CITY OF PASADENA

Traffic Reduction Strategies Study

Draft Report

Appendix B: Traffic Reduction Strategy Sheets

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Introduction to the strategy sheets

Pasadena's General Plan provides a clear vision of the city's desired future. The Mobility Element of the General Plan sets forth the goals, policies, objectives and the strategies to achieve that vision. As the introduction to the Mobility Element explains, the purpose of the Mobility Element is, first and foremost, to set out "measures for the implementation of the city's guiding principle related to mobility -- Pasadena will be a city where people can circulate without cars. Because the Mobility Element provides a strong vision and well thought-out implementation measures, this study does attempt to repeat or reinvent the Mobility Element. Instead, this study illustrates the possibilities for implementing Pasadena's already adopted policies and implementation measures.

As a high-level, long-term document, the Mobility Element appropriately describes broad goals and strategies, including many that have a proven record of effectiveness in reducing vehicle trips and helping people meet their daily needs without a car. However, as befits this kind of long-term plan, the mobility element does not evaluate potential effectiveness of each strategy for reducing traffic, or to evaluate which implementation measures have the greatest potential and deserve the most attention.

The traffic reduction strategy sheets in this report are designed to help answer those questions. Each of the strategy sheets (e.g. Parking Cash-Out) provides a brief description of the strategy, references the places where the strategy is set forth as policy in the Mobility Element, and perhaps most importantly, provides evidence about the demonstrated effectiveness of the strategy in reducing traffic. The strategy sheets also provide specific examples of the strategy at work in other communities (or, oftentimes, in Pasadena, as in many cases Pasadena has already taken the lead in implementing the strategy).

Often, evidence from the published literature about the effectiveness of a particular strategy is limited, or comes from communities with substantially different contexts, or is difficult to untangle from the effects of other transportation strategies that were implemented at the same time. For example, successful transit oriented developments frequently combine several strategies in one place -- a mix of land uses, more frequent transit service, improved pedestrian facilities, and so on -- so that describing precisely which of these strategies produce the reduction in traffic observed is difficult. Nonetheless, despite the complexity of predicting travel behavior, a great deal of evidence on the effectiveness of traffic reduction strategies is available, and can be very helpful in evaluating where to spend limited public dollars, which initiatives to prioritize, and which strategies are best implemented in concert.

The strategy sheets also provide, in most cases, a brief description of potential obstacles to implementation, and potential side effects of the strategy, since being aware of the potential conflicts that can result from a measure is often crucial to its successful implementation.

The strategy sheets are ordered so that the twelve recommendations outlined in the main body of the report appear first.

Strategy	**Market rate pricing of On-Street Parking**
Category	Parking Strategies
In Mobility Element?	Policies: Sections: 3.2.3 Protect Neighborhoods 4.1.3 Protect Neighborhoods 4.1.4 Manage Multimodal Corridors 5.5.1.4 Manage Parking Supply and Demand 5.5.4.4 Provide for Public Parking Needs 
Description	One common source of excess traffic in vibrant urban districts is cruising for parking, that is, people searching and circling to find a free or below market-rate curb parking space. This problem adds more traffic to an already congested street network. In these circumstances, managing parking prices to ensure that there are available curb parking spaces at all times of day is an important strategy for reducing traffic. On-street parking pricing is already in place in several of Pasadena's central districts, and past surveys indicated that at least in the Old Pasadena parking meter zone, the parking rates and hours in effect were achieving an 86% occupancy rate, or essentially optimal parking occupancies for preventing cruising traffic while still making good use of the parking supply and attracting customers. By charging for curb parking late into the evening and even on Sundays -- something that many other large cities fail to do, even when a district has very high demand for parking at these hours – Old Pasadena has been a model of preventing cruising for parking. However, under current policies, parking meter locations, rates and hours of operation are not specifically set to maintain an optimal number of vacancies and prevent cruising traffic, and in parts of Pasadena outside of Old Pasadena, it is likely that cruising traffic is occurring. Also, new meter technologies, such as the multi-space meters used in a Pasadena pilot program, could allow the City to more easily optimize parking demand through fair market rate pricing, rather than traditional parking management methods that use inflexible flat hourly pricing and time limits regardless of demand patterns which can vary substantially by location and time-of-day. The following policies for the pricing of on-street parking can effectively eliminate the excess traffic created by drivers cruising for parking: 1. **Set a policy goal of keeping occupancy rates at an optimal 85% (so that 1 in 8 spaces, or about one per block, will always be available).** This rate is a widely-accepted industry standard that provides a high level of convenience for parkers and largely eliminates the circling for parking which contributes to increased driver frustration, traffic congestion and collisions. This policy will also ensure turnover of the most convenient curb-parking spaces and availability for customers, particularly where there are concentrations of ground floor retail businesses (This latter goal is already set forth in Pasadena's Mobility Element.) 2. **Grant staff authority to adjust hourly rates based on Council-adopted optimum occupancy standard (85%).** In order for fair market rate pricing to be effective, staff need to be able to respond quickly when occupancy rates dip well below or go over the optimal standard (85% of stalls occupied), rather than having every adjustment to prices be a lengthy political event. Under this policy, Council sets the overall goal and

	then delegates to staff the responsibility of achieving that goal. 3. **Plan regular occupancy checks and adjust rates.** Make occupancy checks and rate adjustments (if necessary) at a minimum on a quarterly basis. With some of the new meter technologies, the City should have the capability to monitor hour-by-hour occupancy. Meter rate changes could then be made from the City control center without any need for expensive on-street surveying or staff to adjust meter pricing displays.
Examples of Leading Cities	Redwood City, CA is the first city in the United States to have implemented a zoning ordinance that follows the parking management principles described above. The policy applies in its Downtown Meter Zone. Parking rates are varied to meet the 85% target occupancy principle, and digital multi-space meters are being installed both for the convenience of drivers and to collect information on occupancy. The following process for adjusting Downtown meter rates has been adopted in the Municipal Code (Sec. 20.120): A. To accomplish the goal of managing the supply of parking and to make it reasonably available when and where needed, a target occupancy rate of eighty-five percent (85%) has been established. B. At least annually and not more frequently than quarterly, the Parking Manager surveys the average occupancy for each parking area in the Downtown Meter Zone that has parking meters. Based on the survey results, the Parking Manager adjusts the rates up or down in twenty-five cent ($0.25) intervals to seek to achieve the target occupancy rate. In order to secure and maintain the support of the downtown merchants and employers for this policy, Redwood City's ordinance (inspired by Old Pasadena's successful use of the same approach) requires that all net revenue from the parking meters be spent on public improvements that benefit the Downtown Meter Zone.
Effectiveness	Studies performed on cruising for parking found an average of 30% (and a high of 74%) of downtown traffic was caused by cruisers and the average cruising time was about 8 minutes. A separate study by Professor Donald Shoup (2005) investigated cruising for parking patterns in Westwood Village in Los Angeles. Every day, cruisers within a 15-block district drove a distance farther than the distance across the U.S. Over a year, cruising within the same blocks created 945,000 excess vehicle miles traveled (VMT) – equivalent to two roundtrips to the moon. Market-rate parking pricing effectively eliminates cruising, thus reducing congestion and improving mobility.
Implications	*Economic* As demonstrated by the success of old Pasadena's parking meter zone, charging for on-street parking according to the 85% target occupancy principle will not drive customers away. Under the policy, if rates are set too high, so that too many spaces are empty, the policy requires adjusting rates downward until the parking spaces are again well-used by customers. *Socio-Economic* The most convenient and therefore the most attractive parking spaces may be too expensive for economically disadvantaged persons when using the 85% target occupancy rate. However, this group of people walks, cycles and uses transit much more than any other income group and are therefore less affected by parking pricing. In addition, the market rate principle applies in the opposite direction as well. Parking a block or two away can therefore be free or much less expensive than the most convenient parking spaces. Furthermore, revenue may be used to improve pedestrian, bicycle and transit accessibility to the district.
Resources	Redwood City Redevelopment. *Downtown Parking.* Accessed on August 22, 2006 at http://www.redwoodcity.org/cds/redevelopment/downtown/parking.html. Redwood City (2005) *Downtown Parking Management Plan.* Staff Report, June 6, 2005 (To the Honorably Mayor and City Council From the City Manager).

	Redwood City Municipal Code. Sec. 20.120. *Periodic Adjustment Of Downtown Meter Zone Meter Rates*. Redwood City Municipal Code. Sec. 20.121. *Use Of Downtown Meter Zone Parking Meter Revenues*. Shoup (2005) *The High Cost of Free Parking*. American Planning Association, Planners Press, Chicago, IL.

Strategy	**Parking Benefit District**
Category	Parking Strategies
In Mobility Element?	Section 4.1.4 Manage Multimodal Corridors
Description	Revenues from paid parking in a Parking Benefit District should fund public improvements that benefit the District itself. ("Revenues" means total parking revenues from the area, less revenue collection costs, such as purchase and operation of the meters, enforcement and the administration of the district.) If parking revenues seem to disappear into the General Fund, where they may appear to produce no direct benefit for the District, there will be little support for installing parking meters, or for raising rates when needed to maintain decent vacancy rates and prevent cruising traffic. But when District merchants and property owners can clearly see that the monies collected are being spent for the benefit of their blocks, on projects that they have chosen, they become willing to support market rate pricing. To ensure such continuing support for a Parking Benefit District, and for continuing to charge fair market rates for parking, it is crucial to give stakeholders a strong voice in setting policies for the District, deciding how the parking revenues should be spent, and overseeing the operation of district to ensure that the monies collected from their customers are spent wisely.
Examples of Leading Cities	The City of Pasadena was the first city in the entire United States to create a Parking Benefit District. In Old Town Pasadena, the City chose to divert all meter revenues collected from this area back to it in the form of public improvements. The resulting improvements to the streetscape, including conversions of its alleys into walkways with access to shops and restaurants, have transformed the district into a vital shopping, dining and entertainment area. The choice to fund local improvement in this district benefited the City of Pasadena by vastly increasing property values and resulting property tax revenues. In other cities, similar improvements have been funded using parking benefit districts in which a smaller proportion of the meter revenue is dedicated for improvement in the area where the revenue was generated. For example, San Diego has a 45% local return policy in its 3 parking meter benefit districts.  In Boulder, Colorado, all downtown parking meter revenue -- more than $1 million per year -- is returned to the Downtown's business improvement district. Among other things, the revenue is used to fund more than $325,000 per year worth of transportation demand management programs, including a free universal transit pass for all downtown employees, a Guaranteed Ride Home program, ride-matching services, bicycle parking and a number of other benefits. In Portland, Oregon's Lloyd District, revenue from the district's meters is given to the district's Transportation Management Association, providing the funding needed to support the district's universal transit pass program for its member employees.
Effectiveness	There are two primary reasons for a Parking Benefit District to be considered a traffic reduction strategy: first, it generates revenue to support transportation demand management programs and/or to improve the streetscape, and hence also the pedestrian environment; and equally importantly, it generates the political support required to maintain a policy of pricing parking at

	rates high enough to eliminate the problem of cruising traffic. However, a Parking Benefit District that helps revive an economically struggling district (as Old Pasadena's Parking Meter Zone did) has most likely both a positive and negative impact on mobility – it increases pedestrian mobility but may increase traffic to that specific district as it evolves into a more vibrant community (which is often a primary goal when establishing a Transportation Improvement district).
Implications	*Socio-Economic* Priced parking may be too expensive for economically disadvantaged persons. However, this group of people walks, cycles and uses transit much more than any other income group and are therefore less affected by parking pricing. Additionally, revenue is often used to improve streetscape and pedestrian accessibility, benefiting all visitors to the district, or to provide transit passes to employees, which is especially beneficial to low income households who are more likely to use transit. Overall, the equity effects of parking benefit districts will vary depending on how the revenues from the district are spent.
Resources	City of Pasadena (2002) *Old Pasadena Zoning Parking Credit*. Staff Report to City Council, September 9, 2002. City of Pasadena (2002) *Zoning Parking Credit Program Modifications*. Staff Report to City Council, December 9, 2002. City of Pasadena (2002) *Old Pasadena Zoning Credit Parking Program Guidelines*. Gruber, Frank (2001) "The Black Hole of Planning, *The Look Out*, June 8, 2001. Kolozsvari, Douglas and Shoup, Donald (2003), Turning Small Change into Big Changes, *Access*, 23, pp 2-7. Litman, Todd (2006) *Parking Management Best Practices*. Institute for Transportation Engineers. Redwood City Municipal Code. Sec. 20.121. *Use Of Downtown Meter Zone Parking Meter Revenues*. Shoup (2005) *The High Cost of Free Parking*. Urban Land Institute.

Strategy	**Transportation Management Association (TMA)**
Category	Transportation Demand Management
In Mobility Element?	Policies: 4.13 Sections: 4.1.4.3 Managing Demand
Description	According to a nationally recognized publication (NCTR, 2001), a recommended definition of a TMA is: "A Transportation Management Association (TMA) is an organized group applying carefully selected approaches to facilitating the movement of people and goods within an area. TMAs are often legally constituted and frequently led by the private sector in partnership with the public sector to solve transportation problems." There are currently about 150 known TMAs in North America, varying in size, structure and mission. Glendale TMA, Burbank TMO and Pasadena TMA are only a few of the TMAs present in Los Angeles County. Services often provided by TMAs are (NCTR, 2004): • Vanpool services and subsidies • Rideshare matching • Guaranteed Ride Home program • Transit pass subsidies • Shuttle/local transit • Parking pricing/management • Information and education, events and promotional materials • Assistance with trip reduction surveys
Examples of Leading Cities	As described in one of this report's case studies, Lloyd District TMA in Portland, OR is one of the most successful TMAs in the United States. Strategies include the heavily subsidized annual transit pass called Passport, offered at less than a quarter of the cost of a regular annual transit pass to employers who distribute the passes to all employees; parking management, employee parking pricing and on-street parking pricing; information service; Transportation Store; and infrastructure improvements for pedestrians, bicyclists and transit in the district. 
Effectiveness	In the nine years since the baseline study was conducted in 1997, the drive alone rate among all Lloyd District employees (both among TMA employees and employees not covered by the TMA) has fallen almost 29%. Transit ridership has increased more than 86% over the same period. TMA employees have demonstrated even more remarkable results with some businesses showing a transit and bike mode split of nearly 65%.

Implications	TMAs often increase equity by giving non-drivers a benefit comparable to free parking. They often also benefit low-income and transportation disadvantaged employees by improving travel choices.
Resources	Lloyd TMA (2006) *Lloyd TMA Annual Report 2006*. Accessed on August 31, 2006 at http://www.lloydtma.com. National Center for Transit Research (2001) *TMA Handbook*. Association for Commuter Transportation and the Florida Department of Transportation. National Center for Transit Research (2004) *2003 Transportation Management Association (TMA) Survey*. Association for Commuter Transportation and the Florida Department of Transportation. Phone Conversations with Rick Williams, Lloyd TMA Executive Director, August 21-22, 2006.

Strategy	**Universal Transit Passes**
Category	Transit
In Mobility Element?	No
Description	In recent years, growing numbers of transit agencies have teamed with universities, employers, or residential neighborhoods to provide universal transit passes. These passes typically provide unlimited rides on local or regional transit providers for low monthly fees, often absorbed entirely by the employer, school, or developers. A review of existing universal transit pass* programs found that the annual per employee fees are between 1% and 17% of the retail price for an equivalent annual transit pass. The principle of employee or residential transit passes is similar to that of group insurance plans – transit agencies can offer deep bulk discounts when selling passes to a large group, with universal enrollment, on the basis that not all those offered the pass will actually use them regularly. Universal transit passes provide multiple benefits, as discussed below: *For transit riders* • Free access to transit (e.g., eliminating the current $0.50 per ARTS ride, $1.25 for an average Metro Gold Line ride and $1.00 for a Foothill Transit ride) • Rewards existing riders, attracts new ones • For employees who drive, making existing transit free can effectively create convenient park-and-ride shuttles to existing underused remote parking areas *For transit operators* • Provides a stable source of income • Increases transit ridership, helping to meet agency ridership goals • Can help improve cost recovery, reduce agency subsidy, and/or fund service improvements *For communities* • Reduces traffic congestion and increases transit ridership • Reduces existing parking demand: Santa Clara County's (CA) ECO Pass program resulted in a 19% reduction in parking demand • Reduces unmet parking demand: UCLA's BruinGo! program resulted in 1,300 fewer vehicle trips which resulted in 1,331 fewer students on the wait list for parking permits (a 36% reduction) • Reduces future growth in parking demand: University of Washington's U-Pass program helped avoid construction of 3,600 new spaces, saving $100 million (since 1983 the university population increased by 8,000 but actually reduced the number of parking spaces) *For developers* • Universal transit pass programs can benefit developers if implemented concurrently with reduced parking requirements, which consequently lower construction costs • Providing free cost transit passes for large developments provides an amenity that can help attract renters or home buyers as part of a lifestyle marketing campaign appealing to those seeking a "new urban lifestyle" *For employees/employers*

- Reduces demand for parking on-site
- Provides a tax-advantaged transportation benefit that can help recruit and retain employees

Examples of Leading Cities

An excellent example of a universal transit pass is the Eco-Pass program managed under the Central Area General Improvement District (CAGID) in downtown Boulder, which provides free transit on Denver's Regional Transportation District (RTD) light rail and buses to more than 8,300 employees, employed by 1,200 different businesses in downtown Boulder. To fund this program, Boulder's downtown parking benefit district pays a flat fee for each employee who is enrolled in the program, regardless of whether the employee actually rides transit. Because every single employee in the downtown is enrolled in the program, the Regional Transportation District in turn provides the transit passes at a deep bulk discount. The table below shows the rates if Downtown Boulder businesses were to buy their passes individually. The cost per employee per year varies from $86 to $118, which is only 5.8% to 7.9% respectively of the cost of an equivalent annual ValuPass ($1,485 per year). Since CAGID encompasses more than 2,000 employees, and has a special contract with RTD, passes are purchased at the rate of $83 per person. The Seattle and Tri-Met programs offers similar discounted annual passes to employers who enroll all of their employees in the program.

Boulder 2006 Eco Pass Pricing

Employees	Contract Minimum Per Year	Per Employee/Per Year				
		1-24 Employees	25-249 Employees	250-999 Employees	1,000-1,999 Employees	2,000+ Employees
1-10 11-20 21+	$1,188 $2,376 $3,564	$118	$106	$97	$90	$86

Santa Clara Valley Transportation Authority (VTA) provides both employee and residential Eco Passes. The cost per pass varies depending on size of the company or residential area and proximity to high-quality transit service. The table below shows the variable rates. The cost per annual Eco Pass varies between $7.50 and $120, which is only 0.6% and 9%, respectively, of an Adult Express Pass ($1,348 per year), which is comparable to an Eco Pass.

eco pass residential eco pass

Company Location/Service Level				
Downtown San Jose	1 – 99 Employees	100 – 2,999 Employees	3,000-14,999 Employees	15,000 + Employees
	$120	$90	$60	$30
Areas served by bus & light rail	1 – 99 Employees	100 – 2,999 Employees	3,000-14,999 Employees	15,000 + Employees
	$90	$60	$30	$15
Areas served by bus only	1 – 99 Employees	100 – 2,999 Employees	3,000-14,999 Employees	15,000 + Employees
	$60	$30	$15	$7.50

**The term Universal Transit Pass is also sometimes used to refer to regional pass programs, such as Metro's EZ Pass program in the Los Angeles region, which allows transit riders to purchase a*

	pass that is good for passage on several different transit systems. It is also occasionally used to refer to electronic universal fare cards, such as the Translink program (under development for the San Francisco Bay Area), which acts as an "electronic purse", deducting fares for the different transit systems – BART, Caltrain, San Francisco Muni, etc. – as the rider uses each system. However, for the purposes of this study, by a Universal Transit Pass program, we mean programs such as the Eco-Pass programs operated by Denver's Regional Transportation District and the Santa Clara Valley Transportation Authority, which offer employers the opportunity to purchase deeply discounted transit passes for their employees, on the condition that a pass is purchased for every employee (i.e., there is universal enrollment).
LA Metro Program	Metro currently offers three employer/institution-based universal transit pass programs: • *A-TAP* (Annual Transit Pass) allows businesses to provide annual passes for those employees who currently take Metro transit to work. There is no discount on this pass, so the only convenience is that the employee gets an annual pass instead of having to get monthly passes. The cost for an annual pass equals the cost of 12 monthly passes at $54 each, totaling $624/year. There are currently a handful of employers who participate in A-TAP. • *B-TAP* (Business Transit Pass) was designed exclusively for businesses wanting to offer annual transit passes as part of benefits packages. This pass is distributed to all full-time employees. However, the employer can get exemptions for vanpool riders and transit commuters who can not take Metro to work, but rely on another transit provider. Each business has the flexibility to choose how the passes are paid for, either by a full or partial subsidy or by allowing employees to pay the cost through payroll deductions. The cost of each employee pass is based on the service level of transit stopping within two blocks of each site. There are three levels of service: o *High* (e.g. bus frequency of 20 minutes or less) with an annual cost of $194/employee. This equals 31% of a regular annual pass. o *Medium* with an annual cost of $138 per employee. This equals 22% of a regular annual pass. o *Low* (only a few buses stopping per day) with an annual cost of $92 per employee. This equals 15% of a regular annual pass. In addition, the fee is prorated for new employees or for a company who does not join in the beginning of the year. The B-TAP program was introduced in August 2005, but was not marketed until November 2005. There are currently 25 B-TAP members, varying in size from a few employees to 220 employees (June, 2006). • *I-TAP* (Institutional Transit Pass) is available to larger organizations such as colleges, universities and trade schools. The fee per student is based on a combination of service level (see B-TAP) and existing and expected ridership. Each institution negotiates with the Metro Commute Services Department separately to reach an agreement. Once the program is implemented, Metro keeps track of the number of distributed passes at each institution, which then forms the basis for how much the institution must pay the following year. It should be noted that the cost of the annual B-TAP pass is 15-31% of a regular annual pass. Both Boulder's and Santa Clara VTA's universal transit passes cost at the most less than 10% of their regular annual transit passes. Metro is currently investigating the possibility of including other LA-based transit agencies into its universal transit pass program, similar to its EZ Pass program which covers more than 20 transit

	agencies throughout the Greater Los Angeles Region.
Effectiveness	Universal transit passes are usually extremely effective means to reduce the number of car trips in an area; reductions in car mode share of 4% to 22% have been documented, with an average reduction of 11%. By removing any cost barrier to using transit, including the need to search for spare change for each trip, people become much more likely to take transit to work or for non-work trips.

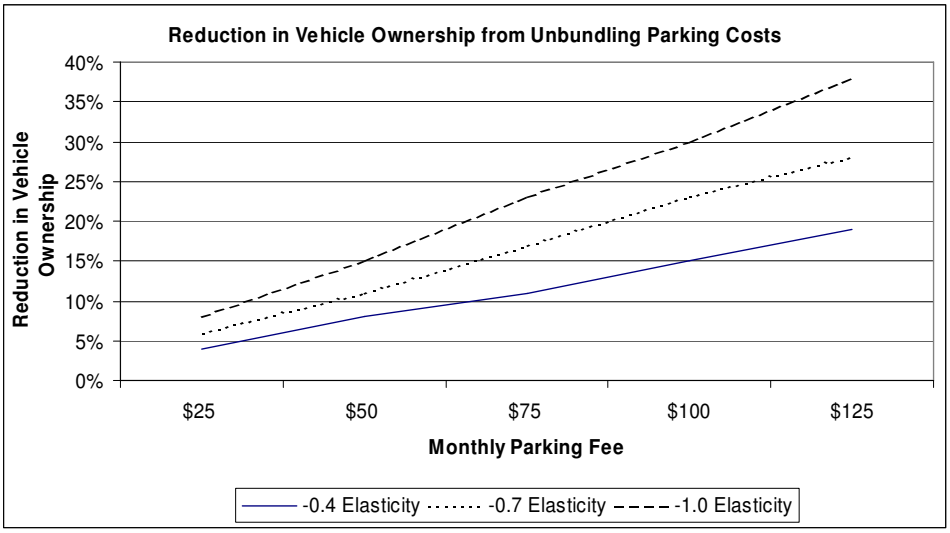
Location	Drive to work		Transit to work	
Municipalities	Before	After	Before	After
Santa Clara (VTA)	76%	60%	11%	27%
Bellevue, Washington	81%	57%	13%	18%
Ann Arbor, Michigan	N/A	(4%)	20%	25%
Downtown Boulder, Colorado	56%	36%	15%	34%
Universities				
UCLA (faculty and staff)	46%	42%	8%	13%
Univ. of Washington, Seattle	33%	24%	21%	36%
Univ. of British Colombia	68%	57%	26%	38%
Univ. of Wisconsin, Milwaukee	54%	41%	12%	26%
Colorado Univ. Boulder (students)	43%	33%	4%	7%

Many cities and institutions have found that trying to provide additional parking spaces costs much more than reducing parking demand by simply providing everyone with a free transit pass. For example, a study of UCLA's universal transit pass program found that a new parking space costs more than 3 times as much as a free transit pass ($223/month versus $71/month).

Implications	*Economic* Positive effect on the ability to attract and retain jobs/residents as it is a benefit. No negative economic effects for the public sector as long as the new pass revenue to transit agency/ies is greater than the costs of lost revenue from individual passes, plus the costs of adding any new transit service required to handle additional patrons. For many suburban transit agencies, which have excess capacity, no additional hours of transit service are required. For the private sector, economic impacts will vary depending on whether participation in the program is entirely voluntary, or mandated (e.g., by city ordinance). *Social* Increases affordability and equity, since employees and students no longer have to pay for the often significant costs of transit passes. Universal transit pass programs are particularly beneficial to low income employees, residents and students, who are more likely than the average person to ride transit. May decrease walking/biking share, which may have a negative impact on health and the environment.
Resources	Brown, et. al. (2003) Fare-Free Public Transit at Universities. *Journal of Planning Education and Research* 23: 69-82. King County Metro (2000) *FlexPass: Excellence in commute reduction, eight years and counting*. Accessed on August 18, 2006 at http://www.commuterchallenge.org/cc/newsmar01_flexpass.html. LA Metro (2006) Phone Interview with Donna Blanchard at Metro's Commute Services Department on June 30, 2006. Meyer et. al. (1998) *An Analysis of the Usage, Impacts and Benefits of an Innovative Transit Pass*

	Program. Mode shift one year after implementation in 1994. Santa Clara Valley Transportation Authority. Accessed on August 31, 2006 at http://www.vta.org/ecopass/ecopass_corp/index.html Toor, et. al. (2004) 1989 to 2002, Weighted average of students, faculty, and staff; *Transportation and Sustainable Campus Communities*. White et. al. *Impacts of an Employer-Based Transit Pass Program: The Go Pass in Ann Arbor, Michigan*. Accessed on August 18, 2006 at http://www.apta.com/research/info/briefings/documents/white.pdf Wu et. al. (2004) *"Transportation Demand Management: UBC's U-P ass – a Case Study",* 2002 to 2003, the effect one year after U-Pass implementation. Poinsatte F. et. al. (1999) *Finding a New Way: Campus Transportation for the 21st Century*.

Strategy	**Unbundling Parking Costs**
Category	Parking Strategies
In Mobility Element?	No
Description	Parking costs are generally subsumed into the sale or rental price of housing and commercial space for the sake of simplicity, and because that is the more traditional practice in real estate. But although the cost of parking is often hidden in this way, parking is never free. The expected cost for each new structured parking space in Downtown Pasadena, for example, is more than $30,000 per space. Given land values in the area, surface spaces are at least as valuable.
Examples of Leading Cities	Bellevue, WA: Transportation researcher Todd Litman reports that Bellevue "requires building owners to include parking costs as a separate line item in leases and to charge a minimum rate for monthly long-term parking that is equal or greater than the cost of a bus pass. This makes it easier for employers to determine the value of their current parking subsidies [when employers are establishing employee parking charges or parking cash-out programs]." Additionally, this policy means that employers who successfully reduce parking demand and traffic to their worksites are able to reap financial benefits by leasing fewer parking spaces. San Francisco enacted a new zoning ordinance in 2006 affecting downtown commercial and residential zones (DTR and C-3 Districts) which requires the unbundling of parking costs in all residential structures over ten dwelling units. The Planning Code now states (Article 1.5: Off-Street Parking and Loading, Sec. 167.): "...(a) In DTR and C-3 Districts, all off-street parking spaces accessory to residential uses in new structures of 10 dwelling units or more, or in new conversions of non-residential buildings to residential use of 10 dwelling units or more, shall be leased or sold separately from the rental or purchase fees for dwelling units for the life of the dwelling units, such that potential renters or buyers have the option of renting or buying a residential unit at a price lower than would be the case if there were a single price for both the residential unit and the parking space…" *UCLA Weyburn Terrace Apartments, Los Angeles* provides a local example of unbundling parking. The decision to unbundle parking led to a 21% reduction in the number of necessary parking spaces from 1,804 to 1,430. The reduction decreased parking cost by 29% per apartment from $35,000 to $25,000. This shift generated more space for housing by decreasing parking square feet as a percentage of housing square feet from 93% to 73%.
Effectiveness	Charging separately for parking is the single most effective strategy to encourage households to own fewer cars, and rely more on walking, cycling and transit. According to a study by Todd Litman (2004), unbundling residential parking can significantly reduce household vehicle ownership and parking demand. These effects are presented in the figure below.



Source: Litman (2004).

Implications

Socio-economic

Unbundling parking costs changes parking from a required purchase to an optional amenity, so that households and employers can freely choose how many spaces they wish to lease. Especially among households with below average vehicle ownership rates (e.g., low income people, singles and single parents, seniors on fixed incomes, and college students), allowing this choice can provide a substantial financial benefit. Unbundling parking costs means that these households no longer have to pay for parking spaces that they may not be able to use or afford.

The unbundling of parking costs has the positive effect of helping those with the greatest need – low-income residents. Each purchase of a vehicle for a low-income household consumes a greater percent of the household budget than a similar purchase for a wealthier household, naturally limiting the vehicle ownership rates of poorer households. A parking space costing $100 per month represents only 5% of the $2,000 cost of a luxury condominium, but 20% of the $500 cost of a small apartment (Litman, 2005).

Moreover, parking tends to squeeze out smaller units that are the most affordable. By increasing the parking requirement from one to two parking spaces, the maximum number of 500 square foot units per acre drops 37%. This has a disproportionately large effect on low-income households. In comparison, the number of 2,000 square foot townhomes designed for wealthier households declines at only a fraction of the rate (ibid).

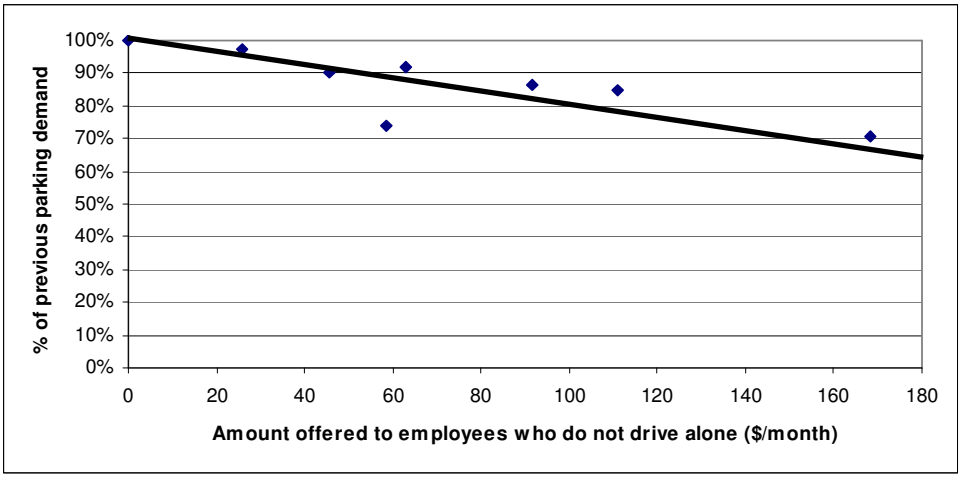
Resources

City and County of San Francisco (2006). City and County of San Francisco Municipal Code Planning Code. Article 1.5: Off-Street Parking and Loading, Sec. 167. Parking Costs Separated from Housing Costs in New Residential Buildings.

Litman, T. (2005) *Parking Requirement Impacts on Housing Affordability*. Victoria Transport Policy Institute.

Shoup, D. (2005) *The High Cost of Free Parking.* The American Planning Association.

Strategy	**Parking Cash-Out**
Category	Parking Strategies
In Mobility Element?	Section 5.5.4.9 Promote Trip Reduction Programs
Description	The majority of all employers provide free or reduced price parking for their employees as a fringe benefit. Under a parking cash out requirement, employers are allowed to continue this practice on the condition that they offer the cash value of the parking subsidy to any employee who does not drive to work. The cash value of the parking subsidy can be offered in one of two forms: • A transit/vanpool subsidy equal to the value of the parking subsidy (of which up to $105 is tax-free for both employer and employee) • A taxable carpool/walk/bike subsidy equal to the value of the parking subsidy Employees who opt to cash out their parking subsidies should not be eligible to receive free parking from the employer, and should be responsible for their parking charges on days when they drive to work. The benefits of parking cash out are numerous, and include: • Provides an equal transportation subsidy to employees who ride transit, carpool, vanpool, walk or bicycle to work. • Provides a low-cost fringe benefit that can help individual businesses recruit and retain employees. • Employers report that parking cash-out requirements are simple to administer and enforce, typically requiring just one to two minutes per employee per month to administer. In addition to these benefits, the primary benefit of parking cash out programs is their proven effect on reducing auto congestion and parking demand.
Examples of Leading Cities	Santa Monica requires proof of compliance with the State of California's parking cash out law before issuing occupancy permits for new commercial development. Another enforcement mechanism that has been considered in San Francisco (but not yet implemented) is to require employers to provide proof of compliance (via an affidavit signed by a company officer) at the same time that they receive/renew their business license or pay their annual business taxes. This method ensures that all employers are in compliance with parking cash out requirements on an ongoing basis, rather than limiting proof of compliance to a one-time enforcement for employers occupying new or renovated commercial buildings.
Effectiveness	The figure below illustrates the effect of parking cash-out at seven different employers located in and around Los Angeles. It should be noted most of the case study employers are located in areas that do not have good access to transit service, so that a large part of the reduced parking demand that occurred with these parking cash out programs resulted when former solo drivers began carpooling. *Effects of parking cash-out on parking demand. Source: Derived from Donald Shoup, "Evaluating the Effects of Parking Cash-Out: Eight Case Studies," 1997. Based on the cost in 2005 dollars.*



Implications	*Socio-Economic* Parking cash-out provides an equal transportation subsidy to employees who ride transit, carpool, vanpool, walk or bicycle to work. The benefit is particularly valuable to low-income employees, who are less likely to drive to work alone. It also provides a low-cost fringe benefit that can help individual businesses recruit and retain employees. *Mobility* Increases mobility by reducing auto dependency, congestion and air pollution.
Resources	Shoup (1997) *Evaluating the Effects of Parking Cash-Out: Eight Case Studies*.

Strategy	**TDM & Trip Reduction Ordinances**
Category	Transportation Demand Management
In Mobility Element?	Policies: 4.13 Sections: 4.1.1 Promote a Livable and Economically Strong Community 5.5.1.8 Air Quality Improvements 5.5.4.4 Provide for Public Parking Needs 5.5.4.9 Promote Trip Reduction Programs
Description	Transportation Demand Management (TDM) refers to a package of strategies to encourage residents and employees to drive less in favor of transit, carpooling, walking, bicycling and teleworking. It encompasses financial incentives such as parking charges, parking cash-out or subsidized transit passes; Guaranteed Ride Home programs to give employees the security to carpool or ride transit; and information and marketing efforts. An expansion in TDM strategies can: • *Allow intensification or expansion of existing uses.* Property owners may wish to convert industrial sites to offices or other uses that involve more employees. However, limited on-site parking is a major constraint, which TDM may be able to help mitigate through reducing parking demand. • *Allow new development to take place with less parking and traffic.* TDM can be required as a condition of approval for new development projects, reducing traffic impacts and allowing less on-site parking to be provided. • *Provide transportation choices for employees of existing businesses.* TDM is not limited to new development or changes of use, but can alleviate traffic, parking and pollution concerns from existing businesses. Enforcement of TDM requirements, particularly for smaller employers, can be a major challenge. Fines, bonds and monitoring requirements are three common techniques to help ensure that TDM is actually implemented. Smaller employers can be encouraged or required to join a Transportation Management Association, which offers or implements TDM measures on their behalf. Several cities around North America currently have trip reduction or TDM ordinances that require new development to comply with certain traffic reduction requirements. The City of Pasadena has a trip reduction ordinance in place that is currently under revision. Naturally, these ordinances only affect new development. They can therefore have a significant impact on trip and parking generation in new developments. However, since new development usually is fairly limited compared to existing built use in a city, it will take many years before a robust TDM ordinance has an impact on citywide mode split.
Examples of Leading Cities	South San Francisco, CA provides a good example of a TDM ordinance for new development. It requires all large non-residential projects east of US 101 to implement trip reduction measures that achieve at least 28% alternative mode usage, and also allows reduced parking as a result. With increasing FARs, the alternative mode usage rate increases as well. For new office development with the maximum allowable FAR, the alternative mode usage must be 45%. The following table lists required and additional measures for all projects generating 100 or more trips.

Table 20.120.030-B: Summary of Program Requirements	
Required Measures for all Projects Generating 100 or More Trips	**Additional Measures Chosen by Applicant to Meet the Required Alternative Mode Use (at least one measure required of all projects)**
A. Bicycle Parking, Long-Term	A. Alternative Commute Subsidies/Parking cash out
B. Bicycle Parking, Short-Term	B. Bicycle Connections
C. Carpool and Vanpool Ridematching Service	C. Compressed Work Week
D. Designated Employer Contact	D. Flextime
E. Direct Route to Transit	E. Land Dedication for Transit Facilities/Bus Shelter
F. Free Parking for Carpool and Vanpools	F. Onsite Amenities
G. Guaranteed Ride Home	G. Paid parking at Prevalent Market Rates
H. Information Boards/Kiosks	H. Telecommuting
I. Passenger Loading Zones	I. Reduced Parking
J. Pedestrian Connections	J. Other measures as determined by the Chief Planner consistent with (B) below
K. Preferential Carpool and Vanpool Parking	
L. Promotional Programs	
M. Showers/Clothes Lockers	
N. Shuttle Program	
O. Transportation Management Association Participation	

Specific information about each required measure can be found in the ordinance.

All projects required to submit a TDM program in South San Francisco are subject to an annual survey. Applicants seeking an FAR bonus are also subject to a triennial report and penalties for noncompliance.

The purpose of the *annual survey* is to report on the compliance of a project with the TDM plan. The city or the city's designated representative prepares and administers the annual survey of participants in the TDM program. The survey administrator must use statistical sampling techniques that create a ninety-five percent confidence in the findings.

The purpose of the *triennial report* is also to encourage alternative mode use and to document the effectiveness of the final TDM plan in achieving the required alternative mode use. The triennial report is prepared by an independent consultant, retained by the city and paid for by the applicant, who works in concert with the designated employer contact. The information for the triennial report must be obtained from *all* employees working in the buildings, and *all* non-responses are counted as a drive alone trip. If a development has not achieved the required alternative mode use, it must provide an explanation of how and why the goal has not been reached and a detailed description of additional measures that will be adopted in the coming year to attain the required alternative mode use. In addition, the triennial report includes a comparison to historical responses on the survey and if a mode share has changed significantly, a detailed description as to why the mode share has changed.

If after the initial triennial report, the subsequent triennial report indicates that, in spite of the changes in the TDM plan, the required alternative mode use is still not being achieved, or if an applicant fails to submit a triennial report, the city may assess a penalty established by city council resolution on the basis of project size and actual percentage alternative mode use as

	compared to the percent alternative mode use established in the TDM plan. In determining whether a financial penalty is appropriate, the city may consider whether the applicant has made a good faith effort to achieve the required alternative mode use. If a penalty is imposed, it is used by the city toward the implementation of the final TDM plan. It should be noted that the ordinance has only been in effect for a few years, and no triennial reports have been required yet. However, anecdotal evidence shows that affected developments comply with the requirements. Other successful cities are Bellevue, WA and Cambridge, MA, which trip reduction ordinances have had a significant impact on drive-alone rate. See further case studies "Bellevue, Washington Trip Reduction Ordinance" and "Cambridge Massachusetts Parking and Travel Demand Management Ordinance" in this report.
Effectiveness	TDM programs have been shown to reduce commuting by single-occupant vehicle by up to 40%, particularly when financial incentives are provided. However, these results are more common in distinct geographic areas or for a specific company, rather than a whole city. Nevertheless, as can be read in this report's case studies, in Bellevue, WA, drive-alone rate has dropped from 76.6% in 1993 to 69.2% in 2001, a 10% decrease, in large due to its Commute Trip Reduction Ordinance. Downtown Bellevue worksites dropped from 72.9% to 58.5% - a 20% decrease. In Cambridge, MA, the Parking & TDM Ordinance particularly affected residents who work in Cambridge. This group displayed a nearly 24% drop in drive alone trips with a 35% increase in bicycle trips. *Employee Commute Trip Reduction* The table below presents nine different packages of TDM programs and the employee vehicle trip reduction impact that can be expected from each. The impact of these programs is measured as the percentage of employee vehicle trips reduced from the existing baseline. The impacts are measured at the site level. The TDM program impacts are presented as ranges, since sites offering the very same programs may have different results based on: • Corporate support for the TDM program • The level of TDM staff support at the site and the salary/grade level of the TDM program manager/coordinator • The urban / suburban nature of the site – the amount of mixed-use development on-site on nearby • External transportation factors (e.g. HOV lanes, bus service, traffic conditions) • Nature of workforce (work schedule reliability, skill levels, salary levels) • The synergy of the elements in the TDM package and how they work for that particular site The nine packages are organized from least to most aggressive. The first six show potential program impacts of TDM programs when parking is free. The last three show potential program impacts when parking is not free. The program packages vary in their combinations and intensity of each of the following five elements: • Information • Services (e.g. preferential HOV parking; Guaranteed Ride Home programs, shuttles) • Financial Incentives • Financial Disincentives • Site Design **PACKAGE:**

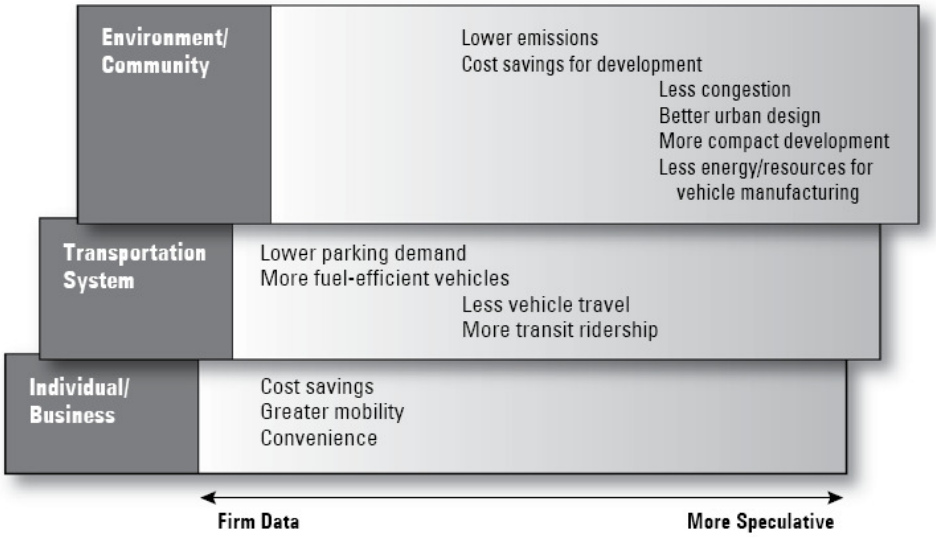
A. Information Only Programs	
Trip Reduction	1% to 3%
Elements	• New employee orientation • Brochures • Information kiosk • Newsletter articles • Preferential carpool parking with no staff support or enforcement • Advertise carpool information phone number • Annual promotional events
B. Information + Modest Services/Incentives	
Trip Reduction	3% to 9%
Elements	• Information: see above • Preferential carpool parking with enforcement and promotion • Carpool and vanpool database / formation • Promotional financial incentive (e.g. one-time transit subsidy or chances to win prizes) • Commuter Club that offers discounts at stores/restaurants, mugs, monthly give-aways of small items, etc. • On-site amenities – cafeteria, bank machine
C. Information + Moderate Services & Moderate Financial Incentives	
Trip Reduction	7% to 15%
Elements	• Information services described above • Bicycle lockers, showers • Guaranteed Ride Home program • Full-time TDM program coordinator/manager • Lower frequency shuttles, as applicable and/or a mid-day shopper shuttle • On-site circulator shuttle or golf-carts and/or campus bicycles • On-site amenities - dry cleaning, café/restaurant, convenience retail • Vanpool support – e.g. empty seat subsidies, formation meetings • Moderate financial incentives – e.g. 30% coverage of transit costs, monthly gift certificates or drawings for substantial prizes ($100+ value) • Fleet vehicles for mid-day trips • On-site transit ticket sales, if applicable • Allow employees to work alternative work schedules or telecommute
D. Information and Aggressive Services	
Trip Reduction	12% to 25%
Elements	• Information services described above, plus • Subscription buses • Employer-owned/sponsored vanpools • Aggressive carpool formation and HOV parking program • Frequent shuttle service up to all-day service

	• Extensive shuttle program – e.g. on-site, mid-day downtown connector, local residential shuttles • Aggressive alternative work hours program (e.g. some departments automatically work 9/80 or 3/36 unless an exception is made) • Aggressive telecommuting program (e.g. employer pays for home office set-up) • On-site amenities – child care, fitness center • Bicycle Commuter Club/Promotion, • Bike parking (variety of options), showers
E. Information and Aggressive Financial Incentives	
Trip Reduction	12% to 25%
Elements	• On-going transit subsidies covering at least 50% of transit costs • Vanpool subsidies • Eco-Pass (free transit for everyone) • Transportation allowance received by all users of alternatives
F. Information + Aggressive Services and Financial Incentives	
Trip Reduction	17% to 33%
Elements	• Services listed in D • Financial incentives listed in E
G. Institute Parking Charges where Previously Free	
Trip Reduction	18% to 35%
Elements	• Maintain existing conditions, but begin charging up to market rates for parking
H. Information + Aggressive Services and Financial Incentives + Parking Charges	
Trip Reduction	22% to 40%
Elements	• Package F + • Parking Charges or Parking Cash-Out
I. Information + Aggressive Services and Financial Incentives + Parking Charges + Site Designed to Limit Trips	
Trip Reduction	25% to 65%
Elements	• Package H + • On-site housing • Wide sidewalks • Street-level, pedestrian facing retail • Building design to embrace pedestrian • Extensive bicycle network and parking • Shared parking or 3rd party-provided parking • Satellite/peripheral/remote • Proximity to transit node • Green spaces that promote picnicking • Mixed-use facility or located within urban core

Trip reduction in the table above refers to estimate of employee vehicle trip reduction.

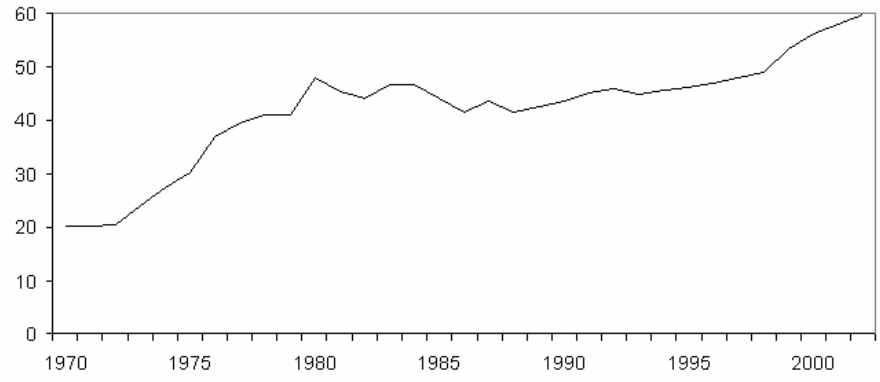
Implications	Trip reduction programs can increase equity by giving non-drivers a benefit comparable to free parking. They often also benefit low-income and transportation disadvantaged employees by improving travel choices. If the program involves negative incentives or does not apply equally to all affected, they may be considered unfair.
Resources	Center for Urban Transportation Research (2005), *Incorporating TDM into the Land Development Process.* City of South San Francisco. *South San Francisco Municipal Code. Chapter 20.120.* Accessed on August 30, 2006 at http://qcode.us/codes/southsanfrancisco/. San Diego Association of Governments (2003), *Congestion Mitigation Strategies Research.* US EPA (2006) *Parking Spaces/Community Places. Finding the Balance Through Smart Growth Solutions*. VTPI (2005) *Commute Trip Reduction* (CTR). Accessed on August 30, 2006 at http://www.vtpi.org/tdm/tdm9.htm.

Strategy	**Car-Sharing**
Category	Transportation Demand Management
In Mobility Element?	Policies: 2.9 Sections: 3.2.2. Encourage Non-Auto Travel 4.1.2 Encourage Non-Auto Travel 4.1.4.4 Parking 5.5.2.5 Foster Non-Auto Travel Demonstration Projects
Description	Car-sharing provides individuals with access to a fleet of shared vehicles, allowing them to avoid owning a car, or a second or third car. Car-sharing can also be a tool for businesses and government organizations, which can use it to replace their fleet vehicles. At the same time, car-sharing at the workplace allows employees to take transit, walk or cycle to work, since a car will be available for business meetings or errands during the day. Communities can help attract car-sharing through several mechanisms: • *Establish car-sharing through new development.* In return for reduced parking requirements or to mitigate traffic impacts, a developer could provide parking and subsidize start-up costs. Typically, a $1,200 to $1,500 monthly revenue guarantee would be required, with the developer making up any shortfall in user fees. Car-sharing can be implemented on a case-by-case basis or, as in San Francisco, formalized in a zoning code. • *Replace vehicle fleets.* A public agency or large employer could reduce or eliminate its fleet of pool cars, and allow employees to use car-sharing instead. This would provide a guaranteed level of baseline use, and enable residents and other employees to use the cars in the evenings and weekends. Philadelphia and Berkeley provide good examples; Philadelphia projects savings of $9.1 million over five years through replacing 500 City-owned vehicles with car-sharing. • *Provide marketing support and other incentives.* Should a car-sharing program be established, towns and cities can assist with marketing, and promote the service through Transportation Demand Management programs. They can also provide car-sharing operators with parking spaces. The most fertile markets for car-sharing will be places where these incentives overlap, and where there is high density, a mix of uses, and low vehicle ownership rates.
Examples of Leading Cities	There are three car-sharing operators in the San Francisco Bay Area. City CarShare, a local non-profit organization which opened for business in 2001, was joined in 2005 by two private operators, Flexcar and Zipcar. City CarShare has today more than 5000 members and 120 vehicles in 60 locations in the Bay Area. The City of Berkeley, CA has implemented a program to replace 15 fleet vehicles with four City CarShare vehicles. Berkeley residents are able to use the car-sharing fleet vehicles on weekday evenings and weekends. Funding is drawn from the operating budget allocations for vehicle-related expenditures in each of the departments participating in the program. Another potential funding source is the cumulative savings from the current fleet vehicle replacement fund. Philadelphia, PA is the first large city in the world to replace its vehicle fleet with carsharing, which

	it terms Automated Vehicle Sharing. The motivation was not to support the local non-profit car-share provider PhillyCarShare but instead to save money through drastically reducing the City's fleet, in the face of a budget crisis. About 310 vehicles had been taken out of the fleet by March 2005. The target is 500 vehicles, including all the City's sedans and SUVs. The City's calculations show savings of more than $9 million over five years. Many of the previous fleet cars were little used for work purposes, and employees would often drive them home at night. In other words, car-sharing is not necessarily cheaper on a per-trip basis, the City found, but can bring about major cost savings through making fleet costs fully transparent. Flexcar is currently the only car-sharing provider in the Los Angeles area.
Effectiveness	Car-sharing supports Transit Oriented Development by reducing parking demand and vehicle travel. According to the Transportation Research Board, each car-sharing vehicle takes nearly 15 private cars off the road. A UC Berkeley study of San Francisco's City CarShare found that members drive nearly 50% less after joining. This allows parking requirements to be reduced accordingly in developments that incorporate car-sharing.
Implications	Probably the most profound effect on car-sharing members is the potential for reducing the numbers of vehicles that they own. This in turn should have ripple effects on the amount of traffic, air pollution, and parking requirements within neighborhoods where car-sharing is active and attractive. The figure below illustrates the layered benefits of car-sharing (Credit: TCRP, 2005).  Overall, car-sharing members make fewer trips by auto after becoming active in car-sharing, and their total mileage driven decreases substantially. These changes have positive environmental impacts, are associated with increased transit use, and lead (to some extent) to an increased reliance on walking, which in turn should have long-term health benefits. Persons involved in car-sharing often realize savings in overall transportation expenses. This is attributable to lower monthly capital costs, lower insurance expenses, lower gasoline and maintenance expenses, and lowered parking expenses. In addition, when located in low-income developments and neighborhoods, car-sharing has a positive effect on the mobility for the low-income households, which typically have much lower vehicle ownership than in other income classes.
Resources	TCRP (2005) *Car-Sharing: Where and How it Succeeds*, TCRP Report 108. 2005. Accessed on August 25, 2006 at http://www.nelsonnygaard.com/articles/article_carsharing.htm

	City CarShare website. Accessed on August 25, 2006 at www.citycarshare.org. City CarShare (2004) *Bringing Car-Sharing to Your Community*. Accessed on August 25, 2006 at www.citycarshare.org/download/CCS_BCCtYC_Long.pdf. Transportation and Land-Use Coalition (2004) *Instant Advocate – Car-Sharing*. Accessed on August 25, 2006 at http://www.transcoalition.org/ia/carshare/01.html

Strategy	**Expanded Transit Service and Bus Rapid Transit (BRT)**
Category	Transit
In Mobility Element?	Policies: 1.6, 2.1, 2.2, 2.3, 2.5, 2.6 Sections: 4.2.1 Public Transit 5.5.2 Encourage Non-Auto Travel
Description	Transit service can be expanded and improved in several ways, for instance by improving: • Frequency • Reliability • Travel time • Hours of operation • Service and comfort Transit can also be improved by adding a completely new route or a new type of service, such as Bus Rapid Transit (BRT). BRT is defined as, "a flexible, rubber-tired rapid-transit mode that combines stations, vehicles, services, running ways, and Intelligent Transportation System (ITS) elements into an integrated system with a strong positive identity that evokes a unique image." In short, BRT uses various tools (dedicated running ways, longer inter-station distances, off-vehicle fare collection, ITS, "clean" vehicles, frequent service) to produce a fast and convenient method of transportation. It has often been described as a rubber-tired version of light-rail transit (LRT). However, it differs in frequently having much lower capital and operating costs. BRT also stands in contrast to buses as a speedier, more reliable, and easily identifiable alternative. The advantages of BRT are: • *Cost.* In deciding to construct a rapid transit system in 1976, Ottawa opted for BRT after it was discovered capital costs would be half those of rail transit and 20% cheaper to operate. It should also be noted that BRT operating costs can be the same or less per passenger trip than LRT. • *Travel Times.* BRT time savings are influenced by the design of the system. Buses operated on dedicated running ways save between two to three minutes per mile while those same vehicles driven on arterial streets normally save one to two minutes per mile when compared to regular bus lines. Greater time savings are made during peak congested hours – Pittsburgh's BRT line reports a time savings of five minutes per mile during peak hours.
Examples of Leading Cities	Boston's Silver Line includes the essential BRT elements. It combines exclusive running ways, such as tunnels or bus lanes, with surface bus routes operating in general traffic. Pre-boarding fare collection in stations is planned for tunnel stops with on-board payments at other stops. Ridership is expected to rise from 40,000 in 2005 to 65,000 daily riders in 2025. (Photo Credit: allaboutsilverline.com)

	As a local example of quickly deployed investment in transit, it is worth noting the success of the Los Angeles Metro Rapid Program. This partnership between the Los Angeles County Metropolitan Transportation Authority (MTA) and the city of Los Angeles Department of Transportation (LADOT) is a marriage of major improvements in street design, to protect the speed and reliability of transit, with investment in frequent service, better buses and less frequent stops. According to the Federal Transit Administration, the result is an express arterial bus service that has reduced passenger travel times by as much as 29%, with ridership increases of nearly 40%. Approximately one third of the reduction in travel time results from the bus signal priority system, with the majority of the balance attributed to fewer stops and headway-based schedules. 
Effectiveness	The elasticity of transit use with respect to transit service frequency is about 0.5, which means that a 1.0% increase in service (measured by transit vehicle mileage or operating hours) increases average ridership by 0.5% (Pratt, 1999). The elasticity of transit use to service expansion (e.g. routes into new parts of a community already served by transit) is in the range of 0.6 to 1.0, which means that 1.0% of additional service increases ridership by 0.6-1.0%. Comprehensive improvements, such as Light Rail or Bus Rapid Transit systems, can provide large increases in transit use and attract large numbers of discretionary riders who would otherwise travel by automobile. Various cities have seen increases in bus ridership with the introduction of BRT service – Pittsburgh (38%), Los Angeles (40%), Brisbane (42%), Adelaide (76%), Leeds (50%). Impacts of other expansions in transit vary depending on the conditions in which it is implemented (VTPI). Portland, OR has implemented several successful transit projects including the MAX regional rail system, Portland Streetcar, Intercity Passenger Rail and the OHSU tramway over the last decades. Support strategies, such as walking and cycling improvements, transit encouragement programs, and TOD have also contributed to the success. The figure below illustrates how per capita transit ridership has increased between 1970 and 2002 (Image Credit: VTPI). *Figure 1* **Annual Transit Trips Per Capita in Portland, Oregon Region** 
Implications	Transit improvements increase mobility, reduce auto dependency, congestion and air pollution and is a very important mode of transportation for lower-income families.
Resources	Levinson, Hebert, et al. Bus Rapid Transit Volume 1: Case Studies in Bus Rapid Transit. *Transit Cooperative Research Program (TCRP) Report 90*. Washington, DC: Transportation Research

	Board, 2003. Federal Transit Administration. *Los Angeles, CA: Los Angeles County Metropolitan Transportation Authority and Los Angeles DOT*. Accessed at: http://www.fta.dot.gov/assistance/technology/research_4300.html. MBTA. *Boston's First Bus Rapid Transit Service*. Accessed on 8/22/06 at http://www.allaboutsilverline.com Pratt. R. (1999) *Traveler Response to Transportation System Changes*, Interim Handbook, TCRP Web Document 12. Victoria Transport Policy Institute (2005). *Traffic Calming*. Accessed on 8/22/06 at http://www.vtpi.org/tdm/tdm4.htm.

Strategy	**Pedestrian Improvements**
Category	Bicycle and Pedestrian Improvements, Traffic Calming
In Mobility Element?	Policies: 2.4, 2.5, 2.7, 3.3, 4.4, 4.6 Sections: 3.2.4 Manage Multimodal Corridors 4.1.2.3 Bicycle and Pedestrian Travel 5.5.2.9 Promote Pedestrian- and Bicycle-Friendly Places 5.5.2.10 Promote Pedestrian- and Bicycle-Friendly Linkages and Priority Areas 5.5.4.8 Enhance Vehicular, Pedestrian and Bicycle Safety at Signalized Intersections Also in Pasadena Pedestrian Plan (2006)
Description	A walkable environment gives people more transportation choices and improves quality of life. A well-designed network of streets and pedestrian ways is key to pedestrian accessibility, and includes streets, alleys, trails, midblock crossings and pedestrian pass-throughs. *Accessible Routes/ADA* Pedestrian routes need to satisfy disability access standards including crosswalk treatments, sidewalk widths and curb ramp design. *Intersection design* The detailed elements of intersection design must support safe and convenient street crossings. Design elements can include high visibility pavement markings and signing, special signal devices including in-pavement lights, and tight curb radii.
Examples of Leading Cities	Old Pasadena is a great example of recent investments in successful pedestrianization. Today, the parking meter revenue funds the district's beautified alleys, street furniture, trees, tree grates and historic lighting fixtures, and fund its marketing, mounted police patrols, daily street sweeping and steam cleaning of sidewalks.
Effectiveness	It is difficult to estimate exactly how much walkability investments affect travel, since it is often accompanied by investments in other alternative transportation means and changes in land use. The Victoria Transport Policy Institute lists a couple of studies: • Moudon, et al (1996) found that walking is three times more common in a community with pedestrian friendly streets than in otherwise comparable communities that are less conducive to foot travel. • According to Cervero and Radisch (1995) residents in a pedestrian friendly community walk, bicycle, or ride transit for 49% of work trips and 15% of their non-work trips, which are 18- and 11-percentage points more than residents of a comparable automobile oriented community.
Implications	Investments in the pedestrian environment have positive impacts on all road users. It reduces auto-dependency and air pollution, improves livability, increases mobility for low-income households and even increases retail sales and property values (LGC, 2001). There are no negative implications.
Resources	Cervero, R. & Radisch, C (1995) *Travel Choices in Pedestrian Versus Automobile Oriented*

Neighborhoods, UC Transportation Center, UCTC 281.

ITE (2006) C*ontext Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities*.

Kent, Fred and Andrew Schwartz (2001) Eleven Ways to Fix a Place. *Places.* Vol. 14, Number 2.

LGC (2001) *The Economic Benefits of Walkable Communities*. Local Government Commission.

Moudon, et al. (2003) *Effects of Site Design on Pedestrian Travel in Mixed Use, Medium-Density Environments*, Washington State Transportation Center, Document WA-RD 432.1.

National Bicycling and Walking Study (1994) *Case Study No. 19. Traffic Calming, Auto Restricted Zones and Other Traffic Management Techniques—Their Effects on Bicycling and Pedestrians*.

Victoria Transport Policy Institute (2005). *Walkability Improvements*. Accessed on 8/21/06 at http://www.vtpi.org/tdm/tdm92.htm.

Strategy	**Bicycle Improvements**
Category	Bicycle and Pedestrian Improvements, Traffic Calming
In Mobility Element?	Policies: 2.4, 2.8, 3.3, 3.6, 3.7, 4.4, 4.6, 4.12, 4.13 Sections: 3.2.4 Manage Multimodal Corridors 4.1.2.3 Bicycle and Pedestrian Travel 5.5.2.6 Design and Operating Considerations for Bicycles 5.5.2.7 Encourage use of Travel 5.5.2.8 Bicycle Provisions at Transportation Centers 5.5.2.9 Promote Pedestrian- and Bicycle-Friendly Places 5.5.2.10 Promote Pedestrian- and Bicycle-Friendly Linkages and Priority Areas 5.5.4.8 Enhance Vehicular, Pedestrian and Bicycle Safety at Signalized Intersections Also in Pasadena Bicycle Master Plan (2000)
Description	Bicycle facilities are a critical part of future development and the existing bicycle network. They allow easy access for residents and visitors to and from destinations and transit hubs. Trips with distance between one and two miles make up a long walk, but a brief bicycle ride. *Bikeways* Safe accommodation of cyclists should be made within travelways of the street in either mixed flow or within designated bicycle lanes. There are several types of on-street bicycle facilities, including: • *Single-striped bike lanes* are the most standard types. Research has shown that bike lanes neither increase nor decrease the safety of bicycles, however they do encourage greater use of bicycles, especially more novice bicyclists. • *Double-striped bike lanes* are sometimes used where the bike lane is adjacent to a parking lane, especially if the parking lane or bike lane widths are substandard. They are installed to encourage drivers to park closer to the curb. They also help keep bicyclists from riding too close to parked cars, where they can be "doored" by people emerging from the parked cars. • *Shared route pavement markings* (or "Sharrow") are used to highlight that bicyclists are permitted on roads without bike lanes. They also provide guidance on where the bicyclist should ride, toward the right, but not close to parked cars, to avoid being "doored" by people emerging from parked cars. • *Bike boulevards* are bicycle preferential streets (see image below). They do not require pavement markings (as shown in the photo) and motor vehicles are permitted on them. Features of bicycle boulevards are the following: o Vehicles are slowed to bicycle or near-bicycle 

speeds, around 15 mph

- Vehicles are not encouraged to use these streets (though not excluded), ie. at intervals, vehicles are diverted off the streets through the use of road blocks, diverters, bicycle/pedestrian only bridges.
- Stop signs on the bike boulevard are minimized by having two-way stop signs at intersections, with cross-streets stopping more often, or traffic circles.
- Main roads that cross the bike boulevard are signalized making it easy for bicyclists to cross. Bicycle-sensitive signal detectors allow bicycles to position themselves correctly at the signal.
- Routing of bicycle boulevards should be cross-town routes that are easy have few if any turns on them. It's also useful if they are directly parallel to major arterials with destinations. Bicyclists could then use the bike boulevard to access the destinations as much as possible.

Neighborhood streets are good candidates for bike boulevards because they often already have several of the features that make a bicycle boulevard effective. Residents often enjoy living on bicycle boulevards because there is less vehicular traffic and people drive more slowly.

Bicycle Parking
Bicycle parking is an essential part of encouraging bicycling and typically serves two important markets.

- Long-Term parking is needed for bicycle storage for residents and employees. This parking is located in secure, weather-protected, restricted access facilities (Class I parking)
- Short-Term parking serves shoppers, recreational users and other visitors (Class II parking). As well as security, convenient locations are a priority – otherwise, bicyclists will tend to lock their bicycles to poles or fences close to their final destination.

A mix of *long-term bicycle parking* facilities is often recommended:

- *Bicycle racks inside garages*. These primarily serve employees. Racks should be located in clear view of a garage attendant, and may replace one or more vehicle parking spaces. If there is no attendant, racks can make use of nooks and corners that are too small for a vehicle parking stall, provided that these are close to the entrance.
- *Bicycle cages in garages primarily serve residents.* The cage is typically secured with a locked gate (ideally using an electronic keycard). Within the cage, cyclists are able to lock their bicycles to a rack, providing an additional level of security.
- *Bicycle lockers* can provide an additional option for the most security-conscious bicycle users (both residents and employees). Since they are more space-intensive than other options, they could be made available for a modest fee.

A parking garage is the most suitable location, as bicyclists can use the vehicle entry without the need to navigate stairs or elevators. Bicycle parking should be on the ground floor, as close to the entry as possible.

Short-term parking is typically provided by means of on-street racks immediately adjacent to high-demand locations, in the following locations:

- On retail frontages
- Next to primary transit stops; this will allow cyclists to park their bicycle should the on-bus

	racks be full • In other locations, where the presence of bicycles locked to fences or railing indicates demand A single "U" or similar rack should be placed as close as possible to the entrance of all retail businesses where this is not prevented by other obstructions. Additional racks are easy to install and this should be done based on demand. The street furniture zone will generally be the most appropriate place for racks, where they can be placed in between street trees and lights. This maintains the maximum clear width for pedestrians. *Bicycle Stations* A high level of bicycle access suggests that a transit station may be suitable for a "bicycle station." Bicycle stations offer secure bike storage and typically offer bicycle rental, repairs and information. Bicycle storage is staffed, meaning that cyclists do not have to reserve space in advance. Designed well, they have been shown to dramatically expand the "catchment area" of a transit station by removing a key obstacle to increased bicycle use, the fear of having a bike damaged by weather or vandalism, or stolen. Bicycle stations operate at rail stations throughout the US, including the Palo Alto Caltrain Station, Embarcadero and Berkeley BART stations, Long Beach Blue Line station in California; Pioneer Square Tunnel Station in Seattle; and Millennium Park in Chicago. There may also be opportunities for increasing bicycle access in a station area through the use of specific bicycle infrastructure tools: • *Bicycle Signage.* Wayfinding systems aimed at cyclists are already in place in portions of the region's trail system, directing cyclists to key destinations and offering distance information. • *Intersection Crossings.* Bikeways are only as good as their worst gap. If an excellent bike path suddenly ends at a busy roadway with no accommodation for crossing it, the bike path with have little utility. It is important, therefore, to ensure high quality design where minor bikeways connect to major bikeways, and where bikeways cross major arterials.
Examples of Leading Cities	Pioneered in Palo Alto, CA, bicycle boulevards provide a high level of accommodation for bicycles where there is insufficient right of way for dedicated lanes or paths. This is accomplished through traffic calming measures that slow motor vehicles to speeds that are compatible with bicyclists and well as traffic diverters that eliminate through motor vehicle traffic from a street. Berkeley, CA, also has an extensive network of bicycle boulevards. Recognized as one of the most bike-friendly cities in the country, it has a Bikestation at Downtown Berkeley BART that offers free attended bicycle parking. Although bicycling rates in Pasadena are still modest, compared to Palo Alto and Berkeley, Pasadena residents bike to work at rates double the national average. Recently, Pasadena expanded the bikeway network with 50 miles of additional bike lanes, enhanced bike routes, and standard bike routes. Bike parking has been increased throughout the City with the installation of 200 new bike racks. Additional efforts to expand bicycle parking in the twelve public parking facilities are underway throughout Pasadena as part of the City's Bikeway Program.
Effectiveness	One important advantage of bicycling compared to walking is that bicycling can substitute directly for automobile trips with longer distances. Several before-after studies of bicycle facility

	implementation have been conducted in recent years: • According to Nelson and Allen (1997), each mile of bikeway per 100,000 residents increases bicycle commuting 0.075 percent, all else being equal. • Dill and Carr (2003) states that for U.S. cities with more than 250,000 residents, each additional mile of bike lanes per square mile is associated with a roughly one percentage point increase in bicycle commute mode share. • In March 1999, bike lanes were striped along Valencia Street in San Francisco, changing the street from four-lanes to two-lanes with bike lanes and a median lane for left turns. Bicycle usage on Valencia Street increased 144 percent during the PM peak hour and motor vehicle traffic dropped by 10 percent and redistributed to parallel arterials (San Francisco Department of Parking and Traffic, 2001). • Striping of bike lanes and removal of a travel lane along Polk Street in San Francisco increased bicycle ridership by 41% in the AM peak hour and 28% in the PM peak hour. It should be noted that Muni transit on-time performance decreased as part of the project, although travel times were not affected (San Francisco Department of Parking and Traffic, 2001).
Implications	Bicycle improvements increase mobility, reduce auto dependency, congestion and air pollution and can be a very important mode of transportation for lower-income families.
Resources	City of Walnut Creek (2006) *Downtown Parking and Transportation Study*. Nelson\Nygaard Consulting Associates, Inc. Dill, J. & Carr, T. (2003) Bicycle Commuting and Facilities in Major U.S. Cities, *Transportation Research Record* 1828, Transportation Research Board, pp. 116-123. ITE (2006) *Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities*. Nelson, A. Allen. D. (1997) If You Build Them, Commuters Will Use Them; Cross-Sectional Analysis of Commuters and Bicycle Facilities, *Transportation Research Record* 1578, pp. 79-83. San Francisco Department of Parking and Traffic (2000) *Valencia Street Bicycle Lanes: A One Year Evaluation*. Prepared for the Board of Supervisors City and County of San Francisco. San Francisco Department of Parking and Traffic (2001) *Polk Street Lane Removal/Bike Lane Trial Evaluation*. Prepared for the Board of Supervisors City and County of San Francisco. Victoria Transport Policy Institute (2005). *Cycling Improvements.* Accessed on 8/21/06 at http://www.vtpi.org/tdm/tdm93.htm.

Strategy	**Reduced Minimum Parking Requirements**
Category	Parking Strategies
In Mobility Element?	Section: 4.1.1 Promote a Livable and Economically Strong Community
Description	Most minimum parking requirements levied by local jurisdictions – not just in Pasadena, but around the country – take into account only two variables, namely land use and the size of development. They are typically expressed in terms of number of spaces required per 1,000 square feet of a particular land use, or per residential unit or (for restaurants and stadiums) number of seats. In reality, however, parking demand is affected by many more variables, such as: • The geographic location of a development – encompassing factors such as the quality of the local pedestrian environment, the number of other land uses within walking distance, and the availability of transit • The demographic characteristics of residents • Demand management programs such as parking pricing and car-sharing Vehicle ownership levels (and thus residential parking demand) typically vary considerably between different parts of a city. Local jurisdictions can amend their zoning codes to take these variations into account, based on the following factors: • *Unit Size.* Smaller households tend to own fewer vehicles. Tailored requirements based on unit size have been introduced (at least to some extent) in many Californian cities, such as San Anselmo and Larkspur. • *Affordable Housing.* There is a strong link between vehicle ownership and income, which means that less parking is needed when housing is targeted to low-income households. • *Senior Housing.* Senior citizens tend to own fewer vehicles than younger adults, meaning that parking requirements can be reduced for senior housing facilities, including independent living as well as assisted living and convalescent care facilities. • *Rental Units.* Households that rent their homes own fewer vehicles, on average, than owner-occupiers. Tailored requirements are applicable in any part of a city, particularly in multi-family units where parking can easily be shared between different units. • *Transit Corridors/Downtown.* Parking demand is lower in areas that are well served by transit, and in downtowns that offer employment and services within walking distance.
Examples of Leading Cities	The City of Milwaukee, WI has low city wide parking requirements. Parking ratios for retail are 2 spaces per 1,000 square feet, compared to Pasadena's retail requirement of 3 spaces per 1,000 square feet. In the downtown zone, there are no minimum parking requirements for any land use except high-density housing, where the ratio is only two spaces per three units. The City of Seattle allows reductions in minimum parking requirements based on several factors, including: • *Affordable housing. Reduction to 0.5-1.0 spaces per unit, depending on income, location and size of unit.* • *Senior housing and housing for people with disabilities.*

	• *Dedicated on-site car-sharing parking in multi-family developments.* • *Location. No parking minimums* in downtown, reductions in mixed-use, dense neighborhoods. The City of Pasadena has already reduced its minimum parking requirements for new development in TODs and the Central District. However, both the general requirements and the requirements for TODs and the Central District could most likely be reduced even more.
Effectiveness	There are no studies that specifically link reduced minimum parking requirements to actual reductions in traffic. However, as described in the main report, minimum parking requirements ordinarily result in lower parking prices, which in turn increases vehicle trips. Reducing requirements can help to reduce this effect, by making it sensible to adopt parking charges, and frequently also by allowing for savings on parking costs. Savings on parking costs can in turn be used to fund transportation demand management measures.
Implications	*Socio-Economic* Parking typically accounts for a significant component of the cost of development. By reducing parking supply in new development, each tenant will experience a much lower overall cost, thus making the development more affordable. This is a benefit to all residents and tenants, particularly low-income households. *Mobility* No direct effect on mobility. Indirect and long-term effect is that the strategy will help reduce traffic.
Resources	City of Seattle. *Seattle Municipal Code, SMC 23.54.015 Required parking.* Accessed on August 23, 2006 at http://clerk.ci.seattle.wa.us/. EPA (2006) *Parking Spaces / Community Places. Finding the Balance through Smart Growth Solutions.* Development, Community and Environment Division. Milwaukee Department of City Development. *Milwaukee Zoning Code, Section 295-403. Parking.* Accessed on August 23, 2006 at http://www.mkedcd.org/czo/. Nelson\Nygaard (2002) *Housing Shortage/Parking Surplus. Silicon Valley's opportunity to address housing needs and transportation problems with innovative parking policies*. Transportation and Land Use Coalition. Accessed on August 22, 2006 at http://www.transcoalition.org/reports/housing_s/housing_shortage_home.html. Russo, R. (2001) *Planning for Residential Parking: A Guide For Housing Developers and Planners. Non-Profit Housing Association of Northern California.* Available at: www.nonprofithousing.org/actioncenter/toolbox/parking/ The Shoup, D. (1999) The Trouble with Minimum Parking Requirements, *Transportation Research Part A*, 33: 549-574. Shoup, D. (2003) Truth in Transportation Planning, *Journal of Transportation and Statistics*, 6(1): 1-16. US Census and Census Transportation Planning Package 2000 (2005).

Strategy	**Removed Minimum Parking Requirements**
Category	Parking Strategies
In Mobility Element?	No
Description	Minimum parking requirements are intended to achieve specific goals, most commonly avoiding overspill and congestion of on-street parking. However, these goals can be achieved through other policies, such as pricing curb parking at market rates, Residential Permit Parking programs and other on-street parking management techniques. Eliminating parking requirements would not mean that no new parking would be constructed. Rather, it would mean that market forces would determine the appropriate level of supply, based on market demands. Minimum parking requirements could be waived anywhere in the City of Pasadena where there are or could be measures in place to combat overspill. However, the policy is most useful in transit corridors and downtown.
Examples of Leading Cities	Several cities around the United States, including the ones provided below, have completely removed minimum parking requirements in downtown or the Central Business District: • *For commercial development*: Boston, MA; Columbus, OH; Coral Gables, FL; Eugene, OR; Fort Myers, FL; Fort Pierce, FL; Los Angeles, CA; Milwaukee, WI; Olympia, WA; Portland, OR; San Diego, CA; Seattle,WA; Spokane, WA; Stuart, FL. • *For multi-family residential (1-2 bedroom)*: Eugene, OR; Fort Myers, FL; Fort Pierce, FL; Los Angeles, CA; Milwaukee, WI; Olympia, WA; Portland, OR; San Diego, CA; San Francisco, CA; Seattle, WA; Spokane, WA; Stuart, FL.
Effectiveness	There are no studies that specifically link removing minimum parking requirements to actual reductions in traffic. However, as described in the main report, minimum parking requirements ordinarily result in lower parking prices, which in turn increases vehicle trips. Removing requirements eliminates this effect, by making it sensible to adopt parking charges, and frequently also by allowing for savings on parking costs. Savings on parking costs can in turn be used to fund transportation demand management measures.
Implications	*Socio-Economic* Parking typically accounts for a significant component of the cost of development. By reducing parking supply in new development, each tenant will experience a lower overall cost, thus making the development more affordable. This is beneficial to all residents and tenants, particularly low-income households. *Mobility* No direct effect on mobility. Indirect and long-term effect is that the strategy will help reduce traffic.
Resources	Shoup, D. (1999) "The Trouble with Minimum Parking Requirements," *Transportation Research Part A*, 33: 549-574. Excerpts from each City's Zoning Ordinance or Land Use Code.

Strategy	**Maximum Parking Requirements**
Category	Parking Strategies
In Mobility Element?	Policies: 1.17 Section 4.1.1 Promote a Livable and Economically Strong Community
Description	In contrast to minimum parking requirements, parking maximums restrict the total number of spaces that can be constructed. Reasons for setting maximum requirements may include a desire to: • Restrict traffic from new development, for example through relating parking provision to roadway capacity • Promote alternatives to the private automobile • Limit the amount of land that is devoted to parking, for example to preserve open space or limit stormwater runoff Parking maximums can be introduced anywhere where there are or could be measures in place to combat overspill. While the policy is most likely to be appropriate in transit corridors, downtown and areas with high levels of traffic congestion, it can be useful in any district that wants to limit traffic or the amount of land devoted to parking.
Examples of Leading Cities	According to Davidson & Dolnick (2002) parking maximums are in force in many cities around the United States, including Cambridge, MA; Gresham, OR; Helena, MT; Jefferson County (Louisvillle), KE; Pittsburgh, PA; Redmond, WA; San Antonio, TX; San Francisco, CA and Seattle, WA. Portland, OR, has also adopted parking maximums. In large parts of the city, the minimums have been completely removed and are instead used as maximums. In other parts, minimums remain but are accompanied by maximums to limit the amount of parking a developer can provide. EPA (2006) states that the maximums are lower than both the parking generation rates published by the Institute of Transportation Engineers, and even the minimums adopted by most cities. Pasadena's downtown parking maximum for new office is 2.7 spaces per 1,000 square feet, whereas Portland's downtown maximum is 1 space per 1,000 square feet.
Effectiveness	There are no studies that specifically link maximum parking requirements to actual reductions in traffic. However, as described in the main report, by capping the amount of parking a developer can provide, maximum parking requirements ordinarily result in parking pricing, which in turn reduces vehicle trips.
Implications	*Socio-Economic* Parking typically accounts for a significant component of the cost of development. By reducing parking supply in new development, each tenant will experience a lower overall cost, thus making the development more affordable. This is beneficial to all residents and tenants, particularly low-income households. *Mobility* No direct effect on mobility. Indirect and long-term effect is that the strategy will help reduce traffic.
Resources	Davidson & Dolnick (2002) *Parking Standards*. American Planning Association. EPA (2006) *Parking Spaces / Community Places. Finding the Balance through Smart Growth*

	Solutions. Development, Community and Environment Division. Millard-Ball, A. (2002) "Putting on Their Parking Caps," *Planning*, April 2002, pp 16-21.

Strategy	**Toll Zones**
Category	Congestion Pricing
In Mobility Element?	No
Description	Congestion charging, or in this case toll zones, is today considered one of the most successful strategies in reducing traffic congestion in and around cities. Cities around the world have for several years used tolls to invest in new infrastructure and increase mobility. The strategy has recently been given new light as a result of London's and Stockholm's successful congestion charging schemes of the inner cores. Other toll ring systems have been in place in Singapore and Norway for several years. In addition, the Federal Highway Administration (FHWA) is showing an increasing interest in potential pilot programs in North-American cities, and San Francisco will be the first city in the nation to study the concept under the FHWA program. This new view of congestion pricing does not only realize the benefits of increased mobility, but also as a way for cities to attract new development. Kathryn Wylde, CEO at Partnership for New York City, a network for business leaders, has stated that businesses in New York view congestion pricing as a necessary means for New York to continue to be attractive and develop.
Examples of Leading Cities	*London* The London congestion program has been in place since the beginning of 2003 and operates between 7:00AM and 6:30PM Mondays to Fridays, except on public holidays. There is a flat fee of £8 ($15) per day for entering, exiting or driving within the zone if the fee is paid by 10:00 PM on the same day. There is an additional surcharge of £2 if the fee is paid between 10:00 PM until midnight. Late payment fees start already after midnight, and amount to £50 for the first 14 days after the visit, £100 for the following 14 days, and after that £150. There is currently a network of 203 enforcement camera sites, of which 174 sites are located along the boundary and the remaining 29 sites throughout the 10 square mile large zone in central London. All lanes of traffic at exit and entry points as well as at the sites within the zone are monitored and ten Mobile Patrol Units are used for enforcement purposes. There are an additional 64 monitoring camera sites which provide supplementary traffic monitoring over and above that provided by the enforcement network. According to the most recent Annual Report (June, 2006) reductions in congestion inside the zone average 26% since the introduction in 2003. Road accidents have also fallen with a net reduction of between 40 and 70 personal injury accidents per year. There is no evidence of adverse traffic impacts on roads surrounding the zone. On the contrary, there is an overall pattern of slowly declining 'background' traffic levels from various measurements of traffic in inner London. There are no significant impacts on business performance or economy and 78% of the charge payers are satisfied with the quality of service. *Stockholm* Sweden's capital Stockholm is the most recent city to introduce congestion charging. The Swedish government and the City of Stockholm facilitated a 7-month trial period of a congestion tax in Stockholm between January 3 and July 31, 2006. During this period vehicles entering 

	or exiting any of the 18 control points in to or out of Stockholm inner city on weekdays between 6.30 AM and 6.29 PM were required to pay a congestion tax. A referendum on the permanent implementation of congestion charges will be held in conjunction with the general election in September 2006. The zone is approximately 13 square miles in size. (Image Credit: Stockholms Stad) Vehicles are registered by cameras photographing the number plates, similar to the London scheme. Vehicles equipped with an electronic onboard unit for direct debit payment are also identified through this means. Traffic flow is not affected as drivers are not required to stop or slow down when driving past a control point. The cost per entrance or exit is $1.35, $2 or $2.70 depending on the time of day. The maximum amount is charged during peak hours between 7.30-8.29 AM and 4.00-5.29 PM. The maximum amount payable per vehicle and day is $8. Payment must be registered within 14 days of passage. Owners of vehicles that are not equipped with an onboard unit must pay the fees at local chain stores, via credit card on the Internet or through Internet banks. If the tax is not paid within the two-week time frame, the vehicle owner will receive a reminder to pay the tax within four weeks, and an additional administration charge of $9.50. If the tax and fees are not paid within the four-week period, a new reminder is sent out with an additional $70 fee. Six months into the trial the average traffic reduction across the control points between 6:30 AM and 6:29 PM is 22%. This percentage reduction has been more or less consistent throughout the trial and is equivalent to almost 100,000 fewer passages per day. The reduction peaks during the morning and evening peak hour periods, although traffic has also been reduced outside of the hours of congestion tax. Traffic flow on arterials within the zone has dropped as well, although not as much as 22%. As a direct consequence of the traffic reduction, mobility and travel time between various destinations have improved. Large reductions in travel time have been noted on the entrances to the city, where time spent in congestion has drooped by a third in mornings and even halved in the afternoon peak. Major roads outside of the zone have in general not experienced significant increases in traffic. However, there are a couple of major throughways that have gained in traffic, although not all of the gain can be contributed to the trial. Public transport usage has increased by 6% between spring 2005 and spring 2006. The congestion trial seems to explain 4.5%, while increase in gas prices and other external factors cover the remaining 1.5%.
Effectiveness	London: Congestion delays dropped 26% since 2003 from 2.3 to 1.8minutes per kilometer. Figures from 2005 show a 17% decrease in total traffic with a 31% drop in potentially-chargeable vehicles entering the zone. From 2002 to 2005, the total number of car "vehicle-kilometers driven" fell 39%. The fee is not considered to be a perfect solution due to it not being time or location-variable. Stockholm: Average traffic reduction across the control points between 6:30 AM and 6:29 PM is 22%. The reduction reached its peak during afternoon rush hours with a 24% drop. Traffic reduction in the inner city shows a 15% drop in vehicle kilometers traveled. Vehicle travel times dropped significantly within and around the inner city. The largest reductions were observed around the control points, where time spent in congestion was reduced by a third in the morning peak hour and by half in the evening peak hour. No adverse traffic impacts on surrounding road network.
Implications	*Mobility* The overall result is that mobility increases significantly with a congestion charging scheme, both as a car-traveler (as time spent in traffic is reduced), and as transit-dependent (due to coupled investments in transit service). *Socio-Economic*

	If made permanent, the Stockholm system would be repaid in less than 7 years, according to projections. In addition, estimates of socioeconomic gains, due to shorter travel times, increased traffic safety and improved health and environment, yield savings of an additional $100 million annually. The London system, with about 20 times more entry/exit points than the Stockholm system, is more costly. One concern is that local residents should be negatively affected by a toll scheme. However, in both London and Stockholm the schemes have been accepted by a majority of the population. Before the Stockholm trial was introduced, 44% of the Stockholm residents considered the scheme a good or very good strategy. This increased to 54% in a 6-month period. Residents who considered the scheme bad or very bad have decreased from 51% to 42%. Residents and commuters are economically impacted if they are car-dependent and need to move in and out of the zone on a regular basis. This may have a negative impact on low-income households. On the other hand, a congestion charging scheme should be coupled with significant improvements in the transit system as well as in bicycle and pedestrian networks. This increase in mobility is extremely important for low-income households. *Legal* Nossaman, Guthner, Knox & Elliott, LLP, a California-based law firm specializing in complex public policy law, recently produced a memo to support the viability of congestion charging and innovative parking management in a proposed San Francisco development. As stated in this memo: "There is no statutory authority under current law providing for the formation of a public agency to levy the Congestion Pricing Charge. The City and County of San Francisco, a charter city would not be able to adopt an ordinance under its broad powers with respect to "municipal affairs" to form such an agency because traffic control is not a "municipal affair" in the sense of giving a municipality (whether holding a constitutional charter or not) control thereof in derogation of the power of the state. In fact, the State has already adopted legislation under the Vehicle Code prohibiting fees for use of public roads. […]Assuming that appropriate state legislation is adopted authorizing the formation of a public agency to levy the Congestion Pricing Charge, it is likely that levy of the Congestion Pricing Charge would not require voter approval under Propositions 13, 62 and 218." In brief, this would mean that for a Congestion Pricing Charge to be levied in Pasadena, state legislation would be required to authorize the formation of a public agency to levy the charge. Once approved in state legislation, the scheme would not require voter approval.
Resources	Transport for London (Accessed on June 26, 2006 at www.tfl.gov.uk). Transport for London (2006) *Central London Congestion Charging. Impacts Monitoring.* Fourth Annual Report, June 2006. Litman, Todd (2006) *London Congestion Pricing, Implications for Other Cities.* VTPI. The Stockholm Trials (Accessed on June 25, 2006 at www.stockholmsforsoket.se) Stockholms Stad (2006) *Facts and results from the Stockholm Trial.* Second Version - August 2006. Nossaman, Guthner, Knox & Elliott, LLP (2006) *Levy of User Charges to Pay for Transit Facilities and Operations to Serve the Treasure Island Community Development Project*. April 18, 2006. 290498-0001.

Strategy	**High Occupancy Vehicle (HOV) Lanes/ High Occupancy Toll (HOT) Lanes**
Category	Congestion Pricing
In Mobility Element?	In Glossary
Description	HOV lanes give priority to High Occupancy Vehicles, including transit, vanpools and carpools. Depending on location and circumstances, vehicles with a minimum of 2, 3 or 4 occupants are required to be considered an HOV. HOV lanes are used on highways and arterials and are sometimes reversible by adding capacity in the peak direction. HOV lanes typically improve travel time, with savings from 0.5 minutes per mile on arterial streets to 1.6 minutes on congested freeways (VTPI, 2006). HOT lanes are designated lanes which motorists driving alone can use if they pay a toll, allowing them to avoid traffic delays in the adjacent regular lanes. HOT lanes usually are combined with HOV lanes that have enough capacity to handle more vehicles. Toll-paying drivers and toll-free carpools/vanpools share the lane, increasing the number of total vehicles using the HOV/HOT lane. Revenue can be used to help pay off bonds issued to finance construction, provide for maintenance, operations and enforcement of the lanes, and to fund new or enhanced transit service. (Image Credits: MTC & Sandag)   The number of cars using the reserved HOT lanes can be controlled through variable pricing (via electronic toll collection) to maintain free-flowing traffic at all times, even during the height of rush hours.
Examples of Leading Cities	California's two HOT lane projects, which have been in operation for several years, have demonstrated convincingly the ability of electronic variable pricing to maintain congestion-free conditions even during peak hours. *Orange County's 91 Express Lanes* The 91 Express Lanes provides two HOT lanes in each direction in the median of the Riverside Freeway/State Route 91 (SR-91) for a ten mile stretch in eastern Orange County. The facilities are operated by a private developer, managing traffic flow via a price schedule that charges different prices at different hours of the day, ranging from $1.15 during off-peak hours up to $8.50 between 3:00-4:00PM on Thursdays and Fridays (in peak traffic direction). In Fiscal Year 2005 the 91 Express Lanes had new records in ridership, carpooling, and revenue: • Total vehicle trips exceeded 12.7 million — up 13% over the prior year • The average number of riders per vehicle during the morning peak period was 1.52 — up 2 percent over the prior year • Total revenue was $39.6 million — up nearly 27% over the prior year. All Southern California motorists who travel the Riverside Freeway (State Route 91) have

	benefited from the development of the 91 Express Lanes. Average speed and travel time, particularly during peak hours, have dropped significantly compared to before the implementation. See excerpt below from the 91 Express Lanes Annual Report. **City of Corona 2004 speed & travel time analysis for westbound rush hours (5:40 am to 7:40 am)** Average speed / Average travel time Before improvements ..... 12 mph ..... 58 minutes After first improvement ..... 47 mph ..... 14 minutes After second improvement ..... 52 mph ..... 13.5 minutes *San Diego's I-15 FasTrak Program* The Interstate 15 FasTrak™ Program allows solo drivers to pay a per trip fee to use the existing HOV lanes located in the center median along eight miles of I-15 in the City of San Diego. Carpoolers (2 persons or more) use the HOV lanes for free. Tolls vary from $0.50 to $8, depending on congestion level. Toll prices reflect the changing level of traffic on the Express Lanes. Sensors in the road detect traffic levels, and toll prices are set to maintain free-flow on the Express Lanes at all times. Revenue from the project is used to improve transit services in the area, and special focus is given to Bus Rapid Transit along the HOT system. The Program is currently under expansion and will in 2012 be 20 miles long.  Other HOT lanes are in place in Houston, TX and Minneapolis, MN.
Effectiveness	*HOV Lanes* HOV lanes typically improve performance of transit and ridesharing and encourage shifts from SOV to HOV travel modes. Comsis (1993) and Pratt (1999) state that HOV facilities can reduce vehicle trips on a particular roadway by 4-30%. Ewing (1993) estimates that HOV facilities can reduce peak-period vehicle trips on individual facilities by 2-10%, and up to 30% on very congested highways if HOV lanes are separated from general-purpose lanes by a barrier. *HOT Lanes* State Route 91's "three-ride-free" program allows carpools of three or more people to use the toll lanes for free during most hours and for half price during high-demand periods. Since its inception in 2003, the program has boosted carpooling nearly 9.6 percent. According to MTC, carpooling in the Interstate 15 corridor in San Diego has increased 80% since 1996 when the conversion of HOV lanes to HOT lanes took place.

Implications	HOT lanes are often thought of as "Lexus lanes", only providing space to high-income drivers. However, people of all income levels use the HOT lanes, particularly when saving time is an important consideration. Utility vans and delivery trucks are a far more common sight on California's HOT lanes than luxury vehicles. Also, HOT lanes have the potential to improve transit travel times by ensuring access to relatively free-flowing travel lanes for commuter bus service, especially during rush hour, hence increasing mobility for all road users, and particularly for transit-dependant people.
Resources	Comsis Corporation (1993) *Implementing Effective Travel Demand Management Measures: Inventory of Measures and Synthesis of Experience.* USDOT and Institute of Transportation Engineers. Accessed on September 5, 2006 at www.bts.gov/ntl/DOCS/474.html. Ewing, R. (1993) TDM, Growth Management, and the Other Four Out of Five Trips, *Transportation Quarterly*, Vol. 47, No. 3, pp. 343-366. Metropolitan Transportation Commission. *HOV/HOT Lanes*. Accessed on September 5, 2006 at http://www.mtc.ca.gov/planning/hov/. OCTA. *91 Express Lanes Annual Report*. Accessed on September 5, 2006 at http://www.91expresslanes.com/generalinfo/91annualreport.pdf. Pratt, R. (1999) HOV Facilities. *Traveler Response to Transportation System Changes, Interim Handbook, TCRP Web Document 12*. Accessed on September 5, 2006 at http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_webdoc_12.pdf. Reason (2003). *Hot Networks: A New Plan For Congestion Relief And Better Transit*. Policy Study 305. Accessed on September 5, 2006 at http://www.reason.org/ps305.pdf. Sandag. About I-15 *FasTrak*™. Accessed on September 5, 2006 at http://www.sandag.org/index.asp?classid=29&fuseaction=home.classhome. Sandag. I-15 *FasTrak On-line*. Accessed on September 5, 2006 at http://fastrak.sandag.org/faq.html. VTPI (2006) *HOV Priority*. Accessed on September 5, 2006 at http://www.vtpi.org/tdm/tdm19.htm.

Strategy	**Safe Routes to School**
Category	Bicycle and Pedestrian Improvements, Traffic Calming
In Mobility Element?	Policies: 3.7 Sections: 4.1.2.3 Bicycle and Pedestrian Travel 5.5.3.2 Support Neighborhood Initiatives Also in Pasadena Pedestrian Plan (2006)
Description	Safe Routes to Schools programs integrate health, fitness, traffic relief, environmental awareness and safety under one program. The goal is typically to increase the number of non-motorized (walk and bike) and higher occupancy (carpool and transit) trips to schools, in order to: • Reduce traffic congestion around schools • Increase physical activity for children and youth • Foster a healthier lifestyle for the whole family • Create safer, calmer streets and neighborhoods • Improve air quality and a cleaner environment A program typically consists of five key components: • *Education.* Classroom lessons teach children the skills necessary to navigate through busy streets and show them how to be active participants in the program. • *Engineering.* A licensed traffic engineer can assist schools in developing a plan to provide a safer environment for children to walk and bike to school. • *Encouragement.* Events, contests and promotional materials are incentives that encourage children and parents to try walking and biking. • *Enforcement.* Police officers, crossing guards and other law enforcement officials can participate throughout the Safe Routes process to encourage safe travel through the community. • *Evaluation.* Program participation should regularly be monitored to determine the growth in student and parent participation. Typically, "before and after" surveys are taken to ascertain any change in travel mode to school over the course of the year.
Examples of Leading Cities	Marin County's Safe Route to Schools program is a national model, regarded as one of the most successful and mature Safe Routes programs in the United States. The program has since 2000 expanded in every year of its operation, to its current level, with 45 schools and over 18,470 students participating Countywide. Each year, the program successfully decreased the drive alone rate at participating schools through innovative classroom activities, contests and events, and implementation of engineering improvements. Since the inception of Marin's program, numerous other safe routes programs have developed in the US, including the expansion of national research and training projects. Pasadena regularly conducts safety programs for children. The Safe Routes to School Program,

<table>
<tr><td></td><td>classes on safe biking and pedestrian safety initiatives conducted at grade schools prior to opening the light rail service are examples of City initiatives. Pasadena also participates in the region's Watch the Road Campaign and conducts safe driving classes for high school students

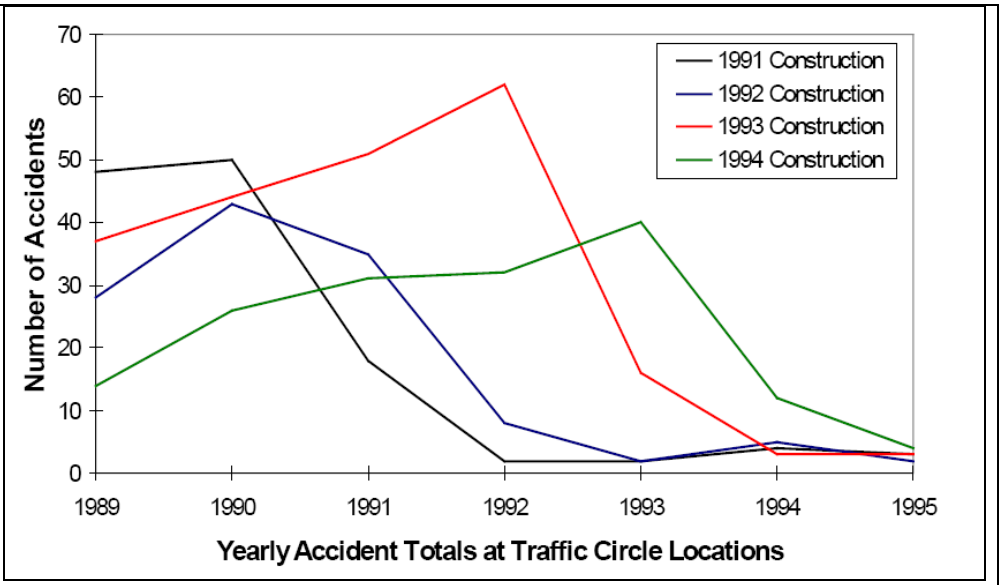
 
</td></tr>
<tr><td>Effectiveness</td><td>Marin County's Safe Routes to Schools program is considered very successful, particularly in reducing "chauffeured student trips". To measure the effectiveness of the program, individual classroom teachers administer "before" and "after" surveys at participating schools (both public and private) to determine how students travel to school. The "before" survey is generally taken at the beginning of the semester in which Safe Routes education is offered and the "after" survey is taken at the conclusion of the school year. A survey conducted between fall 2004 and spring 2005 shows that the annual education program reduced the chauffeured student trips by 24%, and increased walking by 43%, biking by 29% and carpooling by 29%.

<table>
<tr><th></th><th>Fall 2004</th><th>Spring 2005</th><th>% Change</th></tr>
<tr><td>Single Student Car</td><td>55%</td><td>42%</td><td>-24%</td></tr>
<tr><td>Carpool</td><td>17%</td><td>22%</td><td>+29%</td></tr>
<tr><td>Bus</td><td>7%</td><td>7%</td><td>0%</td></tr>
<tr><td>Bike</td><td>7%</td><td>9%</td><td>+29%</td></tr>
<tr><td>Walk</td><td>14%</td><td>20%</td><td>+43%</td></tr>
</table></td></tr>
<tr><td>Implications</td><td>Safe Routes to School programs have largely positive impacts on society. They teach young children how to behave in traffic and often increase walkability and accessibility to schools by improving the pedestrian environment surrounding the school. They benefit household budgets by helping families take advantage of the lowest-cost modes of transportation. Against this must be set the cost of the program to public budgets. Public health practitioners, who are increasingly alarmed by what they describe as an epidemic of childhood obesity, brought about in part by sedentary lifestyles, view the demonstrated increases in walking and bicycling as an important public health benefit. However, concerns are sometimes voiced about children walking and bicycling to school. Walking and bicycling exposes children to traffic dangers, and while the abduction of children by strangers is statistically extremely rare, it remains a strong concern for many parents. About Safe Routes to School Programs, two aspects should be noted: whenever families voluntarily walk, bicycle or take the bus to school, they reduce traffic dangers for others, by reducing the amount of automobile traffic around the school, and by providing safety in numbers, as research has demonstrated that risk for bicyclists and pedestrians fall as increasing numbers of bicyclists and pedestrians take to the road. Additionally, many Safe Routes to School programs improve safety from crime by implementing programs such as "walking school buses", which help students walk to school in organized groups.</td></tr>
<tr><td>Resources</td><td>Pasadena DOT website. Accessed on August 31, 2006 at http://www.ci.pasadena.ca.us/trans/.

Transportation Authority of Marin (2005) *Safe Routes to School, Best Practices Review*.

Transportation Authority of Marin (2006) *Safe Routes to School, Evaluations and Recommendations 2005-2006*.</td></tr>
</table>

Strategy	**Traffic Calming**
Category	Bicycle and Pedestrian Improvements, Traffic Calming
In Mobility Element?	Policies: 3.4 Sections: 3.2.3 Protect Neighborhoods 4.1.3 Protect Neighborhoods 5.5.3 Protect Neighborhoods
Description	Traffic calming refers to a variety of physical measures intended to reduce the effect of motorized vehicle traffic in urban and residential areas, ranging from minor modifications of an individual street to comprehensive redesign of a road network. The Pasadena Neighborhood Traffic Management Program (2004) has calmed traffic on many neighborhood streets in recent years. The program has the following goals: • Improve the safety and convenience for motorists, pedestrians, and bicyclists. • Protect neighborhoods from traffic intrusion through traffic control measures • Increase the quality of life by creating safe and attractive streets. • Promote non-auto modes of travel. • Achieve transportation programs desired and supported by the community. Since reducing speeding by motor vehicles is a key component in developing a safe pedestrian environment, street calming programs are an important part of traffic reduction. Slowing cars down improves the visibility of local businesses. Also, slower cars make for more pedestrian friendly atmosphere. Currently, the perception of traffic danger for children walking to school is a primary barrier that discourages parents from allowing their children to walk and bike to school, so calming traffic on routes to schools fits well with Safe Routes to School programs. Planners and engineers may question how traffic calming fits in as a traffic reduction strategy, since it often just diverts traffic from a residential street to an arterial. However, as walking and bicycling conditions improve, more people will walk and bike in these areas to get to a local grocery, to visit nearby friends and to reach the nearest transit stop, instead of driving to the destination.
Examples of Leading Cities	Seattle, WA has an extensive traffic calming program, of which one sub-program is the Traffic Circle Program. This program receives approximately 700 requests per year from neighborhoods in the city, and over 600 traffic circles have been installed so far. Each year 30 new traffic circles are installed. The figure below shows that the number of accidents in traffic circle locations was reduced by on average 94% compared to before installation (Image Credit: Seattle DOT). The number of injuries in the same locations was reduced by 99%.



Effectiveness

Short-term effects of traffic calming effects can often be attributed to diversion of traffic from the streets where traffic has been calmed to other streets (often, to arterial streets that are more appropriate for handling commute traffic). Long-term effects, however, can be expected to include shifts from auto usage to more walking, bicycling and transit usage, since it evidently does lower speeds and/or volumes and improves streetlife. A Danish before-and-after study shows that the number of pedestrian/cyclist crossings across a calmed highway increased by 82% and 39%, respectively.

Vinderup, Denmark	Before	After	% Change
Pedestrians	1,062	1,935	+82%
Cyclists	840	1,168	+39%

Source: Herrstedt (1992)

Another study from Berkeley, CA of afternoon peak hour traffic counts on Milvia Street before and after the introduction of traffic calming (reconstruction as a slow street with neckdowns, chicanes, speed humps, and center islands) shows that the number of motor vehicles dropped by roughly 20%, while walking and bicycling increased significantly.

Berkeley, CA	Before (motor vehicles/ bicycles/ pedestrians)	Before (motor vehicles/ bicycles/ pedestrians)	% Change (motor vehicles/ bicycles/ pedestrians)
Block #1	540/52/63	441/113/93	-18%/+117%/+48%
Block #2	500/73/42	399/109/95	-20%/+49%/+126%

Source: Bouaouina, & Robinson (1990)

Implications

According to VTPI, traffic calming can be a disadvantage to some "motorists (particularly those who want to speed), and benefits non-drivers most." Traffic calming neighborhoods are often limited in size, and can therefore be more beneficial to residents living within the area, compared to residents living on an adjacent street that are affected by diverted traffic. However, the overall effect of traffic calming is that it creates a more balanced transportation system that benefits people who are economically, physically and socially disadvantaged.

Resources	Bouaouina, M. & Robinson, B. (1990) *An Assessment of Neighborhood Traffic Calming – Milvia Slow Street in Berkeley, California*. Paper for course CP 213, University of California at Berkeley. Ewing, R. (1999) *Traffic Calming: State of the Practice*. Prepared for the U.S. Department of Transportation, Federal Highway Administration; prepared by Institute of Transportation Engineers. Fehr & Peers. *Traffic Calming.* Accessed on August 22, 2006 at http://www.trafficcalming.org. Herrstedt, L. (1992) Traffic Calming Design – A Speed Management Method. *Accident Analysis & Prevention*, Vol. 24, No. 1, pp. 3-16. ITE. *Traffic Calming for Communities*. Accessed on August 22, 2006 at http://www.ite.org/traffic/tcdevices.htm Pasadena Department of Transportation (2004) *Pasadena Neighborhood Traffic Management Program, Community Handbook*. Seattle Department of Transportation. *Neighborhood Traffic Control Program Studies and Reports*. Accessed on August 22, 2006 at http://www.seattle.gov/transportation/ntcpreports.htm Victoria Transport Policy Institute (2005). *Traffic Calming*. Accessed on 8/22/06 at http://www.vtpi.org/tdm/tdm4.htm.

Strategy	**Fare Free Zones**
Category	Transit
In Mobility Element?	No
Description	Up until a few years ago Pasadena's local transit service, ARTS, was free to all riders. As such, it was a Fare Free Zone to anyone traveling within Pasadena. Due to operating deficits and transit expansions concurrent with the opening of GoldLine, a general fee of $0.50 per ride was introduced in 2003. A Fare Free Zone provides an incentive to anyone traveling within the zone to use public transportation instead of driving.
Examples of Leading Cities	Portland, OR is currently the only city in the United States that operates a fare free zone (called the "Fareless Square" in Portland) within such a large geographic boundary, during all hours of operation and all modes of service. All transit trips that begin and end within the 330-square block Fareless Square in Portland are free. Fareless Square includes most of downtown Portland as well as the light rail MAX stations from the Rose Quarter to Lloyd Center and bus stops along NE Multnomah to 13th Avenue. Currently, TriMet does not have any information on the costs or the actual effects on mobility and sustainability of Fareless Square. The Citizens Advisory Committee recommends in its report to the transit agency's (TriMet's) Board of Directors a review of Fareless Square. The evaluation would provide answers to these issues. Other areas with fare free zones include Downtown Pittsburgh, PA and Asheville, NC. The Downtown Pittsburgh Free Fare Zone was established to promote the use of transit, encourage intramodal transfer and reduce boarding delays. Fares are free within the zone 4:00A.M-7:00 P.M., seven days a week.
Effectiveness	Of the transit agencies discussed above none have conducted studies of how the strategy actually affects transit ridership. However, when Pasadena ARTS introduced a fare on its entire system (from free to $0.50), overall ridership decreased by almost 40%, although new service was provided. However, the effectiveness varies most likely significantly between having a complete fare free system, such as in Pasadena, and a fare free zone with fees in the surrounding transit system. Refer people to the evidence on elasticity of transit ridership with regard to fares, in the other transit sheet. It is important to note that ridership gained through fare free zones is normally to some extent created by attracting cyclists and pedestrians from their previous modes of transportation, and also tends to induce people to travel more often, meaning that each additional transit trip created by establishing a fare free transit zone does not correspond to a reduction of one motor vehicle trip.
Implications	*Economic* Positive effect on the ability to attract and retain jobs/residents as it is a strong incentive not to drive and provides additional access to businesses and other destinations within the zone. Direct loss of revenue within the Zone for the transit agency due to lost ticket sales. There are also signs that there could be an indirect loss in revenue from people boarding within the Zone and not paying the fare when traveling outside the Zone. *Social* Increases affordability and equity, since transit riders -- which generally includes a large share of

	low income households -- no longer have to pay for transit. May decrease walking/biking share, which may have a negative impact on health and the environment. *Mobility* A fare free zone increases mobility for all users, since the obstacle of a fare is removed.
Resources	City of Asheville. *Transit & Parking Services Department.* Accessed on August 28, 2006 at http://www.ci.asheville.nc.us/transit.htm City of Pittsburg. *Zone Fare Structure.* Accessed on August 28, 2006 at http://www.portauthority.org/ ride/pgZones.asp. TriMet Citizens Advisory Committee (2006) *Report to the Board of Directors, Citizens Advisory Committee on the Budget.* Tri-County Metropolitan Transportation District of Oregon, Spring 2006.

Strategy	**Employee Parking Pricing**
Category	Parking Strategies
In Mobility Element?	No
Description	A majority of American commuters who drive to work today can park for free at work, which creates a strong incentive to drive to work alone. Considering parking construction costs and rising land values, this is an expensive subsidy to provide for any employer. This subsidy is usually also the only transportation-related employee benefit that an employee receives. Transit subsidies are not nearly as common as parking subsidies. Parking pricing is one of the transportation demand measures that have the largest impact on employee drive-alone rate. Having great or even good transit availability is not a necessity for parking pricing to work. As Willson & Shoup (1990) explains, "A lack of transit service is often cited as a reason why employers subsidize employees' parking at suburban employment locations. The argument is made that sufficient alternatives to solo driving do not exist. However, the 20th Century case study demonstrates that significant changes in mode split can be achieved at suburban locations that lack transit service – carpooling is the underutilized option."
Examples of Leading Cities	Employee parking pricing is often one option of several Transportation Demand Management (TDM) strategies in a TDM or Trip Reduction Ordinance. However, no city that we know of has implemented mandatory pricing of employee parking as a citywide strategy or ordinance. The examples presented in the Effectiveness box below are from single employers or districts, and would have a significant impact if implemented city-wide.
Effectiveness	The following list of employee parking pricing case studies have been collected from various sources (see source list after the table). Some of the cases, such as Warner Center, Mid-Wilshire and Downtown Ottawa, are based on surveys of commuting behavior *before* and *after* employer-paid parking was eliminated. Other cases, such as Century City, Los Angeles Civic Center and Downtown Los Angeles, compare commuting behavior of matched samples of employees *with* and *without* employer-paid parking. In either case, the pattern is clear, as employees pay for parking, the demand for parking decreases. Today, in an area with little public transportation, these studies suggest a reduction in parking demand by 26% if all employees are charged a monthly parking fee of $64. Most of the parking demand reduction will in this case come from people switching from driving alone to carpooling.

Location	Scope of Study	Parking Fee in $/Month (2006 $)	Decrease in Parking Demand
Group A: Areas with little public transportation			
Century City, CA[1]	3500 employees at 100+ firms	$107	15%
Cornell University, NY[2]	9000 faculty and staff	$45	26%
Warner Center, CA[1]	1 large employer (850 employees)	$49	30%
Bellevue, WA[3]	1 medium-size firm (430 empl)	$72	39%
Costa Mesa, CA[4]	State Farm Insurance employees	$49	22%
Average		**$64**	**26%**
Group B: Areas with fair public transportation			
Los Angeles Civic Center[1]	10,000+ employees, several firms	$166	36%
Mid-Wilshire Blvd, LA[1]	1 mid-sized firm	$119	38%

Washington DC suburbs[5]	5500 employees at 3 worksites	$90	26%
Downtown Los Angeles[6]	5000 employees at 118 firms	$167	25%
Average		**$135**	**31%**
Group C: Areas with good public transportation			
University of Washington[7]	50,000 faculty, staff and students	$24	24%
Downtown Ottawa[1]	3500+ government staff	$95	18%
Average		**$59**	**21%**
Overall Average		**$89**	**27%**

Sources:
[1] Willson, Richard W. and Donald C. Shoup. "Parking Subsidies and Travel Choices: Assessing the Evidence." *Transportation*, 1990, Vol. 17b, 141-157 (p145).
[2] Cornell University Office of Transportation Services. "Summary of Transportation Demand Management Program." Unpublished, 1992.
[3] United States Department of Transportation. "Proceedings of the Commuter Parking Symposium," USDOT Report No. DOT-T-91-14, 1990.
[4] *Employers Manage Transportation*. State Farm Insurance Company and Surface Transportation Policy Project, 1994.
[5] Miller, Gerald K. "The Impacts of Parking Prices on Commuter Travel," Metropolitan Washington Council of Governments, 1991.
[6] Shoup, Donald and Richard W. Wilson. "Employer-paid Parking: The Problem and Proposed Solutions," *Transportation Quarterly*, 1992, Vol. 46, No. 2, pp169-192 (p189).
[7] Williams, Michael E. and Kathleen L Petrait. "U-PASS: A Model Transportation Management Program That Works," *Transportation Research Record*, 1994, No.1404, p73-81.

The table below shows the difference in auto commute rates between employer-paid parking and employee-paid parking. The average result for the five case studies is a 27% reduction in auto trips when the driver has to pay for parking.

	Autos Driven per 100 Employees		
Case Study and Type	**Employer Pays for Parking**	**Driver Pays for Parking**	**Decrease in Auto Trips**
Mid Wilshire, Los Angeles (before/after)	48	30	-38%
Warner Center, Los Angeles (before/after)	92	64	-30%
Century City, Los Angeles (with/without)	94	80	-15%
Civic Center, Los Angeles (with/without)	78	50	-36%
Downtown Ottawa (before/after)	39	32	-18%
Average of Case Studies	**70**	**51**	**-27%**

Source: Willson, Richard W. and Donald C. Shoup. "Parking Subsidies and Travel Choices: Assessing the Evidence." Transportation, 1990, Vol. 17b, 141-157 (p145).

Implications

Economic
Employer-paid parking is an important component of the benefits package in most American companies. The elimination of the subsidy -- unless it is matched by an equal size increase in pay or other benefits for the employee -- is therefore a significant economic loss to employees who drive to work. Low-income households rely to a much larger extent on transit and other alternative transportation modes, which most often are not subsidized, and are therefore less often affected than higher income employees by changes to parking benefits. To avoid the problems -- for both employee morale and employee recruitment -- that can be caused by parking pricing, the institution of an equal size increase in pay at the same time as parking charges are introduced is a useful model. The city of Pasadena, which followed this strategy when introducing parking charges for city employees, is an excellent example of this approach.

	For employers, eliminating subsidized parking for employees can significantly reduce costs (if no simultaneous pay increase is provided), for two reasons. First, those employees who drive pay for their own parking. Second, because eliminating subsidized parking reduces parking demand, fewer parking spaces need to be provided than when employee parking is subsidized. However, if minimum parking requirements prevent the employer from reducing the number of parking spaces that it must build and operate (or must lease), this second type of savings cannot be achieved.
Resources	Cornell University Office of Transportation Services (1992) *Summary of Transportation Demand Management Program*. Unpublished. State Farm (1994) *Employers Manage Transportation*. State Farm Insurance Company and Surface Transportation Policy Project. Miller, G. K. (1991) *The Impacts of Parking Prices on Commuter Travel*, Metropolitan Washington Council of Governments. Shoup, D. and Willson R. (1992) "Employer-paid Parking: The Problem and Proposed Solutions," *Transportation Quarterly*, Vol. 46, No. 2, pp 169-192 (p189). United States Department of Transportation. *Proceedings of the Commuter Parking Symposium*, USDOT Report No. DOT-T-91-14, 1990. Williams, M. E. and Petrait, K.L. (1994) U-PASS: A Model Transportation Management Program That Works, *Transportation Research Record*, No.1404, p73-81. Willson, R. W. and Shoup, D. (1990) Parking Subsidies and Travel Choices: Assessing the Evidence. *Transportation*, Vol. 17b, 141-157 (p145).

Strategy	**Modified Residential (Preferential) Permit Parking**
Category	Parking Strategies
In Mobility Element?	Policies: 1.17 Sections: 4.1.4.4 Parking 5.5.1.2 Apply Project Review Guidelines 5.5.4.4 Provide for Public Parking Needs
Description	In order to prevent spillover parking in residential neighborhoods, many cities including Pasadena implement residential permit districts (also known as preferential parking districts) by issuing a certain number of parking permits to residents usually for free or a nominal fee. These permits allow the residents to park within the district while all others are prohibited from parking there for more than a few hours, if at all. Residential parking permit districts are typically implemented in residential districts near large traffic generators such as central business districts, educational, medical, and recreational facilities but have several limitations. Most notably, conventional residential permit districts often issue an unlimited number of permits to residents without regard to the actual number of curb parking spaces available in the district. This leads to a situation in which on-street parking is seriously congested, and the permit functions solely as a "hunting license", simply giving residents the right to hunt for a parking space with no guarantee that they will actually find one. (An example of this is Boston's Beacon Hill neighborhood, where the City's Department of Transportation has issued residents 3,933 permits for the 983 available curb spaces in Beacon Hill's residential parking permit district, a 4-to-1 ratio.) An opposite problem occurs with conventional residential permit districts in situations where there actually are surplus parking spaces (especially during the day, when many residents are away), but the permit district prevents any commuters from parking in these spaces even if demand is high and many motorists would be willing to pay to park in one of the surplus spaces. In both cases, conventional residential parking permit districts prevent curb parking spaces from being efficiently used (promoting overuse in the former example and underuse in the latter). To avoid these problems, a residential parking benefit district could replace existing preferential parking districts. This will prevent excessive spillover parking from commuters trying to avoid parking charges and further strengthen a vibrant atmosphere. *Implementation details* Implementation of a Residential Parking Benefit District will differ from conventional parking permit districts in four key ways: 1. Limit the number of permits issued to residents to a number that results in a peak hour occupancy of 85% or less, as determined by an initial city survey supplemented by periodic surveys thereafter (at least biannual). Residents should be issued free permits. 2. Rather than entirely prohibit nonresident parking as with many conventional residential parking permit districts, the District should sell permits for any surplus parking capacity to non-resident commuters at fair market rates, up to 90% of available parking supply.

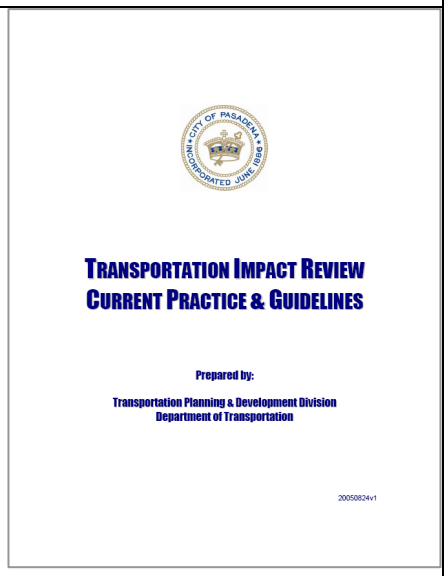
	3. Use in-vehicle meters for non-resident parkers (who will primarily be commuters) rather than adhesive permits or rearview hangtags. These in-vehicle meters allow user and geographic transferability, multiple payment methods, variable pricing options, and networking capabilities. 4. Finally, the rates for non-residents' parking permits should be set at fair market rates as determined by periodic surveys, and all net revenues above and beyond the cost of administering the program should be dedicated to pay for public improvements in the neighborhood where the revenue was generated.
Examples of Leading Cities	Boulder, CO sells permits to *residents* for $17 per vehicle per year, permits for *businesses* located within a zone for $75 per year and *commuter* permits for $78 per quarter ($312 per year) in its Neighborhood Permit Parking zones. Each permit is valid on a specific block and a maximum of four non-resident permits are issued on any given block face within a zone, and only if the vacancy rate is greater than 25% during daytime. Vehicles without a permit can park one time per day but may not repark on the same day in the zone after the initial time limitation. The program is currently revenue neutral with all revenue from nonresident permits being used to reduce the price of the resident permits. The City of Boulder states that "The Neighborhood Permit Parking Program is designed to make Boulder neighborhoods safe and pleasant places to live, work and attend school by encouraging less driving and reducing on-street parking congestion." Santa Cruz, CA has modeled its permit parking program after Boulder's program and provides residential permits in certain districts at a cost between $15 and $20 per year. Commuters can purchase monthly permits at an annual cost of $240 and each permit is only valid on a specific block face. The City only sells commuter permits on streets that have resident parking occupancies of less than 75% during the daytime restricted parking hours. Other examples include Aspen, CO; Tucson, AZ and West Hollywood, CA.
Effectiveness	In neighborhoods with overcrowded on-street parking, implementing well-designed residential parking permit programs that create sufficient vacancies in the on-street parking supply can eliminate significant amounts of cruising traffic. (For details on the impact of cruising traffic, see the strategy sheet on Market Rate Pricing of On-Street Parking.) In other conditions, this strategy will not have a direct impact on traffic reduction. However, it is a very important tool in avoiding spill-over parking from adjacent neighborhoods with stricter parking management, such as areas with parking pricing and parking cash-out. As a result, implementing residential parking permit programs is frequently an essential precondition for the successfully implementation of other strategies that do significantly reduce traffic, such as parking pricing and parking cash-out programs. Pasadena's decision to implement residential parking permit districts around the new Gold Line stations, for example, was an important action that made it possible to implement parking pricing for the park-and-ride lots at the stations.
Implications	If set up as a typical preferential permit parking district, it may lead to under-utilization of the on-street parking supply (since only residents have access to them). This may cause mobility issues, where people looking for parking can not use available spaces, forcing them to "cruise for parking" which often is a major reason to congestion in urban areas. However, if set up as parking benefit district, where residents have first priority and commuters and other users have access to unused spaces, the mobility issue is reduced. Revenue generated can also benefit the neighborhood by being invested in physical or alternative transportation improvements.
Resources	City of Boulder. Accessed on August 25, 2006 at http://www.bouldercolorado.gov/index.php?option=com_content&task=view&id=1358&Itemid=1296. Shoup, D. (2005) *The High Cost of Free Parking.* American Planning Association.

Strategy	**Alternative Work Schedules**
Category	Transportation Demand Management
In Mobility Element?	Policies: 4.14 Sections: 4.1.4.3 Managing Demand
Description	Alternative Work Schedules typically allow or force employees to start and/or leave work outside of peak hours. These strategies are often a part of a company's Trip Reduction or TDM program and include: • *Flextime.* Employees are allowed some flexibility in their daily work schedules, e.g. starting at 7:30AM or after 9AM and leaving at 4 PM pr after 6 PM. • *Compressed Workweek (CWW).* Employees work fewer but longer days, such as four 10-hour days each week (4/40), or 9-hour days with one day off every two weeks (9/80). • *Staggered Shifts.* Shifts are staggered to reduce the number of employees arriving and leaving a worksite at one time, e.g. one shift works between 8:00 and 4:30, another shift 8:30 and 5:00, and a third 9:00 and 5:30.
Examples of Leading Cities	Alternative work schedules are often an option in cities' trip reduction or TDM ordinances, and many companies provide the option in its transportation-related programs. The effects are most often studied on a micro-level, for a specific business or site.
Effectiveness	Flextime can directly reduce peak period congestion and make ridesharing and transit use more feasible (Freas and Anderson, 1991). Staggered shifts can reduce peak-period trips, particularly around large employment centers. According to Ewing (1993), flextime and teleworking together can reduce peak-hour vehicle commute trips by 20-50%. Compressed Workweeks and staggered shifts can also reduce total vehicle travel. CUTR (1998) found that CWW reduced automobile commutes by 7-10%, making it among the most effective commute trip reduction strategies considered. However, CWW may also encourage some employees to move further from worksites or to drive rather than rideshare.
Implications	According to VTPI (2006), this type of programs can help achieve equity objectives: "Many economically and physically disadvantaged workers (e.g., single mothers, transit-dependent non-drivers, people with physical disabilities) place a particularly high value on optional Alternative Work Schedules. However, some disadvantaged workers have jobs with inflexible schedules (factory staff, receptionists, service workers, etc.) and so may feel excluded and disadvantaged compared with employees who can use Alternative Work Schedules."
Resources	CUTR (1998) *A Market-Based Approach to Cost-Effective Trip Reduction Program Design.* Center for Urban Transportation Research, for Florida DOT. Freas, A. & Anderson, S. (1991) Effects of Variable Work Hour Programs on Ridesharing and Organizational Effectiveness. *Transportation Research Record 1321*, pp. 51-56. VTPI (2006) *Alternative Work Schedules*. Accessed on September 5, 2006 at http://www.vtpi.org/tdm/tdm15.htm.

Strategy	**Intelligent Transportation Systems (ITS)**
Category	Intelligent Transportation Systems
In Mobility Element?	Sections: 4.1.4.1 Multi-Modal Corridors 5.2.2 Federal and State Grants
Description	 Intelligent Transportation Systems (ITS) cover a wide range of systems and services. A very good source of information can be obtained from USDOT's ITS website. As defined by USDOT, "Intelligent transportation systems (ITS) encompass a broad range of wireless and wire line communications-based information and electronics technologies. When integrated into the transportation system's infrastructure, and in vehicles themselves, these technologies relieve congestion, improve safety and enhance American productivity." According to the same source, ITS is made up of 16 types of technology based systems. These systems are divided into intelligent infrastructure systems and intelligent vehicle systems: • Intelligent infrastructure: 1. *Arterial management.* Employs traffic detectors, traffic signals, and various means of communicating information to travelers, using information collected by traffic surveillance devices, to smooth the flow of traffic along travel corridors. Disseminates important information about travel conditions to travelers via technologies such as dynamic message signs (DMS). 2. *Freeway management.* Comprised by traffic surveillance systems, traffic control measures (e.g. ramp meters), lane management applications (e.g. HOV priority), Motorists are now able to receive relevant information on location specific traffic conditions in a number of ways, including dynamic message signs, highway advisory radio, in-vehicle signing, or specialized information transmitted only to a specific set of vehicles. 3. *Transit management.* Includes surveillance and communications, such as automated vehicle location (AVL) systems, computer-aided dispatch (CAD) systems, and remote vehicle and facility surveillance cameras, which enable transit agencies to improve the operational efficiency, safety, and security of the nation's public transportation systems. 4. *Incident management.* Can reduce the effects of incident-related congestion by decreasing the time to detect incidents, the time for responding vehicles to arrive, and the time required for traffic to return to normal conditions. 5. *Emergency management.* Includes hazardous materials management, the deployment of emergency medical services, and large and small-scale emergency response and evacuation operations. 6. *Electronic payment.* Employs various communication and electronic technologies to facilitate commerce between travelers and transportation agencies, typically for the purpose of paying tolls and transit fares.

	7. *Traveler information.* Uses a variety of technologies, including Internet websites, telephone hotlines, as well as television and radio, to allow users to make more informed decisions regarding trip departures, routes, and mode of travel (e.g. the 511 phone number, which is now available to nearly 100 million Americans). 8. *Information management.* Supports the archiving and retrieval of data generated by other ITS applications and enables ITS applications that use archived information. 9. *Crash prevention and safety.* These systems detect unsafe conditions and provide alerts for e.g. traffic approaching at dangerous curves, off ramps, high-volume intersections, and also provide warnings of the presence of pedestrians, and bicyclists, and even animals on the roadway. Crash prevention and safety systems typically employ sensors to monitor the speed and characteristics of approaching vehicles and frequently also include environmental sensors to monitor roadway conditions and visibility. 10. *Roadway operations and maintenance.* Monitor, analyze, and disseminate roadway and infrastructure data for operational, maintenance, and managerial uses. Help secure the safety of workers and travelers in a work zone while facilitating traffic flow through and around the construction area. 11. *Road weather management.* Includes road weather information systems (RWIS), winter maintenance technologies, and coordination of operations within and between state DOTs. 12. *Commercial vehicle operations.* Designed to enhance communication between motor carriers and regulatory agencies, e.g. electronic registration and permitting programs, and several applications to assist operators with fleet operations and security. 13. *Intermodal freight.* Facilitates the safe, efficient, secure, and seamless movement of freight. Applications being deployed provide for tracking of freight and carrier assets such as containers and chassis. • Intelligent vehicles: 14. *Collision avoidance systems.* Improves the ability of drivers to avoid accidents. These applications use a variety of sensors to monitor the vehicle's surroundings and alert the driver of conditions that could lead to a collision. 15. *Collision notification systems.* Detect and report the location and severity of incidents to agencies and services responsible for coordinating appropriate emergency response actions. 16. Driver assistance systems. Assist the driver in operating a vehicle safely. Systems are available to aid with navigation, vision enhancement and speed control systems. ITS should not be considered a traffic reduction strategy. However, due to its ability to alleviate congestion and improve safety, it is included in this report. It can also help redirect through-traffic from local (Pasadena) streets to arterials and highways.
Examples of Leading Cities	Several agencies in Los Angeles are currently investing heavily in various ITS systems. The City of Pasadena has recently received federal funding for transportation improvements that will mitigate, on an interim basis, the traffic impact of the 710 Freeway gap on City streets. A significant amount of the funding will be used to deploy ITS measures in the City, with focus on the Traffic Control and Monitoring System. ITS deployment has already occurred in several locations in Los Angeles County. In the City of Los Angeles, a transit signal priority (TSP) system has been deployed on two corridors (Ventura Boulevard and Santa Monica-Beverly Hills-Montebello Route). The system includes 210 TSP equipped intersections, 331 loop detectors, and more than 150 on-board transponders. It grants early greens, extensions, free holds (holds a signal green until the bus passes through the intersection), and phase calls (brings up the selected phase that is not normally activated, i.e., left

	turn) as necessary. Buses are also instructed to slow down or speed up to avoid interference with other buses en-route. The system has reduced bus journey times by 22-27%. It is estimated that 30-40% of a 25% reduction in travel time realized on each route was the result of bus priority technology. The remaining benefits were the result of reducing the number of stops from one stop every 0.2 miles, to one stop every 0.8 miles. (Chada & Newland, 2002)
Effectiveness	*Sample findings for Arterial Management Systems (USDOT):* • *Safety.* Automated enforcement of traffic signals has reduced red-light violations 20-75%. • *Mobility*. Field studies in several cities have shown that adaptive signal control systems can reduce peak period travel time 5-11%. • *Productivity.* Transit signal priority on a Toronto Transit Line allowed same level-of-service with less rolling stock. • *Energy & Environment.* Model estimates showed advanced traffic signal control systems can reduce fuel consumption 2-13%. *Sample findings for Transit Management Systems (USDOT):* • *Mobility.* Computer Aided Dispatch (CAD) and Automatic Vehicle Location (AVL) technologies improved on-time bus performance 9-23%. • *Productivity.* In San Jose, CA, a paratransit scheduling and routing system increased shared rides 45% and reduced operating costs $500K the first year.
Implications	Improves mobility and safety for all road users, although particularly for automobile users.
Resources	Chada, S. & Newland, R. (2002) *Effectiveness of Bus Signal Priority, Final Report*. National Center For Transit Research (NCTR), University of South Florida. ITS America. *ITS Technologies*. Accessed on September 5, 2006 at http://www.itsa.org/its_technologies/c9/What_is_ITS/ITS_Technologies.html. USDOT. *Intelligent Transportation Systems*. Accessed on September 5, 2006 at http://www.its.dot.gov/index.htm.

Strategy	**Transportation Impact Review Practices**
Category	Regulatory Reforms
In Mobility Element?	Policies: 1.4, 2.4, 3.1 Sections: 3.2.1 Promote a Livable and Economically Strong Community 4.1.2.3 Bicycle and Pedestrian Travel 4.1.4.3 Managing Demand 5.5.1 Promote a Livable and Economically Strong Community 5.5.2 Encourage Non-Auto Travel 5.5.4 Manage Traffic on Multimodal Corridors to Promote and Improve Citywide Transportation Services
Description	Most cities have adopted Transportation Impact Review practices, to guide new development in regards to traffic generation. One typical inclusion in these guidelines is to determine trip generation by using the current edition of the Institute of Transportation Engineers (ITE) Trip Generation. This publication is the customary reference for figuring the number of vehicle trips likely to be produced by a given amount of development. The manual draws on more than 4,250 empirical studies and includes information on 150 different land uses. However, as the companion Trip Generation Handbook reports, "The data contained in Trip Generation are, by definition, from single-use developments where virtually all access is by private automobile and all parking is accommodated on site."  CITY OF PASADENA INCORPORATED JUNE 1886 **TRANSPORTATION IMPACT REVIEW CURRENT PRACTICE & GUIDELINES** Prepared by: Transportation Planning & Development Division Department of Transportation 20050824v1 Why is this true by definition? ITE's recommended site-selection procedures for a trip-generation study declare that it should be possible to isolate the site for counting purposes. Therefore, selected sites must have "no shared parking (unless the parking areas for the site are easily distinguishable); no shared driveways (unless the driveways for the site are easily distinguishable); limited ability for pedestrians to walk into the site from nearby parcel; [and] limited transit availability or use (unless transit usage can be counted—e.g., elementary students to ride a school bus)." These procedures rule out counting the traditional mixed-use neighborhoods and new infill/TOD development. While ITE has the largest trip generation database, its figures need to be adjusted downwards for these factors before being used in a context such as Pasadena. Indeed, the user's guide for Trip Generation already advises: "At specific sites, the user may wish to modify trip generation rates presented in this document to reflect the presence of public transportation service, ridesharing or other TDM measures, enhanced pedestrian and bicycle trip-making opportunities, or other special characteristics of the site or surrounding area." The following section provides a recommended step-by-step process for determining trip generation rates: 1. *Determine land use mix.* The basic input required is the type of land use (e.g. general office

or single-family residential), the relevant ITE land use code, and the quantity of development (number of units or square footage).

2. *Determine base trip generation rate.* This is looked up in the ITE Trip Generation manual. Procedures in the Trip Generation Handbook (pp 9-11) should be followed to determine whether to use the regression equation or a weighted average rate. Alternative trip generation sources may be used with the approval of City staff.

3. *Convert to person trips.* ITE trip generation rates refer to vehicle trips, while the adjustment factors relate to the number of people using alternative modes. ITE trip generation rates therefore need to be increased to account for the (often small) number of people using alternative modes. The person trip conversion assumes that 10% of the vehicle trips are carpools, average carpool occupancy of 2.25 people, and that other modes (transit, bikes and pedestrians) are equivalent to 5% of the number of person trips by vehicle. (This is equivalent to multiplying the ITE trip generation rate by 1.18.) Alternatively, other references such as SANDAG's Traffic Generators manual provide person trips directly.

4. Estimate proportion of home-based work trips (for residential uses only). A default of 40% can be assumed.

5. Calculate baseline vehicle trips using neighborhood adjustments. Multiply the number of person trips by the number of auto trips per person in that neighborhood (equivalent to drive-alone mode share + carpool mode share / 2.25). This needs to be done separately for home-based work trips and other trips.

6. Calculate additional trip reductions. Deduct the total percentage reduction from the number of baseline vehicle trips, to account for on-site trip reduction programs.

7. Estimate reduction for mixed-use development (internal capture). Internal capture refers to trip-making within a development, and this step deducts trips that are internalized within a project. At a multi-use development including offices and shops, for example, some of the trips made by office workers to banks may occur on-site, and not generate any internal trips.

Another tool that determines trip generation is the URBEMIS mitigation component; it employs standard traffic engineering methodologies, but provides the opportunity to adjust ITE average rates to quantify the impact of a development's location, physical characteristics and any demand management programs. In this way, it provides an opportunity to fairly evaluate developments that minimize their transportation impact, for example, through locating close to transit or providing high densities and a mix of uses. The table below provides a summary of the specific trip reduction credits that are granted by URBEMIS.

	Residential (1)	Non-Residential
Physical Measures		
Net Residential Density	Up to 55%	N/A
Mix of Uses	Up to 9%	Up to 9%
Local-Serving Retail	2%	2%
Transit Service	Up to 15%	Up to 15%
Pedestrian/Bicycle Friendliness	Up to 9%	Up to 9%
Physical Measures subtotal	*Up to 90%*	*Up to 35%*
Demand Management and Similar Measures		
Affordable Housing	Up to 4%	N/A
Parking Supply (2)	N/A	No limit
Parking Pricing/Cash Out	N/A	Up to 25%
Free Transit Passes	25% * reduction for transit service	25% * reduction for transit service

	Telecommuting (3)	N/A	No limit
	Other TDM Programs	N/A	Up to 2%, plus 10% of the credit for transit and ped/bike friendliness
	Demand Management subtotal (4)	*Up to 7.75%*	*Up to 31.65%*

Notes:
(1) For residential uses, the percentage reductions shown apply to the ITE average trip generation rate for single-family detached housing. For other residential land use types, some level of these mitigation measures is implicit in ITE average trip generation rates, and the percentage reduction will be lower.
(2) Only if greater than sum of other trip reduction measures.
(3) Not additive with other trip reduction measures.
(4) Excluding credits for parking supply and telecommuting, which have no limit.

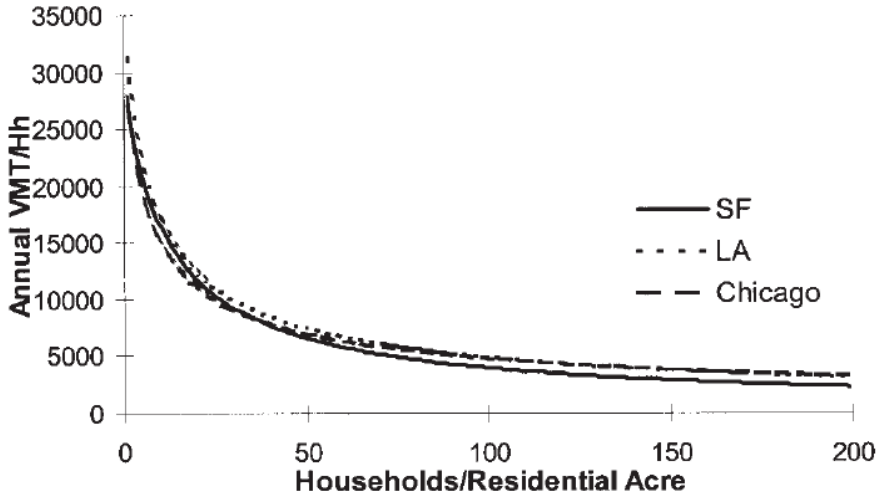
The Urbemis software can be downloaded from the California Air Resources Board.

Examples of Leading Cities

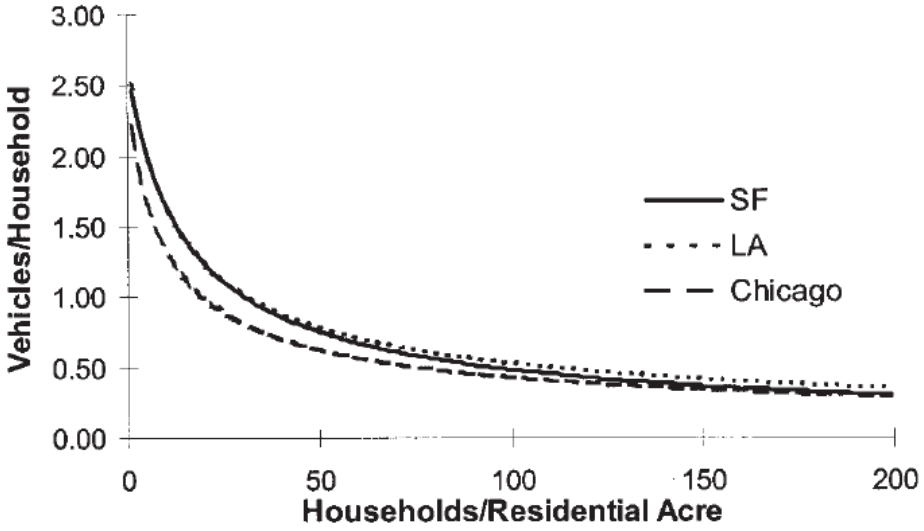
The URBEMIS model is used by air quality management districts statewide. The Urbemis trip reduction model is accepted for use by the City of San Mateo for use in traffic impact of development project reviews. The Urbemis model has also been employed for calculating trip reduction rates for the Heart of the City project in San Marcos, CA and the 325 Lytton redevelopment project in Palo Alto, CA. Furthermore, URBEMIS has been used to calculate trip generation in Roseville, Placerville and Sacramento, CA.

Effectiveness

Revised Transportation Impact Review guidelines will not have a direct impact on traffic generation. However, by determining effects based on factors such as mix of uses, density, accessibility etc, it may affect how new development is planned and built, which may affect trip generation. When neighborhoods are compact, and many of a person's daily needs can be found within a few minutes walk, vehicle trips per household decline rapidly. As shown in the figures below, there is a very strong correlation between the density at which people live (measured in these graphs in households per residential acre), the number of vehicle miles per year that a household drives and the number of vehicles that a household owns.



Source: Holtzclaw et. al. (2002).

	 Source: Holtzclaw et. al. (2002).
Implications	New development in denser areas with higher transit and ped./bike access promotes a more balanced transportation system.
Resources	California Air Resources Board. Urbemis 2002 Program. Accessed on September 6, 2006 at http://www.arb.ca.gov/planning/urbemis/urbemis2002/urbemis2002.htm. Holtzclaw, J. et. al. (2002) Location Efficiency: Neighborhood And Socioeconomic Characteristics Determine Auto Ownership And Use – Studies In Chicago, Los Angeles And San Francisco. *Transportation Planning and Technol*., Vol. 25, pp. 1–27. ITE (2003) *Trip Generation, 7th Edition*. Institute of Transportation Engineers. Millard-Ball, A. & Siegman, P. (2005) *Crediting Low-Traffic Developments Adjusting Site-Level Vehicle Trip Generation Using URBEMIS*. Nelson\Nygaard Consulting Associates. Accessed on September 6, 2006 at http://www.nelsonnygaard.com/articles/urbemis.pdf. Rimpo, T. (2006) Phone Interview on July 26, 2006. Jones & Stokes, Sacramento.

Strategy	**Transportation Impact Fees**
Category	Development Impact Fees
In Mobility Element?	Sections: 5.5.1 Promote a Livable and Economically Strong Community Appendix D
Description	Cities are increasingly turning to development impact fees to pay for transportation improvements. These fees can both provide an attractive source of new revenue, and ensure that developers pay their "fair share" costs of mitigating their transportation impacts. A 1997 study found that 116 of the 206 surveyed California cities (56%) imposed Transportation Impact Fees (TIFs). Traditionally, impact fees have been dedicated exclusively to roadway improvements to handle forecast traffic increases. A growing number of California cities, however, are beginning to use this tool to mitigate a development's impact through investment in transit, bicycle and pedestrian facilities, and other trip reduction strategies. Such development impact fees are governed by the Mitigation Fee Act. This requires the City Council to make certain findings in order to establish a fee. These findings must: • Identify the purpose of the fee. • Identify the use to which the fee is to be put and the facilities (if any) to be financed. • Determine how there is a reasonable relationship between the fee's use and the type of development project on which the fee is imposed. • Determine how there is a reasonable relationship between the need for the public facility and the type of development project on which the fee is imposed (Gov't Code §66001(a)). The California courts have interpreted the AB1600 finding requirements to also require that a development fee be shown to "bear a reasonable relationship, in both use and amount, to the deleterious impact of the development." (Id., at 671). Most cities, including the City of Pasadena, base their transportation impact fees on a per unit or per square foot basis. However, a recommendation is instead to base the fee on projected trip generation for the new development, as described above in the Transportation Impact Review Practices. The City of Pasadena City Council recently adopted a new fee schedule, where approximately 50% of the fees will be used for transit-related improvements. The City can therefore defend its policy of basing the fee on a per unit and per square foot basis, since everyone (including denser development) should contribute to the transit improvements.
Examples of Leading Cities	The City of Pasadena has in June 2006 adopted a new and improved Transportation Impact Fee schedule that will to a large extent fund transit and mobility/safety improvements, as well as street and intersection improvements. Riverside and Arcadia are other Californian communities that invest a large portion of their development fees in transportation improvement.
Effectiveness	Impact fees that are directed towards transit and pedestrian/bicycle improvements will have a positive impact on traffic reduction. However, there is currently no data on how large this effect is.
Implications	If impact fees are directed towards other transportation modes than the Single Occupant Vehicle, they will create a more balanced transportation system, which will benefit low-income households and transportation-disadvantaged people.

Resources	Government Code Section 66000 et seq. Santa Barbara County Association of Governments (1997) *Traffic Impact Fee Survey.*

Strategy	**Street Typology & Performance Measures**
Category	Transportation Performance Measures
In Mobility Element?	Policies: 1.6, 4.6
Description	In most cities that have succeeded in growing with no increase in traffic congestion, a fundamental part of that success has been improved transit. A key element is protecting transit vehicles from rising traffic congestion, which will otherwise cause steadily declining transit speeds, de-creasing reliability, higher operating costs and eventually deterioration of the entire transit net-work. In addition, key corridors – typically the primary retail and/or transit corridors – should ideally give the highest possible level of comfort and safety for pedestrians. Still, these goals do not mean that the needs of automobile drivers can be abandoned, not only because it is a political reality, but since auto access will continue to be a key part of the economic health of Pasadena. The solution is to clearly designate priorities for different types of streets: • *Primary Auto Streets* give first priority to moving automobile traffic. On the streets, first priority is given (e.g., in signal prioritization) to meeting automobile level of service standards. Other modes, while not entirely ignored, take second priority. • *Primary Transit Streets* need to give first priority to moving transit. These are the streets where, for example, signal prioritization should give first priority to speeding up buses, even at the expense of some loss of performance or automobile level of service, where queue jumps or exclusive bus lanes should be installed when needed. These are also the streets where high priority must be given to creating excellent conditions for pedestrians, in the design of both streets and buildings. • *Primary Pedestrian Streets* give first priority to creating excellent conditions for pedestrians. This designation is usually most important on primary retail and transit corridors, but also desirable on many residential streets. • *Primary Bicycle Streets* are the key streets in the bicycle network. Bicycle streets do not necessarily require eliminating auto or parking lanes to create a separated bicycle lane, but may be designated as a bicycle route because of their topography and minimal auto/transit conflicts. The following section describes how to measure the quality of service for each of the four primary street types. *Transit Quality of Service* A broad variety of approaches to measuring Transit Quality of Service exist. The most suitable methodology is described in great detail in the Transportation Cooperative Research Program's Transit Capacity and Quality of Service Manual, prepared by Kittleson & Associates. The first edition (TCRP, 1999) outlined a large group of factors affecting quality of service. The five key measures that best define the service characteristics are: • Frequency • Span of Service • Reliability

- Loading
- Travel Speed

These selected measures are described below. The proposed "System of Measurement" charts are especially important. For each measure, specific targets are set that correspond to numerical Quality of Service "scores." These scores are equivalent to the A-F letter scale in traditional Level of Service measures, but they have two key advantages:

Automobile Quality of Service
There is a range of different methods of measuring performance for automobiles. These include:

- Volume/capacity (v/c) ratio
- Intersection delay
- Graded A-F level of service (which can be sed on v/c ratio or intersection delay, accounting for road-way type and free-flow speed)
- Average travel times between destinations

Pedestrian Quality of Service
Roadway designers can use a variety of tools for measuring how well a given road accommodates pedestrians. A pedestrian "Level of Service" analysis focuses on the physical capacity of the pedestrian area: Is the sidewalk wide enough to accommodate the expected pedestrian flow? Will pedestrian delays at a traffic signal create crowding that will impede pedestrian flow? In a pedestrian Level of Service analysis, a wide sidewalk with no pedestrians ranks very well, while a busy sidewalk full of shoppers may rank poorly.

A pedestrian "Quality of Service" analysis, on the other hand, examines the roadway from the user's perspective: will pedestrians feel safe and comfortable walking here? Will the sidewalk attract pedestrians?

Many communities have set Pedestrian Quality of Service standards, including Fort Collins, CO; Kansas City, MO; Portland, OR; Gainesville, FL; the State of Florida; and Sweden. Together, these standards measure dozens of factors, but some of the most common include:

- Ease of street crossings, such as the number of travel lanes that must be crossed, provision of adequate signal time, presence of pedestrian refuges, etc.
- Adjacent motor vehicle speed, with high speed traffic creating significant pedestrian discomfort
- Continuity and directness, with small block sizes and abundant pedestrian crossings providing a higher QOS score
- Landscape amenities, with a "green buffer" between the sidewalk and traffic lanes being especially important
- Pedestrian-scale lighting, with an even pattern of light at the sidewalk level and minimal glare
- Pedestrian oriented development along the developed edge of the sidewalk. In commercial and more urban areas this is sometimes defined by percent fenestration at the ground level (more windows and fewer blank walls produce higher pedestrian QOS), doorway frequency (more front doors for shops and residences produce higher pedestrian QOS), and/or percent streetwall (the more buildings fronting the sidewalk and fewer parking lots, the higher the

	QOS). In lower density residential areas, landscape factors are emphasized.
	
	Bicycle Quality of Service
	Recent research has resulted in two emerging national standards for bicycle level of service:
	
	• Bicycle Compatibility Index, developed for the Federal Highway Administration
	• Bicycle Level of Service, developed for the Florida Department of Transportation
	
	Both are similar, in that they employ a formula to take into account various roadway design features and traffic characteristics, and express results on a scale of A through F. Grade "A" represents the best conditions for bicycles. The Bicycle Compatibility Index (BCI) is the best established of the two measures. The BCI requires the following inputs:
	
	• Geometric and roadside data:
	  o Number of through lanes
	  o Curb lane width
	  o Bicycle lane or paved shoulder presence and width
	  o Area character (residential or non-residential)
	• Traffic operations data:
	  o Posted speed limit
	  o 85th percentile speed of motor vehicles
	  o Average Annual Daily Traffic volume
	  o Percentage of traffic constituted by trucks
	  o Percentage of vehicles turning right into driveways or minor intersections
	• Parking data
	  o Presence of on-street parking
	  o On-street parking occupancy
	  o Parking time limit
	
	Note that both of these methodologies apply to mid-block segments only. Intersection level of service methodologies for bicycles can be found in Landis et. al. (2002).

Examples of Leading Cities	Street typology schemes are an emerging principle, recently implemented in a few cities such as San Francisco (Transit First), Vancouver and Minneapolis, MN. The strategy has been partially implemented in many of these and other cities with successful results.
Effectiveness	There is currently no data available on the effectiveness of a Street Typology Scheme. However, it can be considered a very important tool in achieving an overall traffic reduction, and also helps monitor progress.
Implications	Creates a more balanced transportation system with less focus on the automobile and higher focus on other transportation modes.
Resources	Federal Highway Administration (1998) *The Bicycle Compatibility Index: A Level of Service Concept. Implementation Manual*. FHWA-RD-98-095. Accessed on September 6, 2006 at www.hsrc.unc.edu/research/pedbike/98095/index.html. Landis, B., et. al. (1997), Real Time Human Perceptions: Toward a Bicycle Level of Service, *Transportation Research Record* 1578. Landis, B. et. al. (2001), Modeling the Roadside Walking Environment: Pedestrian Level of

	Service, *Transportation Research Record* No. 1773. Landis, B., et. al. (2002) *Intersection Level of Service: The Bicycle Through Movement*. Transportation Research Board. TCRP (1999) *Transit Capacity and Quality of Service Manual*, prepared by Kittleson & Associates.