



ENVISION UTAH

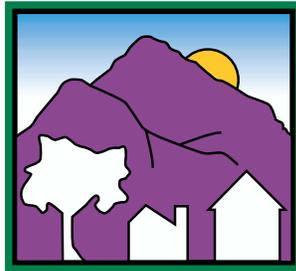
A Partnership for Quality Growth

Urban Planning Tools for Quality Growth

First Edition and 2002 Supplement

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**First Edition
and 2002 Supplement**



ENVISION UTAH

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A Partnership for Quality Growth

Formed in January of 1997, Envision Utah is a public/private community partnership dedicated to studying the effects of long-term growth in the Greater Wasatch Area of northern Utah. Sponsored by the Coalition for Utah's Future, Envision Utah and its partners – with extensive input from the public – have developed a publicly supported growth strategy that will preserve Utah's high quality of life, natural environment and economic vitality during the next 50 years.

The Envision Utah partnership includes state and local government officials, business leaders, developers, conservationists, landowners, academicians, church groups and general citizens. This unique and diverse coalition is working together to implement a common vision for the Greater Wasatch Area as it faces the prospect of immense growth in the coming decades.

The poet Walt Whitman wrote of pioneers as “moving yet and never stopping,” a fitting description for those who are embarking on this important journey to make Utah an even more remarkable place. Like most journeys, the twists and turns in the road and the choices made along the way are as important as the final destination. Our ultimate goal is to create an ideal place to live and work, raise a family and enjoy beautiful surroundings.

The quality of human settlements was important to Utah's founders. In 1847, within three days after entering these valleys, a planning commission was convened that created a community plan that would last for generations. In 1892, LDS church President John Taylor wrote, “In all cases in making new settlements, the Saints should be advised to gather together in villages, as has been our custom from the time of our earliest settlement on these mountain valleys. The advantages of this plan, instead of carelessly scattering out over a wide extent of country, are many and obvious...By this means the people can retain their ecclesiastical organizations...Co-operate for the good of all in financial and secular matters, in making ditches, fencing fields, building bridges, and other necessary improvements. Further than this they are a mutual protection and a source of strength...[which]...gives them many advantages of a social and civic character which might be lost, misapplied or frittered away by spreading out so thinly that inter-communication is difficult, dangerous, inconvenient, and expensive.” (Mormon Country, by Wallace Stegner)

In building a community today, we do not face the enormous physical difficulties confronted by our ancestors. But the path to improving our communities and the quality of life for our ourselves and our children is nonetheless fraught with difficult decisions and complicated ideas. True, we generally don't have to worry about storing enough food for the winter or fighting back crickets ... but we live in a much more complex world, with a spinning array of choices, ideals, opinions, and technology to help us achieve our goals. In other words, we may carry a PalmPilot and rely on modems and six-lane highways, but we are no less pioneers than those who came before us.

This document is a guidebook that outlines tools to take us to a community that, in many ways, echoes back to our past – with its close-knit neighborhoods, tree-lined streets, pedestrian-friendly walkways, nature and farmland within reach of the city, and houses marked by character. The goal may be low-tech, but the best method for getting there definitely is high-tech – thanks to modern advances in planning, transportation and design.

This toolbox is an invitation to build better communities... to become a pioneer who “moves and never stops.”

Jon M. Huntsman, Jr., Chair Emeritus
Envision Utah

Envision Utah would like to thank those who financially supported the development of the Implementation Toolbox.

George S. and Dolores
Doré Eccles Foundation
Surdna Foundation
The William and Flora
Hewlett Foundation
Church of Jesus Christ of
Latter-day Saints
Foundation
Marriner S. Eccles
Foundation
Union Pacific Foundation
Zions Bank
PacifiCorp/Utah Power
Environmental Protection
Agency
Federal Highway
Administration

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Protecting Sensitive Lands

What are sensitive lands?

► **“To people living along the Wasatch Front and Back, peace of mind is largely based on an appreciation for the scenic beauty and recreational opportunities of the natural landscape.”**
(Wirthlin Worldwide, 1997)

When the Mormon pioneers arrived in the Valley of the Great Salt Lake in 1847, they brought with them a commitment to careful community building. The urban center, it was believed, must nurture social interaction and the survival of each community was dependent upon a harmony between the town and the surrounding countryside.

Agriculture, water and wildlife resources were vital to existence, and they were respected and cared for. Pioneer communities were nestled in the valleys and deserts throughout Utah and the Mountain West, but the greatest concentration and density of growth has occurred in the Greater Wasatch Area. As home to 80 percent of Utahns, the Greater Wasatch Area sets the stage for the quality of our urban environment and ultimately for the quality of our lives.

Therefore, it is not surprising that the threat of encroachment by urban development on the natural environment is greatest in the Greater Wasatch Area. Some of the agricultural land in Utah is here and is disappearing rapidly under concrete and asphalt. Watersheds, floodplains and wildlife habitat are also continually threatened by development.



A remnant of the rural way of life in Park City.

► **The issue of how to protect Sensitive Lands is covered in detail in "Land Conservation in Utah-Tool Techniques and Initiatives," a report published in 1997 by the Governor's Office of Planning and Budget. Contact GOPB at 801-538-1556 or on the Internet at www.governor.state.ut.us/planning/critical lands.**

Some potential land hazards in the Greater Wasatch Area.

Citizens who participated in the Envision Utah process identified the protection of natural and environmentally sensitive lands as one of their primary concerns regarding growth in Utah. This reflects the strong feelings of many residents that the protection of sensitive lands should be elevated to a more prominent role in Utah planning. For this reason, sensitive lands protection is central in the Quality Growth Strategy.

Sensitive land includes any area in which development is either not appropriate or must be approached with care to ensure there is no long-term loss of property or human life. Sensitive land also refers to areas with exceptional eco-

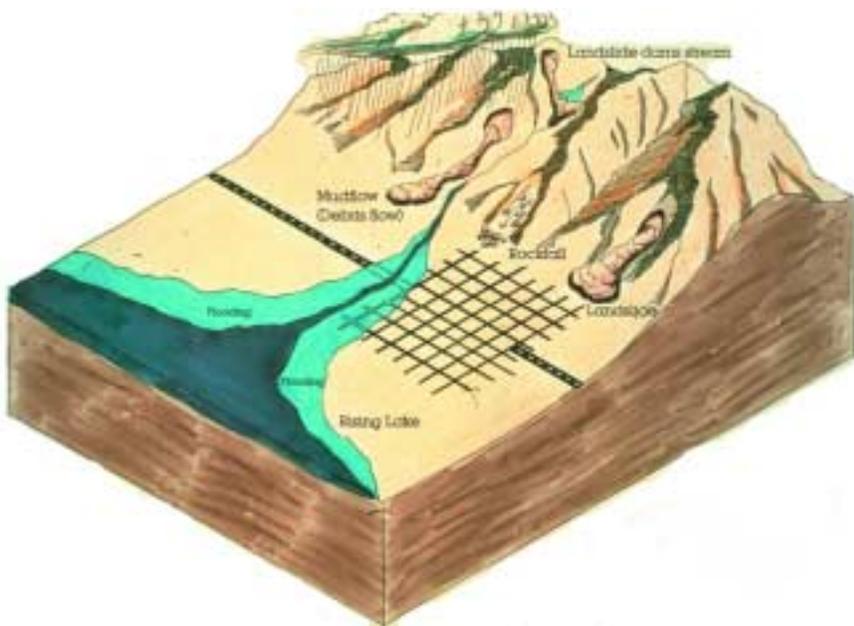
logical, open space or agricultural value. Concern for sensitive lands in community planning will help protect life and property from natural hazards and environmental areas from destruction, preserve air and water quality, reduce soil erosion and preserve an important part of our quality of life – the scenic beauty that surrounds us.

Types of sensitive lands/strategies

For the purposes of this workbook, sensitive lands are divided among three general categories:

- **Natural Hazard Areas** present a danger to humans when developed;
- **Environmentally sensitive areas** have important ecological features that often are disrupted by development;
- **Open space and agricultural land** possess cultural, aesthetic or economic importance that can be lost when developed.

These categories are not mutually exclusive. Hazardous lands, for example, also can be environmentally sensitive and beautiful as open space.



Natural Hazards

There are three types of hazardous lands covered in this workbook: (1) geologically hazardous land subject to slope failure, (2) land subject to flooding, and (3) land subject to wildfire. Maps and data often can identify these areas along the Wasatch Front and Back. Available maps and data can be accessed through the Quality Growth Efficiency Tools (QGET) land-use database. The database is included with the Envision Utah publication “Model Codes and Analysis Tools for Quality Growth.”

Geologic hazards

The primary geologic hazard addressed in this workbook is slope failure or landslides. Earthquake hazards such as liquefaction and ground-shaking also exist, but because these events are geographically widespread, they typically are addressed through building code requirements that ensure structures are designed and retrofitted to withstand earthquakes.

On the other hand, slope failure and rock fall usually occurs in well-defined areas and on lands with predictable land characteristics. Land-use regulations based on slope were first established in Los Angeles in the 1950s and since have evolved in a number of different directions. In this workbook, we will discuss ordinances that limit or prohibit development on those portions of land that exceed a certain slope, usually 25 to 30 percent grade.

Because of the varied geology, soil structure and vegetation cover of the Greater Wasatch, many areas have potential for slope failure. Many local governments prohibit or greatly limit development

► **Building roads across land with a slope greater than 30% involves large and increasingly complex land disturbance.**

To protect hillsides against scarring cut and fill, areas over 30% slope are often restricted from development, and slopes over 15% are frequently regulated.



Slope failure claimed 60 homes in Kelso, Washington, in 1998.

on slopes over 30 percent grade, due to both slope failure and erosion hazards. In addition, both ancient and active landslides are known to exist, and many have been mapped (see the QGET land-use database for the best available information). Several tragedies have occurred resulting in loss of property and lives due to development on known or suspected slope failure areas. While modern engineering often can lessen the risk, often the best strategy is to eliminate or reduce the number of structures developed on these lands. Slope failure can rarely be prevented through engineering techniques. Tragic consequences sometimes occur when development is located on inappropriate land.

Construction with inappropriate erosion controls.



STRATEGIES FOR SLOPE FAILURE AND EROSIIVE LANDS

Codes that address slope failures center on two strategies: limiting or restricting development on steep slopes, and reducing erosion. When sloped terrain is excavated, disturbed or altered for road cuts, it becomes particularly susceptible to debris flows and other forms of landslides. Following is a list of tools that communities have used to plan effectively for geologically hazardous lands:

- Some municipalities increase minimum lot sizes or decrease density (units per acre) as slopes increase in steepness. Ogden is one such city.
- Development should leave a minimum percentage of the site undisturbed and full of vegetation.
- Disturbed areas should be replanted with erosion-resistant or indigenous plant materials within a specified time.
- Drainage control also is an important way to guard against erosion and slope failure. Roof, driveway and parking drainage should be directed and controlled to guard against erosion.
- All cuts and fills should be designed to be stable. This can be difficult on sloped land; often a stabilizing wall is a better strategy on a cut and fill area than a sloped fill.

Flooding hazards

Floods have been the bane of many urban areas for much of human history, as some of the best places to urbanize often were the floodplains of major rivers and lakes. Certainly, Utah has not been a stranger to flooding, with several memorable events during our short history in this area. The Greater Wasatch is not only subject to stream flooding, but also is subject to the fluctuating shorelines of the Great Salt Lake and Utah Lake. Both of these lakes have relatively shallow depths such that, in wet years, the waters of these lakes can cover an area much larger than their typical shoreline.



After decades of mounting national losses due to continued development in floodplains, the federal government enacted a flood insurance program in 1968 (*the National Flood Insurance Act*). Under this program, the federal government offered to underwrite flood insurance in exchange for local governments enacting some basic regulations on flood hazard reduction. The Federal Emergency

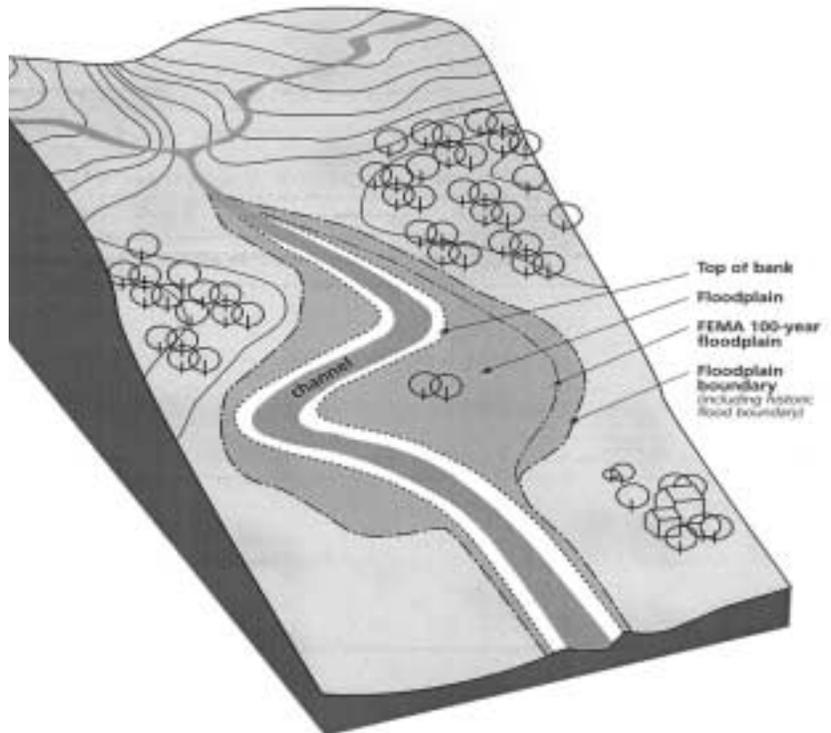
Management Agency (FEMA) wrote a model flood hazard ordinance that could be enacted in any city or county in the country. In exchange for adopting and enforcing the flood hazard ordinance, FEMA would certify the community as eligible for flood insurance.

In the 1970s and early 1980s FEMA also conducted hydrologic studies for most of the drainages in the country – a massive undertaking, considering the state of computer technology at the time. The maps are called Flood Insurance Rate or FIRM maps.

► **Salt Lake City’s Lowland Conservancy Overlay District establishes minimum setbacks and a “natural vegetation buffer strip” around waterbodies and wetlands.**

Contact Salt Lake City planning at 801-535-7757.

Various flood area definitions.



The FEMA flood hazard ordinance is a baseline nationally – a code that works for many communities all over the country despite their varied circumstances and needs. Most communities in Utah also have adopted the FEMA minimum standard.

However, FEMA recently recognized that the standard flood hazard ordinance and the FIRM maps are not the ideal for many communities. The official maps do not always delineate land that has experienced historic flooding. In addition, many communities want stricter development regulations in flood-prone areas. They have come to the decision that building homes and businesses in areas

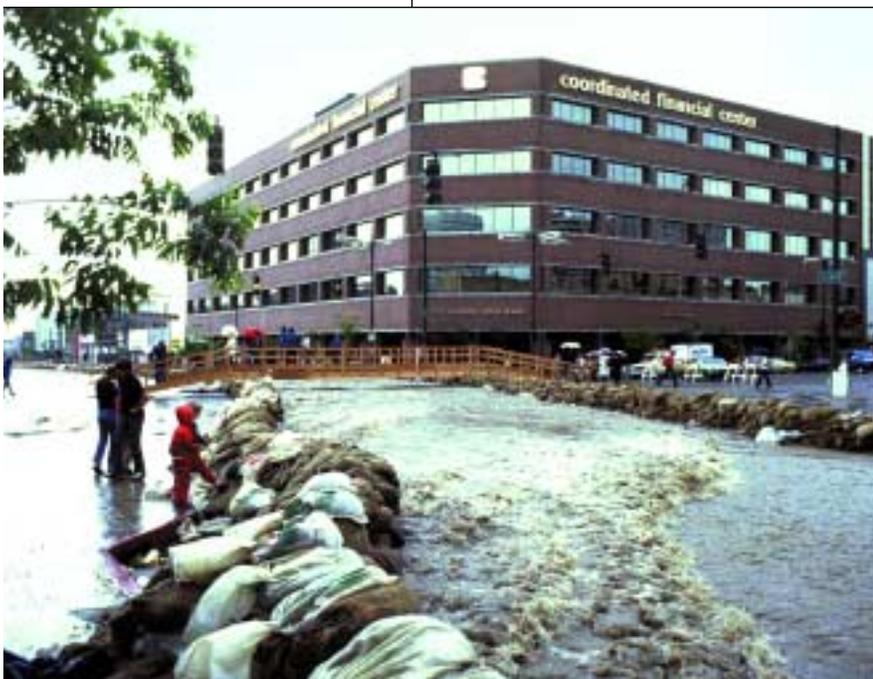
known to flood is a fundamental planning mistake that can be avoided with better subdivision and building designs.

In Utah, floodplains are relatively small in comparison to those of the Mississippi or Ohio rivers, and alternatives can be found to allow reasonable development and still protect the floodplain. Therefore, many communities in Utah have adopted regulations that, in lieu of floodplain development, limit floodplain fill and restrict the placement of new structures.

In addition to preventing property damage, restricting development in floodplains serves many other important functions. These include water recharge, protection of wildlife and riparian habitat and flood water storage.

Recognizing the value of keeping floodplains undeveloped, FEMA has created a community rating system to provide for lower flood insurance rates in communities that exceed the FEMA minimum standards. Communities can demonstrate that they exceed FEMA standards by engaging in activities such as mapping areas not shown on the FIRM, preserving open space, enforcing higher regulatory standards and managing stormwater.

Downtown Salt Lake City, 1983.



STRATEGIES FOR FLOOD-PRONE AREAS

Local governments often restrict fill within the floodplain through a variety of methods:

- Balance cut and fill whereby the overall flood-storage capacity of the floodplain remains constant.
- Limit fill only as is necessary for construction of permitted structures.
- Limit the total amount of permitted fill per site.
- Specify permitted locations of fill on a site. For example, designate fill for the portion of the lot furthest from the floodplain.

Regulations also center on ensuring all structures are adequately protected from recurrent flooding:

- Buildings may be required to be flood-proofed to within a specified height of flood events. Flood-proofed buildings allow no water to enter below the flood-proofed height. This typically means that at or below the specified elevation there are no entryways or windows or no habitable space.
- Codes also can restrict building siting to non-floodplain lands or to portions of the lot with the shallowest potential flooding.
- Minimum buffers or setbacks from water bodies also may be used. Buffers should be established based on the capacity of the water body and the slope of the shoreline.
- Some codes also limit construction of fences in floodplains so that they do not collect debris or obstruct flood waters.

Wildfire potential

Another hazard often found in the Greater Wasatch Area is wildfire. Ironically, many of the natural ecosystems in this area evolved with and rely upon the periodic natural occurrence of fire – or at least certain types of fire. Frequent, small wildfires tend to clear the ground of fuel preventing the buildup of vegetation which could produce a fire large enough to threaten large, mature shrubs and trees. Small fires also help some plant species germinate, and reduce competing vegetation. Since the pioneers settled Utah, there are fewer small wildfires and, as a result, more large and threatening fires. In addition, development in the foothills and sloped areas has made both property and life subject to catastrophic damage due to wildfire.

▶ **Tragic wildfires have recently occupied national headlines. The May, 2000, Los Alamos wildfires in New Mexico destroyed 200 homes.**

The Jordan River in West Valley.

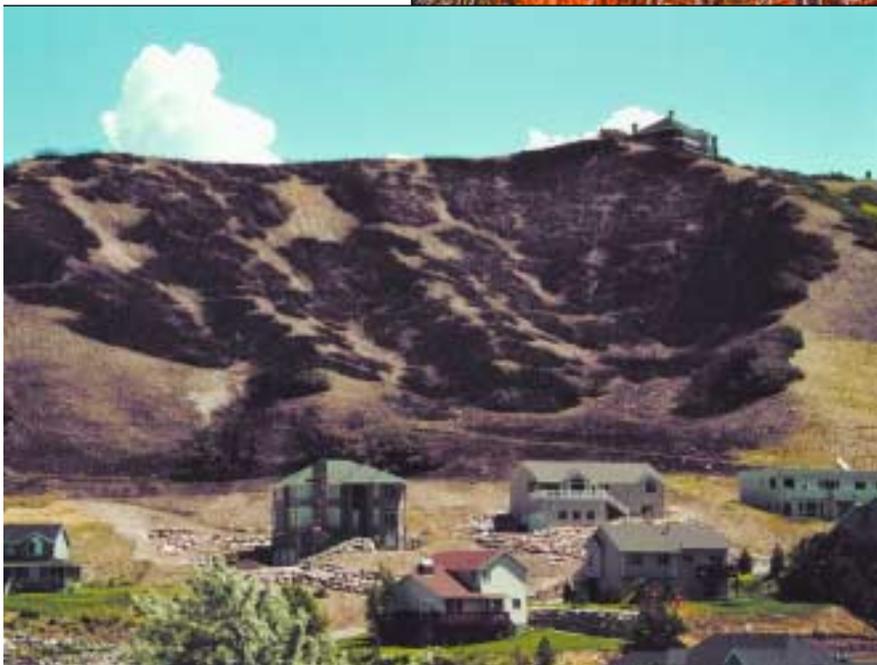


► **The Utah Department of Natural Resources, Division of Forestry, Fire, and State Camps has wildfire hazard ratings as a reference. 801-538-5555**

Areas subject to dangerous wildfires can be identified easily, and strategies to manage wildfire hazards are well known. One of the most common wildfire prevention strategies is to remove vegetation. This, however, may conflict with erosion and wildlife management goals, and vegetation tends to naturally return over time. For these reasons, wildfire management is an ongoing commitment.



A July, 2000, wildfire burned these strands of scrub oak, narrowly missing homes in Bountiful.



STRATEGIES TO ADDRESS LANDS SUBJECT TO WILDFIRE

There are a number of steps that can be taken to prevent or greatly reduce the incidence of wildfires as a land-use hazard. The following steps should be taken at the time of permit application for such development actions as subdivisions:

- The property owner may be required to remove dead, dying and severely diseased vegetation.
- The owner may be required to reduce the interlocking canopy of trees to diminish the likelihood that a fire will spread.
- Adequate emergency access is especially important in foothill areas subject to wildfires. Roads and driveways should be sufficient for emergency vehicles to access and suppress wildfires.

Preserving A Healthy Environment

One of the biggest issues in urban development in the coming years will be identifying and managing areas that have environmental significance. Historically, environmentally sensitive areas have been destroyed to make way for development. Wetlands have been filled, streams buried or turned into culverts and lakeshore areas filled and reclaimed. However, in the last few decades, Utahns have become more aware of the value of a healthy natural environment, and many communities have tried to enact land-use codes that call for a balance between the natural environment and urban areas.

Similar to the management of hazardous lands, an excellent strategy to address environmentally sensitive lands is to create a comprehensive map of areas that are known to, or may, have environmentally sensitive characteristics. In addition, some of the most

effective codes, while clearly spelling out the rules for protecting these areas, also allow for a reasonable amount of development. On the other hand, code language tends to be ineffective when environmental areas are loosely identified and policy standards are vague. In this type of system, communities must make ad hoc decisions about the applicability of code language when each development is reviewed. Sometimes the result is that too much protection is given to insignificant resources and too little afforded to valuable areas.

► **Park City’s Sensitive Lands Ordinance protects prominent ridgelines from development that would impact scenic views.**

Contact Park City Planning at 435-615-5056.

Oquirrh Mountains east of Tooele.



- **Salt Lake City’s “Groundwater Source Protection Overlay District” establishes criteria for regulating the use of substances that pose a contamination threat to groundwater. It also outlines proper sewage and stormwater management in important recharge areas.**

Contact Salt Lake City Planning at 801-535-7757.

Generally speaking, environmentally sensitive lands can be divided into four categories:

- 1] Riparian areas – lands adjacent to streams and lake shores;
- 2] Wetlands – areas that have characteristic vegetation and soil formed by long periods water-saturated soil;
- 3] Wildlife habitat – where important species depend on a particular habitat for food and cover;
- 4] Groundwater recharge areas.

Riparian and lake shore areas

“Riparian” refers to those areas that are adjacent to streams and lakes; often, it refers to floodplains, wetlands and natural habitat found within those areas. Riparian areas are beneficial to water quality when they are preserved and when the streams are lined with natural vegetation. These areas, especially when vegetated, provide stream bank

stabilization (reducing erosion), shade the water (which reduces water temperature), and filter and retain stormwater flowing across the stream buffer. Many studies have been done on the appropriate width of stream-side development buffers and most jurisdictions have adopted 25 - 100 foot buffers. Often the buffer width varies depending on the size of the stream or the area drained by the stream.

STRATEGIES TO ADDRESS RIPARIAN AREAS

Generally, riparian areas should be subject to the same code requirements applied to floodplains. Some exceptions to this rule include:

- Placing an emphasis on the preservation or restoration of streamside vegetation. Often the removal of vegetation is quite restricted, or restoration required, in the riparian buffer area.
- The percentage of disturbed land in riparian areas should be much more restrictive than for a floodplain – a maximum of 10 percent lot disturbance.
- Possibly require disturbed areas to be restored with native vegetation.

The shore and adjacent wetlands of the Great Salt Lake are a key stopover for migratory birds.



Wetlands

Wetlands are recognized nationally as valuable environmental resources. This represents a change of attitude of historic proportions when one considers that wetlands once were viewed as useless nuisances. Wetlands are now valued for their ability to provide crucial habitat, filter water, provide for storm water retention and recharge groundwater.



The national enforcement of wetland laws is conducted by the Army Corps of Engineers. In most cases it is sufficient to preserve the benefits identified above. However, it is important that local codes identify and allow for the replacement of lost wetlands, as the national laws can be much more effective and less onerous if they are coordinated with local land development codes. The QGET database outlines wetlands identified in the National Wetlands Inventory.

In addition, it is important for wetlands to be inventoried as much as feasibly possible. Some communities have established something called “wetland banks,” where small insignificant wetlands in important development areas are filled, and new wetland areas are created in larger contiguous areas. Large, contiguous wetlands are often more viable than many small wetlands.

Wildlife habitat

Important wildlife habitat includes wetlands and riparian areas as well as upland areas such as foothill habitat. Some of the most important wildlife habitat areas to preserve in the Greater Wasatch Area are the seasonal habitats used by migratory animals. The shore and adjacent wetlands of the Great Salt Lake serve as a key stopover on one of the most important migratory routes for waterfowl. Many species’ existence depends on the continued health of these habitats. While encroaching urban areas are not the only threat to these habitats, sensitive lands protection would greatly help preserve these migratory species and also provide the added benefit of nearby wildlife that many Utahns value.



Elk depend on the continued health of upland habitat.

► **Salt Lake County's Foothills and Canyons Overlay Zone is a very good example of a comprehensive approach to protecting sensitive lands and habitat located on hillsides.**

Call Salt Lake County at 801- 468-2000 for information.

In addition to avian habitat, winter range for elk and mule deer is also important. If the winter range is reduced, the herds will become stressed and reduced in size. This is a problem that is subject to cumulative effects. Most urban developments, taken one at a time, do not have a severe effect on winter range. Several hundred developments, built over a decade, can devastate a herd.

Many important known wildlife habitat areas in the Greater Wasatch Area have been identified. QGET has maps of these wildlife habitats, and communities working on plans should get the best available data on these wildlife areas before conducting planning for future development.

Open Space, Agriculture and Our Quality of Life

Protecting agricultural lands

Agricultural lands are valued in Utah for many reasons – their beauty, their contribution to the economy and their value as open space and buffers from other uses. In addition, Utah has a unique bond to the productive land of the Wasatch Area. Agricultural areas have a prominent place in the history and culture of Utah communities. Agriculture enabled Utahns to be self-sufficient in the early history of this region – the pioneers truly created a garden in the desert.



Farmland in Morgan County.

Agricultural lands protection is often controversial due to a frequent misunderstanding of agricultural issues. An important aspect to remember about agriculture is that it is a business and, as with any business, profit is essential for its continuance. Residents who move into agricultural land because of its bucolic nature often are disturbed by the necessities of modern agriculture: around-the-clock harvesting, manure spreading, pesticide and herbicide spraying and the presence of strong odors and flies. Meanwhile, suburban residents can disrupt the business of agriculture by clogging roads with traffic, making the transport of agricultural equipment difficult and hazardous, owning dogs that harass livestock and filing nuisance complaints against farmers.

It also is important to understand that a farmer's land is his primary capital asset after a lifetime of work. Urban residents value the open space that agricultural land represents, but zoning that restricts land use to agriculture only is often resisted by the farmer if the land can be sold for urban development, as that will maximize the return to the farmer.

There are several recommended methods for preserving land for agricultural use. One method is for local governments, especially counties, to adopt zoning codes that allow and encourage the preservation of agricultural businesses. This approach differs from many agriculture-related zoning strategies that aim to protect suburban residents from the nuisances of agricultural business, rather than protecting farmers from negative and disruptive suburban impacts.

Hi-Ute ranch in Summit County.



- **Zoning that seeks to protect suburban residents from the noises and smells of modern farming undermines agricultural business.**

Protecting agricultural business

The more profitable farming remains, the more farmland will be preserved. One method to protect agricultural business is to permit ordinary agricultural operations and allow the vertical integration of the processing and sale of products by the farmers in the same zone. To survive, many small farmers have found that they must process and sometimes sell their products in addition to growing them. In this way they retain the profits otherwise collected by middlemen. With Utah's small average farm size and large number of health conscious residents, specialty farming holds great potential for vertically integrated farms. Specialty farming provides high quality or niche products to the local community.

ZONING STRATEGIES

Zones that are flexible with regard to land-uses that are supportive of the agricultural industry help maintain the profitability of agriculture. Permitted uses in ag-friendly zones may include food processing and storage as well as farm equipment and supply stores.

Zoning can also allow or conditionally allow uses that help farmers supplement their farm income without compromising aspects of the farm economy. For example, bed and breakfasts and restaurants can be complementary to farming and help the rural economy stay viable.

CONSERVATION EASEMENTS

- **In Utah, Conservation Easements are one of the most widely used tools to protect sensitive lands. A Conservation Easement is an outright purchase of development rights between a willing seller and a willing buyer, although sometimes landowners choose to donate their development rights. In exchange for donating or selling the development rights, a conservation easement is placed on the land. The landowner still owns the land, it can still be used for agricultural or other purposes, but additional development is limited or restricted entirely. In exchange for selling or donating development rights through a conservation easement, a landowner receives a significant tax benefit as a result of lower property tax valuation.**

The Utah Legislature saw the value in this approach to Land Conservation when it passed the Quality Growth Act of 1999. This Act created the Leray McAllister Fund, with over \$3 million appropriated annually for Land Conservation through Conservations Easements. These projects must have a local partner and the State dollars coming from the McAllister Fund must be partnered with other private sector or local government funds. Over a dozen projects have been funded to date using this mechanism and fund.

For information contact the Governors Office of Planning 801-538-1556.

Clustering development

Another strategy to protect agriculture is to preserve large contiguous tracts of land by encouraging the clustering of development. Communities often attempt to preserve agricultural land through low density zoning. Large-lot zoning often is not enough to maintain farming uses because this approach is ineffective in preserving contiguous tracts large enough to allow *some* farming to be viable. On the other hand, development clustering is more effective in preserving contiguous tracts with their intrinsic open space aesthetic appeal. However, clustering alone is not sufficient to preserve *healthy* agricultural business operations which require very large unbroken tracts of land. The farmland preserved by clustering alone is typically useful only for marginal farm uses, such as pastures or truck farming. Clustering provisions and very low-density zoning (as opposed to very large minimum lot sizes) together provide the potential for a viable farming economy.

ZONING STRATEGIES

- Clustering helps preserve farmland for open space and at least marginal agricultural use. One regulatory technique to enable clustering is to provide maximum density requirements in lieu of minimum lot sizes.
- Clustering can be encouraged through the use of density bonuses. Density bonuses may be given in exchange for dedicated open space, for land held in a common undivided interest or if the land is dedicated to a recognized land trust. One example is a 60 percent increase in density in exchange for 50 percent open space. Often such density bonuses are only made for relatively large developments of, say, 50 acres or more.

Rural clustering is in the foreground, scattered development is in the background.



► **Effective TDR systems designate receiving zones in areas where market demand is well above zoned allowable densities. Examples of such TDR systems are in Boulder, Colorado, and Thurston County, Washington.**

Transfer of development rights

One method that has been used to protect agricultural lands and other open space is a Transfer of Development Rights (TDR) system. Several other states have TDR programs that have been in use for two decades or more. In Utah, West Valley City recently has adopted a TDR process; development rights from a 600 acre wetland sending area may be relocated to most parts of about half of the city. In a TDR system, an area to be protected is designated as a “sending area” and is zoned for agriculture or some other open space use. A “receiving area” is established in the same jurisdiction. Development rights can be purchased from a property owner in the sending area and used in the receiving area. By buying the development rights from a farmer, a developer can achieve a higher density in the receiving zone than otherwise would be permitted. The beauty of a TDR system is that the compensation amount is determined privately between the property owners involved – and the result is permanent protection of the farmland.

ZONING STRATEGIES

■ Codes must establish sending zones (land to be protected), and receiving zones (those areas where additional development is desired).

■ Transfers work best when development rights are exchanged privately. Normal development reviews are followed and development credits are tracked, but exchange prices and transactions are negotiated privately so as not to encumber the exchange process.

■ Transfer of Development Rights can be established between jurisdictions as well as intra-jurisdictional. Similar ordinances must be adopted in both jurisdictions with an inter-governmental agreement.

■ A maximum receiving zone density should be established to prevent incompatible densities.

■ Examine receiving zone requirements that limit densities to ensure that transferred development rights do indeed increase the overall density. Landscaping, setbacks, maximum height requirements and even parking requirements should be examined to determine if they limit maximum densities in such a way that transferred rights cannot increase the density of a development.

Agricultural protection planning practice

1] Designate an agricultural protection area.

Utah Code, Title 17-41-201, provides for Agricultural Protection Areas. According to this law, local ordinances must exclude normal and sound agricultural operation or activities from public nuisance definitions if they are located in “agricultural protection areas.” This legislation helps farmers defend themselves from nuisance claims from encroaching suburban residents. To take advantage of this state law, the city or county government must designate the land as a protection area. Preliminary steps include a signed petition of the majority of property owners in the prospective area.

2] Support cooperatives.

Seed money and guidance can help local farmers in your community develop cooperative purchasing, processing, marketing or retailing. Encourage agricultural support businesses. Incentives to attract agricultural support businesses such as seed and feeds and tractor and farm machinery sales and service can help solidify the local farm-based economy.

3] Buffer open space.

Used to help avoid conflicts between farmers and their suburban residential neighbors.

4] Adopt agriculture-friendly zoning.

Agriculture-friendly zoning outright permits farm uses and also is flexible with other aspects of the farming economy such as processing plants and food and equipment sales.

5] Identify areas in the general plan that will not develop within the long-range planning period.

Farmers will not likely make long-term capital investments unless they have an assurance that the farm economy infrastructure will

Zoning that permits food and equipment sales helps maintain local farming economies.



last long enough for them to recoup their investment. This tool simply maps the estimated geographic area that will not receive city services and urban development within, at least, the next 20 years.

6] Support and maintain contiguous farming areas.

Suggestions for accomplishing this include land banking, outright purchase of conservation easements and purchasing rights of first refusal for farmland. Up-zoning in response to encroaching urban growth should be done in a way that keeps contiguous areas in farm-friendly or very low-density zones.



7] Develop farmers' markets in urban areas for local agricultural sales.

Farmers' markets offer an advantage to both sellers and buyers by removing middlemen from transactions.

8] Allow rural cluster development, also known as conservation subdivisions.

These subdivisions preserve the rights of property owners in terms of gross density or total numbers of permitted units but protect relatively large contiguous areas for farming. This tool is discussed above under "Clustering of Development."

A farmer's market is an urban amenity that provides a place for farmers to sell directly to the public.



Regulatory Protection

Limits on protection

Before regulating private property rights, it is important to consider the legal issue of “taking without just compensation.” Under the U.S. and Utah court decisions, regulations can diminish the value of land without constituting a taking if there is a connection between the regulation and the public’s valid interests (a “legitimate public interest”). However, public opinion and the local view of what is fair often act as a more restrictive standard than the technical legal limit of what can be regulated.

Sensitive lands regulations should clearly document the public purpose of the regulation. There often are overlapping reasons for protecting lands, from natural hazards to environmental areas to aesthetics. Regulations should be clear about what is being protected and why. Another safeguard to avoid takings claims is to adopt regulations that establish a clear minimum property right to ensure that each property retains some economic benefit for the owner.

It is important to note that regulations that limit the use of private property can be more restrictive without creating a taking than regulations that require the dedication of property to the public. The legal standards for a dedication of land – even if the land is, for example, on an unbuildable floodplain – are much higher than legal standards for a regulation that restricts development of the floodplain.



An airphoto is a valuable tool to develop and check a sensitive lands map. This is an aerial photo of a 100 Year Flood.

Natural hazard and environmental areas regulatory protection

Regulations for natural hazard or environmentally sensitive areas typically take two different forms in their design. One form is text-based. It operates through text definitions of sensitive land based on land characteristics such as slope or the distance from a stream or hydrologic feature. In a text-based system, when someone applies for a development permit, he or she must conduct a study of these environmentally sensitive characteristics and delineate the land area subject to regulation. Government officials then review the results of these private studies. With some exceptions, this is the way wetlands are regulated by the federal government. It is advisable that the applicant contact the Corps of Engineers prior to beginning design work.

The other type of regulation is map-based. In this system, an official map is adopted and the regulation takes the form of an overlay zone. If an area is defined in the map, it is subject to regulation. Typically, there is a provision to adjust the map based on better data that the applicant may supply. However, if an area is not on the map, it is not regulated – even if it meets the criteria for inclusion (thus the map must be drawn with great care). Floodplains are regulated this way through FEMA's recommended code.

We recommend that the map-based system be used in conjunction with text. This technique gives property owners specific notice of regulatory effects. The maps can be adjusted for minor deviations, for areas where development has already occurred, or for areas where development is more important than protection, such as in a downtown area. This system also allows the overall regulatory impact to be estimated by the jurisdictions. For example, a city can use the sensitive land map to help determine the town's development capacity. This has been discussed more in a separate workbook called the "Model Codes and Analysis Tools for Quality Growth," published by Envision Utah in December, 2000.

Developing the map

The “Model Codes and Analysis Tools” workbook includes instructions on how to develop a basic sensitive lands map consistent with the zoning strategies outlined in this chapter. This data should serve as only the beginning of a sensitive lands map, which should then be field-checked and reviewed with property owners. Overlaying the map data and tax-lot boundaries on an ortho-registered digital air photograph is a very useful technique to review and adjust sensitive lands maps. This technique is possible in most jurisdictions today with minimal effort.

Zoning and the sensitive lands map

While sensitive lands often are addressed using overlay zones, the underlying zone should be considered as well. Areas with severe constraints should be zoned for low-density development. As the environmental constraints increase, the density should decrease. Clearly there will be

exceptions to this rule, but underlying zoning that permits relatively high development density, which overlay regulations then greatly reduce, often creates conflicts with property owners. Generally, the more sensitive land an area has, the closer the overlay zone should be to the underlying zone in terms of permitted development intensity.

Density transfers

One of the most effective regulatory provisions in mitigating reduced land values is a density transfer system. With density transfers, a property owner has the right to the same number of units and allowable uses, but the units are transferred on the same parcel from more sensitive land to less sensitive land. With density transfers, the owner’s overall development rights are not subject to approval through a discretionary decision-making planning process.



Existing site has a significant stand of trees and a pond on a steep hillside.



Minimum lot size regulations encourage development of uniform lots that ignore the natural characteristics of the site.



A density transfer allows a property owner to develop the same number of units on the site while preserving sensitive natural features.

Percentage disturbance standards

Some areas do not need to be left completely undisturbed to be adequately protected. For example, riparian areas can survive quite well with some disturbance as long as the developed land is not immediately adjacent to the stream. Recognizing this, some jurisdictions allow a 10 to 30 percent clearing of the outer parts of buffer areas.



Although we cannot predict or always control lands that are subject to wildfires, we can take steps through the planning process to control the types of development that occur on those lands.

Summary

The issue of sensitive lands is something that Utahns cannot ignore. Sensitive lands – whether they are environmentally delicate or pose a hazard to humans – are there for the duration and should be respected for their longevity, as well as for their role in where and how we live. Fortunately, there are ways to mitigate or make compromises that will accommodate both human need to occupy the land and nature’s need to simply be the way it has been for generations. While we cannot predict or always control lands that are subject to flooding and wildfires, we can take steps through the planning process of reducing or controlling the types of development that occur on those lands. Agricultural lands also fit into the category of sensitive lands – primarily because of their special needs, their importance to the area’s economy and the pressures they face as development encroaches near their borders.

2

Meeting Housing Needs

The Role of Housing

► **Quality design is paramount for small-lot and yard-free housing to be compatible with standard single-family homes and community expectations.**

Shelter is among the most basic of human needs – we cannot live without it. Yet in most modern societies housing is much more than just shelter – it expresses many cultural values held by the occupants. In addition, a government’s laws and ordinances may direct the style and location of housing. In Utah, as in most of the United States, housing is constrained by



One can hardly tell, but a glance at the sign reveals that this building in Bend, Oregon is occupied by a small retail shop on the main floor with a housing unit above.

many local and state laws, contained primarily in zoning and building codes. Where and how new housing is built in turn drives many other aspects of our lives and can create a domino effect of changes and important livability decisions.

In the Greater Wasatch area, new housing is frequently built on former farm or ranch lands. Rooftops and pavement are built, which increase storm runoff and create the need for an urban storm drainage system. Modern sewer and water systems must be built. New residents require police, fire-fighting, schools and other services. New roads must be built, since the majority of these new residents will drive to almost all their destinations. This new traffic also will consume available capacity on existing roads, increasing congestion and emitting additional pollutants.

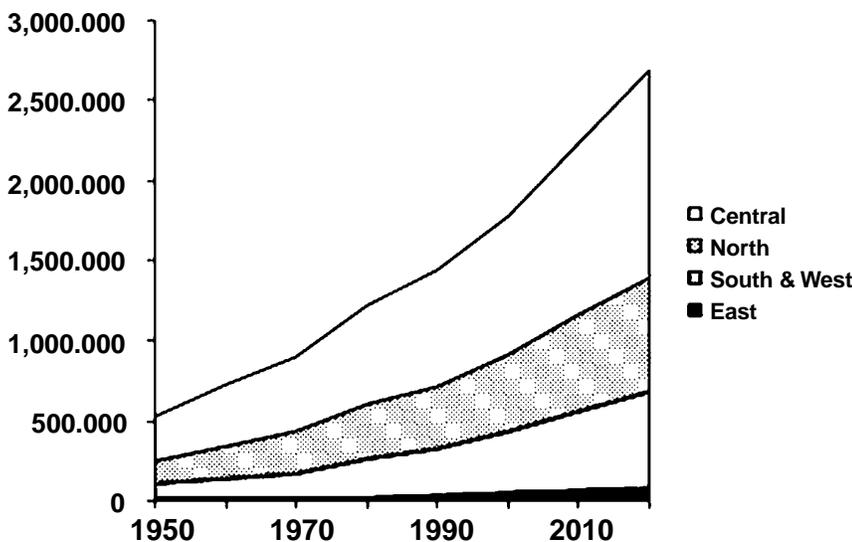
► **Greater Wasatch Area population is expected to grow from 1.7 million in 2000 to 2.7 million in the year 2020.**

Considering the impacts, it is not surprising that new housing construction often is the subject of controversy. Neighbors know that it will bring many changes. However, in this chapter, our primary concern is how to use local planning and zoning tools to ensure that the achievement of housing needs is not frustrated by local government regulations. With an eye toward present and future population trends, community leaders and planners can design zoning codes to meet the market demand. At the same time, the codes can ensure that the location of housing in a community is compatible with neighboring uses and avoids the negative impacts of development.

Fortunately, many of Envision Utah's strategies to meet tomorrow's housing serve a variety of other purposes, including: making our transportation system more efficient, reducing the costs of new infrastructure, building walkable communities, conserving open space and restricting development on sensitive lands. However, most of these strategies cannot be put into practice with the zoning and planning systems commonly used today. This chapter covers the methods that can be used to achieve a housing supply that matches the needs of the future population while ensuring compatibility with lower-density housing types. This chapter also outlines how to best use that new housing mix to achieve other goals such as making our community pedestrian-friendly. A pedestrian-friendly community supports neighborliness and is accessible to children and the elderly as well as automobile drivers.

Population in the Greater Wasatch Area by subregion, 1950 to 2020.

(State of Utah Long -Term Economic and Demographic Projections, 1997)



Utah's future population

The Wasatch area has grown rapidly in the last few decades – this should come as no surprise to residents. The region is predicted to continue to grow by 2.2 percent per year. Two-thirds of this growth is expected to come from our children growing up, settling in this area and starting their own families. (*Econorthwest, 1999*)

Utah has a unique demographic characteristic that comes in part from the value we place on having children. The nation as a whole, including Utah, experienced a baby boom after World War II. However, Utah's baby boomers had more children than their non-Utah counterparts and had them earlier in life. The children of Utah's baby boom generation are expected to continue this pattern of relatively large families.

Other national demographic trends also are evident in Utah. There are more single-parent households than in the past, and more people are choosing to live alone. The rise of single-parent and single-person households means that average household sizes are dropping and the number of new households is increasing faster than population.

Single-parent and single-person households also tend to have lower household incomes. (*Econorthwest, 1999*)

Housing choice is a very personal one and there is within each identifiable demographic group a diversity of preferred housing types. In addition, housing choices change over time, as innovations in housing come on the market and achieve success. In short, the kind of housing that is optimal for each person or family changes over time, is different for individuals, and is affected by market innovation.

Income and housing

Other than personal taste and family situation, household location is the most important factor in making a housing choice. As in many aspects of life, people must balance what they would like with what they can afford. Housing affordability is the term used to describe the ratio between a household's income and the cost of the housing. Guidelines from the Federal Department of Housing and Urban Development (HUD) specify that no more than 30 percent of a person's income should be spent on housing. Typical mortgage

► In 2000, 43% of households at or below the median income level cannot afford an average home in the Salt Lake City area.

(National Association of Home Builders Housing Opportunity Index)



An example of housing with parking located behind.



These townhomes are owner-occupied at 12 units per acre.

The intersection of life cycles and housing preferences.

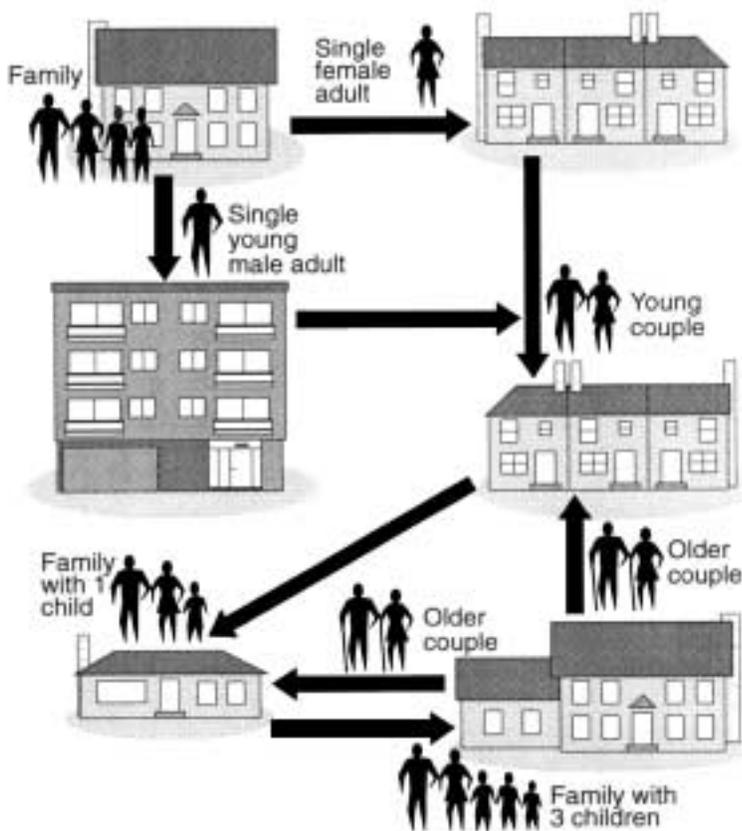
(Clark & Dicleman, 1996)

lending rules limit housing payments to no more than 28 percent of a household's gross income. These limits help define the available choices for housing type and location available to people in the future.

We can then define the probable mix of housing that people will choose in the future, assuming that there is a wide range of housing types available, by looking at what types of housing people in various demographic groups currently select, and comparing these preferences to expected housing costs.

What kind of housing will be needed?

Based on the population forecasts prepared by the state of Utah (Governor's Office of Planning and Budget), the household mix of the Greater Wasatch area will change during the next 20 years. There will be a rise in senior households (head of household over 60 years) from the current 21 percent to 27 percent in the year 2020. Household size will decline from 3.15 people per household in 1990 to 2.78 in 2020. Decreasing household sizes mean the number of new households will increase proportionately faster than the population. Household sizes are expected to decrease as a result of more single-person and single-parent households and fewer two-parent families with children. Assuming that real incomes will remain more or less the same, smaller households mean there will be less demand for large-lot, single-family homes and more demand for smaller, less expensive housing. There also will be more demand for housing types that require minimal maintenance.



The Mismatch Between Housing Needs and Zoning

The problem with zoning

Zoning evolved in the early 20th century as a means to stabilize property values and reduce conflicts between land uses. Zoning's roots are in ordinances that prohibited nuisances, such as the odors and pollutants associated with tanneries or smokestacks. These early ordinances were innovative for the time because they sought to prevent conflicting land uses, rather than trying to remedy them after the fact. Early precursors to zoning listed a few obnoxious uses that were prohibited within any given district. This practice logically led to a map-based system in which the entire city was divided into distinct districts, each with a list of permitted and prohibited uses.

While early codes primarily dealt with separation of industrial and residential uses, it was not long before different classes of residential uses began to be separated from one another. Traditional neighborhoods usually contained a variety of housing types: large

family homes, cottages, boarding houses, duplexes and small apartments. Early zoning first separated apartments from other residential areas. Zoning subsequently evolved to separate duplexes and, finally, zones were created that separated single-family homes from one another based on lot size.

Why did zoning evolve into such a detailed division of residential uses? One of the primary reasons communities regulate home type and lot size is that impacts from housing development – especially traffic – sometimes increase with density. Even though region-wide, low densities increase rather than decrease overall traffic and congestion, the local impact of a high-density development can be significant as well. Individual localities focus more on the impacts of individual developments than the regional impact of a generalized pattern of growth.

Senior-oriented housing.



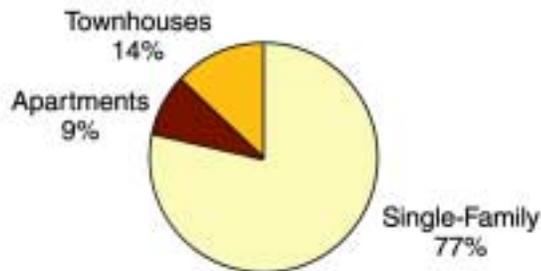
The graph on the left represents the housing supply that will be added between 1998 and 2020 based on current zoning. The graph on the right represents the additional housing units needed to balance total 2020 supply with expected 2020 housing demand based on expected 2020 income and demographic characteristics. (AGRC, FCA, EcoNorthwest, 1998)

There also is a darker historical reason for the distinction between various housing types. Zoning often was used as an explicit way to discriminate among population groups. People were separated into different neighborhoods based on income, sometimes resulting in divisions among different age groups, ethnic origins and race.

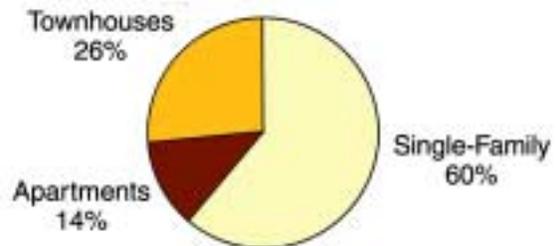
Even when neighborhoods differ from one another due to housing types, an overall balanced housing mix may be achieved. But the pervasive misconception that higher density alone causes crime, pollution and congestion has resulted in entire communities limiting the choice of housing to a very narrow range of options – usually large-lot, single-family housing types.

The cost of low-density housing to our communities can be significant. First, overall housing prices are generally higher with less housing within financial reach. Those who cannot afford the higher costs of large-lot, single-family housing – namely the poor, the young and the old – are limited to living in relatively few areas. As a result, they often are forced to travel long distances to their jobs. Driven by negative perceptions of housing types that are different from single-family housing, we are developing neighborhoods and communities that do not respond to the housing choices Utahns would make in an open housing market.

Additional housing supply from 1998 to 2020.



Current Zoning



Balanced 2002 Housing Demands

Zoning as a tool to create good housing options

It is speculation as to what housing choices would be without the current zoning regulations that frustrate the housing market. Nonetheless, we do not advocate the removal of zoning because it is an important tool in managing growth. Our recommendation is that each community look at the overall effects of its zoning code and adjust regulations to meet the needs of both those who already live there and those who would live there if appropriate housing choices existed. In addition to providing a better fit between housing supply and demand, this strategy can be used to achieve a walkable community – one that provides a more coherent and efficient community that discourages sprawl and better conserves our resources, agriculture and open spaces.

Envision Utah and QGET's research calculates the additional housing supply from 1998 to 2020 if zoning remains constant in the Greater Wasatch Area (AGRC, FCA, EcoNorthwest, 1998):

- 77 percent single-family houses
- 14 percent apartments
- 9 percent townhomes and duplexes

Again, this mix is constrained by zoning and does not represent the housing mix based on expected open-market conditions.

According to the same research, the additional housing mix needed to match expected 2020 housing demand based on expected 2020 income and demographic characteristics, an open-market approach would yield:

- 60 percent single-family houses
- 26 percent apartments
- 14 percent townhomes and duplexes

The difference between future supply based on zoning and based on actual housing preferences is not, for the most part, composed of a large deficit in available rental

▶ WHO NEEDS MODERATELY PRICED HOUSING?

Many people need housing that is more affordable including our teachers and policemen, young families buying their first home, single adults and the elderly.

A triplex in Bountiful that resembles a single-family home.



► **The Envision Utah Quality Growth Strategy uses existing infrastructure with more efficiency. Compared to the baseline 2020 growth scenario, (the future based on current trends), the Quality Growth Strategy reduced total infrastructure cost by \$4.5 billion.**

[Envision Utah Quality Growth Strategy and Technical Review]

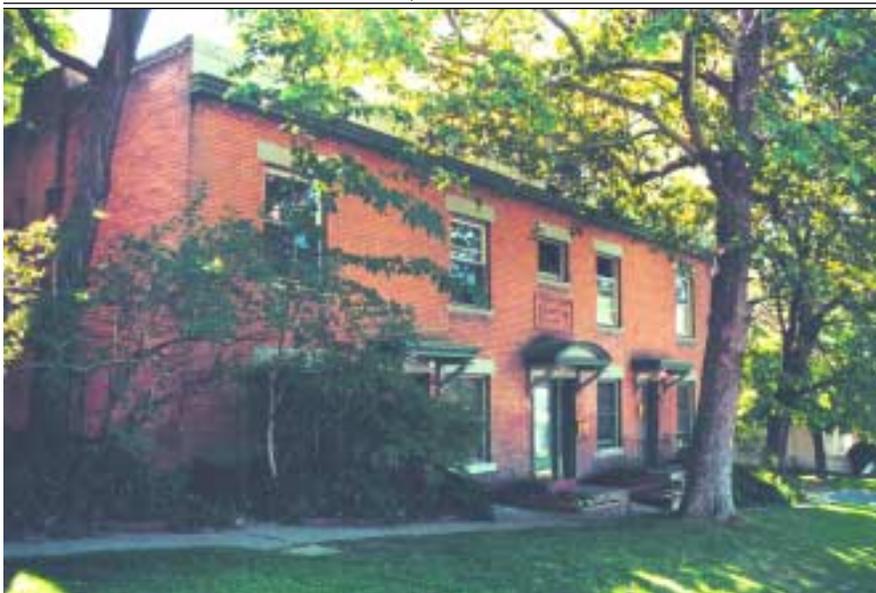
housing. Instead, there aren't enough for-sale housing alternatives to large-lot, single-family housing units. There are smaller quantities of townhouses, duplexes and small-lot, single-family homes in Utah than elsewhere in the United States. In the next 20 years, the supply of housing types and overall housing preferences likely will continue to diverge as the demand for a range of housing choices increases and as zoning continues to constrain housing options to large-lot homes. In addition to a shortage of townhouses and duplexes, single-family lots are expected to increase in size – and therefore expense - further increasing the disparity between the housing supply and the market demand for housing.

There are growing indications that many developers in the Wasatch Area are willing to invest in a greater variety of housing. The challenge for Utah cities and counties is to ensure that their zoning regulations, taken as a whole, do not limit the availability of housing that is needed and desired by our residents. In developing a palette of housing options for the future, Utah cities and counties should use the different housing types to their best advantage. If properly sited, townhouses, condominiums and apartments can be used to help meet many community goals such as the creation of walking-friendly communities and increased transit use. These housing types can also help conserve open spaces sensitive lands.

A basic tenet of livable communities is good design, particularly when providing more dense and inexpensive housing types.

Higher density housing types should be designed so that they seem part of the overall community, free of the negative visual qualities that often turn communities against housing that is not for large-lot, single-family use. In this chapter we do not recommend detailed architectural guidelines but instead suggest site design standards that will make a community both pedestrian-friendly and compatible with the character of the neighborhood.

Historic rental apartments in Salt Lake City.



Moderate Income Housing and Utah Law

Utah law is quite clear that all communities must plan for a sufficient amount of affordable housing. State law requires communities to plan to meet their five-year moderate income housing need, including an estimate of moderate income housing supply and demand and a survey of current residential zoning. The state law also requires communities to evaluate their zoned densities, one of the biggest factors in making housing affordable.

Making a mix of moderate income housing available is important to a community that wants to be responsive to the needs of its residents. In the 1990s, Utah housing went from one of the least expensive housing markets in the western region to one of the most expensive. Similar rises in housing prices have been recorded in other popular western cities such as Denver and Portland. If the widespread practice of zoning for mostly large-lot homes is not modified, economic problems will increase and people will be extremely limited in their lifestyles and household choices.

Utah Code Annotated, 10-9-307, requires communities to meet 5-year projected moderate income housing needs. Each locality was, by December 1, 1998, to put a plan in place (part of the general plan) to identify the affordable housing demand and how it will be met. Plan is to include:

- a. an estimate of the existing supply of moderate income housing located within the municipality,
- b. an estimate of the need for moderate income housing in the municipality for the next five years,
- c. a survey of total residential zoning,
- d. an evaluation of how existing zoning densities affect opportunities for moderate income housing, and ,
- e. a description of the municipality’s program to encourage an adequate supply of moderate income housing. (Moderate income defined as 80 percent of the median gross income.)

There are many benefits to having a diversity of housing in each community:

1] As people move through life’s various stages, they can live and grow in the same community. Young couples, families and the elderly can live near relatives. Children may grow up knowing people from different ages, walks of life and from different income groups.

2] There is less demand on infrastructure. Envision Utah’s studies show that greater choice in housing would reduce land consumption and increase redevelopment, thus reducing demand for new sewer, water and transportation infrastructure significantly.

► **Built Green Utah is working to encourage environmentally friendly building practices – "green building" – in Utah. Homes built to green standards may be more affordable, due to lower operating cost and higher performance, and may also offer home buyers greater comfort, reduced maintenance cost and higher resale value. Built Green is a voluntary program spearheaded by Fannie Mae that provides a range of tools to assist builders and lenders in providing reasonably priced, environmentally-friendly buildings.**

Contact Fannie Mae at (801) 715-6863 for information.

More information on Built Green Utah and tools to increase homeownership are included in the appendix to this workbook.

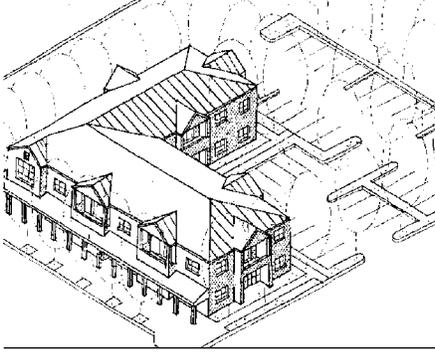
3] Also, if communities are designed in a manner that is conducive to walkable and transit friendly neighborhoods, the demand for additional road capacity reduces.

4] With more choice, housing can be made available where there is demand for it. More people will be able to choose locations that allow for less driving and that are close to shopping, work and school.

5] Providing housing choices in each community allows more families the opportunity to choose from a variety of locations while keeping their housing costs within their budget. A diversity of housing can aid in reducing both homelessness and the impacts of poverty by keeping housing costs within the range of more families.

Changes to zoning alone are not sufficient to remove the disparity between housing need and supply, but they remove obstacles to solving this problem that have been created by the public sector. Our recommendations don't seek to make zoning more restrictive, but instead outline tools to make zoning more flexible and responsive to market forces.

New Housing Types to Consider



Mixed-use housing above retail.

In developing a housing strategy, communities should look to a variety of housing types to meet the range of housing alternatives people prefer. Our zoning codes often offer limited alternatives to detached housing and apartment complexes. The housing industry has adapted to this unfortunate trend. Financing, building and marketing have become standardized and adapted to national markets.

Encouragingly, however, new hybrid housing types, which utilize some characteristics of single-family housing with the advantage of increased convenience and affordability have evolved in the past decade. The following are some housing types that should be considered.

Traditional mixed-use housing and retail in Salt Lake City.

Mixed-use housing above retail

Traditional neighborhoods and business areas often contain housing on the upper floors of retail establishments, or they mix apartments and shops on the same street. In districts where pedestrian access is a goal, it is still a good strategy to provide these types of housing. Recent developments like this have proven popular in the Salt Lake City area, as well as in other western cities. A major advantage of this type of mixed-use development is human activity at night and on weekends, resulting in healthier commercial areas.





Courtyard apartments

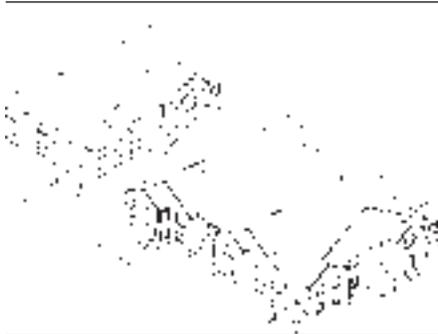
Before apartment projects became conglomerations of identical units, apartment houses often sat in residential neighborhoods, close to shopping. The best of these designs included courtyards near the entry, occupying about one-fourth of the lot area. These courtyards provided charm and open space, while the apartments were fairly dense, in three-story designs. These styles have made a comeback in many cities but are precluded by many suburban height and parking zone standards.



Top: Courtyard apartments near downtown Salt Lake City.

Middle and right: Courtyard apartments in a single-family neighborhood.





Big-house® apartments.

“Big house”® apartments

Some traditional neighborhoods have very large homes that were originally built to accommodate large extended families. Later, these large homes were converted into apartments to provide housing for family members in their later years or to provide housing for smaller families. From these historical examples, some developers have learned how to design apartments to fit into neighborhoods: apartments can be designed to appear to be a large home while accommodating two, four or even eight units.

This “Big House”® includes 4 owner-occupied units



Big House® Apartments, roughly 20 units per acre.

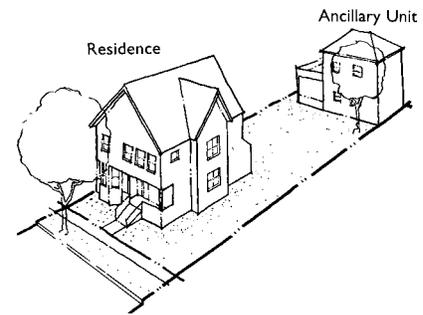
► **Some communities attempt to limit accessory units to owner-occupancy while others have implemented them through conditional use permits. We recommend each community use accessory units as they feel comfortable. Experience and familiarity will illuminate how to locate and design this housing type for either owner-occupancy or rental use.**

An example of live-work homes in an old warehouse.



Live-work units

Before zoning existed, people often conducted work from their homes, sometimes complete with a separate entrance and discreet signage. This traditional housing type recently has been rediscovered and is now known as a live-work unit. Zoning to accommodate a live-work unit must permit certain businesses to operate and, unlike zoning provisions for “home-occupations,” must allow office use by non-resident employees and customers. While retailing typically is prohibited, everything from professional services to small manufacturing can be home-based. The total non-residential work space in live-work units usually is limited to between a few hundred square feet and roughly 2,000 square feet.



Accessory (ancillary) dwelling unit.

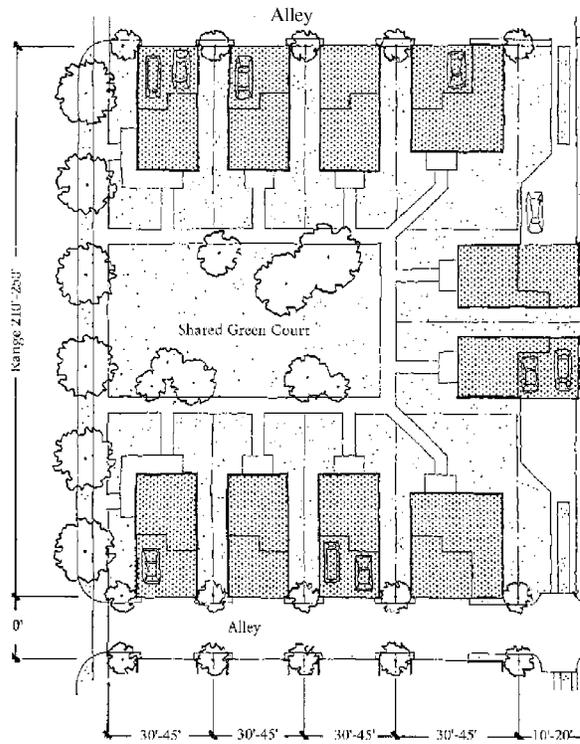
Accessory dwelling units

When extended families were housed on the same site, they sometimes converted a basement, carriage house or guest house into separate living quarters. Often separate servants’ quarters were included in large homes. Curiously, this sometimes is permitted today in otherwise strictly exclusive single-family zones. Modern accessory dwelling units are often built over the garage. These units can be used as a studio, a teenager’s bedroom, or rented as a separate apartment to help offset the cost of a mortgage.

Live-work units in Salt Lake City.

Garden courts

A garden surrounded by urban housing has been one of the most successful development types for higher density housing in history. This housing type evolved in large European cities of the 17th century. Residents found that they had all the conveniences of living in the city but were also able to enjoy a bit of greenery and space in an otherwise crowded community. Many of those early housing developments are still around today, and their property values reflect their success. The idea was used in some of the most beautiful American cities, from Boston to Savannah, Georgia. Modern examples of small-lot homes or townhomes surrounding a green or plaza area also have been very successful. Typical modern zoning, based on minimum lot sizes, makes such housing difficult to develop. Densities may be the same as permitted, but minimum lot size code language is too inflexible to allow a portion of the lot area of each unit to be shared in a common green.



Garden court.



Garden courts in Washington State.

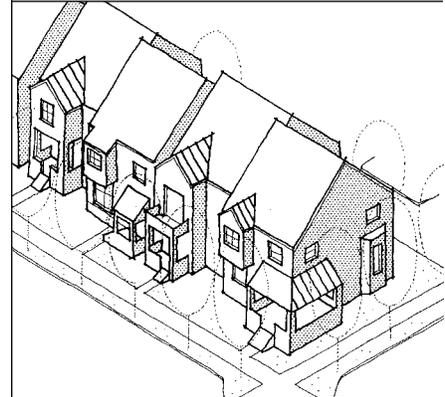




New townhomes representing traditional design.

Alley-fed townhomes and cottages

Early subdivisions often contained alleys. Without zoning, buildings could be built from one property line to the other. To ensure access for trash removal and service deliveries, alleys were reserved in each undeveloped block. During the 20th century, alleys fell out of favor but recently have been reintroduced to serve as garage access in small-lot and townhouse developments. When small-lot and townhouse developments have garage access from the street, the streetscape becomes a continuous line of garages and driveways. With garages accessed from the alleyways, the street is absent of driveways. Zoning that allows an inverse-crown curb



Alley-fed townhomes.

design helps make alleyways less expensive and more feasible. Some suburban city engineering departments, unfamiliar with alleys, have required the same development standards as public streets (wider widths, curb and gutter, sidewalks), making alleyways prohibitively expensive.



Townhomes in Draper's South Mountain area.

What's the Solution?

Envision Utah does not advocate the elimination of zoning. Utahns should continue to benefit from the way in which zoning protects property values and ensures predictable future land use. We do believe, though, that much of today's zoning should become more flexible and inclusive. Some of our proposals run counter to some of the current practices of local land-use agencies. However, we believe that they are feasible and will work to improve dramatically the available selection of housing for area residents while improving their overall quality of life. Generally, our recommendation is to develop zoning that allows a variety of housing types in each neighborhood, defined as about a one-half square mile area. Following are some recommendations that we believe will help address housing issues for Utahns.

Zoning should allow a variety of housing in each community.

Balance the number and size of zoning districts with the demand for various types of housing

This recommendation supports a fundamental provision of Utah State law, UCA 10-9-307, that each community should provide sufficient choices for all kinds of housing. While the current state law focuses on moderate income housing, we recommend that a diversity of housing be permitted and encouraged by local zoning.

We do not recommend zoning without density limits. Limits on gross density help a community control impacts on infrastructure and local services. The best strategy is to concentrate on quality city-scale design while aiming to meet housing needs. A community should mix and arrange the various uses and densities so that

► **Some citizens connect higher density rental housing to lower levels of property maintenance and higher rates of crime.**

■ **Certain zoning techniques can be used to address these concerns.**

■ **Condominiums fill an important housing role for singles, empty-nesters and those who seek affordability.**

■ **Zoning language can ensure that a large percentage of housing is designed to appeal to buyers. For example, apartments or condominiums can be limited in a performance subdivision to less than eight to twenty units per structure or complex.**



► **The walking commute:**
Housing types that are easier to afford for the young and old can be placed next to shopping and work opportunities to help build a community where day-to-day activities may be accomplished on foot.

New modern townhomes with traditional exterior materials.



an optimal city-scale design emerges, complete with quiet neighborhoods, parks and busy business districts. Height, bulk and design regulations can be used to control the densities in any given area. Cities would continue to have their own unique character and design emphasis.

Balancing zoning with housing demand involves a number of somewhat technical steps, outlined in the “Model Codes and Analysis Tools for Quality Growth” workbook. In general, an accurate estimate of the capacity of local existing zoning, categorized by housing type, is compared with the local share of the countywide forecast for housing demand by type. Zoning is then adjusted to eliminate any disparity between future supply and future need. This allows the full range of desired housing types to occur in each city, according to the long-term preferences of present and future residents. With periodic monitoring and updating, cities and counties can be well planned and be flexible enough to meet future housing needs as they may arise.

Adopt performance-based development regulations

One of the major goals of zoning is to provide predictability of land use and to mitigate negative impacts. Most Utah cities and counties use a kind of zoning that prescribes a specific solution to each potential land-use conflict. Density, for example, is regulated by lot size. Minimum lot sizes achieve the goal of limiting density but do so with a rigid solution that limits the kind of housing provided.

Like typical zoning, regulations that are “performance based” also define acceptable levels of impact but leave the solution to the creativity of the landowner or developer. For example, a performance system regulates overall density to control impact, just as a minimum-lot-size regulation does, but it permits a variety of housing to be built within a given development. Under the minimum-lot-size system, a developer penalizes himself with fewer housing units if he varies from the absolute minimum standard specified in the code. Other performance standards, such as allowable lot coverage, open space area minimums and landscaping percentages can achieve some of the same results as yard setbacks but with more flexibility.

Performance standards have been criticized as difficult to enforce. Standards based on complex factors such as noise or traffic levels often are difficult to predict and enforce. The model code we recommend, for ease of enforcement, is a hybrid of simple performance standards and more traditional zoning standards. We also recommend performance-oriented street standards, where minimum street widths and improvements are diminished for streets with a low expected traffic flow.

In addition to performance-based standards, it is important to permit a wider variety of uses than included in typical modern zoning. The code language in the Model Code document is flexible: Accessory units and live-work units are permitted in some lower density zones and offices and mixed-use retail can occur in higher density zones.

Adopt basic design standards for small-lot, townhouse and multi-family development

One reason that large-lot, single-family zoning often is adopted in lieu of performance standards is that the design of low-density, single-family areas is fairly

predictable and in line with community standards or comfort levels. The design of higher-density housing types often is much less predictable and often unacceptable to nearby residents. While we do not recommend detailed design standards for architecture, we do recommend that simple, effective design standards be adopted to ensure that diverse housing types will meet the community's design expectations. Small lots less than 6,000 to 7,000 square feet, attached housing, zero lot line housing and the various forms of multi-family housing often are better accepted by residents when basic standards for landscaping, building placement and materials are adopted. The next chapter will address design standards in detail, but we maintain that it is important to combine design standards with the more flexible performance standards recommended in this chapter.



An example of court-yard housing.

Addressing Housing Needs in Your Community

Once zoning or comprehensive planning capacity is adjusted to allow enough overall housing to be built, the next step is to ensure that regulations permit the specific housing types needed by the market. As we mentioned before, performance-based subdivision regulations go a long way toward allowing variety in housing types. Many national performance-based codes exist, but “Model Codes and Analysis Tools” includes a simple add-on model code chapter that allows a community to conduct performance-based development without

a complete rewrite of other local ordinances. The code language acts as a complete package that includes the sensitive lands protection recommended in Chapter 1 and the design standards recommended in Chapter 3.

The recommended code includes simple performance standards based on major impacts, such as gross density. Street standards are on a performance basis as well, with minor streets requiring fewer improvements than major streets. If language does not exist elsewhere in a community’s code, additional standards – lot coverage, landscaping and tree canopy requirements – may be necessary to implement the included model code.

The performance standards do not rely on minimum lot size requirements. Density is controlled by units per acre, and landscaping is controlled by lot coverage and landscaping standards. Design standards do not dictate architectural style, but ensure projects are at a level of quality to meet a community’s aesthetic requirements.

Alley-fed single-family homes that share a common wall.



NON-REGULATORY SOLUTIONS

While land-use planning is the focus of this toolbox, there are many other tools a community can use to increase the choice and affordability of housing in the community:

- Rehabilitation loans for existing but uninhabitable housing stock
- Lower permitting fees for affordable housing construction
- State or federal funds or tax incentives
- Programs offered by the Utah Housing Finance Agency
- Affordable housing programs administered by the Department of Community and Economic Development

Condominiums with retail on the ground floor



Summary

Planning and land-use regulations are necessary components of modern cities. However, the current process of zoning and planning often conflicts with the proper functioning of the housing market. In the Greater Wasatch area, the market distortion has artificially increased the supply of housing toward large-lot, single-family housing. If zoning remains as-is the mismatch between housing market demand and supply will become further skewed. This chapter outlined tools to enable zoning to be more flexible while maintaining control over development impact and ensuring quality design.

Providing people with a range of housing choices has many positive aspects – both for the community in general and for individual families. For the community, a market approach to housing consumes relatively less land and provides housing types that can serve as the backbone for communities that are walkable and support transit use. As individuals and families move from one stage of life to the next, a market approach enables them to live in housing that suits their needs and desires while allowing them to maintain their neighborhood bonds and live close to extended family members.

- ▶ **Utah State Residential Rehabilitation Tax Credit is a 20% non-refundable state income tax credit available for the rehabilitation of historic buildings (National Historic Register) that are used as owner-occupied residence or residential rentals. For more information contact the Utah State Historical Society, State Historic Preservation Office at 801-533-3533.**

UCA 10-9-307 for reference

Plans for moderate income housing.

(1) The availability of moderate income housing is an issue of statewide concern. To this end:

- (a) municipalities should afford a reasonable opportunity for a variety of housing, including moderate income housing, to meet the needs of people desiring to live there; and
- (b) moderate income housing should be encouraged to allow persons with moderate incomes to benefit from and to fully participate in all aspects of neighborhood and community life.

(2) As used in this section:

- (a) “Moderate income housing” means housing occupied or reserved for occupancy by households with a gross household income equal to or less than 80% of the median gross income of the metropolitan statistical area for households of the same size.
- (b) “Plan for moderate income housing” or “plan” means a written document adopted by a municipal legislative body that includes:
 - (i) an estimate of the existing supply of moderate income housing located within the municipality;
 - (ii) an estimate of the need for moderate income housing in the municipality for the next five years as revised annually;
 - (iii) a survey of total residential zoning;
 - (iv) an evaluation of how existing zoning densities affect opportunities for moderate income housing; and
 - (v) a description of the municipality’s program to encourage an adequate supply of moderate income housing.

(3) Before December 31, 1998, each municipal legislative body shall, as part of its general plan, adopt a plan for moderate income housing within that municipality.

(4) A plan may provide moderate income housing by any means or combination of techniques which provide a realistic opportunity to meet estimated needs. The plan may include an analysis of why the means or techniques selected provide a realistic opportunity to meet the objectives of this section. Such techniques may include:

- (a) rezoning for densities necessary to assure the economic viability of inclusionary developments, either through mandatory set asides or density bonuses;
- (b) infrastructure expansion and rehabilitation that will facilitate the construction of moderate income housing;
- (c) rehabilitation of existing uninhabitable housing stock;
- (d) consideration of waiving construction related fees generally imposed by the municipality;
- (e) utilization of state or federal funds or tax incentives to promote the construction of moderate income housing;
- (f) utilization of programs offered by the Utah Housing Finance Agency within that agency’s funding capacity; and
- (g) utilization of affordable housing programs administered by the Department of Community and Economic Development.

(5) (a) After adoption of a plan for moderate income housing under Subsection (3), the legislative body of each city that is located within a county of the first or second class and of each other city with a population over 10,000 shall annually:

- (i) review the plan and its implementation; and
- (ii) prepare a report setting forth the findings of the review.

(b) Each report under Subsection (5)(a)(ii) shall include a description of:

- (i) efforts made by the municipality to reduce, mitigate, or eliminate local regulatory barriers to moderate income housing;
- (ii) actions taken by the municipality to encourage preservation of existing moderate income housing and development of new moderate income housing;
- (iii) progress made within the municipality to provide moderate income housing, as measured by permits issued for new units of moderate income housing; and
- (iv) efforts made by the municipality to coordinate moderate income housing plans and actions with neighboring municipalities.

(c) The legislative body of each city that is located within a county of the first or second class and of each other city with a population over 10,000 shall send a copy of the report under Subsection (5)(a)(ii) to the Department of Community and Economic Development and the association of governments in which the municipality is located.

3

Making Our Community A Good Place To Walk

Overview

► **Pedestrian-oriented neighborhoods, with a center of small-scale shops, provide residents with a connection to community life. Many residents are willing to pay a premium to live in an area where walking around the block is pleasant and walking to the store is both feasible and enjoyable.**
[Market Perspectives, 1993]

Pedestrian-scaled streets and buildings are rooted in the history of human communities. The features of walkable communities still exist in older neighborhoods that developed in the early 20th century. These areas have experienced a resurgence in popularity throughout the United States and in Utah. The Avenues in Salt Lake City is an example of a popular traditional walkable area. This

neighborhood is an attractive, vibrant place with small blocks, leafy canopies of tall street trees, on-street parking, a range of housing types and sizes, an age-diverse population and useful destinations within walking distances.

Walkable communities are a key strategy in the toolbox for achieving “quality growth.” Communities should work to apply the principles at all levels – from individual buildings, to blocks, to 1/2-mile walkable neighborhoods and to entire towns and cities. A concerted effort to shape development into livable, walkable communities will not only help accommodate the one million new residents expected in the greater Wasatch Area over the next 20 years, but will protect our beautiful environment for future generations.

This chapter explains the principles and benefits of walkable communities and explains strategies to create such communities in both existing and new growth areas.



Residents enjoying Ogden's 25th Street.



The characteristics of a walkable community include:
 - a diversity of uses (bottom)
 - a connected street grid (middle)
 - and, often, transit service that ties into the heart of the community (top).



Density, diversity and design

Making communities walkable is not a mysterious process. People naturally will walk more if useful destinations are close to their homes and places of work and if the walking environment is reasonably safe, interesting and pleasant. Walkable communities share several key characteristics that differ from auto-oriented development.

Walkable communities are compact, built at somewhat higher densities than conventional development. This compactness brings people and potential destinations closer together, making a walk feasible. An additional benefit is that compact communities use less land. Even moderate increases in housing density and commercial intensity can yield great improvements in accessibility and preservation of open space. For example, a reduction in average residential lot size from 15,000 square feet to 12,500 square feet would preserve 170 square miles of open space and 115 square miles of agricultural land through 2020 (*Envision Utah's Quality Growth Strategy and Technical Review, January, 2000*).

Compact developments are not automatically walkable, however; other criteria are essential as well. Walkable communities contain a diversity and mix of uses as well

as useful destinations and daily conveniences, such as shopping or day care, clustered at the center of the community. This mix of uses minimizes distances between housing and various destinations. In commercial centers, a mix of uses fosters higher levels of pedestrian activity that in turn create a sense of safety. Transit service often is available at the core of the walkable community as well, linking these highest-intensity areas to their surroundings, and riders to shops and services.

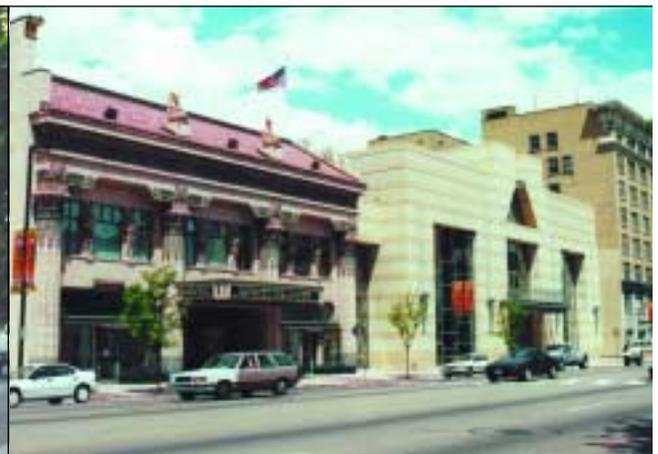
Finally, walkable communities have a human scale that makes walking and bicycling more enjoyable in addition to accommodating the automobile. Non-residential buildings, with many windows and doors, are set close to the street. This configuration enhances the relationship between the private realm of buildings and the public realm of the street, creating an interesting walking environment. Narrower streets cause drivers to be naturally more cautious, which slows traffic and

reduces accidents. Smaller street widths also minimize crosswalk distances for pedestrians.

Applicability to a range of scales

The principles of walkable communities apply to neighborhoods of many different scales. While a walkable community may be a specific neighborhood-sized area (with a 1/4- to 1/2-mile radius,

Pedestrian oriented streets at the neighborhood (Avenues in Salt Lake), community (Brigham City) and regional level (Ogden).





An unwalkable area (top) can be transformed, piece by piece. Street trees (upper middle) set the context. A successful first project (lower middle) can lead to a cohesive walkable streetscape (bottom).

discussed later), many walkable areas can and should be combined and linked with whole towns or cities. Pedestrian friendly concepts can be applied to developments ranging from the scale of individual buildings to small business districts to the downtowns of larger cities.

Finally, the walkable concept can be applied to different types of locations. It can be used for infill development within existing areas such as downtowns or older suburban neighborhoods, for new growth at the edge of existing development, or for freestanding new towns.

Who creates walkable communities?

Both public and private actions help create walkable communities. Public planning staff, front desk clerks, engineers, public works departments and legislative boards provide a public framework of streets, trees, parks and natural open spaces. They also regulate and guide private development. In the private sector, developers build pedestrian-scale, livable communities. Finally, private citizens help encourage and promote walkable development through supportive attendance at public hearings, by sending favorable letters to elected officials or the local newspaper, and, most importantly, by frequenting the shops and living in walkable communities.

Finding appropriate areas for walkable communities

A community needs to determine which areas are most appropriate for transformation or repair into walkable districts. A walkable area should be large enough, through new development or redevelopment efforts, to create a critical mass of activity. Ideally, walkable districts should be connected to the greater community and not be isolated islands.

A walkable community should not be cut off by infrastructure or environmental constraints. Wide arterial roads with heavy traffic and some transit facilities such as train tracks or grade-separated busways may act as barriers to pedestrian access. Environmental constraints such as steep slopes also can restrict pedestrian accessibility and limit the amount of land available for development. Park-and-ride lots, buildings with no opportunity for “pass-throughs,” and even transit stops or stations themselves also can constitute pedestrian barriers, if excessive in size or walled off from the surroundings.

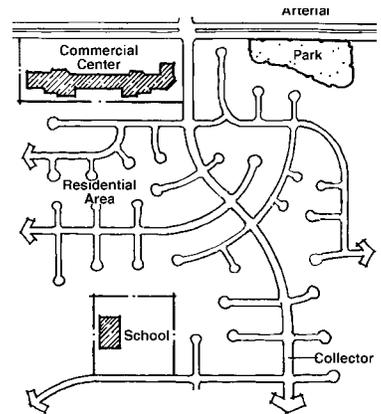
In some situations, a more appropriate configuration may be a “one-sided” walkable area. This approach could be used to place large retail businesses that require high visibility from automobiles along an arterial street, while focusing pedestrian-scale elements farther inside the walkable district, away from the arterial street.

Walkable Communities Are a Return to Traditional Utah

The traditional design of Utah towns includes many walkable features. In contrast, post-World War II communities have developed primarily to favor and accommodate the automobile.

When Brigham Young and the Utah pioneers settled the Great Basin, they were guided by the town planning ideal set forth in the plat of The City of Zion with its well-known gridiron street pattern. As a result, the original core of many Utah cities has a regular grid of streets. A grid provides multiple parallel routes from one destination to another. This helps reduce traffic levels on individual streets because there are more streets to distribute and carry traffic loads.

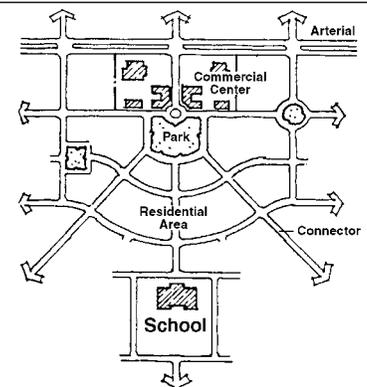
In contrast, during the postwar era, traffic engineers have sought to channel traffic loads through a hierarchy of local, collector and arterial streets. While local streets benefit from low traffic levels, larger streets carry heavy and fast-moving traffic that makes them unattractive and dangerous for pedestrians or bicyclists.



YOU CAN'T GET THERE FROM HERE

Unconnected streets (top) increase traffic on the relatively fewer through streets. Additional demands on the thoroughfare system often lead to extremely large public expenses that could be avoided if drivers used the residential and collector network for local trips (bottom).

Connected street networks also have improved emergency response time and likely have lower refuse collection and snow removal costs.



Commercial and community centers located on these busy arterial or collector streets are nearly cut off from pedestrian access. Furthermore, walking distances are longer with the disconnected, hierarchical street pattern. Discontinuous street systems require more driving and more turning, decreasing capacity and increasing congestion.

Traditional towns in Utah, such as Brigham City, often have a “main street” within walking distance of residents where people can run their errands and chat with their neighbors. The shops, post offices and other useful destinations are set close to the street, making the sidewalk a more interesting and therefore inviting environment for walking.

Cars parked in on-street parking spaces help provide a buffer between traffic on the roadway and pedestrians on the sidewalk. Any off-street surface parking on these main streets is located behind or to the side of buildings, rather than between the building and the sidewalk.

On a smaller scale, street design plays an important role in creating a pedestrian-friendly realm. Traditional streets have generous sidewalks landscaped with grass planting strips and shade trees that make walking pleasant.

A unique feature of many streets in Utah is extremely wide roadways, a result of historic Mormon city planning practices that favored avenues wide enough to allow a team of oxen to turn around. Today, these wide streets pose special challenges to, and unique opportunities for, creating pedestrian-friendly environments. Often, the streets are wider than necessary for the existing or planned street traffic capacity. The excess width encourages travel at high speeds. However, there is silver lining: These wide streets provide the potential for improving the pedestrian environment through sidewalk widening, extensive tree planting, the addition of landscaped center medians and added on-street parking.

Traditional main-street buildings on Ogden’s 25th Street.



Finally, at the regional scale, traditional development styles can show us much about how to structure growth in compact communities surrounded by open space. Compact, walkable development in cities and towns is a formula for maintaining Utah’s beautiful landscape. Traditionally, people lived in villages and small towns that had a finite edge set up against green space. Views from town of surrounding mountains provided a visual tie-in to the regional location and, therefore, offered a sense of place. While driving along a road, the transition from countryside to town was readily apparent. Today, the line between development and the natural landscape is blurred due to “leapfrog” and low-density development.

Advantages of Walkable Communities

Walkable communities have many benefits, from the regional scale to the local scale. They encourage a mix of housing choices to suit various stages of life, such as families with children, empty-nesters or retirees. Walkable communities channel growth in new areas to protect habitat, agricultural land and open space. They reduce dependency on the automobile and reduce infrastructure investment costs.

Walking-friendly restaurant in Bountiful. Walkable design concepts can apply to conventional suburban commercial buildings.



Regional balance and health

There is a growing concern across the country that central city and suburban areas are unbalanced in terms of land use. Many downtown areas have become places that lack housing and any evening or weekend activity. Suburbs have become places that separate housing, retail and employment uses in different, mutually exclusive areas making residents dependent upon their cars to accomplish even the simplest errands.

Walkable communities can be part of an organized, concerted effort to address region-wide accessibility, congestion and sprawl. Channeling development in compact patterns, reducing automobile dependency and improving the public transit system will help the regional transportation network perform better. Because walkable communities

complement housing with nearby retail, employment or community services, they may help improve the ratio of jobs to housing locally and region-wide. People may be able to live, work and shop in the same community. The mix of uses may help local governments achieve greater economic strength and resiliency in the face of recessions or market declines in different sectors. Individual developers and businesses will gain a wider market area because of street connectivity and greater population within and near the walkable community.

Urban revitalization

Walkable communities form an efficient framework for infill and redevelopment of underutilized lands in older urban and suburban areas (see the next chapter, “Reuse and Infill”). Tools to increase pedestrian access help communities improve their livability and compete regionally for residents, workers and shoppers.

Creating walkable communities in existing but underutilized urbanized areas is particularly cost-effective because the public infrastructure (roads, parking areas, street lights, transit service and parks) already exists, although there may have to be some updating.

This pedestrian friendly development in Salt Lake City was built on a former brownfield.



The walkable community concept also capitalizes on and enhances the historic, cultural and aesthetic infrastructure in an existing community, including buildings, views and the legacy of a shared past.

Choice of housing for different stages of life

The population and demographic trends that will affect housing demand in the Greater Wasatch Area are discussed in Chapter 2, “Meeting Housing Needs.” Today’s diversity of households includes young single people, childless couples, parents with children, empty-nesters and retirees. Mixing these housing types in a well-designed, walkable community allows people to continue to live in the same community as their housing needs change, rather than forcing them to move away to find appropriate housing. Walkable communities also provide greater autonomy for children, seniors, low-income persons and others who may lack ready access to cars. Children can walk to school or to friends’ houses, and seniors can walk to buy groceries, go to the bank and do other errands.

Choice of sites for commercial tenants

Walkable communities also provide choice and diversity for retail, office uses and other tenants. Visitors who drive to the community to shop can park just once and walk to all their destinations and errands, rather than having to make multiple short trips by car from parking lot to parking lot. Developments in walkable communities often can get by with lower parking requirements (discussion on shared parking in Chapter 4, “Reuse and Infill”). And of course, residents and workers in walkable communities can walk to the commercial core to do errands. Retailers can offer a rich shopping experience in this pedestrian-friendly environment by providing places to linger, people-watch and stroll.

Human activity and buildings that face the sidewalk with transparent windows foster a safe environment.



► Crime Prevention Through Environmental Design

■ CPTED recognizes that the design and use of the physical environment affects crime by affecting human behavior. Identifying intruders is much easier in, and criminals are deterred by, a well-defined space that delineates and reinforces ownership.

■ Criminals don't want to be seen. Placing physical features, activities and people in ways that maximize the ability to see what's going on discourages crime.

■ To learn more, visit www.ncpc.org/cptedcop.htm.

Walkable communities are gaining in popularity among large office tenants. For example, in 1994, Apple Computer relocated 500 new jobs to Laguna West, a new traditional-style neighborhood near Sacramento. State Farm Insurance located more than 1,000 jobs at Northwest Landing, a new pedestrian-friendly community near Dupont, Wash. Microsoft is planning to locate a three million square foot campus at the Issaquah Highlands Town Center, adjacent to Seattle. In the Greater Wasatch Area, NuSkin located its corporate headquarters in downtown Provo.

Safety

Combined with street-oriented architecture, the great variety of activities in a walkable community (such as walking, biking, roller

skating, street vending and people watching) fosters a safe environment because there are always people present to look out for one another. Pedestrian-oriented design features, such as numerous storefronts, windows and porches facing the street, also help provide “eyes on the street” (informal surveillance).

Street design in a walkable community plays a role in improving safety for children and other pedestrians. Balanced, reasonable street widths, park strips, street trees and traffic-calming measures, such as narrowed intersections, slow traffic to manageable levels. In contrast, conventional streets often are designed to accommodate traffic speeds of 15 miles per hour faster than the posted speed limit (*Vanesse Hangin Brustlin Inc., 1994*).

This practice encourages drivers to speed at the expense of pedestrian safety.

Environmental benefits

Walkable communities have numerous indirect environmental benefits. By channeling development in compact patterns, walkable

Walkable communities, with their ample trees and lower amounts of asphalt, reduce summer temperatures, energy use, urban ozone levels and storm water runoff.



communities help preserve open space, habitat and other sensitive lands. Development that might have encroached on critical lands instead is steered to vacant or redevelopable parcels in areas with existing infrastructure, or to buildable sites in designated new areas.

An ample number of trees helps mitigate “urban heat islands” caused when asphalt and other man-made surfaces absorb and radiate heat, making ambient air temperatures much higher in urban and suburban areas. Trees reduce energy demand for air conditioning in homes and businesses because the shade lowers ambient air and ground temperatures. Trees also reduce carbon dioxide levels in the air, filter pollutants and produce oxygen.

Air and water quality improve when people are able to walk and bike more and drive less. Automobile emissions are reduced, including chemicals and particulates from tail-pipes and particulate matter from tires. Much of these pollutants are washed into streams and other water bodies during heavy storms.

Walkable communities tend to be more compact than conventional development. The smaller lawns consume less water per household. This helps protect Utah’s valuable and scarce water supplies.

Transportation and air quality benefits

Studies have shown a link between the qualities associated with walkable communities – density, diversity of uses and pedestrian-scale design – and travel behavior. Travel behavior varies by trip purpose (commuting to work, shopping, socializing, etc.) and by form of travel (car, transit, biking, walking or a combination).

Overall, members of households in walkable communities drive fewer miles and make fewer trips, compared to people in automobile-oriented areas. This is true even when comparing households at the same income level.

WHAT AFFECTS HOW OFTEN PEOPLE DRIVE?

One study (*Fehr & Peers, 1992*) compared travel behavior of residents in older traditional communities to that of residents in conventional suburban developments. The number of automobile trips in suburban areas was 23 percent higher than in older traditional communities. Suburban residents also drove alone much more often than residents of older traditional communities (68 percent versus 49 percent).

WHAT AFFECTS HOW FAR PEOPLE DRIVE?

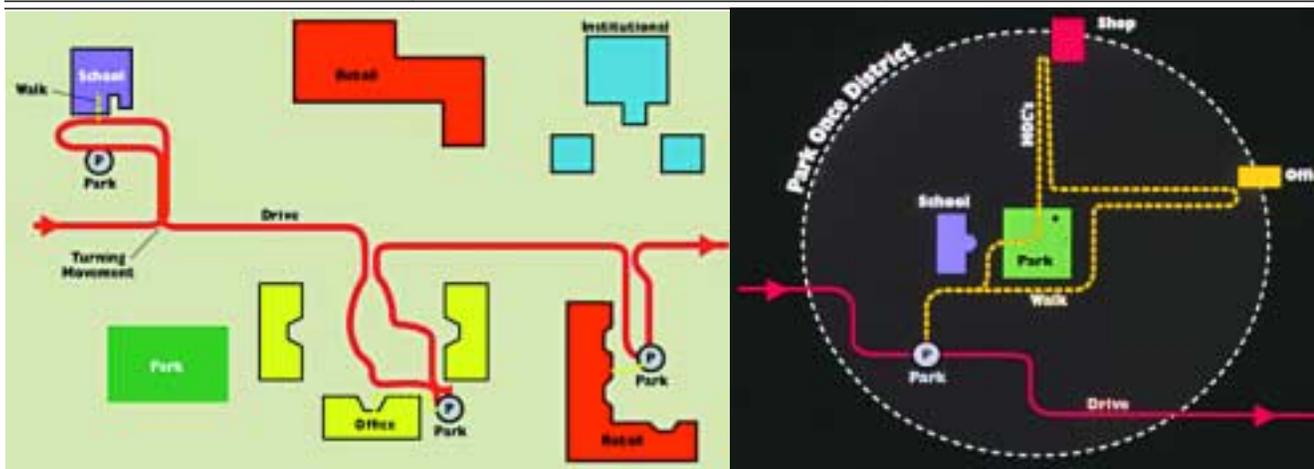
Another study, which controlled for income levels, found annual VMT in households in traditional neighborhoods to be nearly 50 percent lower than that in more recent standard suburban development. VMT is “vehicle miles traveled,” used as a measure of how much a household drives in a year. By doubling the residential population density, VMT was reduced 20 to 30 percent. Carbon monoxide emissions were more than 40 percent lower in the traditional neighborhoods (*Holtzclaw, 1991*).

While transportation planning and engineering efforts such as highway and transit facility planning usually focus on trips to and from work, these commute trips account for just one-fourth of average daily vehicle-miles-traveled (VMT) for a typical household. The average suburban household now makes 10 to 12 auto trips per day, and the majority of these trips are made for non-commute purposes such as shopping, getting kids from school, nighttime entertainment or visiting friends. The walkable community concept has potential for a great influence on travel behavior for these non-commute trips. Walkable communities would allow people to walk or bike for many of these frequent but short non-commute trips. People can combine multiple destinations and purposes into one walking trip, rather than making several short trips by car for several different purposes.

In 1994, Raleigh, North Carolina, planners studied the effect of connectivity on traffic. They found that a 1500-foot street grid will produce maximum traffic volumes on any one street of about 2500 vehicles per day (vpd). If the grid is expanded to 3000 feet, the maximum traffic volume on any one street jumps to about 8600 vpd. On the other hand, a 750-foot grid reduces the maximum volumes on streets to 1100 vpd or less. This same study showed total travel costs to be about a third greater in the 3000-foot grid than in the 1500-foot grid. We recommend a 600-foot grid, about eight intersections per mile, to minimize traffic flows on any single street. (Fehr and Peers, 1997).

Ideally, residents should be able to walk to shopping and other errands from their homes. However, in many areas, this may be unrealistic. For example, small towns may have a retail district that draws people who live

In an auto-district, one car uses 3 to 5 parking spaces in the course of a day. Walking areas are “park-once” districts, where small day-time errands can be accomplished on foot.



dozens of miles away. In these situations, it is still possible to reduce automobile dependency within this retail area by configuring buildings and streets to create a walkable, “park-once” district.

When people can meet many of their trip needs by walking or biking rather than driving, air quality improves, particularly since short auto trips are more polluting per mile.

The relationship between density and transit ridership

Several studies have shown that higher densities and compact patterns of development lead to substantially higher rates of transit ridership. A 1984 study found that transit ridership rose most sharply when net residential densities increase from 7 to 16 dwelling units per acre (*Smith, 1984*). This is equivalent to moving from a small-lot, single-family home to a duplex home. A more recent study showed that with every 10 percent increase in population density there is a 6 percent increase in boardings at light-rail transit stations (*Parsons, Brinckerhoff, Quade and Douglas et. al., 1995*). In the San Francisco Bay Area, researchers have determined that, even after controlling for income and transit service levels, transit-oriented neighborhoods on average generate about 70 percent more transit trips and

120 percent more pedestrian/ bicycle trips than nearby automobile-oriented neighborhoods (*Bernick & Cervero, 1997*).

Walking and biking to the transit station

People are more likely to use transit if it is within walking distance and they do not have to drive or take a “feeder” bus to get to the transit station. The pattern of multiple connected streets in a walkable community creates direct routes between destinations, making walking quicker and distances shorter. Bike lanes are an integral part of the transportational network that encourage bicycling. When people are able to walk or bike to transit, they reduce the need for all-day parking spaces at the transit station, an inefficient use of land. Furthermore, when people can walk or bike to transit, local air quality improves.

Infrastructure savings

Compact development uses infrastructure efficiently, saving money for developers, residents and government. Infrastructure outlays (such as roadways and sewer lines) are minimized with compact development, and infrastructure costs per unit are lower, since costs can be spread over more units for the same given

► **A Florida study showed that providing infrastructure at a moderate residential density of 12 units per acre cost \$24,000, while at 3 units per acre the cost doubled to \$48,000 (Kassowski, 1992).**

COORDINATE DEVELOPMENT WITH TRANSIT SERVICE

While the level of intensity of development in a walkable community will vary with local conditions, as a rule the higher-capacity forms of transit service should be supported by the highest densities. The highest intensity of uses should be clustered around higher-capacity transit stops or stations, such as light rail stops or dedicated “busway” stations, to maximize benefits from the substantial investment involved. More moderate densities are acceptable adjacent to bus stops serving regular-frequency bus routes, due to the lower capital cost investment associated with this flexible mode of travel.

► **A community identity is created by a central core of activity in each walkable community and the traditional design features of its streets.**

Many residents are willing to pay a premium for such a “sense of place.”

area. Furthermore, because residents need fewer cars per household, and employees and visitors can often arrive by transit, walkable communities allow for a reduction in conventional parking requirements.

Reduced demand for off-street parking frees up more land for buildings, parks and other uses. The vibrancy of commercial and mixed-use districts is often compromised by too much land dedicated to parking.

Infrastructure costs per housing unit are lower in more compact communities. In examining alternatives for Salt Lake City’s growth, Envision Utah estimated the infrastructure costs associated with continued sprawling suburban development patterns to be more than \$30,000 more per housing unit than those associated with a more compact, transit-friendly and walkable alternative.

Compact, walkable developments also offer significant long-run fiscal advantages. Numerous

economic studies, dating back to 1955, show that the mixed-use patterns and compact densities associated with pedestrian-friendly, traditional developments offer significant savings for developers and reduce tax burdens typically associated with growth (*Frank, 1987*). A recent Rutgers University study showed that a New Jersey development plan that adopted a pedestrian-friendly, connected approach to roads, housing and facility placement would save the state \$1.3 billion in capital costs and more than \$7 billion in operation and management costs over a 20-year period (*Burchell, 1992*).

Adoption of Envision Utah’s Quality Growth Scenario would save an estimated \$4.5 billion in transportation, water, sewer and other utility infrastructure costs by 2020, compared to a continuation of current growth patterns.

Market advantages for residential development

Connections to community life and “town center” activities are increasingly cited as important considerations when buying a home. The diversity of housing types and the attractive public features of walkable communities help homes sell as well as or better than homes in conventional

People are more likely to use transit if it is within walking distance and they do not have to drive or take a “feeder” bus to get to the transit station.

When people are able to walk or bike to transit, they reduce the need for all-day parking spaces.



suburban developments. Studies have found that walkable developments match the absorption rate (the rate at which new homes are purchased as they become available for sale) of competing suburban developments, even in cases in which the most attractive neighborhood amenities (such as parks, street trees and fountains) were not yet in place.

Surveys of home-owners in new neighborhoods designed with traditional principles have shown that home-buyers prefer many design features associated with traditional neighborhoods, such as narrow streets, front porches and alleys. In one study, more than two-thirds agreed that their pedestrian-oriented community had a stronger sense of neighborliness when compared to other developments in which they had lived. In the same survey, many home-owners admitted that they paid more to live in their walkable development, and 84 percent said that they would do so again (*Market Perspectives, 1993*).

Of course, not all walkable communities are new or expensive developments. The walkable concept is an excellent way to retrofit older existing areas and design new areas in patterns that provide affordable, modest housing for rental and for purchase.

Shaping a Walkable Community

Configure communities for convenient pedestrian access

All areas in a walkable community have easy pedestrian connections to a core area that contains retail, transit or other conveniences. Ideally, the core is near or at the center of the walkable area, surrounded by higher intensity uses. A connected street network links the core to the remainder of the walkable district. The walkable environment should not be isolated by impediments to pedestrian movement, such as busy arterial roadways, large parking lots and rugged terrain.

Jack's Market, which has upstairs housing space, creates a unique identity for a new neighborhood in Tooele City.



Core areas that have retail typically must be positioned on busier roads for drive-by patronage. Where buildings and activities face this major road, a mixed-use boulevard can be established that serves uses on both sides of the road. Where buildings cannot reasonably address the major road (due to heavy, loud traffic levels or other constraints), retail uses can still relate to abutting uses with local street connections and architecture that faces these streets.

Size communities for easy walking

While the principles may be applied to any size project, walkable communities have an ideal minimum and maximum size. The minimum physical size of a walkable community guarantees that there will be enough population to support retail and other

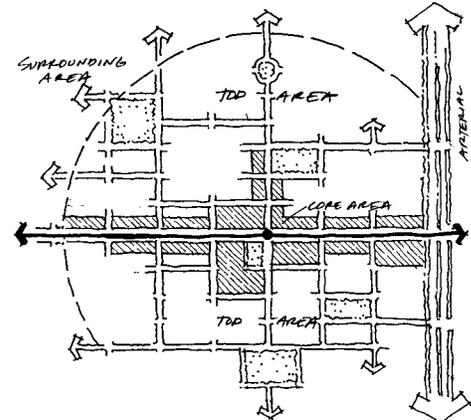
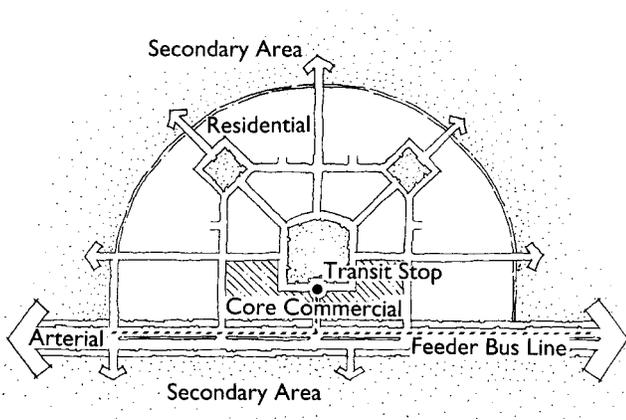
services. The maximum size of a walkable district ensures that residents and workers will be able to walk to the services in the core.

A one-half-mile walk that takes about 10 minutes constitutes the outer limits of a walkable community, while a higher concentration of uses should occur within a one-quarter-mile radius. While a walkable district can be as large as 500 acres, the minimum size is 30 to 60 acres, depending on the scale of the community and the regional location.

Focus communities on a central core of retail and services

Walkable communities should be focused on a core or town center that serves as a focal point for the neighborhood and provides convenient access to shops, restaurants and community-oriented services, such as day care, libraries

One- and two-sided walkable districts, each oriented around a central core.



and meeting halls. A modest-sized public plaza or park is also appropriate in the core. A transit stop in the center allows transit and other forms of travel to be combined. A core may be in linear form as well. For example, the classical main street functions as a core.

Other higher-intensity uses, including offices, public facilities (such as clinics, government services, post offices and gymnasiums), cinemas, hotels, health clubs and high-density housing also are appropriate in the core as long as parking does not compromise the pedestrian character of the area.

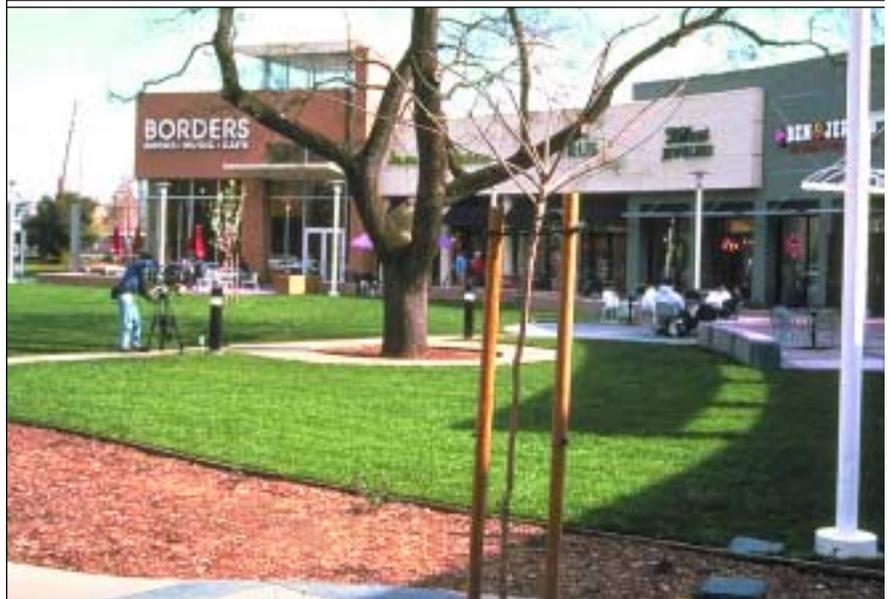
The size of the core varies with the scale, character and accessibility of the individual community. The core should comprise about 5 to 40 percent of the land area of the walkable district. For example, a small village may be able to support only a minimal amount of retail or community-oriented services. In contrast, larger towns and higher density areas will be able to support a significant amount of retail, as well as offices and a city hall or other community functions in the core. Outside the core, the remainder of the walkable district is usually comprised of moderate-density housing, although offices, parks and other uses are possible as long as they contribute to a pedestrian-friendly environment.

Include a diversity and mix of uses

Walkable communities should contain a mix of uses, concentrating the highest intensity of retail, commercial, civic and residential uses in the core. Lower intensity uses should be located farther from the core.

Ideally, the core should support daytime and evening activities to create an attractive and safe neighborhood destination. Offices support cafes during lunch hour, shops draw people during the day and on weekends and restaurants and movie theaters draw people at night and on weekends.

New commercial core at the heart of a walkable community.



► **An interconnected street network reduces the traffic load on any single street by dispersing it. Without interconnected streets, arterials become congested with traffic and become unwalkable barriers to pedestrian activity. Streets that connect help pedestrians by providing them with direct walking routes compared to standard cul-de-sac subdivisions.**

Increase street connectivity

By definition, the highly connected street pattern in a walkable community is composed of smaller block sizes to minimize walking distances between destinations. The scale of residential lots and ownership patterns lends itself to smaller blocks than commercial areas (particularly retail anchor stores with large parking lots). As a rule, the maximum block size for residential uses is 3 acres (220 by 600 feet), while the maximum block size for commercial uses is about 4 to 7 acres (500 by 600 feet). Note that these block sizes are maximums; smaller block sizes are always possible and are encouraged.

Increased street connectivity can be accomplished with a traditional gridiron pattern, but there are more interesting alternative street layouts that offer the same advantages which a community may

consider. Connected street-patterns may take a curvilinear form or a radial form.

Require street-oriented buildings

In walkable communities, buildings should face and be sited close to the street, rather than behind large front parking lots or garages. Putting buildings, windows and entries at the street (with minimal setbacks) helps define the sidewalk as a pedestrian environment by adding activity, architectural variety and a pleasant sense of enclosure to the street.

Ensure sufficient density to create activity and support retail

The intensity of development in walkable communities should be sufficient to support retail

Street-oriented mixed-use buildings in a modern (left), and traditional style (right).



businesses and transit service in the core. It should also create activity and interest along streets and in parks. Development intensity in walkable communities can be administered using minimum Floor Area Ratios (FAR) for commercial uses or mixed uses and minimum densities for residential uses. Minimum FAR and density standards can enhance greater pedestrian access.

Walkable neighborhoods should include a variety of housing types and sizes to suit the needs of different households. Residential development intensity should be governed by minimum and maximum average density, rather than limited lot sizes, so that there may be more variety within each area.

Public Streets and the Parks Form the Framework

Design streets for pedestrian comfort

Streets are public investments that shape the public realm and provide a civic gathering space for the community. Streets in walkable communities provide for the comfort of pedestrians as well as the needs of the automobile. Streets are lined with buildings, rather than parking lots. Parking is set behind buildings, away from the street. Streets have trees to shade pedestrians and motorists. Minimum roadway widths discourage fast automobile speeds, while still allowing automobile access throughout the site.

► **Floor Area-Ratio is the ratio of building floor area to land or parcel area.**
A 10,000-square-foot building on a 5,000-square-foot lot has a FAR of 2.0



Walking-friendly housing at 8 units per acre (left) and 50 units per acre (above).



Minimize roadway width in street section design

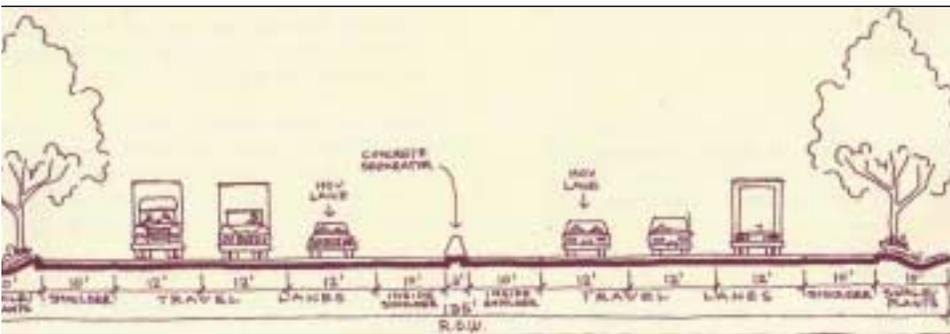
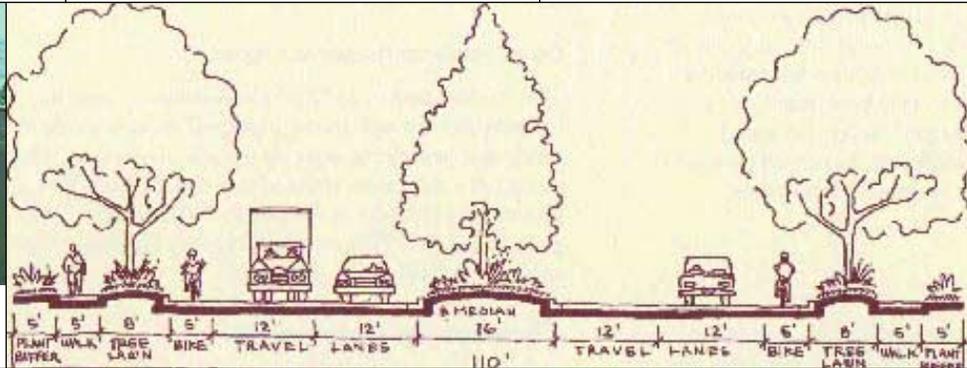
Many existing streets in Utah are very wide. The width and traffic levels on these streets may create a barrier to pedestrians trying to cross the street, create a hazardous scenario for walking or divide a community into two halves. In contrast, narrow roadways tend to have the effect of making drivers travel more slowly and carefully. New streets should be designed such that lane widths, designed speeds and number of travel lanes are kept to a minimum without compromising safety.

All roadways serving walkable areas should have on-street parking. On-street parking helps provide a buffer between the traffic on the street and the pedestrians on the sidewalk and encourages drivers to travel more slowly. However, if there is too much off-street parking, no one will park on the street. On-street parking is effective only when it is actually used.

MAJOR STREETS



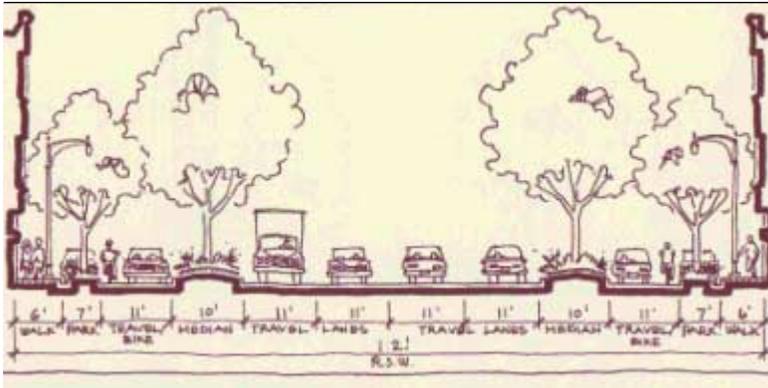
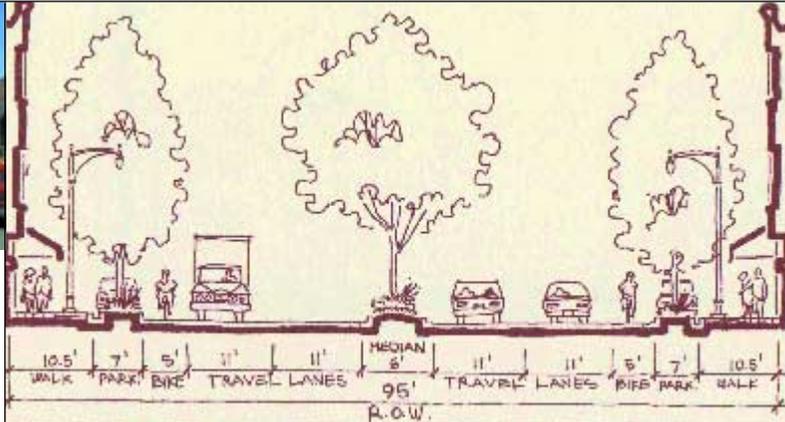
Auto street with accommodation for bikes and pedestrians.



Streets for automobiles.



Multi-modal street with emphasis on non-auto travel.



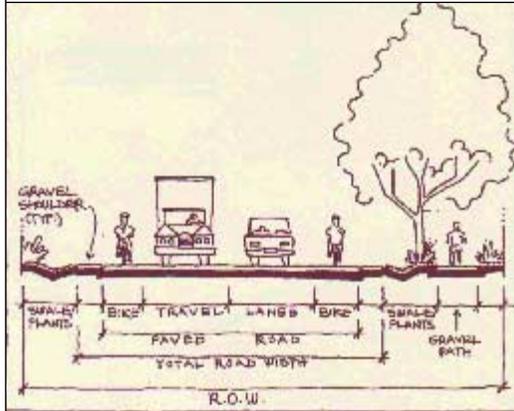
Multi-modal boulevard design.

Streets that must carry heavy traffic can be boulevards

Wide streets that must carry a high load of traffic still can support an active and attractive pedestrian environment by converting them to boulevards. A multi-modal boulevard is a roadway with a center throughway, typically of four lanes, for fast through traffic. There are access lanes for local, slow-moving traffic on either side,

separated from the main through roadway by tree-lined medians. The local access lanes usually include one or two rows of parallel or diagonal on-street parking. Pedestrian space on the sidewalks at the edge of the boulevard is augmented by secondary pathways on the medians, which also can include bike paths and transit waiting areas. Traffic moves slowly on the local access lanes, creating a third pedestrian-friendly environment.

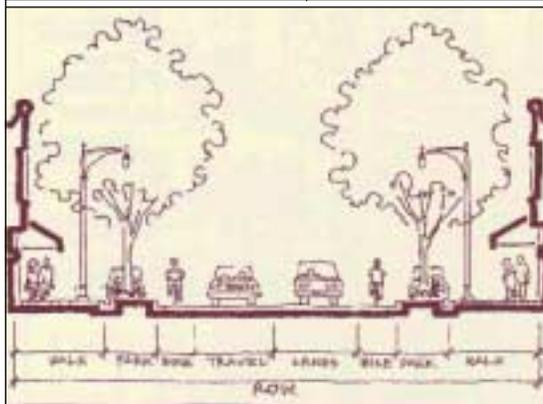
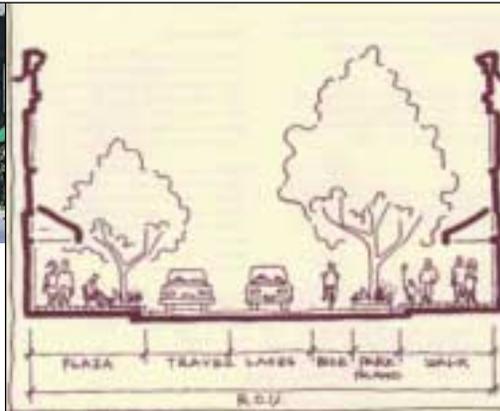
MINOR STREETS



Low activity level.



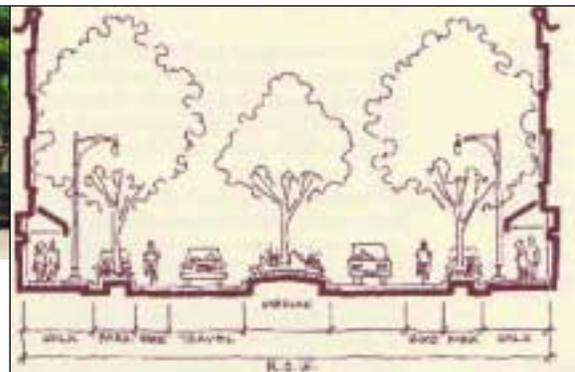
Moderate activity level.



Higher activity level.



Higher activity level with traffic flow devices.

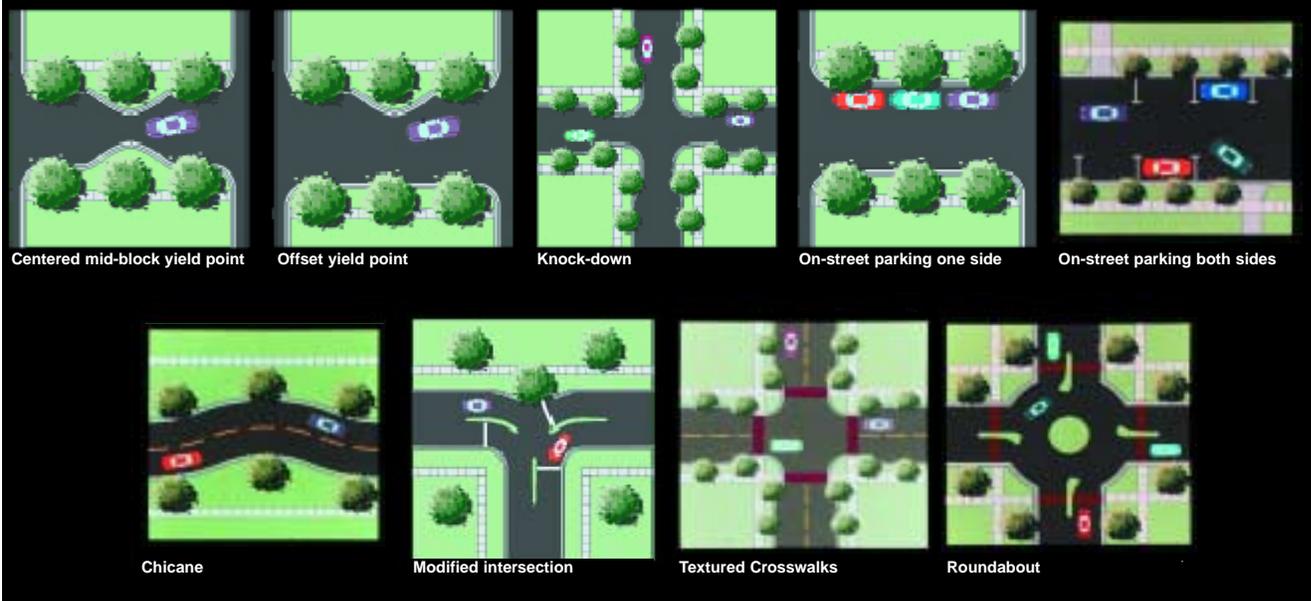


TRAFFIC CALMING ON EXISTING STREETS

“Traffic calming” measures such as “knock-downs,” where sidewalks are widened into the parking lanes to reduce pedestrian crossing distances, may be appropriate when it is not feasible or too costly to reduce an entire street’s width. The simple addition of on-street parking also helps narrow wide existing roadways.

Drainage, snow removal and storage should be accommodated in the design and maintenance of these features. Access for emergency vehicles can be accommodated through design solutions such as mountable curbs on traffic circles and removable posts.

A standard source on traffic calming is the Institute of Transportation Engineers' "Traffic Calming - State of the Practice" by Reid Ewing.



PEDESTRIAN FRIENDLY STATE HIGHWAYS?

Can the walkability of State Highways be improved where they run through the main-street style shopping districts in communities in the Greater Wasatch Area?

This is a difficult issue that must balance, 1) maintaining traffic capacity on vital state routes and 2) maintaining the health and viability of communities' historic main streets.

Envision Utah believes that these decisions should be based on a cooperative effort between local jurisdictions and the Utah Department of Transportation.

Points to consider are:

- Communities are not just a link in the state highway chain, they are also destinations in their own right.

- A basic role of the state highway system is to serve important local destinations.

- Traffic capacity can often be maintained with slower traffic speeds. In addition to a friendlier walking environment, slower speeds likely improve pedestrian safety.



Park blocks in Sandy (top, Sandy Civic Center Mall); in Boca Raton, Florida (middle); and Portland, Oregon (bottom).

Consider park streets to calm traffic and increase the amount of on-street parking

A “park street” or “park block” is a street with a linear park at the center, with one-way roads running on both sides. They are an appropriate device to separate two-way traffic into a one-way couplet, with roads and on-street parking on both sides. They are successful at reducing traffic congestion from turning movements because they create more space for queuing. Extremely wide roadways can be retrofitted as park streets. Ideally, the planted center area of park streets should be at least 80 feet in width from inner curb to inner curb, to function as usable recreational space.

Configure schools to promote walking

Due to their land-intensive nature, schools (particularly high schools) should not be located at the most central, core area of a walkable community. Rather, they should be located at the edge of the typical one-quarter to one-half mile walkable area.

However, if a walkable district is largely residential and retail uses are not viable, a school may be located in a more central area so

that its grounds and buildings are more accessible to the community. In such a case, sports fields, play courts and classrooms should be available in the evenings and on weekends for recreation, adult education and community meetings.

Although all schools should be conveniently accessible on foot, the greatest attention to detail is needed for elementary and middle schools because these youngest children need the safest walking routes to school. Schools that have bright lighting for evening outdoor sporting events may not be appropriate next to residential areas due to the noise and glare produced.

Set aside space for parks and open space

Parks, plazas and other open spaces serve as focal points for civic life, allowing a range of spaces for active sports and passive (sitting, people-watching) recreation. These spaces may be located adjacent to retail, office and other higher-intensity uses in mixed-use and commercial districts, as well as in quieter residential districts. They may be paved or landscaped.

The perimeter around a park should be surrounded by streets and building fronts to provide

activity and informal surveillance. One notable exception is where parks abut sensitive lands or open space. In no case should a park be located behind buildings, away from public view and access.

Place transit stops and stations in the core

If there is transit service to a walkable community, the transit stops or stations should be located in the high-activity core. Parking lots, busy roads and other obstructions should not interrupt pedestrian and bicycle access to transit. Fences, berms and other barriers that impede pedestrian or bicycle movement should be removed. The road and pathway connections to transit stops or stations should minimize pedestrian travel distances.

Transit riders disembarking from the bus or train should be able to understand where they are and orient themselves easily through visual cues, views and landmarks.

The overall character of the transit station should be pedestrian-friendly with direct paths lined by street trees, landscaping and benches. Transit stops should be sited where the street is level, with a barrier-free sidewalk, and where there is space to build a firm-surfaced pad that can accommodate a wheelchair as well as standing passengers.

Shaping a Walkable Community in Privately Owned Areas

Following are some design guidelines for making privately owned areas, including residential, more appealing to pedestrians. While the street and public facility standards discussed in the previous section shape the public realm, the following site design and architectural standards shape the private realm. These standards apply to development on vacant, green-field sites as well as underutilized land in developed areas. These standards are basic guidelines necessary to achieve and enhance pedestrian access in a community.



Parks should be surrounded by buildings to provide activity and informal surveillance.

Design guidelines for mixed-use and commercial buildings

Use buildings to frame the street

Buildings in walkable communities should create a fairly continuous “street-wall,” with minimal breaks for driveways, curb cuts, parks and plazas and side yards. Parking lots should be sited behind buildings, away from the street. Small parking lots along the sides of buildings are acceptable as long as they minimize their frontage and curb cuts along the street.

Having primary entrances face and be accessible from the street helps create a walking-friendly neighborhood.

A regulatory device known as a “build-to line” that defines a maximum front-yard set-back (the opposite of the more common minimum setback) can be used to show on a map the segments of streets or blocks where buildings are required to be located at the street. Build-to lines are discussed further in “Methods for achieving walkable communities.”

Minimize building setbacks from street

In walkable communities, buildings should be sited close to and face onto the sidewalk to create a more interesting walking environment. Ideally, commercial and mixed-use buildings should be located at, or within, ten feet of the public sidewalk. Residential uses may be set back somewhat, especially farther from the core.



Retrofit existing commercial areas for pedestrian access

The modern commercial landscape is a familiar sight, with one shopping center after another arranged along a wide, sidewalk-less street. Many of these strip commercial districts are successful economically, but they certainly make it difficult to get there on foot or walk around once you arrive. Strip commercial areas also may be fenced off from one another, to discourage anyone who is bold enough to walk from one to the next. Buildings are set back behind generously-sized parking lots. What can be done to make these areas more pedestrian-friendly?

■ **Add continuous sidewalks.**
Sidewalks should be on both sides of the street, linking shopping centers and including landscaping with street trees and planter strips.

■ **Improve crosswalks.**
Add or improve crosswalks and pedestrian crossing signals at intersections and between high-volume shopping centers to allow pedestrians to cross busy arterial streets safely.

■ **Remove fences between adjacent shopping centers.**
Explain to shopping center businesses that they will benefit from increased pedestrian patronage as people who park next door walk over to their shopping center.

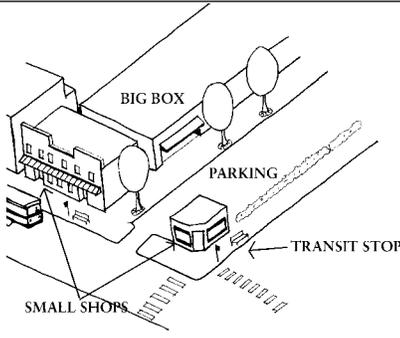
■ **Reinforce pedestrian connections through parking lots.**
Make it safer for people to walk from the sidewalk through parking lots up to building entrances. Solutions include painted or colored asphalt, different paving material or texture, raised walkways, shrubs, shade trees and other landscaping.

■ **Make parking lots cooler.**
In a related vein, parking lots can get oppressively hot in the summer, as the black asphalt absorbs all the sun's heat. Regularly-spaced "orchard" trees can shade parking lots and make them more hospitable to walking.



Orientation away from pedestrians (top) and toward pedestrians (middle).

Street trees (bottom) complete the comfortable walking environment.



Infill “liner” buildings at the street can create a pedestrian-oriented district in the midst of large scale “big boxes.”

■ ***Infill parking lots with small buildings that face onto the street.***

Businesses such as camera stores, cafes, and flower shops usually have a small square footage and could be sited at the street to make walking along the sidewalk a little more interesting and varied. This can be a great way to increase economic use of underutilized parking lots. Parking lots on streets that extend into neighborhoods should have the highest priority for this sort of infill.

Street-facing facades

The primary building entry and windows should be visible from a street. Street-facing building facades should not have large segments of blank wall (for example, no wider than 30 linear feet). Windows and entries should be used to break up facades into segments. A large proportion (for example, at least 50 percent) of the linear length of street-facing facades for non-residential buildings should contain windows, doors or arcades at all levels.

Where parking structures are located along pedestrian-oriented streets, they should contain shops or other inhabitable spaces. The frequency of garage doors or entrances to parking structures along pedestrian-oriented streets should be minimized. For example, no more than 30 linear feet of curb cuts to parking structures should be allowed along each block.

Minimize the dominance of parking

A compact, pedestrian-friendly setting can be created with the use of surface parking sited away from the street to the rear of buildings, with on-street parking in front. On-street parking in front of a building should be considered to help meet parking demand. Development at highest intensities would likely require structured parking.

To minimize parking costs and impacts, different uses (such as retail, office and entertainment) should share off-street parking spaces, particularly in mixed-use districts. By recognizing that peak demand occurs at different times for different land uses, shared parking facilities help minimize the amount of land and expense devoted to parking lots or

garages. The Urban Land Institute’s Shared Parking standards, or an equivalent, should be used to calculate the total number of shared parking spaces.

Streets in a community’s center provide for the comfort of pedestrians and the needs of the automobile. On-street parking is an important component of a walkable street’s design, providing a buffer between the traffic on the street and the pedestrians on the sidewalk. On-street parking should occur on all streets where structures front onto both sides of the street. Either parallel or diagonal on-street parking may be appropriate, depending on the street width, parking demand and traffic volumes.

Parking structures or garages are discouraged along walkable streets unless they include ground-floor retail, office or civic uses. Parking structures should not occur within 40 feet of a residence.

Parking lots for commercial and industrial uses should be sited away from the street and behind buildings, or to the side of buildings in long, narrow configurations that minimize the street frontage.

Where existing parking lots abut streets, they can be mitigated in several ways:

■ **Connect building entrances to sidewalks.**

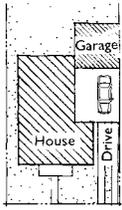
Some buildings, such as retail anchor stores, may have entrances that are behind parking lots, rather than right at the street. In these instances, entries should be linked to the street with connecting walkways. These walkways should be tree-lined, landscaped, lighted and detailed for pedestrian safety and comfort.

■ **Screen parking lots from the street.**

Use landscaped frontages, which may be landscaping, walls or trellises. However, design and siting of landscaped frontages should not provide ambush points or obstruct views. Walls and hedges should be 2-3 feet tall to offer screening while maintaining visual surveillance.

Parking for this bagel store on Salt Lake City’s 15th East, is to the side, creating a pedestrian-friendly identity for this neighborhood.





Side Drive (Attached)

Recessing the garage behind the rest of the front facade helps create a street that is enjoyable to walk on.

Trees should be planted 30 feet apart, to provide a sense of a “street-wall” while avoiding the creation of ambush points.

■ ***Break up large parking lots.***

Connecting walkways and landscaping should be used to break up large parking lots into sections of no more than 300 spaces each.

■ ***Shade parking spaces with orchard planting.***

Parking lots must include one shade tree for every six parking spaces, spread uniformly throughout the parking area. Trees should be set into a tree well and protected by posts or tree guards.

Bicycle parking should be provided in easily accessible locations. The amount of bicycle space can be tied to levels of use, which often is a function of the square footage of building space. For example, one bike space is appropriate for every 2,000 square feet of building floor area. Bicycle parking should be visible from storefronts or office building front doors to improve security for parked bicycles.

Design guidelines for residential buildings

The following design guidelines are recommendations to create pedestrian-friendly residential buildings:

Site homes to frame the street

With the exception of accessory dwelling units, the primary entrance of every dwelling should face and be accessible from a street, park or other open space. Entries should not be deeply recessed or hidden. An accessory unit is a modest sized living space built at the rear of an existing single-family lot – either freestanding or over a garage.

Minimize view of garages and parking from the street

Garages should be set back from the street-facing facade. Garages should comprise less than 40 percent of the width of the total street-facing frontage. Alley fed garages are often beneficial in meeting this standard. Tandem parking garages (a narrower garage where one car is parked behind another) make up one device for reducing the impact of garage doors. They should be permitted and encouraged.

Parking for attached residences with shared unit entrances, such as apartment buildings, may be provided in several acceptable ways, including:

- Within the structure or behind a street-facing living space, retail or home office space
- Underneath the living space of a residence
- Surface parking behind a structure

Provide variation in housing mix

A variation in housing mix (architectural styles, lot sizes and building types and sizes) in walkable communities creates greater visual interest along sidewalks for pedestrians. In contrast, streets lined with identical homes and blank garage doors make walking less appealing. In new residential areas, a mix of housing models and architectural treatments are recommended.

Methods For Achieving Walkable Communities

This section discusses ways to guide new development and retrofit existing development to be more pedestrian friendly. Physical plans and standards can direct public and private actions. Inducements, such as financial incentives, streamlined approvals and site preparation, can help encourage developers to pursue innovative practices.

Integrate the vision for pedestrian access into the community master plan process

Stakeholders – citizens and public officials – must work together to assure that the vision for a walkable community is clearly articulated and included among the goals for the community general plan. Clear goals permit stakeholders to see how all elements of the plan fit together. A clear plan will help ensure that redevelopment follows the initial vision over the years or even decades. The community can monitor the general plan as parcels redevelop, streets are repaved or other opportunities arise to implement portions of the plan. The plan can include maps that show the planned street network, open space and land uses and explain the desired quality of the urban landscape.

► **A master street plan specifies the general location of future streets and intersections to ensure connectivity. Another tool is a maximum block size limit to prevent the very large blocks that reduce the connectivity of a street network. Maximum block standards generally range from 4 to 8 acres.**

Street Connectivity

Master street plans

Too often, street locations in large-scale developments are left to the discretion of developers, resulting in a disconnected street system that makes walking and biking difficult. In older existing areas, streets may be too wide or the street network may have become disjointed due to development of multi-block complexes that straddle streets. In either case, a jurisdiction can do much to shape a walkable environment by defining the alignment and design of streets through the master street plan element that is included in the general plan.

By identifying the alignment of all “connector” streets (streets that connect, rather than “collector” streets that funnel traffic onto arterials) in the master street plan, a jurisdiction can ensure a connected network that minimizes walking and biking distances between destinations. The network of streets must be strong to distribute traffic to a point where traffic volumes are low enough for street-facing uses. While commercial streets can tolerate higher traffic volumes than residential streets, major streets that do not support street-facing uses are not appropriate to walkable communities. A master street plan will

define the network of streets, such as arterials, major and minor collectors and local streets.

Maximum block sizes

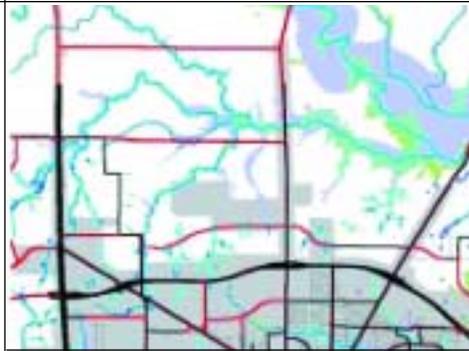
Developers of large residential areas prefer some leeway in the location of local streets, as this gives them more flexibility in selecting block size and lot widths and depths. Instead of specifying the location of future intersections, the jurisdictions may adopt maximum block sizes and connectivity requirements (such as no cul-de-sacs, or pedestrian connections from cul-de-sacs to through streets) associated with the various local street types to build additional flexibility into street network design. Other general goals also should be tied to general street design standards. For example, it may be important to specify that local streets maintain vistas towards important views or parks.

We recommend a maximum block size of about 600 feet per side, though this can be stated in acreage, for example eight acres, to give flexibility from gridiron to curvilinear or radial street patterns.

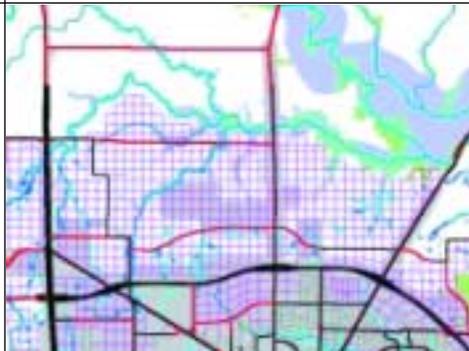
Environmental Constraints



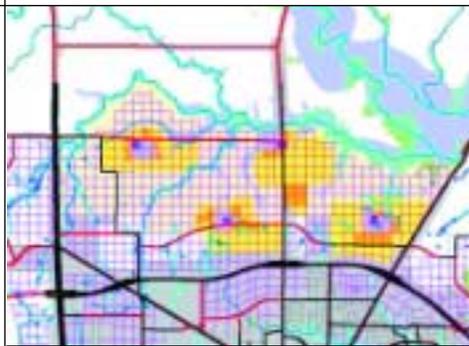
Future Arterials



Street Connectivity Grid



Future land uses and neighborhood centers



► It is important to link together all the elements that help create a walkable community.

■ This series of maps shows the development of individual elements of a comprehensive plan. After existing conditions are identified, environmental areas are considered, new arterial streets are planned, a minor street connectivity grid is outlined at a 600 foot interval between intersections, and comprehensive land uses are designated to locate future neighborhood and town centers.

■ With this kind of a plan, as developments occur, they become part of an overall community, fitting together like pieces of a jig-saw puzzle. Without this kind of planning, cities can grow to be just an unrelated collection of developments.

- ▶ **Connectivity comes in many forms.**
 - **Simply because a master street plan lays out a connectivity pattern, the streets inside a development do not necessarily need to be arranged in a gridiron.**
 - **The important thing is that there be dead-end streets at the perimeter of the development where the master street plan specifies connections to future developments. This enables each development to hook together in a seamless street network.**
 - **Connected street patterns may be in a gridiron, curvilinear, organic, radial, or any other style that provides for internal connections and external linkages.**



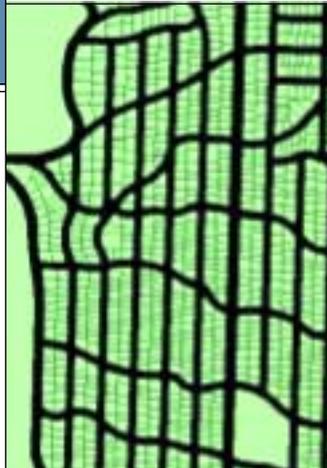
Gridiron



Curvilinear



Radial



Organic

Street network tied to future land uses

Future land uses or future zoning should be outlined in the comprehensive plan to ensure the highest intensities in the neighborhood are at the core of the street network and that there is a diversity of land uses throughout the neighborhood. Both mixed uses and a neighborhood core naturally entice people to walk from place to place.

Block standards

In contrast to a comprehensive plan approach that addresses each element of a walkable community separately, a block standard is a tool that combines a set of policy options together into one package. Minimum block sizes, densities, parking requirements; site design considerations such as building orientation, height; and allowable land uses are linked with each other in a coherent policy framework. Depending on the location of the prospective site in the community, a developer can choose from a variety of block standard packages. An example from Orlando, Florida, is included.

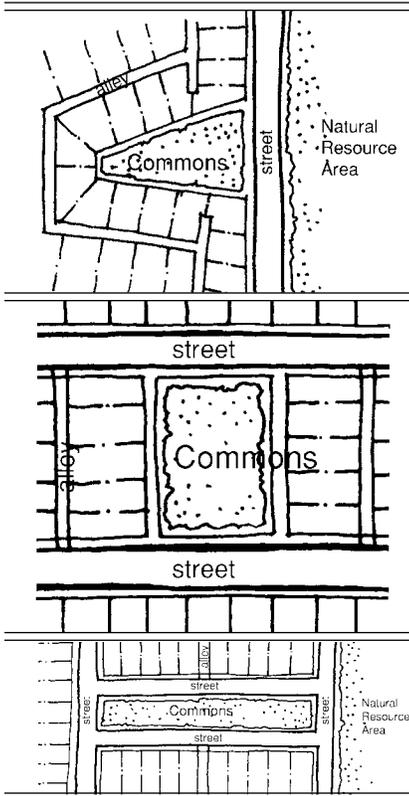
BLOCKS STANDARDS FROM ORLANDO, FLORIDA

Within the Town Center or Village Center locations, there are block standards for Mixed-use, Commercial, Residential, and Civic Blocks.

Commercial blocks, for example, may be no more than 30% of the area of a Town Center.

	Town Center	Village Center
Mixed-Use Blocks Mix of Uses*	15-40% of Center	15-40% of Center
*30-80% retail, cinema, or hotel required each block, 20-70% other.	Retail, Services, Restaurants, Office, Cinema, Grocery, Hotel, Residential, Civic, Park/Plaza.	Grocery, Local-Serving Retail and Services, Restaurants, Gas Stations, Professional Offices, Residential, Civic, Park/Plaza
Maximum Block Size	7 acres	7 acres
Minimum FAR	FAR: 0.4	FAR: 0.3
Minimum Frontage	65% of each street	65% of each street
Parking Ratio	3 spaces : 100 sf.	3 spaces : 100 sf.
Building Height	2 to 10 story	1 to 3 story
Commercial Blocks	0-30% of Center	0-30% of Center
Allowable Uses	"Office, Retail (10% Max.)"	"Office, Retail (10% Max.)"
Maximum Block Size	7 acres	4 acres
Minimum FAR	FAR: 0.4	FAR: 0.3
Minimum Frontage	65% of each street	65% of each street
Parking Ratio	3 spaces : 100 sf.	3 spaces : 100 sf.
Building Height	2 to 10 story	1 to 3 story
Residential Blocks	30-75% of Center	40-75% of Center
Allowable Uses	Apartments, Condos, Townhomes, Duplexes, Bungalows	Apartments, Condos, Townhomes, Duplexes, Bungalows, Small lot single-family
Maximum Block Size	3 acres	3 acres
Density Range	7 to 50 du/ac.	7 to 25 du/ac
Minimum Frontage	65% of each street	60% of each street
Parking Ratio	1.5 spaces/unit	1.5 spaces/unit
Building Height	2 to 5 story	1 to 3 story
Civic Blocks	10% of Center	10% of Center
Allowable Uses	"Parks, Recreation, Civic, Day Care"	"Parks, Recreation, Civic, Day Care"
Maximum Block Size	3 acres	3 acres

Examples of park configurations appropriate in a walkable community.



Mixed-mode street design

The jurisdiction should provide cross sections for all planned street types – both major streets with specified alignments and local streets with flexible alignments. The cross sections should show overall right-of-way widths, roadway and sidewalk widths, on-street parking, street tree and planting locations and other features such as medians.

Examples of street cross sections appear in this chapter under “Minimize roadway width in street section design.”

The process of developing street designs should include feedback from developers and public works, fire and police departments. At the same time, communities should recognize that developers and public servants might require some education about the way mixed mode streets function. Street practices and standards frequently focus on the risk of two vehicles colliding, rather than risks to people on foot. This has led to the practice of wide roadways, despite the resulting higher speeds and subsequent serious or fatal injuries. Emergency vehicle access has been another overriding concern that still can be achieved with street dimensions that are narrower than is standard practice.

Parks and open space elements of the master plan

A parks and open space element should specify locations of important parks, plazas and other open spaces. This element of the general plan may show specific locations of these spaces or simply require a certain acreage or percentage of land to be devoted to open space within each neighborhood. No resident should be more than a few blocks from a small park; this may require slightly higher maintenance costs than for larger remote parks. Parks may be publicly or privately owned and maintained, but all should be publicly accessible.

Small area plans

Public agencies and jurisdictions can help attract developers and other private parties by creating clear pedestrian-oriented vision of development specific to a one-half-mile district. A small area plan provides the framework around which the community can adopt zoning, capital investment and development strategies for an area.

A small area plan can identify the types and densities of land uses and infrastructure improvements, including street networks, within a project area. The guidelines in a small area plan should be flexible and adaptable to ensure that the type of development can change in response to market conditions.

Regulatory maps

A regulatory map governs the siting and location of public investments, such as streets and parks, as well as private development. A regulatory map may be part of a small area plan, or it may be a stand-alone document. Regulatory maps show proposed zoning, the locations of required streets and the street type, required locations and/or sizes of parks, civic plazas or other open spaces and locations of “build-to lines.”

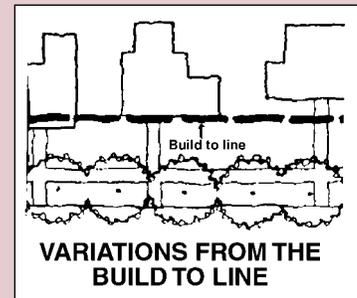
Strategies for incremental change

While creating a walkable community in an underdeveloped area is fairly simple, it can be a challenge to transform existing automobile-oriented suburban areas and many urban areas to walkable environments. Such a

transformation requires gradual, incremental strategies. There are many physical design strategies a community can use to improve existing areas, while working at whatever pace the community’s budget and staffing allows. Community planners should work with local citizens to determine which approaches will work best in their area.

BUILD-TO LINES

Bringing building fronts close to the edge of streets enhances the continuity, attractiveness and intimacy of pedestrian spaces. Build-to lines are a conceptual device that may be shown on a regulating map. The build-to line defines a location at which (1) buildings should front the street, and (2) those buildings should be built within a maximum distance from the sidewalk.



Specific regulations for build-to lines:

- Where specified, a build-to line is at the edge of the dedicated right-of-way, where private property meets a publicly-accessible sidewalk or path.
- To contribute towards meeting the build-to requirement, building facades should be sited within 0 to 5 feet of the public right-of-way.
- The primary entries to buildings should face onto build-to lines (rather than onto rear or side parking lots or alleys).
- Parks or plazas may be used to satisfy up to 20 percent of the build-to requirement and should be landscaped with shade trees and furnished with seating areas.
- Parking lots, driveways, loading zones, and other auto-related areas do not count toward the minimum build-to requirement.

For example:

- Plant street trees.
- Transform disconnected street grids by adding new streets or pedestrian connections as parcels redevelop.
- Use “traffic calming” to narrow streets, slow traffic and improve the pedestrian environment on existing streets.
- Create a pedestrian area on wide, traffic-heavy streets by changing to a boulevard design. Boulevards separate through traffic from local traffic.
- Gradually infill parking lots and low-intensity areas with street-facing buildings as parcels redevelop.

Historical mixed-use building in Salt Lake City. Walkable communities are a return to this traditional form of development.



- Add small-footprint “liner” retail stores along the street in front of big box parking lots that are expected to remain. For example, cafes occupy small footprints but have high activity levels and create more interest for pedestrians along the sidewalk. Because these buildings are small and single-storied, they do not encroach significantly on the visibility of the anchor stores from the street.

- Add visual interest to large, bland buildings over time by adding doors, windows, trellises and architectural features.

- Adapt attractive older buildings to new uses rather than tearing them down. For example, many old warehouse buildings are suitable for conversion to loft condominiums.

- Allow construction of accessory (secondary) and live-work units in single-family residential neighborhoods. To minimize a crowded appearance, secondary units should be allowed only on single-family lots that are above a minimum size, such as those greater than 5,000 square feet.

PARK CITY'S HISTORIC DISTRICT DESIGN GUIDELINES are a good example of architectural standards that promote pedestrian friendly development. The guidelines promote street-oriented storefronts with large display windows and signs oriented to walking traffic. For more information contact the Park City Planning Department at 435-615-5061.

SALT LAKE CITY'S D-1, CENTRAL BUSINESS DISTRICT zone guides the development of walkable downtown streets by bringing buildings within 5 feet of the front lot line, specifying a minimum amount of ground floor glass, and by encouraging mid-block walkways. For more information contact the Salt Lake City Planning Department at (801) 535-7757.

RIVERWOODS is a walkable commercial development in Provo with a proposed townhouse and live-work housing component. Communities can encourage development similar to Riverwoods by being flexible with regard to setbacks and minimum lot sizes. PUD (Planned Unit Development) zoning, performance subdivisions (that use a unit per acre standard instead of minimum lot sizes), and small area plans are flexible regulatory mechanisms that can be used without a complete zoning code overhaul. These tools can help developers build projects that would otherwise fail to meet traditional zoning standards while giving the local government valuable design oversight.



Riverwoods

- **The Utah Quality Growth Commission allocates planning grants to local governments throughout Utah. These grants provide vital resources for communities to plan for quality growth. Any Utah town, city or county is eligible to apply. The grants are awarded annually, and require a 50% match. Past grant recipients have conducted quality growth surveys, completed downtown revitalization plans, open space plans, urban design standards, and various other planning projects. Contact the Governor's Office of Planning and Budget for more information at (801) 538-1619.**

Summary

Walkable communities are keys to Envision Utah's Quality Growth Strategy of managing future growth and maintaining the high quality of life in the Greater Wasatch Area. Walkable communities return to the wonderful pattern of the traditional small town, with friendly neighborhoods, a regular network of tree-lined streets, porch-front homes and street-oriented commercial buildings. Walkable communities range from largely residential neighborhoods, including some retail and local services, to "main street" or "downtown" environments containing a mix of uses. Whatever their form or character, these walking-friendly areas make any community a better place to live, work and play.

Traditional mixed-use housing in an historic warehouse in Salt Lake City.



4

Reuse and Infill

What is Reuse and Infill?

Although Utah has been settled for more than 150 years, most of the structures in the Greater Wasatch Area (GWA) are on land that had never been developed before – some former farmland, most virgin desert. However, it is natural for a city as it matures to experience increased building activity on land that has previously been developed – to have an increase in the reuse of developed land.

The Rose Wagner Theater, which uses previously developed land, is helping establish a cultural identity in the recycling west side of downtown Salt Lake City.



The reuse of urban land is most evident in ancient cities, such as Rome, that have been inhabited continuously for more than 1,000 years. Much of Rome is built on the remains of previous buildings that had been built on the remnants of yet older buildings, and so forth. The original undisturbed soil for most of Rome is between 50 and 100 feet below the surface. The depths are composed of the rubble of centuries of reuse.

As development in the Greater Wasatch Area ages, the process of land reuse will accelerate. The central blocks of many Wasatch Area cities, such as Salt Lake City Provo, Ogden and Brigham City, are well over 100 years old. A few structures are pioneer originals, most have recycled once or maybe twice, but many are again facing deterioration and obsolescence. The Gateway development in downtown Salt Lake City is evidence of increasing land reuse. Gateway is the largest private development in Utah's history and is occurring in a portion of the city that had long since lost its purpose and functional value.

Land reuse is what keeps cities and towns from deteriorating after their first buildings age and become obsolete. Regions and cities that rely solely on the development of vacant land to absorb growth soon develop the “rotten core” syndrome: all the investment and growth occurs at the edge while the older parts of the city deteriorate, as obsolete buildings and crumbling infrastructure make the center less livable. People flee the deteriorating center, reducing the population and leaving behind the very poor who cannot afford to move. Although this has been the fate of many cities in the United States, it is not an inevitable consequence of an aging center. There are many examples of cities, both in the United States and worldwide, that have accommodated growth with

a combination of development on vacant land and reuse of older parts of a city.

While some historic buildings are worthy of preservation, many of them – especially one-story commercial buildings – deteriorate or become outdated in a 30- to 50-year time-span. Some developments, such as strip commercial centers, malls and big-box retail developments, are so tied to a particular style of retailing that when that marketing concept goes out of fashion, there are few alternative uses for the buildings.

There are many benefits to reuse as a strategy to accommodate growth, in addition to the continuing maintenance of a healthy community. Having a robust downtown and older close-in suburbs helps a region stay economically vital. In recent years, suburban growth in the Greater Wasatch Areas, while still attractive to many, has been coupled with an increasing level of negative growth-related impacts. Air pollution has worsened, commuting times have increased, and traffic has become more congested. In addition, the prospect of continually increasing highway capacity to accommodate growth on the edge has proven to be extremely expensive and disruptive.

Reuse isn't necessarily demolition and new construction. Many older buildings can be adapted to new uses.



Reuse can help the region stay economically vital by making use of the extensive infrastructure already in place in developed areas, mitigating traffic increases, cutting air pollution and reducing the need for expensive new highways.

Reuse and infill development are valuable tools to create and improve walkable neighborhoods and to meet the housing needs of the community. Reuse often takes parcels with relatively small and underutilized buildings that do not have pedestrian-friendly characteristics, and replaces them with buildings that add housing and vitality. Infill development does much the same by utilizing relatively small vacant parcels that otherwise detract from pedestrian access in the neighborhood.

What this chapter covers

Envision Utah's Quality Growth Strategy encourages reuse and infill as important methods to manage the growth that is coming to the Greater Wasatch. This chapter focuses on tools for overcoming obstacles to reuse and for planning renewal of existing areas. Specifically, this chapter will:

- Discuss the development opportunities that exist through reuse and infill. We will primarily address a type of development that is both relatively dense and contains a mixture of complementary uses – residential, retail, office and more. This type of development can contribute to the creation of walkable neighborhoods. Although mixed-use, medium- to high-density development is traditional in older, established parts of most cities, it is very different from the auto-oriented development that has been prevalent in the U.S. and Utah since the 1950s.

This land reuse project in Park City extended the historic Main Street.



- Define infill (development on relatively small parcels that are vacant within an area that is generally developed) and reuse (replacement of a building or the retrofit and expansion of a building).

- Outline the conditions necessary for reuse.

- Look at actions that a community can take to encourage or participate directly in infill and reuse.

Obstacles to reuse and infill

While the idea of infill and reuse is appealing, there are many obstacles to their implementation. These obstacles can be grouped into four categories:

Legal obstacles, such as zoning codes

Often, zoning codes are drafted to address development on vacant land and to preserve existing land use patterns. However, the process of reuse is fundamentally different from development on vacant land. Vacant land typically produces little or no income, and the owner often has a strong economic incentive to develop. In addition, on vacant land, it is comparatively easy to adapt a proposed development to comply with a variety of zoning regulations.

Reuse can help improve the walkability of a community. This bookstore in Sugarhouse is part of a project that recycled low intensity auto-oriented retail with higher intensity uses oriented to both autos and pedestrians.



In contrast to vacant land development, reuse must evaluate existing structures and uses on a parcel to determine their suitability for building or land reuse. Reuse typically involves costly demolition or retrofitting. In addition, even an obsolete building may still produce some income stream, increasing the cost of property acquisition. Finally, because of the existing built environment, there may be limitations on compliance with requirements that are common in suburban zoning and building codes. Local governments that seek to encourage reuse need to be sensitive to the realities of developing on typically small lots in a built environment, and adapt their zoning to these logistical concerns. Governments that do not adjust their zoning and other regulatory standards risk inadvertently discouraging or eliminating the opportunity for reuse.

Lack of investment in adequate infrastructure

The growing parts of a region often monopolize the available capital for infrastructure investment. This situation leads to deferred investment in needed sewer, water, street and other infrastructure maintenance and upgrades in developed areas. Cities are then tempted to ask developers of potential reuse projects to shoulder the complete financial burden of needed infrastructure improvements. These costs can make reinvestment in developed areas prohibitively expensive.

Zoning is often drafted with development of vacant land in mind.

Standard yard setbacks, parking requirements and building codes are often too rigid and stringent for land and building reuse.



► **Bountiful's Lakewoods helps demonstrate that reuse need not be limited to the larger cities in the Greater Wasatch Area.**

Market perceptions

Promising reuse areas frequently suffer from a rundown reputation. Many of the most feasible areas for reuse are characterized by abandoned buildings, marginally profitable businesses, rundown housing and a concentration of poverty. The very reason they are feasible to redevelop is that the structure is obsolete and ready for change. However, investor confidence may erode if effective efforts are not made by the public sector to reverse the course of decline.

Environmental pollution from prior uses

Earlier industrial or commercial development sometimes leaves contaminated land that must be cleaned to federal or state standards before reuse can be allowed to take place. Well-intentioned laws designed to rid land of contaminants may place the financial burden on new development and delay the permit approval process. In some cases, these added costs may make reuse not feasible without support from the local government.

The Lakewoods lofts in Bountiful combine retail, office and residential uses in a former furniture store. The original building is over 100 years old and began as an opera house.



What is the difference between reuse and infill?

Reuse is the recycling of existing built land with new structures and uses. It can occur: (1) without government intervention (through private-sector action alone), (2) through private-public partnerships, or (3) through direct government action. The term 'reuse' also refers to the reuse of significant but underutilized buildings or additions to existing buildings. Land reuse and building reuse pose most of the same challenges and offer similar advantages.

Reuse, by its nature, is relatively expensive. For example, it involves purchase of existing structures with the land and involves either demolition or building rehabilitation costs. As a general guideline, reuse will occur without government participation if: (1) there is sufficient market demand, and (2) permitted zoned densities are significantly higher than the density of the existing structures on the sites. Having zoned densities significantly higher than existing densities gives a substantial financial incentive to a property owner to redevelop.

Unlike reuse, infill occurs on smaller tracts of vacant land in otherwise developed areas. For

example, infill may occur on small, isolated parcels that have never been developed, on surface parking lots, on land that was occupied until structures were removed or on land partially occupied by development but with a significant portion of the parcel vacant.

Advantages of reuse and infill

While both infill and reuse may involve higher costs than new construction in terms of private-sector expenses, a big advantage is that infrastructure systems and services exist and are nearby. When all of the costs to the community and region are calculated, reuse and infill are often less expensive than growth on the urban fringe. Advantages include:

- **Reduced land consumption.** When older areas are abandoned in favor of vacant land development, growth occurs –

▶ **A community that wishes to encourage reuse should be careful to avoid overzoning. Zoned densities that are significantly higher than justified by market demand result in land speculation and “hold-outs” that work against reuse.**

Reuse preserves vacant land by recycling developed land and saves a community's financial resources by utilizing existing infrastructure. This is an infill/reuse project on Salt Lake City's 9th East.



► **Non-walkable redevelopment and infill has many advantages, but new development or reuse in older areas must be combined with pedestrian-friendly characteristics and densities to help reduce vehicle use and congestion.**

typically at low densities and on farms and other natural areas. This increases a community's land consumption and can lead to what is commonly called "sprawl." Reuse attracts new growth to land that has already been developed, preserving land by recycling it.

■ ***Decreased automobile use.***

If built in a pedestrian friendly form (see the preceding chapter), or near high-quality transit, reuse and infill can increase walking, biking and transit use, thereby reducing auto use and the resulting pollution. Reuse and infill often occur in the older areas of our communities where there is an interconnected road system, high-frequency transit and other pedestrian friendly features.

■ ***Use of existing infrastructure.***

Reuse and infill take advantage of existing infrastructure systems, saving the community financial

resources. Areas of historically intense development have potential for reuse. After the area declines, and as household sizes shrink, much of the infrastructure is left unused. New construction and reuse in these areas can take advantage of this underutilized infrastructure and the investments that already have been made. (Please note that, in some cases, infrastructure maintenance has been deferred and this expense must be met.)

■ ***Revitalize neighborhoods and commercial areas.***

Reuse and infill often improves the health and appearance of existing areas. New residents and businesses typically increase property values and improve the overall viability of an area.

These infill projects help reduce congestion by encouraging walking and through their locations on high-frequency bus routes.



The Dynamics of Reuse

Reuse can occur when a potential project will generate enough income to offset all development costs as well as the risk involved. A careful determination of the likelihood of reuse of a particular site can be a complex task, but communities can review several of the preconditions of reuse to ensure that the public sector is doing what it can to encourage the private sector to engage in land recycling.

How to estimate reuse potential: Compare reuse costs with potential revenue

A local government can analyze parcels for potential reuse by comparing potential costs with potential revenues. This type of analysis shows the effects of zoning and parking policies on development financial returns to inform a community how zoning parameters might change to encourage reuse. (The details of how to conduct this analysis, and spreadsheets to aid in the work, are included in the “Model Codes and Analysis Tools” workbook.)

One of the key factors determining potential reuse of a site is the estimated revenue after reuse. In planning for a specific area, careful attention can be given to market demands and expected rent levels. However, in a community-wide reuse analysis, this often is not feasible. A community-wide reuse analysis must necessarily set aside the issue of market demand to simply compare revenue with expenditures.

Revenue

Revenues are estimated from calculating the allowable development permitted, given the combined effect of all codes and zoning regulations. The average rent levels in the community for the type of use expected (residential, retail, office) should be used. The following are factors used to determine the potential rent that can be generated by a new building:

Zoning that allows mixed commercial with residential uses helps ignite reuse more than zones that permit residential uses only.

Often more residential reuse will occur if it can “piggyback” more profitable retail reuse.



► **Envision Utah’s “Model Codes and Analysis Tools for Quality Growth” includes a simple spreadsheet that calculates the permitted densities that are the combined result of a community’s regulations.**

Minimum parking requirements have a significant but less than obvious effect on development intensity.

Surface parking competes with the building footprint for available lot space.



■ *Allowable densities.*

Maximum density regulations often are not the limiting factor in development. Sometimes the cumulative effect of regulatory heights, parking, setbacks and landscaping acts to limit allowable densities below the specified maximum density in the zoning code.

■ *Rent per square foot.*

Once the square footage of developable area is calculated, and the amount of rent per square foot researched, the total revenue is simply rent per square foot multiplied by total floor area.

Costs

Development costs include property acquisition costs, demolition expenses and construction costs. Acquisition costs can be estimated using tax assessor’s data.

Demolition and construction costs are best estimated using expert opinion or statistics tracked by the construction industry.

Simply put, reuse occurs when it makes financial sense. A parcel with estimated return on a potential investment of 10 to 30 percent is expected to redevelop in the long term if there is sufficient market demand. If few or no

parcels are estimated to have reuse potential in an underutilized area, a community can try a number of techniques to increase reuse potential. A community can more easily affect potential development revenue than expenses in its efforts to encourage reuse. Therefore, the first order of business is to determine if the development density allowed is too low to attract investment and, if it is, to consider modifications to zoning regulations that will be appropriate for the surrounding neighborhood.

Removing regulatory obstacles

Parking

In many communities, off-street parking regulations have the most impact on limiting development densities. Developers in most of the Greater Wasatch Area prefer surface parking because land is relatively inexpensive, and structured or tuck-under parking is four to five times more expensive per space. However, surface parking competes with the building footprint for available lot area, reducing development intensities. The more surface parking on a site, the less room there is for the

footprint of the building. One way to address this dynamic is to lower artificially high minimum parking requirements. Lower minimum parking rates do not necessarily result in less parking supply, but enable developers to balance parking supply to demand. The market regulates the amount of parking supply. Developers and property owners have a natural incentive to match parking supply with demand as they try to reduce development costs (by decreasing parking) while ensuring there is enough parking for the development to be successful. The increased densities that result from less parking help make for a more connected urban fabric where people are more enticed to walk and take transit.

Landscaping requirements and minimum setbacks

While greenery is attractive, excessive setbacks and landscaping standards inhibit reuse and pedestrian activity. The most appropriate open spaces in walkable neighborhoods are active places for recreation and public gathering. Large green buffers between buildings and the street increase walking distances without providing usable open space.

Maximum height limits

Place a low priority on increasing maximum height limits. Increasing height limits rarely increases densities as much as reduced parking and landscaping requirements. In addition, increasing heights can be controversial as taller buildings may be incompatible with existing development. Typically, most areas can achieve reuse with mid-rise (3- to 6-story) development. In fact, some of the world's most walkable cities are built at this scale. High-rise developments can provide spectacular views and add an element of luxury housing, which can revitalize an area, but mid-rise height limits with modest landscaping and parking requirements do not present regulatory obstacles to reuse. Coupled with appropriate design controls, mid-rise buildings produce a very pedestrian friendly and inviting urban environment.

► **In close-in areas served by transit, lower rates of parking supply enable developments to be more walkable. Attractive, pedestrian-oriented buildings and streets encourage people to use the available transit by making the inevitable walk from transit to destination more pleasant.**



Zoning need not permit height limits greater than 3 to 6 stories to achieve vibrant reuse. This area in Geneva, Switzerland, was recycled in the 1950s and 60s. In good weather this sidewalk cafe occupies on-street parking.

Developing a Reuse and Infill Strategy

The aforementioned analyses and techniques can reveal the areas with the most reuse potential, a necessary first step in determining the best areas in which to implement an infill and reuse strategy. Two ingredients that are essential in a successful reuse strategy are a relatively high level of reuse opportunity and supportive regulations. However, as with baking a cake, it is how all ingredients are assembled that determines success.

Often, one of the chief obstacles to overcome in redeveloping an area is a perception, sometimes quite justified, that the area is in decline. When an area is considered undesirable, market rents are generally below the point at which potential private investment would be profitable. In these cases, a series of public investments, properly placed, can help change the perception of an area and thereby increase private interest in it. Investments and pilot projects need not be large in scope. In fact, a small and very successful pilot project that exemplifies the vision for the district will do more to change market perceptions than a large project that attains only a modest success.

Choosing areas to focus efforts

High financial returns (low potential expenses and high expected revenues) are not sufficient to warrant public investment and a focused reuse strategy. At least three to four of the following characteristics also should be present to warrant public effort:

- *Raw financial potential for reuse as indicated by analysis.*

Santa Maria Liguria is a small Italian city that exists at a density over 200 households per acre, yet most of the buildings are between 3 and 6 stories. Note that most of the architectural details are simply painted on. The key to the town's success is its friendly streets and quaint plazas.



■ ***Underutilized infrastructure.*** Areas where infrastructure sits underutilized because it was constructed for the historically peak activity in the district.

■ ***Pedestrian-friendly physical characteristics.*** Areas that either currently have or have the potential for connected streets, street-oriented architecture and moderate to low levels of traffic.

■ ***Reuse would further other neighborhood revitalization objectives.***

■ ***Close to frequent transit service, in addition to adequate automobile access.***

■ ***Unmet housing demand.*** As discussed in the chapter “Meeting Housing Needs,” many communities in the Greater Wasatch Area are expecting to have a shortfall of elderly-friendly (low yard maintenance) and less expensive owner-occupied housing types such as townhomes and condominiums. Reuse that includes housing can help meet this need.

■ ***“Character.”*** This is that hard-to-define quality that makes an area unique. Character can be fostered to give a district a unique identity and to help develop market interest. Sometimes this quality stems from the presence

of historical buildings with potential for reuse. Sometimes it is a unique combination of businesses: a series of antique shops, an entertainment district, businesses oriented to authentic local or ethnic products or close proximity to a large regional facility such as a university campus or hospital.

A significant aspect of a successful reuse plan is the identification of an area’s assets and an outline of strategies to build upon them. Other key actions include fostering and improving the basics of quality urban living: safety, good schools, parks and adequate public facilities.

Encouraging reuse in your community

Once an area is identified as appropriate for a focused reuse strategy, several public actions can help stimulate private investment. Some of the key actions that will promote both reuse and increased pedestrian access follow:



Mixed uses such as these condominiums above retail create an appealing village character.

Allow retail and office uses to mix with residential uses

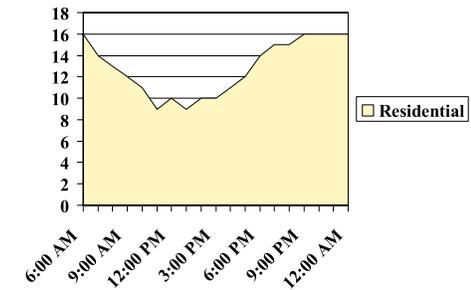
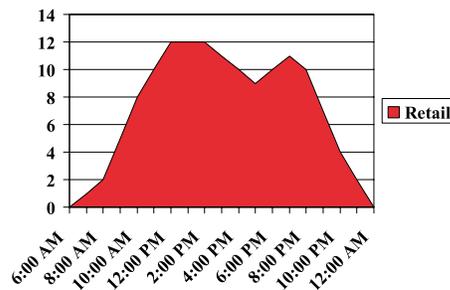
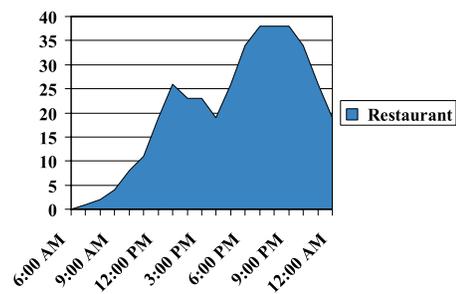
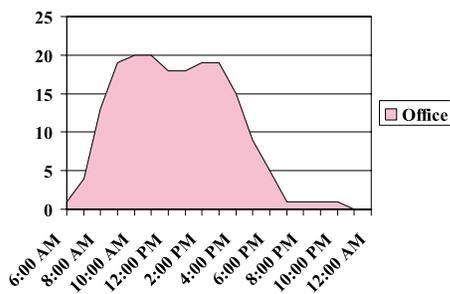
Mixing uses creates an appealing urban or village character. When designed to meet the street, ground-floor retail is especially useful in creating a vibrant pedestrian-oriented experience. Street-level retail also tends to encourage development of more housing. The additional income generated from the retail uses helps make more reuse feasible, including the reuse of housing on upper floors. When there is not enough market demand for large amounts of street retail, live-work units – residences with a small ground-floor, street-facing room for a home office or small business – can provide much the same function as ground-level retail.

A worker in a mixed-use environment may walk to a number of nearby restaurants at lunchtime, pick up a birthday gift for that evening, and walk home to her townhouse up the block. All of these activities are done without fighting traffic.

Invest in shared parking

High off-street parking requirements consume large amounts of land and, by doing so, tend to inhibit reuse. The solution is not to ignore parking demand, but to move parking supply from inefficient and piecemeal private parking lots to efficiently-used and space saving district-wide shared parking lots or structures. Shared parking can be simply

Each land use has its own unique parking demand curve.



► **STANDARD PARKING**

Standard suburban parking regulations require each user to, at a minimum, meet peak parking demand and often more.

Typical suburban commercial developments provide parking to meet the peak demand of the 5th busiest day of the year – 15 to 20% more than is needed at the peak time of an average day.

Zoning regulations also generally require more supply than necessary to meet average peak demand.

In the example below, 1800 parking spaces are needed based on average peak demand if parking is not shared between any adjacent land use, like a water well system.

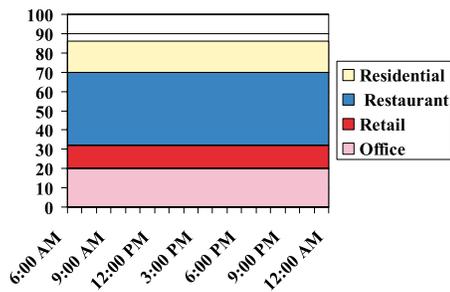
Typical supply would be approximately 2100 spaces.

► **SHARED PARKING**

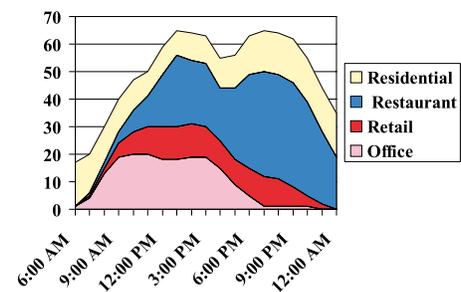
In a walkable town setting, parking can be used as a shared utility, like a municipal water service, resulting in much more efficient use.

■ A main street district where parking is shared would require only 1500 parking spaces.

■ For shared parking to be successful, there must be a mixture of uses – to stagger peak parking demand, and walkable streets – so pedestrians will be willing to walk from one land use to the next.



No Sharing: Every use must provide parking for their individual peak demand.



Sharing: Parking supply must meet the total peak of all adjacent land uses.

explained. Each land use has its peak parking demand at a different time of day. For example, office uses have their peak parking demand in the late morning, restaurants peak in the early evening and movie theatres have their peak demand late in the evening. When parking is not shared between adjacent businesses but instead is provided on each individual site, parking supply must be large enough to accommodate the cumulative peaks of each individual land use or business. At any given time of day, most of the parking is vacant, although the unused parking spots move from one parcel to another. When parking is shared among nearby businesses that represent land uses with different

periods of peak parking demand, fewer parking spaces are needed to serve parking demand. Because adjacent land uses peak at different times, balancing each other out, only the blended peak demand must be provided for.

On-street parking is the most efficiently used and one of the cheapest types of parking to provide. It is not proprietary to any one business, has high visibility, is seldom left vacant and is available for any business within walking distance. The available on-street supply in a district often can be increased by striping individual parking spaces or through alternative configurations such as diagonal on-street parking.

Provide capital infrastructure investments

Capital investments to beef up existing infrastructure, in addition to shared parking, can spark reuse. Potential capital investments include:

■ *Streetscape improvements.*

Streetscape improvements can leverage private investment by quickly establishing a new district identity. Streetscape furniture, trees and paving material demonstrate to the private sector a public commitment to the district.

Public parking is the most efficiently shared supply;

it can help revitalize a business district and ignite a pedestrian-friendly streetscape.

When siting a public parking facility consider the following:

- Include retail on the ground floor of the public parking structure.
- Don't build a large public facility in the center of town where it will detract from walkable design. Place it within walking distance of the center. The connections from the public parking to the center are an opportunity to draw pedestrians along a new or revitalized main street.
- Don't overbuild public parking. Public parking, like all parking, is costly to provide. It is not a magic bullet that, by itself will revitalize an area. Public parking should be balanced with other strategies and investments to encourage redevelopment.

Improvements also encourage new construction to address the street. Street-facing architecture and shaded sidewalks are also critical to walkable neighborhoods.

■ ***Information infrastructure such as fiber optic cables.***

These improvements help attract business firms and residents that are dependent on high-speed internet connectivity.

■ ***Transit and road improvements to improve accessibility.***

■ ***If necessary, basic infrastructure upgrade and repair*** (streets and utilities).

■ ***Environmental (brownfield) restoration.*** Prime reuse or infill opportunities are often held back by real or potential environmental contamination. The federal legal framework regarding contaminated sites discourages the transfer of property because the buyer may be held liable for the entire cost of cleanup. If financially feasible, a community may clean or certify that a site is within an acceptable level of soil contamination.

Create financing and funding mechanisms

Think creatively when devising ways to provide monetary incentives for those interested in reuse and infill. A range of funding mechanisms could include:

■ ***Reduce planning fees.***

Offer reduced fees or waive them for eligible projects in targeted reuse or walkable areas. For example, in Orlando, Florida, transportation fees are reduced or even waived for projects that have local destinations that can be reached on foot and that are built at densities that support transit. This fee waiver is based on the realization that walkable and transit-oriented development reduces the demand for expensive highway improvements.

Reuse of historic buildings in Salt Lake City. Retail on the left, residential on the right.



► **In the San Francisco Bay Area, households in neighborhoods with regional rapid transit and walkable connections spent roughly half as much on transportation as households with similar demographic characteristics but in more auto-dependent locations.**

■ ***Prioritize public funding.***

When there is competition for limited public funding, priority should be given to projects in targeted reuse or pedestrian-scale projects. When projects compete for public funding, they should be reviewed to gauge whether they are compatible with the desired scale and quality of development and the services planned for the area. The review also could gauge whether a project implements a planned element of regional or local transportation plans, whether it may require acceptable modification to such plans, or whether it is fundamentally at odds with regional or local transportation planning.

■ ***Guarantee funding for “risky” projects.***

Jurisdictions can help obtain funding or guarantee/underwrite financing for developments so that risk-averse financial institutions will be more willing to lend funds to

projects such as mixed-use developments and live/work housing.

■ ***Provide funding to improve existing areas.***

■ ***Encourage people and businesses to locate in central areas.*** Examples include jurisdictions that offer down payment assistance to people buying houses and condominiums in central communities. Down payment assistance helps make housing and business costs more affordable and more competitive with outlying areas.

■ ***Location-efficient mortgages.***

A “location-efficient mortgage” is an innovative financing concept that rewards people for living in areas of high transit accessibility, areas that typically coincide with reuse opportunity. The concept is gaining ground throughout the country. For example, in Chicago, banks are required to consider the likely reduction in auto-related expenses when households in transit-served neighborhoods apply for home mortgages. The theory is that households in transit-oriented neighborhoods save money on transportation because they tend to have fewer cars and drive fewer miles. The money saved on transportation should be considered in determining how much income a household



An example of infill townhouses in a modern architectural style.

has available for a home mortgage. Jurisdictions in Utah could work with banks and state regulators to encourage these types of mortgages.

Direct participation in reuse and infill

The role of government in a reuse area is to provide the leadership necessary to create positive momentum necessary to stimulate private development. Often the tools described previously are enough to invite private investment. Sometimes more direct strategies are necessary. One strategy involves public partnerships with the private sector; another involves the use of the legal authority available to a local redevelopment agency which includes tax-increment financing and eminent domain.

Public-private partnerships and redevelopment agencies

A public-private partnership is a useful tool to encourage reuse and infill. Though some Utah local governments are cautious about a partnership with the private sector, often some public participation is necessary in the early stages of a reuse plan. One of the best justifications for a public-private partnership is to create a pilot project to demonstrate the market potential in an area. A highly successful

first development accomplished through a private-public partnership can help ignite otherwise weak market demand and reduce the development risks for the private investment to follow. A strong success in a modest-scaled development tends to improve market perceptions much more than a modest success in a large-scale development.

Redevelopment agencies

An effective but controversial way to partner the two sectors is through a redevelopment agency (RDA). An important tool available to a local government RDA to finance reuse efforts is tax-increment financing. Tax-increment financing makes available for up to 25 years any property

FLAG LOTS

Often, large parcels of land in otherwise developed areas are left vacant because they lack street access. Flag lots can be an appropriate solution to this problem if they follow some of the following guidelines:

- A flag drive serving two or more lots should be shared to minimize curb-cuts and visual impacts on adjacent lots. Shared drives should be only slightly more wide than single-lot drives. For example 12' for one lot and 15' for two or more lots.
- There should be no parking 10 feet on either side of the flag drive entrance. The flag drive should be screened from view from adjacent lots with hedges or a fence. Snow removal space should also be included to the side of the flag drive.
- Careful attention should be given to separation and screening between the front-yard of flag lots and the backyard of adjacent lots to ensure privacy.

tax revenue generated above the “base year tax roll” – the property tax assessment as of the year the specific redevelopment project is officially approved. This increment must be used for improvements within or supporting the designated redevelopment project (except that up to 20 percent of the increment may be used anywhere in the city for affordable housing).

The first step in this process is to establish an RDA for the local jurisdiction. The governing body, such as the city council, becomes the governing board for the rede-

velopment agency. The available powers of the agency are established by the “Utah Neighborhood Development Act” (17A-2-1200 *et seq.* U.C.A.). The Act provides for a choice of an economic development or a redevelopment project. If an RDA chooses a redevelopment project, the designated area must qualify as “blighted.” This authorizes the RDA to purchase properties through eminent domain (available during the first five years an area is a designated redevelopment district), provides the ability to relocate residential or commercial occupants and includes the use of tax-increment financing. After an RDA forms, it may adopt a redevelopment plan for a specific area. A committee of seven members representing the city, the county, the local school district and the state school board must approve the project area and proposed budget.

Redevelopment agencies in Utah generally have produced positive results. However, the tools available to an RDA have been questioned and challenged. Despite potential controversy, these agency powers can be very valuable in shaping viable and attractive neighborhoods. Following is a review of some tools that can be used effectively by a redevelopment agency:

PROGRAMS FOR HISTORICAL PROPERTIES

Several federal, state and local programs are available to assist in the rehabilitation of older, historically significant properties.

In addition to the programs listed below, there are several municipalities throughout the state that offer low-interest loan and grants programs for the rehabilitation of buildings.

■ **Federal Commercial Rehabilitation Tax Credit.** A 20% investment tax credit (ITC) is available for the rehabilitation of historic buildings that are listed on the National Register of Historic Places.

■ **Utah State Residential Rehabilitation Tax Credit.** A 20% non-refundable state income tax credit is available for the rehabilitation of historic buildings (National Register) that are used as owner-occupied residence or residential rentals.

■ **The Utah State Historic Preservation Office** offers grants for rehabilitating old buildings. Grants for communities are available for many preservation related activities including “brick-and-mortar” rehab work. Additional grants are earmarked for older commercial buildings as part of “Main Street” revitalization efforts.

For more information contact the Utah State Historical Society, State Historic Preservation Office at (801) 533-3533.

■ ***Eminent domain and selective demolition*** can be used to assemble land into cleared parcels large enough to be attractive to the private sector. Large pieces of land are easier to develop since they offer more flexibility with site design and development programming. Typically, it is prohibitively expensive for the private sector to assemble land because of absentee ownerships or property hold-outs.

■ ***Relocation of residents*** should be used with extreme caution. There should always be a net increase in housing units and the total number of affordable housing units should be at least maintained. If dilapidated housing must be replaced, new units should be developed nearby to help relocated residents maintain their social network. In many cases, older housing units provide the character upon which a district identity can be built. Recognizing this, many cities choose to fund programs to renovate and rehabilitate older housing units rather than raze them.

■ ***Tax increment financing.*** Anticipated future tax increment funds often are leveraged to bond for funds that can be used soon after a reuse district is established. Bonding enables a city to establish positive momentum in a district by making significant up-front improvements.

Reuse and housing

One of the lingering failures of modern redevelopment was the urban renewal plans of the 1950s and 1960s. Many of these were attempts to tear down “slums” that were actually struggling but viable working-class neighborhoods. This form of reuse destroyed these neighborhoods and scattered residents to locations where they were without social ties. Much of the reuse from this era replaced small-scale, pedestrian-friendly architecture with large-scale, automobile-oriented development.



The Artspace adaptive reuse project in Salt Lake City helped turn around west downtown.

Most reuse projects, especially those that seek to provide a pedestrian-friendly and pleasant urban experience, benefit from mixed-income housing. One of the most challenging problems to solve in a modern urban setting is a pocket of poverty. When an entire area suffers from poverty and high unemployment, other social ills soon follow. Many successful reuse areas avoid creating a concentration of low-income housing by subsidizing roughly one-third of housing units.

Mixing housing units that serve a variety of market segments has a number of other advantages. There is sufficient disposable income to support a variety of retail and restaurant uses; there is no stigma associated with living in the area; and all residents, including those of lower incomes, benefit from the stability and opportunity that a vibrant community affords. Many profitable developments start with luxury housing and, after the district's housing market is proven, follow with moderate income housing. Affordable housing should not be excluded or forgotten in a reuse area. Many reuse areas are well served by transit, services and employment opportunities that are convenient for working and lower-income singles and families.

Summary

Much of our history has been in settling and taming the often-harsh Utah landscape. Today, the prime concern of many Utahns is to preserve the quality of life that we have built here. As we begin the 21st century, our cities and towns will turn increasingly to managing and focusing growth into desirable and environmentally less damaging areas. Reuse and infill should be tools that every community investigates using for areas more than 30 to 40 years old. Properly planned and administered, they can bring tremendous benefits to a community. In addition to being a cost-effective and environmentally sound way to accommodate growth, they can foster living and working environments that are almost impossible to create on vacant land. Redeveloped areas can combine historical development with new buildings, mix walking and bicycling with automobile use, and build unique identities centered around the intrinsic qualities of an area. While the amount of reuse in Utah has never been measured, some western cities accommodate as much as 30 percent of their new housing growth through reuse and infill strategies. They are valuable tools that Envision Utah believes will be used to improve our quality of life.

Upon its release in October 2000, Urban Planning Tools for Quality Growth, or “The Toolbox” as it has come to be known, was enthusiastically received by many municipalities. One year later, communities now regard it as an essential resource as they seek to create quality neighborhoods and projects, and to balance growth with the preservation of sensitive lands and other precious resources.

Because of the overwhelming reception of the Toolbox and continuing interest in the topics it addresses, Envision Utah decided to re-issue it with four additional chapters. When the Toolbox was first released we did not foresee a need to update and expand it. The Toolbox was published to serve municipalities, developers and other stakeholders for the foreseeable future. However, as we identified other topics and best practices, we decided to publish this new and expanded edition.

Two new chapters build on the section “Making our Community A Good Place to Walk” from the original document by providing more strategies in the area of Commercial and Retail Development and Street Design and Pedestrian Safety.

In addition, we have updated the Water Efficiency chapter due to changing data and findings since the first release. This chapter is now placed in a subdivision of the Toolbox called Natural Resources. Also included in this section are new chapters of Energy Conservation and Urban Forestry. The three areas of water efficiency, energy conservation and urban forestry touch on the everyday concerns of our cities and counties as they try to accommodate development while preserving our precious natural resources. Obviously, how we handle these challenges will significantly affect the quality of life in Utah and the Wasatch Front well into the future.

We hope this revised edition of the Toolbox will contribute to keeping the Greater Wasatch Area an incredible place to recreate, live and raise a family for many generations to come. We trust that you will embrace this second edition with as much enthusiasm and excitement as the first.

Greg Bell, Chair
Envision Utah

Natural Resources Introduction

As Utah's population continues to grow, local communities must balance consumption and conservation of the state's natural resources. How can the growing need for water in a thirsty community be balanced with limited resources and expensive infrastructure alternatives? Are there opportunities for energy savings by introducing a variety of trees into our urban landscapes? Can water conservation programs bring secondary energy saving benefits to communities trying to provide expansive services to growing communities?

Recognizing the key to successful resource management is bringing together motivated people empowered to do the right thing. Communities that focus on collecting and managing good information and providing inclusive processes that are respectful of differing values, become the stewards for progressive and responsible resource management. This stewardship is translated into comprehensive plans that support the development, conservation and management of a community's natural resources.

The first step in capturing the benefits of proactive management is understanding the interrelationships between the seemingly unrelated resources. It takes energy to capture, process and distribute water to a community. Effective water conservation programs not only reduce the need to build expensive water utility infrastructure, but these programs save energy. Trees planted strategically and managed properly in a community also help communities save money while performing street maintenance. Cooler streets and communities shaded by the urban forest reduce energy needs of community homes and businesses. A win-win situation for everyone involved.

Understanding the interdependency of our natural resources and then taking the next steps to properly manage them is an admirable goal being undertaken by many communities. Managing energy use, water use and supporting the viability of urban forests improves the quality of life for many residents along the Wasatch Front. The following chapters, Water Conservation, Urban Forestry, and Communities Planning for Energy Efficiency, include tools, strategies, and concepts to help communities take these next steps. These tools provide an opportunity to realize the benefits of addressing the needs of growing communities and their use of limited natural resources.

5

Water Conservation

Water Use and Population Growth

As the population in Utah continues to grow, the demand for water increases. The population along the Wasatch Front is currently 1.6 million people and is expected to increase to 2.2 million people in 2020 and to more than 5 million by the year 2050 (*Envision Utah 2000*). In Utah, 67% of residential water is used for outdoor use. This indicates a key area for us to save water in Utah.

The traditional role of water districts and purveyors has been to develop the water resources within their service areas through supply management projects that meet the unique and growing needs of the communities they serve. According to the American Water Works Association (AWWA), “In balancing current and future water supply and demands, the objective should be to determine which combination of supply-and-demand management alternatives is optimal from social, environmental and economic perspectives” (*AWWA, 1993*). Various water management practices can be conveniently separated into supply management (augmentation) and demand management (conservation) measures.



Deer Creek Reservoir

► **Water conservation helps improve water quality. Urban development can impact water quality in a variety of ways. As areas become more developed, a greater variety of pollutants are generated. Some of these, such as petroleum products or industrial discharges, can be highly toxic to aquatic life and can pollute an entire drinking water supply. The effects of other pollutants, such as fertilizers, are more indirect. These nutrients can stimulate excessive microscopic plant growth in our reservoirs, creating taste and odor problems.**

► **Water quality management in Utah's urban areas generally falls into four major categories:**

- **Protection of surface and groundwater sources of drinking water;**
- **Management of the quality of municipal and industrial point source discharges so that the receiving waters are not degraded;**
- **Reduction of the impacts of storm water runoff from urban areas;**
- **Watershed scale protection, including reduction of nonpoint source pollution.**

Benefits of Conservation

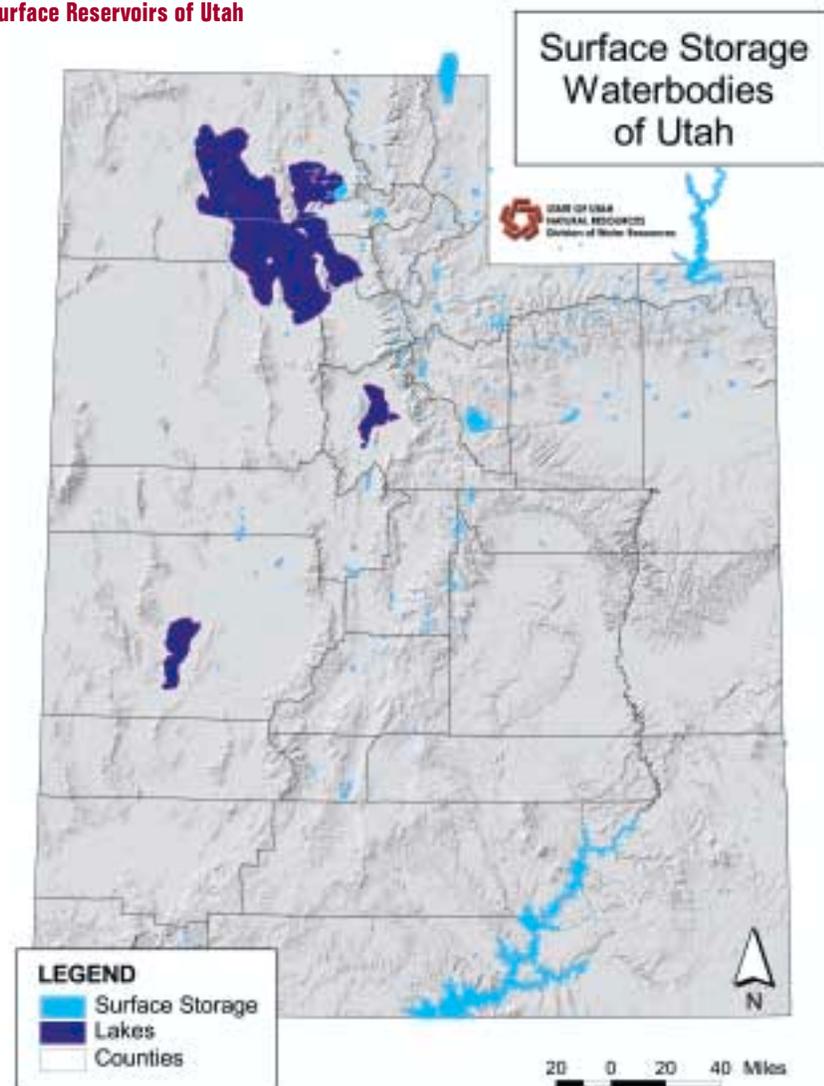
The Utah Division of Water Resources (2001) lists the following benefits of water conservation:

- Delay costs associated with capital investments to upgrade or expand existing water facilities,

including the need for additional staff, O&M costs, and other expenses the new capital projects would require;

- Reduce impacts from sewage or wastewater flows, delaying or reducing the need for more wastewater treatment facilities;
- Conserve energy, as less water needs to be treated, pumped, and distributed to the consumer;

Surface Reservoirs of Utah



Sara Larsen, Utah Division of Water Resources

- Lessen the leaching of chemicals and sediments into streams and aquifers with improved agricultural and urban irrigation efficiencies; and
- Reduce stream diversions, enhancing water quality and environmental and recreational functions.

The Environmental Protection Agency (2001) echoes the above benefits and emphasizes that water conservation offers major environmental, public health, and economic benefits while improving water quality, maintaining aquatic ecosystems, and protecting drinking water resources. Reducing wastewater flows, recycling industrial process water, reclaiming wastewater, and using less energy have significant benefits to the environment .

Ground Water Aquifers

- ▶ **CONVERSION OF ACRE FEET TO HOUSEHOLDS TO HOUSEHOLDS**
The average household uses 860 gallons of water per day. This is equal to 25,800 gallons of water per month or 309,600 gallons of water per year. This equals approximately 1 acre foot per year.
- ▶ **The major water degradation culprit in urbanized areas is the increase in “impervious surfaces,” which can alter the water movement through our watersheds. Paved driveways, sidewalks and parking lots are impervious surfaces. Salt Lake City has stormwater rates to encourage the increase of permeable surfaces for commercial and industrial customers.**



No. in Fig. 5	Area	'85-'90 Avg. (ac-ft/yr) [†]	No. in Fig. 5	Area	'85-'90 Avg. (ac-ft/yr) [†]
1	Salt Lake Valley	133,000	20	Beaver Valley	8,800
2	Utah and Goshute Valleys	100,000	21	Dugway, Skull Valley, Old River Bed	8,800
3	Beryl-Enterprise area	60,000	22	Rush Valley	4,800
4	Palmard Valley	60,000	23	Grouse Creek Valley	4,800
5	East Steens area	60,000	24	Cedar Valley, Utah County	3,800
6	Mildred area	40,000	25	Park Valley	3,800
7	Calden Valley	36,000	26	Park City area	*
8	Cedar Valley, Iron County	30,000	27	Vernal area	*
9	Parowan Valley	29,000	28	Upper Bear River Valley	*
10	Catch Valley	28,000	29	Spanish Valley	*
11	Tropic Valley	27,000	30	Blending area	*
12	Sevier Desert	25,000	31	Bear Lake Valley	*
13	Jubb Valley	21,000	32	Monticello area	*
14	Central Sevier Valley	19,000	33	Heber Valley	*
15	Central Virgin River area	17,000	34	Duchesne River area	*
16	Ogden Valley	13,000	35	Upper Sevier valleys	*
17	Garfield Valley	12,000	36	Upper Fremont River	*
18	Snake Valley	10,000		Total of other areas (*)	42,800
19	Malad-Lower Bear River	8,000			
STATE TOTAL					854,800

* Less than 3,000. See "Total of Other Areas (*)" for combined total.
[†] Source: Tables 1, 2 & 3 in, Ground-Water Conditions in Utah: Spring of 2000, Cooperative Investigations Investigations Report No. 41. U.S. Geological Survey, Utah Division of Water Resources and Utah Division of Water Rights.

Existing Conditions

The State of Utah has been engaged in water planning for many years. From the state's perspective, a major water problem is getting the water from where it occurs naturally to where it is needed for municipal, industrial and institutional purposes.

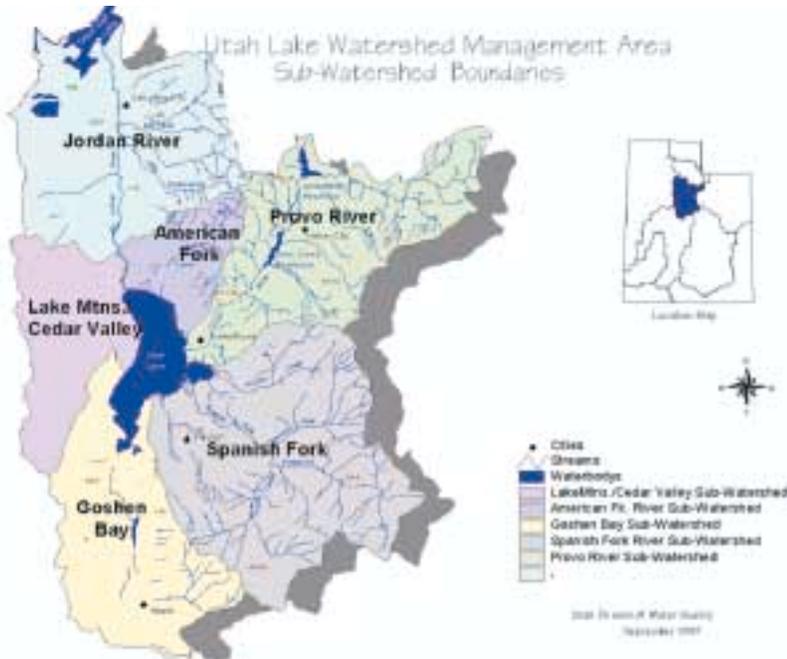
The greater Wasatch Area, comprising the Jordan River, Utah Lake and Weber River basins, will need 481,000 acre-feet more water per year by 2050. While conversion of agricultural water to municipal and industrial uses will meet much of the expected demand in some basins, further movement of water from basins with a surplus supply will be required to meet future needs in others. The amount to be moved between basins can be reduced by ground water development, reuse

of sewage effluent and effective water conservation programs. Recognizing water conservation or demand reduction as a partial solution to the imbalance between water supply and demand, the state has set a goal of reducing public water use 25 percent by 2050. This will reduce statewide demand by 400,000 acre-feet per year. *(2001 Utah Water Resources)*

The Utah Division of Water Resources has also examined commercial, industrial and institutional water use, and has concluded that the area of greatest waste, and therefore of greatest potential savings, is in outdoor use. *(Municipal Industrial Water Supply and Uses, 2000).*

Conservation Plan Development

“A carefully designed plan is the blueprint for a successful water conservation program.” *(AWWA 1993)* For water conservation to become a reality in Utah, water users must adopt a new ethic of efficient water use. Clear, objective and purposeful planning by local, state, and federal government officials and agencies will become the catalyst for conservation. Long-term conservation of water resources must also be supported by private industry and organizations. Developers and landscapers can incorporate water conservation strategies in their plans and activities.



Need for a Plan

Cities, in their role as retail water providers, are in the best position to promote water conservation because they are closest to the end user. Water districts, which provide wholesale water to cities, are also key stakeholders. The traditional role of water districts has been to develop, treat, and deliver new water supplies for present and future users. Recent state legislation requires water conservancy districts and retail water providers to assume an additional role. Water districts and cities that supply culinary water and have more than 500 service connections are now required to submit water conservation plans to the Utah Division of Water Resources, updating and resubmitting these plans every five years. The purpose of this legislation is to encourage cities and water conservancy districts to plan for more efficient use of existing water supplies.

Careful planning precedes a successful water conservation program and identifies major water problems in providing water for expected growth. Planning includes setting specific, measurable goals and evaluating the methods for reaching these goals. One key method is an effective water conservation program that reduces the per capita demand for water.

Creating a Water Conservation Plan

An effective water conservation plan must include sufficient detailed information for the conservation team to follow the plan through to its complete implementation. Indeed, water conservation plans may never be fully implemented as they were originally written, as periodic updates may uncover new opportunities for additional water demand reductions. For any water conservation plan to be successful, it must be incorporated into a city's general plan. When plans are tied together and strive to achieve integrated goals, a high degree of acceptance and success can be realized.

Useful plans will include the following elements:

Description of the Water Storage and Delivery System

This section should include the number of acres covered by the physical system, the number of people and connections served, land uses and demographics. If the system includes unique characteristics or pertinent history that explains water use habits or conditions, these should be added. Significant losses to the system from old and leaking pipes and storage facilities may also be identified in this section.

► Water Conservation Planning Elements

- Description of the Water Storage and Delivery System
- Inventory of Water Supply
- Estimates of Present and Future Water Demands
- List of Water Problems
- List and Analysis of Potential Solutions
- List of Goals
- Procedure for Implementing the Plan
- Procedure for Assuring Completion
- Media Development

Inventory of Water Supply

Identifying and quantifying the sources of water supplies assists the planner in understanding the extent of the available water supply. Such an inventory is most often presented in acre-feet but may be shown in the units used for metering and billing purposes such as 1000 gallons (kgals) or 100 cubic feet (ccf). The inventory should calculate and show the amount of available water for which water rights are owned and the amount purchased each year from another entity. Constraints or limitations on the water system should be shown in this section. These may include limits on system capacity or inadequate water rights.

Estimates of Present and Future Water Demands

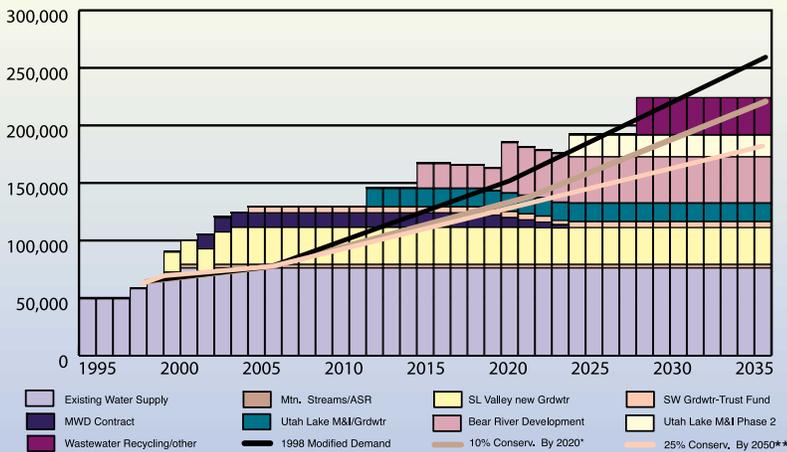
Here the present water use is quantified from meter readings or water sales according to billing records.

Major water users and their current requirements should be identified. Future demands on the water system are usually based on population growth estimates, obtainable from the Governor's Office of Planning and Budget for most Utah communities. <http://governor.utah.gov/gopb/>

List of Water Problems

In this section the water manager should identify, and, when possible, rank the problems being experienced with the water system in order of severity. If future problems can be foreseen with a degree of certainty, they should be included. Problems may be those identified above relating to significant losses, constraints on system capacity, or insufficient water rights. Part of defining water problems should include a calculation of the system's per capita water use, and a comparison to the state average water use and the water use of similar size communities.

FIGURE 9
Potential Impact of Conservation Goal on the Water Needs of JVVCD



* JVVCD's water conservation goal.
 ** Hypothetical line showing the effects of the state's goal of 25% conservation by 2050.
 (Adapted from Jordan Valley Water Conservancy District's, "Water Conservation Plan," March 1999, Fig.2-16, p. 2-15.)

List and Analysis of Potential Solutions

Potential solutions should be described that may include finding and repairing leaks or replacing old lines and tanks. Needed water supply source additions may be described in this section. Water conservation, or demand reduction, should be emphasized in this section as a means of delaying expensive additions to the supply or delivery system. The analysis of potential solutions should focus on comparing the costs of implementing conservation practices to

reduce demand with the cost of adding another source of water supply.

List of Goals

Once problems are identified and the various solutions are analyzed, the community planner has sufficient data to set clearly defined, measurable and attainable goals. These goals may include fixing leaks in the system, reducing the peak use, minimizing overall water use or increasing supply source options. For example, if the problem is inadequate water rights or source of supply, a practical goal may be to reduce the water use rate to an amount that is appropriate for the current situation. Some communities are self-supplied for a fraction of the total water needed and must purchase additional water from a wholesale supplier. If the purchased water is significantly more expensive than the owned supply, the goal may be to reduce the future amount of water purchased. An evaluation of the costs and benefits for each of the selected demand reduction practices should be included. In this evaluation, the costs involved to reach each of the goals should be compared to the costs that would be incurred if water were purchased and water savings were not realized through conservation.

Procedure for Implementing the Plan

Implementation begins with acceptance of the plan by the community's governing body, e.g. city council or district board.

Creating a financial plan to show how the selected water conservation practices may be funded is helpful. It is also important that the water conservation plan is incorporated into the community's general plan, development and other ordinances. The financial plan should include possible sources of grant and loan funds that may be available from state and federal agencies to fund water conservation programs. The use of excess reserve funds in the city's water and sewer enterprise fund may be evaluated, in addition to the general fund budget. Once funding sources are identified, timelines should be estimated and responsibility assigned to the individual(s) who will carry the planned practices to completion and monitor progress toward the goals.

Procedure for Assuring Completion

Attention should be focused periodically on whether or not the water demand reduction practices and facilities are doing the job and moving the community toward its water conservation goals. Questions most often asked are: Whether or not the adopted conservation practices having the desired effect? It is also recommended that goals be reset or updated every year. Time and resources need to be scheduled for updating the water conservation plan every five years to comply with the statutory requirement. This update requirement provides an opportunity to review the community's conserva-

■ **Public support and participation have been key factors to the success of Envision Utah. We have found a successful methodology to engage people in dialogue and encourage on-the-ground action at local and regional levels. Envision Utah's fact-based, public involvement process involves key stakeholders and the community from the beginning, using a bottom-up process to find local solutions to accomplish a regional vision.**

■ **Envision Utah can work directly with communities to help develop broadly and publicly supported plans. Professional planners from Envision Utah can help evaluate optimal approaches and identify best management practices both locally and nationally. Our staff is available to help communities identify key stakeholders, provide technical expertise and help plan workshops where residents and stakeholders work together to analyze problems and suggest solutions that can be used in the development of water conservation techniques. By bringing residents and key stakeholders to the table from the beginning, the best possible success for implementation can be achieved.**

tion program, determine its effectiveness, and measure progress toward agreed-upon goals.

Media Development

Once a plan has been developed, it is important to familiarize the appropriate constituencies and stakeholders with the contents of the plan. This will help accomplish successful implementation of the water conservation plan and awareness of new procedures that have been developed.

Public involvement is a vital component in the success of any water conservation program. Ways to involve the public might include:

- Hosting public hearings to allow the public an opportunity to ask questions and offer comments on the proposed water conservation plans and/or policies.
- Providing public education materials, including flyers in billing statements. Information given to the general public should be easy to read and concise, without technical language. The major benefits of the plans, describing why they have been developed and what results they bring, should be highlighted. Identify the number one message that needs to be shared with the public and try to develop one or two sentences to relay that message. Details of the plan can be included, but should not be needed to help the reader understand the message.

- Inviting key stakeholders to release information together.

A press conference can be used to encourage media support. Holding a meeting to release information can assist reporters with getting information needed to write a story. The participation of visible leaders, such as local officials, can draw more media representatives to a press conference.

A press release should be distributed upon final development of the plan. Local weekly newspapers are more likely to publish the information; however, the major daily newspapers may also be interested in this information if a regional angle can be provided. Each major newspaper has a reporter who covers informational targets in various regions. Contact the assignment editor for the name of the reporter covering a particular city or county.

A press release should include the following information:

- Contact name and number from participating organization
- A brief paragraph (one or two sentences) describing the number one message that the public needs to know
- A quote from key leader lending support to plan
- Information on press conference time and location
- Benefits that implementation will bring to the community

- A more detailed description of what the plans entail
- Copy of the actual plan or report attached

Faxing or e-mailing information is the most effective way to reach the press with information, but it is essential to follow-up with a phone call, speaking with the media representative to encourage coverage.

Example of the form used by the Division of Water Resources for evaluating water conservation programs.

Best Management Practices and Examples

Best Management Practices (BMPs) are conservation activities that are intended to reduce long-term urban water demands. These BMPs are in addition to programs that may be instituted during occasional water supply shortages. The following fourteen BMPs are commonly implemented in water conservation programs.

► **Envision Utah’s Community Design Workshop process helps communities develop a plan, given existing conditions and basic principles for the area. These workshops involve teams of citizens representing a cross-section of local interests working together to develop rough concept plans. Residents and key stakeholders are divided into teams that are carefully designed to represent a variety of interests. These teams analyze information, including the current situation, best management practices and potential solutions. At the conclusion of the working session, each team presents its ideas to the entire group of participants for comment and critique.**

This information is then analyzed by planners and incorporated into the development of a final product. This workshop process is important in ensuring general acceptance of the plan. Public comment hearings are not enough. Bringing residents and stakeholders to the table through working sessions, where ideas are discussed, argued and presented, gives planners critical information to help in the development of plans.

Water Conservation Plan Evaluation Form

Plan Submitted by: _____ Reviewed by: _____ Date: _____
 Scoring: Rate each of the following items on a scale from 1-10. (1 to 4=inadequate, 5 to 7= adequate, 8 to 10=excellent)

Characteristics of an Adequate Plan	Score	Comments
I. Description A. Describes the service area and water system B. Details pertinent demographics (population, connections, land use, etc.) C. Explains unique characteristics or pertinent history of system		
II. Water Supply Inventory A. Identifies and quantifies the water supply sources of its system B. Describes constraints of the system (water rights, system capacity)		
III. Present Water Use and Future Water Needs A. Quantifies the present water use in the system B. Identifies abuses, overuses, and losses in the system C. Estimates future water needs based on population growth projections		
IV. Water Problems, Conservation Measures, and Goals A. Identifies and prioritizes present and future water problems B. Describes current water conservation measures C. Identifies other water conservation measures D. Quantifies the costs and effectiveness of all conservation measures E. Sets water conservation goals that can be quantified		
V. Implementing and Updating the Water Conservation Plan A. Recommends measures to reach water conservation goals B. Recommendations are consistent with present and future needs C. Identifies the resources required to monitor progress and accomplishment of goals D. Sets deadlines for implementation of measures and accomplishment of goals E. Details a procedure for updating the water conservation plan		
		AVERAGE SCORE

Governor Leavitt at Kick-off for Utah's Water Conservation Effort 2001.



Example of improper water usage.



1] Water Survey Programs for Single-Family Residential and Multi-family Residential Customers. Develop and implement a strategy of water-use surveys to single-family and multi-family customers.

Example:

To survey outdoor water use in their local community Jordan Valley Water Conservancy District has partnered with other Salt Lake City and water districts and retailers to form a public services contract with Utah State University to offer Water Checks to the public free of charge. A typical Water Check lasts 60-90 minutes. A USU intern calculates the precipitation rate (sprinkler output), distribution uniformity (sprinkler efficiency), and water pressure, and then checks the soil and depth of the turf-grass roots. Once this information is collected, a customized irrigation schedule can be generated and reviewed with the customer. Water Checks are offered from mid-May through mid-August. In the fall, district and Salt Lake City staff assist USU in obtaining water use records of those who have had Water Checks and USU evaluates this data by tracking water use for three years before and three years after a Water Check. A toll-free “Slow the Flow” hotline (1-877-SAVEH2O, 1-877-728-3420) was established, and a second team was created to perform Water Checks for large water users and commercial businesses (in Salt Lake County only). Residential Water Checks were recently extended into Utah, Juab

and Wasatch Counties by Central Utah Water Conservancy District.

2] Residential Plumbing Retrofit. Identify single-family and multi-family residences constructed prior to 1992. Develop a targeting and marketing strategy to distribute or directly install high-quality, low-flow showerheads, toilet displacement devices, toilet flappers, and faucet aerators practical to residences requiring them.

Example:

Granger-Hunter Improvement District includes low-flow device information in their “New Account Packet” as people sign up for a new account.

3] Residential ULFT (Ultra Low Flow Toilet) Replacement Programs. Implement programs for replacing existing high-water using toilets with ultra-low-flow toilets in single-family and multi-family residences.

4] System Water Audits, Leak Detection, and Repair. Annually complete a prescreening system audit to determine the need for a full-scale system audit.

Example:

Salt Lake City Department of Public Utilities audits water usage of commercial and industrial customers for the purpose of detecting leaks. Water use increases of 25% or more between November

and March are flagged and the customer is notified.

5] Metering with Commodity Rates for all New Connections and Retrofit of Existing Connections. Require meters for all new connections and billing by volume of use. Establish a program for retrofitting existing unmetered connections and billing by volume of use. Identify intra- and inter-agency disincentives or barriers to retrofitting mixed-use commercial accounts with dedicated landscape meters, and conduct a feasibility study to assess the merits of a program to provide incentives to switch mixed-use accounts to dedicated landscape meters.

6] Large Landscape Conservation Programs and Incentives. Provide non-residential customers with support, education, and assistance. Identify accounts with dedicated irrigation meters and assign Evapotranspiration-based water use budgets. Develop and implement a strategy of targeting and marketing large landscape water use surveys to commercial, institutional and industrial accounts with mixed-use meters. Provide information on climate-appropriate landscape design, etc.

Example:

Kearns Improvement District has targeted schools as large water users and has installed separate

landscape meters. The schools are also placed on water budgets, resulting in significant water savings.

7] High-Efficiency Washing Machine Rebate Programs. Sets goals, objectives, and a timetable for implementation of the program. Front loading washing machines typically use half as much water as a top loading washing machine.

8] Public Information Programs. Implement a public information program to promote water conservation and water conservation related benefits.

Example:

Jordan Valley Water Conservancy District

hired a professional advertising agency to assist in a public information/education campaign. The “Slow the Flow, Save H₂O” slogan, a jingle, outreach agent (Water Lou) and advertisements have been established. In its third year, 2001, “Slow the Flow, Save H₂O” has become a widely recognized campaign associated with the district and its partnering agencies in their efforts to promote water conservation. Ads and printed materials are updated annually to promote new programs as well as existing programs as they are continued from year to year.

Water Lou - Jordan Valley Water Conservancy District Spokesperson.



Waste Not!

The Water Conservation Demonstration Garden at the Jordan Valley Water Conservancy District was designed and built to be an education tool for the community. The garden emphasizes proper landscape design, irrigation technologies and low-water-use plant selection to show how to have a beautiful yard and still save water. Plants are chosen for their ability to do well with low precipitation, extreme temperatures, low humidity, and alkaline soils. A weather station will measure evapotranspiration to guide precise irrigation. Free Waterwise Gardening workshops, a volunteer maintenance group, and tours add to the educational program.

9] School Education Programs. Implement school education programs to promote water conservation and water conservation related benefits.

Example:

The State Office of Education (SOE), in partnership with entities such as the Utah State University International Office of Water Education, Division of Water Resources, water conservancy districts, the non-profit *Living Planet*, and other state and local agencies, sponsors a variety of water science and conservation-focused in-service opportunities for teachers. In addition, the SOE can schedule educational exhibits that travel to local schools for educational demonstrations.

Schools in the Uinta Basin make extensive use of materials, teacher training, in-class demonstrations and field trips through the Plants, Animals, Water, and Soil (PAWS) program sponsored by the USDA Dinosaurland RC&D Office. Water science and conservation account for at least 25% of the Basin's science curriculum.

10] Conservation Programs for Commercial, Industrial, and Institutional Accounts. Identify and rank commercial, industrial, and institutional customers according to use and establish long-term implementation targets for the replacement of high-water-using fixtures and practices.

11] Wholesale Agency Assistance Programs. Wholesale water suppliers could provide financial incentives or equivalent resources and conservation-related technical support and information to their retail water agency customers to advance water conservation efforts and effectiveness.

12] Conservation Pricing. Eliminate non-conservation pricing and adopt conserving pricing.

Jordan Valley Water Conservancy District's Demonstration Gardens.



Example:

Kearns Improvement District has implemented a new pricing structure to discourage wasteful water practices. High water users pay their full fair share including a high peaking rate.

Salt Lake City and Sandy City also have seasonal rates that offset the peak demand.

13] Designate a water conservation coordinator to promote water conservation.

Example:

Some water purveyors, cities, and agencies in Utah currently have Conservation Coordinators, including Salt Lake City, Central Utah Water Conservancy District, West Jordan City, Jordan Valley Water Conservancy District, St. George, Utah Division of Water Resources, Washington County Water Conservancy District, US Bureau of Reclamation, City of Sandy and Utah State University.

14] Waste Water Prohibition. Enact and enforce measures prohibiting gutter flooding, single pass cooling systems in new connections, non-recirculating systems in all new conveyor car wash and commercial laundry systems, and non-recycling decorative water fountains.

Tools and Resources

Practical tools and resources are fundamental to managing Utah's water resources. Water agencies, districts, and cities all look for opportunities to make better use of key natural resources for many communities. The State Division of Water Resources plays a significant role in the education of practical concepts, tools and pricing methodologies that all work together to provide a strong foundation for conservation.

The Utah Division of Water Resources

The Utah Division of Water Resource's traditional solution to water supply problems has been to furnish funding and technical assistance to districts and local governments that have direct responsibility to provide water to customers. The state has cooperated with federal agencies in building major water storage and conveyance projects such as the Provo River and Central Utah projects. State agencies have been the source of funding for numerous water conveyance, storage, and treatment projects throughout Utah. All projects funded by Utah Division of Water Resources are required to be analyzed for engineering feasibility as well economic feasibility.

Key recommendations from the Division of Water Resources include the following:

- Educate the public on the importance of using Utah's water resources more efficiently.
- Provide programs for training and licensing of landscape and irrigation contractors and managers.
- Remove disincentives to conservation such as volume discount rates.
- Provide incentives for conservation through managed-demand pricing, educational programs, incentives and other strategies.
- Enact monthly meter reading and billing.
- Support and promote water check programs.
- Study the feasibility of tax incentives as a means to encourage water use efficiencies.

(2001 Utah's Water Resources: Planning for the Future)

Reaching the State's goal of reducing annual demand for water by 25% will result in saving about 400,000 acre-feet of water per year.

Reaching this goal by 2050 will be achieved only if community water system managers and operators

pursue similar goals. Utah Division of Water Resources does the following to achieve water efficiency:

- Monitors attitudes and habits that explain how Utah residents use water.
- Tests new conservation products for effectiveness in Utah.
- Assists water conservancy districts, retail water agencies and industry groups to educate their customers about effective programs through media campaigns, workshops, seminars, conferences and individual consultation.
- Works with public and private agencies to develop new water conservation tools, technologies and practices.
- Supports a water conservation committee to develop best management practices including pricing systems, share program experiences, assist with specialized studies and promote technology development.

Water Pricing as a Conservation Tool

Nationwide research has indicated that Utah has some of the lowest water prices in the western United States.

Water districts and municipalities need to assess whether the pricing structures they use reflect the limited nature of water as a resource and the cost of acquisition, treatment and distribution. As pricing structures are analyzed, other costs associated with water use that are not typically included in water rates ought to be considered. These secondary costs include land-use impacts, water quality and quantity impacts and environmental impacts. It is important that communities consider the ecological costs when developing water polices and pricing structures.

Studies published in recent years indicate that pricing does have an impact on water usage. If water is priced too low, a message is sent to the public that the resource is abundant and readily available. In an era where new water sources are becoming less available and economically and environmentally prohibitive, pricing can and must be used to alter public perception of the abundance of water. “Pricing can be more than a means of meeting revenue requirements or even turning a profit.” (Stallworth, 2000) Pricing can be an effective means of impressing on a population the intrinsic value of water.

Pricing by itself is not an adequate incentive to conserve. Price as an incentive to conserve is most effective when partnered with other conservation strategies (Beecher, 1994). Generally, water-use linked to necessities (cooking, bathing, sanitation) is less responsive to price than is water used for more discretionary purposes such as for car washing, landscaping and swimming pools. As household income increases, pricing strategies as a tool for conservation become less effective. (Beecher, 1994)

Clearly, effective conservation programs need several components. Pricing incentives, public education, and other strategies are critical to a successful water resource management program.

Water Prices of Various Western Cities

City	Estimated Cost per 1,000 gallons
Reno	\$3.39
Seattle	\$2.30
Los Angeles	\$2.22
Park City, UT	\$2.20
Tucson	\$1.81
Boise	\$1.68
Las Vegas	\$1.65
Phoenix	\$1.61
Albuquerque	\$1.41
Denver	\$1.14
Sandy, UT	\$0.99
Salt Lake City	\$0.89
Provo, UT	\$0.75
Sacramento	\$0.75
AVERAGE	\$1.63
Utah Average	\$1.15
National Average	\$1.96
Date	<u>2001</u>

Prices of water from various western cities.

Pricing

Cost-based pricing quantifies the costs of water supply acquisition or capture, treatment and distribution. This is the traditional pricing method used by water districts and municipalities. It is designed to ensure financial self-sufficiency for water and wastewater systems. Pricing strategies can be developed to include intangible and less quantifiable costs such as depleted water sources, land-use issues, environmental impacts and conservation ethics.

Demand-management pricing combines the tools of incentives with cost-based pricing to create pricing structures that: 1) support traditional costs associated with water and wastewater systems, and 2) provide motivation to lower demand and to slow the rate of demand growth.

Demand-management pricing elements include:

- Repeal of volume discounts: removing existing disincentives to conservation.
- Block rates: charging a higher unit price as use rises.
- Seasonal rates: charging more for unit price during peak seasonal demand periods.
- Excess loading or excess use charges: assessing surcharges or increasing unit prices when use exceeds contracted or allotted amount.

In order to gain public acceptance of pricing increases, it is important for public education programs to explain the reasons and the goals behind the pricing strategies.

When conservation-oriented rate structures are introduced, public acceptance is improved if increased rates are linked to:

- Avoidance or deferral of the price tag associated with capital improvement programs such as expansion and upgrades.
- Avoidance of the need to develop a new water supply source, for example, when moving from groundwater to surface water.

Example of water-wise landscaping.



- The collateral benefits associated with water conservation, pollution prevention through reduced water withdrawals and wastewater flows; habitat protection; and energy conservation.
- The potential to pay for conservation measures such as metering, improved water accounting, leak detection, water-use audits, retrofits, reuse and recycling, and landscape improvements. *(Stallworth, 2000)*

Pricing Models

The following two pricing models exemplify the potential for conservation pricing. The models promote the same goal, to encourage efficient water use and reduction. The models focus on incentives to reduce peak seasonal demand as a means of infrastructure cost control. Both models strive to accurately reflect the true cost of service, particularly the price for excess watering.

Model #1:

Salt Lake City
Under this scenario, a utility calculates the incremental cost of providing water based on peak seasonal demand. Since pumps, pipes and related infrastructure are usually sized to meet peak, rather than average demands, conservation programs that target peak demand offer more value than those that target base, or average, demand. This seasonal rate structure is being used by Salt Lake

City, as well as numerous other communities, including Denver, Phoenix, Seattle and Portland.

The monthly bill clearly signals the cost of wasted water. Requirements include marginal cost pricing as well as monthly meter reading and billing to modify water usage.

Model #1 Goal:

To reduce summer peak usage (July and August)

Model #1 Objectives:

- Discourage excess watering during the hotter summer months.
- Promote conservation.
- Delay need for new infrastructure.



BEFORE

Many Utah homes are built on hillside slopes, and overwatering increases runoff, negatively impacting the stormwater system.



after

This low-water landscape with “drip irrigation” reduced runoff while increasing the variety and color of the landscape.

Model #1 Strategy:

Seasonal Rate Structure

- Focus groups, workshops or community council meetings.
- Citizen Advisory Council.
- Literature explaining the process and new rate structure.
- Customer service outreach.
- Water bill that graphically demonstrates water usage.

Model #2:

West Jordan City
(Anticipated Spring 2002)
Population growth on former dry farmlands has put pressure on the existing water delivery system. A citizen advisory committee was formed to examine the issue, identify potential solutions, and offer recommendations. The advisory

committee recommend that the city implement an ascending block rate structure, because it would:
1) ensure revenue stability;
2) reward efficient use; and
3) penalize water waste.
West Jordan’s model follows the Irvine Ranch Water District Model. Every customer will be given a “water budget” based on number of occupants, landscape area and weather conditions (evapotranspiration [ET data]). ET data is provided to customers to assist them in determining actual water needs for their landscape. This model requires:

- Strong support from the city council/board.
- Detailed customer information (landscape area, number of occupants, etc.)
- A sophisticated computer system and software program with weather stations at strategic locations within the community.

(Sustainable Use of Water: California Success Stories, Pacific Institute)

Benefits include revenue stability, flexibility to manage consumption during times of shortages or high peak demands, link to sewer charges, fairness and equitability, (since those who use more pay more), and a clear efficiency message.

Customers are provided with information and resources to help them make wise choices regarding water efficiency.

Water efficient garden.



The bill is also designed to clearly communicate the cost of wasted water. All of these things combine to create a strong water efficiency message.

The ascending block rate structure penalizes water waste in the landscape by charging more for water that is used over the predetermined base water use.

Model #2 Goal:

Water conservation coupled with revenue stability

Model #2 Objectives:

- Generate sufficient income for future development.
- Allocate costs across customer base.
- Provide customer incentives towards conservation.
- Reward efficient use and penalize water waste.
- Demonstrate responsiveness for the various types of water users (residential, agricultural, business, industrial, etc.).
- Create an efficiency ethic, regardless of the presence of “wet” or “dry” years.

Model #2 Strategy:

Ascending Block Rate Structure/Tiered Pricing

Model #2 Education:

- Focus groups, workshops and/or community council meetings.
- Citizen Advisory Council.
- Literature explaining the process and new rate structure.
- Customer service outreach when complaints are received.

Billing

For a water bill to provide motivation for conservation, it needs to do more than penalize for excessive use. The pricing mechanism should also:

- Inform the user of the real cost of water.
- Be promptly and accurately presented.
- Demonstrate the amount of water used.

- Demonstrate levels of waste.
- Provide comparisons of seasonal usage.
- Provide levels of comparable usage.
- Establish the intrinsic value of water.

Indoor Use

Indoor residential water use has been in decline primarily from steady improvements in the efficiency of plumbing fixtures and appliances. Governmental regulations pushed these improvements, such as the U.S. Energy Policy Act in 1992 that established a national maximum allowable water-flow rate for toilets, urinals, showerheads and faucets. Clothes washers and dishwashers have also improved in water and energy efficiency. Retrofitting older homes with newer, low-volume fixtures and appliances will result in significant water savings. As an example of savings, replacing a high volume toilet that uses 3.5 gallons per flush with a low-flow toilet that uses 1.6 gallons per flush can save the average Utah household of 3.13 persons (2000 U.S. Bureau of Census) an estimated 11,070 gallons per year. Fixing leaks and replacing dishwashers, washing machines, faucets and showerheads can all contribute to indoor water savings. A study by the Utah Division of Water Resources estimates the following:

Salt Lake City Draft Combined Water Bill illustrating water use.



- Total indoor water use is approximately 33% of a household's total water use.
- Indoor conservation devices save about 20 gallons per day per household throughout the year.
- Indoor use rises slightly as income increases.

Outdoor Water Use

According to a study by the Utah Division of Water Resources. Outdoor water use is approximately 67% of total residential water use. The area of greatest consumption, and therefore of greatest potential savings, is in outdoor use, whether residential, commercial, industrial or municipal.

Fundamentals of Waterwise Landscaping

Landscape managers and homeowners can design landscapes that will require less watering, mowing, fertilizer and other chemicals to keep it looking great. The basic waterwise principles can be summarized in the following steps:

1] Plan and Design

When designing a landscape, take into consideration how the yard will be used and how it can provide the greatest benefit with the least amount of maintenance. Plan landscapes so that plants with similar water requirements are grouped together. Designate zones for areas requiring frequent watering occasional watering, and no watering at all. Be sure to match plants to yard conditions such as sun, shade, dry or damp.

Water efficient planting.



► The Xeriscape Conversion Study

The Southern Nevada Water Authority (SNWA) is conducting a Xeriscape Conversion Study with participants who live in single-family residences in southern Nevada. The study includes three groups: the Xeriscape Study group, the Turf group and a noncontacted comparison group. The Xeriscape Study group was composed of 499 properties where at least 500 square feet of traditional turfgrass was converted to xeric landscapes (low-water-use landscapes). New xeric landscapes were required to have a minimum of 50% canopy coverage, which avoided unattractive “zero-scapes.” The Turf Study group, 253 residences, was composed of landscapes where an average 2,462 square feet was in turfgrass.

All study participants had in-ground irrigation systems and controllers. Meters were read on a monthly basis. Four years of data show that outdoor water use for landscapes that were converted to xeriscapes was reduced by almost 40% during the summer months. The mean cost to irrigate a turfgrass landscape in Nevada is \$11.16 per 100 square feet compared to only \$1.80 for a xeric landscape. Landscape maintenance costs and labor time were reduced on average by one third. On a per unit area basis, water consumption in xeriscaped areas (17.3 gallons per square foot per year) was much lower than traditional turf (79.2 gallons per square foot per year). This study is ongoing and will conclude at the end of 2001. However, four years of data yield show that converting a traditional turfgrass landscape to a xeric landscape can save water, maintenance time, and money. For more information contact the Southern Nevada Water Authority at www.snwa.com.

► **Utah Native Plant Society Heritage Gardens:**

The Utah Native Plant Society (UNPS) is dedicated to the understanding, preservation, enjoyment, and responsible use of Utah native plants. The Society's mission is to foster public recognition of the spectacularly diverse flora of the state – a natural treasure to be valued and respected. The Utah Heritage Garden Program was founded to provide public demonstration gardens where people can see native plants growing in a garden setting. There are now twelve gardens in various locations around the state. Several more are in the planning stages. Contact UNPS if you are interested in establishing a Utah Heritage Garden. The only requirements are that the garden acknowledges UNPS sponsorship, include only Utah native plants, and be in a place accessible to the public. UNPS can help with planning, plants, and interpretive signage. A few Heritage Garden locations are listed below; check the UNPS website at www.unps.org for more garden locations and other information about the organization.

**Wasatch Elementary School
1080 N 900 E
Provo**

**Price Heritage Garden
46 E 300 S
Price**

**University of Utah Mallway
North of the Phys. Ed. Complex
Salt Lake City**

2] Make Sure Soil is Healthy

One benefit of using native and adapted plants is that many prefer poor soils, and don't need extra organic matter or fertilizer applications. Compacted soils will need to be aerated, though, regardless of what type of plant material is used. Soil preparation for more demanding plants may require enriching the soil with organic matter. A little extra work in the beginning will pay off with healthier plants. Organic matter, such as compost, will benefit the water and nutrient holding capacity of both sand and clay soils.

3] Use Native and Low-Water-Use Plants

Choose appropriate plants that are native or adapted to the local climate and soil conditions. Utah has extreme temperatures, low humidity, low precipitation, and alkaline soils. Selecting plants that thrive in these conditions will save time, money and help make a successful gardener. See the Landscaping Resources section of this document for drought tolerant and native plant and seed sources.

4] Create Practical Turf Areas

Kentucky Bluegrass, the most typically used turf in Utah, has a high water requirement and should be limited to those areas needed for practical uses such as recreation. Beautiful but less water-needy plants could be used in the remainder of the landscape. Match turf areas to their intended use, as well as topographical and soil conditions. For example, avoid using turf as a "fill in" material and placing turf in areas that are difficult to irrigate properly such as steep inclines and isolated narrow strips along sidewalks and driveways. Consider using drought tolerant turfgrasses such as Blue Grama or Buffalo Grass and groundcovers like Creeping-Thyme.

5] Use Mulches

Mulches aid in moisture retention, discourage weed growth and reduce heat stress. Organic mulches such as bark also provide essential nutrients as they decay. Mulches can also be used in areas not appropriate for planting. Materials can include bark, wood chips, pine straw, nut shells, gravel, crushed stone, shredded leaves or landscape clippings.



Inefficient sprinkler system.

6] Irrigate Efficiently

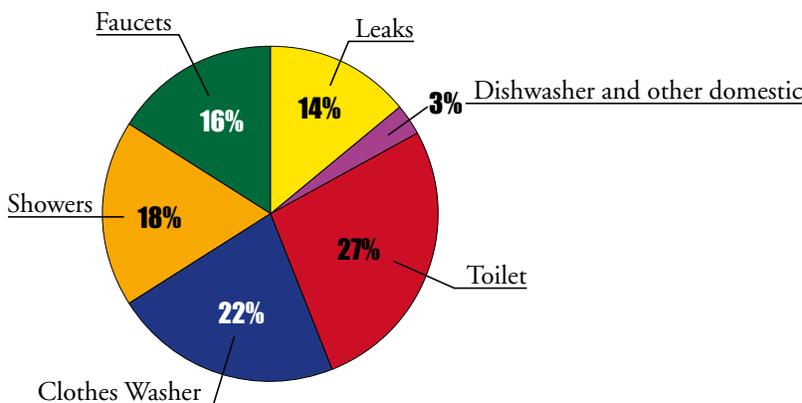
Proper irrigation will not only conserve water but promote deeper root growth, resulting in a healthier, more drought tolerant landscape. Efficient irrigation means applying water in the proper amount and only when necessary. The design of a sprinkler system affects its efficiency, but the most efficient irrigation system can waste water because the amount of water it uses depends on how often and how long it is programmed to run. Understand the different water requirements of the “zones” in the landscape, and check automatic sprinkler or drip irrigation systems periodically to ensure plants are receiving the water they need without being overwatered. Program the irrigation system so it is adjusted to respond to the changing seasonal variations of temperature and rain. The run time of each zone should be in multiple cycles to avoid runoff. Modern irrigation technology can help save even more water in the landscape. Rain shut-off devices prevent automatic systems from irrigating during and after rain. ET-based irrigation con-

trollers aim at applying a more exact amount of water needed by the landscape based on temperature, wind, humidity and solar radiation. Soil moisture sensors gauge plant water needs by monitoring soil moisture to determine proper time and amount of water needed.

7] Maintain the Landscape Regularly

All landscaped areas need maintenance to look beautiful and stay healthy. Control weeds so they don't steal needed water from desired plants. Minimize the use of fertilizer to avoid plant overgrowth and increased water needs. Repair hose and irrigation leaks. Maintenance needs of a carefully planned waterwise garden should decrease over time as plantings mature.

Typical water use within the home.



► TYPICAL WATER USE WITHIN THE HOME

The typical U.S. residence consumes about 69 gallons per person per day inside the home. This is approximately equivalent to one completely full bathtub.

As indicated by the accompanying chart, approximately 27% of all the water used indoors goes down the toilet. The clothes washer uses another 22% for a total of nearly 50% of indoor water use from just two household appliances. Showers and baths consume about 18%, and faucets another 16%. Leaks account for a significant 14%.

Surprisingly, only 3% of water used indoors is used by the dishwasher or other domestic purposes such as cooking and cleaning. Despite this fact, 100% of water supplied inside the home must meet stringent drinking water standards.

The American Water Works Association (AWWA) estimates that a comprehensive program to install water efficient plumbing fixtures within the home and fix leaks could reduce total indoor water consumption by as much as 30%.

[AWWA 1999]

Landscape Ordinances

Landscape ordinances are commonly used throughout the western United States to provide guidelines for water wise landscaping. Landscape ordinances can be developed around the following methods:

Public Education

Landscape ordinances that serve mainly to heighten public awareness are not usually enforced and do not require much staff time. Public education ordinances can be adopted readily. Like other education-related programs, they deal with changing behavior, which is difficult to quantify. A public education ordinance can serve its purpose by priming the public as more stringent ordinances are adopted over time. Public acceptance of these ordinances is traditionally high.

Restrictive Measures and Mandates

Restrictive ordinances are most commonly used in extreme situations where water is scarce. Restrictive ordinances can be used in situations where an agency is facing a short-term crisis, such as a mandatory percentage of reduction during a drought. These kinds of ordinances can also be used in long-term planning for areas where the water supply is limited and water development is no longer allowed. Components

within a long-term restrictive ordinance could include turf limitations, seasonal watering times or consequences for runoff. Because of their stringent nature, restrictive ordinances are prone to controversy. Public acceptance is low when there is little effort to educate the public. However, when public awareness is increased, reduction in water use can be achieved quickly and in a positive manner.

Water Budget

Ordinances that take the greatest amount of staff time yet are most equitable and fair to the public are those that require the end-user to comply with a water budget. The water budget is calculated based on the end-user's total landscaped area and outdoor features. A water purveyor can offer incentives to conserve water by tying the budget to its respective water rate structure. Those who stay within their budget are charged a lower rate; those who exceed the budget are charged more for the extra water. This kind of incentive also acts as an enforcement mechanism. Those agencies that have implemented a water budget successfully have had the ordinance coupled with a conservation water rate. To achieve meaningful conservation through this type of ordinance, a community's staff should plan on spending a considerable amount of time educating the public about the end-user's water budget and how to interpret the water bill.

When choosing a style of ordinance, it is important to consider:

- Current Water Situation
- Growth Issues
- Staff Requirements
- Involvement of Key Stakeholders
- Strategy for Educating Customers/Public

Jordan Valley Water Conservancy District (JVWCD), as a wholesaler to nineteen member agencies (municipalities and improvement districts), acts as a resource to assist in conservation and growth issues. Over an 18-month period, JVWCD and a consultant drafted model landscape ordinances that address all new development. Representatives from Utah State University, the Utah Division of Water Resources and the Utah Nursery and Landscape Association also formed a working group to assist JVWCD in refining the ordinance. The commercial ordinance requires all new developments to submit a Landscape Plan, which includes a calculated water budget. The residential ordinance is a public education-based ordinance where all new homeowners are presented with a Landscape Education Packet containing information about water wise landscaping. These ordinances are available for all agencies throughout Utah to use and adapt to their respective city. The ordinances (commercial and residential) can be located on the JVWCD web site at www.jvwcd.org.

Wholesale Water Districts

Educating and assisting member agencies in conservation programs is one of the responsibilities of wholesale water districts. For example, Jordan Valley Water Conservancy District's goal of conserving 25% by 2050 cannot be achieved without the participation of member agencies. Programs implemented by the district are to be shared and expanded by member agencies. In acting as a resource agency, the district's objective is to provide a consistent message for the service area and complement each of the retailers' conservation plans. Since the district's adoption of its conservation plan in 1999, member agencies have become stakeholders, along with others in the region who participate by submitting voluntary contributions to fund effective programs. These agencies are referred to as partnering agencies and include member agencies within the district service area and some who may purchase water from the district. For more information call the hotline at 1-877-728-3420. Conservation related resources at the district include:

- Water Conservation
 - Demonstration Gardens free to the public,
- Garden Fairs at the
 - Demonstration Gardens,
- Free Waterwise Workshops,

- Waterwise Landscaping informational handouts, and
- Free Water Check Program (irrigation check) for residences and commercial landscapes.

Secondary Irrigation Water

An additional component important to managing the water resources of the Wasatch Front is secondary irrigation systems. Such systems deliver untreated, lower quality water or treated wastewater from a treatment plant for outdoor lawn and garden irrigation. It is difficult to monitor total water use in a community, because typically water used in secondary systems is not metered, and is priced at a flat rate, without consequences for over-use. The primary benefit of secondary systems is that they reduce the demand for higher cost treated water, which is usually in short supply. It is often through the installation of a secondary system that water previously treated and used in agriculture can be converted to municipal uses.

Reclamation System Example: Tooele City

Tooele City has successfully created a wastewater treatment and reclamation project that will significantly reduce the future demand for culinary water in Tooele Valley. A separate secondary water system was developed to provide irrigation water to the community. The project was a cooperative effort involving the city, a developer, the city's engineering firm and state and federal agencies.

Tooele City is facing water supply problems in meeting its culinary and secondary water needs because its watershed is "closed" and fully allocated. The city's water needs accelerated during the 1990's due to a sudden increase in its population growth rate.

Tooele needed to replace its wastewater treatment facility, originally built in 1950, due to obsolescence and lack of capacity. The city was faced with several obstacles, from limited fiscal resources to finding prospective facility sites. In 1995, the city's engineering firm identified an optimum site for servicing existing and projected growth within the city. The city's original plan was to discharge the treated wastewater from the proposed plant location to the Great Salt Lake via Six-Mile Creek. However, working with the landowner, Overlake Development, and the engineering firm, it was determined that the opportunity existed to expand the

Tooele Valley Reclamation System incorporates Overlake Development.



project to include a reuse reclamation or secondary water component. Design of the wastewater and reclamation project involved the treatment plant, interceptor sewer lines, advanced treatment technology, 17 lakes for storage of the secondary water, an 18-hole public golf course and distribution lines to commercial and residential users within the potential service area. The project produces Type I effluent for unrestricted reuse in a secondary water system. The reuse system is designed to treat 2.35 million gallons of wastewater per day, with the capacity to expand to 4.7 million gallons per day.

Overlake, a planned community within Tooele, has constructed secondary water lines to each of the 695 residential housing units built to date. In the spring of 2002, secondary water will be available to these homes. At build-out, the secondary water system will service over 8000 residential units, as well as commercial and recreational facilities within and neighboring the Overlake project. Secondary water is used as the sole source of irrigation water for the 18-hole Links at Overlake golf course. Tooele City, through utilization of the secondary or reuse water, will reduce its annual demand for culinary water in the range of 4,600 acre-feet. For more information about the system, or to make reservations for public tours, call 801-843-2137. Please visit Tooele City's website at www.tooelecity.org.

Additional Reading & Resources

Waterwise Landscaping Sources:

- The Center for Water - Efficient Landscaping, www.cwel.org
- Utah Native Plant Society, www.unps.org
- Native and Adapted Plants for Utah Landscapes, www.hort.usu.edu/natives/index.html
- Smart Gardening, www.smartgardening.com
- Xeriscaping, www.xeriscape.org
- Utah State University Extension, www.usu.edu
- Utah State University Horticulture Department, www.usu.edu
- Clean Air Lawn Care Association of America, www.aqmd.gov/monthly/garden.html
- Utah Division of Water Resources, www.nr.utah.gov
- Conserve Water, www.utah.gov

Native Utah Seed and Plant Sources:

- Granite Seed (Wholesale), 1697 West 2100 North, Lehi, Utah 84043. www.graniteseed.com. 801-768-4422/801-531-1456

► **Specialized Training Sessions for Toolbox—Envision Utah staff and consultants can visit your planning commission or city council to train them on how to best use the information included in Envision Utah's Urban Planning Tools for Quality Growth. We can specifically address any chapter, providing information on how it was developed, why these strategies work and how a community can implement the ideas included in the workbook. Concerns of local officials responsible for making planning decisions, can be addressed in a non-threatening open forum, with experts available to provide them with needed information.**

- Great Basin Natives, PO Box 134, Holden, Utah 84636.
www.grownative.com,
435-795-2303
- High Desert Gardens, PO Box 1419/2971 South Hwy 191, Moab, Utah 84532.
435-259-4531
- Utah Native Seed, C. Paul Ames, PO Box 355, Eureka, Utah 84628. 435-433-6924
- Utah Wildflower Seed, Virginia Markham, 3650 West 2150 South, Salt Lake City, Utah 84120. 801-277-8423
- Wildland Nursery, 550 North Highway 89, Joseph, Utah 84739.
janett@wildlandnursery.com,
435-527-1234
cell:801-232-8164
- Check out this website for a list of drought tolerant and native seed and plant sources:
www.thearb.org/seed_sources.htm

Waterwise Gardening Books:

- *The Xeriscape Flower Gardener*. Jim Knopf, Boulder, CO, Johnson Books, 1991.
- *Xeriscape Plant Guide*. David Winger, ed., Denver Water, AWWA, Fulcrum Publishing, 1996.
- *Plants for Natural Gardens*. Judith Phillips, Santa Fe, Museum of New Mexico Press, 1995.

- *Water-wise Landscaping*. Terry Keane, Utah State University Extension, 1995.
- *Xeriscape Color Guide*. David Winger, Denver Water, Fulcrum Publishing, 1998.
- *The Undaunted Garden: Planting for Weather-Resilient Beauty*. Lauren Springer, Fulcrum Publishing, 1994
- *Waterwise Gardening*. Lauren Springer, New York: Prentise Hall Gardening, 1994.
- *Natural by Design: Beauty and Balance in Southwest Gardens*. Judith Phillips, Santa Fe, Museum of New Mexico Press, 1995.
- *Landscaping for Water Conservation: Xeriscape*. Kim Knox, ed., Jointly published by City of Aurora and Denver Water, Denver, CO, 1989.
- *Landscape Plants for Western Regions: An Illustrated Guide to Plants for Water Conservation*. Bob Perry, Claremont, CA: Land Design Publishing, 1992.
- *Water-Efficient Landscape Guideline*. Richard E Bennett and Michael S. Hazinski, American Water Works Association, 1993.
- *Desert Landscaping, Plants for a Water-Scarce Environment*. University of Arizona, 1996.
- *Mediterranean Gardening: A Waterwise Approach*. Heidi Gildemeister, Palma de Mallorca, Editorial Moll, 1995.

Demonstration Gardens:

- Conservation Demonstration Gardens, Jordan Valley Water Conservancy District, 8215 S 1300 W, West Jordan
- Day Riverside Library, 1575 W 1000 N, Salt Lake City
- Department of Natural Resources, 1594 West North Temple, Salt Lake City
- Sego Lily Gardens, 1500 E Sego Lily Drive, Sandy
- USU Greenville Research Farm, 1800 N 800 E, Logan
- Provo Water Resources, 1377 S 350 E, Provo
- Rock Canyon Trailhead Park, Utah Heritage Garden, East end of 2300 North, Provo

Appliances and Plumbing Fixtures:

- Greenseal, www.greenseal.org
- Consumer Toilet Reports by Terry Love, www.terrylove.com/crtoilet.htm
- Toiletology 101, www.toiletology.com/index.shtml
- Dripping Faucet, water loss calculator, www.waterwisser.org/books/dripcalc.html
- Better Way to Save, www.betterwaytosave.com

6

Urban Forestry

Introduction

America's urban forests are missing 634,407,719 trees.

In a 2001 national study conducted by AMERICAN FORESTS titled "Gray to Green: Reversing the National Urban Tree Deficit," satellite imagery was used to document the number of trees that are missing from America's urban areas due to development and other factors. The study also demonstrates that many cities across the country are becoming "cities of sidewalks and parking lots."

Utah residents enjoying the urban forest.



Today, 80 percent of Utah's population lives and/or works within urban areas. The quality of life for them and their families is dependent upon the urban environment. Healthy, safe, and well-managed urban forests enhance this environment by contributing to clean air and water, increasing property values, moderating temperature, lessening energy demands, reducing erosion and storm water runoff, providing wildlife habitat and offering year-round enjoyment. Without a vibrant urban forest, quality of life would appreciably suffer.

Urban Forestry Programs, supported by a variety of organizations and agencies within Utah, promote the use of trees and other plants as tools to enhance the quality of life within our cities and towns. As Utah continues to grow and urban areas expand, the need for urban forests increases, as does the need for their proper management.

► **Attention to Utah's unique climate provides the opportunity to support diverse and thriving urban forests. Climate is characterized by many factors including temperature, precipitation and relative humidity. The most widely used climate classification system, the Köppen system, has categories based on annual and monthly averages of temperature and precipitation. Within the Köppen system, the climate of Utah's populated areas is categorized as both dry arid (desert) and dry semiarid (steppe) depending on the location within the state.**

Urban forests in Utah present many opportunities as well as great challenges. Utah is a good place to grow trees. Utah has fewer of the disease and pest problems that affect trees in other, more humid parts of the country. Tree diversity in Utah is possible and should be an ongoing goal in its many agencies and organizations. A key forestry challenge, however, is Utah's soil. It tends to be saline in some areas with a high pH.

Climate issues present the major opportunities and concerns when dealing with Utah's urban forest. The climate of Utah's most populated areas along the Wasatch Front may be categorized as dry and semiarid or steppe (*Köppen Classification System*). Average annual precipitation amounts range from a high of 23 inches in Ogden to a low of 13 inches in Orem. The use of trees in the urban landscape, when coupled with these low precipitation amounts, necessitates a water use plan that incorporates irrigation.

In order for most trees to prosper in Utah's climate, water needs to be applied in proper amounts and at the proper times. It is especially critical to apply water to younger plants, to keep them from drying out and to support their early development. More mature trees also need water, especially during extreme heat. It should be noted, however, that many trees have lower water requirements than other more commonly used landscape plants like annual flowers and turf grass. The investment in proper water planning and tree maintenance yields many dividends for the urban forest.

Benefits of the Urban Forest

When successfully established, the Urban Forest creates many benefits for the surrounding community. Examples of these benefits include:

Sense of Community

Trees serve to define neighborhoods and communities and give them a unique identity. Large established trees line the streets of many Utah neighborhoods. The canopies that protect the Harvard and Yale communities in Salt Lake City give the streets an inviting and unique sense of belonging. Large cottonwood trees in the Holladay area provide the namesake for many community and local businesses.

Salt Lake City's Yale community.



Quality of Life

Trees soften the hard urban landscape with color, texture, fragrance and overall beauty. Trees add visual interest to an otherwise monotonous environment. These environments change and grow, adding value to the community over time.

Increased Property Value

Studies show that tree lined streets and neighborhoods show higher property values by as much as 20%*. Tree lined commercial and retail properties tend to have higher traffic and therefore higher customer volumes than those located on barren streets, pushing up the value of the property.

(*Article: SLC Tribune, February 27 1999).

Reduced Road Maintenance Costs

Shade from street trees is economically beneficial to cities because it protects the street paving from weathering. The asphalt paving on streets contains stone aggregate in an oil binder. Without shade, the oil heats up and volatilizes, leaving the aggregate unprotected. Vehicles loosen the aggregate and much like sandpaper, the loose aggregate grinds down the pavement. Streets should be overlaid or slurry sealed every 7-10 years over a 30-40 year period, at a cost of \$50,000 a mile. Heavy shade can defer this maintenance from 10 years to every 20-25 years.

Cooling and Energy Savings

According to a study conducted by the University of Utah and TreeUtah, shaded surfaces can be cooler by as much as 9 degrees when compared to non-shaded surfaces. Trees shade dark surfaces and cool the air through evapotranspiration. Urban trees provide shade and protection from the strong Utah summer sun, enhancing the human comfort level realized by that community. This shade effectively moderates the high temperatures that often occur in the urban landscape and thereby reduces cooling costs. Planting trees to shield the sun's rays can reduce the amount of heat that buildings absorb. These savings can range from 10 to 40 percent for a typical home or office in energy use savings. Evergreen trees strategically placed for windbreak protection can save as much as 20 percent towards energy use.

► **Utah's great climate variability can make the care of trees and other landscape plants challenging for Utah residents. Precipitation in Utah is much more variable in the mountainous areas than in the valley regions and this is largely the result of the interaction of storms with mountain ranges. Many peaks in the Wasatch Range, the Uinta Mountains, and other isolated areas may receive 40 or more inches of precipitation annually. In contrast, large areas of the Great Basin and smaller sections of the Canyonlands area and Uinta Basin receive less than 6 inches of annual precipitation.**



Urban trees provide cooling shade to streets and sidewalks.

- ▶ **Benefits of the Urban Forest:**
- Sense of Community**
- Quality of Life**
- Economic Value – Increased Residential Property Value**
- Reduced Road Maintenance Costs**
- Cooling / Energy Savings**
- Air Quality Improvements**
- Improving Water Quality**
- Enhancing Personal Health**
- Wildlife Enrichments**
- Shade and Cooling**
- Reduced Noise Pollution**
- Bioremediation**
- Reduction of the Urban Heat Island**
- Traffic Calming**
- Pedestrian Friendly Spaces**

Over time, a tree in an urban landscape will grow and provide shade to the surrounding buildings and streets. It takes just 10 to 15 years for a tree to grow to a significant size, enabling it to produce significant cooling and energy savings.

Air Quality Improvements

Trees help cleanse the air by absorbing gaseous pollutants like CO, NO₂ and SO₂. They adsorb airborne particulate matter like dust, smoke and ash. One acre of trees provides enough oxygen to support 18 people and will absorb the amount of CO₂ produced by a car driving 26,000 miles per year.

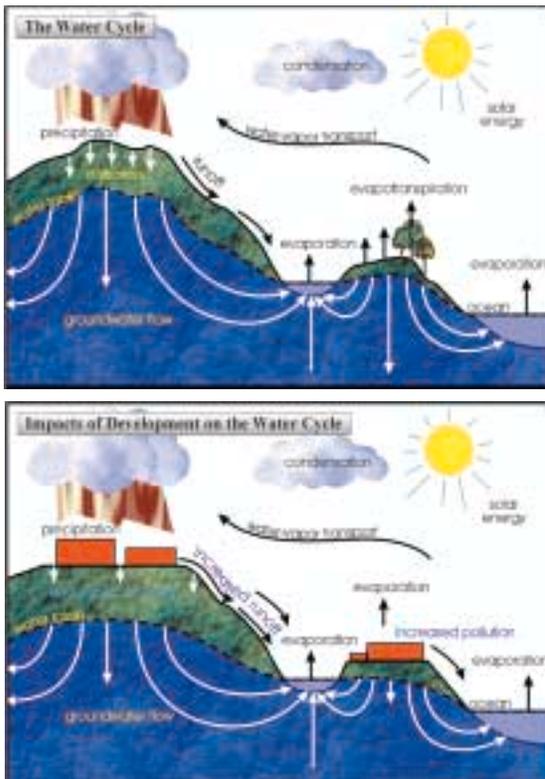
Improving Water Quality

Trees and their supporting root structures provide the foundation that holds a community together. They stabilize the ground and help to decrease storm water run off and erosion. Trees in the urban landscape serve to hold topsoil and groundcover in place—reducing erosion and minimizing chemicals that flow into storm drains, rivers and creeks. Runoff is decreased as tree crowns intercept precipitation reducing the rain's impact on the ground and by increasing evaporation. This slower process enables more precipitation to permeate the ground and support a greater recharge of ground water supplies.

Enhancing Personal Health

Trees create feelings of relaxation and well being. For those individuals living in urban environments, trees are often a major component of their connection to nature. The benefits of trees within the community have been documented in unique ways. For example, medical research indicates that patients assigned to rooms with a view of trees and green open spaces have shorter post-operative hospital stays.

Trees increase infiltration, improving water quality.



Wildlife Enrichment

The urban forest supports a variety of other creatures. Many forms of wildlife come to live in urban communities solely because trees provide a protective habitat in which they can live. Trees are the natural nesting and resting places for wildlife and birds providing a more complex and vibrant environment for humans. Wildlife provide other valuable services to the community, for example some birds serve as natural predators to pests.

Noise Pollution

The sound of leaves moving in the breeze creates a “white noise” that softens the harsh sounds associated with a typical urban environment. Trees provide a softer environment, giving the perception that noise pollution is reduced and the normal sounds associated with the urban environment are more easily tolerated.

Bioremediation

Trees can remove and break down pollutants in areas with contaminated soil and ground water. Roots absorb polluted groundwater and add organic matter to the soil that enhances pollutant breakdown through increased microbial activity. A local example of this process is located in Ogden, Utah. Poplar trees were planted to clean groundwater contaminated with petroleum hydrocarbons. A Utah company, Phytokinetics, Inc., installed this very effective system in 1996.

Reduction of the Urban Heat Island Effect

Densely populated areas with their many streets, asphalt parking lots, and little room for open spaces, contribute to a condition called an urban heat island. Urban heat islands exist in cities across the nation and around the world. Due to large expanses of dark impervious surfaces, minimum tree canopy, and emissions of CO, NOX, and other pollutants from industry and traffic, ambient temperatures in urban centers are hotter than the surrounding environment. This increased temperature coupled with gaseous pollutants and particulate matter result in ground level ozone (smog) causing problems with public health, the environment, and human comfort. Planting and managing more trees in these Urban Heat Island areas can significantly offset the concerns with pollution and increased temperatures.

Trees are used to clean petroleum hydrocarbons from the soil at this Ogden location.



Traffic Calming

Studies show that trees help to slow traffic along commercial and residential streets by giving the perception of a narrower roadway. When coupled with other traffic calming techniques, street trees are especially effective.

Pedestrian Friendly Spaces

Trees planted in park strips provide a barrier between busy streets and sidewalks, making pedestrians feel safer and more comfortable. Trees shade hot sidewalks during summer months, offering people the opportunity to spend more time shopping, visiting or sightseeing in the city.

The benefits to a well-planned and managed urban forest are many. Communities are healthier, more enjoyable, diverse with wildlife and inviting. Utah's early ancestors and planners recognized these benefits and called for large community gardens and green spaces as seen in today's Pioneer Park.

Large street trees give the perception of a narrower roadway, which slows traffic.



Costs and Disadvantages of the Urban Forest

Urban forests and trees have many benefits, and while these benefits far outweigh the costs, they are not without problems. A good urban forestry program must acknowledge these problems and minimize their impacts.

Problems to be aware of include:

- Citizen support for urban trees usually is very strong in the abstract, but support for spending significant amounts of money on public trees is much weaker.
- Trees are biological organisms that create litter (leaves, bark pieces, twigs). Litter problems can be minimized by good selection and placement, but not eliminated.
- Even healthy trees can drop limbs or break in unusual circumstances, like heavy snow or ice loading or very strong winds.
- Trees eventually weaken and then (usually slowly) die. Through this process they become more and more hazardous, with the possibility of falling limbs, breaking trunks, and wind-throw.
- Trees sometimes damage or interfere with infrastructure, especially pavement and utilities.
- Business people often are concerned about trees blocking the view of their signs and storefronts.

- Trees cost money to establish and maintain.
- It requires more planning to include trees in landscapes than to pave or turf an area.
- Trees and shrubs can obstruct views and hinder crime prevention and detection.
- Urban forest management takes a considerable amount of fairly specialized expertise. Many towns and cities have little of this expertise available on staff. This is not really an urban forest/tree problem, but it leads to many problems.

Trees always present at least some potential hazard just by their presence, and declining or dead trees become especially hazardous to people and property. Eliminating these hazards is not possible without eliminating trees, something few would want. Trees therefore are sources of liability for a community and must be managed to eliminate unreasonable risk of harm to people and property. Communities have a “duty of care” or a legal duty to act to protect others against this unreasonable risk or hazard and therefore must not turn its back on public trees and their management. Warnings from citizens or staff of hazardous situations must be acted on quickly and the situation remedied. Instituting a municipal tree hazard management program can go a long way toward helping a

community act reasonably and responsibly in the management of their trees. Elements of such a program include:

- A written, approved urban forest management plan that addresses hazard tree management;
- Establishing a level of acceptable risk;
- Use of a systematic tree inspection and inventory procedure and keeping accurate records;
- Personnel training;
- Timely control of hazardous situations;
- Regular program review.

As shown above there are many issues to consider regarding the urban forest. The remainder of this chapter will focus on key elements necessary to plan for and manage a viable and vibrant urban forest.

Community Goals, Plans and Resources

Creating a Community Vision

A community needs to start with a vision in order to set goals for the urban forest. Community involvement is essential to developing this common vision. Based on the vision, long-range goals can be established with clear planning steps. The vision and goals may need to be revisited as you proceed through the planning process and as you gain new information or a community's situation changes.

Historically, Utah has made a strong commitment to the establishment of trees in the urban environment. The vision of green landscapes was brought into the Great Basin with its settlers arriving from the Midwest. The plans and ordinances of Utah's original cities mandated a strong urban forest and this can be seen in the older parts of many Utah cities. It

is just in the recent years, with the fast pace of development in Utah that new urban forests have not been created and their many benefits not realized. Communities need to first recreate the vision of the urban forest, and then create the forests.

Goals for the urban forest take many forms, and in order to realize these goals a clear understanding of what the community wants needs to be established. A plan is then created to realize these goals.

Residential Planting Goals

The aesthetic role of trees in residential areas is to provide continuity to neighborhoods comprised of homes of various architectural styles and landscapes. A community can achieve a style or appeal by requiring certain residential plantings. Visionary guidelines can provide for the quality that defines communities, as they are established and mature.

Commercial Planting Goals

There are a number of areas to consider for commercial landscaping. They include the downtown area, the commercial strip and parking lots. There are many site-related constraints on trees located in downtown areas. Two areas that are often overlooked in the selection of trees are the limited rooting space accorded trees located in tree wells and potential conflicts between the trees canopy and storefront signs.

Trees help create a community vision, as shown here in the Sugarhouse section of Salt Lake City.



Defining the goals for commercial plantings and the coordination with signage and street constraints ensures a viable and productive environment for trees to mature.

Community Awareness

Another important goal is to make the communities aware of the importance of trees. Two of the many ways to accomplish this goal are through Arbor Day celebrations or a Tree City USA designation.

Arbor Day is a special day set aside for tree planting. Arbor Day celebrations vary from a simple tree planting to all-day affairs. The important thing is that the activity a community plans meets its goals and objectives. Goals vary from educating the public about the value of trees and the need to make provisions for them, to getting people involved and supportive of the efforts of a community leader focusing on the benefits of the Urban Forest. A basic Arbor Day ceremony may include: introduction and comments by a community leader, a reading of Arbor Day history, singing songs or reading poems about trees and the impact they have on our lives, the planting of a tree, and completion of the planting.

Since its inception in 1976, the Tree City USA program has been recognizing communities around the country for their tree management efforts. The program has also had the effect of encouraging

those communities who do not already have a community forestry program to pursue establishing one. A community must meet these four standards to become a Tree City USA:

- 1] A tree board or department which is legally responsible for the care and management of the community's trees.
- 2] A community tree ordinance, which designates the establishment of a tree board or forestry department and gives this body the responsibility for writing and implementing an annual community forestry work plan.
- 3] A community forestry program with an annual budget of at least \$2 per capita.
- 4] An Arbor Day Observance and proclamation.

Any questions regarding Tree City USA designations can be directed to the state forester's office. The state forester's office is responsible for verification and approval of applications and information is then forwarded to The National Arbor Day Foundation. Qualifying communities receive a Tree City USA flag, two road signs, a plaque and several commemorative items to show this commitment to the urban forest to its residents and surrounding communities.

► **Communities are the stewards of the urban forest. Forest trees in urban landscapes only live for 7-10 years. We must acknowledge the benefits of urban forestry and work actively to achieve these benefits.**

■ **A community's identity, its health and vitality are all impacted by the trees growing in its landscapes. Close integration with the buildings and other infrastructure allow the community to define their image and declare their purpose.**

City Forester

Another way a community can realize the goal of a vibrant urban forest is by having a city forester on staff. The position of City Forester is created to manage the community's tree resource and administer their tree ordinance. In some smaller communities this duty may fall to a volunteer tree board or in some communities may be entirely neglected. City foresters are typically given the authority to manage all publicly owned trees within a community. This management includes the planting, pruning, treating disease and insect pests and removal of public trees. They also often have the authority to address private trees and to address public concerns such as insect and disease control and hazardous tree situations.

Some communities have made provisions for the licensing of spray applicators and tree pruners. The City Forester or tree board typically issues these licenses. Applicants for a license may be required to demonstrate competence and knowledge in the business of spray application or tree pruning by passing a written test and by demonstrating the necessary skills in a field test.

Creating an Urban Forest Plan

After a community vision has been established and goals have been set, the next step is the creation of an urban forest plan. Planning is simply systematic decision-making. It provides a means for progressing towards a goal. If there is a single action that could advance the planting and care of trees in most communities, it is a well thought out plan. Involving key stakeholders in the planning process is important for the creation of an Urban Forest Plan. The establishment of a shade tree commission, tree board, or the position of city forester is a good step toward planning for the urban forest. Individuals interested in or already responsible for municipal tree care would be invited to serve in these positions. A community's Urban Forest Plan needs to become part of the community's general plan, stated both as long-range goals and also as policy. This integration into the general plan heightens the awareness of the urban forest and incorporates the strategies into the City's overall goals. An efficient and collaborative approach provides opportunities for all city departments and citizens to be included in the planning process from the beginning. Working together to create a vision and set goals provides the foundation for an Urban Forest Plan to be successful.

Conduct a Tree Inventory

As part of the urban forest plan, an inventory of the community's trees needs to be conducted. Few communities have any idea how many trees they have on their streets, let alone where they are, what species they are, and what condition they're in. In addition, an assessment of the resources available to manage the urban forest assets should be included.

There are many different kinds of inventories and even a greater variety of ways to conduct them. Tree inventories usually collect at least the following information: species, size, tree condition and tree location. Additional information might be necessary to attain the goals set out in the urban forest plan. There are many sources of assistance available to help set up tree inventories listed at the end of the chapter.

Species

How many types of trees are located in the community? A diverse tree population protects a community's urban forest against the devastating effects of an insect or disease outbreak. Understanding the composition of your urban forest will also assist in planning for and identifying which species could be planted in the future to ensure a diverse tree population.

Size

Size is often an indication of the age of a tree, which is an important factor in the long-term viability of the urban forest. The ideal urban forest will have a broad range of ages, achieved through continuous planting and removal based on tree condition. Size is typically measured as diameter at breast height (DBH). It is measured four and one-half feet above the ground. Inventories typically place trees into diameter classes with 2 or 4-inch increments.

Condition of Trees

The condition of individual trees or stands of trees gives an idea of the urban forest's health and long-term vitality. This information helps address problem areas such as insect or disease concerns. Planting, maintenance and removal decisions can be made from understanding the condition of the trees in the community.

A common tree classification system based on condition is:

- 1] A "healthy," vigorous tree with no apparent signs of injury, disease or insect damage. Tree has form typical for species;
- 2] Tree of average condition or vigor. May have some disease, damage or injury and is somewhat off form. May need some pruning;



3] In a state of decline for any reason. Death not imminent. Serious pruning may be required;

4] Dead or Dying. Removal required.

Location

Another important inventory element is location. Trees can be located in public places such as street rights-of-way, public parks, and those in the gardens of public buildings. Commercial areas and private property also are home for many community trees.

Location information collected may vary depending on the type of area, from a general description in a natural area to an exact site address for a street tree. If one of the purposes of the inventory is to schedule maintenance work, addresses must be recorded in order to return to the location. Global Positioning System (GPS) equipment may be helpful for cataloging densely populated forests.

Conducting an inventory requires a certain amount of training. The areas of most concern are the ability to identify tree species and judge condition. These concerns can easily be addressed by contacting one of the sources of assistance located in the reference section of this document.

How to Use Trees in a Community Design

There are three basic concepts for planting trees in urban environments: formal, informal, and planting for wildlife habitat. These three concepts can also be combined on a site. Initially when planning a planting project, consideration should be given to the goal that is being sought by the project. Selecting the concept that is best suited for the project is important.

Formal

Formal planting emphasizes geometric patterns, a limited number of species, and uniform spacing. Typically only one species is utilized appropriately with predetermined spacing. Formal planting is generally appropriate when used with a grid or other geometric system of streets where a pattern already exists. Many of the most recognizable Main Streets in Utah are formal plantings composed of rows of a single species lining both sides of the street. Farmington and Brigham City are good examples of this concept.



This streetscape is an example of a formal planting pattern.

Informal

The informal style of planting emphasizes randomness, a large number of species and irregular spacing. It is most appropriate for large areas, where trees can provide variety and relief from the grid pattern of streets and homes, such as parks and open space. Informal planting in parking strips is appropriate if the area is large (15 feet or more). The informal effect cannot usually be achieved without a large area to plant in.



Many tree plantings on streets use an informal planting style, as shown here.

Wildlife Habitat

These plantings are designed to attract and sustain birds and animals that reside in and/or utilize urban areas. Plantings should emphasize irregular planting patterns, with diverse species, and sizes. Connected and continuous plantings should be selected over small, isolated plantings. There are many areas within a community where such plantings are appropriate, such as parks, cemeteries, golf courses and open spaces.



Deer inhabit this example of wildlife habitat.

The goal with these plantings is to create three vertical vegetation layers consisting of ground cover, shrubs and trees. By creating multiple layers, different habitat and cover types are created for a variety of animal species.

When utilizing these three planting concepts, a planting pattern is created. The city forester or shade tree commission can select the planting concept which best suits the specific area of the community the project is located in. Often times the character of the community is defined by the concept of the tree planting undertaken.

Managing Utility Placement Constraints

The placement of utilities, whether above or below ground, can create considerable constraints for tree planting and the viability of existing trees. The conflict created between utility lines and trees is possibly the most controversial tree issue. With thorough planning, some of these conflicts can be avoided or properly managed—trees can share space with utilities in park strips.

Improper tree selection around utilities can lead to poor tree health and bad pruning practices.



When planning a new development, a community has the opportunity to include trees in the planning process. Conducting a thorough project site evaluation to understand the growing conditions and other pertinent site factors, such as utilities, is the first step prior to selecting which tree species to plant. This opportunity also allows for the consideration of where utilities will be located in relation to existing trees. Separating the trees and utilities as much as possible and providing for wider planting strips can help avoid many of the conflicts between utility lines and trees.

Managing existing spaces where trees and utilities coexist requires a relationship between utility representatives and community officials to address concerns and create opportunities to proactively manage the community's urban forest.



Properly selected and pruned trees create a safe urban environment.

Development Review Process

In established areas of the community it may be difficult to have a significant impact with regard to vegetation unless ample planting space has already been provided, or the area is in a process of being rebuilt. In newer or undeveloped areas, there is a greater potential through the building review process to make decisions that will affect existing vegetation and provide for successful plantings. There are many groups that need to be involved, such as landscape architects and urban foresters, in order for the building review process to be successful. If a community does not have a landscape architect or urban forester on staff there are sources of assistance, detailed at the end of the chapter, which can be utilized during the review process. In order to incorporate the goals of the Urban Forest Plan, a site evaluation can be conducted prior to the landscape plan being accepted. This site-based review is fundamental to incorporate the benefits of the Urban Forest Plan into the growth and dynamic change experienced by most communities in Utah currently. It is for this process that a community's Urban Forest Plan is implemented.

Tree Ordinances and Requirements

Tree ordinances and requirements are tools used by communities striving to attain a healthy, safe, well-managed community forest. By themselves, tree ordinances cannot assure that the trees in and around our communities will be improved or even maintained. Tree ordinances simply provide the authorization and standards for management activities and should reflect the values of a community. If these activities are not integrated into an overall management strategy or Urban Forest Plan, problems can arise.

Many times, existing or model ordinances are used to draft an ordinance. Provisions are then taken and or modified from these ordinances that suit a particular community's situation. There are several reasons why this approach to drafting an ordinance can be problematic. The most important of these is that the resulting ordinance is often enacted in the absence of an integrated tree management strategy. Without an integrated strategy, provisions may be included which are inappropriate, or omitted. The ordinance is often seen as an end in itself, rather than one of many tools that must be used to attain a healthy, safe, well-managed community forest.

Ordinance Components

There are many components that can be incorporated in an ordinance, such as street tree, permit, landscape, and tree preservation requirements. Street Tree Requirements primarily cover the planting and removal of trees within public rights-of-way. Provisions outlining maintenance or removal of private trees that pose a hazard to the public are also often included. Landscape requirements include requirements and specifications for trees, or refer to separate documents containing this information. Tree Preservation requirements are directed at providing protection for existing trees, or trees that are historically significant.

Street Tree Spacing and Location Requirements

Trees can be classified into three different size classes based on their mature heights: small trees are those with a height of 25 feet, medium trees are those with a height of 45 feet, and large trees are those over 45 feet. Typically small trees should be spaced 20 feet apart, medium trees 35 feet and large trees 45 feet. Communities should strive to make planting strips at least 5 feet across, whenever possible, to increase tree vitality. Trees or woody plants should not be planted on the parking strip without the approval of a community official.

► Crime Prevention Through Environmental Design (CPTED)

■ CPTED recognizes that design and use of the physical environment affects crime by affecting human behavior. Identifying intruders is much easier in, and criminals are deterred by, a well-defined space that delineates and reinforces ownership.

■ Criminals don't want to be seen. Placing physical features, activities, and people in ways that maximize the ability to see what's going on discourages crime.

Trees should have a canopy high enough to walk under comfortably and allow numerous sight lines to make the pedestrians feel safe.

Permits for Planting, Pruning, and Removal

A process needs to be developed to address tree problems when they are identified and allow for the tree board or urban forester to have input prior to trees being planted, pruned or removed. In many communities, a notification and permit system has been developed to deal with this issue.

A notification process addresses the nature and solution for a tree problem. When a tree problem needs to be addressed, the notification states what the problem is and that the work must be completed according to standards set by the community, subject to inspection. Penalties can be established for work that is not completed in a timely manner and does not meet community standards. A permit system is often utilized by communities to assure that informed decisions regarding the planting, pruning and removal of trees are made.

Landscape Requirements

For benefits to be achieved from an Urban Forest Plan, guidelines need to be established to avoid conflicts with other city objectives. Improperly placed trees can create conflicts and lead to damage of sidewalks, streets, curbs and utility lines. Because of these conflicts, trees often become liabilities to the community and require premature removal.

When developing landscape ordinance requirements for residential and commercial areas there are certain things which need to be taken into account: the width of the street, the size of the parking strip, location of overhead and underground utilities, clearance above street and sidewalk and any potential sign conflicts. To minimize or avoid conflicts and reduce liability, the height of a mature canopy tree bottom should be sufficient to support sidewalk and street traffic.

Tree Preservation

The goal of tree preservation ordinances is to protect native trees or trees with historical significance. They are particularly useful in communities that are experiencing rapid growth. These ordinances typically define and identify specific trees, outline permitting procedures, discuss enforcement methods, and discuss violations and penalties to be imposed.



Tree Species Selection and Planting

Tree Species Selection

The benefits of trees are numerous but the key to these benefits is to select the right tree and plant it in the right location. The right tree in the right place not only ensures a longer life and long-term enjoyment of a tree's beauty, it also keeps maintenance costs low. A tree that is not properly matched to a site can become more of a liability than an asset. Whether planting trees along a city boulevard, in a park or around a home, the effort is worthless unless the proper tree species is selected and the tree is planted correctly.

Matching A Tree to A Site

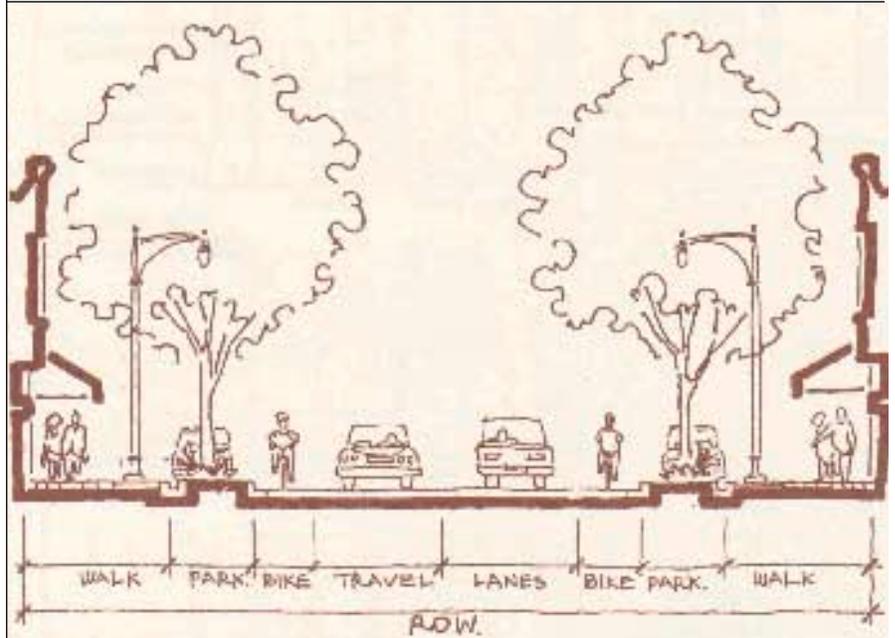
It is very important to match tree selection to the site. Planting sites have environmental characteristics that must be considered, such as temperature extremes, soil pH, light levels and water availability. A tree should be selected to match these characteristics and thrive. In addition trees should be planted to provide a function in the landscape. For example, trees may be planted to create shade in a parking lot, screen a view, or camouflage a building. It is important to choose a tree species that is capable of growing in a location with unique environmental conditions,

as well as fulfill the desired landscape functions. In many cases, it is difficult to find a tree that matches every characteristic of the site and therefore priorities must be set when selecting a tree. The light and water requirement of a tree species on site should have the highest priority. Other compromises must be made between the goals of the tree function and the limitations of the site. For example, if the shading and screening of a building is desired, a large shade tree with several smaller trees or shrubs might be planted. There are a variety of conflicts, such as overhead power lines, that might also limit the type of tree selected. In the case of the overhead power line, a tree with a maximum height of 25 feet at maturity should be selected.

Trees can be used to block the view of large buildings in the urban environment.



When designing street environments, proper species selection is essential to meet the design goals.



Improper tree selection can create numerous problems as the tree grows to full size.



Site Evaluation

It is a good idea to do a complete site analysis before a landscape plan is designed. The site evaluation will document existing site conditions that will affect the plant selection. The functional goal of the landscape can also be outlined at this time. Many site characteristics should be considered in plant/tree selection. These include:

- growing space
- light levels
- water availability
- drainage
- soil pH
- clearance requirements
- soil type
- weather
- temperature
- overhead and underground utilities

The amount of growing space available for a tree is also important. The area available above and below ground must be large enough to allow the tree to grow to its full height, branch spread and trunk diameter without interfering with its surroundings. Many trees can grow over 100 feet tall and other trees can grow wider than they are tall. Large trees have many benefits but they should never be planted beneath overhead power lines.

Shorter-growing trees or shrubs are more appropriate under overhead power lines. Trees without appropriate growing space can damage sidewalks, driveways and foundations. Knowledge of a tree's branch spread can help avoid planting it too close to buildings where siding or window damage can occur. It can also help avoid planting too close to intersections or signs, where visibility can be blocked.

Too little light or too much light or heat can cause severe problems. Some trees can develop scorched leaves. Norway maples are an example of the many species that can experience severe leaf scorch in Utah when planted on sites with inadequate water when combined with warm dry weather.

High soil pH can limit nutrient availability. Much of Utah has very alkaline (high pH) soils. The former bottom of Lake Bonneville, which at one time covered much of the Wasatch Front, has left these soils with a very high alkalinity. The high alkalinity translates to low iron availability for plants. Many tree species including Silver maple and Amur maple suffer chlorosis (yellow leaves) due to the unavailability of iron in Utah's alkaline soils.

Trees planted in poorly drained soils are subject to root diseases and poor root development. Poorly drained planting sites can cause the death of most tree species. Excess water in the root zone suffocates and kills the roots.

Drainage problems in urban landscape sites are often not recognized until after planting is complete. If a site is known to have poor drainage, drain tiles can be installed prior to planting to carry excess water away from the site. In soils where water infiltration is slow, steps can be taken to limit standing water. When irrigating plants in poorly-drained soils, slow the application rate and increase root zone aeration by drilling holes 6 to 18 inches in depth, and backfilling with sand, compost, or pea gravel. It is important to choose trees that are tolerant of wet soil conditions in poorly drained areas.

Tree Species Considerations

A tree’s size at maturity, the growth rate, form, hardiness, insect and disease resistance, and maintenance requirements are some of the many factors to consider during species selection. Trees that grow and mature fast often grow well on poor sites and provide shade very quickly. However, these fast-growing trees (Siberian elms, boxelder, and willow trees) often have weak, brittle wood with poor branch structure, and may break easily in storms. Fast-growing tree species are usually more susceptible to decay and other insect or disease problems.

A tree’s hardiness to cold weather must also be considered. Trees are listed by the lowest (coldest) zone in which they will thrive, or a range of zones in which the tree will grow. Trees planted in contain-

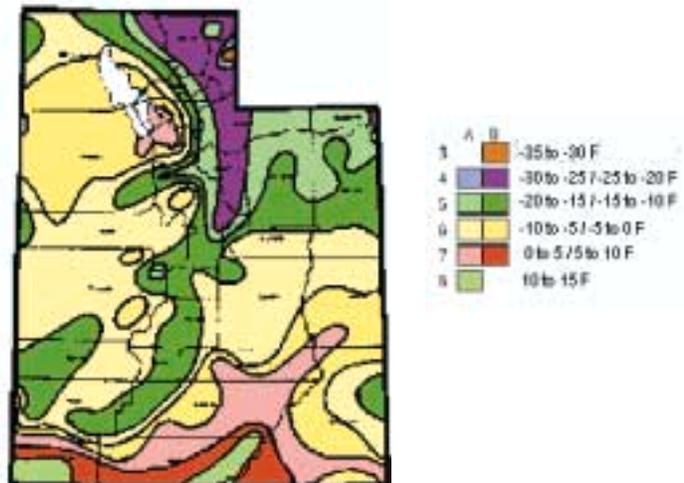
ers where these roots are above ground may decline in low temperatures because their roots are left unprotected.

High temperatures and dry conditions will stress many tree species. Quaking aspens, which are native to our mountains, do not do well in the warm dry climate in Utah, becoming stressed and susceptible to borers and other pests.

It is important to consider a tree’s root system. Some trees have large surface roots that can damage pavement and side walks, or are difficult to mow around. Most trees can have root systems that can invade or plug broken sewer lines.

Looking at the whole picture, it is important to select a tree that is the appropriate size for the site, and that will not be stressed by the site conditions. It is also important to select trees that are more resistant to insect and disease problems.

The USDA zone hardiness map is an important tool to use when selecting trees. Trees are rated for the coldest zone they can easily survive in.



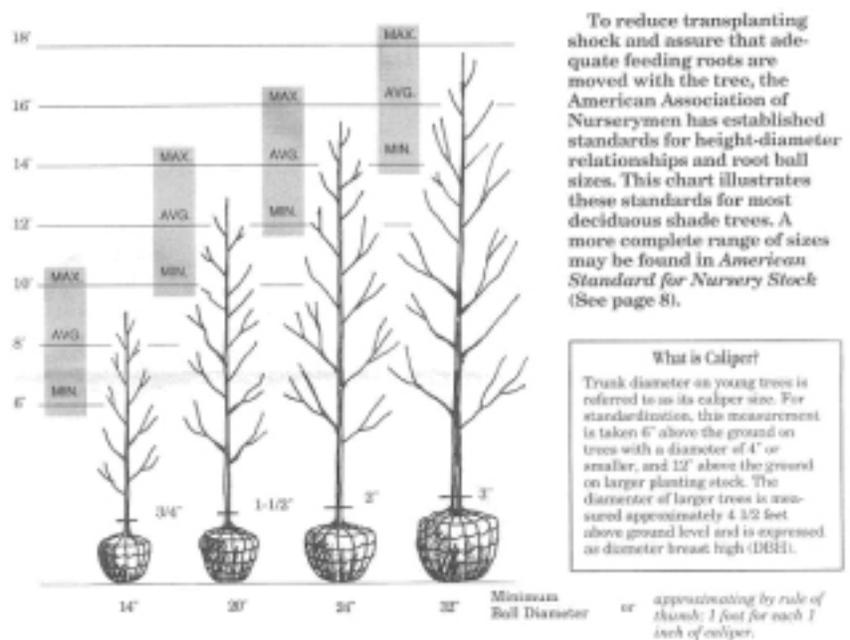
► **Utah State University Extension has produced a variety of publications. A key document, “Selecting and Planting Landscape Trees,” includes a table with several pages that summarize a great deal of tree selection information for Utah. The Tree Selection Guide identifies cultural characteristics such as tree tolerance for poor drainage, drought, salt, alkalinity and shade as well as hardiness and transplanting ease. The guide also identifies general species characteristics such as growth rate, mature height, longevity, ability to coexist with power lines and crown shape. An online copy of this booklet can be found at the Utah State Extension website www.extension.usu.edu/publica/natrpub2.htm**

Specific tree characteristics may make a tree more desirable or even unacceptable for certain locations. Exfoliating bark, flowers and fall leaf color are a few characteristics people desire in a tree. Other characteristics such as excessive leaf, fruit or twig drop may make a tree unacceptable adjacent to sidewalks, patios or parking lots.

Tree Planting

Trees can last a lifetime, so it is important for a community to spend the appropriate amount of time and money to get the very best. It is important to buy the right size and type for a specific planting need. Trees can be purchased as seedlings, potted, or balled and burlapped (B&B). A tree too small for a particular urban setting is often vandalized, reducing its chance of survival. A two-inch caliper (diameter) tree is considered the most appropriate size for planting in the urban setting. They are large enough to the reduce risk of vandalism and small enough to have a root to shoot ratio adequate for surviving planting.

How to Check Proper Size and Root Ball Proportions



Trees are perishable products and must be treated accordingly. Reputable nursery operators know how to protect trees in shipment or while on display. When a tree is brought into the community, however, it is the community's responsibility to manage its well being. The following two rules will help keep trees alive until they can be planted in the ground.

Rule #1

Carry trees carefully when transporting. Unload gently, being careful not to break branches. Always provide support beneath balled or potted plants. Never carry or move trees by holding only the trunk.

Rule #2

Keep the roots moist. Techniques to prevent drying vary based on type of tree and how long they must be stored prior to planting. Bare root trees should have packing material around the roots and should be stored between 30-40 degrees Fahrenheit. Balled and burlapped, or potted trees should be checked for dryness by finger length probing into the soil; sprinkle or water if necessary, then store them in a cool garage or shaded area out of the wind. Don't store trees for a prolonged period.

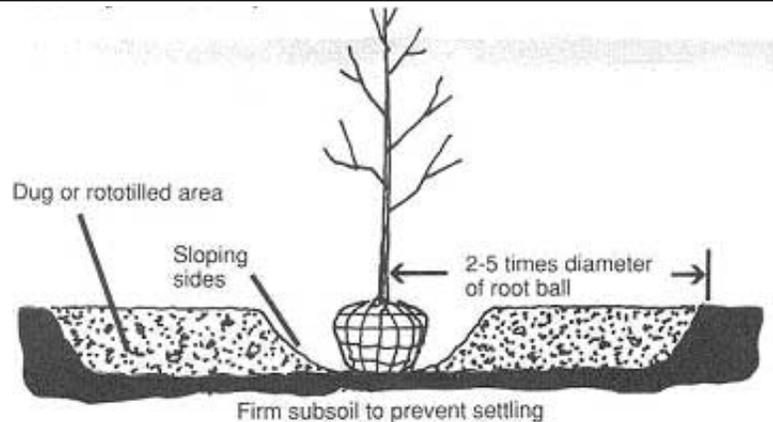
This diagram shows how large a hole needs to be dug to provide the tree with the best chance of survival.

Don't plant a \$100 tree in a \$10 hole!

A properly dug and prepared hole will encourage root growth rather than adding to the difficulties already challenging the young tree. The following guidelines are based on average conditions.

Before digging, always contact Blue Stakes or your local utility offices. In most areas, the utilities offer to locate and stake underground cables and pipes at no cost. The diagramed method below recognizes the fact that most roots spread through the top 12-18" of soil laterally around the tree. Slope the side of the hole and dig or deeply roto-till an area around the hole at least twice the diameter of the ball or container. An area up to 5 times the diameter of the root ball or container is recommended if the soil is compacted, as space and aesthetics allow. Careful consideration should be given to existing trees so as not to damage their roots during this process.

Trees should be placed at the proper height to ensure continued health.



Pots, burlap and wire baskets should be removed before backfilling the planting hole. Do not remove the burlap or wire until the tree is placed at the proper depth in the planting hole. Plant the tree at or shallower than the depth it was planted in the nursery. Define planting depth. Once the tree is set in the planting hole, cut the wire basket away from the root ball and cut and remove all burlap and rope from around the root ball and trunk. It is best to leave the burlap and wire under the root ball only if removing it will damage the root ball.

Backfill the hole with native soil unless it is clay from basement excavation or other undesirable fill material. In that case, mix in soil amendments according to instructions from a local nursery or bring in as much good topsoil as possible. Tamp gently and add water to fill large air spaces and give the tree its first watering in its new home. Be sure to water the surrounding soil area to encourage root spread.

Construction Issues

Construction affects the urban forest in many ways, and in turn the urban forest affects constructed objects, including sidewalks, streets and certain buried utilities. Though trunks and branches are the most obvious tree parts affected by and affecting construction, root systems are much more important, yet are the easiest to

forget. The remainder of this section will discuss preparing sites for new tree planting after construction, protecting existing trees during construction, and the effects of trees on constructed objects.

Establishing New Trees After Construction

Allowing adequate room for a tree's trunk and crown after construction is important and easy to do. Much more critical, and more difficult, is allowing adequate room for a good root system. A tree root system is a network of fine roots that reach far out into the soil, connected to small and large woody roots that connect to the trunk.

Most roots grow laterally within 12 inches of the surface and roots can extend 2 to 3 or more times the tree's crown spread. Deeper roots are important but not very numerous.

Roots take up water and minerals from the soil and help hold the tree upright.

Fine roots only live a matter of weeks or months, but new ones are constantly being formed to replace the old ones.

To survive and grow, roots need oxygen, moisture, and a soil that is not too dense. Soil left after construction must provide these needs or roots won't survive and grow and the tree will die.

Characteristic tree root system.



To have enough roots, trees must have access to an adequate volume of well-aerated soil that's not too deep. Most of this soil should be within the top one to three feet of the ground's surface to ensure oxygen availability, but the area can have a shape from long and narrow to a square or circle. Trees need approximately 2 cubic feet of good soil per square foot of projected crown area to grow well.

If the tree's soil volume is inadequate or the soil is poor, the tree may do fine when young but eventually will be stressed or kept from reaching its full potential as it reaches the limits of its soil resources.

The soil available to the tree is most usable if it is open to the air (not paved) and is mulched. Trees can use soil under pavement but the more compact the soil, the less useful it is. Tree roots commonly access soil under and beyond sidewalks, but less commonly under streets and parking lots. Loose-laid pavers are one way to pave while allowing oxygen and water movement into the soil. Rigid pavement can be suspended over usable soil with piers or footings but such systems are expensive. Structural soils are being researched that would allow better root access under pavements while protecting pavement from cracking, but results so far are inconclusive.

Tree grates provide water and oxygen movement into the soil.

Soil on construction sites is usually left in very poor condition and requires more than a light grading to make it suitable for trees. Construction debris and chemicals should be removed from the site. The soil will almost certainly be heavily compacted so deep tillage should be done to reduce density and increase aeration. Then grading and topsoil additions can be done.

Irrigation planning is essential for most planted trees to survive in Utah. Planning for and installing an irrigation system as a site is remediated helps prevent tree roots from being disturbed later. Consider placing trees and other water-needing landscape plants in areas where runoff from pavement

Construction sites are typically not beneficial environments for trees.

► **A Norway maple that will eventually have a 30 foot diameter crown, or a projected crown area of about 700 ft² (3.14 x 152), will need at least 1,400 ft³ of soil volume (700 x 2) to support its needs. Possible planting areas that would supply this soil volume are 26' by 26' by 2' deep, 37' by 37' by 1' deep, or 10' by 47' by 3' deep.**



► **Trees located in wide parking or landscaping strips provide great value. They shade the surrounding pavement and beautify the open space. Trees need adequate room to support their root system. The best-designed parking strips are wide enough to support a tree that will grow to have a 2' trunk. Additional space is necessary to provide a buffer between parked cars and the tree. The ideal soil surface is not covered with turf, but with coarse bark or chip mulch or with loose laid pavers. An adequate circle opening around each tree trunk is also necessary. Curbs are necessary to keep cars away from trees and a high curb/low soil level can help keep mulch in. Including trees in the landscape design of parking lots is an ideal addition to the urban forest.**

This landscaping strip is designed wide enough to provide ample root space for trees and provide protection from traffic.

is channeled. This can supply needed water to the tree while using water that otherwise might accumulate. Tree contaminant uptake and increased microbial activity in soils with roots in them also can break down some contaminants that might be present in runoff. Selecting the proper tree for unique site requirements and situations will help insure a long and vital tree life.

If a site is very compacted or soil volume is restricted for other reasons, consider building berms to contain groups of landscape plants including trees. This can be especially useful over old parking lots and landfills. Trees in such situations can even be planted by placing them right on the undisturbed ground with a berm built up around their root ball. In such circumstances be sure to plan for and supply adequate rooting volume in the berms.

Vaults or planters used for trees rarely have adequate soil volume to sustain a tree once it gets large. This may be acceptable for some situations where a small tree is better than no tree, but planning to grow a large tree in a small-



enclosed planter is a fatal decision for the tree. If a closed planting container must be used, allow for irrigation, drainage, and for oxygen to reach all parts of the soil volume. Relying on systems that require intensive maintenance like removing drain water by suction is expensive and difficult to manage.

Protecting Trees During Construction

Saving a tree during construction is a difficult problem. Even though a tree may be standing when the construction is complete, this doesn't mean the tree is healthy and will continue to live. A healthy tree trunk and crown doesn't ensure a viable root system. Well-written and administered construction contracts and knowledge about trees and their root systems will increase the probability that more trees can be saved during construction on a site. The following are important steps for saving trees in construction areas:

1] Involve a knowledgeable person who cares about the trees to be saved and who understands the health and function of a tree and its root system.

■ This person must be given authority in the construction process or have access to a person with authority.

■ Constant oversight is needed. Trees can be lost in an hour if a trench is dug in the wrong place.

2] Assess how much the tree will

be affected by the construction; if too much of the top or root system will be lost then change construction plans or remove the tree.

- Save roots by moving trenches out from or curving them around trees. A trench 12-inches deep right next to a tree's trunk cuts off almost half of its roots.

- Avoid deep fills over root systems as they deprive the tree of necessary oxygen. Techniques are available that can save trees even when very deep fills are necessary on a construction site. These techniques can be expensive and should be targeted to saving only very valuable trees.

- Avoid heavy equipment traffic that compacts soil and kills roots.

3] Take necessary steps to identify and save valuable trees.

- Fence out portions of root systems and crowns with good fences that will be respected. Assume roots and crown outside the fence will be lost.

- Do not allow even temporary placement of supplies or equipment or any parking in the fenced area.

- Prune off parts of the crown and cleanly cut woody roots that will otherwise be torn or broken.

- Irrigate the tree regularly.

In many cases not enough room is left between the tree and the sidewalk.

Effects of Trees on Constructed Objects

Trees can negatively affect buildings, pavement, and utilities. Trees can also impact overhead utilities. Woody roots and the base of the trunk can affect pavement through cracking and heaving. The best way to prevent this is to allow for planting areas wide enough to contain the trunk base and larger woody roots near the trunk. A minimum parking strip width, for example, should be 6' to 8' to allow for root and trunk growth. This wide strip is important for large and small trees, since small trees will never get their crowns high enough to clear traffic in the street on pedestrians on the sidewalk.

Sidewalk irregularities can be mechanically ground to delay tree replacement for a few years. When damaged pavement is replaced, consider moving it farther away or curving it around the tree.

Minimize the cutting of large roots and make sure they're cut cleanly. Also minimize disturbance of the surface soil around the tree since most roots are shallow. Root barriers that are placed along the edges of pavement succeed in deflecting roots temporarily, but the roots will eventually grow under the barrier and back up toward the surface.

Trees sometimes damage buildings if planted too close. Pruning or tree removal may be necessary in such cases. Tree roots rarely damage buildings. Roots can grow into cracked foundations, but the problem is the weak foundation, not the tree.

Similarly, trees rarely damage underground utilities. Growing woody roots can pinch off or break shallow irrigation lines, but buried electric, water, gas, and sewer lines are normally too deep to be affected by roots.



Roots often encounter old sewer lines and grow inside through cracks, but they can't enter sewers that are intact and they don't cause cracks. The biggest conflict between trees and buried utilities is the occasional need to excavate utilities causing tree damage or removal. Grouping utilities and placing them away from trees can minimize such conflicts.

Tree Maintenance Watering

Trees absorb water and minerals dissolved in the water from the soil. Without sufficient soil moisture, a tree cannot absorb essential elements, photosynthesis is reduced, and tree growth is limited.

Proper watering is often referred to as the ultimate green thumb skill of horticulture. Specific recommendations for amounts of water needed vary with different environmental conditions. Frequency of irrigation depends on the species of tree, rainfall, daily temperatures, wind conditions, moisture holding capacity of the soil, evapotranspiration drainage and the stage of root system establishment.

Frequency of watering directs the type of root growth. Infrequent but deep soakings encourage production of a deeper root system and a more drought tolerant tree.

The most beneficial time to irrigate is during the early morning. Evaporation is minimized and the foliage has time to dry thoroughly during the daylight hours.

"A Tale of Two Trees."

FAMILY A'S TREE —
Not Pruned When Young



At Planting
Family A didn't ask for planting instructions. They knew how to plant a tree. When that was done, they believed their work was done.

Actually, they were partly correct. You may receive instructions to the contrary, but little should be done to the tree at this stage. In most cases, it is best to leave all the leaf surface possible to manufacture food that will build a larger root system. It has been found that both roots and top will be larger after one year if left unpruned.

After 3-4 Years
By the time many transplants are in their new homes for 2 to 4 growing seasons, sprouts and suckers may appear. The root suckers protruding near the base sap strength from the tree. The sprouts are disproportionately vigorous and weakly attached to the tree. And look at the broken limb. By now, it has sprouted numerous branches just below the break – too many in fact.

After 5-7 Years
The baby is quickly becoming an adult. The results of not making corrections early in life are now quite visible, although some are still not obvious to the untrained eye. To the more careful observer, the form of the future crown is apparent.

15 Years After Planting
Family A's tree is now not only unattractive, but dangerous, especially when the wind is blowing. Lopsided and dense, the tree in full leaf catches the wind like a sail. Also, the narrow branch angles and multiple leaders have resulted in a weak top. The broken branch not only attracted insects, but may soon break off under the weight of too many sprouts. Decay has entered the trunk where the little bent branch tore off many years ago and a jagged stub protrudes just above it. The tree is an accident waiting to happen. It is becoming more of a liability than an asset for the property.

FAMILY B'S TREE —
Pruned When Young



At Planting
Family B also planted their tree correctly, but they also noticed a broken branch and a branch that was competing with the leader. Both were pruned close to the trunk. Another, swollen from the sting of an insect laying eggs (a gall), was snipped off. Otherwise, all branches were left intact to provide maximum leaf surface to manufacture food during the first year of life in its new home.

After 3-4 Years
By now root growth should be well on its way to anchoring the transplant and expanding to the size necessary to nourish the growing branches. Family B decides to cut off the root suckers and sprouts in the crown. Other excessive branches are thinned to reduce competition for light, water and nutrients, and a co-dominant leader is removed. A few of the lowest limbs are also removed, but others are temporarily left to help the trunk develop more taper and strength.

Growth is far enough along to reveal problems developing such as branches that rub or are growing in an undesirable direction. Narrow angles are also eliminated.

After 5-7 Years
Now is the time to make a good tree even better. Lower limbs are pruned off to "raise" the bottom of the crown well out of the way of human heads. The lowest limbs are now the permanent lowest limbs. An important fact is recognized here. Branches do not move upward as a tree grows taller. The center of a branch at 5 feet will always be at 5 feet.

Higher up, a few overzealous branches are cut back so they do not protrude beyond the graceful outline of the crown. A branch here and there is removed for space – but basically the job of sculpturing the tree is now complete.

15 Years After Planting
Family B was amazed to see their tree survive a major windstorm one summer day. While many other trees in the neighborhood suffered, split tops and broken limbs, their's stood strong and firm. Proper pruning gave strength to the branches and allowed the wind to pass harmlessly through the thinned crown. Early each spring, the tree gets scrutinized and dead or damaged limbs are cut off using proper pruning methods. Otherwise, Family B has only to enjoy the beauty and shade of their tree. And what do you know? Just before they moved recently, the real estate agent told them it was the trees in their yard that helped sell the property so quickly.

Drip irrigation can be used to reduce water waste, allowing more water to be absorbed in the soil with less evaporation. Water is applied very slowly over a longer period of time. When planning and planting for minimum irrigation, plants with similar water requirements should be grouped together and shade used wisely.

Pruning Versus Topping

Pruning is a job that needs to be done. Just like maintaining an automobile, trees must be maintained by regular pruning to ensure a long and healthy life. Forest trees grow quite well with little or no pruning, but in landscape situations, tree pruning is often necessary to remove dead branches, improve tree structure, enhance vigor, or maintain safety. Proper pruning also supports the principals of Crime Prevention through Environmental Design (CPTED).

Pruning cuts must be made with an understanding of how the tree will respond to a cut. One of the most common pruning practices, topping, is also one of the most damaging. The following are some reasons why trees should never be topped.

Starvation

Topping removes so much of the crown that it upsets an older tree's well developed crown-to-root ratio and temporarily cuts off its food-making ability. Good pruning rarely removes more than 1/4 to 1/3 of the crown, which in turn, does not seriously interfere with the ability of a tree's leafy crown to manufacture food.

Shock

A tree's crown is like an umbrella that shields much of the tree from the direct rays of the sun. By suddenly removing this protection, the remaining bark tissue is exposed and scalding may result. There may also be a dramatic effect on neighboring trees and shrubs. If these trees or shrubs thrive in shade and the shade is removed, poor health or death may result.

Insect and Disease

The large stubs of a topped tree have a difficult time forming callous. The terminal location of these cuts, as well as their large diameter, prevents the tree's chemically based natural defense system from doing its job. The stubs are highly vulnerable to insect invasion and the spores of decay fungi. If decay is already present in the limb, opening the limb will speed the spread of disease.

Weak Limbs

At best, the wood of a new limb that sprouts after a larger limb is truncated is more weakly attached than a limb that develops more normally. Rot may exist or develop at the severed end of the limb, and the weight of the sprout makes a bad situation worse.

Rapid New Growth

The goal of topping is usually to control the height and spread of a tree. Actually, it has just the opposite effect. The resulting sprouts, often called water sprouts, are far more numerous than normal new growth and elongated. The tree returns to its original height in a very short time, and with a far denser crown.

Tree Death

Some older trees are more tolerant to topping than others. Beech trees, for example, do not sprout readily after severe pruning and the reduced foliage most surely will lead to death.

Ugliness

A topped tree is a disfigured tree. Even with its re-growth it never regains the grace and character of its species. The landscape and community are robbed of a valuable asset.

Cost

To a worker with a saw, topping a tree is much easier than applying the skill and judgment of good pruning. Therefore, topping may cost less in the short run. However, the true costs of topping are hidden, including reduced property value, the expense of removal and replacement if the tree dies, the loss of other trees and shrubs if they succumb to changed light conditions, the risk of liability from weakened branches, and increased future maintenance.

Improper pruning can cause damage to a tree that will affect it for the rest of its life. No branch should be removed without reason because each cut has the potential to change the growth of a tree.

Common reasons for pruning are to remove dead branches, remove crowded or crossing limbs that may create future structural problems, eliminate hazards, and to slow growth. Trees may also be pruned to reduce wind resistance or to increase light penetration.

In most cases trimming is of a corrective or preventative nature. Pruning cuts should be made carefully, at the correct location leaving a smooth surface with no jagged edges or thorn bark. The correct anatomical location is just beyond the branch collar and branch bark ridge.

It is important to keep in mind the goal when pruning, and the street or sidewalk clearances. Consider hiring a Certified Arborist to perform tree work. The International Society of Arboriculture certifies arborists through an exam process, and requires continued training, ensuring that the arborist is knowledgeable in all areas of tree care. Work should be completed in accordance with American National Standards (ANSI) A300 Standards for "Tree Care Operations. Tree, Shrub, and other Woody Plant Maintenance-Standard Practices" (pruning).

Don't do this to trees!



Fertilization

Trees require certain essential elements to function and grow. Fertilizing a tree can increase growth, reduce susceptibility to certain diseases and pests, and can help reverse declining health. However, if the fertilizer is not applied wisely, it may not benefit the tree, and may adversely affect the tree.

Mature trees making satisfactory growth may not require fertilization. Nitrogen can unnecessarily increase growth requiring more pruning. Avoid fertilizing shade trees until late spring of the second year following planting because fertilizers can “burn” roots or stimulate crown growth faster than the roots can supply water.

Organic mulches provide some fertilization, while improving soil structure and retaining soil moisture.

Staking

Stakes and guy wires should be used only if support is necessary. Stakes can be a tripping hazard, and can weaken the tree as well.

Common problems can be avoided by keeping the following in mind when staking.

- If the main stem droops, find the best place for support ties by moving your hands up the trunk to locate the point above which

the top can stand up on its own, place the support ties about 6” above that point.

- Use at least 2 ties to minimize the chance of bark damage from rubbing.
- Allow slack when staking and guying to allow the top to sway.
- Avoid driving stakes into the root ball, or using stakes with flanges that will break roots when removed.
- Remove support ties after 1 or 2 years.

Mulch

Mulch is a young tree’s best friend. It holds down competing weeds or grass, retains soil moisture, prevents soil cracking that can damage new roots, protects the trunk from lawnmower damage, and helps prevent soil compaction. Organic mulches such as wood chips or bark mulch can also contribute to better soil structure and aeration as they decompose.

While the complete removal of grass in areas around trees is sometimes impractical, as much area as possible in the drip line of the tree should be covered with mulch. Avoid limestone rock and allow no mulch to touch the tree’s trunk or to be piled higher than 6 inches around the trunk.

The proper use of mulch around trees is very important.



Plant Health Care

Today plant and tree management needs to focus on keeping the tree in good health. Plant Health Care (PHC) is a holistic approach to maintaining trees and landscape plants in good health. It combines cultural, biological and chemical strategies. The focus is on the plant rather than the pests.

Tree health problems are usually the result of many stress factors. While pesticides play an important role in plant health management, they also have limitations. Integrated Pest Management (IPM) is a systematic approach to insect and disease management. It includes a combination of techniques including the use of resistant plants and cultural controls of plant pest problems. The goal is to maintain tree health while minimizing the adverse ecological impact of the controls.

Trees greatly enhance Utah's urban environment!



Conclusion

Trees are a valuable addition to any community. When properly and successfully established and managed, the urban forest provides a significant range and quantity of benefits. Communities see an increased quality of life, a defining sense of place, economic advantages, reduced road maintenance, energy savings, improved air and water quality, enhanced personal health of the community residents, reduced noise pollution, increased traffic calming, enriched wildlife habitats, bioremediation, and friendly environments for pedestrians to wander.

Capturing some or all of these benefits requires a diligence and commitment to the well being of a community's urban forest.

The state of Utah is fortunate to have many groups that can provide assistance in creating a healthy urban forest.

Sources of Assistance

Many agencies and organizations are available to help cities and towns plan for and implement urban forestry programs. The list below describes some of these sources and how they can help you.

Agency/Organization

Utah Division of Forestry, Fire & State Lands (UDFFSL)

Description: UDFFSL is a state agency that provides direct technical urban forestry assistance to communities. The Utah Community Forester (Brook Lee) provides consultation to communities on how to develop their urban forestry program and runs the Tree City USA recognition program (see above). The Urban Forestry Coordinator (Tony Dietz) makes grants available for community forestry development, tree planting, and outdoor classroom development. The coordinator also coordinates the Arbor Day poster contest with elementary schools.

Types of Assistance: Technical assistance to communities, grants, Tree City USA, Arbor Day poster contest.

Contact Persons: Brook Lee, Utah Community Forester; Tony Dietz, Urban Forestry Coordinator

Address: Utah Division of Forestry, Fire & State Lands, P.O. Box 145703, SLC, UT 84114-5703

Phone: (801) 538-5456 (Brook Lee) or (801) 538-5505 (Tony Dietz)

E-mail: nrslf.blee@state.ut.us or nrslf.tdietz@state.ut.us

Web Address:
www.nr.utah.gov/slf/slfhome.htm

Agency/Organization

Utah State University Extension

Description: USU Extension is dedicated to extending the resources and knowledge of USU to Utahns. A Forestry Extension Specialist is based at USU (Dr. Mike Kuhns), who works with county-based Extension Agents and others to carry out forestry Extension educational programs across the state. Educational programs and materials are available on urban forestry programs, tree selection and maintenance, and urban forest management at the wildland-urban interface.

Types of Assistance: Educational programs and materials.

Contact Persons: Mikel Kuhns, Extension Forestry Specialist; County Extension Agents

Address: 5215 Old Main Hill, Utah State University, Logan, UT 84322-5215

Phone: (435) 797-4056 (Mike Kuhns) or your County Extension office

E-mail: mikek@cnr.usu.edu (for the Forestry Extension program)

Web Address:
extension.usu.edu/natres/forests

Agency/Organization

National Arbor Day Foundation (NADF)

Description: NADF is an international non-profit organization that helps people plant and care for trees in many ways. They promote Arbor Day worldwide, encourage good urban forestry programs through the Tree City USA recognition program, increase the quality of utility forestry through the Tree Line USA recognition program, and educate communities and people about urban forestry programs and tree care. Tree City USA in Utah is coordinated through the Utah Division of Forestry, Fire & State Lands.

Types of Assistance: Educational programs and materials, community and utility recognition (Tree City USA, Tree Line USA), Arbor Day promotion.

Address: National Arbor Day Foundation, 100 Arbor Avenue, Nebraska City, NE 68410

Phone: (402) 474-5655

E-mail: info@arborday.org

Web Address: www.arborday.org

Agency/Organization

TreeLink

Description: TreeLink is a comprehensive website about urban & community forestry. With over 15,000 links, viewers can link to local organizations, government agencies, academic institutions and national groups whose mission involves trees and tree care.

Types of Assistance: Education, networking, promotion.

Phone: (801) 359-1933

E-mail: info@treelink.org

Web Address: www.treelink.org

Agency/Organization

TreeUtah

Description: TreeUtah is a non-profit organization dedicated to improving Utah's quality of life by enhancing the environment through tree planting, stewardship and education. They organize tree-planting projects, provide community grants, and can work with and train local volunteer tree planting groups.

Types of Assistance: Tree plant-

ing, volunteer organization and motivation, grants.

Address: TreeUtah, 511 W 200 South Suite 150, SLC, UT 84101

Phone: (801) 364-2122

E-mail: treeutah@treeutah.org

Web Address:

www.treelink.org/treeutah

Agency/Organization

Utah Community Forest Council (UCFC) and Utah Chapter ISA

Description: UCFC is a non-profit organization that promotes urban and community forestry in Utah by providing training opportunities for professional tree care providers and lay people. It distributes educational materials, produces a newsletter, sponsors educational events, and keeps registers of certified arborists and of tree appraisers. The International Society of Arboriculture encourages proper tree care throughout the world through its promotion of the science and practice of arboriculture and through its Arborist Certification program. The Utah ISA Chapter carries ISA programs out in Utah in conjunction with the UCFC.

Types of Assistance: Educational materials and programs, newsletters, tree care and urban forestry training and promotion, arboriculture assistance and arborist certification.

Address: Utah Community Forest Council, P.O. Box 961, SLC, UT 84110-0961

E-mail: rrpickettus@yahoo.com

Additional Reading**Tree Pruning: A Worldwide Photo Guide**

By Dr. Alex L. Shigo

Published by Shigo and Trees, Associates
Durham, New Hampshire 03824

ISBN 0-943563-08-9

Principles and Practice of Planting Trees and Shrubs

By Dr. Gary W. Watson and
Dr. E.B. Himelick

Published by the International
Society of Arboriculture
Savoy, Illinois 61874

ISBN 1-881956-18-0

**Trees and Development
A Technical Guide to
Preservation of Trees During
Land Development**

By Nelda Matheny and

Dr. James R. Clark

Published by the International
Society of Arboriculture

ISBN 1-881956-20-2

**Urban and Community Forestry,
A Guide for the Interior Western
United States**

Gordon L. Younker, Editor

Published by the USDA Forest Service,
Intermountain Region, 1990

Available from the Utah Community
Forest Council (see above).

**Trees of Utah and the
Intermountain West**

By Michael Kuhns

Published by Utah State University Press,
Logan, UT 84322-7800

ISBN 0-87421-244-8

7

Energy Efficiency

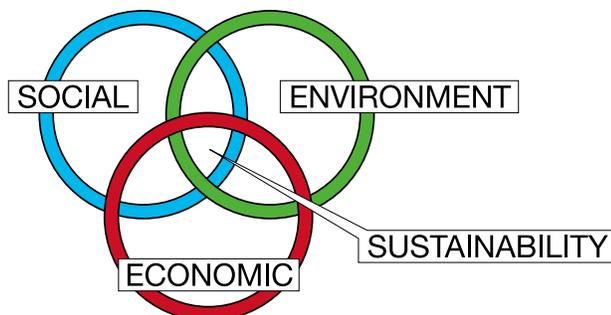
Communities Planning for Energy Efficiency

► **Governor's Proclamation**
Governor Leavitt stated: "It is in our economic and personal financial interest to cultivate an ethic of conservation and energy efficiency."

In times of concern, citizens look to strong and well-informed leadership for solutions and ideas. Officials in government and in energy related fields have worked hard to create political, economic and social solutions to the recent energy problems experienced in the West. The primary goal of this chapter is to provide local government, community planners, and concerned citizens with concepts designed to integrate energy efficiency strategies into communities. These strategies, if implemented, help reduce energy consumption and energy related infrastructure costs, as well as increase reliable energy supplies and economic and resource sustainability.

Benefits of Sustainable Energy Communities

The United Nations in 1987 defined sustainable development as "... (meeting) the needs of the present without compromising the ability of future generations to meet their own needs." Economic, environmental, and social factors are three interconnected elements of sustainability. To gain maximum sustainable benefits from these three elements, a sustainable community works to bring them into balance.



Sustainable communities work to bring these three factors into balance.
(UEO)

Consider the three fundamental factors of sustainability as individual rings that overlap. A skewed ring means the other two no longer overlap equally and the entire system is off balance. For instance, a skewed economic “ring” causes the social and environmental “rings” to become imbalanced. This imbalance promotes isolation, which does not sustain the three “rings” to work efficiently and respectfully toward a sustainable community.

Incorporating energy efficiency into community planning is a major step towards community sustainability. Although energy is an integral part of our everyday life, attaining energy sustainability is a way of life. Energy sustainability is a dynamic process that supports change and encourages new ways of thinking.

Economic Benefits

Sustainable energy strategies benefit a community because they save money. For example, sustainable community designs typically plan for narrower and shorter streets, shorter utility corridors, and fewer streetlights and traffic signals than traditionally developed areas. This type of urban design can result in less money spent and energy consumed for construction materials and follow-up maintenance. These communities then have the option to spend energy savings on parks and civic centers that contribute to a healthy and social lifestyle.

Additional economic benefits of an energy efficient and sustainable community, in comparison to more traditional urban designs, may include the following:

- Increased savings on air emissions control systems and maintenance because of reduced energy production.
- More money retained within the community because of decreased purchases for power on the open market, especially during peak energy demands.
- Increased workforce because of energy-savings revenue reinvested in community and economic development.
- Greater opportunities for start-up and relocating high tech firms because of utilized alternative energy resources.
- More disposable dollars for education because less money is spent to heat and power schools.
- Increased eligibility for affordable housing because of decreased spending for energy utilities and transportation services.
- Increased discretionary income because of decreased spending for energy utilities.

These financial gains can increase the quality of life for the community and boost local economies. All of these possible economic benefits are dependent on many factors and not solely on energy sustainability. A sustainable energy community has a greater potential to experience these benefits compared to traditional communities because they can fund improvements from their own energy savings.

Environmental Benefits

Energy efficient communities inherently generate less air polluting particulates and gases than energy inefficient communities. Cleaner air is a result because energy sustainable communities provide more opportunities to walk and use alternative transportation methods. Furthermore, these communities use less energy per capita for cooling and heating compared to energy inefficient communities.

Informational programs, such as the Utah Department of Environmental Quality (DEQ) alert program may further reduce concentrations of air pollutants. DEQ monitors air quality around the state and provides Utah citizens with daily air particulates and gaseous concentrations as well as advisory warnings. On occasion, locations in Utah, particularly along the Wasatch Front, exceed federally mandated air quality standards. The major sources of air pollution during the summer are from vehicle and industrial emissions, and other area sources associated with urban living. The major sources in the winter are from vehicle and industrial emissions, and smoke and gases from woodburning stoves and fireplaces. Wintertime temperature inversions exacerbate the concentration of these air pollutants. DEQ prohibits the burning of wood or coal on winter days in counties that register high in air particulates. DEQ also recommends driving less on any day in counties that register high.

The benefits of reduced vehicle emissions and fossil fuel air-borne pollutants by a single community in Utah not only affect the quality of life at the local level, but also at regional and global levels. Economic burdens related to health care of a local community decrease by reducing air quality related illnesses. The quality of life at the regional level improves by helping to protect view sheds near national landmarks, such as Zion National Park. The wellness of our

Salt Lake Valley on a clear day and on a summertime smoggy day.

[UEQ/Nan Weber]



► **Computer modeling programs that use Geographic Information Systems can quantify the “ecological value” of various parcels of land. These programs use data to quantify and compare the energy and environmental impacts arising from different types of development. Assigning comparative ecological values to the actual costs of the different development plans could help steer development into the least sensitive parcels.**

Three-D imagery and environmental modeling.
(EU/AGRC)

global economy and environment also improves by reducing Utah’s contribution to the global greenhouse gases.

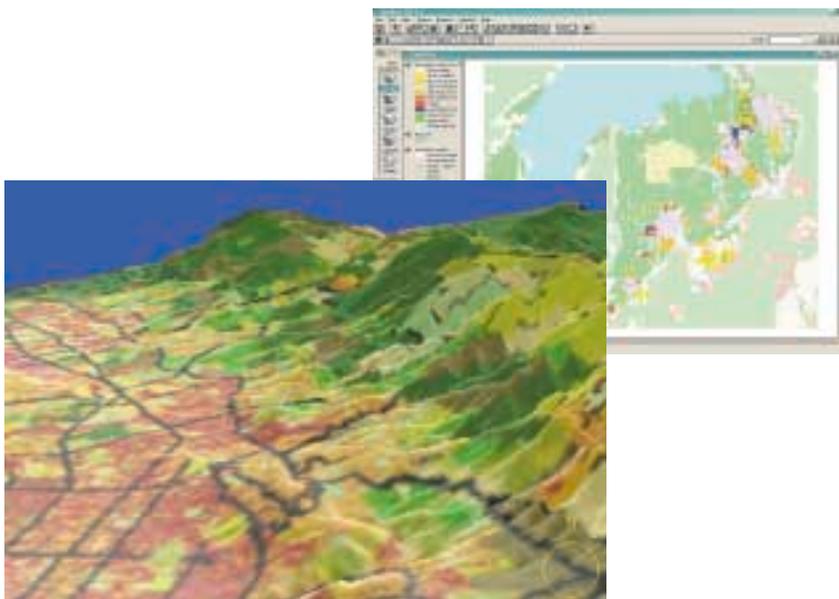
Social Benefits

Moving towards a sustainable energy community may boost social benefits. Traditional urban and suburban land-use patterns often create communities where citizens may feel detached with less sense of community. Communities that reflect the principles of energy sustainability benefit by: more citizen involvement in community affairs, increased interaction between citizens and neighborhoods, and a greater sense of community and social cohesion. These benefits occur because the recommended process for adopting and incorporating sustainable energy components in a community energy plan is citizen based. Community members

willingly contribute ideas and support for community energy planning, which strengthens community continuity and spirit.

Steps to Draft an Energy Plan

Fundamental steps on assembling an energy advisory committee to present concepts of energy efficiency to the community and on creating a task force to draft an energy plan are below. These steps can be followed for creating community vision and planning energy efficiency into policies that can be carried out for individual projects such as new community developments, commercial buildings, housing projects, and transportation. The Department of Energy’s Center of Excellence for Sustainable Development and the Rocky Mountain Institute offer more detailed information and instructional workbooks about planning energy town meetings and drafting energy plans.



Assemble an Energy Advisory Committee and Hold a Town Meeting

Step One: Assemble an energy advisory committee.

The committee develops an overview of issues and recommendations with respect to community energy-use patterns and transportation. The committee also plans an energy town meeting.

A mayor, county commission, or a well-known energy champion may assemble the energy advisory committee. The person or group that organizes the advisory committee invites a diverse group of people familiar with energy sustainability and sustainable development. The committee may include representatives from economic and community development departments, state and local governments, municipal planning officials, architect and engineering firms, educational institutions, environmental and civic organizations, the media, and energy officials.

Step Two: Invite the community to energy town meetings. The energy advisory committee presents the overview and creates vision at the energy town meeting. The committee also directs discussions to other energy-related matters such as the following:

- General plans of any proposed developments.
- Approximate physical boundaries of developments.

- Likely financial, political, and social barriers to increasing energy efficiency.
- Current municipal ordinances and actions for energy efficiency.
- Present energy supplies and consumption by the community.
- Potential incentives to include energy sustainability strategies into projects.
- Possible energy efficiency strategies for the community.
- Potential alternative energy resources available to the community.

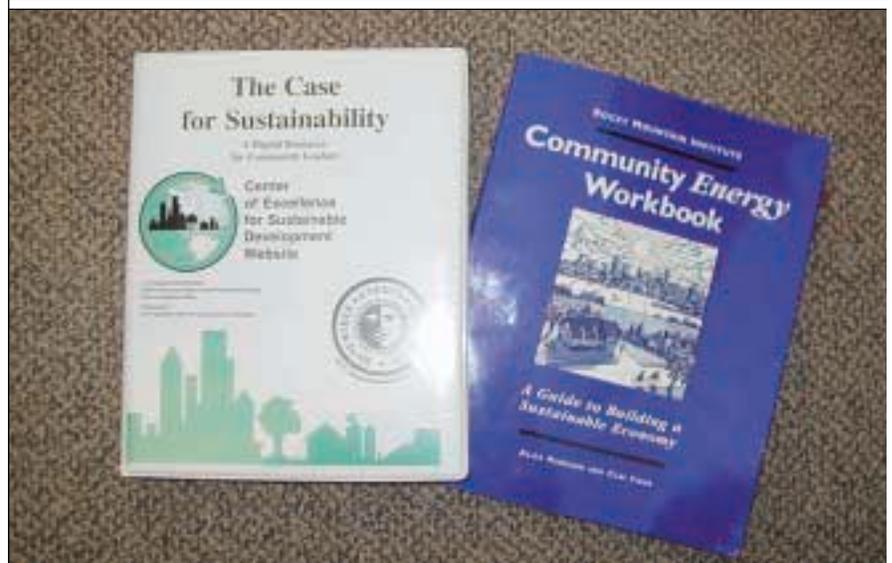
Community members discuss the effects of these energy-related matters on the sustainability of their local economy, environment, and energy-use patterns.

The committee introduces a plan to develop an energy task force to help guide the community towards energy sustainability.

The group provides suggestions of individuals or groups to serve on the energy task force as well as possible energy champions with administrative skills to lead the task force.

Department of Energy's Center of Excellence for Sustainable Development: A Digital Resource for Community Leaders

Rocky Mountain Institute Community Energy Workbook: A Guide to Building a Sustainable Economy
(UED)



Assemble an Energy Task Force and Draft an Energy Plan

Step Three: Assemble an energy task force (ETF). The ETF should consist of involved members from the advisory committee along with representatives from construction firms, financial corporations, utility companies, transportation groups, building facility-management teams, and energy trade businesses. The ETF should also have members that lead the plan expeditiously through the political, planning, and implementing phases.

Step Four: Define the Scope of Work of the Energy Task Force. Energy-related concepts and strategies to include in the energy plan are provided in the section titled “The Energy Plan.”

The ETF constructs a comprehensive and strategic energy plan. The plan should contain technical information that is current and dependable. Projects in the plan should include energy efficiency strategies and time-lines that are flexible and attainable. The energy plan can have breadth and cutting edge ideas and strategies by researching current case studies that demonstrate sustainable energy communities. Useful case study data includes the project goals, procedures, successes, and setbacks. Another way to identify possible sustainable energy strategies for the plan is to visit proposed project sites.

The ETF coordinates with different partners and stakeholders to draft the energy plan, details the respective goals of the participant groups, and identifies specific energy efficiency strategies that contribute to those goals. The ETF makes sure the plan offers alternative strategies, especially for major components of potential projects. These alternatives provide decision-makers with the opportunity to select the best strategies for implementing a community vision into any future development.

The ETF should present objectives of proposed projects as they relate to the energy plan to different levels of government. This presentation helps prevent uninformed decisions about the projects that would compromise implementation of energy efficiency strategies. An executive summary of the energy plan as well as other pertinent information and special requests is an efficient way to inform officials.

Implementing the energy plan requires the support and collaboration of those involved in the project including planners, developers, financiers, and realtors. It is essential that planners, developers, builders, and project managers possess the skills and techniques required for planning, developing, or building for energy efficiency. These building-related groups must also appreciate the benefits of energy efficiency strategies, remain current on new technologies and actual costs of energy efficient products, learn about possible financial incentives for energy and location efficiency strategies, and

support change for outdated energy-related policy. For financiers and realtors, it is essential that they publicize and market energy efficiency mortgages, understand energy and location efficiency home mortgages, and sell commercial and residential buildings based on energy efficient features.

The Energy Plan: Components and Strategies

Each section below provides information and examples to stimulate innovative thinking about community energy planning. The sections also provide general information on policy, financial support, and education programs as well as the status on Utah building codes and energy efficiency technology. There are also a number of energy efficiency strategies included that may be evaluated for individual project applicability.

The energy plan should contain an energy status overview that describes energy-related matters in the community and tallies the estimated total energy consumed by a community. The following checklist identifies essential data to collect:

Energy Status Overview Checklist

1. Demographics
2. Transportation routes
3. Energy resources: traditional and alternative

4. Utility companies

- a. Present power company fuel sources, e.g., coal, hydro, nuclear, wind, solar, geothermal.
- b. Present power generation facilities, natural gas extraction sites, and transportation fuel and distribution centers.

5. Estimated total energy consumed = Sectors (in Btu) + Transportation (in Btu)

The following information details essential data to collect:

- a. Sector energy consumed in Btu: Gather the data requested below to estimate total community energy consumed by the residential, commercial, and industrial sectors. To facilitate this step, it may be easier and more organized to prepare a spreadsheet for the data. Energy suppliers can provide the data requested below.
 - i. Input total amounts of all the different types of energy sold in conventional energy units (kilowatts and kilowatt-hours, therms, and other units of energy). Convert the conventional units to millions of Btu for ease of comparison among the different types of energy consumed.
 - ii. Input total amounts of all the different types of energy sold in dollars.
- b. Transportation energy consumed in Btu: Gather the data requested and use the spreadsheet below to estimate total community energy consumed

► ENERGY PLAN OUTLINE

Separate the outline of the energy plan into major components. Each component should provide energy-related strategies, programs, and information. Major components may include the following:

Executive Summary

Town Meeting Results:

Community Energy Goals and Vision for Projects

Overview of the Energy Status Energy Policy

Recommendations

Financial Support Possibilities

Education Plans

Energy Efficient Strategies

Communities and Neighborhoods

Commercial Buildings

Residential Buildings

Transportation

Alternative Energy Opportunities

Follow-up and Analysis Measures

References and Resources (R/R)

► **EXECUTIVE SUMMARY OUTLINE**
List of task force members
Overall objectives for community development
Energy efficiency strategies for development
Economic, environmental, and social benefits of the energy efficiency strategies
Correct and pertinent information about current energy matters
Details of the proposed support needed from individual resources
Possible resources may come from government, private, and nonprofit groups. The services these groups offer may include financial assistance to implement energy efficiency strategies and information on energy technology, policy, regulations, and permits.

by transportation.

- i. Number of vehicles registered
- ii. Average annual price of gasoline
- iii. Location of vehicle fuel stations in relation to distribution center
- iv. Average annual gallons of gasoline consumed per vehicle

c. Estimated total energy consumed = Sectors (in Btu) + Transportation (in Btu)

Total the amount of residential, commercial, industrial and transportation energy consumed in millions of Btu and dollars for the community. The total provides the estimated quantity and cost of energy consumed. The data is useful to help identify the effects of energy consumption on community economics and the environment. The task force can also use the data to prioritize energy efficiency strategies for achieving the greatest economic and environmental gains as well as to forecast future energy matters.

_____	x	1148 Average annual gallons per vehicle (estimate 2000 value for Utah)	=	_____
Estimated number of local vehicles				Total gallons consumed
_____	x	_____	=	_____
Total gallons consumed		Average local price per gallon		Annual transportation fuel bill
_____	÷	42 (number of gallons in one barrel)	=	_____
Total gallons consumed				Barrels of oil
_____	x	125,071 Btu per gallon of gasoline (138,691 Btu per gallon of diesel)	=	_____
Total gallons consumed				Transportation Btu

Spreadsheet to calculate the average annual transportation energy consumed. This spreadsheet was adapted from Hubbard A and Fong C 1995, The Community Energy Workbook, Rocky Mountain Institute, Pg 59.

Energy Policy Recommendations

Government Policy and Energy Efficiency

Utah communities can join the nation's leaders in sustainability by implementing progressive zoning and building energy codes.

Communities can incorporate into the energy plan, local codes that are more progressive than the State's energy codes.

Communities can suggest that local government and bordering school districts or individual schools also follow similar progressive codes.

The U.S. National Renewable Energy Laboratory (NREL) recommends that buildings can be built at least 50% more energy efficient than existing code allows, with little or no increase in the cost, by using better design and construction. Salt Lake City is one Utah community that is committed to making change towards sustainability. Salt Lake City's High Performance Building (HPB) taskforce is drafting policy intended to increase building energy efficiency and resource sustainability (See R/R). The HPB taskforce is referring to the concepts recommended by the Leadership in Energy and Environmental Design (LEED) program of the U.S. Green Building Council to draft the new policy.

Energy sustainability in Utah

communities can increase by recommending, in the energy plan, flexible building permits and regulations designed to allow speedy inclusion for newly developed energy efficient technology. Many times policies are outdated and hinder implementation of innovative energy efficiency strategies. For example, one of the construction requirements of LEED is to recycle construction waste. Salt Lake City's adoption of the proposed HPB plan, therefore, creates a challenge because Salt Lake City does not have the appropriate recycling center. Supportive city officials of the HPB plan, therefore, are recommending a permit for a new recycling plant in Salt Lake City. Changing regulations and streamlining the permit process lifts the recycling barrier that could hinder the implementation of the innovative HPB plan.

One of the leading challenges to increasing energy sustainability in Utah is the actual enforcement of energy codes by the local enforcement agencies. One way to ensure energy codes are enforced, is to heighten awareness and understanding of the codes. The state of Utah currently provides education programs on local codes to code officials and the building community (see R/R).

An energy plan may include recommendations for local government to fund an energy code enforcement staff. Many cities in Utah established energy specialist positions following the 1970's energy crisis. These positions, since then, have slowly vanished.

► **Utah state government improved the energy building codes by replacing the ASHRAE 90.1 Version 1989 commercial building energy codes with the Version 1999. The State has also committed to increasing energy efficiency by achieving an additional 25% above the ASHRAE standards in all state buildings. The Division of Facilities and Construction expects to save at least \$0.25 per square foot per year out of the operating budget of each new state building. For residential buildings, the state of Utah has replaced the 1995 Model Energy Code with the 2002 International Energy Conservation Construction Code. The State's new building standards went into effect in January 2002. This helps ensure that new construction and major renovation projects include updated technologies for energy efficiency [see R/R].**

► **Policy can limit subsidized sprawl by charging fees and taxes only to those who use the service(s). A community in Florida, for example, showed that sewer hookup to outlying subdivisions cost about \$7,000 more than hookup fees for the adjacent city-center. Residents in the outlying area and adjacent city, however, were all charged \$6,000 for connections (Longman 1998). In terms of economics, this fee meant that the people in the city were subsidizing growth to the outlying areas. In terms of the environment, this development pattern meant that land-use was not linked to energy sustainability.**

For Utah cities to reinstate these positions, funding would need to be identified. Portland, Oregon, overcame a similar financial limitation by implementing a fee program administered to certain city government departments. These departments are charged 1% of their annual energy costs. The fee, however, can not exceed \$15,000. The city invests this money for an energy manager to run a program to increase energy efficiency in Portland. Another benefit that arose from the Portland program is, departments that consume less energy contribute less to the pool that funds the energy program. For energy sustainability, Portland's solution was a win-win situation.

Other innovative policies to include in an energy plan relate to user fees, alternative energy production, and regional cooperation. A community can implement user fee programs for infrastructure to encourage consumers to balance their needs with the real costs of services. These fees can decrease demand by consumers, which leads to energy and cost savings for construction materials and daily operations. Another way to increase energy sustainability is to recommend local and state agencies purchase alternative energy in amounts equal to no less than a certain percent of total energy consumed. For example, a mid-west city will purchase at least 20% of their total energy needs for streetlights, subways, and public buildings, in alternative energy sources. Energy sustainability can also be addressed regionally.

Neighboring communities can endorse similar, up-to-date energy efficiency standards. These standards may prevent project managers from selecting development sites in communities with the lowest energy building standards. Another interlocal agreement to endorse is to share growth-driven revenues between one city that encourages development and another that protects open space.

Utility Policy and Energy Efficiency

In the state of Utah, the Utah Public Service Commission (PSC) regulates privately owned utilities. The primary responsibility of PSC is to ensure safe, reliable, adequate, and reasonably priced utility service. The PSC has supported energy sustainability by allowing utilities to sell alternative energy supplies and energy efficiency strategies. The PSC does not regulate municipal utility companies. An energy plan, therefore, may include suggestions for elected officials of the local municipality to draft regulations for publicly owned utility companies similar to those implemented by the PSC. There are groups that provide answers to questions on policy for energy efficiency.

One local example of how regulation supports a utility company to sell alternative energy is Utah Power's Blue Skysm program. This program is a partnership between Utah Power and its consumers. Blue Skysm gives customers a choice in how their energy is produced. The program also gives consumers an opportunity to help increase the demand for renewable energy resources. Some consumers ask why Utah Power requests customer help to provide wind power? As a regulated utility, Utah Power is required to provide customers the least cost power available. On average, power from coal and natural gas is currently less expensive than renewable power. Through programs, such as Blue Skysm, customers pay for the incremental difference between market cost energy and wind power, and associated costs for customer education.

Participation in Blue Skysm has been so great that last year, Utah Power purchased an additional three megawatts of wind energy from the Wyoming Wind Energy Project, located near Rawlins, Wyoming. This addition will produce enough clean energy for more than 1,550 average homes in the West. Since Blue Sky's launch in 2000, through December 2001, 2,849 Utah Power customers have signed up for Blue Sky energy. The purchase of 452,100 kilowatt-hours of new wind energy each month offsets approximately 3,796 tons of greenhouse gases per year. This offset has the same environmental benefit of not driv-

ing 8,136,000 miles or planting approximately 1,537 acres of trees. Customers' involvement directly helps increase the percentage of wind power on the grid system, provides environmentally friendly power generating sources and builds sustainable economies.

Financial Support Possibilities

Financial budgets of a community are one of the primary limitations to writing and implementing a community energy plan. The actual strategizing and writing of an energy plan may require commitment in time and resources. Implementing the energy efficiency strategies into projects may not necessitate financial expenditures or may require substantial financial support. Below are recommendations for possible financial support to include in the energy plan.

Financial support is available through many different organizations including agencies from state government. The Utah Energy Office, for example, helps public and private organizations by providing technical information and financial assistance, which is primarily met with partnerships brokered by the Utah Energy Office. The Utah Energy Office helped the University of Utah secure technical expertise, as well as helped secure \$44 million in private sector funding, for an energy-related project. The University's project-derived energy savings helps pay

Wind farm in Wyoming.



for the private sector financing. As funding allows, the Utah Energy Office also provides no interest loans for state and local governments and school districts. Other low interest loans are available for public and private fleet purchase of alternative fuel vehicles. The Office also administers a renewable tax credit available for homeowners and businesses. When federal energy grants are available, the Utah Energy Office issues announcements through the local media and assists eligible applicants with their proposals.

Another state agency that provides energy funding assistance is the Utah Division of Community Development. This agency administers the low-income Weatherization Assistance and HEAT programs (see residential section below). The agency also provides funding for municipal energy projects through the Community Impact Fund and Community Development Block Grant program.

The Quality Growth Commission is one more example of a state entity that offers financial incentives. The Commission has two programs to help local communities' fund energy efficient growth. First is the planning grant program that is available annually to communities for quality growth planning. Projects funded vary by community, but they include regional open space and infrastructure plans, downtown revitalization plans, and walkable communities and transit oriented development plans. The commission also

administers the Leray McAllister Critical Lands Conservation Fund. This fund is available to help local communities preserve or restore lands that are critical to their quality of life. Many of these projects include trails and other amenities including the Kays Creek Corridor project in Layton, the Dry Creek Restoration Project in Sandy, and the Jordan River Restoration Project in West Jordan. Preserving and restoring stream corridors helps reduce ambient air temperatures of surrounding areas, which then reduces energy consumption for summertime cooling. These corridors also provide transportation alternatives and walkable recreation options.

Many other state governments have adopted substantial incentive opportunities to help reduce energy consumption. The California Energy Commission, for example, approved a two million dollar Cool Communities Contract that is disbursed to contractors that retrofit roofs with reflective coating materials. The California Cool Communities campaign seeks to save a total of 200 megawatts during peak hours by providing incentives that average 10 cents per square foot of qualifying roofs. This incentive not only stimulates the economy, but also saves enough energy to light 1,000 average sized California homes.

There are conventional mortgage programs available that target energy and location efficiency. The energy plan could recommend these programs for business

and community members. Communities working with financial partners can make a number of financing options available to homebuyers interested in purchasing a home that is energy efficient, a home that would benefit from energy efficiency improvements, or a home located near public transportation. Additional financing options are available to homeowners who are refinancing their energy efficient home, refinancing to make their home energy efficient, or financing home improvement projects that increase energy efficiency, durability, and value (See R/R for more information).

Mortgage financiers, such as Ogden City, have energy efficiency mortgage packages that offer potential buyers greater purchasing power compared to conventional mortgage products. The power is “earned” from the savings predicted for energy efficient homes or from other financial incentives, such as down payment or closing cost assistance and an interest buy down.

The Wasatch Front is now among five nationwide communities participating in a location efficiency mortgage experiment. The Fannie Mae Utah State Partnership Office and Utah Transit Authority have begun work on an innovative “Smart Commute” program. This program will recognize home buyer savings resulting from the purchase of a home located in a densely populated community served by efficient public transportation, such as commuter rail,

light rail, and bus services. The “Smart Commute” program is among a few homeownership initiatives to link housing with public transportation.

► **Additional financial support for planning and implementing an energy plan may come from the following:**

- **Federal government: U.S. Department of Energy’s Rebuild America program partners with the Utah Energy Office and interested communities to provide small grants and technical support to communities that plan to ‘rebuild’ sections of towns or renovate individual buildings.**
- **State government: The Utah Division of Air Quality provides information on opportunities to finance energy efficiency and other sustainable energy programs through emissions trading. With emissions trading, business and industry offset air pollutants resulting from consumption of fossil fuels by funding energy efficiency and other strategies that reduce pollutants elsewhere in the community. See R/R for more information.**
- **Utilities: Utilities often offer zero or low interest loans, rebates, and technical assistance.**
 - **Utah Power’s FinAnswer™ program offers expert advice and cash incentives to help upgrade commercial or industrial heating, cooling, refrigeration, compressed air, lighting, pumping or industrial processes to the most energy efficient system available.**
 - **Questar Energy Services offers energy efficient products and services including financing and energy audits as well as emerging energy technology such as fuel cell, micro turbines and combined heat and power systems.**
- **Nonprofit organizations: Many nonprofit organizations help community efforts in understanding the relationship between energy and development.**

- ▶ **Other successful partnerships include joint ventures between different government, private, and nonprofit groups and our children. These programs provide information about energy efficiency to our youth. The energy plan could include suggestions for partnerships between schools and any of the groups below:**

- **Government**

- Kool Kids Program - Utah Energy Office**



- K-12 Schools Program – Utah Energy Office**

- Rebuild America’s Energy Smart Schools – Department Of Energy (DOE)**

- **Public Utilities**

- Kid Power Program – Murray City Power**

- Energy Education Program – Utah Municipal Power Agency**

- **Private Utilities**



- Rain Forest Van – Utah Power**

- Do the Bright Thing – Utah Power and National Energy Foundation (NEF)**

- **Nonprofit**

- Utah LivingWise™ Program – NEF**

- Academy of Energy Education – NEF**

- Jordan School District Energy Action In Schools™ Program – NEF**

- Salt Lake Clean Cities Coalition Education Outreach Program – NEF**

- Utah’s On-line Environmental Education Database – Utah Society for Environmental Education.**

The energy plan could also include proposed support for schoolteachers who include energy efficiency in their curricula.

Education Plans

Education is essential to incorporate energy efficiency strategies into people’s way of life. People provided with facts on energy sustainability have a better understanding of energy-related issues and are more likely to become part of the solution. The energy plan could include recommendations for education-related programs for the community. Workshops and conferences are probably the most direct path to inform significant numbers of people about energy concerns. Within the state of Utah, there is a wide range of instructional programs and workshops on energy-related matters. The goals of these programs and workshops range from providing technical assistance to professionals in the energy field to increasing public awareness on energy efficiency strategies. Government agencies, private corporations, nonprofit organizations, and educational institutions offer energy-related programs and workshops. News releases, newsletters, and websites offer listings of upcoming programs and workshops.

Often, greater numbers of people receive information if groups with



similar energy-related goals establish partnerships. The energy plan could include recommendations for education-based partnerships among groups within in the community. The Power Forward pro-

gram, for example, is a partnership between state government and private energy officials as well as media spokespersons. Their effort informs consumers, daily throughout the cooling season, to practice moderate (green day), cautionary (yellow day), or critical (red day) conservation strategies. Energy officials report that because of this program, 100 megawatts were saved during the four yellow days in the summer of 2001. This amount of energy saved is enough to power 51,300 average sized homes.

Additional ideas to include in the energy plan on educating communities about energy sustainability include the following:

- Recommend training seminars on energy sustainability directed primarily toward decision-makers and government officials.
- Provide continuing education courses on energy matters. Check with Continuing Education at the University of Utah and Salt Lake Community College for any special courses on energy efficiency and renewable energy.
- Plan and build demonstration projects ranging in size from single buildings to entire neighborhoods that easily illustrate energy efficiency strategies. A great arena to showcase energy efficient housing is the local Home Builder Associations' annual Parade of Homes. The probability of informing thousands of people in a short amount of time is high. Schedules of these events are available from the Utah Home Builder's Association or the Utah Energy

Conservation Coalition.

- Recommend energy audits of residential and commercial buildings. Energy auditors provide data on energy inefficient locations as well as information of how to increase efficiency in those locations. Consumers should view the process of energy audits as personalized educational tours.
- Promote the use of clean fuel vehicle fleets and the opening of refueling stations.

► **The energy plan could include education programs that would be free to the public, such as the recommendations below:**

- **Suggest businesses in the energy trade offer mini-seminars introducing new technology to maximize energy savings.**
- **Offer mini-seminars at local home improvement centers and community centers to educate the public on energy efficiency strategies.**
- **Recruit the expertise of the media to help make energy issues and events newsworthy.**
- **Provide brochures and newsletters on energy matters, for example, Utah Power's Voices newsletter reaches 650,000 homes in Utah every month.**
- **Supply information that identifies the sources of supplied energy to consumers and explains environmental problems caused by energy production and consumption.**
- **Provide public service announcements that alert the community on possible energy supply shortages:**
 - Explain reasons for the shortages**
 - Forecast the degree of magnitude of the shortages**
 - Provide energy efficiency strategies that may help reduce the magnitude of the shortages**
 - Provide information that explains the consequences of maintaining the status quo**
- **Recommend local financial institutions offer information on the availability and benefits of energy and location efficiency mortgages.**

Information and Energy Efficient Strategies for an Energy Plan

Suggestions of energy efficiency strategies and energy-related considerations for general development, building design and transportation are below.

Communities and Neighborhoods

Many aspects of urban design usually show little energy-related consideration. An energy plan ensures that energy efficiency is included in all aspects of design and construction in new development as well as revitalization projects. Certain construction elements to consider for the plan include embodied energy, urban planning and land-use pattern, infrastructure and landscape design.

Embodied Energy

Embodied energy is the energy consumed by all the processes associated with production of a building, from the acquisition of natural resources to product delivery. The Architecture League of New York reports that the most common building material requiring the least embodied energy is wood. Wood consumes about 640 kilowatt-hours per ton, mostly from the industrial drying process, and some from the manufacture of and impregnation of preservatives. In comparison, all other building products require up to many times (X) more embodied

energy than wood: for example, brick 4X, concrete 5X, plastic 6X, glass 14X, steel 24X and aluminum 126X. Although some of these products may be extremely energy efficient, the embodied energy consumed for those materials must be considered when analyzing the total energy budget of a project.

Australia's Commonwealth Scientific and Industrial Research Organization (CSIRO) suggests that in determining which materials to use for a project, consider additional energy consuming factors other than just absolute embodied energy values. Such factors include project design and configuration as well as material quantity, quality, and durability. For example, wood and concrete require relatively low embodied energy, but the total quantity used is typically high. The total embodied energy, therefore, for these two materials may be very high.

Analyzing only the energy used to operate a building is also not acceptable, especially if the building is highly energy efficient. Research by CSIRO showed that materials used in the construction of an average household contain about 1,000 gigajoules of embodied energy. This amount of energy is equivalent to about 15 years of operational energy.

Embodied energy for a project may be minimized by the following:

- Use local resources: Energy consumption is higher for transported materials than for local materials.

- Conserve and restore old buildings.
- Reuse old building materials: The reuse of building materials commonly saves about 95% of embodied energy. (CSIRO)
- Use recycled products: The use of recycled products may lower embodied energy if reprocessing and transportation energy consumption is low.

Urban Design and Land-Use Pattern

As America's urban communities spread over ever-wider areas, they contribute to loss of open space, expanding highways, and greater traffic congestion, all of which affect energy consumption, especially for transportation. There are two considerations to help mitigate the impacts of sprawl and decrease transportation energy consumption. One consideration is the drafting of zoning ordinances that do not isolate housing developments from employment sites and shopping centers. The second is to avoid low-density growth such as homes on large lots and widely scattered subdivisions. Both of these considerations can reduce the amount of vehicle miles traveled. Although 70% of the Wasatch Front's population desires and supports low density growth, strategies to introduce energy sustainability in these areas need to be explored.

For more information on urban design to minimize transportation-

related energy consumption, see "Transportation" section of the Energy Chapter. For more information about land-use patterns and urban planning for resource efficiency, see "Open Space, Agriculture, and Quality of Life" of the Protecting Sensitive Lands Chapter in Envision Utah "Urban Planning Tools for Quality Growth."

Infrastructure

Counties, municipalities, and cities may want to adopt strategies and programs targeted toward infrastructures that reduce energy consumption. Counties could establish a program assisting cities in annexing that guarantees sufficient and sustainable energy infrastructure that supports proposed development. To accomplish this program, governments can require that future developments analyze and compare the costs of infrastructure as it relates to distance and accessibility between existing and future developments.

Urban sprawl creates energy inefficient communities.

(CRS Architects)



Geographic Information Systems (GIS) program applications such as ArcView's Spatial Analyst® can model direct route time and distance. GIS mapping can also help track existing infrastructure and capacity as well as determine whether future development in different areas could be absorbed without the need to build additional infrastructure. A partnership with the Utah Governor's Office of Planning and Budget and the Division of Water Resources has developed an infrastructure-costing model that evaluates the economic impact of expanded infrastructure associated with growth.

Adopting a water conservation program is another way to save energy. Energy is used to pump and heat water as well as to transport and treat wastewater. Reducing the demand for water reduces energy costs and associated emissions for both water and wastewater infrastructure. Lower water demand may postpone the need to expand facilities, resulting in additional energy and cost savings. The energy plan may include water conservation programs as well as partnership recommendations between the water and energy groups to share financial cost associated with implementing the conservation strategies.

Other strategies related to infrastructure that may reduce energy consumption include recycling and partnering. Recycling saves energy by reducing the transportation fuel used to haul materials to a landfill and by reducing embodied energy

in recycled finished products. Reusing and reducing save energy by reducing the amount of energy used for production and consumption. Partnering with other organizations or government entities to share facilities may also reduce energy consumption for construction materials and daily operations.

Public and Residential Landscapes

Moderate to high density and mixed-use developments clustered with interconnecting greenspace is one strategy to help reduce the consumption of energy and other resources. A greenspace corridor reduces energy usage, in part by promoting walking within and among communities and lowering summertime urban temperatures. Local municipalities may want to include in an energy plan a strategy to combine land-use for utility corridors with greenspace.

Other strategies for the community energy plan are to increase tree and other plant coverage. These strategies may be facilitated by using City Green modeling software. This program is designed to add a "green layer" in land development decision making and encourage additional plant cover to increase air quality and to reduce energy consumption along with stormwater runoff.

Salt Lake City took action and adopted a landscape ordinance that requires all vehicle lots to landscape at least 5% of the lot's interior.

This green space does not include the required landscape around the perimeter. The Salt Lake City ordinance results in many new lots featuring islands with trees and shrubbery. For help with developing and evaluating tree ordinances, refer to the website phytosphere.com.

Plants are a relatively inexpensive way to reduce energy consumption and save money. DOE estimates that shade resulting from as few as three trees can save the average household between \$100 and \$250 annually in energy costs. Iles (1998) reports that plant canopies can reduce municipal energy costs up to 50% and 22% during the summer and winter, respectively. Energy savings similar to those reported are achievable in Utah through proper site and species selection. Below are, a few planting strategies to include in the energy plan that increase energy efficiency for homes and communities:

- Plant trees, shrubs, and woody vines to provide shade. Trellised vines are a great solution for areas with limited space.
- Shade the west- and east-facing sides of structures. Shading the west side of structures is the most important because afternoon heat is radiated to surfaces in two ways: direct radiation from the sun and radiation from surfaces that store significant amounts of heat throughout the day.
- Select deciduous woody species for the west and east sides of the landscape because they provide

shade in the summer, yet allow solar radiation to filter through the leafless canopy in the winter.

- Plant at a distance such that the vegetation significantly casts shade on the buildings. In general, the taller the plant the further it can be planted from the building and still provide shade. Another general rule is to plant about 20 feet from windows and select species that grow at least 10 feet taller than the windows. Because no plant is able to significantly shade very tall buildings, the planting of trees insignificantly affects the overall energy budget for a high story building.
- Plant tall trees away from the south side of buildings. A tree in this location casts little shade because the solar angle is high in the summer. In winter, however, the same tree casts undesirable shadows on structures to the north for most of the day. If shade trees are already present on the south side, remove lower branches to permit more winter sunlight to reach the structure.
- Select evergreen trees for the north side of buildings to protect from prevailing winds during the winter. Trees planted as wind-breaks can reduce wind speed for distances several times their height. Neighborhoods with canopy cover of more than 50% can decrease wind speed by half, therefore, decreasing wintertime energy consumption (DOE 1997).
- Plant trees or shrubs to shade central air conditioning units. A cool air conditioner consumes less energy for cooling the same volume of air compared to a hot conditioner. Note that air conditioner units are naturally cooler if

they are located on the north sides of buildings.

- Plant tall growing species away from power lines to reduce power outages and the need for costly tree trimming and removal. Utah Power has a program called “Plant the Right Tree in the Right Place” that teaches citizens the best species to select for areas near power lines.
- Contact local nurseries and university extension offices for more information concerning appropriate species selection.

Although it is advisable to plant woody species to reduce energy consumption, a word of clarification must be mentioned about the water they require. Utah is the second driest state in the United States, and we are justifiably reminded to conserve water. Most officials in the plant and water industries agree that improper irrigation procedure is the largest water waster in Utah. Although plants consume water, the amount of water used by plants is insignificant compared to the amount that ends up in gutters and sewers. By

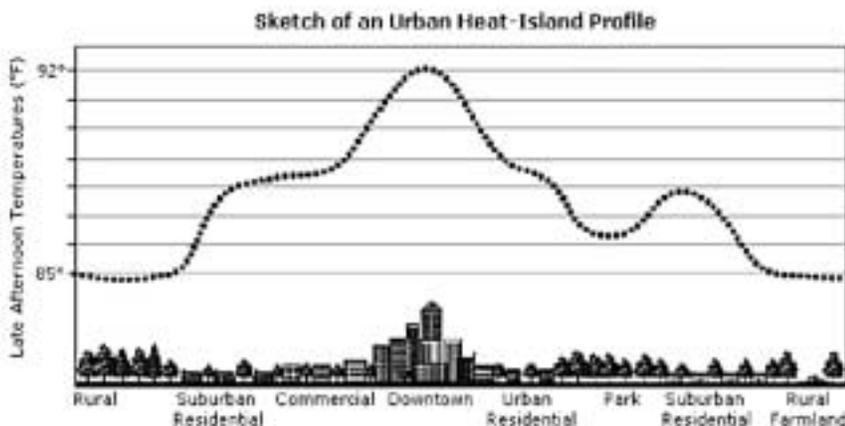
far, the most efficient way to save water is to properly irrigate, not to remove or reduce vegetation. Even if plants are removed, the amount of water saved would be insignificant compared to the amount of energy consumed by not maintaining plants.

Urban Heat Islands

Urban heat islands are urban areas that are hotter than surrounding rural areas. Factors that contribute to heat islands include the removal of local vegetation and natural surfaces as well as the addition of heat absorbing surfaces like dark roofs and pavements. Many US cities are urban heat islands with temperatures between 2 and 15° Fahrenheit hotter than their surroundings (Akbari 1996). Utah urban areas that are landscaped present a special case because much of the surrounding areas are actually dry, hot deserts. However, within Utah urban areas there are localized high-temperature patches caused by the same factors that cause urban heat islands.

Urban heat islands are expanding with spreading populations and new building construction. Since 1940, summertime temperatures of many cities have climbed steadily by 0.25 to 1 degree Fahrenheit per decade (Akbari, 1994). As temperatures increase, the need for air conditioning increases, this places more demand for power generation. Los Angeles, for example, experienced one of the largest ever observed heat island cause and effects. This city experienced a peak cooling demand increase of 1.5% for every rise of 1 degree Fahrenheit (Akbari 1993). Power plants must generate the additional

Temperature comparisons among different types of communities. (UEO)



electricity to meet these peak-cooling demands, and in the process, they also produce air pollution. One of the main compounds released into the atmosphere, as a byproduct of power generation is the greenhouse gas, carbon dioxide.

The increase in temperatures also increases the rate of release of volatile organic compounds (VOCs) into the urban environment. VOCs enter the atmosphere as a byproduct of transportation and industry fuel consumption as well as from biogenic sources. Certain VOCs, when combined with nitrogen oxides (NOx) and in the presence of sunlight, react to form ground-layer ozone. This pollutant is a powerful oxidizing compound and is the major contributor to summertime smog. In the energy plan, suggest coordinating with air quality groups to develop control strategies for the State Implementation Plan that results in greater reductions in VOCs and NOx emissions.

Thermal image of Salt Lake City: Hot (red) downtown compared to cooler (blue/green) areas near UofU.
(NASA)



To decrease urban temperatures and prevent the consequences, an energy plan could include the following recommendations:

- Promote the use of light colored roofing.

Modify building and residential codes to recommend roofing materials with a high albedo (or reflective in infrared wavelengths, such as Classic Products). Standards that are consistent with US Environmental Protection Agency's (EPA) criteria for Energy Star™ labeled roofing systems are a good guideline. Recommend that existing buildings are reroofed or topcoated following the new standards by a specific date. Recommend existing houses to use high albedo roofing materials when they have new roofs installed.

- Promote use of light colored pavement.
- Recommend a light colored aggregate chip seal on roads, new or resurface projects.

► **The Environmental Protection Agency and other partners funded the Marshall Space Flight Center's Global Hydrology and Climate Center's fly-over project, to locate hot spots in target cities. Salt Lake City was fortunate to be selected as one of the four target cities in the United States. In July of 1998, National Aeronautics and Space Administration (NASA) sent a Lear jet equipped with thermal (infrared) imaging equipment to take aerial photography of the Salt Lake City valley. The results of the data showed, in part, that it is cool near bodies of water, along roads that are tree-lined, and in areas that are significantly vegetated, such as Liberty Park and the Salt Lake City County Building. These cool temperatures ranged from about 60-70 degrees Fahrenheit. The results also showed that it is hot in vast asphalt paved parking lots (about 120 degrees Fahrenheit) and hottest on dark colored rooftops (exceeding 140 degrees Fahrenheit), such as the Salt Palace and Matheson Courthouse. These results generated by NASA and other heat island researchers, assist groups such as the Utah Energy Office to promote and implement Cool Communities strategies. Contact the Utah Energy Office to help forecast possible benefits of implementing Cool Communities strategies.**

Energy efficient visitor center at Zion National Park.
(UEO)



- Recommend that parking lots are either cement or asphalt with a light colored aggregate chip seal on top.
- Amend current codes governing off-street parking facilities, including vehicle sales and lease lots, to recommend use of reflective asphalt emulsion sealcoats, pavers, turfblock, or whitetopping for reconstructed asphalt.
- Increase vegetation cover.

► **The Zion National Park Visitor Center and Comfort Station is a local example of a building designed for maximum energy efficiency. This complex was designed and built through a partnership among the National Park Service, NREL, and American Institute of Architects. NREL estimates that the Zion's Visitor Center will save \$14,000 per year because of the energy-saving strategies. Some of these strategies include the following:**

- **Strategic site location of building and plaza for maximum summertime cooling and daylighting.**
- **Trombe wall for passive solar heating.**
- **Downdraft cooltowers for summertime cooling and natural ventilation.**
- **Thermal mass flooring for maximum wintertime heat gain.**
- **Photovoltaic system for supplemental power.**
- **Clerestory windows for natural daylighting.**
- **Energy efficient lighting system to supplement natural daylight.**

Other notable energy efficient buildings around the state include the Utah House in Kaysville [completion 2002], Skating Oval in Kearns, Department of Natural Resources State Office Building in Salt Lake City, and American Red Cross – Salt Lake City Chapter [planning in progress]. These buildings are designed, in part, for visitors to gain information about energy efficiency strategies and resource efficient products.

Commercial Buildings

Buildings in the US use one third of all energy consumed in the US and two thirds of all electricity consumed in the US (*DOE 1997*). A 30% increase in building energy efficiency could reduce consumer costs by \$100 billion each year. To help reduce energy consumption and environmental impact, the building industry is beginning to practice “green” building design and construction. This type of building approach focuses on the whole building system as well as on the building process. Matters such as site placement, building materials, indoor air quality, and construction clean up are all considered in order to reduce energy and resource consumption during and after construction.

Energy efficient office building, Department of Natural Resources.
(UEO)



Many architects and building engineers are turning to the LEED rating system to design and construct commercial buildings. LEED provides a definitive standard for what constitutes a “green commercial building.” It also provides detailed requirements, basic technologies/strategies, and information for each of the categories. It is designed to rate new and existing commercial, institutional and high-rise residential buildings. Buildings that meet the terms of LEED are rated as certified, silver, gold or platinum. In Utah, the Kearns Skating Oval is rated as “certified” and the American Red Cross has challenged its designers to achieve a LEED rating for its new Salt Lake City facility.

Details and recommendations for a green building design and construction are well covered in LEED and other documents, such as the Salt Lake City “High Performance Building Plan.”

Residential Building Considerations and Strategies

Residential energy programs usually include a mix between voluntary standards and mandatory codes. Under voluntary standards, new and existing homes are rated for energy efficiency. In Utah, voluntary standards are set by the Utah Energy Conservation Coalition. That group provides “Home Energy Ratings” for residence based on the nationally recognized and accredited Home

Energy Rating standards adopted by the Residential Energy Services Network, Mortgage Bankers Association, and the National Association of State Energy Offices. The incentive to build homes, voluntarily above the energy code, is customer driven with some incentives from lenders who take energy cost savings into account when underwriting mortgages.

Although mandatory codes set the standard and are enforceable, they can hinder implementing innovative energy efficiency strategies. An energy plan could recommend that mandatory codes provide flexibility for energy efficiency, yet assure compliance. Under the U.S. Department of Energy Building Standards and Guidelines Program there are four energy code compliance packages that can be used to demonstrate code compliance for residential structures, they are the following:

- Prescriptive compliance package – using a predetermined “package” of energy efficiency measures.
- Points compliance package – using simple tradeoffs of various energy efficiency measures, which are assigned point values.
- Performance compliance package – by modeling on a computer a proposed building’s heating and cooling energy needs.
- Enforcement strategies that include financial penalties (DOE/GO-10095-073).



Energy Star rated home in Cottonwood Heights: 5 star rating.
(UEO)



Department of Energy and Environmental Protection Agency's Energy Star program.

Utah Energy Conservation Coalition conducting a home energy audit.
(UECC)



► **Community members should always require and inspect the inclusion of at least the following items for new developments or remodels:**

- **Longest axis of the home is oriented east-west to maximize solar gain.**
- **Insulation for ceiling, walls, and floors is greater than energy code standards.**
- **Appliances installed are EPA Energy Star™ rated.**
- **Appliance size is appropriate for the need.**
- **Fluorescent lamp fixtures are the T8 models.**
- **Windows are double panes, low E glass.**
- **Water fixtures are efficient to conserve water and use less energy.**
- **Outdoor lighting is equipped with motion detectors to save energy.**

“Built Green Utah Checklist” provides information on energy efficient construction. In addition, DOE provides simple software that performs and analyzes energy efficiency for residences. See R/R for more information.

The energy plan should recommend building residential developments to the EPA Energy Star HOMES Program standard. This program ensures home energy efficiency is raised a minimum of 30% above the current energy code minimum standard. Homes are “labeled,” which identifies them as more efficient by at least 30% than “standard” homes in the housing marketplace and industry. All homes are independently rated and analyzed according to either a Home Energy Rating System score or similar nationally recognized energy compliance package. See the EPA Energy Star website for additional benefits of energy rated buildings.

The energy plan should also contain recommendations to increase energy efficiency in low-income housing. Low-income households typically spend 14% of their total annual income on energy, compared with 3.5% for other households. The Utah Department of Community and Economic Development addresses this discrepancy by administering the DOE’s Weatherization program. The major goal of this program is to enable low-income individuals and families (particularly the elderly and handicapped) to participate in energy conservation programs, which lessen the impact of utility costs. Participating households are averaging nearly 25% savings or about \$300 per year. Some of the features of the Weatherization program include insulation installation, duct sealing, heating system repairs as well as client education

on energy efficiency measures (see R/R for more information).

Transportation

Population growth and transportation should parallel in a sustainable energy planned community. Often, however, the building of transportation facilities does not keep pace with population growth and, the result is significant traffic congestion. For example, travel demand modeling and socioeconomic data projects a population increase of 71% along the Wasatch Front between 1996 and 2030 (Wasatch Front Regional Council 2001). The modeling also projects vehicle miles traveled (VMT) to increase 77%. Such an imbalance between population growth and VMT illustrates the necessity of long-range comprehensive transportation planning for communities. This planning helps improve air quality, reduce congestion, provide local energy security, and improve economic development as well as increase the quality of life.

The transportation sector includes surface transportation, federal highway system, aviation, motor carriers, railroads, maritime, and Coast Guard. These sectors devour 79% of all oil consumed in Utah. Because this consumption is so significant, it may be necessary to form a sub-committee of the Energy Task Force (ETF) to address energy efficiency specific to transportation. This sub-committee can recommend strategies

for sustainability and automobile reductions for their community. The Transportation ETF can also suggest a variety of transportation choices that reduce dependence on unpredictable petroleum sources. The Metropolitan Planning Organization (MPO) could include these recommendations into the Long-Range Transportation Plan (LRTP) to insure that the energy-efficient transportation goals and air quality standards are achieved.

Transportation Planning: Goals and Objectives

When the public helps plan for transportation matters, they provide input to the local Association of Government, in rural areas, or to the MPO in urbanized areas with populations over 200,000. These official groups may then integrate the public's ideas into the LRTP. Mountainlands Association of Governments (MAG) and the WFRC are responsible for coordinating and preparing the LRTP (2000 – 2030) for the Wasatch

Front Counties. The current LRTP from the WFRC includes the following goals:

- Provide a balanced, interconnected transportation system with a range of convenient, efficient and economical choices.
- Increase transportation mobility and accessibility for persons and freight that promotes economic vitality in the region.
- Increase transportation safety and security for all modes of travel.
- Provide a transportation system that protects and enhances the environment, promotes conservation of energy, and improves the quality of life.
- Protect existing and future transportation systems through ongoing maintenance, preservation, or reconstruction.

The WFRC has a number of objectives to achieve the transportation goals in the LRTP, which include the following (see R/R for more information):

- Provide a system that integrates multiple modes of transportation

► The Transportation Energy Task Force's mission is to:

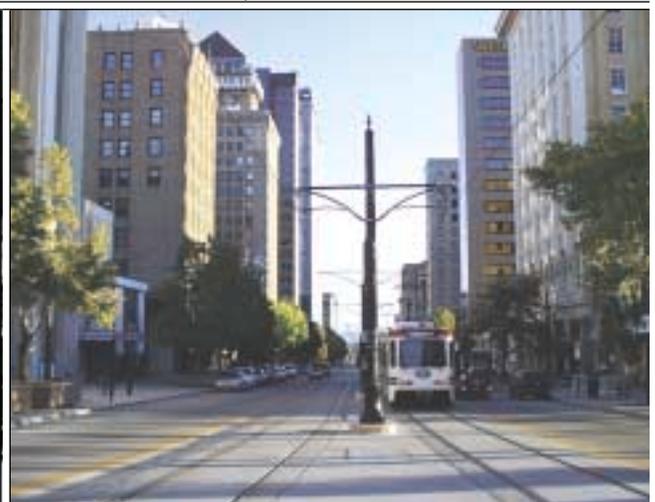
- Identify local issues, priorities, and solutions for local transportation.
- Conduct research on transportation solutions.
- Establish partnerships with the public and private sectors.
- Exchange transportation and planning ideas with the community and local Governments.
- Present energy-efficient transportation strategies that illustrate quality of life.

(Public Technology, Inc., Urban Consortium Task Force)

Salt Lake City Past: Wide Sidewalks, angled parking and trolley car.

Salt Lake City Present: Narrower sidewalks, minimal parking, and energy efficient trolley.

(CRS Architects)



► **Intelligent Transportation System (ITS) uses advanced computing, information systems, and communications technology and applies it to the control and management of traffic and infrastructure to achieve:**

- **Safer transportation system**
- **Better informed travelers**
- **Improved traffic control systems**
- **Increased efficiency of transit systems and traffic infrastructure.**

The benefits of ITS include reduced congestion, fewer transportation-related deaths and injuries, and reduced energy consumption and pollution.

by connecting them for efficient transfer between modes.

- Use transportation system technologies that are innovative.
- Minimize travel time for both passenger travel and freight.
- Increase accessibility to employment districts, commercial and industrial sites as well as education, medical, and recreation centers for all persons in the region.
- Provide access to nearby developing areas.
- Improve safety for pedestrians and bicyclists.
- Provide a transportation system that serves and complements desired community development standards.
- Reduce the degree of air, water, noise, and visual pollution.
- Minimize the disturbances to the natural aesthetics and wildlife habitat of the region.
- Identify and protect corridors for future highway, transit, freight, or other transportation system requirements.

A community needs an energy efficient transportation plan to help direct future transportation demands as the community grows in a sustainable manner. Improved transit service, intelligent transportation systems, increased bicycle and pedestrian options, creative land-use planning, and public education programs are general concepts to all contribute to reducing VMT. Additional strategies that reduce VMT and urban impact, include:

- Build high-density developments

with access to existing public transit.

- Establish a job-to-resident ratio that reduces VMT.
- Add to past investments through infill and brownfield redevelopments.
- Develop residential areas close to existing amenities.
- Institute incentive programs that increase public transit ridership and reduce VMT.
- Install Intelligent Transportation Systems to keep traffic moving.

Road and Parking Lot Design

Sustainable communities use road and parking lot design strategies that reduce VMT and environmental impact. The transportation subcommittee of the ETF may want to consider some of the following energy efficiency strategies for roads:

- Minimize the length of streets and highways.
- Design road width and configuration for specific needs, such as maintenance and snow removal, emergency vehicle access, and evacuation routes.
- Incorporate bikeways, walkways, carpooling links, and transit into roadway planning.
- Anticipate interconnectedness of future development to minimize road building.
- Include pedestrian right-of-way whenever possible to encourage walking.
- Design facilities for business and trucking operations for maxi-

mum transportation efficiency.

- Plan road construction activities and detours to limit congestion and reduce fuel consumption.
- Use energy saving materials and techniques during road construction, such as concrete and asphalt recycling.

Community energy planning should also contain recommendations for parking lots. Large parking lots are often built to entice customers with the notion of convenient parking. Studies show that suburban parking lots provide up to 36% more parking than the average peak demand. Land is too valuable to provide massive parking lots that encourage single-occupant driving when there are alternative modes of transportation available. Shared parking is one strategy for energy efficiency land-use planning. This type of parking allows two or more enterprises to share one parking area. The enterprises should have different hours

of patronage to be most effective. For example, a bank whose peak hours of business are during the day might arrange to share parking with an adjacent apartment complex that primarily requires parking from dusk until dawn.

Communities that implement energy-efficient transportation strategies can also save energy used for lighting. Shorter roads and smaller parking lots naturally require fewer lighting fixtures than longer road and larger lots. Fewer fixtures mean less energy consumed for lighting. Building managers and road departments can also increase energy savings by eliminating unneeded lighting fixtures and reducing 20-30 light candle fixtures to 2-10 light candle fixtures. Increases can also come from using motion sensors to illuminate parking lots after hours as patrons approach and selecting energy-efficient light fixtures that direct light source only where needed.



E-BIKE: Electric bike with rechargeable battery, great for city commuting. (UEO)



Wide 6 lane road at 1300 East 2700 South in Salt Lake City creates a localized heat island. (UEO)

Public and Traditional Transportation, and Alternative Fuels

Public transportation provides energy efficient travel for large numbers of people. The viability of public transit, however, is highly dependent on population density. Areas of higher density usually have more reliable and adequate public transportation service compared to areas of lower density. The community members of high-density areas that use public transportation save money and time. The community energy plan could recommend development patterns that are higher density to decrease transportation energy use.

For families that are unable to take advantage of public transportation, employers may be able to offer energy efficiency strategies for the daily commuter. These

strategies can include offering premium parking spaces to employees that carpool, arranging for employees to work outside the office, and compressing work-weeks. Another strategy is to offer the Utah Transit Authority Rideshare program.

Alternative fuel vehicles are another option for the daily commuter. The Clean Air Act Amendments of 1990 and the Energy Policy Act of 1992 encourage the use of alternative fuels for environmental, economic, and energy security reasons. Natural gas, propane, electricity, ethanol, and biodiesel are the most common alternative fuels and are obtained or produced in North America. Use of these fuels can bring energy security to a community as well as cleaner air.

Until a few years ago, alternative fuel vehicles were gasoline vehicles converted to run on a different fuel. Today, all auto manufacturers offer a wide range of AFV choices along with a full-vehicle warranty. AFVs do not experience loss of power, and start easily and run smoothly in all types of weather and terrain. AFVs emit less air pollution because the fuels have lower carbon concentration compared to gasoline.

Trax commuter rail in residential area of South Salt Lake.

(Clean Cities Coalition Stock Photo)



- ▶ **A study in Southeastern Wisconsin shows the economic impact of transportation options for a family of four living in a single family dwelling (Alternatives to Sprawl in Southeastern Wisconsin by Citizens for a Better Environment).**

TRANSIT AVAILABLE	MODE OF TRAVEL [20 MILES]	GOODS AND SERVICES ACCESSIBLE BY FOOT AND BIKE	COST PER YEAR	HOURS IN TRAFFIC
None	2 cars	Poor	\$10,010	1,430
Some	1 car 1 bus	Some	\$ 5,525	715
Most	2 cars 1 bus 1 rail	Good	\$ 4,050	415
All	1 bus 1 rail	Very good	\$ 2,020	0

Natural gas and propane-powered vehicles use fuels that may not be readily available outside the I-15 corridor. The significant cost of the specialized fuel systems in natural gas and propane-powered vehicles is offset by the low cost of the fuels. Flex-fuel vehicles can be fueled by either ethanol or unleaded gasoline. Biodiesel, a cleaner burning alternative to diesel, can run in most diesel engines without any modifications or increased cost to the vehicle. (see R/R for more information.)

Utah has become a leader for encouraging the purchase and use of AFVs. The State of Utah offers a number of incentives that encourage AFVs. Another incentive includes a lower price for natural gas at the pump, and available funds through the local Clean Cities program. There is even an incentive that permits the right to use the commute or carpool lane of the freeway with only one occupant in the vehicle. Companies can also use AFV in their fleets. Successful AFV fleets in Utah are Newspaper Agency Corporation, Questar Energy Services, Jordan School District, Flower Patch, Park N' Jet, Salt Lake International Airport, and Danville Services Corporation (see R/R to review a list of incentives).

Transportation Funding

New transportation design features may be costly to implement. There are numerous grant solicitations for community revitalization projects that often include transportation improvements. Federal funds for transportation projects are available with government support:

TEA-21: Transportation Equity Act for the 21st Century funds many transportation projects. The state Departments of Transportation and the MPO direct the funds. Public input can ensure that MPOs fund projects that create more workable and livable communities. Government must sponsor projects that receive this funding.

FTA Section 5303 & 5313 Planning Programs: MPO prepares transportation plans for submission to UDOT for approval, which ties directly to apportioned FTA 5303 funds earmarked for each state. UDOT staff addresses statewide transportation planning needs outside of MPO boundaries

Compressed Natural Gas (CNG) vehicle being fueled by local fueling station.
(Clean Cities Coalition Stock Photo)



under FTA 5313. Federal Transit Administration awards the States.

CMAQ: Congestion Mitigation and Air Quality Program: A federal program formed by the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) is designed to help states implement their air quality plans in conformity with the Clean Air Act Amendments of 1990 (CAAA). The energy task force may want to recommend these funding opportunities. (see R/R for more information.)

Alternative Energy Opportunities

Strategies and Incentives

Communities can implement strategies to increase the reliance on renewable energy sources by adopting solar easements. These easements guarantee that as new developments arise, the preexisting structures that depend on the sun for heating or power are not shaded and do not lose access to the sun's rays. Another strategy applies to those communities with municipal utilities. These communities can adopt special green pricing programs where citizens voluntarily subscribe and purchase a portion of their monthly electrical consumption from renewable sources in turn acquired by the municipal power company. A third strategy is for communities to adopt performance standards for new buildings that require a percentage of a buildings annual energy use to be from renewable sources. Finally, some communities with municipal utilities have also set a renewable portfolio standard where a percentage of the total power grid is derived from renewable sources.

Utah offers an incentive in the form of a state income tax credit for renewable energy systems, such as solar, wind, biomass, and hydropower. The credit for residential systems is 25% of the equipment and installation cost, up to a maximum of \$2,000. Commercial systems receive a

► **The US represents only about 4-5% of the world population but consumes 25% of the world's energy resources. In a typical community, 40-50% of that energy use is due to the transportation sector (The Energy YardStick 1996). Because of this significant proportion, community members must know about energy strategies that help reduce vehicle fuel consumption, such as the following:**

- **Ensure local governments know about intelligent transportation systems, sustainable mobility, and other transportation information technologies.**
- **Encourage the community to reduce VMT.**
- **Keep vehicles properly tuned for the most fuel-efficient operation.**
- **Maintain the recommended pressure in vehicle tires.**
- **Drive a commuter car that gets good mileage or uses alternative fuel.**
- **Disseminate the "10 tips for saving gas when driving" brochure.**
- **Expand driver education programs to cover energy efficient transportation.**
- **Encourage walking and biking in communities.**

10% tax credit up to a maximum of \$50,000. The Utah Energy Office administers the tax credit.

Another incentive that can be adopted and is being considered in Utah, is a net metering law. This law would require electric utilities to allow customers to connect generation systems to the grid for their own use and to supply excess electricity to the electric grid. The utility would “net” the customer’s electricity use and production over a defined period of time, in essence, paying the customer retail price for the electricity they produce. Currently there are 34 states with net metering laws. Utah has a proposed net metering bill that will be considered in the 2002 legislative session. This bill, as currently proposed, states that if net metering results in excess customer-generated electricity during the billing period, the electrical corporation shall credit the customer for the electricity at a value that is at least avoided cost.

Definitions of Alternative Resources

Alternative energy resources can provide substantial and reliable energy supplies. Below are definitions of resources that may be encouraged in the community energy plan. Careful surveying and analysis helps determine whether alternative energy resources are available and economical for individual communities.

Wind

Wind turbines convert the kinetic energy of the wind into mechanical power that runs a generator to produce clean, nonpolluting electricity. There are three major factors to consider when determining whether a turbine is reasonable and cost effective. First, the building structure must be as energy efficient as possible before alternative energy resources are considered. Second, there must be ample windspeed to meet the power demand. Third, the results of an energy budget identify the size of the turbine required. A general rule of thumb for estimating the cost of a residential turbine is \$1,000 to \$3,000 per kilowatt.

Wind energy can provide a practical and economical source of electricity if

- Property has a good source of wind.
- Building is located on at least one acre of land in a rural area.
- Local zoning codes or covenants allow wind turbines.
- Average electricity bills are \$150 per month or more.
- Building is in a remote location without easy access to utility lines.
- Finances can absorb long-term investments.

Geothermal

Geo (Earth) thermal (heat) energy is an enormous, underused heat and power source that is clean and reliable. This resource is converted into heat and electricity with little or no greenhouse gas emission, and is released or generated domestically, making us less dependent on foreign oil.

One technology that uses geothermal energy is geothermal heat pumps. In winter, heat from the relatively warmer ground is pumped through the heat exchanger into the house. In summer, hot air from the house is pumped through the heat exchanger into the relatively cooler ground. Heat removed during the summer can be used as no-cost energy to heat water.

A homeowner investing in a heat pump may pay \$15 more per month for the cost of the system but may save more than \$30 a month on their electricity bill.

Electricity use is reduced by 30% to 60% compared to traditional electric resistance heating systems, allowing system payback in 2 to 10 years. These low-maintenance systems can remain operable for 30 years or more. Where natural gas fired heating is used, the total energy bill may not be reduced by changing to a geothermal heat pump.

Photovoltaic

Photovoltaic (PV) panels convert sunlight to electricity, directly. PV panels vary in size ranging from a few square inches to about the size of a door. The largest panels generate 300 watts in full sunlight, which is equivalent to power one refrigerator or 12 - 25 watt compact fluorescent light bulbs. A PV system can provide enough electricity to power parking lot lights to large systems that power cities.

These systems have several advantages including no moving parts, low maintenance, and providing an alternative to utility line extensions. Photovoltaics may be preferred even in areas with utility service because electricity is produced without polluting the environment. The visitor center at Zion National Park, for example, has a PV system that contributes power to the building without affecting air quality.

Photovoltaic panels at Dangling Rope marina, Lake Powell.
(VEO)



Solar thermal

The sun heats solar collectors, which transfers gained energy to water or air in the collector. Because Utah has a high amount of solar radiation due to high elevation and many cloudless days, a solar thermal heating system can meet a majority of a home's water and interior heating needs.

Another solar thermal system consists of perforated panels attached to the south wall of a building with a few inches between the panels and the building wall. The dark colored panels absorb heat from the sun. The buildings heating system draws incoming air through the perforations and behind the panels where the air is heated before entering the building.

Passive solar

A passive solar design is one that permits direct sunlight to enter through windows to warm interior spaces. This design is intended to not overheat the building and to minimize heat lost through windows at night. Solar radiation passes through windows and is absorbed by interior materials such as stone and brick. These materials temporarily store the infrared radiation (heat) until the interior temperatures drop, then they reradiate heat back into the interior space. In Utah, 50 to 75% of total heating is achievable with these systems if designed properly.

Small-scale hydro

Hydropower plants convert the energy of flowing water to electricity and do not necessarily require large dams such as Glen Canyon. Diversion hydropower channels a portion of the water to a canal and through a turbine, from which power is generated. The water is later returned to the river, minimizing the environmental impact.

The economics of small-scale hydropower are site specific and can be very competitive with traditional electricity sources. The electric output is site specific and can vary from a few hundred watts to a megawatt or more. Utility connected hydropower can be a practical and cost-effective addition to the energy mix.

BioEnergy

Biomass to Energy (BioEnergy) is energy produced from any renewable organic matter including forest residues, agricultural crops and wastes, wood and wood wastes, animal wastes, livestock operation residue, aquatic plants, and municipal wastes. Examples of BioEnergy include using municipal wastes to produce methane, fermenting feedstock to ethanol, and converting animal fat waste to diesel fuel (BioDiesel). BioEnergy is successful primarily because it converts waste into useable forms of energy. New demonstration projects are coming on line as the need for energy rises.

Follow-up and Analysis Measures

Actual inclusion of energy efficiency strategies into a project may not occur even though officials and those involved in the project support the plan. The ETF, therefore, may want to revisit project managers during the implementation phase of the energy plan to monitor progress of development and individual projects. The ETF can provide suggestions or technical assistance to speed the process along.

Computer software modeling programs are an effective method to quantify existing and future impacts of development design. These programs rapidly produce images of design plans, which allow stakeholders to easily conceptualize recommendations and changes. Certain programs are designed to predict future energy demands, energy-related gas emission concentrations, and energy cost analysis of proposed projects (see R/R for suggested modeling packages).

As an ongoing activity, the ETF should quantify the energy benefits and savings in the community to evaluate the effectiveness of the adopted energy plan. After a particular community development or project is completed, an analysis between the forecasted and actual energy used quantifies success. For a renovation project, a comparative analysis between the amount of energy used before and after implementing energy efficiency strategies quantifies actual energy saved.

These evaluations give the ETF an opportunity to revisit existing strategies and modifying where necessary. The ETF can also incorporate new strategies as data warrants. Publicity of the overall savings in energy units and dollars helps maintain momentum for future sustainable energy projects.

Concluding Remarks

The dawning of the last century here in the United States saw the introduction of new products and technology, most of which are energy consuming. As these products and technologies became an integral part of our Utah communities, the entire economic health of each community and the quality of life of the citizens became dependent on the reliability, cost, and availability of energy sources. Events of 2000-2001 show that no community is immune from a regional or national energy crisis – these crises precipitate local problems. Rapid growth only exacerbates and compounds potential energy problems for our communities.

This Envision Utah Energy Chapter has discussed how each community can address present and future energy issues through “sustainability” – using resources wisely and efficiently in the context of community to create certain economic, environmental, and social benefits. Steps that Utah

Sustainable community design for downtown Ogden.

(CRS Architects)



communities can take to becoming “sustainable” have been presented along with the organizational elements needed for development of customized community energy plans. As each community develops a plan, this chapter can serve as a valuable resource for delineating strategies needed to meet the goals of the community energy plan.

The key to any community achieving sustainability is the synergy that develops as local officials, citizens, business, developers, and industry work together toward common energy goals. No great society was built upon the status quo. As individuals representing each of these sectors embark on this quest for sustainability, they will exemplify the best in leadership with vision for change and a commitment to success. We can make a difference for the better in Utah’s communities and energy future.

8

Strategies for Walkable Commercial

Introduction

► Traditionally, business districts were places where our cultural and economic lives united.

Commercial areas can be integrated into primarily residential neighborhoods, such as this retail development with apartments above.

Shopping districts are one of the most significant parts of any community. Since the beginning of cities, shopping districts have been organized around areas where trade occurs. As in the design of the cities themselves, the location and design of these areas of trade changed based on the technology, the economic systems, and the customs and needs of the people they served.

Traditionally, markets, main streets, and business districts were integrated into the community – they were places where our cultur-

al and economic lives were melded. During the last 50 years, primarily in the United States but also in the rest of the developed world, a form of retailing has occurred that is designed around the spread-out suburban world. While this new form of commercial development has taken many shapes – strip malls, regional malls, those that defy conventional retail categories (such as Wal-Mart), factory outlet stores – they all share a common purpose of catering to retail only.

While this retail form has supported the growth of some of America's largest and most profitable corporations, segregating retail away from other parts of a community or neighborhood can cause problems. For example, congestion occurs in areas that depend heavily on retail services located along local arterials or freeway exits. More time must be spent driving to several locations rather than to a few close, convenient ones. Finally, many people object to the way auto-oriented retailing looks, and to the dependence it creates on the car as the sole mode of travel – reinforcing the tendency to make all trips by car, all the time, to the detriment of both our individual and our community's health.



► **During the last 50 years a new form of retailing has taken hold that is separated from other parts of a community's life.**

This chapter explores urban design strategies that will retain the benefits of modern retailing, while also integrating commercial development into business districts so people can walk to visit several stores or retail services. By doing this, we can achieve a key strategy in Envision Utah's Quality Growth Strategy — the development of mixed-use centers. Through the strategies in this chapter, communities can realize the many benefits of a community where walking is a means of transportation and not something done just at the local health club.

Benefits of a walkable commercial area

When successfully established, a business district that is amenable to pedestrians can:

Increase accessibility of goods and services to the community.

Walkable commercial areas provide access through a variety of means, including transit, biking, walking or driving. This is especially beneficial for residents who are unable to drive. In addition, pedestrian-oriented shopping areas tend to be more successful when they are clustered together. The result is that residents can get to a variety of goods and services in one trip. Walkable commercial areas are not only more convenient for the pedestrian, but they also foster thriving businesses as areas become destinations and gathering places.

Become the hearts of our neighborhoods and cities.

Nearby neighborhoods and service businesses can thrive as a result of attractive shopping streets that are filled with pedestrians and often can become community gathering spaces. Walkable centers also create a safer environment because of the constant presence of people.

Help reduce traffic and congestion as trips made by car are replaced by walking and transit trips.

This is true even when people come to a pedestrian shopping area by car, because subsequent trips between stores are “captured” internally, thus avoiding additional auto traffic.

Help a community achieve the health benefits of more walking.

There is an increasing association between suburban design and obesity in America, which creates a

An example of a retail development with little connection to the surrounding community.



number of associated health risks.

Reduce the need for new land to accommodate new growth and satisfy the demand for additional transportation facilities.

A walkable district uses less land than one that is auto-oriented. Buildings are not necessarily bigger, but they are more compact, parking lots diminish or become part of a shared facility, and street sizes are reduced. This means more land is available for preserving open space and communities spend less money on costly infrastructure such as new roads and sewers.

Auto-oriented and walkable forms of development may seem entirely at odds. However, in the last 20 years many communities and businesses have developed new commercial businesses that successfully meet the needs of both the auto and the pedestrian. In fact, like so many things in life, there are many shades of gray between the prototypical auto-oriented design and the ideal pedestrian-oriented design. In this chapter of the toolbox, we will examine a variety of ways to increase the pedestrian attractiveness of several types of retail environments.

Basic Characteristics of Auto-Oriented Design

Much of today's retailing practice aims to create a prototype design that can fit into any suburban environment in the United States. Regardless of whether you're in Topeka or Santa Fe, certain retail

chain stores will look essentially the same. This uniformity of design is important for retail corporations that have little time or expertise in customizing a store to a neighborhood. In most areas, this strategy provides a reasonable assurance of financial success. In these prototypes, everything is oriented to the private automobile — making sure cars have access and can find parking. These businesses perform best when they are visible and accessible along arterial streets with a lot of traffic. Parking is designed so that customers walk the minimum distance possible to their destination. In many cases, parking lots are designed to provide parking on the busiest day of the year — generally December 12 between 1 p.m. and 3 p.m. Buildings resemble large billboards, with simple box forms showcasing large distinctive graphics.

This business district in Colorado is the heart of the community.

► **In 1977, children aged 5 to 15 years walked or biked for 16 percent of all their trips; by 1995, children made only 10 percent of their trips by foot or bicycle (Corless and Ohland, 2001). Meanwhile, the percentage of adults who are overweight or obese has risen from 47 percent in 1976 to 61 percent in 1999 (CDC, 2001).**

■ **In Utah, the prevalence of obesity among adults has also risen. In 1998, 16 percent of Utah adults were considered obese, up from 9 percent in 1991. (Utah Department of Health, Utah Health Status Update: Obesity and Overweight, December 1999)**



In this environment, there must be very low density, and land costs must be relatively cheap. Shopping center developers use a rule of thumb that an acre of land is required for each 10,000 square feet of building – a floor area ratio (FAR) of less than 0.25. Most new shopping centers are built on land that has not been developed before – so-called “greenfield” development.

“Parking Requirements for Shopping Centers”; Urban Land Institute; 2000

Basic Characteristics of Pedestrian-Friendly Commercial

On the other hand, successful commercial developments that depend on walk-in traffic – in main streets, entertainment districts, downtowns, and other

pedestrian friendly districts – rely on advertising goods to passing pedestrians. Pedestrians typically arrive by car but abandon their car and then walk around visiting several stores or services. Good auto access is important, but traffic moves more slowly. Another important source of customers are the people who live or work nearby. Pedestrian-oriented commercial development can thrive in suburban or rural areas. If they are designed as a true commercial center, they become a destination for surrounding neighborhoods. These areas, like their auto-oriented cousins, depend on designs that attract shoppers into their stores. In fact, the interiors of enclosed malls have much in common with pedestrian-friendly shopping areas. They depend on attracting the eye of the slower moving pedestrian. Shop windows are crucial, as is the concentration of shopping opportunities along the pedestrian paths. Shop fronts display their most tan-

Designing for Redevelopment

Changes such as street improvements or zoning modifications can alter a site’s surrounding characteristics over time. Therefore, it is often beneficial to plan for a higher level of walkability than the site currently supports.

Parking lots can be organized in a grid pattern with street right-of-ways in order to accommodate future pedestrian-oriented development that would redevelop portions of the surface parking.



Cascade Station, Portland, Oregon.

talizing merchandise, and displays change every 25 feet or so to create an ever-changing rhythm of goods. The presence of other pedestrians is an attraction and helps to foster a safer environment – the opposite of auto design, where the goal is to be a solitary driver.

Because the pedestrian moves at a slower speed and becomes bored quickly, the best pedestrian areas have a higher density of shops, each of which is smaller than the typical auto-oriented prototype. Even a large shop within a pedestrian area (such as a department store), must have display windows that follow the smaller format's rhythm. Because these many small stores depend on the health of the entire shopping environment, a certain "mass" of stores is required, unlike small neighborhood stores that can exist in isolation. Therefore, the business district as a whole frequently uses a common strategy to lure shoppers into the area, rather than relying only on each store's advertising efforts.

Because of the emphasis on creating a pedestrian environment, parking is never located between the building entrance and the pedestrian; instead, parking is along the street or in common parking areas in parking lots of structures that do not disrupt the pedestrian environment. The concept is to provide a convenient location where shoppers can leave their cars and get to areas

for walking as soon as possible. The parking areas tend to be fairly inconspicuous, and the amount of parking supplied is usually less with a much more custom approach to the amount needed.

Redevelopment of Auto-Oriented Commercial

When auto-oriented commercial sites are redeveloped, it is an opportunity to incorporate walkable design. Strategies include introducing storefront commercial along the periphery of parking lots, opening a dying mall to the surrounding community through exterior entrances, and adding a mix of uses such as housing, office and entertainment in former parking lots.



An existing auto-oriented shopping mall.



The same site redesigned for pedestrian access and convenience. (Calthorpe Associates)



Design parameters of typical auto oriented development:

Building Design

- Typical auto-oriented buildings look like a single story “box” with little or no structural variation.
- Inexpensive construction methods, such as solid concrete brick walls, often are used even though they may not be architecturally interesting or pleasing to the eye.
- Often, there is only a single entry into a large building. Although the purpose is to control access in and out of the store, it is inconvenient and creates poor accessibility.
- Most buildings have few outside windows so that they can have more internal display space. The result is bulky and dominant blank walls.

Parking, plentiful and visible

- Parking is designed for the peak hours of the year (December 12 between 1 and 3 P.M.). This means that the parking lot has many vacant spaces for the other 3,000 hours a year a store typically is open.
- A common rule of thumb is to provide five parking spaces on site for each 1,000 square feet of building space, even though parking use varies greatly among suburban shopping centers.
- Vacant parking spaces are designed to be as clearly visible to passing motorists as possible.
- Diagonal spaces and wide aisles are designed for easy access for large vehicles.

Location

- Since these buildings are by definition auto-oriented, their locations, such as near freeway interchanges or on busy arterials, are designed to capture as much drive-by traffic as possible.
- Easy access for cars is considered essential for success.

Visibility

- Signs and building graphics are large and simple to catch the attention of high-speed auto traffic.
- Often, the sheer size and bulk of a building are intended to draw the eye of passing motorists. To take advantage of their size, many stores design their buildings to act as giant logos.

Connections

- Both auto and pedestrian connections to nearby developments intentionally are made difficult to navigate so that patrons of adjacent stores do not use their parking.

Density

- The net effect of the design parameters is a relatively low overall density – typically 0.25 FAR or less.

*Design parameters of pedestrian-friendly stores:***Building Design**

- Street-facing windows encourage window shopping and lure consumers inside.
- Narrow, repeated frontages encourage walking with the promise of the upcoming interesting things to see.
- Visible, friendly entrances into the stores' faces that are directly accessible from the main pedestrian path.

Parking

- Parking does not interfere with pedestrian traffic and often is behind buildings.
- There is a greater reliance on shared parking because it is more space efficient (see chapter 4).
- Consumers often park once and then shop in several stores on foot.
- The amount of parking supplied is decided on a case-by-case basis, eschewing national average parking standards.

Location

- Stores thrive best when they are part of a business district that acts as an overall destination.
- Close proximity to residences and local workers means more walk-by traffic.
- Stores also benefit from auto traffic, but traffic must be at slower speeds to be compatible with pedestrians – i.e., collectors or slow, less busy arterials.
- Development often is compact and multi-stories to afford the most destinations with a pedestrian 'reach.'

Visibility

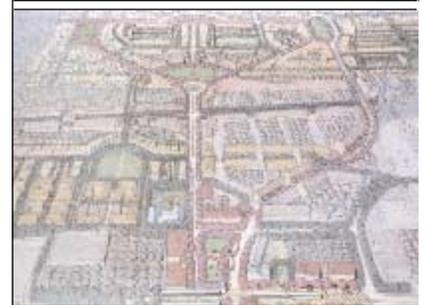
- There should be two dimensions of visibility, in which stores lure from both pedestrians and slow-moving cars.
- A business' identity is tied to the overall business district in addition to the brand name of the store.

Connections

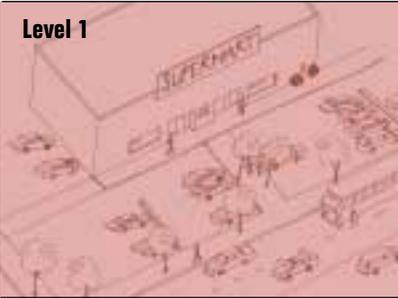
- The store and business district are connected with the surrounding neighborhood to increase pedestrian traffic.
- Connections with other businesses increase parking efficiencies.
- Connections with other businesses are vital in creating the business district as a shopping destination.

Density

- Usually there is multi-story development and less parking.
- Typical densities are at least 0.5 FAR for a common main street, but an FAR of 2 or higher is not uncommon.
- A variety of land uses often are located together on the same parcel or block.



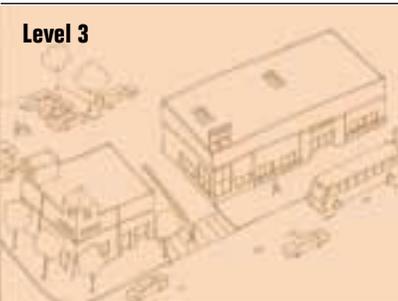
Level 1



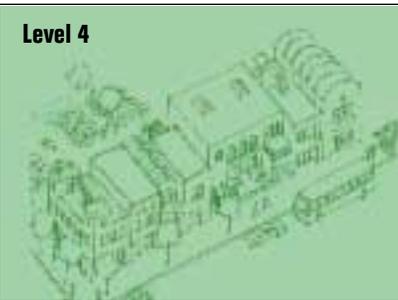
Level 2



Level 3



Level 4



Bridging the Gap: A Spectrum of Walkable Design

Auto-oriented and walkable forms of development may seem entirely at odds.

However, in the last 20 years many communities and businesses have developed new commercial businesses that successfully meet the needs of both the auto and the pedestrian. In fact, like so many things in life, there are many shades of gray between the prototypical auto-oriented design and the ideal pedestrian-oriented design. In this chapter of the toolbox, we will examine a variety of ways to increase the pedestrian attractiveness of several types of retail environments.

These types of retail environments are divided into four levels as follows:

Level 1: Pedestrian Appliqué Design

Buildings and sites are designed with mostly auto-oriented characteristics but have added facilities for pedestrian access.

Level 2: Integrated Pedestrian Design

This includes buildings that have many auto-oriented characteristics, but the site design has been modified to better integrate into a pedestrian area.

Level 3: Prevailing Pedestrian Design

In this design, the interiors of buildings often conform to the design requirements of larger chain stores, but both the exterior of the buildings and the site design have been modified extensively to develop a pedestrian-oriented environment.

Level 4: Storefront Commercial

In this level, the traditional street-oriented design is primary. The focus is on the main street commercial development, with extensive modification to the interior and exterior of buildings.

Identifying A Suitable Site For Each Level

Selecting appropriate environments is the first important decision in developing pedestrian friendly areas. Requiring a Level 4 storefront commercial building on an isolated freeway interchange with no source of pedestrians would be a mistake. If the buildings were ever built, they would fail to attract much business. Indeed, many main streets have failed after their environment was disrupted by highway improvements. The following are essential elements to consider in deciding what level of pedestrian friendliness is appropriate.

Understanding the requirements of each level of design also tells us how to improve key areas and better fit one of the levels of walkable development.

The Walkability Survey

On the next page is a scorecard to use as a guide in determining how walkable areas in your city could be, based on current plans or those under consideration.

Source of pedestrians

One of the first decisions to make is where the pedestrian shoppers will come from. Choose the most prominent destination in the vicinity where pedestrians will most likely be coming from or areas where a source of pedestrians can grow; then score accordingly, not to exceed 4 points.

Transit service

Transit access and frequency can help determine the amount of pedestrian activity a development realistically can expect and reduces the need for parking. Since most riders walk to transit stops, pedestrian activity increases near transit service. Choose the following statement that best describes the development site, not to exceed 4 points.

Street connectivity

Determining the level of connectivity in an area will help establish a site's accessibility. Connectivity is the variety of ways and means available to reach a location. Calculate the number of intersections within a 1/2 mile radius that will exist after planned buildout of an area, not to exceed 4 points.

Traffic characteristics

It also is important to have traffic speeds that are conducive to safe walking. The faster traffic moves, the less pleasant the pedestrian environment. Choose the appropriate posted traffic speed, not to exceed 2 points.

Street characteristics

The physical make up of a street, such as sidewalks, street trees and on-street parking, is important in providing a safe and pleasant pedestrian environment. Add points for existing or proposed amenities, not to exceed 6 points.



THE WALKABILITY SURVEY

Use the survey to measure the effectiveness of the plan in creating a pedestrian-friendly environment.

<p>PROXIMITY TO PEDESTRIANS (Add together the points in this section)</p> <p>Proximity to a college or similar: within 2 miles 1 within 1 mile 2 within 1/2 mile 3 within 1/4 mile 4</p> <p>Employees within 1/2 mile radius (500 acres): 500 to 1000 1 1000 to 2000 2 2000 to 4000 3 over 4000 4</p> <p>Number of residences within 1/2 mile radius (500 acres): 500 to 1000 1 1000 to 2000 2 2000 to 4000 3 Over 4000 4</p>	<p>score: ----- (6 points maximum)</p>	<p>STREET CONNECTIVITY Intersections within 1/2 mile (500 acres) 40 to 60 1 60 to 100 2 100 to 140 3 over 140 4</p>	<p>score: ----- (4 points maximum)</p>
<p>ACCESS TO TRANSIT (Frequent =15 minute headways)</p> <p>Frequent peak-hour transit service within 1/4 mile 1 All day frequent transit service within 1/4 mile 2 Adjacent to peak-hour frequent transit service 3 Adjacent to all day frequent transit service or light rail within 1/4 mile 4</p>	<p>score: ----- (4 points maximum)</p>	<p>APPROPRIATE TRAFFIC SPEEDS Posted traffic speeds on primary streets: 35 m.p.h. or less 1 25 m.p.h. or fewer 2</p>	<p>score: ----- (2 points maximum)</p>
		<p>ROW CHARACTERISTICS Will connected sidewalks be present? 1 - 8 foot sidewalks? 2 - 12 foot sidewalks? 3 Will there be street trees? 1 Will there be on-street parking? .. 3 Will shared parking be available? 2 Will crosswalks be present and at minimum every 300 feet? 1 Will crosswalks be signalized or protected? 1</p>	<p>score: ----- (8 points maximum)</p>
		<p>SCORING: 2-6 points Plan supports Ancillary Pedestrian Level 1 6-12 points Plan supports Integrated Pedestrian Level 2 12-18 points Plan supports Prevailing Pedestrian Level 3 Over 18 points Plan supports Storefront Commercial Level 4</p>	

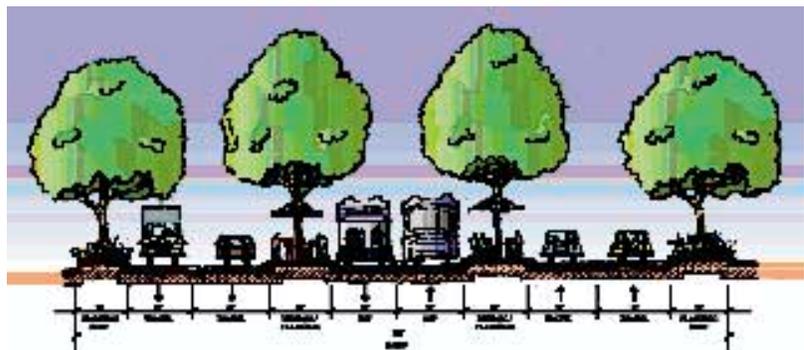
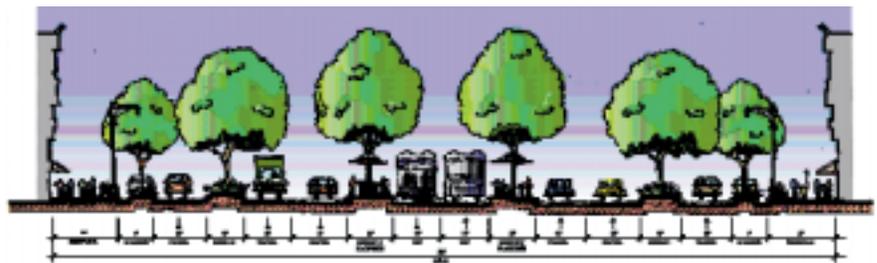
Consider land and streets together

A walkable district cannot thrive unless there is a good fit between building and street design. This is because the way a street is designed has a great deal to do with the appeal of adjacent buildings. Pedestrians do not simply visit individual buildings; they experience the overall environment created by the design of both buildings and the street.

Much of this chapter addresses site design and building considerations, but streets must be designed to balance the needs of all forms of travel so that walking and as a result, transit use, are viable choices in getting from one place to another. Streets should be thought of as a conduit to move people, not just cars.

Some areas are good candidates for walkable commercial development at levels 3 and 4 except that the street right-of-way is a poor fit. In these areas, cities should consider modifications to the right-of-way to improve their ability to handle

multiple forms of travel, especially walking. Chapter 3 has several examples of cross-sections that represent how the wide street rights-of-way typical in Utah can be modified to become attractive, pedestrian-friendly streets. Some of these options, such as a double-median boulevard, can maintain reasonable traffic flows and are therefore suitable to state highways. Also see Chapter 9 for more information on street design.



Utah's wide right-of-ways have the advantage of being able to accommodate a boulevard or parkway design. Boulevards and parkways can have dedicated lanes for transit in addition to through-traffic lanes for long trips and local traffic lanes serving pedestrian-oriented buildings for shorter trips.

► TODAY'S PARKING REQUIREMENTS

Typical zoning and industry standards act to require enough parking that:

- Parking is 50 percent vacant for 50 percent of the year
- Parking lots that are 85 percent full are “functionally” full
- Parking lots are “functionally” full only 20 hours a year (0.3 percent of the year)

In a national survey of Regional Shopping Centers, a standard parking ratio line explained only 9% of the variation in parking demand. (ULI, 1999)

Parking demand myths

A common feature of modern zoning ordinances is that there is a minimum off-street parking requirement. These requirements usually are expressed as a ratio proportionate to the gross leasable area of the building. For example, a 1,000 square foot building may be subject to a standard of providing five spaces per 1,000 square feet. The ratios largely have been determined from “rules of thumb” that govern the real-estate industry for developing and using postwar buildings such as shopping centers.

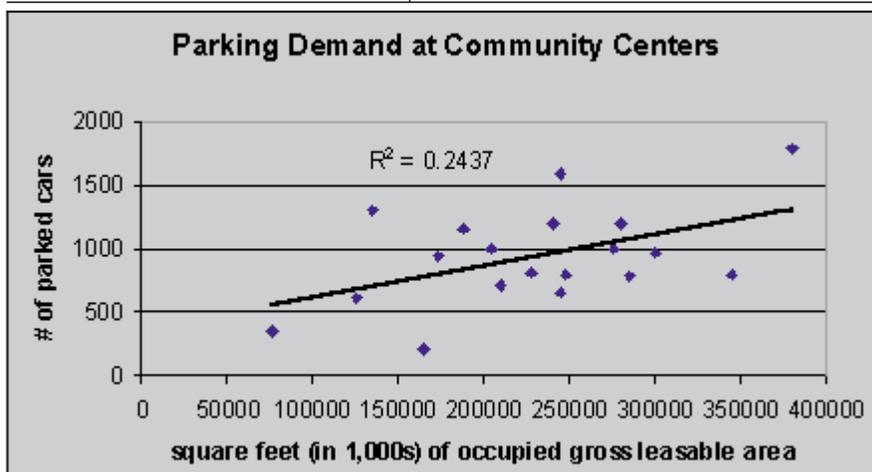
Industry standards

Since it is important for auto-oriented development to entice consumers with available parking, parking lots are designed so that they have capacity to accommodate the peak hours of the year, statistically December 12, from 1 to 3 P.M. – less than 1 percent of the hours a shopping center is open per year. During this time, the “functional capacity” reaches 85-95 percent – the standard in which

patrons should be able to find a parking space as soon as they enter the parking area. This means that more than half the spaces are empty for 50 percent of the 3,000 hours a year a center is open — and are almost never actually used to 100 percent capacity. In a study by the Urban Land Institute (ULI), 43 percent of shopping centers reported that their parking lots were never full, and only 25 percent reported being “functionally full” for 10 days a year.

How does this standard compare with measurements of how parking is actually used? In a ULI national survey of parking use, shopping centers of fewer than 600,000 square feet were oversupplied by one parking space per 1,000, 50 percent had demand for fewer than four spaces, and 14 percent had fewer than three.

ULI data further shows that there is a very poor correlation between the size of a business and its parking demand. In regional centers, the standard relationship of parking spaces per square feet explained only 10 percent of the variation in the data (show graph). Clearly, there are better ways than looking at a building's size to estimate the amount of parking needed. There are many examples of pedestrian-oriented businesses and shopping areas that do quite well on 2.5 spaces per 1,000 or fewer—by having on-street parking, shared parking, and an environment that invites shoppers to walk.



New parking standards for pedestrian-friendly businesses

In areas where a local government wants to encourage pedestrian activity, it should adopt lower parking requirements. Even in Level 1 areas, parking requirements should be lowered from the 4.0 to 5.0 ratios predominantly in use today to acknowledge the way parking is actually used based on national surveys. Lower requirements do not necessarily mean less parking will be built, but they free developers to balance the needs of automobile users with the financial constraints of development and the desire for walkable site and building design.

Recommended basic parking requirements:

Level 1: 4 spaces per 1,000
 Level 2: 3.5 spaces per 1,000
 Level 3: 3 spaces per 1,000
 Level 4: 2.5 spaces per 1,000 or less*

Standard parking ratios leave 50% of parking empty 50% of the year. [ULI, 1999]



Provisions for lower requirements

In addition to these reduced basic parking standards, local governments should give parking credits or should lower standards in certain instances, such as:

- 1] Adjacent on-street parking always should be credited toward meeting parking requirements.
- 2] Parking requirements can be partially or completely met through “in-lieu” fees earmarked for a future shared parking facility.
- 3] Lower standards should be applied when development is proposed near a shared parking facility. In some main street or downtown areas where there is sufficient public parking, no off-street parking should be required.
- 4] Lower standards should be applied if development is proposed adjacent to high-frequency transit or within one-half mile of a high-capacity transit station or transit center.

► WHY PARKING STANDARDS MATTER SO MUCH

■ **High parking standards can be devastating to the formation of a walkable district.**

■ **First, large surface parking lots separate buildings and increase walking distances – people are much less likely to walk because of the inconvenience.**

■ **Having substantial separation between buildings also works against the natural formation of a business district. Businesses seeking to relocate understandably do not view separated or spread-out commercial areas as a destination district where people will arrive and then visit multiple businesses. They see these areas instead as a collection of unrelated businesses.**

■ **Surface parking competes against a building’s footprint for the available lot area, reducing development intensities — the more surface parking on a site, the less room there is for a building. High parking requirements increase development costs by forcing a developer to find a larger site for a proposed building. Parking requirements are especially onerous for potential redevelopment projects that often are the best locations for walkable districts (see Chapter 4, Reuse and Infill).**

**Level 1:
Pedestrian Appliqué Design**

These strategies are best used in areas with heavy auto use and little potential for pedestrian activity. Traditionally, auto-oriented commercial structures created poor walking environments with vast parking lots and minimal or no sidewalks. However, new parking areas can be designed and old structures retrofitted to cater to the car while providing safe and attractive pedestrian access.

Sidewalks and crosswalks are essential in providing safe access for pedestrians. Perimeter sidewalks are the first step in allowing pedestrian access to a business. However, narrow sidewalks or sidewalks too close to a busy street will feel unsafe to pedestrians, and therefore are less likely to be used. Sidewalks should be at least five to eight feet wide and be set apart from streets with a planter strip or even a low decorative wall. In addition, if pedestrians must cross through busy, fast-moving traffic without a safe crosswalk, a perimeter sidewalk is meaningless. Even the most auto-oriented business has pedestrian activity generated from motorists getting out of their cars and walking into a store. Therefore, safe access needs to be provided through sidewalks and pedestrian amenities connecting parking areas and store entrances, such as wide raised walkways and ample landscaping.

Fred Meyer, Salt Lake City, Utah

- Adjacent to busy arterials on all sides, this large retail chain has still managed to provide some pedestrian amenities.
- Landscaped sidewalks surround the site, as well as two walkways that run through the parking lot, allowing safe pedestrian access from the street.
- The building has multiple entrances.
- Both structured and surface parking is available.



Design Principles:

- Appropriate for locations with large volumes of auto traffic, near busy arterials and at high-way exchanges.
- Architecture is designed or modified to be at a comfortable scale for pedestrians, while still attracting attention from the street.
- There often is only one entrance.
- Parking is in front but is punctuated by landscaping in medians and along pedestrian paths.
- Parking supply:
(4 spaces/1,000 square feet)
- Buffer developments from busy streets by placing smaller retail buildings along the perimeter of the parking lot.
- Landscaping includes street trees and landscape buffers between parking, pedestrian areas and the street.
- Streets should enable safe crossings for pedestrians through strategies such as medians for “pedestrian refuge” and wide visible crosswalks.
- Sidewalks should be wide, at least eight feet, and be buffered from busy streets.



**Level 2:
Integrated Pedestrian
Design**

Integrated pedestrian design begins to treat pedestrians as equally important as the car. Although parking is still prevalent and visible from the street, walking distances have decreased substantially from Level 1 because the buildings are now adjacent to the street.

Building design has not changed substantially. There is still one primary entrance, and building architecture is similar to Level 1. However, the building has been modified to provide a comfortable pedestrian area along the street and sidewalk through display windows and appropriate landscaping. Parking most often is located to

the side of the building, still fronting the street and sidewalk. Landscape buffers between parking and the sidewalk, such as shrubs or a low wall, are important to create a safe and pleasant environment for walking. Although parking is still prominent, fewer parking spaces are needed because there are more pedestrians in the area.

Integrated pedestrian design is realistic for areas with moderate pedestrian activity. It also can be a feasible solution for retrofitting existing commercial buildings. Adding smaller retail around the perimeter of a larger parking area can turn an under-utilized Level 1 commercial building into a more profitable and desirable retail environment.

**Sugarhouse Commons,
Salt Lake City, Utah**

- The Commons, located adjacent to Interstate 80, is a retail shopping center which covers one full city block.
- The design includes pedestrian circulation and amenities, such as outdoor dining and sitting areas, a small open space and stream, and sidewalks connecting buildings within the project and adjacent uses.
- The parking areas and sidewalks are landscaped with attractive trees and shrubs.



The net effect of this building and site design is to create a built environment that is safer and much more convenient for walking.

Design Principles

- Appropriate locations include collectors and moderately busy arterials within walking distance to offices, business districts and residential areas, but not near freeway interchanges.
- Architectural details, such as walls facing the street, are broken up with openings.
- There usually is one entrance facing parking, but it often borders the sidewalk.
- Building orientation often is sideways, with one or more walls adjacent to the street.
- Parking is located on the side with buffers between parking and street.
- Parking supply: (3.5 spaces/1,000 sq. ft.), plus credits for on-street parking.
- Landscaping includes street trees and landscape buffers — in developed areas, short decorative walls often are more appropriate than trees or shrubs because they better maintain the character of a streetscape.
- It is necessary for the street network to include adequate access and connections should be provided to areas with high pedestrian volumes.
- Streets incorporate on-street parking, wide sidewalks and safe, efficient pedestrian crossings.



Bountiful, Utah



Denver, Colorado



Portland, Oregon



Salt Lake City, Utah

**Level 3:
Prevailing Pedestrian Design**

Although prevailing pedestrian design is often found along relatively busy streets, the pedestrian realm is safe and inviting. Parking is no longer a dominant feature; it is located behind buildings with minimal curb cuts for increased pedestrian safety. The automobile is not the motivating force behind commercial design. Sidewalk widths are generous to accommodate a wide variety of activities, and store fronts are designed to welcome the passing pedestrian.

The interior layout of stores still mimics the traditional “big box,” but exterior architecture is much more pedestrian-oriented. Prominent doors and display windows face the street and sidewalk, creating a “human scaled” design. Often the exterior façade is visually broken with vertical and horizontal architectural details, thus making a large solid wall appear less massive. This can create the illusion of smaller shop fronts. Another alternative is to actually line a larger commercial building with smaller shops. Regardless, the overall result is a less dominant and overbearing structure that is welcoming to pedestrians.



**Redmond Town Center,
Redmond, Washington**

- The Town Center is an open-air mixed-use center comprised of 120 acres of retail, offices, and entertainment, as well as a 40-acre greenbelt.
- The project is designed to be an extension of the existing downtown corridor.
- Streets with the Town Center are laid out in a modified grid pattern, much like Redmond’s existing street network.
- Parking is accommodated through structured parking as well as some surface parking located behind buildings.



Design Principles

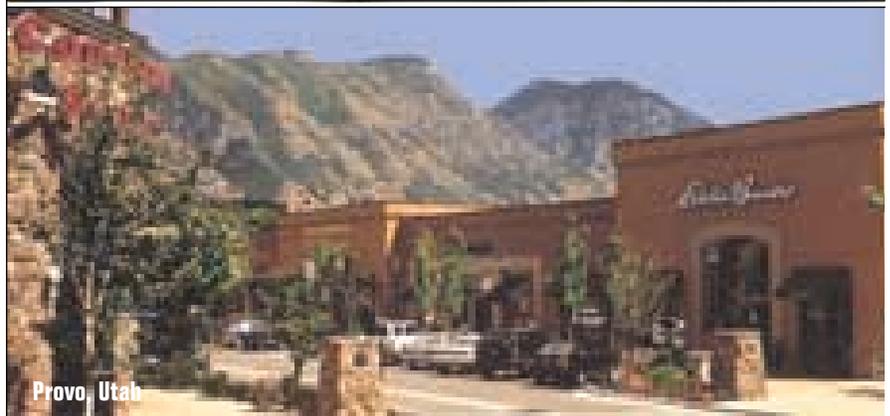
- Locations include busy streets, but with increased pedestrian activity such as near business districts, residential and/or office. Sites also can be on the edge of a storefront commercial district.
- Architecture is human scaled with street/sidewalk facing windows, minimal blank walls and aesthetic interest.
- Entrances are prominent and street facing. There often are two entrances, a pedestrian entrance and an ancillary auto entrance. When one only entrance is provided, it faces the street.
- Buildings abut the street front and sidewalk on at least one side. Parking is located at the rear, although access to parking often is from the main street.
- There is no parking between the building and the street. On-street parking is beneficial for drawing patrons to individual business and the district; large parking areas are divided into traditional blocks sizes with sidewalks and pedestrian crossings.
- Parking supply: (3 spaces/unit) Credits and “in-lieu of” programs are encouraged, as are lower requirements near transit or shared parking.
- Landscaping includes street trees, landscaping and trees in parking areas and along bordering walkways.
- Street network design requires a connected street network with no “superblocks”.
- Street design should incorporate wide sidewalks, pedestrian-friendly intersections, frequent crosswalks, traffic calming measures such as bulbouts and on-street parking.



Seattle, Washington



Portland, Oregon



Provo, Utah



Seattle, Washington

Level 4: Storefront Commercial

Storefront commercial is the most pedestrian-friendly of the four design levels. New storefront commercial follows the model of cities' historic main streets. The setting is immediately engaging for both the motorist and the pedestrian. Narrow streets allow for safe pedestrian crossings and ample time for motorists to be enticed out of their cars by inviting shops and engaging streetside activities. Buildings front an ample sidewalk with room for outdoor seating, walking and window shopping among a lush canopy of street trees. Often, a community or developer has set aside space for plazas and courtyards where pedestrians can listen to a concert or sit and enjoy the outdoors. The physical landscape of a storefront commercial district is extremely important in attracting pedestrians. However, the district's proximity to stores and services that lend themselves to pedes-

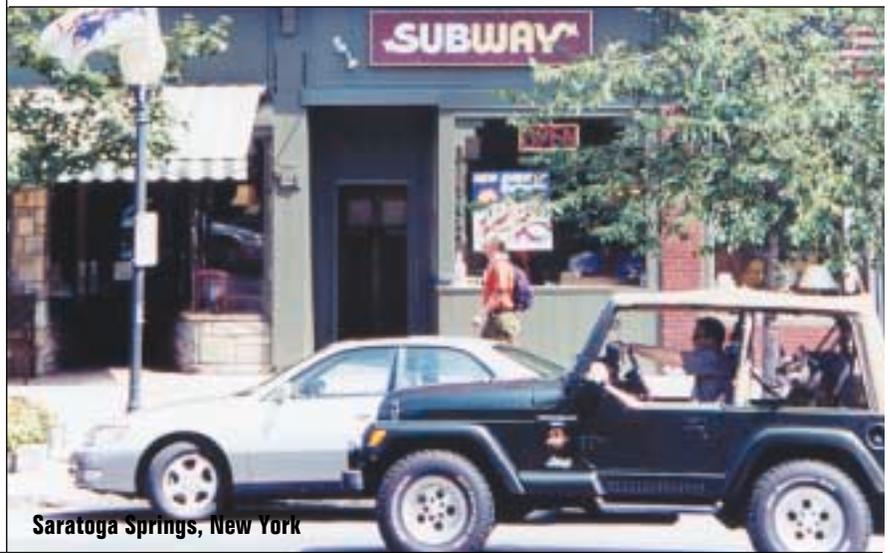
trians (housing, employment, schools, other commercial centers) is equally important. In addition to providing adequate connections to adjacent districts, designing a mix of uses within a storefront commercial district can further ensure pedestrian activity. Historic main streets again can be a model for these "mixed-use" centers.

Traditionally, retail and commercial uses were located at street-level, where they could be the most visible. Residential units and offices were placed above or within short walking distance. Applying mixed-use design principles within a storefront commercial district will promote a vibrant, desirable pedestrian-oriented community.





Seattle, Washington



Saratoga Springs, New York

The Gateway: Salt Lake City

The 3.2-million square-foot project integrates residential, office, cultural, retail and entertainment uses on a 30-acre brownfield site, formerly a Union Pacific rail yard.

■ Developers hope Gateway will initiate urban infill between central downtown and the project site, resulting in “a contiguous, vibrant, two-mile circulation loop and greater connectivity in the urban core.”

■ The project includes many pedestrian gathering areas, including a restored,

historic railroad depot and an open-air plaza.

■ An internal street creates a pedestrian-oriented atmosphere through architecture and sidewalk design, yet allowing for auto access and parking.





Salt Lake City, Utah



Orenco Station, Oregon



Saratoga Springs, New York



Chicago, Illinois

Design Principles

- Appropriate located along narrow, slower speed streets within a business district, close to offices, residential, or near any area with high volumes of pedestrian traffic.
- Architecture should be human scaled with plenty of windows facing streets and sidewalks and no blank walls. The design should be consistent with surrounding architecture and create visual interest by using horizontal planes and vertical articulation (this can be accomplished through the illusion of multiple storefronts).
- Prominent, multiple entries.
- Businesses are oriented to the sidewalk and street front, providing easy access for pedestrians, transit riders and cars.
- Parking should be located to the rear of buildings, or under, if feasible. It should be accessible but not a prominent focal point.
- Parking supply: (2.5 or fewer spaces/1,000 sq. ft.) The number of parking spaces can be reduced greatly through credits and “in-lieu of” programs, nearby transit and shared parking with adjacent businesses or nearby parking facilities.
- Basic landscaping should include street trees and any needed buffering, such as between sidewalks and parking lots.

- Street network design should provide connectivity to adjacent uses, neighborhoods, districts and arterials; no barriers should exist between parking of adjacent firms.
- Street design encompasses narrow streets with large three-zoned sidewalks (sidewalks include a facilities zone for street trees, benches and transit shelters; a wide travel zone for walking; and a frontage zone for outdoor seating, signage, displays or window shopping). Traffic calming measures such as bulbouts, pavement variation, raised crosswalks and on-street parking calm traffic to keep speeds moderate and provide a safe pedestrian environment.



Planning for Walkability

The most effective method to create pedestrian-friendly districts is to use a three-pronged approach to implementation: regulation, public infrastructure and partnerships between private organizations and public agencies. Regulations are tools that shape the form of private investment, such as the location of buildings and parking, the form and size of buildings, and basic design features such as the size and location of a garage door. Regulations can affect the likelihood that development will occur where it is wanted and can discourage incompatible development; however, they alone do not directly alter the built or natural environment.

On the other hand, public investments are direct expenditures that change the form of the built or natural environment, such as changes to the street right-of-way. Public investments can improve an

area single-handedly and also can change the climate in which private decisions are made (more information in Chapter 4, Reuse and Infill).

Partnerships involve a sharing of efforts, money, or expertise between a local government and either another governmental agency, a business entity or private person, or a nonprofit organization. Partnerships can accomplish a wide array of goals, such as developing the land, providing pedestrian amenities and street improvements, and ensuring adequate housing near a business district.

The first step is to identify the areas within a city with the best characteristics or most potential to support pedestrian-oriented commercial districts. The walkability index is a tool available to identify these areas. An important note is to use the scorecard considering both what exists now and how the area could be reasonably modified.

Comprehensive planning

Once a community has identified strategic locations for walkable development, these areas should be identified in a comprehensive plan. The next step is to support the envisioned character of each area with public investments and revised regulations.

Our physical environment is shaped by private investment that is regulated by the public, public infrastructure and by partnerships.



Public Investments

Public investments and public investment policies are key in ensuring that changes to public infrastructure support a walkable community. Without them, street rights-of-ways may either stay incompatible with pedestrian-friendly development, or incompatible public infrastructure could be built that disrupts the walkable character of an area. Public investments to encourage walkable development include:

Right-of-way improvements

- Sidewalk widening
- On-street parking
- Street trees
- Sidewalk bulbouts and median pedestrian refuges
- Street beautification

In some instances, disconnected streets, such as dead ends, can be connected. This often is quite expensive and generally applies only where potential connections rest on vacant land. Where costs are prohibitive to connect existing roads, pedestrian connections accomplish many of the same benefits but at a reduced cost.

Traffic calming devices are sometimes appropriate to lower traffic speeds enabling pedestrian traffic to flourish. Traffic calming devices are discussed in Chapter 3, “Making our Community a Good Place to Walk.”

Shared parking facilities are inval-

able public investments in pedestrian districts partly because they mean landowners do not have to provide large amounts of off-street parking.

Regulations

After updating the comprehensive plan, a city should support or initiate zone changes to help create a walkable commercial district or actively pursue zone changes. What follows are specific zoning ordinance strategies:

■ *Zoning*

● *Land use modifications*

Walkable commercial districts are created not just through the design and land-uses of the immediate district, but they also must have a market of potential pedestrians within walking distance. Existing commercial zoning in these areas always should allow residential development. In more vibrant pedestrian areas, residential land use should not be allowed on the first floor. In addition, overly large commercial districts that act to discourage the development of nearby housing and office uses should be divided into a core commercial district with surrounding residential, office or more mixed-use zoning.

In many cases, busy collector streets that run through predominantly residential areas may be appropriate for the location of small pedestrian neighborhood

centers. Zoning for these centers should allow only low intensity structures to ensure a relatively low impact on surrounding neighborhoods.

Because offices, college campuses and hospitals provide a viable source of pedestrian-oriented consumers, walkable commercial districts are an excellent fit with these land uses. Another popular reason for pedestrian-friendly areas are tourist locations and specialty shopping districts (such as antiques, ethnic goods or art). Areas with appropriate street design and traffic characteristics are excellent places to encourage new pedestrian districts.

Architectural compatibility can help a large retail store, such as this one in Salt Lake City, retain the character and pedestrian scale of the surrounding commercial district.



■ *Development standards*

● *Maximum intensities*

The private sector almost always is the primary engine behind creating a walkable business district. Therefore, it is important to allow enough development intensity to make new development in these areas financially viable. This is especially important in built-up areas where more expensive redevelopment will be the primary method through which change will occur (more in Chapter 4, Reuse and Infill).

● *Minimum intensities*

In vacant areas where a new walkable commercial development should be encouraged, zoning standards should specify either a minimum FAR (preferred) or maximum parking standards to ensure new development is compact enough.

Code Strategies

Envision Utah's website is a source of zoning code strategies for walkable commercial districts. The document "Urban Planning Codes for Quality Growth" is an additional source.

Generally, if a community feels that the underlying zoning in an area is generally appropriate to the allowable land use mix and building sizes and scales, the adoption of a "pedestrian overlay zone" is a straightforward and relatively painless approach to creating the regulatory environment for a walkable commercial district.

A pedestrian overlay zone acts to modify the base zone. Examples of what a pedestrian overlay might include are:

- A set of superseding site design standards such as those listed below:
- Provisions for housing density bonuses.
- Lower parking requirements and a parking credit mechanism.
- Minor modifications to allowable land uses.
- Minimum FAR requirements.

If the overlay zone is used to create wholesale modifications to the underlying zone, a better approach would be to reexamine and modify the base zone itself or change the base zone designation.

Design standards that work

Design standards that are written clearly and unambiguously, based on measurement that can be made on a drawing of the proposed project, tend to be effective on many fronts. First, these standards tend to be more defensible legally and carry more legal weight. Second, they offer developers more certainty about the effect of standards. Often the uncertainty about these effects becomes more problematic to developers than the actual reality of meeting the requirements — making it essential to communicate clearly with the development community. Finally, objective standards are relatively efficient, both in terms of

time and resources, to administer by small or large jurisdictions.

Objective architectural and site design standards for a walkable business district are included in “Model Codes and Ordinances for Quality Growth.” Examples include:

- **PARKING LOCATION:** Parking areas shall be located behind buildings.
- **ORIENTATION:** Buildings shall have their primary orientation toward the street rather than the parking area. This primary entrance must be readily apparent as a prominent architectural component.
- **BUILD-TO LINES:** At least 60 percent of the street frontage shall have buildings within 10 feet of the front property line.

Although it is located on a busy street, this Salt Lake City Starbucks provides pedestrian amenities such as a street front entrance, outdoor seating and landscaped sidewalk.



▶ **Although too much parking can kill walkability, too little stifles business. On-street parking has many advantages. On-street spaces are extremely visible, and they are used more efficiently than off-street spaces.**

This Level 4 Fred Meyer in Seattle, Washington successfully blends into a neighborhood shopping district.

- **WINDOWS AND OPENINGS:** Any wall that is within 30 feet of the main street, plaza or other public open space shall contain at least 50 percent of the wall area facing the street in display areas, windows, or doorways.
- **STREET TREES:** One street tree shall be placed for each 30 feet of frontage for that portion of the development fronting the street.
- **PEDESTRIAN SHIELDS (SYN):** Buildings shall incorporate arcades, roofs, alcoves, porticoes and awnings that protect pedestrians from the rain and sun.

Partnerships

Partnerships are a valuable tool to help spark new, lively, pedestrian-friendly districts or to help create new momentum in an older district. A new project, if successful, can change market perceptions and thereby generate additional private development. In “hot” real estate areas, partnerships also are useful in providing land uses that the market would not provide. One example is housing, including for those with moderate incomes, in areas such as downtown where the market would provide only retail and office development.

Partnerships with groups of existing land and business owners can be used to finance the necessary right-of-way improvements to turn a potentially good walkable district into a great one. An example of a financing mechanism to accomplish this is a Local Improvement District, or LID. LIDs help properties finance needed capital improvements by forming special assessment districts. LIDs permit improvements to be financed and paid for over a period of time instead of in an up front lump sum. These districts have been used in various U.S. cities to finance wider sidewalks with bulbouts, remove medians to make room for on-street parking, and even build modern streetcars. Partnerships are detailed more fully in Chapter 4, “Reuse and Infill.”



Conclusion

As automobile use unquestionably has grown in America over the decades, it has become an everyday part of life for many citizens. Accommodating those automobiles into our communities has been a challenge that many local governments have addressed forthrightly with requirements for street design that accommodate traffic and parking.

This chapter outlined strategies that will accommodate the needs of both cars and pedestrians. The goal is to show that the two needs are not mutually exclusive. Instead, strategies that address both people and cars can mesh together quite well, as many communities are finding successfully. In our efforts to integrate walking back into our communities as one of our primary forms of transportation, we should address the safety, convenience, and amenities needed by pedestrians — just as we have done in past decades for car use. Communities should not feel reluctant to require pedestrian-friendly design in areas where pedestrian activity is expected and encouraged. Street and building design to accommodate pedestrians is as equally justified as parking requirements and traffic accommodating streets — and a bonus is pedestrian requirements tend to be less expensive.

Walking is that vital transportation link that starts and ends every trip, whether it be by car, by transit, or simply a longer walk. If we can successfully bridge the gap between modern business models and pedestrian-friendly design we can build buildings, streets, and communities that accommodate many different means of getting from place to place.

The capacity of a street to move people can be very different depending on the form of travel. Pedestrians, bicyclists and buses occupy much less room than automobiles.



9 Public Safety and Residential Street Design

Introduction

A residential street serves a variety of purposes. These include providing access to homes and properties, the delivery of goods and services, the circulation and movement of vehicles, vehicle parking, allowing opportunities for interaction between neighbors, encouraging pedestrian and bicycle travel, and space for neighborhood amenities such as street trees, sidewalks and lighting that add charm and character to the neighborhood. Residential streets are corridors throughout neighborhoods linking properties and providing space for use by motor vehicles, pedestrians, bicyclists, and other uses. Recognizing the various purposes of residential streets, there should be an awareness that streets must function to meet the needs of the neighborhood. The design of residential streets offers opportunities to achieve a balance between motorized traffic and non-motorized travel with the promotion of an attractive and safe residential setting. These opportunities often focus on reducing the predominance of motorized vehicles, and correspondingly reducing vehicle speeds and traffic volumes.

Residential street design concepts that seek to reduce traffic volumes and traffic speeds are the foundation principles of neighborhood “traffic calming.” This chapter focuses on balancing the purposes of residential streets and achieving a street environment where motorized and nonmotorized travel modes can harmoniously exist.

This chapter also reviews design opportunities to enhance the residential amenities of existing residential streets and identifies appropriate design criteria for new residential street construction. For existing residential streets, the installation of traffic calming measures may be appropriate to lower traffic speeds and volumes. For new residential streets, and to avoid future traffic speeds and volume problems, it may be necessary to modify existing residential street design and construction standards which balance vehicle mobility with the other purposes of the street. Residential street design has a significant influence on vehicle and pedestrian safety and neighborhood quality, stability and desirability.

Figure 1: Residential streets must serve a variety of purposes.



► **One definition of transportation is “the movements of goods and/or people from where they are, to where they have a higher value or want to be.”¹ An efficient transportation system is a prerequisite for the efficient functioning of many social and economic activities.**

Streets and The Neighborhood

The construction of wider and bigger roads has often been a response to meet the demands of the increasing numbers of vehicles within our communities. The construction of wider and bigger roads often means the acquisition of additional road right-of-way (ROW). A lesson learned by many cities is that if insufficient road ROW is available for road widening, additional ROW must be purchased, often at significant costs, which may include the purchase of structures and buildings within the ROW that must then be removed. A national trend has been to build bigger, wider roads to meet the needs of future traffic while still preserving additional ROW. While this may be wise for collector and arterial level roads, it usually only creates additional problems for residential areas. Wider streets mean increased traffic speeds and volumes with accompanying increased traffic noise and the loss of safety in the neighborhood.

A number of surveys indicate that residents believe street noise and heavy traffic in neighborhoods compromise the safety, amenity and quality of the street on which they live.² Other problems reported include:³

Traffic Accidents – The occurrence of accidents, or the fear of accidents occurring on residential streets in the neighborhood. Residents express a desire for

residential streets less prone to accidents.

Noise, Vibration and Air Pollution – These aspects are felt to have a serious negative effect on the quality of life in a neighborhood.

Traffic Speed – Residents object to high traffic speeds because of less safety and increased traffic noise.

Traffic Volume – High traffic volumes are related to other issues including a loss of neighborhood safety and increased noise, vibration and air pollution.

Traffic Composition – As a reaction to noise residents complain specifically of trucks, buses and motorcycles in neighborhoods.

Appearance, Identity, and Maintenance – Increased traffic in residential areas is perceived to detract from the quality and appearance of the neighborhood.

Reduction of Street Activity – With high traffic volumes and associated noise the opportunity for neighbor interaction declines.

Impact on Land Use and Social Stability – High traffic volumes may lead to neighborhood instability and encourage land use changes to commercial and other nonresidential uses.

Neighborhood Crime – Streets with greater auto accessibility may be more susceptible to residential crime.

Figure 2: A major residential street located in Salt Lake City providing center medians, street trees, on-street parking and bike lanes.



Residents' concerns with traffic on residential streets seem to indicate a conflict between the expectations of vehicle drivers on the street and the expectations of those who live on the street.⁴ "Residential street designs that promote moving vehicles over the other purposes of the street add to the potential for conflicts between the vehicle and the other residential values and amenities provided by the street."⁵

Balancing the Purposes of Residential Streets

Moving cars and trucks will always be a purpose of roads and highways. However, for residential streets, the recognition should be that cars and people share the space of the street.

The safest way for vehicles and non-motorized travel to exist together is to minimize their interaction using various techniques such as grade separation and other barriers that eliminate interaction between the different travel modes. While philosophically easy, the reality is there will always be a need for interaction. Whether crossing at a signalized intersection, or walking from the store to the car in a parking lot, vehicles, pedestrians and bicyclists will interact. To minimize vehicle, pedestrian and bicyclist conflicts it is necessary to consider and identify conflict solutions at several levels. These may include:

Education

Promotion of the concept that vehicles, non-motorized travel, and residents share the street. This may be achieved through community awareness campaigns including signage, advertising, public radio and television announcements. It is important that drivers of motorized vehicles be aware that others use the street and understand the needs of pedestrians and bicyclists using the street. Similarly, pedestrians and bicyclists must be aware of their environment. Accidents often occur because pedestrians and bicyclists do not obey traffic signals or do not look before crossing. Both groups must be aware of the other.

Minimizing Interaction

By reducing street crossing widths, for example, the interaction time between vehicles and pedestrians is reduced. Studies have shown that shorter crossing distance correlates to fewer accidents. A reduction in street crossing distances can be achieved by reducing the curve radius and cross-section of the residential street.

Visibility

Drivers typically expect pedestrians at intersections. For areas where pedestrians may be present, methods to improve driver awareness and the visibility of the pedestrian are important. While signing is the oldest method to inform drivers of a pedestrian crossing, drivers often become desensitized to signs, reducing their effectiveness. Actuated signage provides a dynamic indication when a

► **The Institute of Transportation Engineers (ITE) has defined “traffic calming” as “a combination, of usually physical measures, that reduce the negative effects of motor vehicle use, alter driver behavior, and improve conditions for non-motorized street users.”⁸**

pedestrian is in the area. In Boulder, Colorado, for example, dynamic flashing devices located on pedestrian cross walk signs and in-ground pavement lights are activated by pedestrians. Dynamic signage and messaging is effective in improving driver awareness to the presence of pedestrians. Other techniques of dynamic messaging to increase pedestrian visibility and driver awareness include the use of crossing flags by pedestrians and crossing guards.

Reducing Speeds

The ability of a vehicle to stop is related to its speed. If a vehicle’s speed can be reduced by 50%, the distance necessary to stop can be reduced by as much as 200%. Reducing vehicle speeds is critical to making residential streets safer.⁶

For residential streets, a variety of options are available to allow a more harmonious environment for both vehicles and pedestrians. There is a need to balance residential traffic flow with local access and non-motorized travel. The approaches to balance the needs of the vehicle with the other purposes of the street often focus on techniques to reduce vehicle speeds and volumes. For residential streets, actions directed at reducing vehicle speeds and volumes are identified as “traffic calming.”

Residential Streets and Neighborhood Design - History

Traffic calming is defined as being “any action or program that reduces street traffic and slows vehicles within residential areas and makes neighborhoods safer and more people oriented.”⁷ Traffic calming seeks to reduce traffic speeds and volumes to an “acceptable level.”⁹ For the residential street, reductions in vehicle speed and volume can lead to other benefits such as increased pedestrian activity, street safety and street life. Traffic calming techniques focus not only on improving the overall safety and livability of new residential streets, but also on identifying options to improve the safety and residential values of existing residential streets. Traffic calming concepts also encourage nonmotorised mobility in the neighborhood and the replacement of some vehicle trips with non-vehicle trips.

Early traffic calming techniques sought to promote pedestrian amenities and safety. By the 1930’s, newly developing residential areas sought to enhance the safety of residents living on the street.¹⁰ Perry, for example, writing in the early 1930’s, suggested that “children should never be required to cross a main traffic street on the way to school.”¹¹ By the early 1950’s, several communities in the US, including Montclair, NJ,

Grand Rapids, Michigan, and Berkeley, California had installed traffic volume and speed reducing devices to protect residential neighborhoods from increasing vehicle speeds and volumes.¹²

In the 1970's, the Netherlands sought to take back the residential street from the exclusive use of the automobile and identified the concept of "shared space." Shared space is that place where residents and the automobile seek to co-exist.¹³

In the 1970's, Seattle, Washington, commenced experimenting with traffic calming devices in an effort to reduce traffic volumes in residential neighborhoods. Included in this testing was the Stevens neighborhood of Seattle, where various traffic control devices were installed in an effort to reduce cut-through traffic in the neighborhood. With the installation of a variety of permanent traffic control devices the Stevens neighborhood experienced significant reductions in traffic volumes, a fifty-six percent (56%) decrease in neighborhood traffic, and a corresponding and dramatic decrease in neighborhood traffic accidents.¹⁴

According to the Federal Highway Administration (FHWA), the objectives of traffic calming include:¹⁵

- Reductions in vehicle speeds.
- Safe and pleasant conditions for motorists, bicyclists, pedestrians, and residents.
- Improvements in the environment and livability of neighborhood streets.
- Improvements to the real and

perceived safety for non-motorized users of streets.

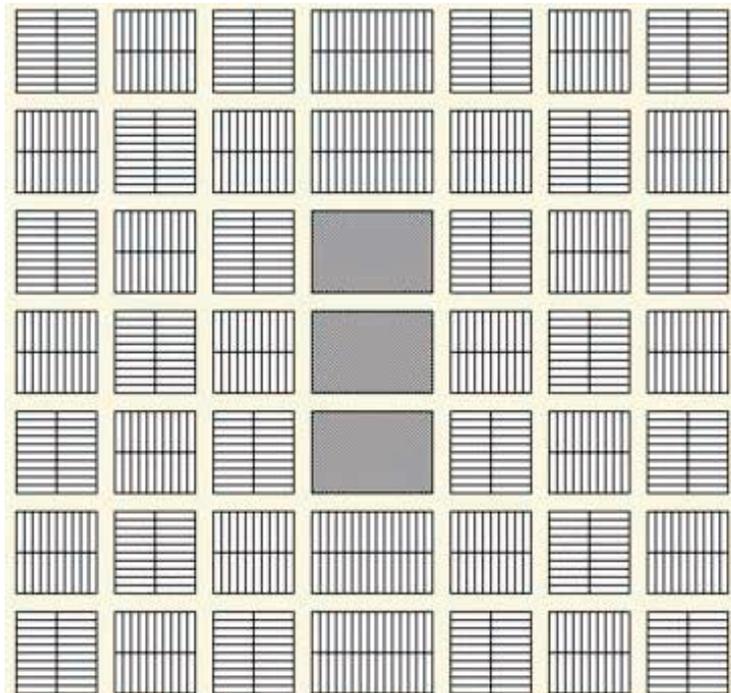
- Discouraging the use of residential streets by cut through vehicular traffic.

Residential Streets in Utah

Utah communities typically have a street pattern based on the historic grid pattern. As originally planned, the design for Utah communities required that street ROW be 132 feet wide, bordering city blocks of 10 acres, measuring 660 feet square. The community and street pattern required that the length of each block did not exceed five (5) times the street width.¹⁶

Commencing with Salt Lake City in 1847, these community design

Figure 3



principles have now been applied, in some form, in virtually every Utah community. Although the width of blocks and street rights-of-way (ROW) may vary, the grid street pattern, at some scale, is the predominant development pattern of Utah communities.

The great advantage of the historic grid street pattern is that it disperses traffic and provides many direct routes of travel.¹⁷ Because of these advantages, grid street systems encourage walking and biking. The contemporary residential street pattern in Utah communities today however typically employs large blocks, curvilinear streets, and a branching street pattern. These street systems seek to encourage lower traffic volumes. Both street patterns have advantages and disadvantages for traffic flows, pedestrian and biking activities and neighborhood safety and livability.

Many communities are now seeking to combine the advantages of the grid pattern and curvilinear residential street pattern. A residential street design pattern is emerging that includes the connectedness and direct routes of the grid system with the safety of the contemporary system.¹⁸

Providing safe residential streets in Utah is particularly important. Utah ranks first in the nation with the highest proportion of children in the population. Approximately 33% of the residents of a community are 0-17 years. The available forms of independent travel for this age group is either walking or biking. If Utah communities do not provide safe routes for walking and bicycling, a large proportion of

the population are unsafe as they walk and bike within their community, or they must rely and become dependent upon parents, or others, for transportation.

Narrower Residential Streets

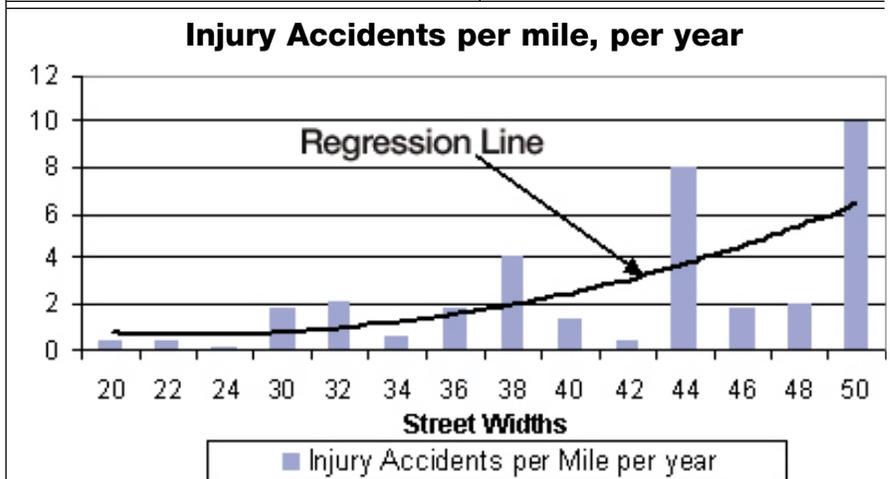
Narrower residential streets than generally accepted today were allowed in Utah communities at an earlier period. Many older, and some of the most desirable residential areas within Utah communities, were laid out with relatively narrow streets. This trend continued up to the early 1940's and 1950's when requirements for wider residential street ROW and pavement widths became the norm.

Several national organizations including the American Society of Civil Engineers, The National Association of Home Builders, and the Urban Land Institute are questioning the wisdom of communities continuing to require wide residential streets. "The tendency of many communities to equate wider streets with better streets and to design traffic and parking lanes as if the street were a 'micro freeway' is a highly questionable practice."¹⁹ The design of a residential street that recognizes the various purposes of the street may occasionally require one driver to slow down or even pull over to let an oncoming vehicle pass. Residential streets should be

designed to have a human scale where pedestrians and residents feel “comfortable” on the street. Residential streets, which define the space for use by vehicles, and which must be crossed by pedestrians, should not be larger than is actually required. Wider streets than required to support local residential traffic also add to the long term street maintenance costs incurred by the community. Existing research demonstrates that vehicle speeds decline as street cross sections are narrowed. Working in the City of Longmont, Colorado, Swift and Associates looked at 20,000 automobile accident reports. The study, “Residential Street Typology and Injury Accident Frequency” determined that “the most significant causal relationships to injury and accident was street width and street curvature.”²⁰ Accidents per mile per year exponentially increased with increasing street widths. Swift and Associates, using the accident information from Longmont, Colorado determined that the safest residential street width is 24 feet (measured from curb face). On the narrower streets, 20 and 22 feet, the number of accidents reported was low, but because a number of these streets were “half streets” other factors potentially contributed to accidents, independent of street width. (The results of the Swift and Associates study for streets narrower than 24 feet remain as inconclusive.) Figure 4 provides a summary of the findings of “Residential Street Typology and Injury Accident Frequency.”

Pedestrian activities on narrow streets are also encouraged. “More elderly users, more people out walking pets, and more pedestrians crossing back and forth all attest to a level of comfort with traffic on narrow streets.”²¹ With the accompanying neighborhood benefits of narrower residential streets and the knowledge that wide residential streets encourage higher traffic volumes and speeds, resulting in less safety on the street, why have communities not universally accepted narrower residential streets? One answer may be that many neighborhood streets are designed for infrequent access by large vehicles, including trucks and emergency vehicles. Other communities may be concerned about encouraging activities on the residential street, including walking, jogging, and bicycling that may raise liability issues. Street designers may also design the residential street from the “center-line out” and often simply run out of available street ROW before bike lanes, sidewalks, landscape areas and other residential amenities are provided.²²

Figure 4



Swift and Associates, “Residential Street Typology and Injury Accident Frequency.”

► **“Bicycle and pedestrian ways shall be established in new construction projects and reconstruction projects in all urbanized areas with few exceptions.”⁷²**

Recognizing the benefits of narrower residential street designs, communities across the nation are now revising residential street standards to require narrower street pavement widths and designing the street to accommodate everyday use, while still protecting emergency vehicle access.²³ It is interesting to note that with the need remaining to provide emergency vehicle access, residential street designs in British and Australian communities allow, or require, narrower pavement widths and tighter curve radii than typically allowed in US communities.²⁴

The benefits to a community of allowing narrower residential streets include:²⁵

- Increasing vehicular and pedestrian safety, and encouraging bicycling and walking as a viable transportation method.
- Adding to the safety, amenity and value of the neighborhood.
- Encouraging efficiencies in land use, and allowing areas that would have been paved to provide space for other uses and activities, including landscaping and sidewalks.
- A reduction in water runoff, and pollution, with less hard surfacing.
- A reduction in street maintenance costs.
- Reductions in the initial street construction costs.

Some of the community initiatives for safer residential streets include:

- Requiring narrower pavement widths to create a sense of place.
- Requiring street amenities and furniture, such as benches and pedestrian-scale street lighting.
- Providing wider park strips to encourage the establishment of large street trees.
- Requiring roundabouts at higher volume intersections, and requiring short curve radius, bends, and other slow points in the residential area.
- Providing necessary street connections, bicycle and pedestrian access.
- Establishing maximum block and cul-de-sac lengths.

A consideration of narrower residential streets should occur within the context of total street design, ensuring the purposes of the street continue to be met.

Options for Street Design to Enhance Safety

Peaceful, quiet residential streets and neighborhoods are the desires of citizens. To achieve these goals the design of the residential street should place a priority on moving low levels of traffic in an environment of quiet and safety. Improving the residential amenity of the residential street can be strengthened if it is treated as a residential place, with amenities being provided for

pedestrian use, such as adequate and connected sidewalks, street trees, pedestrian scale signage and lighting, benches and other features. Priority should be given to the non-motorized forms of travel and the residential setting in which the street is located. Any negative effects to the residential setting, as the result of traffic, should only be allowed to the extent such traffic is necessary to support the neighborhood.²⁶

A reduction in traffic speeds and volumes is key to making residential streets safer. Traffic calming techniques can assist in achieving traffic speed and volume reductions. Traffic calming techniques can be broadly classified as:²⁷

- Physical Methods, including speed bumps, speed tables, traffic diverters, narrower street widths, short road lengths, traffic circles and roundabouts. Physical traffic calming methods are “self-enforcing” and generally do not require enforcement.
- Streetscape Enhancements, that impose the feeling of narrower lane and street widths by the use of street edge and landscaping treatments. Streetscape enhancements, such as street tree plantings, also usually seek to improve the attractiveness of the residential environment and the aesthetic values of the street.
- Regulatory Techniques, such as signs including stop, yield or speed signs. Regulatory techniques provide the advantages of a low capital cost but they require enforcement to be truly effective in reducing traffic speeds.

Examples of Traffic Calming Devices²⁸

Bike Lanes – A portion of a roadway which has been designated by striping, signing, and pavement markings for the preferential or exclusive use of bicyclists.



Bulbouts/Neckdowns/Chokers – Curb extensions at intersections that reduce curb-to-curb roadway travel lane widths.



Center Islands – Raised islands located along the centerline of a roadway that narrow the width at that location.



Chicanes/Lateral Shifts – Curb extensions that alternate from one side of the roadway to the other, forming s-shaped curves.



Forced Turn Lanes – Raised islands located on approaches to an intersection that block certain movements.



Closures – Barriers placed across roadways to completely close through vehicle traffic.



Median Barriers – Raised islands located along the centerline of a roadway and continuing through an intersection to block cross traffic.



Diverters – Barriers placed diagonally across an intersection, blocking certain traffic movements.



Realigned Intersections – Changes in alignments that convert T-intersections with straight approaches into curving roadways meeting at right angles.



Roundabouts / Traffic Circles – Barriers placed in the middle of an intersection, directing all traffic in the same direction.



Speed Bumps – Rounded raised pavement devices placed across roadways to slow and/or discourage traffic.



Speed Tables/Textured Pavement/Raised Crossings – Flat-topped speed bumps often constructed with a brick or other textured material to slow traffic.



Making Residential Streets Safer

Residential street designs that promote and maintain low traffic volumes and speeds will encourage the safety and attractiveness of residential areas.

Traffic Speeds

Reducing vehicle speeds on residential streets will increase safety on the street. By reducing vehicle speeds, shorter vehicle stopping distances are required and the driver has more time to respond to any vehicle, pedestrian, bicycle or other movements occurring on the street. Slower vehicle design speeds should be required on residential streets in order to encourage a street environment conducive to all forms of transportation, including all non-motorized and motorized transportation modes.

Table 1 highlights required stopping distances at selected vehicle

Table 1: Speed, Reaction Time and Required Stopping Distances

Speed (mph)	Total Perception and Reaction Distance (feet)	Required Stopping Distance (feet)	Total Required Stopping Distance (feet)
10	37	8	45
15	55	18	73
20	73	33	106
25	92	55	147
30	110	86	196
35	128	120	248
40	147	167	314

ITE, "Traditional Neighborhood Development – Street Design Guidelines."

speeds.²⁹ Stopping distances increase dramatically as vehicle speeds increase. For example, total required stopping distance increases from 106 feet to 248 feet (an approximate 230% increase) when vehicle speed increase by 75% from 20 miles per hour (mph) to 35 mph (Table 1). Clearly, vehicle speed has a significant effect on the safety of both motorized and nonmotorized users on the street.

Traffic Volumes

The number of traffic accidents occurring on the street is closely related to traffic volume. As traffic volume increases, more accidents are expected. For residential streets, traffic volumes should be low to increase safety for all users and the residential qualities of the street.

Transportation is a response to development and therefore traffic volumes increase because of adjoining land uses. Proper land use planning in residential areas understands the land use – transportation relationship. Permitting only land uses and activities on residential streets with low trip generation potentials, limiting street access points, and requiring a street designed for low traffic volumes will protect the functioning of the residential street, minimize neighborhood cut-through traffic, and preserve residential values.

Accidents

During 1999, 83,000 pedestrian-vehicle accidents occurred in the

United States, accounting for 12% of fatalities occurring on US roads.³⁰ Of the 83,000 pedestrian-vehicle accidents in 1999, 20,000 or nearly 24% resulted in incapacitating injuries. Children under 16 years of age killed in pedestrian-vehicle accidents represented 12% of the deaths while the elderly, over 65 years, represented 22% of the deaths occurring in pedestrian-vehicle accidents. Pedestrians struck by a car traveling at 40 mph have a 15% survival rate. At 30 mph survival increases to 55% and a pedestrian struck by a car, moving at 20 mph, has a 95% chance of survival.³¹ A reduction in traffic speeds on residential streets has a dramatic influence on pedestrian safety.³² The influence of traffic speed on street safety is identified in Table 1, related to required vehicle stopping distances.

In Utah for 1991 - 2000, vehicles hit 8,610 pedestrians (54% were children 0-19 years) with 398 pedestrians killed.³³ Approximately 36% of those killed were children 0 - 19 years old. (The loss of children in vehicle – pedestrian accidents in Utah, 1991 - 2000, was twice (2x) the national average.) The majority of the vehicle - pedestrian accidents occur on two (2) lane streets, relatively close to home.

There were 7,755 vehicle - bicycle accidents, 1991 - 2000, in Utah, with 71 bicyclists killed. The majority of bicyclists killed or injured were children (0 - 19 years). Of those injured 68% were children 0 - 19 years.³⁴

Fire and Emergency Medical Services

Recognizing the goal of providing low traffic volumes and low traffic speeds on residential streets, residential street designs must continue to allow necessary access for emergency vehicles. Traffic calming measures that are effective in reducing traffic speeds can have the same effect on responding emergency vehicles. The concerns of fire and emergency medical agencies with residential street designs that aim to reduce traffic volumes and speeds can be summarized as: (1) potential effects on response times, and (2) effects on the mobility and maneuverability of fire apparatus at the incident scene.³⁵

While recognizing the values of traffic calming for increased safety in neighborhoods, fire departments are concerned about any traffic management action that may slow or inconvenience fire equipment and ambulance services. The larger and heavier vehicles used by fire departments must slow down more than private passenger vehicles and light trucks in order to negotiate a number of traffic calming devices.³⁶ Traffic calming devices, such as traffic humps and bumps, can also have a slowing effect on ambulances transporting patients.

Impacts on Fire Department Response Times

Fire response time is the time from when the fire call is first received by a dispatcher to the commencement of fire extinguishing operations at the scene.³⁷ Response time has a relationship to accomplishing actions related to saving lives and limiting property damage. Residential street patterns and designs can affect response times. The results of studies identifying the impacts of traffic calming actions on response times are presented in Table 2.

Communities where residential streets are designed to encourage lower traffic volumes and speeds have found that effects on emergency vehicle response times can be minimized by certain actions.³⁸ These include:

- 1] Close consultation with emergency response personnel in any residential traffic plan.
- 2] Providing that physical barriers are traversable by emergency vehicles.
- 3] Requiring that any primary response routes remain open.
- 4] Providing additional fire hydrants within the residential area and adjacent to any physical barriers.
- 5] Requiring multiple access routes in neighborhood street patterns.

► **Get to know your Fire Chief! Over the last decade, many designers, engineers, developers, local officials, emergency response personnel, and neighborhood residents have found themselves struggling over seemingly competing objectives when it comes to good street design. Ultimately, however, among the many values at stake in street design, public safety always emerges as the final arbiter. But even within this incontestable objective, a conflict has emerged that has only recently been thoroughly defined and studied, and is starting to be addressed: the seeming conflict lies between the need for rapid emergency responses to any location and achieving slow, safe everyday neighborhood streets.⁷³**

Fire agencies are also concerned with street designs that narrow street pavement widths. Many Fire Departments fear that narrow residential streets will also negatively effect response times and the ability of the Fire Department to establish fire suppression activities at the scene. The Uniform Fire Code, Section 902, requires that “fire apparatus access roads... shall have an unobstructed width of not less than 20 feet.”³⁹ Fire access roads are to be constructed to provide an all-weather surface (*Uniform Fire Code, Section 902.2.2.2*). The Uniform Fire Code, Section

902.2.4.1, provides further clarification and identifies that required fire accesses shall not be obstructed “in any manner, including parking of vehicles.” Clearly, the Uniform Fire Code requires that no residential street, providing fire access, would be less than 20 feet wide, and constructed to provide an all-weather driving surface.

Designing the street for the occurrence of on-street parking and assuming a width of a full size car to be 6 feet, a minimum street width of 26 feet (curb face to curb face) is sufficient to accommodate on-street parking and comply with the requirements of the Uniform Fire Code. A residential street pattern designed with low volume streets and multiple accesses to all properties can improve emergency vehicle response times from those achieved with contemporary street patterns with limited access points to properties.

Many Fire Departments are recognizing the value of narrower residential street designs. Boulder, Colorado, for example, has revised their neighborhood street standards to allow residential streets 26 feet wide with on-street parking.⁴⁰ In Portland, Oregon, various modifications have occurred to allow residential street designs, identified as “queuing streets,” and allowing 26 feet street widths with parking allowed on both sides of the street.⁴¹

During the study period of “Residential Street Typology and Injury Accident Frequency” there was one serious fire and a number of smaller fires. No injuries or fire equipment access problems were

Table 2: Fire Response Times and Selected Traffic Control Devices

VEHICLE*	DEVICE A Time Delay (seconds)	DEVICE B Time Delay (seconds)	DEVICE C Time Delay (seconds)
Engine 18	1.7	2.3	4.3
Rescue 41	0.0	1.7	2.3
Squad 1	1.0	4.1	2.4
Truck 1	1.4	4.9	6.4
Truck 4	3.4	4.9	6.2
Truck 41	4.8	4.7	5.2

Summarized from *The Influence of Traffic Calming on Emergency Response Times*, ITE Journal, August 1997, Crystal Atkins and Michael Coleman.

Notes:

1. a. Device A = 22 foot Speed Bump; Device B = 14 feet Speed Bump; Device C = Traffic Circle
2. Delay is calculated with the desire to maintain a 30 mph Response Speed.
Time Delay is the additional time required to respond due to the traffic control device. As a comparison, stop signs can add an additional 6 to 11 seconds to Response Time depending on the type of response vehicle.
3. Table 3 identifies Fire Vehicle Specifications

Table 3: Fire Vehicle Specifications

VEHICLE	TOTAL LENGTH (ft)	WHEELBASE (ft)	WEIGHT (lbs)	HORSEPOWER (HP)
Engine 18	29'10"	15"5"	34,860	185
Rescue 41	21'0"	11"6"	Na	185
Squad 1	27'0"	14'6"	23,170	275
Truck 1	48'0"	21'0"	53,000	450
Truck 4	57'0"	13'0"	53,960	450
Truck 41	37'6"	16'9"	42,100	350

The Influence of Traffic Calming on Emergency Response Times, ITE Journal, August 1997, Crystal Atkins and Michael Coleman.

reported, with the serious fire located on a 28 foot wide street.⁴² For the study period there were a total of 227 automotive accidents with injuries reported. “Residential Street Typology and Injury Accident Frequency” identifies that “0.32 automotive injury accidents can be anticipated per year per mile on a 24 foot-wide street, compared to 1.21 on a 36 foot-wide street.” “Even if narrow streets did create a moderately greater fire injury risk, they would be safer than wide streets, because the risk of automotive injuries is so much greater than fire injuries.”⁴³

However, information from Minneapolis, Minnesota, does not support these concerns.⁴⁵ In Minneapolis residential blocks with lower accessibility, a characteristic typical of locations where calming is established, experienced lower residential crime rates than residential areas with greater accessibility, with similar crime-related social variables.⁴⁶ A study conducted in Berkeley, California, with various traffic calming devices reported that traffic control devices did not negatively affect police surveillance in residential areas.⁴⁷

Figure 5: Providing emergency vehicle access (25 foot pavement).

Police Services

Police Departments usually express no opposition to traffic calming devices and residential streets designs to reduce traffic volumes and speeds because of the corresponding increase in street safety. Sometimes however, concerns are expressed with any physical barriers that minimize or eliminate access. The concerns of police agencies to traffic calming initiatives may be categorized as;

- 1) Physical barriers increase the difficulty of police surveillance by adding obstacles to access.
- 2) Traffic barriers hamper police pursuits.
- 3) Barriers can negatively affect police response times to calls for service.⁴⁴





Figure 6: Residential street (26 foot pavement).

Figure 7: Residential streets must provide for a variety of vehicles.



Crime

A reduction in neighborhood crime should also be a goal of residential street designs. Studies conducted in Hartford, Connecticut and St. Paul, Minnesota indicates that the incidence of street crime is reduced in neighborhoods with street patterns and designs that reduce traffic volumes.⁴⁸

Crime Prevention Through Environmental Design (CPTED) suggests that crime can be reduced in neighborhoods by designing residential streets to encourage surveillance by residents and others of the street space (“eyes on the street”) and to create difficulties for entry and escape from the area. Residential street designs that encourage street activity and resident interaction, minimize neighborhood cut-through traffic, and provide complexity in the street pattern also discourage neighborhood crime.⁴⁹

Noise

Traffic speeds and traffic noise are directly related. Experience indicates that lower traffic speeds will also lower traffic noise.⁵⁰ As a rule, resulting traffic noise is related to the square root of traffic speed. Residential street designs that lower traffic speeds will have a significant effect on reducing traffic noise in the neighborhood.

Traffic calming measures designed to reduce vehicles speeds will generally have the effect of reducing neighborhood noise levels. However, increased noise levels have been reported with some vertical deflection devices, such as humps and bumps, due to vehicle noise associated with traveling over the device and vehicle acceleration after the device.

Snow Removal

Some traffic calming actions may have an effect on the winter removal of snow and ice. Coordination with road maintenance and snow removal operators on traffic calming strategies will ensure any negative effects on snow removal are minimized and snow removal operations perform efficiently.

A number of communities, located in snow areas, have successfully incorporated traffic calming measures into traffic management and road maintenance programs.

Effects of the Traffic Calming Devices to Reduce Traffic Speeds and Volumes

While traffic calming is recognized as being a method for reducing speeds and volumes, it is appropriate to consider the effectiveness of the various traffic calming techniques. Some of the very questions of how and where to apply traffic

calming were asked and answered in a August, 1997 Institute of Transportation Engineers (ITE) Journal article entitled “Urban Traffic Calming Treatments: Performance Measures and Design Conformance.”⁵¹ The article sites the various traffic calming devices and their conformance to the national guidelines from an opera-

Table 4: Influences of Traffic Calming Devices

DEVICES	DIRECT TRAFFIC EFFECTS						
	Volume Reductions	Speed Reductions	Directional Control	Change In Vehicle Mix	Noise	Safety	Emergency & Service Access
Physical Controls							
Speed Bumps	Possible	Inconsistent	Unlikely	Unlikely	Increase	Adverse effects	Some problems
Undulations	Possible	Yes	Unlikely	Unlikely	No change	No problems documented	No problems documented
Rumble Strips	Unlikely	Yes	Unlikely	Unlikely	Increase	Improved	No problems
Diagonal Diverters	Yes	Likely	Possible	Possible	Decrease	Shifts Accidents	Some constraints
Intersection Cul-De-Sac	Yes	Likely	Yes	Possible	Decrease	Shifts Accidents	Some constraints
Midblock Cul-De-Sac	Yes	Likely	Yes	Possible	Decrease	Shifts Accidents	Some constraints
Semi-Diverter	Yes	Likely	Yes	Possible	Decrease	Shifts Accidents	Minor constraints
Forced Turn Channelization	Yes	Likely	Yes	Possible	Decrease	Improved	Minor constraints
Median Barrier	Yes	On curves	Possible	Possible	Decrease	Improved	Minor constraints
Traffic Circle	Unclear	Minor	Unlikely	Possible	Little change	Questionable	Some constraints
Chokers and Road Narrowing	Rare	Minor	Unlikely	Unlikely	Little change	Improved ped. crossing	No problems
Passive Controls							
Stop Signs	Occasional	Site reduction	Unlikely	Unlikely	Increase	Mixed results	No problems
Speed Limit Signs	Unlikely	Unlikely	Unlikely	Unlikely	No change	No change	No effect
Turn Prohibition Signs	Yes	Likely	Yes	Possible	Decrease	Improved	No effect
One-Way Streets	Yes	Inconsistent	Yes	Possible	Decrease	Possible imp.	No effect
Perception Controls							
Transverse Markings	No change	Yes	No effect	No effect	Possible red.	Possible imp.	No effect
Crosswalks	No effect	Unlikely	No effect	No effect	No effect	Ineffective	No effect
Odd Speed Limit Signs	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Novelty Signs	No effect	Undocument.	No effect	No effect	Unlikely	No effect	No effect

Federal Highway Administration, 2000

tional approach. A Federal Highway Administration (FHWA) report on “Improving Residential Street Environments” also addressed the issues of effectiveness.⁵² Quantifiable results of the traffic calming

impact on speeds, volume and safety are also identified. Table 4 and Table 5 provide information on the effects of various traffic calming devices.

Table 5: Other Characteristics of Traffic Calming Devices

OTHER CHARACTERISTICS

DEVICES	Construction Efforts & Cost	Landscape Opportunity	Site or System Use	Maintenance & Operational Effects Index
Physical Controls				
Speed Bumps	Low	None	Both	Snowplow problems
Undulations	Low	None	Both	No problems noted
Rumble Strips	Low	None	Site	Snowplow problems
Diagonal Diverters	Moderate to high	Yes	Usually system	Vandalism
Intersection Cul-De-Sac	Moderate to high	Yes	Both	Vandalism
Midblock Cul-De-Sac	Moderate to high	Yes	Both	Vandalism
Semi-Diverter	Moderate to high	Yes	Both	Vandalism
Forced Turn	Moderate	Possible	Both	No unusual problems
Channelization				
Median Barrier	Moderate	Possible	Both	No unusual problems
Traffic Circle	Moderate to high	Yes	Both	Vandalism
Chokers and Road Narrowing	Moderate	Yes	Both	No unusual problems
Passive Controls				
Stop Signs	Low	No	Both	No unusual problems
Speed Limit Signs	Low	No	Site	No unusual problems
Turn Prohibition Signs	Low	No	Both	No unusual problems
One-Way Streets	Low	No	Usually system	No unusual problems
Perception Controls				
Transverse Markings	Low	No	Site	No unusual problems
Crosswalks	Low	No	Site	No unusual problems
Odd Speed Limit Sign	Low	No	Site	Vandalism
Novelty Signs	Low	No	Site	Vandalism

Federal Highway Administration, 2000

A similar method for identifying the effectiveness of the various traffic calming techniques is shown in Table 6 provided from the Pennsylvania Department of Transportation.⁵³

Table 6: Effectiveness of Traffic Calming Techniques

	Volume Reductions	Speed Reduction	Conflict Reduction	Emergency Response
Horizontal Deflection				
Bulb-out/curb extension	□	▲	▲	□
Chicane	▲	▲	□	▲
Gateway	□	□	□	□
On-street parking	□	▲	□	▲
Raised median island/pedestrian refuge	□	▲	▲	□
Traffic circle	▲	▲	■	▲
Vertical Deflection				
Textured crosswalk	□	□	□	□
Speed hump	▲	■	▲	■
Raised crosswalk	▲	■	▲	■
Raised intersection	□	▲	▲	■
Physical Obstruction				
Semi-diverter	■	▲	▲	▲
Diagonal diverter	■	▲	▲	▲
Right-in/right-out island	▲	□	▲	▲
Raised median through intersection	■	□	▲	■
Street closure	■	▲	■	■
Signing and Pavement Markings				
Speed limit signing	□	▲	□	□
Multi-way stop control	□	▲	▲	▲
Turn prohibitions	▲	□	▲	□
One-way streets	■	□	▲	▲
Commercial vehicle prohibitions	▲	▲	□	□
Roadway narrowing with edge lines	□	▲	□	□
Transverse markings	□	▲	□	□

Minimal or no effect □ Moderate effect ▲ Significant effect ■

Quantifiable benefits of various calming techniques including reductions in speed and volume and accidents are shown. Table 7 shows the benefits from empirical information collected at locations throughout the US.

Table 7: Effects of Traffic Calming Measures on Speed, Volume and Safety

Speed Impacts of Traffic Calming Measures

	Sample Size	85th Percentile Speed Afterward (mph)	Average Change in 85th Percentile Speed (mph)	Average % Change
12' Humps	179	27.4	-7.6	-22%
14' Humps	15	25.6	-7.7	-23
22' Tables	58	30.1	-6.6	-18
Longer Tables	10	31.6	-3.2	-9
Raised Intersections	3	34.3	-0.3	-1
Circles	45	30.2	-3.9	-11
Narrowing	7	32.3	-2.6	-4
One-Lane Slow Points	5	28.6	-4.8	-14
Half Closures	16	26.3	-6.0	-19
Diagonal Diverters	7	27.9	-1.4	-0

Volume Impacts of Traffic Calming Measures

	Sample Size	Average Change in Volume vehicles per day	Average % Change
One-Lane Slow Points	5	-392	-20%
Full Closures	19	-671	-44
Half Closures	53	-1611	-42
Diagonal Diverters	27	-501	-35

Safety Impacts of Traffic Calming Measures – Average Number of Collisions

	Number of Observations	Before Treatment	After Treatment	% Change in Collisions
12' Humps	49	2.7	2.4	-11%
14' Humps	5	4.4	2.6	-41%
22' Tables	8	6.7	3.7	-45%
Circles	17	5.9	4.2	29%

Revised from Traffic Calming State of the Practice, ITE/FHWA, August 1999

Residential Street Designs in New Developments

Recognizing that residential streets are used for variety of purposes, it could be expected that the design of new residential streets would balance the purposes of residential streets. However, the majority of streets in new residential areas and contemporary street designs require residential streets with the primary goal of moving traffic. Many Utah communities continue to require minimum street pavement widths greater than required to support the needs of local traffic. Many Utah communities typically require street pavement widths of 36 feet, or more, for local residential streets.

► **Great towns, villages and cities in all parts of the world are based on simple, easily understood principals. The people who built these great places had ordinary minds. They worked as much from common sense and their hearts as anything else. Once we understand these principals, we know what kind of streets to provide.**⁷³

The Wilmington Delaware Area Planning Council (WILMAPCO) provides an example of a local initiative to identify a residential street design that recognizes and balances the purposes of the residential street.⁵⁴ The Wilmington Delaware Area Planning Council has recommended residential street design standards for communities within their area based on the following design criteria:

- A design speed of 20 mph.

- The residential street design vehicle is a 266-inch wheelbase school bus.
- Local residential street designs should recognize the needs of pedestrians.

Based on these design criteria, Table 8 highlights how the WILMAPCO design standards deviate from the American Association of State Highway and Transportation Officials (AASHTO) guidelines.

**Table 8: Wilmington Area Planning Council
Residential Street Design Recommendations**

Design Standard	AASHTO Local Urban Street Standard	WILMAPCO Local Street Standard	Rationale for WILMAPCO Standard
Design Speed	20-30 mph	20 mph	20 mph is safe for pedestrians and is acceptable to most residents. 30 mph is not.
Right-of-Way Width	50 feet	41 feet	41 foot right-of-way is consistent with individual cross sectional elements.
Pavement Width	26 feet	18 feet	One clear travel lane is sufficient on streets carrying less than 500 vehicles per day. On street parking on only one side is sufficient with ample off-street parking.
Travel Lane Width	9-12 feet	9 feet	Equals AASHTO minimum.
Pavement Edge Treatment	Normally 4 inch to 9 inch vertical curb	6 inch or 8 inch vertical curb	Greater than AASHTO standard. Higher curb discourages parking on planter strips and enhances pedestrian safety

Design Standard	AASHTO Local Urban Street Standard	WILMAPCO Local Street Standard	Rationale for WILMAPCO Standard
Horizontal Curve Radius	100 foot minimum	90 foot minimum when curve is unsigned. 45 foot minimum curve is signed as a traffic calming measure.	Less than AASHTO standard. Sufficient for the design vehicle.
Vertical Curve Length	60 foot minimum at the 20 mph design speed.	Same as AASHTO when curve is unsigned. When signed as a traffic calming measure and marked - no requirement.	Proposed standard exempts AASHTO standard in traffic calming situations.
Sidewalks	On both sides of streets used to access schools, parks, etc. On one side in other locations.	On both sides of streets with densities 2 plus units per acre. On one side at densities 1-2 units per acre.	A small cost increment to enhance pedestrian amenity.
Sidewalk Width	4 foot minimum	5 feet with planting strip. 8 feet without planting strip.	5 foot width is comfortable for pedestrians walking in pairs and passing other pedestrians. Provides greater separation for traffic with no planter strip.
Planting Strip Width	2 foot minimum	5 foot minimum	Normal minimum to sustain street trees and provides adequate separation between pedestrians and vehicles.
Corner Radius	15 foot minimum	25 feet (local-local) 30 feet (local-collector) 40 feet (local-collector without parking lane).	Greater than AASHTO standard to accommodate design vehicle.

Wilmington Delaware Area Planning Council

Of particular interest in the Wilmington Delaware Area Planning Council (WILMAPCO) recommendations is the recommendation for residential street pavement widths of 18 feet. Designed to accommodate a school bus, this recommended pavement width is nearly half of the pavement widths required by many Utah communities.

Traffic Calming Implementation Strategies

The evidence is that traffic calming has a positive impact on:

- Reducing accidents on residential streets.
- Decreasing traffic speeds and volumes.
- Enhancing pedestrian safety.
- Increasing the residential quality of the neighborhood.

Impacts to noise, crime, and emergency vehicle response times vary by calming technique.

Understanding the benefits and weaknesses of each traffic calming

action helps determine which calming approach is most appropriate for a given condition. It is important to:

- 1] Identify if a problem exists by speed, accident and volume data. A point system such as shown in Table 9 from Pennsylvania Department of Transportation recommends methods that may be applied.⁵⁵ Salt Lake City, Utah also has a ranking technique for prioritizing needs throughout the City.
- 2] Propose and test the calming method with community involvement.
- 3] Community acceptance of traffic calming measures is often related to achieving other neighborhood goals, including reducing neighborhood crime and noise,

Table 9: Project Ranking System

Criteria	Points	Basis for Point Assignment
Speed	0 to 30	Extend by which 85 percentile speeds exceed posted speed limit; 2 points assigned for every 1 mph.
Volume	0 to 25	Average daily traffic volumes (1 point assigned for every 120 vehicles). Crashes 0 to 10, 1 point for every crash reported within past 3 years.
Elementary or Middle Schools	0 to 10	5 points assigned for each school crossing on the project street.
Pedestrian Generators	0 to 15	5 points assigned for each public facility (such as parks, community centers, and high schools) or commercial use that generates a significant number of pedestrians.
Pedestrian Facility	0 to 10	5 points assigned if there is no continuous sidewalk on one side of the street; 10 points if missing on both sides.
Total Points Possible	100	

Pennsylvania Department of Transportation Traffic Calming Handbook (January, 2001)

minimizing street maintenance costs, and improving neighborhood character and desirability.

Safe Routes to School

It is not long ago when children routinely made their way to school by walking or bicycling. However, because of the lack of safe routes, including the lack of sidewalks and bike lanes, and high traffic volumes and speeds in neighborhoods parents are now reluctant to allow their children to walk or bike to school. For these reasons, many parents drive their children to virtually all activities outside the home, including school. Parents driving children to school may account for up to 25% of neighborhood traffic. Where nearly 7 out of 10 children walked or biked to school in the early 1970's now only 1 out of every 10 children walks or bikes to school. The loss of safety on residential streets has severely eroded the freedoms of children.⁵⁶

Increasing the safety of residential streets through reductions in traffic volumes and speeds, and providing pedestrian and bicycle facilities in street designs, can again encourage children to walk or bike to school. Communities across the nation are embracing "Safe Routes to Schools" initiatives to make streets safer for pedestrians and bicyclists.⁵⁷ In Utah, the need for communities and school districts to work cooperatively together to provide safe routes to school is critical. Utah has the highest pro-

portion of any State for school-aged children 5 to 16 years.

Too often school locations are selected without consideration for safe pedestrian and bicycle access. Even years after school construction, children are still required to find their way to school on routes that do not have sidewalks, sidewalks that remain inadequate and unconnected, or sidewalks located immediately adjacent to fast moving traffic. Examples exist of schools sited in locations separated by busy highways and arterial roads from the neighborhoods they serve. To provide convenient and safe walking and bicycling routes to schools will require the coordinated and continued efforts of school districts and local governments.

The laws of the State of Utah, Section 10-9-106(2) and Section 17-27-105(2), Utah Code Annotated (UCA) provide and establish that a school district is subject to a municipality or county land-use regulations, with some prescribed limitations. A municipality, or county, may impose regulations on a school district in order to avoid unreasonable risks to health or safety. For example, a municipality, or county, may require a school district to participate in the cost of a sidewalk, if the sidewalk is necessary for the safety of school children, and is located on or adjacent to school property, or is required to connect an isolated school site to an existing road, Section 10-9-106(2)(b) and Section 17-27-105(2)(b), UCA. A school district is also required to coordi-

nate the siting of new schools with local governments to avoid or mitigate existing or potential traffic hazards and maximize school safety, Section 10-9-106(3) and Section 17-27-105(3), UCA. Additionally school districts are required to notify local governments prior to the purchase of a school site and discuss with the local government (municipality or county) any concerns, including any potential community impacts, Section 53A-20-108(1) and Section 53A-20-108(2), UCA. Clearly, the State of Utah expects, and requires, that school districts and local jurisdictions coordinate and work together to protect the safety of children as they make their way to and from school.

Residential Street Design Standards for Utah Communities

There exists within our communities a variety of residential street types. Some residential streets function to meet the needs of the urban residential neighborhood, while others meet the needs of the suburban neighborhood.

Residential streets are also required to serve residential areas, located within a rural setting.

Figure 8: Routes to school (children must compete with school buses and other vehicles, walking in storm water drainage facilities, to make their way to school).



Recognizing the various roles and purposes of a residential street, the following information is provided, as a discussion guide, for the design and construction of residential streets in Utah communities. The location and design of the residential street is determinative of the attractiveness, functioning and desirability of the residential area. The long-term functionality, safety, and attractiveness of the neighborhood and the street requires the identification of appropriate street design principles and design criteria. Pedestrians, bicyclists, private passenger vehicles, trucks, school buses, emergency vehicles, and others must share the space of the residential street. The needs of the various users of the residential street must be recognized and balanced in the street design.

General Design Principles for Residential Streets

Connected Pedestrian Facilities

Residential streets must provide for pedestrians. All lots and spaces within the neighborhood should be connected via linked pedestrian connections. As a basic design principle, “residential street design and scale should favor the nonmotorist and accommodate the motorist.”⁵⁸ In his book “Great Streets,” Allan B.

Jacobs identifies that “every [great] street is one that invites walking.”⁵⁹ A residential street should invite walking. Significant numbers of neighborhood residents walk for the purposes of exercise and walking is an independent travel mode for children.

Sidewalks, if provided at all on residential streets in Utah communities, are often typically three (3) feet wide. To promote the functioning of the sidewalk for pedestrian activity it is recommended that sidewalks be a minimum width of five (5) feet. Although more expensive than three (3) foot sidewalks, (5) foot sidewalks invite walking and provide a comfortable space for pedestrians, allowing pedestrians to walk together.⁶⁰ The more interesting and inviting the street the more pedestrians will use it. Areas of the neighborhood that cannot be accessed via a street with sidewalks can continue the pedestrian network by a trail, eventually being connected back to a residential street with sidewalks.

Bicycle Facilities

Bicycling is a viable form of transportation and must be considered in the design of the residential street. Not only is bicycling a viable travel option for children, but bicycling is one of the most popular forms of recreational activity. On higher volume residential streets bicycle routes may be required to be separated from motorists. On residential streets designed to encourage low traffic volumes and speeds there is usually no need to identify separate bike lanes.⁶¹

Street Connectivity

To promote neighborhood connections and encourage resident interaction within the neighborhood, residential streets should be connected, as practical. For reasons of neighborhood safety, and to provide necessary motorized and non-motorized circulation, all properties within the neighborhood should be capable of being accessed from multiple directions. Because of site topography, or other site constraints, there may be times when this goal cannot be achieved. This should be the exception rather than the rule. Connected residential streets provide appropriate travel and emergency routes and encourage non-motorized travel. With multiple travel routes available, vehicle trips are spread throughout the neighborhood, and drivers may consider a non-motorized mode of travel mode. The challenge for city planners and street designers is to provide a residential street pattern that allows efficient circulation within the neighborhood while discouraging unnecessary neighborhood cut through traffic.

There will always be significant volumes of traffic in our communities, with the need to move safely and quickly, at higher design speeds than are appropriate for neighborhood residential streets. Highways and arterial and collector roads, with peak hourly traffic flows of 300 vehicles, or greater, will carry significantly more traffic than is acceptable in a neighborhood.⁶² These roads act as barriers to nonmotorized travel and should

be located on the edges of the neighborhood. The design of the neighborhood streets system should provide efficient connections to the community's collector and arterial road system provided with safe and convenient pedestrian and bicycle crossings.

Design Speed

The goal of residential street design is to balance the purposes of the street. Residential streets must encourage and preserve low vehicle speeds. Low vehicle speeds will be achieved through the selection of street design criteria such as pavement width, curve radii, whether on-street parking is permitted, and other criteria.

Typically, the design speed for a residential street should not exceed 20 mph.⁶³ Increased vehicle speeds leads to increased vehicle noise and required stopping distances, and sight distances. Table 1 has identified the relationship between vehicle speed and total stopping distance. From Table 1 the total required stopping distance increases by an additional 141 feet from 20 mph to 35 mph.

On residential streets, a design speed of 20 mph should be applied. A maximum design speed of 20 mph encourages a feeling of safety for pedestrians and bicyclists.⁶⁴

“The risk of very serious injury to pedestrians increases dramatically as the speed of the impacting vehicle exceeds 20 mph.”⁶⁵ Research

has shown that pedestrians are not usually seriously injured when struck by a vehicle moving at less than 20 mph.⁶⁶

Street Width

Conventional traffic engineering requires that vehicles should travel streets without interruption, or with limited interruption. A residential street that balances the purposes of the street, including providing a space where motorized and nonmotorized travel can safely coexist together, will require this premise to be revised. A residential street providing safety, comfort, desirability, and aesthetics for all users will require that vehicles on the street recognize the other users on the street. A street width that balances the needs of all activities on the street, including motorized and nonmotorized travel, must be established.

Examples of attractive and desirable residential streets can be found in many older residential areas of our communities. These areas are often the preferred residential areas over newer subdivisions. Many of the established and older residential areas in Utah communities have street widths much less than 30 feet (curb to curb). These streets also are examples where vehicles recognize other users on the street, and where vehicles must occasionally stop to allow other vehicles to pass. For residential streets, the occasional stop should be accepted by street designers and motorists. The American Association of State and Highway Transportation Officials

(AASHTO) accepts that “the level of user inconvenience occasioned by the lack of two moving lanes is remarkably low in areas [of] single family units.”⁶⁷ Designing residential streets for uninterrupted traffic flows will result in providing a street that is wider than necessary. On such a street, vehicle speeds will be higher than accepted by the other users and residents on the street.

As found by Swift and Associates in Colorado, street width has a significant influence on vehicle speeds, and consequently pedestrian and bicyclist safety.⁶⁸ A clear relationship exists between street width and vehicle speeds. Reducing street widths will reduce vehicle speeds and the dominance of vehicles on the street.

Considering the work of Swift, it is recommended that a street pavement width of 26 feet (curb to curb) be considered for residential streets in Utah. This recommendation considers the need for winter snow plowing activities and the requirements for emergency vehicle access. Typically, development requirements work to minimize on-street parking, since single family units regularly provide off-street parking for at least four (4) vehicles (2 garage or carport spaces plus 2 spaces provided in a driveway) and multi-family residential units are regularly required to provide 2 off-street parking spaces per unit, plus additional visitor parking.

Centerline Radius

The Institute of Transportation Engineers (ITE) in “Traditional Neighborhood Development – Street Design Guidelines” identifies a minimum street centerline radius of 89 feet for a street with a design speed of 20 mph.⁶⁹ Consistent with this recommendation and the recommendation of WILMAPCO, it is recommended that for residential streets (with a 20 mph design speed) a centerline radius of 90 feet be considered.

Curb Return Radius

“When the curbed street meets another, the curbs at the sides of each street are joined by a curved section of the curb known as the curb return.”⁷⁰ As the curb return radius increases, the length of the distance at cross-walks increases, requiring additional time for pedestrians to cross. The shorter the curb return radius the shorter will be crossing distances and the more the street intersection will act as a “slowing point” in street design. Communities should consider and select an appropriate curb return radius for residential streets based on traffic volumes, traffic types, sidewalk and park strip requirements, and other street design criteria, and considering the influence curb return radius will have on traffic speeds, turning movements, street safety and street crossing distances.

Street Right-of-Way Width

A typical residential street right-of-way for many for Utah communities is 60 feet. Within this right-of-way, communities may often require street pavement widths well in excess of 30 feet for the “narrowest” residential streets.

Street right-of-way can be considered a function of several street design criteria including pavement width, sidewalk and park strip widths, and utility requirements. With a street pavement width of 26 feet, and including 5-foot sidewalks and 6-foot park strips, existing community requirements of 60 foot street rights-of-way are more than sufficient to accommodate the street design guidelines suggested here.

On-Street Parking

The presence of on-street parking will slow traffic on the street and provides an additional separation between moving vehicles and pedestrians. It is recommended that on-street parking be allowed on both sides of the streets on residential streets with pavement widths of 24 feet or greater. A recommendation to allow parking on residential streets recognizes the fact that single-family homes and multi-family developments, by way of zoning and development requirements provide significant areas, onsite, for the parking of vehicles.

Figure 9: On-street parking (historically parking has been allowed on Utah streets).



Park Strips and Street Trees

Park strips sized to allow the planting and growth of street trees will provide an attractive edge to the street and provides a separation between vehicles and pedestrians. For Utah communities, and recognizing that park strips also function to provide snow storage areas, park strips of not less than six-feet should be provided. For higher traffic volume streets, and to add attractiveness to the streetscape, wider park strip areas may be required. As evidenced in many neighborhoods, street trees enhance the aesthetics and environment of the street, encourage pedestrian activity and add residential amenity, value and desirability to the neighborhood.

Street Lighting

To provide an attractive element to the residential streetscape, as well as providing street and pedestrian lighting, streetlights should not exceed 12 feet in height, and be placed so as to avoid the conventional practice of providing fewer and higher lights with more intense lighting.

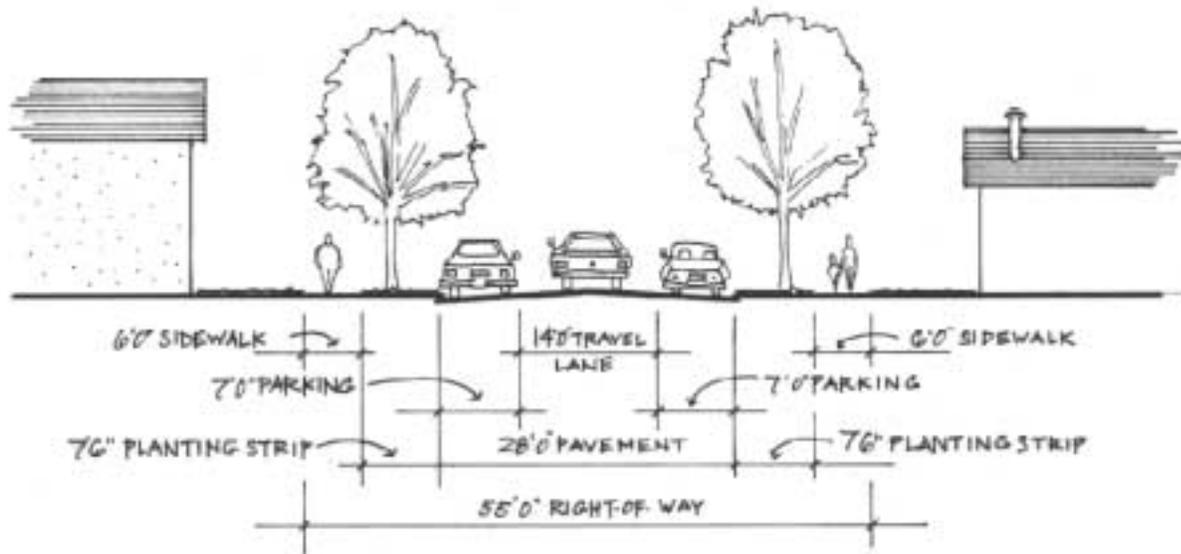
Figure 10: Street trees provide character and beauty to a neighborhood.



Table 10: Residential Street Design Guidelines for Utah Communities A Summary

Residential Street Design Criteria	Recommended Standard
Design Speed	20 mph maximum
Street Width (pavement width)	26 - 28 feet maximum
Centerline Radius	90 feet
Parking	Allowed on both sides
Sidewalk Width	5 feet minimum
Park Strip Width	6 feet minimum
Connections	Provide multiple access points. Multiple accesses will provide alternative emergency response routes. As the number of intersections and blocks increase the number of walk trips increase.

Figure 11: Residential Street Design



The residential street design guidelines for pavement width and sidewalk and park strip widths are consistent with suggestions provided by the State of Utah, Governor's Office of Planning and Budget, for residential streets and identified in Figure 11.⁷¹

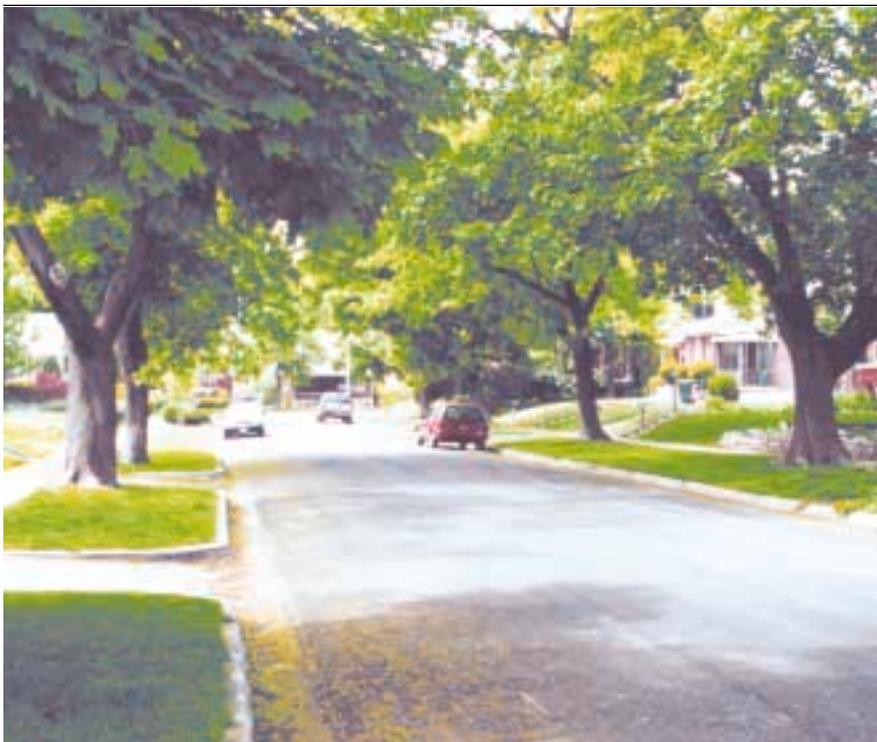


Figure 12a: The residential street (designed generally to the suggested standards).

Examples of attractive, safe and functional residential streets can be found in our communities. Figure 12a and 12b present existing residential streets, meeting the residential street design guidelines suggested here, and functioning to provide the purposes of a residential street while adding quality, safety and amenity to a neighborhood. With thoughtful design decisions, and the goal of balancing the needs of the various users on the street, residential streets can once again become attractive and inviting spaces within our neighborhoods.

Figure 12b



Our thanks to the members of the Toolbox Committee for their assistance in developing the 1st Edition of Urban Planning Tools for Quality Growth.

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HOME OWNERSHIP OPTIONS

Section I Community Lending, Innovative Mortgage Solutions

Community Lending Products:

An issue of concern is the availability and affordability of affordable housing, particularly for first time homebuyers. Several new mortgage products and location based mortgage experiments have been designed to remove the two primary barriers to homeownership - lack of down payment funds and qualifying income. These loans have down payments as low as 1 to 5 percent, and require less income to qualify and less cash for down payment and closing costs than conventional mortgages. When leveraged with other funds and purchasing in designated areas, buyers can sometimes become homeowners for as little as \$500. These products can be effective tools in increasing home ownership rates and stimulating rehabilitation in older suburban neighborhoods, targeted urban areas, as well as encouraging mixed income communities. You can call 1-800-7FANNIE for more information about specialty mortgage products in local Utah markets or get consumer information regarding Fannie Mae via the Internet by going to the web site at fanniemae.com. The Utah Fannie Mae Partnership Office, in conjunction with our lender partners, are also available to discuss specific needs and work on finding appropriate mortgage product solutions in your community.

Community Land Trusts:

Community land trusts can be formed to provide and preserve long-term affordable housing for low- and moderate-income families. Typically, a private nonprofit corporation acquires and holds land for the benefit of the community, often in an urban in-fill area. The community land trust retains title to the land but sells the improvements (the homes) and leases the land (under long-term group leases) to low- and moderate-income families at affordable ground rents. This tool is effective for promoting new construction in in-fill areas and helping to meet affordable housing targets for communities.

FannieNeighbors®:

FannieNeighbors is a nationwide, neighborhood-based mortgage option designed to increase mixed-income homeownership and revitalization in designated areas by removing income limits if the house is located in a HUD-designated central city or underserved area, or in an eligible minority or low-income census tract. Eligible FannieNeighbors communities in Utah presently include Clearfield, Ogden, Provo, Salt Lake City and West Valley City.

Historic Tax Credit (HTC) Investments:

Many underserved areas have historic properties that, once rehabilitated, can provide dramatic visual and community improvement and promote further reinvestment. Certified historic properties are eligible for historic tax credits when redeveloped according to federal restoration guidelines. The American Communities Fund (ACF) provides capital to qualified developers that undertake restoration in return for the federal historic tax credit. In certain circumstances, ACF will provide development equity in addition to HTC equity.

MULTI-FAMILY FINANCING OPTIONS

Section II Multi-Family

Fannie Mae works with a variety of partners including lenders, syndicators, investors, investment bankers, developers, property owners, property managers, nonprofit organizations, faith based organizations, foundations, and federal, state, and local governments to deliver tailored financing through debt, mortgage revenue bond purchases, Low Income Housing Tax Credits, and equity investments in rehab or new properties to provide affordable rental housing.

Low Income Housing Tax Credits (LIHTC):

Legislated into existence in the 1986 Tax Reform Act, low income housing tax credits serve as incentives for corporations to invest in low-income rental housing. Fannie Mae serves previously underserved markets characterized by very low incomes, HOPE VI public housing replacements, and persons with special needs.

Multifamily 3 MAX EXPRESS (All loans on all properties under \$3 MM):

As communities look for new options to increase density, promote infill and walkable communities, they now have new options in financing small multifamily properties of \$3 MM or less. These properties account for approximately one-third of the total multifamily market. Financing options are now available to streamline the underwriting process, reduce transaction costs and data requirements, while reducing and sometimes eliminating out-of-pocket costs for the borrower. Under a delegated underwriting partnership (DUS), underwriting, commitment, closing and servicing may be delegated to a DUS lender partner, spreading the risk of underwriting smaller properties among the primary and secondary lending markets, increasing liquidity and making more financing available to both local developers and community housing organizations seeking to finance or re-finance smaller multifamily developments. For a list of DUS lenders participating in the 3 MAX EXPRESS program or specializing in larger project transactions (entailing credit enhancements, long term debt, or direct bond placements) you can go to the internet and search the web site at fanniemae.com.

Multifamily Rehabilitation:

Investment funds are available to help finance multifamily projects that are suffering from deferred maintenance and in need of capital improvements. Potential partners must have a proven track record in rehabilitation projects and must be capable of co-investing with local lenders. By providing funds to preserve and extend the life of multifamily properties and to maintain them as affordable housing, increased affordable housing opportunities are made available. For more information about the American Communities Fund, contact your local Fannie Mae Partnership Office.

Particular financing is available for low-moderate income multifamily properties in need of moderate or substantial rehabilitation. The initiative provides for rehabilitation dollars in an amount not to exceed \$15,000 per unit.

BUILT GREEN UTAH

Section III Fannie Mae's Housing and the Environment Initiatives

National initiatives with local impact:

Fannie Mae is piloting a variety of initiatives in conjunction with multiple partners to explore ways to provide incentives to reduce residential energy consumption for the

benefit of homeowners and the environment. Our Smart CommuteSM Mortgage rewards home buyers who choose to live near public transit by giving these borrowers an income credit for their reduced commuting costs. The Fannie Mae Energy Efficient Mortgage (EEM) similarly credits home buyers who purchase an energy efficient home or retrofit an existing home. Our Residential Emissions Trading pilot program seeks to quantify the reduction in pollution as a result of energy efficiency improvements and sell these reductions in the emerging international greenhouse gas markets.

Built Green Utah Task Force:

The Built Green Utah Task Force was put together in the fall of 2000 by the Fannie Mae Utah Partnership Office. It was created to bring together the collaborative efforts of the Coalition for Utah's Future / Envision Utah, Quality Growth Efficiency Tools (QGET), Utah Home Builders Association, Utah Mortgage Lenders Association, Realtors, Utah Energy Office, Utah Association of Municipal Power Systems, E-Star Home Energy Rating Program, Public Utilities, Local Water Conservancy Districts as well as numerous building industry representatives and regional energy and environmental consultants to expand the state's supply of environmentally-sensitive homes. Built Green Utah Task Force Members are working to develop a comprehensive Built Green Program that encourages and streamlines green building, while leading the way in measuring and recognizing the savings and value that are derived from homes that are built to more stringent energy, water and resource-efficiency standards.

The goals of the Built Green Utah Housing Forum include:

- Creating market distinction for builders who implement the encouraged practices.
- Creating market demand for green and energy efficient building practices.
- Utilizing market forces to encourage industry practices.
- Demonstrating that an industry-initiated voluntary program can utilize market pressures to positively affect energy- and environment-related practices.
- Educating the home buying public that homes built to green standards may be more affordable, due to lower operating cost and higher performance, and may also offer home buyers greater comfort, reduced maintenance cost and higher resale value.
- Bringing a home mortgage pilot to the market that provides underwriting variances that recognize the added value of energy, water and maintenance savings in the form of additional mortgage funds.

As a voluntary program, Built Green Utah, will encourage home builders to use technologies, products and practices which:

- Provide greater energy efficiency.
- Reduce resource depletion and pollution.
- Protect indoor air quality.
- Conserve water.
- Protect the natural features of the building site.
- Result in a more durable, comfortable home.

When a builder enrolls in the program they may choose to participate at whatever level best suits their market. The program will provide a range of technical support and training opportunities to assist builders in making their check list choices, as well as follow up support. A third-party verification is an extremely important component of the program, bringing enhanced credibility to the overall program impact.

The Built Green Utah Mortgage Pilot can assist in: (1) eliminating the requirement for additional money down, thus allowing 100% financing of the energy, water or resource efficiency improvements; (2) recognizing multiple rating methods and prescriptive programs to determine the efficiency of a home; and (3) developing sample ratings of like-built properties for new construction projects, thus reducing the “per house” cost for efficiency ratings.

Under the pilot, Fannie Mae will allow approved lenders to use the estimated monthly savings in qualifying borrowers for additional funds. Approved lenders may incorporate the benefits of higher performing measures into most Fannie Mae first mortgage products, including conventional fixed-rate and adjustable-rate mortgages.

Features for the Built Green Pilot can include: (1) qualified borrowers of all income levels; (2) borrowers getting “more” house while reducing monthly expenses; (3) combining existing Fannie Mae mortgage products such as new and existing one- to four-family properties, availability for purchase or refinance, and properties that are energy-efficient in their current state as well as properties that add energy improvements after closing.

The alliances between these organizations will give the program strength, credibility and promote access to a broad base of technical expertise in Built Green Program related areas. In addition, the adoption of a Built Green checklist and standards will further support a common message to the consumer and the building industry about energy, water and durable products. But perhaps most importantly, the home buyer will appreciate knowing that their Built Green purchasing decision is a demonstration of their concern for the environment, the future and improving the way we live. For more information on Built Green Utah call the Utah Fannie Mae Partnership Office directly.

Flexible & Community Home Performance Power:

Home Performance Power Flexible and Community 100 Mortgages are zero down payment mortgages that are available to borrowers of varying incomes (80% and above or 80% and below). It also offers the borrower greater buying power by adding projected energy and water savings to the borrower’s income in the mortgage qualifying process. Three percent borrower contribution can come from the borrower’s own funds, gifts, a grant or other sources. Borrowers can use the Home Performance Power Community 100 if the home they are purchasing meets the requirements of the local green building program or the home’s energy efficiency exceeds the model energy code by 30 percent and water conservation is designed into the property.

Built Green Utah Mortgage Pilot:

The Utah Built Green Mortgage Experiment, available in 2002, includes a \$3 million dollar allocation of funds for the local housing market. The product permits a minimum down payment from the borrower to be the lesser of 1% or \$500 (the difference coming from alternative sources) on an EEM. Community Seconds are allowable up to a combined loan to value (CLTV) of 105%. Borrowers must make less than 100% of the area median income, except when the home is located in a FannieNeighbors community where there are no income restrictions.

Location Efficient Mortgage:

The Location Efficient Mortgage (LEM) is a \$100 million experiment that is the first homeownership initiative to link housing with efficient public transportation. It is also a tool that can be used to revitalize urban communities. The LEM recognizes home-

buyer savings resulting from the purchase of a home located in a densely populated community served by efficient public transportation. The idea is that borrowers purchasing homes near efficient public transit are more likely to utilize it, thus saving money that might otherwise be spent on automobile upkeep. The LEM recognizes a portion of these potential savings and adds it to the home buyer's qualifying income - increasing the borrower's home-buying power. The Fannie Mae Partnership Office in conjunction with the Utah Transit Authority are presently mapping Salt Lake County's local transit systems, including bus lines and light rail (TRAX) to determine eligible areas and program features for implementation of a new LEM pilot program in 2002. The goal of the partnership is to bring on additional geographies as the transit system grows.

AMERICA'S LIVABLE COMMUNITIES

Section IV Livable Communities

National initiatives with local impact:

Some Utah communities are eligible to participate in a \$30 billion leveraged public/private community development investment fund targeted towards 300 communities around the nation. This community development initiative supports revitalization efforts in targeted communities to help local partners achieve their vision for a revitalized neighborhood. Regional Community Development teams and local Partnership Offices work with lenders and community partners to strategically utilize debt, investment and service vehicles to advance local housing and community development goals and promote livable communities.

Fannie Mae's tool chest for this effort consists of an array of investment vehicles such as the American Communities Fund, Multifamily and Public Finance, mortgage products, rehabilitation products, technology, market research techniques and Geographic Information Systems. By leveraging the inherent strengths of inner city locations and older suburban neighborhoods, such as proximity to jobs, transportation network, and untapped economic wealth, local partners can produce visible, tangible, and sustainable economic development results in underserved neighborhoods.

Employer Assisted Housing:

Strong economic growth increases demands for affordable housing. Utilizing alternative sources for down payment funds are one key to increasing homeownership rates. One untapped source of funds is Employer Assisted Housing (EAH).

EAH is an employer-provided benefit that helps employees purchase a home. The most common EAH benefits are grants, forgivable loans, deferred or repayable loans, matched savings, interest rate buy downs, and/or home buyer education provided by an employer-funded counseling agency. In return for this benefit, employers can realize increased employee loyalty and morale, decreased turnover rates, and decreased training costs. The savings realized from the decreases in turnover rates and training costs are often more than sufficient to cover the costs of providing an EAH benefit. In addition, a company that offers an EAH plan as part of its benefits package stands apart from its competitors when recruiting new employees. EAH plans can also be combined with efforts of local housing authorities, governments, and non-profit organizations to revitalize specific areas of a community. By providing additional incentives for employees to own homes in areas that need revitalization, communities are strengthened. EAH provides a "win, win, win" scenario: employees win by achieving the dream of homeownership, employers win by enhancing their financial

strength, and communities win by reaping the benefits of increased homeownership levels in their communities.

An EAH plan can be easily customized to meet the unique needs and circumstances of an employer's overall recruitment, retention, benefits, and community strategies. While many EAH plans have similar features, there is no "master plan" that a company must utilize. Each plan is uniquely designed to meet the company's specific goals and to help the company save money. Fannie Mae and its lender partners can assist employers in creating the best EAH structure to support the company's employee and community strategies.

An EAH case study:

Company A with 1,000 employees is currently experiencing a turnover rate of 20%. Each worker has an average salary of \$30,000. When filling new positions, 75% of the hires come from outside the company. The average cost of recruiting and training a new employee is \$2,000.

In an effort to reduce turnover, the company decides to offer EAH as a benefit. Eligible employees receive a five-year forgivable loan of \$4,000 to help with the down payment and closing costs on a new home assuming that the employee remains in good standing with the company and remains in the home for that amount of time. The employee is required to make interest only payments for the life of the loan at 7%. Assuming that each year, only 6% of eligible employees use the benefit, the company realizes a decrease in turnover by 2%. If this occurs, the company would still experience a net savings of over \$65,000 the first year, and \$400,000 over 10 years. The net present value of each year's savings over 10 years, is over \$300,000. If turnover declines by more than 2%, then the savings increase even more dramatically. Clearly, EAH is a valuable and cost-effective tool for employers to recruit and retain good employees.

The Fannie Mae Utah Partnership will offer technical assistance in designing a program and provide a software analysis consultation for interested companies, organizations or governmental entities and/or municipalities.

UTAH PARTNERSHIP OFFICE ASSISTANCE

Section VI Summary:

The Fannie Mae Utah Partnership Office is ready and willing to support Utah communities and citizens in their efforts to expand the reach of homeownership and affordable housing in Utah. In particular, we seek to support Utah cities and towns, community lenders, borrowers, non-profit organizations and, developers and home builders as they plan and create additional homeownership and rental housing opportunities. We believe that strong communities are created when Utahns have a safe place to live, thus strengthening families, communities and our state as a whole. For more information or assistance please feel free to call us any time at 801.715.6860.

Chapter 1

For Envision Utah, Wirthlin Worldwide conducted in-depth research in March-May 1997 to identify what Utahns value about living in Utah and their concerns in the face of current growth trends. Contact Envision Utah at 801-973-3307

Chapter 2

"Greater Wasatch Area Housing Analysis," Econorthwest, 1999
Utah Automated Geographic Referencing Center (AGRC), Fregonese Calthorpe Associates, and Econorthwest, joint research conducted in 1998. Contact AGRC for more information

Chapter 3

Traditional Neighborhood Development Sales Comparison Trends, Market Perspectives, Roseville, CA. February 22, 1999.

Envision Utah Quality Growth Strategy and Technical Review, 1993

"Memorandum to Route 9/100 EIS Citizens Advisory Group," Vanesse Hangin Brustlin, Inc. August 29, 1994, cited in Conservation Law Foundation, below.

The Effect of Neotraditional Neighborhood Design on Travel Characteristics, Fehr & Peers, 1997.

Explaining Urban Density and Transit Impacts on Auto Use. Holzclaw, J Sierra Club and Natural Resources Defense Council, 1991.

"The Impacts of Mixed Use and Density on the Utilization of Three Modes of Travel: The Single-Occupant Vehicle, Transit, and Walking. L. Frank and G. Pivo. Transportation Research Record 1466: 44-52, 1994.

"Mass Transit for High-Rise, High Density Living," Wilbur Smith, Journal of Transportation Engineering, Vol. 110, No. 6, 1984.

"Regional Transit Corridors: the Land Use Connection." Parsons Brinckerhoff Quade & Douglas, Inc., Robert Cervero, Howard/Stein-Hudson Associates, and Jeffrey Zupan. The National Research Council, TRB, TCRP H-1. Washington DC, 1995.

Public Transportation and Land Use Policy. Boris Pushkarev and Jeffrey Zupan. Bloomington, IN: Indiana University Press, 1977.

Kassowski, Kevin, "The Costs of Sprawl, Revisited." Developments, 1992. Cited in Tools for Reducing Vehicle Trips Through Land Use Design, San Diego Air Pollution Control District, January 1998.

Burchell, Robert W., et al. Impact Assessment of the New Jersey Interim State Development and Redevelopment Plan, Report II: Research Findings. Report Prepared for the New Jersey Office of State Planning, Trenton, 1992.

**SOURCES,
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p.24
Reprinted from "Greater Wasatch
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p.26
Reprinted from "Households and
Housing," Clark, William A.V. and
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Developed by Steve Price "in
association w/ Dover Kohl &
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John Gallagher Photography

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Gateway Site Plan courtesy
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Chapter 4

Urban Land Institute. Shared Parking, 1983.

Chapter 5

Envision Utah Quality Growth Strategy and Technical Review, 1999.

American Water Works Association: Handbook of Water Use and Conservation, 1993.

Utah's Water Resources: Planning for the Future, 2001.

Environmental Protection Agency's Statement of Principals on Efficient Water Use, www.epa.gov, 2001.

Municipal Industrial Water Supply and Uses, 2000.

Chapter 7**Energy Resources**

Department of Energy 1997. Tomorrow's Energy Today: Energy Solutions for Cities and Counties.

Hubbard A and Fong C 1995. The Community Energy Workbook. Rocky Mountain Institute. Pg 59.

U.S. Department of Energy: Energy Information Administration: www.eia.doe.gov.

Center for Energy Efficiency and Renewable Technologies
<http://www.sustainable.doe.gov>.

Energy Efficiency and Renewable Energy Clearinghouse: <http://www.eren.doe.gov>.

National Renewable Energy Laboratory (NREL): <http://nrel.gov>.

Energy Efficiency and Renewable Energy Network (EREN): www.eren.doe.gov.

American Council for an Energy-Efficient Economy: www.aceee.org.

Association of Energy Services Professionals International: www.aesp.org.

Association of Professional Energy Managers: www.apem.org.

The EPA Energy Star: <http://energystar.gov>.

Energy Star Program.

EPA Energy Star HOMES Program.

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Queststar www.questar.com.

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Codes and Ratings

Utah Model Energy Code: http://www.eren.doe.gov/buildings/codes_standards/buildings/states.

Utah Engineering Experiment Station (801-581-6348).

Utah Energy Coalition (1-800-550-8322).

U.S. Green Building Council U.S.: Green Building Council Leadership in Energy and Environmental Design (LEED).

Salt Lake City's High Performance Building Task Force: www.HPBtaskforce.com.

Utah Energy Conservation Coalition: Home Energy Ratings.

Environmental Protection Agency: www.epa.gov/air/data/sources.html.

Marsico, Dale J. "Improve the Delivery of Transit Services by Easing Regulatory Burdens." Community Transportation Association of American www.pti.org.

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Plants

Akbari H 1993. Monitoring Peak Power and Cooling Energy Savings of Shade Trees and White Surfaces in the Sacramento Municipal Utility District Service Area. LBL 34411.

Akbari H et.al. 1996. Policies to reduce heat islands. Proceedings of the 1996 ACEEE summer study on energy efficiency in buildings.

Akbari H 1994. CBS Newsletter. Pg. 7 LBL.

Developing and evaluating tree ordinances: <http://www.phytosphere.com>.

Transportation

Alternatives to Sprawl in Southeastern Wisconsin. Citizens for a Better Environment: www.cbew.org.

Urban Consortium Task Force. Public Technology, Inc.: www.pti.org.

Surface Transportation Policy Project: www.transact.org.

Wasatch Front Regional Council: www.wfrc.org.

A Policy on Geometric Design of Highways and Streets "Green Book", 2001.

American Association of State Highway and Transportation Officials (AASHTO): www.aashto.org/publications/bookstore.nsf.

EPA Publication 231-R-01-002, Our Built and Natural Environments, A Technical Review of the Interactions between Land Use, Transportation, and Environmental Quality, 2001 www.smartgrowth.org.

Flexibility in Highway Design: www.fhwa.dot.gov/environment/fhd.htm.

Bicycling and Pedestrian Resource Guide and Program: www.dot.utah.gov/progdev/bike/ResourceGuide.htm.

Argonne National Laboratory Transportation Technology Research and Development Center: www.transportation.anl.gov.

Utah Department of Transportation: www.dot.utah.gov/ops/its/its.

National Clean Cities Coalition: www.ccites.doe.gov.

US DOE - Office of Transportation Technologies Alternative Fleet Buyers Guide - How Can I Buy An AFV? www.fleets.doe.gov/.

Chapter 8

Center for Disease Control and Prevention. Creating a Healthy Environment: The Impact of the Built Environment on Public Health, 2001.

Ohland G. Caught in the crosswalk: Pedestrian safety in California [Online]. Available: <http://www.transact.org/ca/caught99/caught.htm> [2001, August 6].

Urban Land Institute. Parking Requirements for Shopping Centers, 1999.

Urban Land Institute. Shopping Centers and Other Retail Properties, 1996.

Utah Department of Health. Utah Health Status Update: Obesity and Overweight, December 1999.

Chapter 9

1. Garber and Hoel, *Traffic and Highway Engineering*, West Publishing Company, St. Paul, MN, 1988.
2. FHWA (United States Department of Transportation, Federal Highway Administration), *State of the Art: Residential Traffic Management*, 1980, p. 10.
3. *Ibid*, p. 10.
4. *Ibid*, p. 13.
5. Grava, S. *Traffic Calming. Can it be Done in America?* *Transportation Quarterly*, No. 47, 1993, pp. 483 – 505.
6. ITE (The Institute of Transportation Engineers), *Traditional Neighborhood Development – Street Design Guidelines, Proposed Recommended Practice*, ITE Transportation Planning; Council Committee 5P-8, June 1997, p. 14-16.
7. ITE/FHWA (Institute of Transportation Engineers/Federal Highway Administration), *Traffic Calming: State of the Practice*, August 1999.
8. *Ibid*. p. 2.
9. *Ibid*. p. 3. “Acceptable Level” is identified by ITE/FHWA as the “speed and volume of traffic for the functional class of [the] street and the nature of the bordering activity.”
10. FHWA, *supra*, p. 3.
11. *Ibid*, p. 3.
12. *Ibid*, p. 3.
13. PDOT (Pennsylvania Department of Transportation), *Traffic Calming Handbook*, January, 2001, p. 2.
14. ITE/FHWA, *supra*. pp. 14-15.
15. FHWA, *supra*. p. 14.
16. Reprs. John W. Plan for the City of Zion, formatted as a web page, Department of City and Regional Planning, Cornell University, www.library.cornell.edu/Reprs?DOCS/smith.htm.
17. FHWA, *supra*, p. 12.
18. ITE, *supra*, p. 2.
19. *Traffic Calming, Selected Practices, Lessons Learned*. Center for Urban Policy Research, Rutgers University, 2001.
20. *New Urban News, Narrow Streets are the Safest*, Volume 2, No. 6., November-December, 1997, p. 1.
21. *Ibid*, p. 9.
22. United State Department of Transportation, Federal Highway Administration (FHWA), *Design Guidance, Accommodation Bicycler and Pedestrian Travel: A Recommended Approach. A US DOT policy Statement on Integrating Bicycling and*

Walking into Transportation Infrastructure.

23. FHWA, *supra*, p. 19.

24. Ewing, Reid, Residential Street Design – Do the British and Australians Know Something We Americans Don't, ITE Compendium of Technical Papers, 1993.

25. ITE, *supra*, and Burden, Dan, Street Design Guidelines for Healthy Neighborhoods, Local Government Commission, January, 1999.

26. ITE, *supra*, pp. 16.

27. "Urban Traffic Calming Treatments: Performance Measures & Design Conformance," ITE Journal, August, 1997.

28. United States Department of Transportation, Federal Highway Administration (FHWA), Traffic Calming Measures, www.fhwa.dot.gov/environment/calm/part2.htm

29. ITE, *supra*, p. 15, summarized from Table 1.

30. Traffic Calming, Selected Practices, Lessons Learned, Rutgers University, Center for Urban Policy Research, 2001. Also information provided for Pedestrian Safety in Facts and Figures, Pedestrian Safety Roadshow, www.ota.fhwa.dot.gov/walk/facts/index.html

31. ITE, *supra*, pp. 18-19.

32. ITE, *supra*, pp. 18-19. Supported by Child Pedestrian Injuries on Residential Streets: Implications for Traffic Engineering, by Peter Jacobsen, Craig L. Anderson, Diane G. Winn, John Moffat, Phyllis F. Agran and Sheila Sarkar, ITE Journal on the Web, February, 2000.

33. Utah Department of Health, Violence and Injury Prevention Program, Utah Pedestrian Fact Sheet, 3/2001.

34. Utah Department of Health, Violence and Injury Prevention Program, Utah Bicycle Fact Sheet, 3/2001.

35. FHWA, *supra*, p. 131.

36. Atkins, Crystal and Michael Coleman, The Influence of Traffic Calming on Emergency Response Times, ITE Journal, August 1997.

37. *Ibid*, p. 132.

38. *Ibid*, p. 132.

39. Uniform Fire Code, Fire Department Access and Water Supply, Part III, Article 9, 1997.

40. Fernandez, John M., Boulder Brings Back the Neighborhood Street, Planning, June 1994, p. 25.

41. Presentation to Fire Marshals Roundtable, Skinny Streets, September 20, 1995, Salem Oregon, p. 7.

42. New Urban News, *supra*, p. 9.

43. *Ibid*, p. 9.

44. FHWA, *supra*, p. 135.
45. *Ibid.* p. 135.
46. *Ibid.*, p. 135.
47. *Ibid.*, p. 135.
48. FHWA, *supra*, p. 3.
49. *Ibid.*, p. 15.
50. ITE/FHWA, *supra*, p. 43.
51. Institute of Transportation Engineers Journal, *Urban Traffic Calming Treatments: Performance Measures and Design Conformance*, August 1997, pp. 34-40.
52. *Improving Residential Street Environments*, FHWA, 2000.
53. PDOT, *supra*.
54. ITE/FHWA, *supra*. pp. 189-192.
55. PDOT, *supra*.
56. California Safe Routes to School Initiative, *Safe Routes to School March, 2000*, and, *Nationwide Personal Transportation Survey*, Center for Disease Control and Prevention.
57. *Ibid.*
58. ITE, *supra*, p. 13.
59. Jacobs, Allan B., *Great Streets*, Cambridge MA., Massachusetts Institute of Technology, 1993, p. 272-273.
60. ITE, *supra*, p. 28.
61. *Ibid.*, p. 6.
62. *Ibid.*, p. 22. (Identified as a reasonable standard for residential streets and supported by research of FHWA and ITE and consistent with the recommendation of the State of Utah, Governor's Office of Planning and Budget.).
63. *Ibid.*, p. 16.
64. *Ibid.*, p. 16.
65. *Ibid.* p. 16-17.
66. *Ibid.*, p. 28.
67. *Ibid.* p. 25.
68. Swift and Associates, *Residential Street Typology and Injury Accident Frequency*, June 2001.
69. ITE, *supra*, p. 26.
70. *Ibid.*, p. 26.
71. State of Utah, Governor's Office of Planning and Budget, *Residential Street*

Design, www.governor.state.ut.us/planning/LandUse/StreetDesign.htm.

72. U.S. Department of Transportation Policy Statement, March, 2000

73. New Urban News, March 2001

What you can do to get involved

All of the concepts and ideas presented in these chapters are ones that affect our families and us. Envision Utah depends on input from a wide variety of sources, including citizens, business people, civic leaders, political leaders, planners and many more. This program depends both on broad citizen input and continued involvement in the community.

A good community doesn't just occur by happenstance. It requires a thoughtful approach to how a strong community can become even stronger. It also requires a continued commitment to fostering ideas, shaping those ideas into tangible results, and always being open to updating those ideas and results as time goes by.

For more information about Envision Utah, here are some additional resources and ways to become involved to help shape our communities:



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