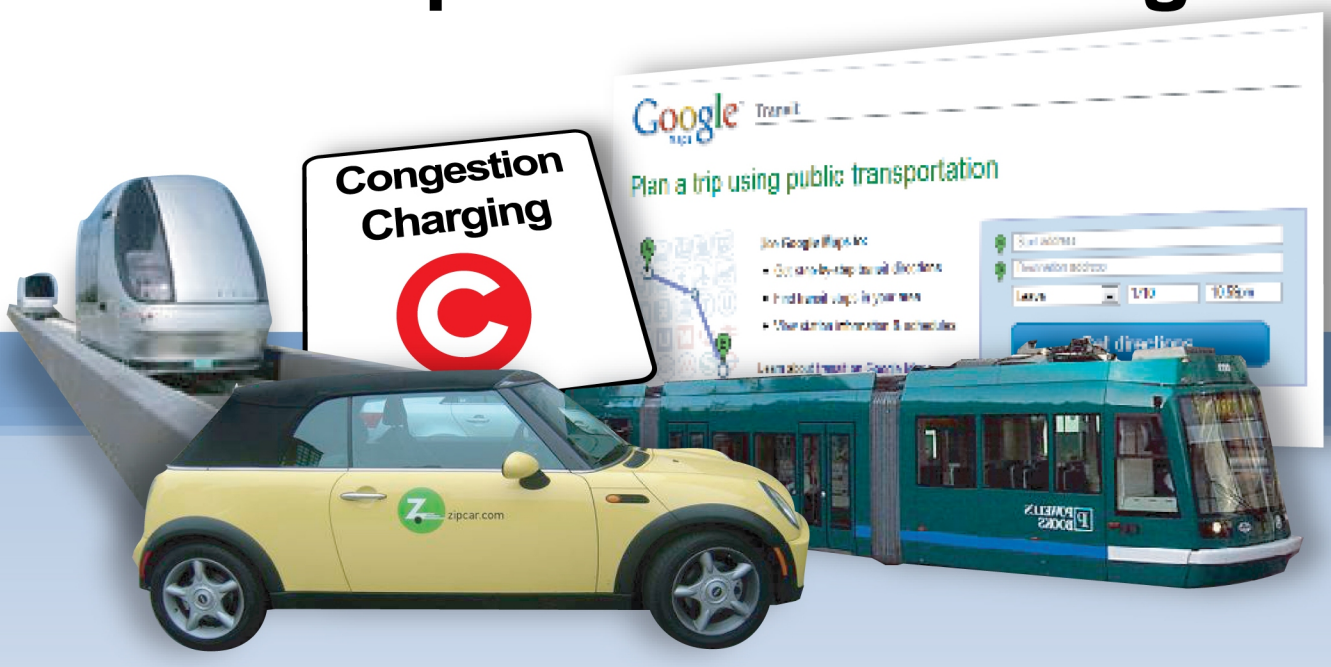
A Compendium of Sustainable Community Transportation Strategies



May, 2009

Foreword

This document inventories some of the leading transportation demand management (TDM) strategies in use around the world for planners and politicians to facilitate the reduction of vehicle-miles traveled (VMT) by their constituencies. It also attempts to compile the economic and greenhouse gas benefits of each strategy to act as a one-stop shopping guide on the subject.

TDM strategies include public mode support, employer-based support, pricing, telecommunications, land-use policies, and public policy and regulation. A major emphasis of TDM strategies and actions exists to reduce single occupant vehicle travel and the number of trips made by single occupant vehicles, attracting individual drivers out of their cars and onto alternative modes of transportation. Reducing single occupancy vehicle travel limits congestion and enables the existing transportation infrastructure to move traffic more efficiently.

Notice

Preface

This report was prepared by CALSTART, Inc. as a guide for city planners and elected officials to help them understand some of the tools that exist in their alternative transportation scenarios. The data contained in this report include planning information that carries a degree of uncertainty. While it may reflect current thinking of transit properties relative to alternative transportation strategies, the specific details to the strategies may change in the future.

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Introduction

In recent years, the California State Legislature has ratified two new pieces of legislation that have far-ranging impacts on land use and transportation in the state. Assembly Bill 32 ("The Global Warming Solutions Act of 2006") requires that by the year 2020, the state's greenhouse gas emissions will be reduced to 1990 levels—a 25% reduction under business-as-usual estimates. AB 32 is the first state law in the nation to reduce greenhouse gas emissions and requires the state board to adopt regulations to require the reporting and verification of statewide greenhouse gas emissions. Senate Bill 375 builds on AB 32 by curbing sprawl and compelling local planning agencies to make planning choices that reduce Vehicle Miles Traveled (VMT).

This document is meant to act as a toolkit of ten groups of technologies or strategies that can help communities achieve these standards, both in terms of emissions and in terms of VMT reduction. It attempts to compile the successful strategies and technologies that can aid transit agencies, city governments, and metropolitan planning organizations in generating the demand for these alternative modes of transportation in the first place. It does so by describing each strategy and technology, by listing some of their showcase communities, by listing their metrics, and by summarizing their strengths and weaknesses.

The tables of metrics spell out the impacts of three categories for each strategy: VMT reduction; emissions reductions (including greenhouse gas emission reductions or criteria pollutant emission reductions); and costs/savings to the community, to the user, or to both. AB 32 defines greenhouse gases as the six specific gases which add to the Greenhouse Effect and exacerbate Global Warming: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Due to the early development of many of the strategies we chose, we were not able to find all of the strategies' greenhouse gas emissions. However, in some cases, we were able to also add the reduction in criteria pollutants caused by these strategies. Criteria pollutants are the six common air pollutants that the Clean Air Act requires the Environmental Protection Agency to regulate: particle pollution (often referred to as particulate matter), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead. This document will not track all of these emission reductions from these strategies, but will list the key reductions when possible.

Finally, there is the economic aspect to the strategies. Studies show that giving up a primary or secondary car in favor of an alternative commuting mode (transit, carpooling, ridesharing, etc…) can result in dramatic cost savings as high as $6,000 per year.[1] In New York City, to acquire an unlimited subway pass for a year might cost less than a sixth of that figure. Not only can alternative modes of transportation reduce the costs to the traveler, but they can reduce the costs to the public government dramatically as well. For instance, the costs of building a parking structure for public transit often runs in the tens of millions of dollars. Each space may cost $25,000 or more to build, and is often left to be filled for free, meaning that the public cross-subsidizes the cost that the vehicle's user should be accruing. At the same time, one parking space can hold multiple bicycles in a safe and secure environment for less than 1/10th the cost. Thus, the opportunity exists to save the public these costs or, better yet, to target these investments for better use.

[1] Reed, Philip, "Your Car's Total Cost of Ownership", April 2002 via the APTA web site (http://www.apta.com/research/info/online/congestion.cfm)

Additionally, there are the soft benefits from switching to alternative forms of transportation, including increased exercise, improved health, and greater social interaction. We hope you will find this work useful and strategic in your government's pursuits.

1. First Mile/Last Mile Connectors

Description: For many, transit use is often inconvenient since station endpoints may be located beyond their normal walking distance, which may require a private vehicle to commute. A first mile or last mile connector is a technology that bridges this distance between the transit rider's home and their local transit node by getting the person to and from the transit station without using the privately-owned single occupancy vehicle. Examples include conventional bicycles, station cars, station bicycles, Segways, and others. Since transit is most effective for trips of moderate to long distance on busy corridors, and since bicycling is effective for trips of shorter distance, the combination of bicycling and transit can provide a high level of mobility comparable to automobile travel in terms of overall travel time. It also allows the rider the freedom to relax on their trip and enjoy added leisure time.

Figure 1: Folding bicycle tucked behind transit seat

Bike-transit programs get passengers out of cars and onto local transit systems. Commuters who leave high-quality bicycles at a transit stop for the day require a high level of security and are willing to pay for it. Thus, it is important to provide good bicycle parking at transit stops and transportation terminals. Although simpler bike racks may be adequate for many cyclists, a mix of paid lockers and free racks may be appropriate. In some cities, during peak periods, bicycles of conventional length may be prohibited from use on transit cars. Thus, the folding bicycle can be an excellent first mile connector, as it can fit easily on a transit car and allow the rider their commute.

Similarly, station car programs act as car-transit programs by facilitating transit access, often with zero emission vehicles. Station cars are shared-use automobiles located at transit stations which can be used by transit riders to reach their final destinations. They are typically leased by the end user. Thus, station cars, just like the bike-transit programs mentioned above, enable individuals to substitute transit for the middle portion of a journey, providing a critical link between transit and the point of origin/destination. Due to the relatively short travel distances involved, many station car programs have been able to enhance the environmental benefits by deploying electric vehicles.[2]

Showcases:

1. Bike/bike storage:
    a. Bikestation (Long Beach, Seattle, Berkeley, and others). Bikestation is a non- profit institution advancing the concept of "bikestations" -- a network of bike-transit centers modeled after European and Japanese examples. Located at transit nodes, the stations use an advanced entry system to allow indoor bike parking at all times of the year to cyclists, who pay a fee for membership. Some of the stations offer attended

Figure 2: Bikestation Long Beach's store

[2] *U.S. Carsharing & Station Car Policy Considerations: Monitoring Growth, Trends & Overall Impacts*; Shaheen, Schwartz, and Wipyewski; Transportation Research Board; August, 2003; page 3.

indoor bicycle parking (free during regular business hours), showers, professional repair services, a bike shop, and more. Bikestation Long Beach was established in 1996 and is the first facility of its kind to open in the U.S.

b. *BC Transit* –British Columbia's transit agency provides bike storage lockers at many transit stations and park-and-ride stops, and is installing bike racks on an increasing portion of their buses. The agency uses a front-mounted rack that carries two bicycles and folds close to the bus when not in use. Bike storage lockers are leased by the month through local bicycle organizations.

2. Station Cars:
   a. *New York Power Authority/TH!NK Clean Commute™*. Launched in 2001, this NYPA program made a fleet of 100 TH!NK city electric cars from the Ford Motor Company available for leasing to MTA commuters at seven New York City area railroad stations for periods ranging from 24 to 30 months. The final leases expired in early 2005 but the NYPA is planning to build on this demonstration program as soon as a suitable new electric vehicle comes to market.[3]

Figure 3: NYPA's TH!NK cars charging while a commuter train passes by.

   b. *New Jersey Department of Transportation's Power Commute program*. Similar to the Clean Commute program mentioned above, this program connected potential transit riders with the Morristown, New Jersey train station via electric car. The idea was two-fold: get new commuters onto the transit system who would normally commute against the flow of traffic and also clean the air by using electric vehicles.
   c. *The San Francisco Bay Area Station Car Demonstration*. A field test sponsored by Bay Area Rapid Transit (BART) and Pacific Gas & Electric from 1995 to 1998, the BART station car demonstration used 40 prototype electric vehicles (two-seaters). It was implemented to determine the viability of electric vehicles for making short, everyday trips. The vehicle was a two-seat battery-powered electric vehicle (EV) made by Personal Independent Vehicle Company (PIVCo). Charging ports were installed at selected BART stations.
3. Innovative Feeder Bus systems:
   a. *TransMilenio Bus Feeder/Bike Station*: In Bogotá, Colombia, the award-winning TransMilenio Bus Rapid Transit system transports over 1.3 million people per day. It uses feeder buses to serve the terminal stations, where passengers transfer to a trunk line. About half of all passengers access the system via the feeder buses, which circulate through the neighborhoods. What sets the system apart is that the feeder buses are free. The feeder bus operators are compensated through the fares collected at the trunk stations, and up to 20 percent of total fare revenue can be used to support feeder bus operations. Making the feeder buses free also created a new incentive to pave the bike paths to the stations. For every twenty people who switched from a feeder bus to their own bicycle to access the TransMilenio system, one feeder bus could be taken off the road, saving the government money that it could invest elsewhere. Today, Bogotá is one of the most bike-friendly cities in South America. In addition to paving bike paths, the city set up large, clean, and free bicycle

[3] NYPA web site: "NYPA Clean Commute™ Program"
http://www.nypa.gov/ev/NYPAcleancommute.htm

storage facilities at the stations, giving people even more incentive to make the first part of their work journey on two wheels.

b. City of Burbank's Clean Shuttle. In 1998, the City of Burbank, California launched its Clean Shuttle program using electric shuttle buses to curry passengers between shopping, work, and transit locations. The 26-foot, 26-passenger buses were perfect for nimble, urban shuttle service.

Metrics:
Vehicle Miles Traveled (VMT) Reduction: For the PIVCo station car demonstration program in San Francisco, the station cars were driven 154,802 miles and produced 179,470 total passenger miles traveled. Among the program's participants, internal combustion engine automobile use decreased an astounding 94% while the use of transit by participants increased by 56% during the demonstration. A Bikestation Seattle survey conducted in October of 2006 found that nearly 50% of the customer base previously drove alone to their destination before using the Bikestation, and close to 75% bike more often now.[4] In the past two years, Bikestation Seattle has: - Taken more than 10,000 cars off the road - Kept over 60,000 pounds of CO2 and other pollutants out of the Puget Sound region's air.
Costs: Because of the success of BikeStation and other bike-share programs, transit agencies in America are now seeing the benefits of investing in bike lockers a la their European counterparts. Los Angeles County MTA has recently chosen to invest $500,000 in bike lockers across the region.
Emissions Reductions: We were unable to ascertain the approximate greenhouse gas (GHG) and criteria emission reductions in any of the three types of technologies/strategies, but it's probably fair to state that the GHG reduction for the PIVCo program would be directly proportional to the amount of VMT reduction

Packaging Ideas:

- **Strengths:** In 2002, insurance was identified as the most important challenge for U.S. shared-use vehicle organizations.[5] Interestingly, for station car programs in the U.S., insurance did *not* play a large role in their failures or success, which is quite different from the impact of insurance services on car sharing programs, where it did play a large role. In the station car models, the programs were able to avoid the assumption of insurance liability for their vehicles, as the end users leased their cars and insured them under their own policies.[6]
- **Weaknesses:** Being that the original station car programs in the United States were small-scale demonstrations, they were highly dependent on funding and were of course unsustainable on subscriber-based fees alone. The few station car programs that existed in the early 2000's decreased in membership dramatically when outside funding disappeared. Bikestations are also dependent on having weather that is favorable for bicycling. However, much of this is dependent on the rider's weather tolerance, as various countries in Northern Europe have strong bicycle cultures even in cold weather climates.
- **What it works well with:** The majority of station car programs were particularly popular with people who place a high value on their presumed social and environmental benefits. A study by Nelson/Nygaard (2003) found that station cars increase BART ridership and fare revenue, as well as

[4] Letter from Andrea White, Executive Director of Bikestation, to Whitney Pitkanen of CALSTART, dated May 12, 2008.
[5] Shaheen, Meyn, and Wipyewski*; U.S. Shared-Use Vehicle Survey Findings: Opportunities and Obstacles for Carsharing and Station Car Growth;* Paper No. 03-4469. In Transportation Research, TRB, National Research Council, Washington, D.C., 2003.
[6] Shaheen, Schwartz, and Wipyewski*; U.S. Carsharing & Station Car Policy Considerations: Monitoring Growth, Trends & Overall Impacts*; page 10; 2003.

overall benefits to consumers and society.[7] However, market research is still required to determine how and where station car use can be maximized.

- **Barriers to implementation:** The achievement of economies of scale was the largest barrier for the station cars in their first evolution, since this would dramatically reduce costs and increase the affordability of the services.

  For the bike transit connections, the larger issue is breaking from the industry norm whereby transit agencies look first to build new parking capacity at far higher costs (i.e.: $25,000 per parking space) instead of attempting to lower the demand of the vehicle parking at far lower costs. Thus, program funding inertia is often a large barrier. Additionally, there may be resistance to carrying bicycles on transit vehicles from transit agency planners and drivers who are concerned about schedule delays and liability problems. When there is a ridership crunch, as there was across the United States in 2008 when ridership on light rail transit increased ten percent, ridership on commuter rail increased six percent, and ridership on bus transit increased two percent due to the rising gasoline prices. During this time, peak hour bike bans were enforced, sometimes causing cyclists to be bumped from their ride. For this problem, folding bikes are an excellent solution since they're small enough to take on the transit cars without taking up very much space, unlike a regular bicycle.

Figure 4: Folding bicycle on a transit car, next to a standard

[7] Victoria Transport Policy Institute's Online Transit Demand Management Encyclopedia: "Carsharing: Vehicle Rental Services That Substitute for Private Vehicle Ownership"; July 22, 2008; http://www.vtpi.org/tdm/tdm7.htm.

2. Streetcar

Figure 5: Portland's modern streetcar

Description: A streetcar is an electrically powered, rail transit vehicle that circulates within specific neighborhoods and shares the pavement with other vehicles, with little or no priority signaling at intersections. A streetcar is often confused with a light rail line, but there are important differences. A streetcar system connects neighborhoods with the vehicles moving at a relaxed pace. A light rail system's vehicles move rapidly between city regions using extensive priority signaling at intersections, with at least 30% of its route operating on 'reserved rights-of-ways.' A streetcar line is usually three to five miles long whereas a light rail system may be dozens of miles in length. Each streetcar can carry up to 150 passengers for local circulation. There are two looks to the streetcar, the vintage/heritage version (i.e.: San Francisco trolley car) or the modern look (i.e.: Portland streetcar), which has a more aerodynamic design similar to a modern light rail train. The heritage car has the appearance of an antique streetcar from the 1940's. The two different looks are similar in function with a few slight differences. The modern cars are a bit longer, have a greater passenger capacity, and have the ability to perform level boarding.

Showcases:

1. Portland, OR: Portland's transit system utilizes the streetcar system in a holistic strategy of services for pedestrian, bicycle, bus, and light rail systems to focus development and maximize transportation options. The streetcar system is managed by Portland Streetcar Incorporated, a non-profit corporation. Funding for the streetcar operations is derived primarily from the local transit organization (TriMet), fares, city parking revenue, and a special property tax assessed on properties near the line. The system has a ridership of over 10,000 persons per day.
2. Seattle, WA: a 1.3-mile streetcar line connecting the South Lake Union neighborhood to Downtown Seattle, the Seattle streetcar's service began in December of 2007. The system will likely be extended to other points across the city. Its initial ridership has been projected at 330,000 riders per year and is expected to grow.

Figure 6: San Francisco trolley car

Metrics:
VMT Reduction: It's estimated that Portland's streetcar system has already decreased the vehicle miles traveled (VMTs) of its riders by 56 million miles per year.[8]
Costs: A streetcar system's costs can range from $20M to $40M per mile, depending on the system requirements. Since Portland announced plans for its system, more than 10,000 residential units have been built and $3.5 billion has been invested in development within two blocks of the line.[9]

[8] Streetcars and Cities in the 21st Century Workshop, Portland, OR; July 27, 2007

Emissions Reductions: We were unable to procure the exact GHG reductions for the aforementioned streetcar systems, but using public transportation in general in their stead, it is estimated that for every passenger mile traveled, public transportation is twice as fuel efficient as private automobiles. Public transportation produces 95% less carbon monoxide (CO), 92% fewer volatile organic compounds (VOCs), and nearly half as much carbon dioxide (CO2) and nitrogen oxides (NOx) for every passenger mile traveled. Public transportation reduces annual emissions of the pollutants that create smog (VOCs and NOx) by more than 70,000 tons and 27,000 tons respectively.[10] Public transportation reduces emissions of CO2, which contributes to global warming, by more than 7.4 million tons a year.[11]

Packaging Ideas:

- **Strengths**: Streetcars are eligible for federal funding via the federal government's New Starts and Small Starts program, which greatly decreases the financial burden on the local municipality. They can also be locally funded via a set of strategies, including tax increment financing. Additionally, they're excellent connector systems for pedestrians, increasing walking trips and decreasing auto trips. They remove the stress from transportation, are consistently on time, and build community and quality of life. Streetcar systems are a great tool for marketing a community by reflecting its culture, history, vision, and connecting the city's "pearls". Finally, a streetcar system can be one of the most effective tools for shaping a city's development since development often follows the line's lay out.

Figure 7: Portland streetcar with tram (above)

Picture Courtesy of John Smatlak Photos from the web site "Railway Preservation Resources: Streetcar and Historic Railway Consultants"
http://www.railwaypreservation.com/vintagetrolley/portland%20streetcar.htm

- **Weaknesses**: Streetcars have not yet caught on in large numbers across the country and do not cover broad expanses of municipality. It can also be challenging at times to find the strong civic leadership and vision necessary to compete for the federal funding.
- **What it works well with**: Streetcars are perfect for high density areas, holistic transportation systems, and "hot" urban real estate markets. When viewed as a tool targeting its own market niche and combined with other transit modes, a streetcar can offer excellent and unique service.
- **Barriers to implementation:** program funding and civic leadership are often the primary barriers. There may also be high infrastructure costs and public resistance to building a system that does not carry large numbers of riders.
- **Where it worked well:** Portland (due to well-planned, holistic system), and other highly urbanized areas.
- **Future projections:** Vancouver, BC; Tacoma, WA; Cincinnati, OH, Boise, ID, and others.

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[9] Driehaus, Bob; *New York Times*, August 14, 20008, "Downtowns Across the U.S. See Streetcars in Their Future".
[10] APTA web site "Conserving Energy and Preserving the Air We Breathe" (http://www.apta.com/research/info/online/preserving_air.cfm)
[11] APTA web site

3. Car Sharing and Vanpooling

Description: Carsharing is an automobile rental service which provides the option of renting a car instead of owning one to groups of people. Members of carsharing services typically use the vehicles only when they need to, and walk or bike more often than conventional car owners, which results in healthier lifestyles. Because car sharing is cheaper than owning a car, carsharing members often give up their first or second vehicle. Carsharing appeared in Europe between the 1940s and 1980s and was popularized in the early 1990s.

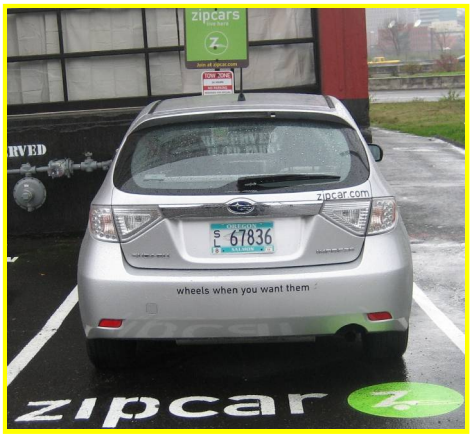

Figure 8: A Zipcar parked at a dedicated spot.

Another group vehicle sharing program is vanpooling, which allows groups of people to share a ride similar to a carpool, but on a larger scale. Most vanpools are self-supporting in that the operating costs are divided among members. Vanpools are the most cost effective mode of public transportation in the United States and the only mode more cost effective than a bus. Vanpooling is particularly suitable for longer commutes (10 miles or more each way) and has a low cost for every passenger-mile traveled, but it is only suitable for prescheduled trips, such as commuting.[12]

Showcases:

1. Zipcar: The world's largest car sharing service, Zipcar caters to over 17 cities with nearly 200,000 Zipcar members sharing just 5,000 vehicles across the world. Each Zipcar replaces over 15 personally owned vehicles. Recent surveys indicate that more than 40% of its members would have kept their vehicle, or would have purchased a primary or secondary vehicle, if Zipcar did not exist.[13] To date, Zipcar estimates its service has resulted in the reduction of more than 50,000 vehicles. Additionally, older Zipcars are replaced with new vehicles that have more stringent pollution controls. Zipcar merged in 2007 with Flexcar and is a for-profit organization.
2. I-Go: A non-profit car-sharing service in Chicago, I-Go claims savings for Chicago residents of up to $3,000 per year, with carbon emission reductions up to 28%. I-Go replaces up to 17 cars for every I-Go car.
3. CityFlitz: A carsharing program in which customers pay $7 monthly fees and get the cars for $1, CityFlitz's vehicles are available every hour of the week to members with access to lock boxes on its parking sites

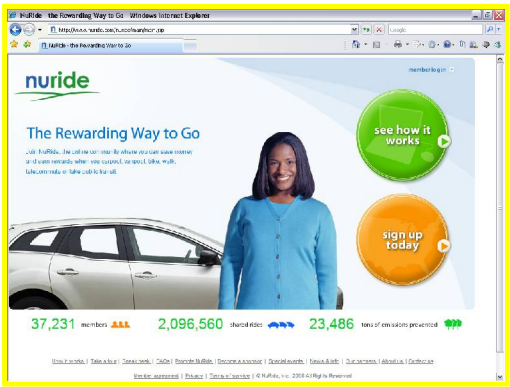

Figure 9: NuRide web site interface
(See next page)

[12] Victoria Transport Policy Institute's TDM Encyclopedia, "Ridesharing: Carpooling and Vanpooling", August 18, 2008, http://www.vtpi.org/tdm/tdm34.htm
[13] Zipcar press release, "Zipcar: Environmental and Community Impact"; January, 2008; http://www.zipcar.com/press/onlinemediakit/environmental_and_community_impact.pdf

across the city. The cost is only $1 a day, but drivers have to travel at least 30 kilometers per trip. The catch is that the cars are wrapped in corporate advertising but it only costs $1 a day.

4. NuRide: NuRide is a web site that provides an online ridesharing community whereby the consumer saves money and earns rewards whenever they share a ride with another person in the community.
5. HOVER ("High Occupancy Vehicles in Express Routes"): A service that is still in the theoretical phase, HOVER will eventually use an electronic, credit-based ridesharing system to allow people to coordinate rideshares at specific nodal drop-off points to and from their destinations.

Metrics:

VMT Reduction: Studies have calculated that in North America, the average VMT reduction has been approximately 44% per carsharing user. European studies also indicate a large reduction in VKT (vehicle kilometers traveled) ranging from 28% to 45%.[14] A Portland carsharing program found that 57% of its users reported taking transit more often.[15]

I-GO has conducted its own research from its four years of operation and has found profound results:

- 25% increased their walking, 15% increased their biking, and 18% increased their public transit usage.
- 46% gave up or postponed purchase of a vehicle or considered selling a vehicle because of joining I-GO.
- Members report driving only 10 miles per week, or 500 miles per year, whereas the typical car owner in Chicago drives 10,000 miles per year.
- Of those who did not own a car at the time of orientation, 56% postponed buying a car because of I-GO or gave up a car prior to joining I-GO.[16]

NuRide announced that its 23,000 members shared over 400,000 rides in 2007, resulting in 12 million fewer miles traveled.

Members of Zipcar report a 47% increase in public transit trips, a 10% increase in bicycling trips and a 26% increase in walking trips.

Costs: For city governments, the costs are relatively low. The governments' share may require the use of dedicated parking spaces across the city but the funding for the program can be completely private. Eighty percent of organizations receive some form of financial support from a variety of public and private sources. Public (federal) and private resources are the predominant funding sources tapped by organizations.[17]

For most carsharing organizational business models, a reasonable price structure would appear to require that 50 to 100 vehicles be driven five or more hours per day. Depending on the density of the vehicle locations, a member to vehicle ratio of about 20:1 appears to be a good balance between utilization of the vehicles and availability to members.[18]

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[14] Shaheen, Cohen, Roberts; *Carsharing in North America: Market Growth, Current Developments, and Future Potential*; page 3; November 15, 2005.
[15] *Evaluation of the City of Portland's Carsharing Pilot Program: June 2004 – July 2005; Portland Office of Transportation;, Page 8; January 2005.*
[16] I-Go web site, "Green Matters": http://www.igocars.org/green_benefits.
[17] Shaheen, Schwartz, and Wipyewski; *U.S. Carsharing & Station Car Policy Considerations: Monitoring Growth, Trends & Overall Impacts*; pages 7-8August, 2003.
[18] David Brook; *Carsharing – Start Up Issues and New Operational Models*; Transportation Research Board; page 10; January, 2004.

Government agencies, university officials, and real estate developers have told Zipcar that each new parking spot can cost from $35,000-$50,000 to develop. The Massachusetts Institute of Technology provides students and faculty access to more than 20 Zipcar vehicles. Because of Zipcar and other transportation demand management initiatives, M.I.T. reports savings of more than $9 million, adding over one million square feet of new office space without a single new parking space.[19]

The City of Seattle recently passed legislation that would allow it to charge extra ticketing fees for users who parked in car sharing spaces with non-car sharing vehicles.[20]

For the end user, there are substantial economic benefits. One of the main benefits is that vehicle access is maintained at lower costs. The average cost/mile for driving 10,000 miles/year increased from 62.1¢ per mile (2006) to 71¢ per mile (2007) but car sharing costs only $1-$2/ hour, plus $.25-$.40/mile. On average, Zipcar members state they save $436/month or $5,232/year using Zipcar, money that could be reinvested locally.[21]

Emissions Reductions: Reduced vehicle ownership and reduced VMTs lower greenhouse gas emissions as trips are shifted to transit, biking, and walking. In Europe, carsharing is estimated to reduce the average user's carbon dioxide emissions by 40 to 50%. Many carsharing organizations include low-emission vehicles (i.e.: gasoline-electric hybrid cars) in their fleets to maximize the environmental benefits. Carsharing members also report a higher degree of environmental awareness after joining a carsharing program.[22]

Each Zipcar member now consumes 219 less gallons of gasoline per year. It is expected that Zipcar members will save more than 15 million gallons of gas, or 32 million gallons of crude oil from being consumed in 2007.

NuRide claimed that its 23,000 members prevented 5,600 tons of total emissions (both GHG and criteria) in 2007, or a quarter of a ton per member.

Packaging Ideas:

- **Strengths:** Increases consumer choice and financial savings. Improves mobility choices for low-income users. For vanpools, the federal tax code allows employers to offer tax-free benefits for the purposes of taking vanpooling (up to $115 is excludable from gross income per month for vanpooling and transit).[23]
- **Weaknesses:** The ultimate issue that any start-up carsharing organization needs to address is finding the capital to expand the business until the service reaches a break-even point. Additionally, the total number of vehicles covered and annual premiums for the entire industry are still too small to attract serious competition from fleet insurance providers.[24] Thus, the insurance costs are still too high for the companies.

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[19] Zipcar Press Release: *Zipcar: Environmental and Community Impact*; January, 2008. http://www.zipcar.com/press/onlinemediakit/environmental_and_community_impact.pdf
[20] "Car sharing vehicles could get more parking spots", Seattle Post-Intelligencer, August 19, 2008.
[21] Zipcar Press Release: *Zipcar: Environmental and Community Impact*; January, 2008.
[22] Shaheen, Cohen, Roberts; *Carsharing in North America: Market Growth, Current Developments, and Future Potential*; Page 3; November 15, 2005.
[23] Rideshare Benefits Info Center web site; "Tax Reducing Vanpool/Transit Benefits"; http://www.commutesmart.info/infocenter/transitbenefits.asp.
[24] David Brook; *Carsharing – Start Up Issues and New Operational Models*; Transportation Research Board; page 3; January, 2004.

- **What it works well with:** Good for higher-density areas, as well as lower- and middle-income residential areas where there are good alternatives to driving. It must be part of a holistic transit system (i.e.: transit-oriented-development, car-free housing, etc…). At Zipcar's current membership adoption rates, the company anticipates that well over 10% of an urban population will participate in its service. In Washington DC, for example, with a current population of over 600,000 residents, a conservative 10% adoption would result in 60,000 carsharing members throughout the city, which would mean that over 24,000 vehicles would be taken off the road.[25] Zipcar already has a 10% adoption in the areas of its established metro markets.
- **Barriers to implementation:** Low-density areas that lack program awareness.
- **Where it has worked well:** Europe and the Northeastern US. Campuses, industrial parks, and transit stations.
- **Where it doesn't work as well:** Low density, rural areas.

Figure 10: Map of Zipcar sites in Manhattan, illustrating the potential density of carsharing sites in urban areas.

[25] Zipcar press release, "Zipcar: Environmental and Community Impact"; January, 2008; http://www.zipcar.com/press/onlinemediakit/environmental_and_community_impact.pdf

4. Car-Free Days (Ciclovía)

Description: On designated days (usually once a week), a city transforms specific streets into car-free zones for bicycling, exercising, and sports. In effect, it turns portions of the city into a large car-free park, prioritizing pedestrians and cyclists above automobiles in those areas. The citizens still have access to all of the shops and restaurants in the Ciclovía area.

Figure 11: Participants at a Ciclovía event

Showcases:

1. Bogotá, Colombia: An estimated two million people attend the Ciclovía event each week (30% of the citizenry) across more than 120 km of streets (70 miles).
2. Portland, OR: Six miles, six hours, zero traffic.

Metrics:
VMT & Emissions Reductions: It is difficult to quantify the actual reduction in vehicle miles traveled, reduction in greenhouse gas produced, and the economic benefits for a Ciclovía event where significant synergies exist between multiple measures taken together. The VMT and GHG reduction may be as high as 100% on selected corridors.
Costs: The initial capital costs for a Ciclovía event are low, since there are no permanent infrastructural changes required. Additionally, it has a sizeable return on investment since it brings a high volume of citizens to a designated area, thereby allowing for revenue from parking and concessions, etc… The costs consist of policing, street barricading, staffing, and the like. Cities often try the events out in a pilot area at first and then expand the stretch of road to include a larger area. A 2004 study found that the economic gains during Ciclovía events significantly outweigh the losses engendered by the street closures.[26] The benefits include generation of revenue streams for local vendors and suppliers, as well as cleaner air and an increase in public health.

Packaging Ideas:

- **Strengths:** Brings together people of all classes, races, and education levels. Creates employment for low-skilled workforce. Increases quality of life. Builds civic love and activism. Cleans the air. Increases safety.
- **Weaknesses:** It is unclear to us how Ciclovía events affect businesses that sell objects that cannot be carried on bicycles.
- **What it works well with:** Bold city leadership**.**

Figure 12: At Ciclovia events, some streets may remain open to prevent traffic hindrance.

[26] "Reclaiming Public Space: The Economic, Environmental, and Social Impacts of Bogotá's Transformation"; Lloyd Wright & Ricardo Montezuma"; 2004.

- **Barriers to implementation:** Though some merchants in the Ciclovía corridors may be impacted negatively, many more have seen positive revenue due to the high numbers of consumers passing by their stores. Every city will need to perform its own impact analysis first, but beyond that, the costs to the city are very low. Some of the common logistical barriers that are identified are the blocking of public transit and emergency vehicle routes. However, with accurate planning and consideration, the events can be easily operated in harmony with these essential services. Additionally, some concerns will be raised about the accommodation of vehicle traffic by those who do not wish to participate. Often, the route is planned in lower-traffic areas to preclude this problem. For those streets that do have higher volumes of vehicles, intersections are controlled so that traffic can still continue to flow.
- **Where it has worked well:** Pretty much everywhere. Ciclovía works just as well in a city of 50,000 people as it does in a city of 10 million.
- **Future:** Ciclovía is currently spreading quickly across Latin America, Europe, and North America, where it is beginning to reach Ottawa, New York City, Portland, El Paso, Las Cruces, and other cities.

5. Bikesharing

Description: Bikesharing is an automated bicycle rental system designed to provide efficient mobility for short trips. It's a bicycle rental service which substitutes for private ownership and is based on hourly rental. A typical bikesharing system consists of a fleet of bicycles, a network of automated stations where the bikes are stored, and bike redistribution and maintenance programs. The bikes may be rented at one station and returned to another. The stations have automated self-serve docking systems to accommodate five to twenty bicycles and are located at major destinations and transportation centers, spaced about 300 meters apart. The use is free or inexpensive for short periods (typically the first 30 minutes), allowing urban residents and visitors to bicycle without needing to purchase, store, and maintain a bike. These systems are most efficient when the bikes have many users each day (as high as twelve daily users per bike in some systems).

Showcases:

1. Vélib (Paris, France): Paris' cutting-edge system, which has over 20,000 bicycles and almost 1,500 stations. The system counted 27.5 million trips in just the first year.
2. SmartBike D.C., (Washington, D.C.): America's first bikesharing system, SmartBike began in 2008. The system has a $40 subscription fee.
3. OV-fiets (the Netherlands): a bikesharing system in Holland geared to the local citizenry that allows the user to access their bike in less than a minute.

Figure 13: A Vélib bikesharing station.

Metrics:
VMT Reductions: The current pace is approximately 120,000 trips per day for the Vélib program, but the VMT reduction numbers have yet to be fully identified.[27] It was found that riders took 27.5 million trips in the first year.
Costs: Starting costs are usually around $10 million. The Vélib program could bring about 30 to 50 million Euros (approximately $40 million to $65 million US) in rental receipts per year, creating a system that can afford to be implemented without using tax dollars. The rights to run the Paris program were purchased by the JCDecaux advertising corporation, which cost it approximately $142 million (US) to purchase, with millions more per year in upkeep. The program includes 20,600 bikes and almost 1,500 self-service rental stations. It employs the equivalent of about 285 people full time to operate the system and repair the bikes for 10 years. The city receives all revenue from the program as well as a fee of about $4.3 million a year. In return, the advertiser receives exclusive control over 1,628 city-owned billboards while the city receives about half of that billboard space at no charge for public-interest advertising.[28]
Emissions Reductions: Approximately 40,000 tons of GHGs are being reduced per year by the Paris program or approximately two tons of GHG reductions per bike per year.

[27] Stein, Adam; WorldChanging website: "Crunching Some Numbers on Paris Bike-Sharing Program"; July 16, 2008 11:33 AM; http://www.worldchanging.com/archives/008228.html
[28] Anderson, John Ward (2007-03-24). "Paris Embraces Plan to Become City of Bikes", The Washington Post, pp. A10. http://www.washingtonpost.com/wp-dyn/content/article/2007/03/23/AR2007032301753.html

Packaging Ideas:

Figure 14: SmartBike DC

Source: The Bike-sharing Blog web site

- **Strengths:** Weaves bike culture into society, provides increased quality of life (healthiness, happiness, etc…) and increased cycling overall.
- **Weaknesses:** Without strong advertising revenue as in the European models, membership fees in themselves might not be enough to sustain a program. Additionally, these programs require active operators to make sure the bicycles are returned in good shape. The Tulsa, Oklahoma program, which is run by the health sciences center, has had bloggers report on the infrequency of finding bicycles in good working condition.[29] In the Vélib program, approximately 15% of the vehicles have gone missing. Portland has had difficulty acquiring the funding for its program due to current restrictions on outdoor advertising, which has served as the main revenue source in Paris. Finally, most American cities still lack the funding to meet the infrastructure needs for their pedestrians and cyclists.
- **Barriers to implementation:** Mobilizing the political will; restructuring the street system and traffic speeds to ensure safety for large numbers of cyclists; reallocation of street, sidewalk, and parking spaces; and finding the right business model to fit the specific place.
- **Where it has worked well:** Compact European cities (Lyon, Paris, Barcelona, Oslo, etc…) and locations with good multi-modal access. A survey of the Vélib system found that quite a number of those passengers use a bicycle on their way to or from public transport as 30% of users travel in a multimodal way. At the start of their journey, 14% use another transport modality and 16% at the end of their journey.[30]
- **Where it hasn't worked as well:** Portland's proposal for a fleet of 500 bicycles was put on hold in June 2008, citing concerns about funding and logistical issues. Additionally, any bicycle program is going to have lower usage rates in cold and rainy climates than in warmer climates.
- **Future:** Bikesharing is catching on across Europe and the United States. Will start in other cities across the United States soon. Current cities include Shanghai (experimental), Montreal (Bixi), Minneapolis (2009), Toronto (2009), and Boston (2010). Several colleges have created their own, including St. Xavier Univ. (Chicago), the University of California-Berkeley, and Emory University in Atlanta.[31] Additionally, the University of Washington is teaming up with Intrago to create an electric bike share program for its Seattle campus. The program will work just like a traditional bikeshare program, but the bikes have an electric assist for hills and longer distances, which eliminates a large problem for riding a bike: hill climbing.[32]

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[29] Gramblin, Aimee; *Urban Tulsa Weekly*; "Not Down with Tulsa Townies: Borrow-a-bike program looks good on paper, if not on pedal"; July 23, 2008; http://www.urbantulsa.com/gyrobase/Content?oid=oid%3A24307

[30] Fietsberaad web site; "Vélib often used to and from public transport"; June 11, 2008; http://www.fietsberaad.nl/index.cfm?lang=en&section=nieuws&mode=newsArticle&newsYear=2008&repository=V%C3%A9lib+often+used+to+and+from+public+transport#SendPage

[31] Center for American Progress: "It's Easy Being Green: Peddling Pedaling on Campus" http://www.americanprogress.org/issues/2008/10/peddling_pedaling.html

[32] Posner, Andrew; Treehugger web site; "University of Washington to Create Electric Bike Share Program" Providence, Rhode Island; December 3, 2007; http://www.treehugger.com/files/2007/12/university_of_w.php

6. Personal Rapid Transit

Description: A transit system that is still very early in its development, Personal Rapid Transit (PRT) is an on-demand transit system that could transform the future of travel. It consists of private, automated pods which serve three to four people at a time and that run on and off elevated guideways at a non-stop pace. It has been called a system of "horizontal elevators" or "elevated, driverless taxis" but it has the potential to move at speeds above 100 miles per hour. The system potentially offers an experience that eliminates stress and is rich with views above the landscape. It can even eliminate the need for some surface transportation and transform the streets below to other uses. The capacity for the early systems appears to be approximately 5,000 people per hour with a 2.5 second headway between pods.

Figure 15: Artistic rendering
Photo courtesy of ULTra Advanced Transit Systems, Inc.
http://www.ultraprt.com/

Showcases:

1. Heathrow Airport (low energy, battery-powered, driverless vehicles) – Should be very fast and efficient and should save half the fuel used by existing forms of transport. Its guideway is 2.5 miles long and uses electrically-powered vehicles, so the vehicles are emission-free. It is scheduled to open in 2009. It costs $50 million in total for an average of $20 million per mile.
2. Masdar Initiative in Abu Dhabi – Masdar is a city in development, so the PRT system does not yet exist, but it will be part of this "eco-city" that is entirely free of automobiles, using no carbon and producing no waste. Masdar is set to have its first citizens move in starting in 2009.
3. Gothenburg, Sweden (simulation) – This PRT system has a 1.3 minute wait period on average.
4. Morgantown, West Virginia – part of an early rollout of PRT systems in the United States in the 1970's, this PRT system has curried to West Virginia University for several years.

Figure 16: West Virginia University's PRT system.

Source: Web site for Professor Jon Bell, Department of Physics and Computer Science, Presbyterian College
http://web.presby.edu/~jtbell/transit/images/Morgantown/WalnutPlatform.jpg

Other prototypes are being explored in various locations in Europe and the U.S., including Santa Cruz, CA and Ithaca, NY.

Metrics:
VMT Reduction: Potentially up to 100% of all non-commercial traffic in a PRT area could be eliminated.

(Continued on next page)

Costs: The capital cost of the early models has been approximately $20 to $40 million per mile. Each pod would likely cost approximately $50,000 per vehicle. Since it operates mainly above the existing streets, the costs for acquiring legal rights-of-way are greatly decreased versus the acquisition of entire street lanes. The potential land value increases in adjacent locations is high.
Emissions Reductions: The system uses electricity to power the pods, so the GHG reduction would be highly dependent on the amount of carbon being produced by the source of the electricity.

Packaging Ideas:

- **Strengths:** Potentially, PRT has the ability to reduce or even completely eliminate many of the costs and other disadvantages of the automobile. It eliminates the use of oil, and with it, the production of emissions. It obviates congestion, accidents, and the resultant lawsuits from accidents. It also avoids the high costs of buying, insuring, and maintaining a car. It can remove vehicles and parking structures from the street and open the spaces for other uses. It also provides another transportation mode for those who are transit dependent. Additionally, if a city were to return the streets below the PRT structures to other uses and re-utilizes the real estate, PRT would immediately become a highly profitable venture.
- **Weaknesses:** PRT's effectiveness remains to be seen. There are high capital costs, and it can be an extremely expensive way to replace cars in congested areas. There is also a lack of options beyond the existing built system. The vehicles are publically owned, which can lead to a lack of care by their users, but there are simple solutions to this problem.
- **What it works well with:** PRT is most useful for medium-density to low-density areas that have population nodes (i.e.: campuses and downtowns). It requires guaranteed ridership and though it has the ability to move large numbers of people quickly, is not to be confused with high-density transit systems. It works well with niche applications with the possibility for expansion in the long-term. For example, it can start as a feeder/distributor system to transit stations while eliminating parking lots in the area, and then have additional lines added later.
- **Barriers to implementation:** Proof of effectiveness and cost competitiveness with existing modes of transportation. Data are lacking on capital and operating costs, rider satisfaction, patronage, revenues, and aesthetic issues. The "eyeball price" seems highly expensive. Questions exist on meeting density requirement, on efficiency and need (i.e.: whether it is redundant or not), on the success of a network of command-control systems, and finally, on whether the public will accept the aesthetic imposition of elevated guideways. There will also be issues with the human-computer interface and the unpredictability of future problems.
- **Where it has worked well:** N/A – still in demonstration mode.
- **Where it hasn't work as well:** N/A – still in demonstration mode.
- **Future:** To be decided.

7. Real-time Urban Traveler Information Systems

Description: Real-time urban traveler information systems provide information for all modes of transportation that is updated to the second. They can be accessed via handheld personal digital assistances ("PDAs"), on-street kiosks, or by conventional computers. They can provide maps of transit systems, text versions, or arrival times, thus allowing the rider to track bus locations and arrival times with the click of a mouse or PDA. Unlike traditional bus schedules, these systems allow the rider to track the moment-to-moment status of any bus or train, so they know the exact time when their ride is going to their destination. Instead of waiting at the bus stop, a passenger can use the service to help them spend their time the way they want to—running another errand, finishing up another project, or simply waiting inside.

Showcases:

1. Long Beach Transit (Webwatch): Long Beach's Webwatch allows the rider to track any of the transit agency's regular buses with the click of a mouse.
2. HopStop/Google Transit: HopStop and Google Transit are transit enablers, offering online mapping services that provide door-to-door directions for subway and bus transit in select cities. A person considering a trip in a car could quickly and easily see whether they can instead make the trip on transit in a reasonable time, and they can learn where to find the bus/train and where to transfer.

Figure 17: The HopStop web site icon

Metrics:
VMT Reduction, Costs, and GHG Reductions: It's difficult to quantify any of the benefits of these programs, since they're each so unique and since most lack ways to track data. However, most are inexpensive or free (i.e.: HopStop, Google Transit) and only require sponsorship.

Packaging Ideas:

- **Strengths:** These systems aggregate usage where it would normally go unmatched. They direct intermodal transit and enables travelers to make smarter choices about routes and transport modes.
- **Weaknesses:** Weather and trip rerouting can cause problems with ITS programs.
- **What it works well with:** These systems can work anywhere as long as the populace is technology friendly.
- **Barriers to implementation:** There are very few barriers, and the upfront costs are low.
- **Where it has worked well:** HopStop has been rolled out in the highest transit-dependent cities of the U.S., such as New York, San Francisco, and Washington, DC.
- **Future:** These real-time urban traveler information systems will be ubiquitous with every system of transportation in the future.

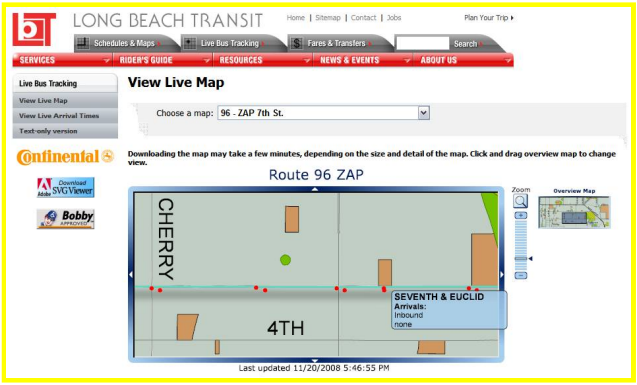

Figure 18: Long Beach Transit's Web Watch. The red dots in the screen's center represent the actual locations of the buses on their route at that moment.

8. Congestion Pricing

Description: Congestion pricing is the practice of charging motorists a higher rate to use a roadway, bridge, or tunnel during periods of heavier traffic. The purpose is to reduce automobile usage during periods of peak congestion, thereby improving traffic flow. It also creates a sustainable funding source for transportation projects, decreases the cross-subsidization of infrastructure, and encourages the use of alternative forms of transportation and zero emission vehicles.

Showcases:

1. *London, England* – Instituted in 2003, carbon-fueled vehicles that enter the city's Central Business District (CBD) are charged £8 (approximately $13 US) between the main hours of the day. The revenue collected through the charge is used to fund expansions and improvements to the regional transit system. Prior to congestion pricing, drivers in central London spent half their time idling in traffic. Since its inception, 20% fewer vehicles enter the Congestion Zone each day, traffic delays have dropped 26%, bus service has become dramatically faster and more reliable, and bicycling rates within the zone have skyrocketed 43%. The city prepared for the modal shift by making transportation improvements, including more buses, bus lines, and trains at peak periods.[33] Additionally, its implementation has helped foster the use of the electric vehicle as the congestion pricing has been used as a carbon dioxide reduction tool.

Figure 19: London congestion charge signs[1]

2. *Stockholm, Sweden* – Implemented initially as a pilot project in 2006, the project was approved for continued existence in 2007. It now funds the creation and maintenance of a bypass road system. The system reduced Stockholm's traffic congestion by as much as 50 percent and decreased noxious air pollution by 14 percent.[34]
3. *Singapore* – The first country to implement congestion pricing all the way back in 1975, Singapore uses Electronic Road Pricing (ERP) for different roads at different times automatically as vehicles pass under gantries. ERP is based on a pay-as-you-use principle and is designed to be a fair system as motorists are charged when they use the road during peak hours. ERP has been effective in maintaining an optimal speed range of 45 to 65 km/hr for expressways and 20 to 30 km/hr for arterial roads.[35]

Metrics:
VMT Reduction: Stockholm's program reduced the daily number of vehicles traveling in and out of the city by 22%, resulting in a 20% decrease in traffic delays. In London, congestion has decreased 26% while cycling in the congestion zone has increased by 43% and public transport–especially buses–has replaced car trips.

[33] Transportation Alternatives Web Site, "Congestion Pricing: International Examples"(http://www.transalt.org/campaigns/congestion/international)
[34] Aaron Naparstek, Streetsblog web site, "Congestion Pricing Returns to Stockholm" (http://www.streetsblog.org/2007/08/01/congestion-charging-returns-to-stockholm/)
[35] Land Transport Authority web site (http://www.lta.gov.sg/motoring_matters/index_motoring_erp.htm)

Singapore's Congestion Zone has seen a 13% reduction of traffic during charging period. It has also led to a reduction of 24,700 cars driving during peak and a 22% rise in traffic speeds.
Costs: In London, there had been a feared drop in business within the Congestion Zone. The decline in business never materialized. The impact of the charge has been broadly neutral with respect to citywide employment, number of businesses, turnover, commercial rents and profitability all remaining stable. In fact, London now leads the UK in economic growth. Additionally, London's program generated net revenues of £123m (approximately $200 million US) in 2006/07, which will be spent on further improvements to transport across London, particularly bus services. Finally, a cost-benefit analysis of the central London scheme suggests that the identified benefits exceeded the costs of operating the scheme by a ratio of around 1.5 to 1 when using a £5 charge (approximately $8 US), and by a ratio of 1.7 to 1 when using an £8 charge (approximately $13 US).[36] Further analysis of economic trend data continues to demonstrate that there have been no significant impacts from the original scheme on the London economy. Indeed, the London economy has been particularly strong over recent years, with recent retail growth at roughly twice the national growth rate.
Emissions Reductions: In London, nitrogen oxides and particulate matter have dropped sharply, while CO2 emissions are down 15%.[37] In Stockholm, air pollutants dropped roughly 10% although VMT decreased 22%. The charge has also been successful in reducing the number of solo drivers and in shifting trips from peak to non-peak times.

Packaging Ideas:

- **Strengths:** Public sentiment can be very strong for congestion pricing. Prior to the initial six-month trial run in Stockholm, the polls showed that as many as 60 percent of Stockholm' residents were against the idea congestion pricing. However, just five months after the original implementation, public opinion reversed itself.[38]
- **Weaknesses:** As the New York City example showed, it can be difficult to pass congestion pricing through all of the political hurdles, especially since it may have to navigate local, state, and regional layers of government to do so. The New York plan was actually rejected by the state legislature. Los Angeles' plan has had an arduous process also.

  Future: The three international examples above have been successful enough to gain interest in other parts of the world, so it seems likely that it will indeed continue to spread and eventually reach the United States.

Figure 20: Congestion pricing icon located in the streets of London to remind drivers.

Source:: Streetsblog, "London Releases Its Fifth Annual Congestion Pricing Study"

[36] Transport for London, *Central London Congestion Charging Impacts Monitoring Fifth Annual Report*, July 2007, pages 10-11.
[37] Transportation Alternatives Web Site, "Congestion Pricing: International Examples"(http://www.transalt.org/campaigns/congestion/international)
[38] Aaron Naparstek, Streetsblog web site, "Congestion Pricing Returns to Stockholm" (http://www.streetsblog.org/2007/08/01/congestion-charging-returns-to-stockholm/)

9. Smart Parking Systems

Description: Smart parking systems are programs that allow motorists to always find an empty space. They may do so by creating fee-based systems that charge varying costs for using parking facilities, depending on whether they are doing so during peak usage or not. They may also have intelligent software that points a driver to an open space or even allows them to pay for the space ahead of time and thus reserve the space. These systems create small incentives to alter consumer behavior (i.e.: get people out of cars) and improve the efficiency of traffic by preventing the need for drivers to circle the block as they search for open spots on a street or parking structure.

The historic protocol for most municipalities has been to provide free street parking for automobiles, which creates an incentive for further automobile usage, over-stuffed parking lots, and extra traffic. Smart parking directly charges motorists the real costs of their parking spaces and parking structures, thus creating a disincentive for driving needlessly, improving traffic flow, and creating a stronger incentive for the usage of alternative transportation. Smart parking systems are used to reduce parking problems in targeted locations, and by so doing, reduce vehicle traffic in those areas. These programs also recover parking facility costs and generate revenue for other purposes. The pricing of commuter parking and time variable-rates (higher rates during peak periods) is particularly effective at reducing peak usage. The goal is usually to ensure that no more than 85 percent of the parking spaces are occupied at a time, thus allowing drivers to quickly and efficiently find spaces and eliminate the need to cruise around the block for parking.

Showcases:

1. *City of San Francisco:* San Francisco is implementing a large-scale effort via technology from Streetline, Incorporated's smart parking system. The technology alerts drivers to empty parking places either by displays on street signs or by looking at maps on the screens of their "smart phones". They might even be able to pay for their parking by cell phone, removing the need to return to the meter to add coins. The parking rates will depend on the time of the day with the higher costs occurring during the highest congestion periods. The program will use a monitoring system that provides real-time information on whether parking spots are occupied or vacant. It can also be used to relay congestion information to planners by monitoring the speed of traffic on the streets.

Figure 21: Streetlines' parking finder service, which is being implemented in San Francisco

Source: Streetline web site

2. *New York*: The City of New York will be doubling its parking meter rates during peak hours in high volume neighborhoods in autumn of 2009. Although a modest price by New York standards, the city expects to see decreases in the frequency of double parking and congestion.
3. *Washington, DC* - will be testing two pilot programs that will adjust rates on a monthly basis to achieve the targeted vacancy rates and will direct the revenue toward non-automobile transportation.

4. *Redwood City, Calif.:* Redwood City has set its downtown meter rates to achieve an 85 percent occupancy rate for curb parking (rates varying by location and time of day, depending on demand) and returned the revenue to pay for added public services in the metered district, creating an estimated $1 million a year for increased police protection and cleaner sidewalks. The merchants and property owners all supported the new policy when they learned what the meter revenue would help fund, and the City Council adopted it unanimously.[39]

Metrics:
VMT Reduction: Cost-based parking pricing typically reduces parking demand 10% to 30% compared with free parking. In New York, a study reported that 28% to 45% of traffic on some streets is generated by drivers circling the street blocks as they search for open parking spots. The same study reported that the total vehicle miles traveled for all of the drivers who were just circling one 15-block area in Manhattan was 366,000 miles per year.[40]
Costs: We were unable to procure the actual costs of the different programs, but we did find that in our research, the technology that San Francisco is using is relatively inexpensive and can be used for several services, such as air quality and noise monitoring.
Emissions Reductions: In direct correlation to the VMT reduction, the GHG reduction can be as high as 45 percent in certain locations and times. In one of UCLA Professor Donald Shoup's studies on the matter, he found that the total vehicles circling for a parking spot in a certain central business district in Los Angeles burned an additional 47,000 gallons of gasoline in one year.[41]

Packaging Ideas:

- **Strengths:** Eliminates congestion quickly and creates a new revenue stream for the municipality.
- **Weaknesses:** Still in the early stages in the United States.
- **Barriers to implementation:** Funding, although this is relatively inexpensive.

[39] Shoup, Donald; *New York Times*; Op-Ed Contributor; "Gone Parkin'"; March 29, 2007
[40] Markoff, John; *New York Times*, "Can't Find a Parking Spot? Check Smartphone", July 12, 2008.
[41] Shoup, Donald; *New York Times*; Op-Ed Contributor; "Gone Parkin"; March 29, 2007

10.Financial Incentives

Description: Since 1993, employers have been able to offer employees a tax-free benefit for commuting by mass transit and eligible vanpools or to pay for commuter parking primarily at transit or ridesharing locations under IRS tax code section 132(f).

Showcases:

1. *MyGoPasadena:* The MyGoPasadena program was a bike-to-transit service that provided cash incentives for commuters to use electric bikes—rather than cars—to reach light rail stations.
2. *Cash for Commuters*: Part of a program launched in 2000 by the Georgia Department of Transportation, Cash for Commuters is an Atlanta-based service that pays single occupancy drivers up to $3 per day or $180 over three months to try out alternative transportation modes such as carpooling, transit, teleworking, bicycling, or walking to work. Participants must commit to a minimum of 13 days over a 90-day period. 68% of participants chose carpooling, followed by transit, telecommuting, and a bike/walk mix. 64% continue to use a commute alternative even when no incentive is available to them.
3. *Way to Go, Seattle!* Seattle's umbrella program for all of its efforts to increase walking, biking, transit use, carpooling, and other eco ways to get around, *Way to Go, Seattle!* offers programs such as selling the car, a commuter cash program, a two car trip reduction program, a thank you program for those who are already minimizing their car usage, and a resource toolkit.
4. *Tax-free reimbursement for bicycle commuting: R*ecent federal legislation allows employees a tax-free reimbursement of $20 per month for bicycle commuting to work.
5. *Telecommuting:* Telecommuting is a highly effective strategy in and of itself. A workforce can decrease its VMTs 20% simply by telecommuting one day per week, which also saves money on gasoline and decreases traffic congestion.

Figure 22: Two commuters in the MyGoPasadena program

VMT Reduction: On average, each full commuting member of the MyGo Pasadena program used the program only three times per week to cover a 34 mile average round-trip, creating an offset of 102 vehicle miles traveled per week. Across a 50 week work year, that amounts to 5,100 miles per commuter, per year. In Atlanta's Cash for Commuters Program, participants have reduced more than 3,000 vehicle trips each day.
Costs: According to a recent study of a parking structure by the University of Colorado-Boulder, it costs 2.5 times as much to accommodate an additional person in the parking structure than to shift one person from driving to an alternative mode. The total annual savings, compared to providing 350 net new parking spaces, was approximately $550,000" or $1,570 per space.[42]
Emissions Reductions: On average, each full commuting member of the MyGo Pasadena program's offsets translates to the following per capita emission reductions *per year*: (Continued on next page)

- 4,000 lbs of CO2 (a major contributor to global warming),
- 4.9 lbs of Reactive Organic Gases (ROG),
- 5.3 lbs of NOx (ROG and NOx help to form ground level ozone smog),
- 2.5 lbs of PM10 (particles that lodge deep in the lungs)

Packaging Ideas:

- **Strengths:** It has been shown that 18% percent of employees who sign up for commuter benefits will switch from driving a car to commuting by mass transit to get to work.[43] Bicycle access tends to be particularly important in suburban areas where densities are moderate and destinations are dispersed. Single occupancy vehicle travel declines fairly rapidly as economic incentives for other modes increase, as seen in the chart tor the right.
- **Weaknesses:** The MyGo program was only a pilot demonstration and has not yet spread elsewhere in its actual form, although similar programs have now been hatched because of MyGo's successes. We were unable to determine the long-term regional impacts of the Cash for Commuters program.

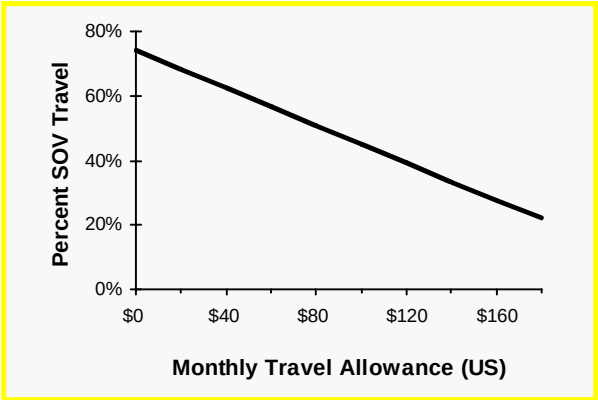

Figure 23: Indirect proportionality between single occupancy vehicle travel and monthly travel allowance.

Source: Transportation Demand Management: Case Studies of Medium-Sized Employers, Transportation Research Record, TRB 1459

- **What it works well with:** the MyGo Program worked well with regular-sized bicycles but would perform better with light-weight, fold-up electric bikes due to limitations on transit capacity.
- **Barriers to implementation:** Funding is often the primary barrier for innovative transportation programs. There may be resistance to carrying bicycles on transit vehicles from transit agency planners and drivers who are concerned about schedule delays and liability problems.