies by community and type of infrastructure. Because of this mixture of responsibilities, this report includes infrastructure 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 primarily is responsible for providing it.

Overall, the public sector provides approximately 55% of the capital spending for physical infrastructure.



Both Public and Private Entities Provide Infrastructure

	Infrastructure Type	Prevalent Provider
	<p>EDUCATION</p> <p>Prekindergarten and child care Kindergarten-12th grade Higher education Public libraries</p>	<p>The public sector provides over 75% of education infrastructure nationally, mostly by state and local governments.</p> <p>Private with some public regulation Public with some private options Public and private choices Public</p>
	<p>ENERGY</p> <p>Electricity Pipelines</p>	<p>The private sector accounts for nearly 90% of the infrastructure spending nationally. State and local governments are responsible for 80% of the remainder.</p> <p>Private with public regulation Private</p>
	<p>HEALTH CARE</p>	<p>Health care is mostly a set of private facilities and services, but the public sector is the source of health insurance for low income residents and a wide array of services to monitor and improve the public's health.</p>
	<p>PUBLIC SAFETY</p>	<p>Police and fire protection and correctional systems are basic to public safety. Mostly publicly provided, some fire protection and prisons are private.</p>
	<p>TELECOMMUNICATIONS</p>	<p>The private sector accounts for some 95% of infrastructure spending nationally, while the public sector often regulates.</p>
	<p>TRANSPORTATION</p> <p>Roads and transit Air, rail, water and other modes</p>	<p>The public sector accounts for 90% of infrastructure spending nationally, with more than half by state and local governments.</p> <p>Predominantly public Public and private mix</p>
	<p>WATER</p> <p>Drinking water Wastewater</p>	<p>In the public sector, 90% of spending is by state and local governments.</p> <p>Typically public, but sometimes private Typically public, but sometimes private</p>
	<p>OTHER</p> <p>Mail and packages Parks and recreation Solid waste disposal</p>	<p>Many other types of services are provided in communities.</p> <p>Public and private Public Public and private; landfills may be public or private, with public permits necessary</p>

Source: Compiled by Center for Competitiveness and Prosperity Research, L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University.

What is the Condition of the Nation's Infrastructure?

In need of repair and renewal

Financial journalist Joseph Lazzaro recently quoted economist David H. Wang's warning about infrastructure. He noted: "Infrastructure problems have and will continue to depress U.S. GDP growth." In turn, consulting giant Ernst & Young and the Urban Land Institute stated in *Infrastructure 2008: A Competitive Advantage* that "the U.S. is headed toward decline and needs to wake up to the dire state of its infrastructure."

Other respected organizations have also sounded the alarm about infrastructure nationally. For example, the American Society of Civil Engineers (ASCE) assessed the condition and capacity of the nation's infrastructure in its 2005 *Report Card for America's Infrastructure*. This professional organization, whose members are closely associated with designing and maintaining various types of infrastructure, gave the nation a D. Four years earlier, the news was only slightly better with the U.S. receiving a D+.

ASCE rated infrastructure in 15 categories, including aviation, bridges, dams, drinking water, energy, hazardous waste, navigable waterways, parks and recreation, rail, roads, schools, security, solid waste, transit, and wastewater. Each one was evaluated on:

- condition and performance
- capacity versus need
- funding relative to need.

Solid waste received the highest grade of C+, while drinking water, wastewater, and navigable waterways got the lowest grade of D-. Other types placed in between. Looking at infrastructure as a whole, ASCE estimates that \$1.6 trillion in investments are needed over five years to bring the nation's infrastructure to good condition.

Washington, D.C.-based Brookings Institution came to a similar conclusion: America's infrastructure has not been a national priority for many years, and there is a need for a concerted effort to rebuild it. Among other issues, Brookings



cites global economic competitiveness as a primary reason for why infrastructure should again be front and center. Brookings contends that today infrastructure is approached from a project-by-project perspective in which politics and "pork barrel" spending are major factors in deciding what gets funded, instead of objective criteria and reasonable standardized schedules for development, maintenance, and replacement.

In the 2008 report *Investing in Infrastructure*, the Congressional Budget Office (CBO) estimates that throughout the nation all governments and the private sector combined invest more than \$400 billion per year in capital outlays for infrastructure. The federal government accounts for approximately \$60 billion, primarily for highways and other transportation modes. Yet,

the CBO describes this spending as 20% less than what is needed to maintain the existing infrastructure only in its current condition. Further, the authors note that additional spending of tens of billions of dollars per year on transportation alone could be considered an economically justifiable investment.

Urban Land Institute (ULI) routinely studies infrastructure because of its prime importance to real estate and community development, major concerns among most of the organization's 30,000 North American members. In *Infrastructure 2007: A Global Perspective*, ULI addressed such topics as the competitive importance of infrastructure, the 50% rise in construction and repair costs since 1999, and the limited potential for the privatization of infrastructure, such as highways. For example in the United States, ULI estimated that only 10% of road projects are expected to attract public-private partnerships. The few that do turn to such financing and management arrangements may be headline names, but the bulk of road projects and facilities are not expected to be appropriate for public-private arrangements or leaders will not find those choices feasible.

The negative assessment of the nation's infrastructure is the result of what many have said are substantially inadequate investments over at least the last quarter century. At the same time, the addition of nearly 3 million people per year to the U.S. population increases infrastructure demands. Thus, declining investments and rising requirements, not to mention greater expectations among current residents, drive the continual demand for more and better infrastructure.

No Question: Infrastructure Spending Has Declined Across the U.S.

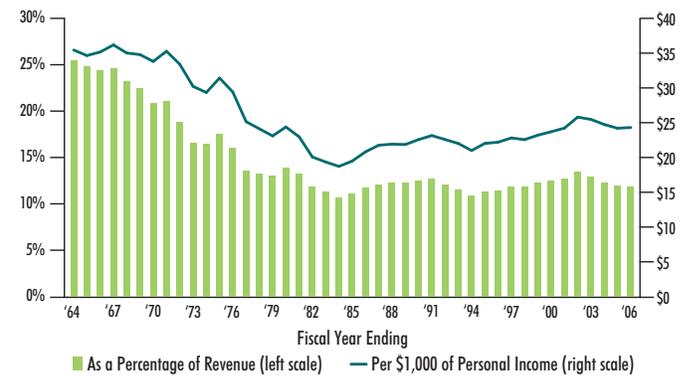
Infrastructure spending relative to economic and population growth has declined significantly in the U.S. since 1964, the first year for which data are available. For example, capital outlays as a percentage of total state and local government revenue exceeded 20% from 1964 through 1971. Since 1977, that share has shrunk to less than 14% yearly and has averaged around 12% in the last three years, which are among the lowest percentages on record.

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, except for 2002 and 2003 when it was slightly above. In the last three years, the figure has been between \$24 and \$25. Education and highways are the two biggest uses of general fund capital outlays among state and local governments. A reduction in highway spending is primarily responsible for the overall decline, but capital outlays for education also fell before partially recovering.

While comparable historical statistics on capital outlays made by the federal government are not available, the Congressional Budget Office has assembled data on federal transportation and water infrastructure spending. (Since the federal government has less responsibility for education, transportation is the primary use of federal resources.) Federal capital outlays on transportation and water have decreased drastically. In 1964, the federal capital outlay per \$1,000 of personal income exceeded \$17. A steady downward trend brought this figure to approximately \$0.75 in 2006.

U.S. INFRASTRUCTURE SPENDING HAS DECLINED SINCE THE 1960S

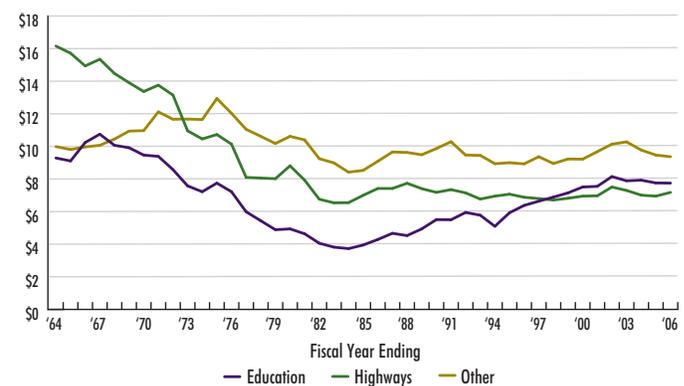
GENERAL FUND CAPITAL OUTLAYS OF STATE AND LOCAL GOVERNMENTS NATIONALLY



Source: Calculated by the Center for Competitiveness and Prosperity Research, L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University from U.S. Department of Commerce, Census Bureau, State and Local Government Finances, and personal income from the Bureau of Economic Analysis.

TRANSPORTATION INFRASTRUCTURE SPENDING IN PARTICULAR HAS DECLINED

GENERAL FUND CAPITAL OUTLAYS OF STATE AND LOCAL GOVERNMENTS NATIONALLY PER \$1,000 OF PERSONAL INCOME



Source: Calculated by the Center for Competitiveness and Prosperity Research, L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University from U.S. Department of Commerce, Census Bureau, State and Local Government Finances, and personal income from the Bureau of Economic Analysis.

Follow the Zeroes: Infrastructure Costs for the U.S. Are Huge

The costs of rehabilitating and building infrastructure to meet the demands of a growing population are beyond significant. The following examples for the U.S. as a whole illustrate the magnitude of the projected costs.

MILLION=1,000,000
BILLION=1,000,000,000
TRILLION=1,000,000,000,000

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 placed the need at \$127 billion. The National Education Association in 2000 put this figure at a much higher \$268 billion.

Energy

The Brattle Group, an international consulting firm, has determined that growing demand for electric services will require an investment of approximately \$1.5 trillion over the 2010-to-2030 period. 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

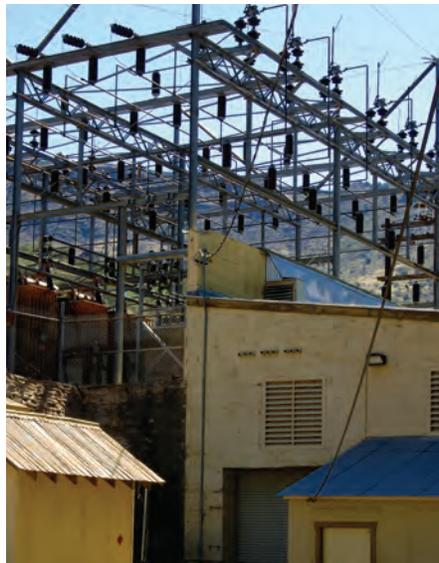
Nemertes Research, a technology analysis firm, suggests that internet usage could outstrip network capacity in North America within the next three-to-five years. The investment required to bridge the gap between demand and capacity ranges from \$42 billion to \$55 billion in the United States, primarily 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 capital outlays on transportation infrastructure in 2004 was \$106.2 billion but that \$126.5 billion needs to be spent annually just to maintain current levels of service. Including economically justifiable investments, the annual cost rises to \$184.8 billion per year.

Water and Wastewater

The U.S. Environmental Protection Agency (EPA) 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's infrastructure needs total \$276.8 billion. Wastewater infrastructure needs, according to the EPA's 2004 Clean Watersheds Needs Survey, total \$202.5 billion from 2004 through 2023.



How Does Growth Relate to Arizona's Infrastructure Needs?

Closely and directly – more people mean more demands

Infrastructure exists to serve people and businesses, so it is no surprise that growth and infrastructure are intertwined. In fact, rapid population and business growth in Arizona is the primary driver of the state's infrastructure needs. Arizona's "to do" list and its composition would be different if the state were not expanding so quickly. In contrast, states with stable populations are driven by the need to improve the quality of existing infrastructure, rather than to build it from scratch.

More People Push Infrastructure Needs Up

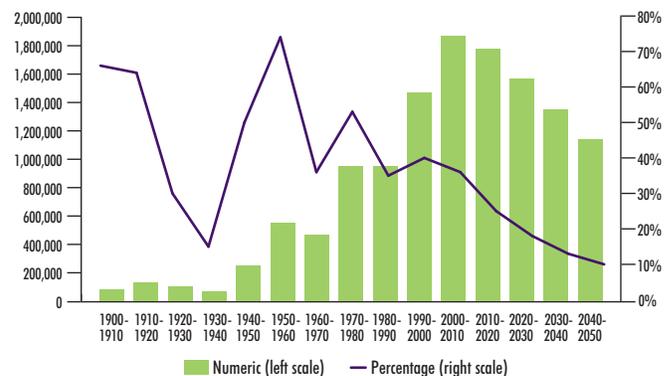
Arizona's population is projected to reach 10 million people before 2030 from approximately 6.4 million now. In the 25 years between 2007 and 2032, projections show Arizona may gain 4.2 million residents.

Until World War II, Arizona was a small, rural state. The state added some people, but the gains were minimal. Thus, the demands on infrastructure from growth were not particularly significant. Due to the war effort, the federal government built a considerable amount of infrastructure in Arizona. These investments helped enable growth to accelerate considerably during the late 1940s and 1950s. Expansion slowed during the 1960s, somewhat relieving the demand for infrastructure. Around 1970, however, an extended period of substantial, accelerating population gains began in Arizona. In particular, growth surged in the 1990s and has continued to rise in the current decade.

While growth is forecast to decline gradually, through 2030 it is expected to remain greater than at any time in the 20th century. Thus, the burden of providing an adequate infrastructure for new residents and businesses will continue to be enormous. Not only have Arizona's population increases been accelerating, the state's share of the nation's growth has been rising as well. The state's share of the national population gain may be peaking currently, but through 2030 it is projected to remain higher than at any time in the past.

POPULATION GAINS IN ARIZONA ARE AT AN ALL-TIME HIGH

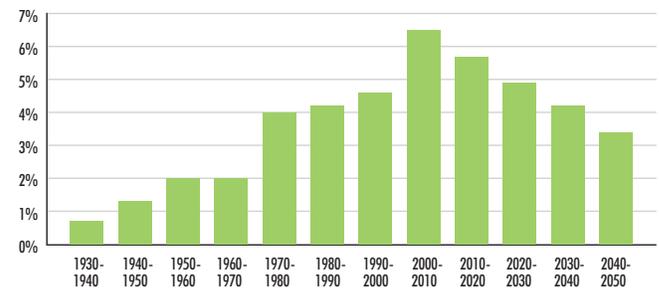
POPULATION CHANGE IN ARIZONA



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.)

ARIZONA'S GAINS AS A SHARE OF THE NATIONAL TOTAL ARE AT A HIGH POINT TOO

POPULATION CHANGE IN ARIZONA AS A PERCENTAGE OF 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.)

Composition of the Population and Economy Affects Infrastructure Needs

In addition to population and economic growth, other factors play a role in determining the nature of infrastructure investments in Arizona. Demographic characteristics, the structure of the economy, the geography of growth, and land use are among the important considerations.

Historically, Arizona's population growth has consisted disproportionately 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 requirement also. In contrast, retirees travel less and do not draw on the educational system. However, their health care needs are much greater than those of younger generations. The large size of the retiring baby boom generation means that the relative number of retirees in and moving to Arizona over the next 15–20 years may be higher than in the past. Quality of life is especially important to retirees and infrastructure plays an important role.

Economic characteristics also affect infrastructure requirements. The relocation, startup, and expansion of basic industries – those that sell to nonresidents – cause the state's population and economy to grow. The infrastructure needs of basic industries, including agriculture, mining, manufacturing, and out-of-state tourism, vary widely. In addition, the location of basic industries is uneven across the state. In contrast, the variation in infrastructure demands across population-serving industries is narrower, and the geographic distribution of such industries relates closely to the location of the population.

In coming years, economic activity based on new, evolving technologies, such as biosciences and nanotechnology, are expected to become more important as basic industries in Arizona. These relatively new fields tend to have specialized infrastructure needs that will have to be accommodated to ensure their development.

The location of growth within the state also will have a significant impact on infrastructure needs and costs. The numeric increase in population during the next 25 years is expected to be similar to that of the last 27 years across most of the state. The exception is the much greater gain projected in Pinal County (606,000 versus 236,000). In addition, new planned communities that are remote from existing population centers have been proposed across the state, but it is unclear how many of these actually will be built.

Growth Presents Opportunities and Challenges

Continued population growth in Arizona is a given in the near term, potentially increasing Arizona's significance as a center of economic and political influence, particularly as the 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 facilities and

services. To maintain and improve Arizona's quality of life and economic prosperity over the next 25 years, the state will have to build more infrastructure, especially in relation to slow-growth states. As a result, Arizona has the opportunity to do things better and smarter. Arizona has a chance to:

- build telecommunications infrastructure on par with world leaders such as Japan, Korea, and France
- develop an energy infrastructure that accounts for rising oil and natural gas prices and reduces negative environmental impacts
- lead development of water conservation technologies and supply strategies, anticipating even greater competition over the West's limited supplies
- build an efficient, safe, advanced transportation infrastructure to carry the state's people and goods where they want to go
- construct, furnish, and staff educational facilities to meet the changing needs of students and create a highly skilled workforce
- provide the police and fire protection resources, court facilities, and correctional systems necessary to ensure public safety
- support development of health care research, facilities, and services
- provide libraries, parks, and other quality of life services commensurate with Arizonans' expectations

Accommodating more than 4 million additional people will not be easy. The magnitude of new residents will complicate the construction and provision of infrastructure necessary for the well-being and economic prosperity of all Arizonans. However, failure to confront the challenges posed by Arizona's growth will most likely lower the quality of life of all Arizonans, negatively impact the state's economy, and limit the state's opportunity to reach its potential as a leading economic center, eventually making it unattractive to talented workers and willing investors.



What is Affecting Infrastructure Development Now?

More competition, costs, and demands with less public investment

Few in business or public policy today would question the dramatic surge in global competition or the effects in Arizona and around the world of changes in technology, science, and learning. Very few would suggest that Arizona should, or even could, go back to a time when being a low-cost leader was the best pathway to economic prosperity. The world has changed, and those days are gone forever. As a result, a cutting-edge economy requires leading-edge infrastructure, especially in education and telecommunications but actually in all areas, to support innovations among the state's best and brightest and to keep Arizona an attractive place for the brainpower it needs.

In recent years, the 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 facilities.

As Arizona's growth expands away from metropolitan Phoenix and Tucson, this too will add to the cost of building and servicing 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 of what is already in place in need of repair or replacement. Thus, not only must Arizona continue to build new infrastructure, it increasingly will need to refurbish existing physical infrastructure as well.

State and local governments increasingly are in charge when it comes to infrastructure. Yet, despite the state's record growth over the last 15 years, capital outlays and current operations spending by state and local governments in Arizona have fallen significantly relative to the state's size and to the national average. Arizona apparently has fallen behind on infrastructure, adding to the burden going forward.

More Competition for an Innovation Economy

Increasingly, Arizona is competing against other countries in addition to other states and urban regions. In a break with its

low-cost past, Arizona has acknowledged in recent years that the state cannot compete on cost when competitors are located in such countries as China and India. An evolution away from an industrial economy to one based on science and technology also has been occurring. A key factor to success in this innovation economy is a talented, trained workforce. In addition to education, telecommunications are more important than ever before.

Escalating 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 rapid cost increases for nonphysical infrastructure, but other costs, such as for higher education, also have climbed more than the overall inflation rate.

Bigger Scope and Scale

Population growth in Arizona since the early 1990s has been considerably higher than in the past. 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 Geography of Growth

The expected shift in growth to Pinal County and other areas has important implications for infrastructure and will require considerable public and private spending for infrastructure building during the next 25 years compared to the last 25. 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 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 there.

The Need for Renovation

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 more infrastructure to serve the needs of new residents and businesses is a greater share of the total expense. Until recently, much of the physical infrastructure in Arizona was relatively new, so extensive refurbishment expenses did not come into play. Thus, Arizona's substantial need for new physical infrastructure partially was offset by little need to renovate old facilities. This situation, however, is shifting. At the same time that the need for new infrastructure is greater than ever before due to the magnitude of the state's 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 Infrastructure Responsibilities

Long before Arizona became a state in 1912, private and public entities both helped to provide infrastructure that would make the area a suitable place to work and live. In some cases, infrastructure was a public endeavor from the beginning or a public-private partnership. In other cases, private infrastructure became public facilities. Given the scarcity of government resources in territorial Arizona, it was inevitable that public sector involvement would grow with statehood and population. Also, Arizona simply followed the national trend of overall increases in the size of government at all levels – federal, state, and local – from the 1800s through about 1975. 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.

The federal government played a major part in the construction of the nation's and Arizona's physical infrastructure during much of the 20th century. In Arizona, Roosevelt Dam provides a singular example of infrastructure development and how it can be a catalyst for economic growth. Overall, federal involvement coincided with a national interest in developing the West, with federal actions to spread new technologies, such as for water, electricity, and telephone service, with the World War II effort – in which the federal government actively improved the nation's physical infrastructure – and with the development of the interstate highway system.

During the last third of the 20th century, however, federal expenditures for physical infrastructure declined. Thus, state and local governments in Arizona are likely to have to cover a greater share of the infrastructure expenses during the next 25 years than during much of the last century.

Policymakers often ask voters to decide on infrastructure questions. These ballot issues may take the form of propositions, referenda, bond questions, resolutions, or ordinances, and are used particularly by cities and towns. However, ballot measures have appeared in state and county government elections as well, and have been used to address a wide range of infrastructure projects. A key example is the voter-approved sales tax measure to fund the regional transportation plan in Maricopa County in 1985. Another successful ballot measure in 2004 extended the levy for another 20 years.

Public Spending Is on the Decline Relatively

Capital outlays by state and local governments in Arizona dropped significantly over the last 15 years relative to national norms and other fast-growing states, and also in comparison to the state's economic gains. Freeway and road building in particular have fallen behind, with capital outlays for elementary and secondary education also lagging.

The relative declines in infrastructure spending have been matched by relative decreases in expenditures for current operations. Thus, not only have construction and repair of the physical infrastructure been limited, funding for the public services associated with the physical infrastructure has been restricted.

Capital Outlays Have Fallen Relatively in Arizona

From 1964-1990, general fund capital outlays as a proportion of revenue in Arizona exceeded 20% in most years, and were less than 17.5% only twice. Since 1992, though, in only one year has the share exceeded 17.5%, and in five years it has been less than 15%, including fiscal years 2005 and 2006, the two most recent years. 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.

Education and highways together have accounted for more than half of all capital outlays in every fiscal year since 1964, nationally and in Arizona. The decline in total capital outlays in Arizona primarily has been due to decreases in highway spending. In the 1960s, at least \$19 per \$1,000 of personal income was spent each 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 year since 1993. Capital outlays per \$1,000 of personal income also have decreased in education. In each of the last three years, the figure was around \$8, compared to \$13 or more in most of the 1960s and early 1970s. In contrast, no downtrend is apparent in other types of capital outlays as an aggregate.



Less Capital Spending 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 expenditures as a ratio to the national average have been substantially less since the early 1990s than during the late 1970s and 1980s. Even during the last 15 years of rapid growth, Arizona's capital outlays have declined on each of these measures.

In 2006, Arizona's infrastructure spending per capita ranked 17th among the 50 states and was 2% higher than the national total. 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 rapid-growth states. Arizona, Florida, Georgia, Idaho, Nevada, North Carolina, Oregon, Texas, Utah, and Washington are the 10 highest-growth states.

Arizona ranked sixth among the 10 fastest-growing states in 2006 with per capita capital outlays 4% below the average of the other nine states. Though 4% seems small, Arizona state and local governments would have had to spend \$218 million more than they did to reach the per capita figure of the fastest-growing states. The 2006 shortfall was only the latest of the state's annual spending deficits relative to the other growth states. Thus, the cumulative figure over time is much larger. The \$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. In contrast, capital outlays in the parks and recreation category were far higher per capita in Arizona than the nine-state norm.

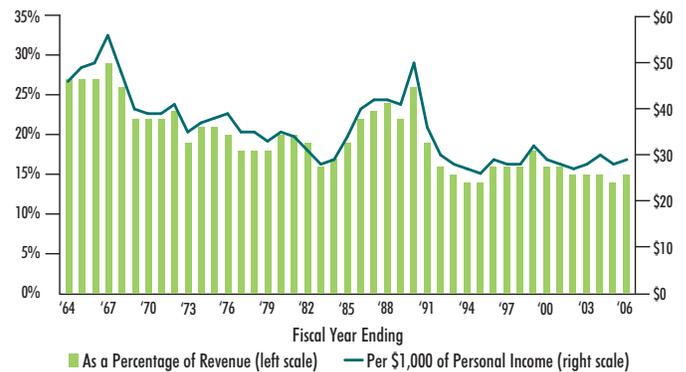
On an inflation-adjusted per person basis, capital expenditures in Arizona between 1992 and 2006 rose 26%, an average of 1.8% per year, which was less than the national total of 41% or 2.9% per year.² The per capita increase in Arizona's capital outlays was less than the gain in prosperity in the state, 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% between 1992 and 2006 in Arizona (an average decline of 0.4% per year), compared to an increase of 6% nationally (0.5% 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. Thus, regardless of the measure used or the states compared, Arizona's change in capital outlays between 1992 and 2006 was below average.

² The comparison period begins in 1992 because that 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 the chart on this page. The latest data are for 2006.

ARIZONA'S SPENDING FOR INFRASTRUCTURE HAS DECLINED RELATIVE TO THE ECONOMY

GENERAL FUND CAPITAL OUTLAYS OF STATE AND LOCAL GOVERNMENTS IN ARIZONA

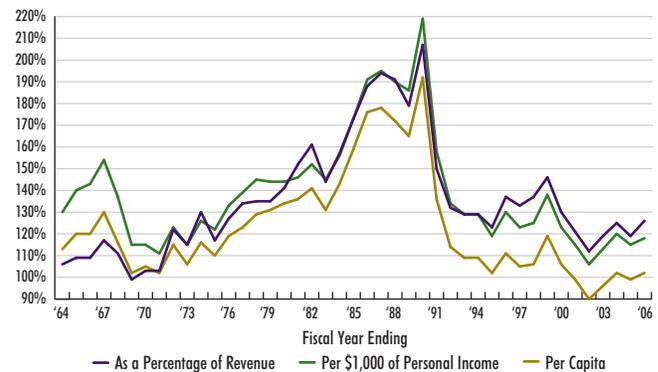


Note: Capital outlays and revenue were estimated for 2001 and 2003.

Source: Calculated by the Center for Competitiveness and Prosperity Research, L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University 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.

ARIZONA'S CAPITAL OUTLAYS HAVE FALLEN RELATIVE TO THE NATION SINCE THE EARLY 1990S

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 by the Center for Competitiveness and Prosperity Research, L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University 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.

Education Capital Outlays: Now Historically Low

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, Arizona's capital outlays for 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, with the

per capita amount below the national average. Among the 10 fastest-growing states, Arizona ranked seventh, with per capita spending 18% below the average of the other nine states. In order to match the nine-state per capita norm, an additional \$249 million in infrastructure spending for elementary and secondary education would have been necessary. Between 1992 and 2006, capital outlays for elementary and secondary education fell in Arizona, in per capita terms 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 31st on a per capita basis, 19% lower than the U.S. average. Compared to the 10 fastest-growing states, Arizona ranked fifth per capita, 11% 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 been required. Arizona ranked 26th on the change in higher education capital outlays between 1992 and 2006, both per capita and relative to personal income. Among the fastest-growing states, Arizona was fifth on both measures.

Capital Outlays for Highways: Also Historically Low

Since 2002, Arizona's capital outlays for highways per \$1,000 of personal income have been the lowest on record, 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, highway capital spending ranked 34th in the nation on a per capita basis. Among the 10 fastest-growing states, Arizona ranked eighth, 22% less per capita than the norm of the other nine states. To bring the highway per capita figure equal to the nine-state norm, \$383 million more in capital outlays would have been required.

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.

Current Operations Spending: Lowest in the Nation in 2006

In 2006, Arizona's per capita spending on current operations was the lowest in the country at 21% less than the national average. State and local government spending on current operations in Arizona in 2006 was nearly \$3 billion below the norm of the nine fast-growing states. Like capital outlays, Arizona's spending on current operations declined between 1992 and 2006 relative to personal income. Nationally, current operations spending relative to personal income rose.

Arizona's share of the nation's current operations and capital outlays expenditures should be rising at the same pace as the state's share of the nation's population, all else being equal. However, this has not occurred. Since the early 1990s, Arizona's share of the nation's current operations expenditures has not climbed as much as its population share. Similarly, the state's share of national capital outlays has declined from well above to about equal to its population share, despite Arizona's fast population growth.

Public Sector Spending in Arizona Is Low and Falling Relatively

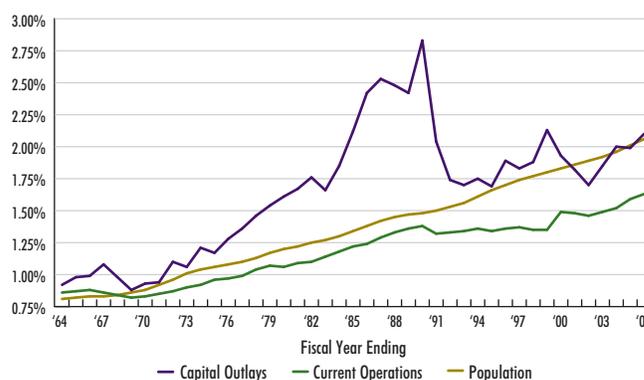
Arizona ranked 48th among states in 2006 on total (current operations plus capital outlays) per capita state and local government general fund spending. Total spending per capita in 2006 was 8% less than the norm of the fastest-growing states. With a shortfall of more than \$500 per person, total spending by state and local governments in Arizona was nearly \$3.2 billion less than the nine-state norm.

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.

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. In contrast, the change was greater than the national average in fire protection, parks and recreation, and sewerage.

ARIZONA'S SHARE OF NATIONAL SPENDING, RELATIVE TO ITS POPULATION SHARE, HAS FALLEN SINCE THE EARLY 1990S

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 by the Center for Competitiveness and Prosperity Research, L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University from U.S. Department of Commerce, Census Bureau, State and Local Government Finances and population estimates.

What Will Arizona's Infrastructure Cost?

Time, energy, persistence, and billions of dollars

Projecting infrastructure costs over the next 25 years is challenging. All long-term forecasts involve many assumptions and should be considered speculative. The cost figures presented here are illustrative of Arizona's needs, not precise projections.

The projected population is the starting point for forecasting all types of infrastructure costs. Additional data needed vary by infrastructure category. In some cases, the desired facts and figures are not available. Thus, different methodologies were employed by category. The findings are not 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 and determining the amount of existing physical infrastructure that needs to be repaired or replaced are equally as challenging.

Think Billions of Dollars in Additional Infrastructure Spending Per Year

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.

Private-sector needs 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.

The gap between state and local government revenues and spending needs – capital outlays and current operations – over the next 25 years is calculated to be \$288 billion, excluding the telecommunications sector in which public sector involvement is uncertain, though public costs are unlikely to amount to more than a few billion dollars. The average deficit per year is \$11.5 billion.

To provide perspective on the magnitude of this projected funding gap, the annual average deficit per year was divided by the average Arizona population of 8.72 million people over the 25 years. 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 (18% less than the national average) to 18th, but Arizona's per capita total of \$7,121 still would have been barely above the national average. For comparison, in 1992, Arizona's per capita expenditures ranked 30th at 9% less than the national average.

In reality, this \$1,323 per capita increase overstates the annual revenue shortfall in meeting the spending needs. Some of the infrastructure spending will use long-term debt, matching the benefits and costs of the investments over their useful life.

The \$288 billion in projected, unfunded infrastructure needs in education, public health, public safety, transportation, water, and other public services categories is 9% of the total projected needs to be paid by state and local governments. The federal government will provide some of the funding.

Projected needs in other infrastructure categories come from the Arizona Investment Council report. None of the energy gap of \$109 billion is assumed to be a public-sector responsibility. Telecommunications needs are projected to be around \$25 billion, with some public-sector involvement likely necessary.

The state and local government portion of the funding shortfall for the water and transportation infrastructures that was projected by the AIC report is included in the \$288 billion overall shortfall. The AIC report identified an overall \$30 billion gap in water.

The AIC report projected transportation needs of between \$253 billion and \$311 billion in capital outlays only. Based on these figures, Arizona state and local governments might be responsible for between \$218 billion and \$270 billion in combined capital outlays and current operations. This range, however, does not reflect revenues from existing, dedicated sources of transportation funding and therefore is not inconsistent with the overall \$288 billion projected gap in state and local government funding.

Public Schools Face Substantial Needs

The growth of Arizona’s population over the next 25 years will create a significant demand for the expansion of schools, learning, and libraries. Public education includes:

- elementary and secondary education
- higher education
- “other” education (such as schools for students who are deaf and blind)
- public libraries.

Though one-third of all state and local government expenditures in Arizona in 2006 were for education, public spending on educational services in Arizona ranked 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 capital outlays and current operations. Yet, the acquisition of knowledge and skills is one of the most important factors for attaining economic prosperity in a knowledge-based economy. Without a quality education infrastructure in Arizona, the standard of living of Arizona residents may lag behind.

Education spending in Arizona likely will need to increase slightly more than the pace of real economic growth over the next 25 years. Enrollments rising slightly faster than population growth, pressures resulting in increasing costs such as higher salaries for quality teachers, and catching up from the state’s low rate of investment will add to future costs.

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

In the elementary and secondary school component, the student population in coming years is expected to increase a bit more quickly 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.

For higher education, planners predict that university enrollment will 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, the increase in 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. Nearly \$37 billion of capital outlays are forecast over the next 25 years. Current operations spending is projected to be \$255 billion. Needs are smaller in the “other” education and libraries subcomponents, at \$36 billion and \$11 billion, respectively.

EDUCATION COSTS COULD BE \$873 BILLION

ANTICIPATED PUBLIC EDUCATION INFRASTRUCTURE COSTS IN ARIZONA THROUGH 2032 (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 All Costs	534.0	291.5	35.9	861.4	11.2	872.5

NA: Not Available

Source: Projected by Center for Competitiveness and Prosperity Research, L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University using State and Local Government Finance data of the U.S. Department of Commerce, Census Bureau.



\$6.2 MILLION LIBRARY SET TO OPEN

Arizona Republic
August 25, 2008

DISTRICT LOOKS FOR WAYS TO EASE CROWDING

Arizona Republic
May 27, 2008

2 TEMPE SCHOOLS TO BE REPLACED WITH NEW CAMPUSES

East Valley Tribune
May 23, 2008

FUNDS FALL SHORT FOR SCHOOL REPAIRS

Arizona Republic
September 8, 2008

Higher Production Costs Will Mean Rising Electricity Prices



The energy infrastructure consists of:

- electricity, including generation, transmission and distribution
- natural gas, petroleum, and other fuels, including refineries, transmission, distribution, storage, and pipelines.

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 because of increases in construction costs well above the overall inflation rate, a sharp upswing in natural gas prices, and a recent mandate from the Arizona Corporation Commission for 15% of the state’s retail sales of energy production to come from renewable energy sources by 2025. Production costs for renewable sources, such as solar and wind generation, are currently higher than the per unit cost of traditional sources.

Assuming no increase in existing electricity prices, the projected funding shortfall – capital costs and current operations – in the electricity component in Arizona is likely to be around \$109 billion over the next 25 years. Given the largely private sector nature of the electricity component, this gap will have to be covered by increases in retail prices.

Requests to adjust retail rates are likely to come before the Arizona Corporation Commission more frequently in coming years. After 20 years of fairly stable prices, customers, regulators, and politicians will need to adapt to a new environment of rising electricity prices.

The total capital investment in electricity infrastructure required to serve Arizona’s growing population to 2032 is projected to be between \$65 billion and \$77 billion depending on the mix of generation technologies employed going forward. These projections are conservative in that relatively low inflation in construction costs is assumed. Expenses for operations are not included.

In the natural gas, petroleum, and other fuels component, \$9 billion in capital costs are projected, but there is no immediately obvious funding gap for pipeline or storage provision. Demand will be met by the private sector, which historically has 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.

CAPITAL COSTS FOR ENERGY MAY BE BETWEEN \$74 BILLION AND \$86.5 BILLION

PROJECTED ENERGY INFRASTRUCTURE COSTS IN ARIZONA THROUGH 2032 (BILLIONS)

	Electricity by 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	NAP	36.1-48.5
Refineries	NAP	NAP	NAP	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	NAP	NAP	NAP	0.2-0.3	0.2-0.3

NAP: Not Applicable

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

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



NATURAL GAS RATES GO UP

Kingman Daily Miner
October 10, 2008

MASSIVE WIND FARM PLANNED

Kingman Daily Miner
June 30, 2008

SRP, APS SUPPORT RENEWABLE ENERGY PROGRAMS

East Valley Tribune
September 4, 2007

Health Care Costs and Demand Are Moving Up

The health care infrastructure in Arizona includes:

- private sector hospitals
- public sector hospitals
- other public health
- other private sector health care. (These services are not addressed in this section.)

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 rapidly. Rapid changes in technology in health care result in considerable uncertainty in planning for the future.

Health care primarily is 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 have surged in recent years.

Projections of the costs of the hospital component are based on surveys taken by the American Hospital Association and the Arizona Hospital and Health Care Association. Arizona hospitals added about 9% to the total stock of beds from 2000 to 2006 and plan to add about 20% more through 2011. Planners expect more than \$3 billion in new hospital construction from 2007 through 2011.

Projected hospital expenses, including capital outlays and current operations, come to 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 anticipates that costs will be higher due to the rapidly expanding elderly population.

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.

HEALTH CARE COSTS MAY COME TO ABOUT \$1 TRILLION

PROJECTED HEALTH CARE INFRASTRUCTURE COSTS* IN ARIZONA THROUGH 2032 (BILLIONS)

	Private Hospitals		Public Hospitals		Other Public	Total*	
	Low	High	Low	High		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 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 Center for Competitiveness and Prosperity Research, L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University 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.



GILBERT HOSPITAL TO BEGIN EXPANSION IN NOVEMBER

East Valley Tribune
September 14, 2008

QUEEN CREEK HOSPITAL IS TAKING SHAPE

Florence News
September 10, 2008

HOSPITAL SEEKS APPROVAL

Kingman Daily Miner
July 6, 2008

Public Safety Likely to Remain a Key Concern in Arizona

Public safety infrastructure in Arizona includes:

- police protection
- fire protection
- corrections
- protective inspection and regulation.

The transient nature of the state’s population adds to the crime rate. Additional pressures come from the enforcement of undocumented worker laws. Relying on state and local government enforcement agencies to cope with immigration issues undoubtedly will put cost pressures on police protection and corrections.

The public sector takes responsibility for nearly all of the public safety infrastructure. In some places, though, fire protection is provided by a private sector company, and some prison inmates are held in privately operated prisons.

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

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. Police protection is projected to have the highest costs over the next 25 years, at \$115 billion. The corrections total 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 component only \$16 billion.



PUBLIC SAFETY COSTS MAY TALLY \$296 BILLION

PROJECTED PUBLIC SAFETY INFRASTRUCTURE COSTS IN ARIZONA THROUGH 2032 (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 All Costs	114.9	59.6	106.1	15.5	296.1

NA: Not Available

Source: Projected by Center for Competitiveness and Prosperity Research, L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University from State and Local Government Finance data of the U.S. Department of Commerce, Census Bureau.



SURPRISE TO OPEN 7TH FIREHOUSE SOON

Arizona Republic
August 28, 2008

SHERIFF’S OFFICE UNLOCKS NEW JAIL FACILITY

Yuma Sun
August 28, 2008

Arizona Can Decide to Improve 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:

- broadband connectivity in rural areas without current service
- fiber-to-the-home (FTTH) networks statewide for faster service.

Access to broadband connections is widespread in Arizona, particularly in urbanized areas. However, approximately 200,000 Arizonans (3% of the population) lack access to necessary “middle-mile” broadband connectivity (community connection to the cross-country fiber). 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.

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 Arizonans without such access, 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 recovered from customers. Thus, much of the cost of providing universal access may need to be covered by the public sector.

Access to very high speed links is limited in Arizona. 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 residents of countries such as Japan, France, and Korea currently enjoy. The upfront costs of providing a FTTH network are considerable, resulting in a lack of interest among private sector companies to provide this service. While the costs 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 economic 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.

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.

TELECOMMUNICATIONS COSTS PROJECTED AT \$25 BILLION

PROJECTED TELECOMMUNICATIONS INFRASTRUCTURE COSTS IN ARIZONA THROUGH 2032 (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 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*, May 2008.



LAGGING WEB ACCESS PUTS ARIZONA KIDS BEHIND

Arizona Republic
August 24, 2008

YUMA CUTTING WIRES, TO BE OFFERING CITYWIDE WIFI

Yuma Sun
April 20, 2006

Transportation Needs Are Considerable and Funding Is Problematic

The transportation infrastructure in Arizona consists of:

- roads and highways
- mass transit
- railways
- 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, traffic congestion and the limited capital outlays for roads and highways over the last 15 years suggest that additional monies will be needed in the roads and highways and transit components to bring the existing infrastructure up to par for existing residents and businesses. Without significant infrastructure investment, declines in performance will affect adversely 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 mechanisms. 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.

The private sector dominates the rail component. All or nearly all of the projected capital costs of close to \$6 billion can be considered to be covered by existing funding mechanisms.

While many aviation services are privately provided, the public sector funds 86% of aviation infrastructure nationally. Thus, the public share of the \$12 billion projected capital cost may be more than \$10 billion, with the state and local government share nearly \$6 billion.

Transit needs are projected to be nearly \$36 billion in capital costs. Nationally, the public sector picks up all of the transit infrastructure expenses, 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 capital cost over the next 25 years in the roads and highways component amounts to \$199 billion to \$257 billion, depending on the assumed inflation in road and highway construction. 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. Thus, nearly all of the projected capital cost can be assumed to be unfunded by existing mechanisms. The public sector share may be between \$179 billion and \$231 billion, with a state and local government portion of \$98 billion to \$127 billion.

Since additional operations monies as well as capital outlays will be required, total needs exceed those presented above. Total state and local government transportation costs could amount to between \$218 billion and \$270 billion over 25 years.

BETWEEN \$253 BILLION AND \$311 BILLION WILL BE NEEDED FOR TRANSPORTATION

PROJECTED TRANSPORTATION INFRASTRUCTURE COSTS IN ARIZONA THROUGH 2032 (BILLIONS)

	Roads and Highways		Mass 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% annual inflation for roads and highways.

** Using 4% annual inflation for roads and highways.

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



STATE PUTS HOLD ON UP TO \$171 MILLION IN HIGHWAY PROJECTS

Tucson Citizen
September 5, 2008

RAILROAD EXPANSION COMING

The Explorer
(Marana, Oro Valley, Northwest Tucson)
August 20, 2008

MARICOPA CITY LEADERS INITIATE COMMUTER BUS SERVICE

USA Today
September 29, 2008

PHOENIX PREPARES TO ALIGN BUS SERVICES WITH NEW LIGHT RAIL

Arizona Republic
August 2, 2007

Rising Costs of Water and Wastewater Services Will Result in Higher Prices

Arizona's water infrastructure includes systems for:

- water supply (dams, reservoirs, canals, and wells)
- drinking water treatment and distribution (drinking water treatment plants and pipelines)
- wastewater treatment and conveyance infrastructure (wastewater treatment plants and sewer lines).

Providing water and wastewater services to new residents and businesses will require supplementing the current water supply in some parts of the state. Further, aging water delivery and treatment systems 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 to new residents and to upgrade existing systems. Costs not funded by existing mechanisms may total nearly \$30 billion, with the bulk of these unfunded costs likely to be the responsibility of state and local governments.

Total water and wastewater costs are projected to be \$109 billion in Arizona over the next 25 years, including capital costs and operations costs. The primary capital cost will be the basic infrastructure to provide drinking water to current and future residents. Augmentation costs statewide are not expected to be a large percentage of total costs since the existing water supply in Maricopa, Pinal, and Pima counties – where 82% of the state's population in 2032 is projected to live – is expected to be adequate until after 2032. However, in Cochise, Coconino, Gila, and Yavapai counties, because of their impending supply needs, the funding gap will be large relative to the number of residents, and the ability to overcome that gap may be limited.

Revenue from current funding sources is projected to total slightly more than \$79 billion, leaving a funding shortfall of nearly \$30 billion. Nationally, a high proportion of the capital costs are covered by the public sector. More than 90% of the public expenditures are made by state and local governments. Therefore, it is likely that the bulk of the \$30 billion gap will have to be covered by state and local governments in Arizona, probably by charging customers more for these services.



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.

\$109 BILLION PROJECTED TO BE NEEDED FOR WATER

PROJECTED WATER INFRASTRUCTURE COSTS IN ARIZONA THROUGH 2032 (BILLIONS)

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

NAP: Not Applicable

* 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.

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



SECOND GREEN VALLEY WATER LINE PROPOSAL

Arizona Daily Star
August 26, 2008

WATER RESTRICTIONS, BOND ISSUE ADDRESS ST. JOHNS WATER SHORTAGES

White Mountain Independent
June 27, 2008

PHOENIX TO RAISE WATER IMPACT FEES ON BUILDERS

Arizona Republic
March 27, 2008

COCHISE COUNTY SUPERVISORS FIRST IN STATE TO APPROVE WATER ADEQUACY ZONING REGULATION

Arizona Range News
March 26, 2008

Other Types of Infrastructure Also Have Needs

The preceding seven infrastructure categories account for most of the overall infrastructure, particularly physical infrastructure. Other public sector expenses can be grouped into:

- social services other than health care
- environment and housing
- government administration
- interest on debt
- 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.

Excluding health care, the public welfare subcomponent, which accounted for 17% 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. 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.

The environment and housing component consists of four areas: natural resources, parks and recreation, housing and community development, and 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.

The Census Bureau splits government administration into financial, judicial and legal, public buildings, and other administration. The judicial and legal subcomponent alternatively might be included with the public safety infrastructure. Capital outlays are a very small share of the total expenses in this component.



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 billion. Data are not available with which to project capital outlays. Payments on debt, resulting largely from long-term financing taken out to build physical infrastructure, are projected to be \$50 billion. Public services not classified elsewhere are projected to have costs of \$70 billion.



ARIZONA STATE PARKS LOSES ITS IMPROVEMENT FUNDING

Arizona Republic
July 30, 2008

DISTRICT SEEKS FUNDS FOR SOMERTON HOUSING

Yuma Sun
September 16, 2007

OTHER INFRASTRUCTURE COSTS PROJECTED AT \$978 BILLION

PROJECTED OTHER INFRASTRUCTURE COSTS OF PUBLIC SECTOR IN ARIZONA THROUGH 2032 (BILLIONS)

	ENVIRONMENT AND HOUSING					SOCIAL SERVICES						TOTAL
	Natural Resources	Parks & Recreation	Housing & Community Development	Solid Waste	Subtotal	Public Welfare	Other	Subtotal	Government Administration	Interest	Other	
Total Capital Costs	\$4.0	\$20.5	\$NA	\$1.8	\$NA	\$NA	\$NA	\$NA	\$NA	\$0.0	\$NA	\$NA
Total Ongoing Costs	37.2	81.6	NA	33.2	NA	NA	NA	NA	NA	50.0	NA	NA
Total All Costs	41.2	102.2	28.0	35.1	206.4	545.0	2.5	547.5	104.2	50.0	69.8	977.9

NA: Not Available

Source: Projected by Center for Competitiveness and Prosperity Research, L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University based on State and Local Government Finance data of the U.S. Department of Commerce, Census Bureau.

Center for Competitiveness and Prosperity Research

L. William Seidman Research Institute

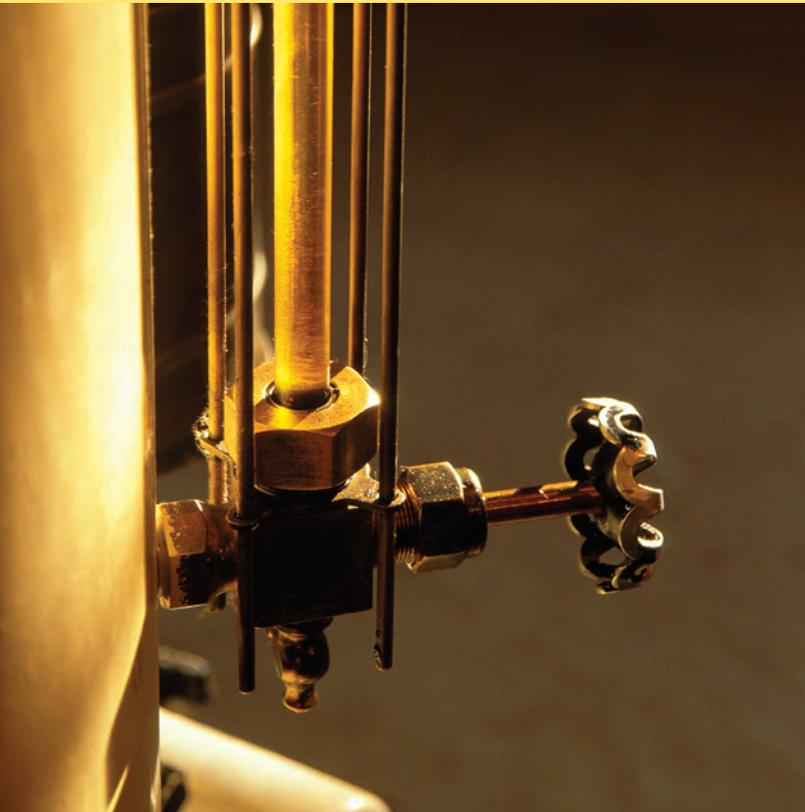
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