3 - DESIGN PRINCIPLES

Conservation and Restoration

Diversity and Balance

Human and Pedestrian Scale

Connections and Interdependence

Principles of Urban Design

The understanding of the importance of Urban Design and Planning has changed greatly in the last twenty years. Far from being concerned simply with aesthetic issues, well-designed places function far more efficiently than poorly-designed ones do. They have positive effects on the environment, on individual health and well-being, and on long-term economic viability and adaptability. Well-designed places are also better and more enjoyable places for people to live and work, which has made good design an important element in efforts to create economic development.

The motivation for the founding of the Maui Research and Technology Park remains as important as ever. Continuing job creation and economic development are essential for the well-being of Maui. This has become even more apparent with the recent economic downturn and the continuing decline of agriculture on the island.

Fortunately, the latest understanding of urban design for quality economic development, especially in fields of high technology, is also urban design which achieves environmental and other goals. Places which attract and create new high technology businesses are those which facilitate the exchange of ideas and make it easier for people to become entrepreneurs, and are able to deliver a high quality of life. By providing a variety of public and private spaces and a quality public environment, these places give people and businesses the flexibility and freedom to experiment, to take chances, and to make connections. These types of places are fertile ground for growth and entrepreneurship.

For these reasons, it is essential to use new models of development for the Park. New development must address many concerns simultaneously, incorporating the latest understanding of multiple issues. While good design involves an infinite number of elements, we have grouped the major concerns of urban design into four categories for purposes of discussion: conservation & restoration of the environment, economic and social diversity & balance, human & pedestrian scale in the public and private realms, and connections & interdependence between the neighborhood, town and region.

Because it is also important that the plan fit the needs and desires of Kihei residents, the details of these principles also incorporate elements of other local guidelines, such as the Kihei Community Association General Open Space and Design Guidelines. The KCA Guidelines are concerned with community quality and livability, with major areas of concern being:

- Open space drainage ways and flood control
- Wetlands and low lying drainage areas
- Neighborhood connectivity and pocket parks
- Shoreline property
- Beach access/impact
- Pedestrian and community safety and de-emphasis of the automobile
- Roundabouts and street design guidelines
- Affordable housing
- Schools, parks and roads
- Commercial and high density developments
- Green Building Guidelines

The design principles and plan which follow address nearly all of these concerns and are in near-total agreement with the KCA Guidelines.

Conservation & Restoration

Before After

Cities represent a fragile balance between our human needs and the capacity of our ecosystems. As we continue to gain deeper understanding of the repercussions of our human activity on the world's environment, the city is increasingly understood as an important place to adopt to a more sustainable lifestyle.

The design of the Maui Research & Technology Park will have an effect on the environment both locally and globally. Design which respects existing topography and other natural features not only is less damaging to construct, but preserves natural systems and the area's cultural and geographic memory.

On the other hand, design which minimizes unnecessary automobile travel has effects on the environment world-wide. The world is facing an environmental crisis of profound economic and social dimensions. Brought about largely by carbon emissions into the atmosphere, climate change is already affecting the human and natural environment and promises to create immense problems in the coming years and decades. Such problems may be particularly pronounced in island communities like Hawaii.

As is now understood, one of the major causes for carbon emissions over the last fifty years has been the way we build our cities. A purposeful emphasis on the creation of cities for automobiles at the expense of pedestrians, bicycles, and transit has increased automobile usage and the associated carbon emissions. At the same time, this style of development has increased land consumption, thereby reducing forest cover and increasing problems with stormwater runoff and pesticide use wherever it has been implemented.

Choices made now will have immense effects on the future of carbon emissions. Creating the Park in an efficient, livable, and environmentally-friendly way will ensure reduced emissions. Using an outmoded, autocentric development model will do the opposite, and the effects will be solidified in the built environment for years to come.

The Maui Research & Technology Park should add to the sustainability of Maui. It will be environmentally responsible by reducing resource waste, demanding less of the environment, and accommodating growth to support the island economy. It will address an ongoing challenge of economic development by attracting new growth in proximity to housing and regional transit.

By incorporating strategies on the neighborhood and building level, the design of the Maui Research & Technology Park can affect not only its site and surroundings, but the health of the planet as a whole.

Diversity & Balance

Mixed Use and Clustering

Mixing of uses and clustering of destinations is a way to reduce distances and make walking and bicycling more convenient. Maui already has development of middle density, but it often lacks clustering with other uses which leaves it seeming unfocused. Bringing the densest development together, ideally around a transit node, shortens trips and makes them more convenient. Having more residents or workers within 1/4 mile of a transit node makes it more likely that those persons will chose to use transit when they go elsewhere in the island, also.

Mixed Use

Mixed use is the mixing of various activities and land uses within a small area. Vertical mixed use means that a single building has several uses within. Horizontal mixed use means that multiple uses and activities are clustered near each other. Both of these types achieve the goal of making trips shorter and more convenient and raising the possibility that people will choose to use walking, bicycling or transit for their trips.

Mixing of uses at the neighborhood scale, within the 1/4 mile walking radius, allows people to reach daily destinations easily by foot. Large areas with single uses such as housing or employment force everyone to travel long distances to get around. Having retail and civic uses within areas of residential and employment uses makes it easy for people to do quick errands during their daily activities. Having recreational spaces nearby allows people to reach them more easily, creating situations where people can incorporate healthful activity into their daily lives. Having appropriate uses and activities near homes allows children as well as older people who can no longer drive a car to have increased independence.

Diversity of Housing

There will never be a single perfect housing type. Housing types must be as diverse as the needs of the people who inhabit them and accommodate changing demographic and consumer preferences. Even a single individual's housing needs change over his or her lifetime. A young person living in a small apartment may want a house after marrying, then a larger house after having children. Once these children grow up and leave home, the empty-nester couple may again choose a smaller home or apartment. Neighborhoods with a diversity of housing can accommodate these changes without forcing someone to move a long way or even to another community. A collection of townhomes, single family dwellings, and low apartment buildings can achieve a diversity appropriate for a growing and changing population.

Jobs Housing Balance

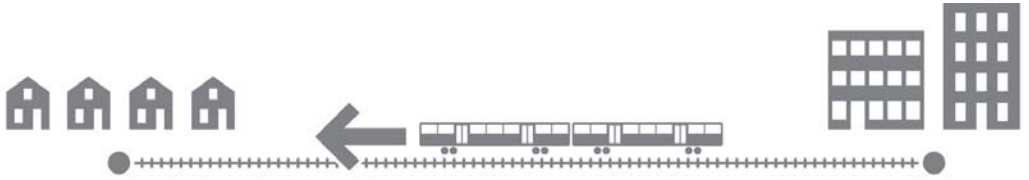
Another important reason for a mix of uses on the district scale is to create jobs housing balance. This means that an area would have a similar amount of jobs within it as it has workers living in it. This not only shortens many commute trips and therefore makes it more likely that people can travel to their jobs by walking or bicycling, but it also makes transit and automobile travel more efficient. By using transportation lines (roads or

bus lines) in both directions in a similar amount, peaking is reduced and a line of the same size can accommodate more travelers. (see diagrams)

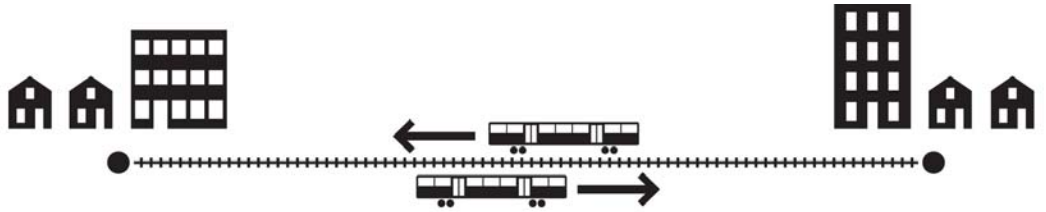
Balanced Flows

As a jobs center, it is unlikely that the Park would achive a complete jobs housing balance. However, adding at least some housing will improve the situation, improving transportation efficiency as well as adding 24-hour activity to the Park. Having people in an area during more hours of the day makes an area safer and helps local serving businesses like restaurants survive, since they hav customers in both the daytime hours and the evening hours. This will make the Park a more livable and economically viable area.

Unbalanced Morning Commute - going to work

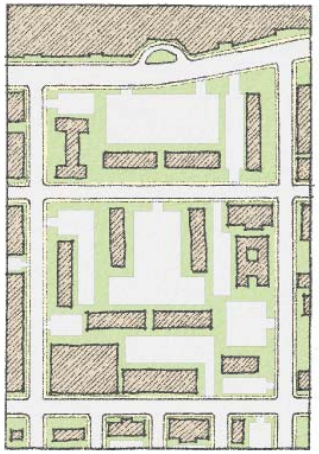


Unbalanced Evening Commute - returning home



Balanced Commute - moderate flows in both directions

Human & Pedestrian Scale



Auto - Scale

Pedestrian - Scale

Creating a place of human scale would leave it in stark contrast to the auto-centric development which has been common over many years and continues all over the world. Human and pedestrian scale recognizes the needs of people for safety, convenience and pleasure in the public realm. By creating places designed for humans, we give people the flexibility to order their lives in ways other than around the automobile.

Mixed Use and Proximity

Human and pedestrian scale includes many aspects of a place. Among the most important factors is a diversity of land use, as discussed in the preceding pages. A mix of uses in close proximity allows people to satisfy needs within an area which can be easily traveled by walking or bicycling. To achieve this result, the development must also be of sufficient density to contain these uses in a small area. Of course, each person differs in the distance which they are willing or able to walk, and factors such as the current weather affect this as well. However, a good rule of thumb is that destinations should be with about five minutes' walk, which is a distance of about 1/4 mile.

Walkable Streets

Another critical factor in human and pedestrian scale is walkable streets. An environment that encourages walking is imperative to the creation of a vibrant community. By walking for transportation we receive a variety of benefits – we reduce the need for the automobile, we provide foot traffic to local businesses, we interact with our neighbours, and we improve our physical health. In fact, a Washington State study found that residents of a pedestrian friendly neighborhood weigh, on average, seven pounds less than residents of a sprawling suburb[1]. In addition, walkable neighborhoods need less infrastructure for cars, thus sparing land for more enjoyable spaces such as parks and promenades.

To be walkable, streets must be well designed. Sidewalks are a must, but the design of the road network and of the streets themselves are key.

Street Networks

Auto-oriented street networks are designed in a very similar way all over the world. Beginning on local streets (often cul de sacs), every journey moves then to collector roads, then arterials, and often then onto a highway. Because of the fear of through traffic and a disregard for pedestrians, road networks are typically designed to force this pattern for every trip, lengthening each trip and congesting all of the arterials. This congestion then creates calls for road widening and the resulting huge roads make walking or bicycling even more difficult and dangerous.

Connector Roads

Rather than this typical street hierarchy of cul-de-sacs, locals, collectors and arterials, the Plan builds a network of interconnected local streets and connector roads. By ensuring multiple connections and routes, connector roads avoid the difficult problem of unlivable, high traffic collectors which are too busy and too noisy to accommodate residential development. Connector roads

[1] *Smart Growth America, http://blog.smartgrowthamerica.org*

typically occur every quarter mile and serve to disperse traffic widely.

Local Roads

Local roads are intended primarily for local access, but are also a vital part of the road network. They only rarely end in cul-de-sacs in the plan. Speed and through traffic are controlled by narrow road widths and curved alignments, while connections on both ends preserve emergency access and add route choice for daily users. Parking is provided along the road, further slowing traffic and providing for more activity on the street as people access their cars.

Street Design

The Evolution of Street Design

The weight of years of experience and research is chipping away at the entrenched practice of creating wide, auto-centric roads in disconnected, discontinuous networks. Promoted for years as the safest and most efficient way to build road systems, it has now been proven that this type of system is just the opposite. Wide roads, contrary to providing an added cushion for error by drivers, instead provoke drivers to speeding and carelessness. The result is more crashes and more severe crashes. Pedestrian and bicycle injuries and deaths are multiplied by large, fast, busy roads, and because few people who have other options choose to walk or bicycle, even more traffic is created.

In contrast, the streets in this Plan are designed with a pedestrian-friendly environment as the first priority. Comfortable, walkable and bikeable streets knit neighborhoods and districts together, adding to a sense of community and facilitating transit use. Each sidewalk needs the shelter of trees, the presence of building entries and porches rather than parking lots, and a buffer of parking to protect the pedestrian corridor from moving traffic.

In all cases streets must be designed to slow traffic, as high speeds are entirely unnecessary within the site. High speed traffic creates a much higher level of noise, disturbing workers and residents. Preserving livability on the area's road network will require reasonable speeds to be maintained. More importantly, high automobile speeds create much greater danger for pedestrians as well as automobiles, making accidents more likely and multiplying the force of a crash many times. A pedestrian struck by a car at 20 miles per hour has a less than 10 percent chance of death. At 30 miles per hour, this chance rises to almost 50 percent. And at 40 miles per hour, fatalities are nearly 90 percent [2]. Speed on all roads in the Park should be limited to 25 miles per hour or less. At these speeds, a driver can still easily reach any Park location in minutes or less.

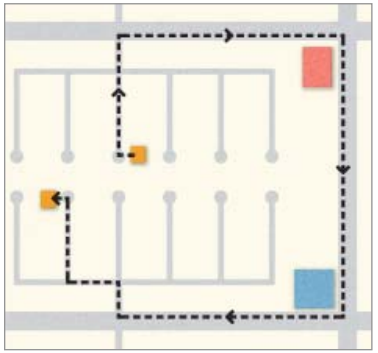
Traffic Calming

Traffic calming is the practice of bringing vehicular speeds and behavior into conformity with the needs of non-drivers. The streets in the Park have been designed to be calmed through their basic design to be more human in scale and character. By sizing the streets correctly and highlighting character elements that emphasize the streets' quality as much as their quantity, the Park's neighborhoods will be naturally safer for all users, including employees, residents, and their children.

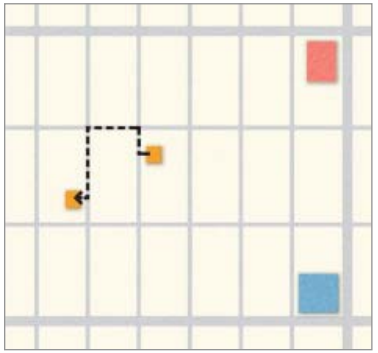
However, where extra care is needed or desired, additional calming methods can be used to ensure a safe and efficient street. Although they vary in application, the basic theory behind these techniques is to present a driver with physical and psychological cues which prompt more careful driving behaviors or choice of travel route. By using signage in concert with uncommon movements, a street's design can encourage safer speeds, reduce volume, or invite more careful navigation. Many times, one or a combination of measures can accomplish all of these goals simultaneously.

There are three major categories whereby a street's design can affect driving behavior, as described below: signage and graphics, deflection (vertical and horizontal), and narrowing.

[2] *http://www.walkinginfo.org/pedsafe/crashstats.cfm*



Heirarchical road networks require long trips on large roads.



Connected road networks allow direct routing and small-scale roadways.

Vertical and horizontal deflections slow traffic

Simple markings can make streets and pathways safer for all users

For further information on traffic calming methods, see "U.S. Traffic Calming Manual", published by APA Planners Press and the American Society of Civil Engineers in 2009, written by Reid Ewing and Steven Brown.

Signage and Graphics

Signage and graphics are the most common traffic calming measures. Not only are they the least costly and usually the least disruptive to implement, they also benefit from a history of use and are therefore familiar to the public and to regulating municipalities. Common types of signage/graphics include:

- Striping
- Bicycle Lanes
- Crosswalks
- Stop Signs
- Child-Related Signage
- Speed Reduction
- Signal Progression
- Pedestrian and Bicycle Signals

Deflection (vertical and horizontal)

Deflections in the travel path require the driver to slow in order to maintain control or to avoid unpleasant forces on themselves or their automobile. Deflections come in vertical and horizontal varieties, and can be gently, or harshly persuasive in form. Common types of a deflection are:

- Speed Humps/Speed Bumps
- Pedestrian Tables/Speed Tables
- Raised Crosswalks
- Raised Intersections
- Chicanes/Slaloms
- Forced Turns
- Street Closures (full or half)
- Median Islands
- Full Roundabouts (full or mini)
- Traffic Circles

Narrowing

When physical elements of the streetscape are drawn in toward the travel lane, the driver feels that the travel lane narrows as well. This perception, real or imaginary, prompts lower speed and more careful observation of the road ahead. Common types of narrowing include:

- Bumpouts/Curb Extensions
- Bus Bulbs
- Pinch Points/Chokers
- Neckdowns
- Narrow Streets
- Narrow Planting
- Streetside Parking

Narrow Streets

One of the primary methods of traffic calming, the use of narrow streets has many advantages, not all of which are immediately obvious. As mentioned above, wide roads are not safer roads. Studies have indicated that for local roads, crash frequency and injury rise with street width. The safest local roads are the narrowest. In addition to safety, narrow roads consume less land, produce less stormwater runoff, and are less expensive to construct and maintain.

Fire Response

One major hurdle to implementation of narrow streets is fire access. The International Fire Code sets a standard of 20 feet clear driving space for fire access. This allows two fire trucks to pass each other while getting to a fire, and allows plenty of space for firefighters to set up their equipment at a fire. This 20 foot standard would forbid roads with narrow lanes such as local roads with

12 or 14 feet of driving area (queueing streets) and two-lane roads with medians and less than 20 feet between parked cars and the median. For these narrow roads, approval of fire authorities is necessary.

Fire access is a critical life-safety issue. However, automobile and pedestrian safety is also a life-safety issue, and an increasing number of fire officials are recognizing this in their approval of alternative road configurations. Alternative street sections have already been proposed on Maui Island, including those in the Pulelehua project such as the “Street” and “Avenue” sections.

On roads with less than 20 feet of clear driving space, fire access can be maintained and even improved compared to a standard road network with a number of strategies:

- Alley access – Alleys provide a critical second means of access for fighting fires and are alternate routes for fire trucks.
- Network connectivity – Having room for fire trucks to pass each other becomes less important with good road connectivity. A connected network of streets allows fire trucks to access a fire from multiple directions.
- Center block staging area – Limiting parking in short sections mid-block, within hose distance of buildings in the middle of the block, can create a valuable staging area for firefighting equipment.
- Entry neck downs – Neck downs limit parking near intersections. In situations where two narrow roads meet, parking too near the corner can reduce turn radii so much that fire trucks cannot enter the street. Neck downs preserve fire access.
- Mountable curbs at corners and roundabouts – Mountable curbs serve to retain access for larger vehicles like fire trucks and freight trucks, while keeping corners tight and thereby limiting vehicular speeds.
- Limited block lengths – Blocks of limited lengths (less

Store fronts benefit from street parking as it activates the sidewalks

Effective streets prioritize spaces for pedestrian

Narrow streets slow down traffic enough to create safe environments for pedestrian circulation

than 300 feet), such as the short ends of typical city blocks, allow fires to be fought from the adjacent intersections even if the street itself is blocked.

- Sprinklers in buildings – Requiring sprinklers in all buildings can reduce fire risk and increase acceptable response time such that a reduction in fire truck speed may be allowed. This strategy was used in Baldwin Park in Orlando, Florida, to achieve local street widths as small as 21 feet across, with street parking.

These strategies, alone and in combination, can keep people and property safe from fires while improving road safety and livability.

Street parking creates a buffer between moving traffic and sidewalk

Parallel parking supplies functional parking for all uses

Street Parking

On-street parking acts as a traffic calming device and protects pedestrians from moving vehicles. While this buffer is not typically needed for physical protection, it serves as a valuable psychological division between the automobile realm and the pedestrian realm. In addition to this function, street parking helps to activate the street with people coming and going, and makes street-facing store and business entries work. Parallel parking is preferred to diagonal parking, as it keeps street widths to a minimum and because, diagonal parking can cause serious conflicts with bicycles since it impedes drivers' ability to see bicyclists while backing.

Intersection Design

Another critical factor for walkable streets is the design of intersections. Intersection design affects the safe and comfortable flow of travel for all modes, including walking and bicycling. Intersections are particularly important to the overall safety of a road network since a high proportion of accidents occur there. A variety of strategies can be used to make intersections safer and more functional for all users while maintaining critical functionality.

Actual Curb Radius and Effective Turning Radius

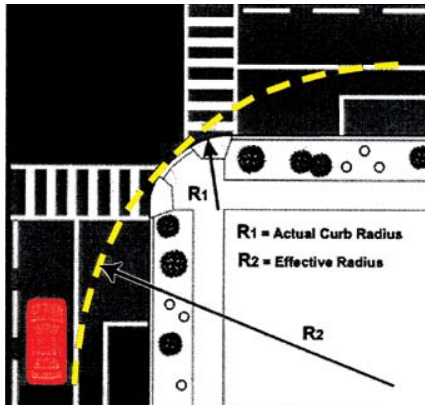
An important factor for intersection safety is the speed of turning vehicles. Smaller curb radii and the associated tighter turns by vehicles at corners can allow normal use by automobiles, while at the same time slowing turning movements and thereby increasing safety.

The effective turning radius (ETR) of a corner refers to the path of travel of the inside wheel of a turning vehicle (see figure at left). This is usually unmarked on the street and is not visible as part of the street assembly. The ETR of an intersection should not be confused with the actual curb radius which is likely to be significantly smaller.

Recognizing the difference between ETR and the actual curb radii is important because overlarge actual curb radiuses serve to make intersection crossing distances longer without enhancing the intersection's performance for automobiles. In fact, large curb radii can actually encourage drivers to take turns at unsafe speeds, endangering themselves, other drivers, and any pedestrians or bicyclists also using the intersection.

Curb extensions

Narrow widths make intersections safer for pedestrians by limiting crossing distances. Intentionally narrowing roads at intersections with curb extensions achieves shorter distances and helps to slow automobile traffic.



AASHTO Comparison of Actual Curb Radius (R1) to Effective Turning Radius (R2)

Curb extensions are allowed and encouraged at all intersections. It is also appropriate to consider curb extension areas as opportunities to achieve other goals of the plan.

In denser and more urban areas, curb extensions are well-suited for bus stops and other pedestrian seating areas. Special care should be taken to understand traffic flow and its implications on safety and signalization when bus stops are located near intersections and within the moving lane.

Curb extensions can also be paired with bicycle storage facilities which provide a safe and visible area for bicycles to be stored on the more active streets. Placing bike facilities in the curb extensions also means that pedestrian walkways and sidewalks in the immediate area are not partially blocked by parked bicycles. Placing bicycles in this prominent area also has the potential to add to the creation of a cycle-minded community where bicycles are not only a priority, but are also aesthetically part of the streetscape.

In lower intensity areas, curb extensions may be well-used as stormwater detention and filtration areas. "Flush" volumes of rainfall can carry unhealthy amounts of surface pollutants when the water runs over the street surface and along the street-side gutter. These pollutants are often carried along hard infrastructure for long distances, and potentially into sensitive waterbodies such as streams and ponds, and eventually the ocean. By catching surface contaminants in street-side swales and retention areas, contaminants can be filtered naturally by plants while the clean water is left to infiltrate into the ground. Using curb extensions to build these retention areas means that contaminants are less detrimental to downstream environments, and stormwater infrastructure has less of a chance of being overwhelmed by large volumes of stormwater runoff when large rain events occurs.

Bicycle and Pedestrian Facilities

Walking and bicycling are important transportation modes. They promote health, reduce traffic congestion, reduce the need for large parking lots, and are often enjoyable recreational activities which will serve as amenities for employees, residents, and visitors to the Park.

Pedestrian Network

The need for pedestrian facilities (sidewalks, safe crossings) is a given. Regardless of whether sidewalks are provided, people will at times walk along roadways, and forcing people to walk in traffic is dangerous and unnecessary. The Plan instead encourages people to walk by providing safe, pleasant sidewalks and pedestrian paths connecting all locations.

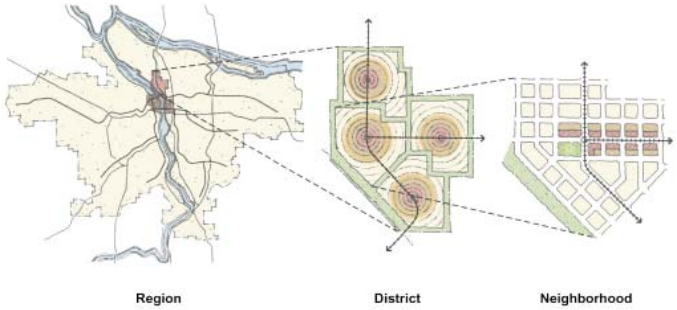
Traffic circles slow traffic without causing delays and can beautify the streetscape

Bicycle System

As for bicycles, they need to travel wherever automobiles travel. Bicycles have many of the health and environmental advantages of walking, and their higher speed allows longer travel distances. This will be especially important in the Park due to its current location outside the main area of development in Kihei.

In contrast to the typical 1/4 mile travel distance limit for pedestrians, their higher speed allows bicyclists to commonly travel much further, between one and 2.5 miles.

Connections & Interdependence



Thinking of individual elements of the urban environment as distinct and unrelated has been a hallmark of Modernist thought and has led to regions which are socially, economically and environmentally disconnected. Contemporary thought searches for a deeper understanding of the relationships between all elements of the built environment. Elements such as the environmental and economic connections and interrelationship of the park to the rest of the county are important considerations, as discussed above. A more direct and very important connection to consider here is transportation.

Intermodalism

Much transportation planning as it is currently practiced is in fact only automobile transportation planning. Given the increasingly-apparent health and environmental benefits of non-automotive modes like walking, bicycling and transit, this emphasis on the automobile is unfortunate. A robust, equitable, environmentally sound transportation system accommodates multiple transportation modes. A variety of strategies can be used to achieve this, from provision of adequate pedestrian and bicycling facilities to implementation of transportation demand management strategies such as parking cash-out, where those who do not use “free” parking receive a cash payment instead.

Connectivity

Connectivity is closely related to intermodalism and is an important tool. Well-connected street networks better accommodate multiple modes. Direct routes are especially important for pedestrians, since the rate of trips made by walking is highly sensitive to distance. Connected streets also affects trip lengths for automobiles, reducing vehicle miles traveled while providing alternate routes in case of road blockages or repairs. And consideration of connectivity between modes, such as good sidewalk connections to transit stations, improves the efficiency and effectiveness of the entire system.

The Fallacy of Free Parking

The issue of parking is one of the most contentious in planning and urban design. For many years, government authorities have required with minimum parking standards that plentiful parking be made available for every type of land use. The reasoning behind this was that if a business or residence did not provide sufficient parking, people would be forced to park their cars on the street, inconveniencing their neighbors. While generally not requiring that parking be free, regulations have required that parking be provided at such high levels that there

Multi-Modal street, Ottawa

has been typically no point in charging for it, and people have become used to the idea of plentiful, free parking wherever they go.

However, free parking is not really free. There are many costs to providing parking, from land costs to construction costs to ongoing maintenance and security. With the current system, however, the costs of parking are bundled into the cost of everything else, and so parking seems free to drivers.

Free, plentiful parking leads to increased driving. When a normal good is underpriced, it will be overconsumed. This applies to parking – because a portion of the journey is subsidized, people's decisions are influenced toward driving and away from other modes or carpooling. In addition, the requirement for large amounts of parking means that destinations are spread further apart by large parking lots. Since parking often takes up more than half of a developed parcel, the amount of destinations within reach in the critical pedestrian quarter mile is often cut by more than half. And few people enjoy walking to destinations through the seas of parking in which buildings often float.

Eliminating Parking Minimums

For these reasons, this plan proposes elimination of mandated parking provision in the Park. Businesses will undoubtedly choose to provide parking, but making their own decisions about the amount of parking will provide one more element of flexibility to businesses seeking to locate in the Park. A business which desires to promote walking, bicycling or transit use, or even to run a commute shuttle service for its employees, may choose to provide less parking.

If street parking becomes scarce, which is to say, if drivers are forced to circle looking for spaces, then metering can be introduced and the price raised to a level where supply equals demand. The resulting income could be devoted to improvements within the park such as sidewalk and street maintenance and improvements, open space maintenance, or transportation demand management measures such as transit passes. Moving automobile parking to a market-based system will help to incorporate market efficiencies and reduce the overconsumption motivated by underpricing.

See "The High Cost of Free Parking" by Donald Shoup for an in-depth discussion of the costs and complications of abundant and underpriced parking.

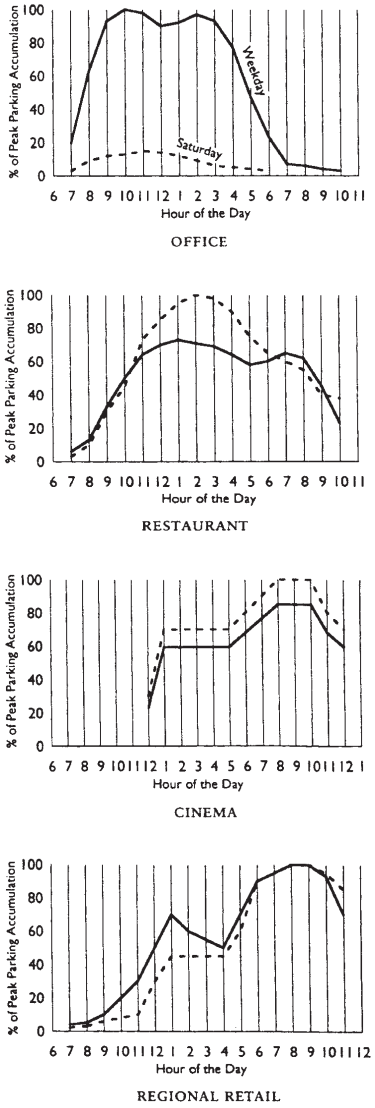
Shared Parking

While parking lots are necessary parts of the transportation system, they are expensive to build and maintain and they spread development out, making places less walkable. There are many benefits to only building the amount of parking that is needed. While each parking space has a financial and environmental cost, additional usage of that space has little additional cost. Thus, for a given amount of parking needed, it is much better to utilize one space for longer periods than have two spaces each occupied for only a portion of the day.

By recognizing that peak demand occurs at different times for different land uses, shared parking facilities help minimize the need for parking lots and garages. For example, office parking lots are typically full during the day Monday to Friday, but nearly empty at other

For more information about shared parking, see Shared Parking (Urban Land Institute, 2005) and Shared Parking Planning Guidelines (Institute of Transportation Engineers, 1995).

Multiple parking facilities can share one parking surface



Parking Demand Diagrams

times. Retail parking has a different pattern, reaching maximum usage on the weekend. Mixed use, retail, office, civic buildings, and multi-family developments may share off-street parking spaces. This approach works well anywhere, as long as walking distances to the parking area are reasonable.

Commercial users in the Park are encouraged to use shared parking. The Urban Land Institute's (ULI's) Shared Parking Standards, or an equivalent, are good ways to calculate the total number of shared parking spaces. To determine parking demand if spaces are shared, parking demands for the two or more uses are added for each hour of the day - for weekdays, Saturdays and any other days with significant variation in parking patterns - to see which hour produces the highest parking demand.

The following steps can be used to determine the minimum number of spaces needed for mixed-use areas:

1. Start with the maximum parking needed for each user which will be using the shared parking arrangement.
2. Determine the parking demand for each user for key times. The ULI uses weekdays and Saturdays at 10 AM, 1 PM, 5 PM, 8 PM and 10 PM.
3. Determine the total parking demand for these key times by summing the demand of the various land uses for each key time.
4. Determine the minimum shared parking space requirement by noting the largest of the aggregate parking demand figures.

Example Shared Parking Calculation

The following example illustrates how to determine the parking demand from joint use shared parking for a mixed-use area containing a 10,000 square foot restaurant and 200,000 square feet of office space:

Assume that the restaurant user estimates a maximum need for 10 spaces per 1,000 square feet of restaurant space and the office user estimates a maximum need for 3 spaces per 1,000 square feet of office space. A 10,000 square foot restaurant and a 200,000 square foot office building thus require 100 and 600 spaces, respectively, or 700 total.

Land Use	Single Use Peak Hour Demand (spaces)	Percentage of Demand for Key Times*									
		Weekdays					Saturdays				
		10 AM	1 PM	5 PM	8 PM	10 PM	10 AM	1 PM	5 PM	8 PM	10 PM
Retail	3/1,000 sf	50	75	75	65	25	50	100	90	65	35
Office	3/1,000 sf	100	90	50	5	5	15	15	5	0	0
Restaurant	10/1,000 sf	20	70	70	100	95	5	45	60	100	95
Cinema	1/3 seats	0	60	60	85	85	0	70	70	100	100
Hotel	1/room	45	30	60	90	100	40	30	60	90	100
Health Club	5/1,000 sf	10	80	100	30	10	60	80	60	30	10
Residential	1.3 - 2/unit (see req's)	85	80	85	95	100	70	65	75	95	100

** From the Urban Land Institute's* Shared Parking Standards, *1983.*

An example of a shared parking demand spreadsheet

To determine parking demand if spaces are shared, parking demands for the two uses are added for peak times on weekdays and Saturdays, to see which hour produces the highest parking demand. In this case, the highest total demand is at 10 am on a weekday, when the the office parking usage is estimated to be 100%, but the restaurant will be using only 20% of peak usage. The total is parking needed is thus 620 spaces, 80 fewer spaces than would be needed with separate parking lots. Even larger reductions in demand are possible with uses that have greater differences in their demand curves, such as office and cinema.

Conclusion

Development-as-usual has proven detrimental to our environment and our health. Maui needs development that is efficient, harmonious with the natural environment, and capable of meeting human needs.

Changing the current standard practice of development will take many years and the efforts of many people. The built environment changes slowly, so for a long time areas with better development patterns will be small pockets in large areas with less to offer. But for places scaled to people, small areas are enough - the walk to the grocery, to work, or to the park will happen at short distances, so even small pockets of quality can function better than they would have as autocentric sprawl.

And it is important to begin now. The Maui Research & Technology Park has the opportunity to showcase an array of cutting edge sustainable design strategies. Workers and residents will enjoy a diversity of housing, transit connectivity, and quality economic development from this community for years to come.

Wide traveling lanes promote higher vehicular speeds

Car-Centered intersections like this one at Lipoa Parkway and Pi'ilani Highway discourage pedestrian activity, leaving the park somewhat cut off from the rest of Kihei.