Pedalling Out of the Greenhouse?

Quantifying the environmental benefits of municipal bicycle law-enforcement patrols in the USA

Heath Maddox
European Centre for Transportation and Logistics,
Technische Universiteit Hamburg-Harburg, Schwarzenbergstrafle 95, Hamburg 21071, Germany
Email: heathmaddox@yahoo.com

Summary

This paper outlines the history and background of municipal bicycle patrols and generally describes their costs and benefits, highlighting their environmental benefits in the form of quantified CO_2 emissions. Data from the Cities for Climate Campaign (CCP) of the International Council for Local Environmental Initiatives (ICLEI) CCP are presented. The framework for quantification employed by the ICLEI CCP Greenhouse Gas Emissions Reductions Software is dicussed, and conclusions are drawn for both bicycle patrols and quantification of the greenhouse gas benefits of bicycle projects in general.

The number law-enforcement officers on bikes in the U.S. has grown dramatically in the last two decades, but bicycles were popular as law-enforcement vehicles well before the dominance of motor vehicles. Police have rediscovered bicycles as an inexpensive, flexible, effective and environmentally friendly mode of transportation.

Bicycles represent a small percentage GHG reductions attributed to transportation programs within the CCP campaign thus far, and quantification of reductions from bicycle projects in general is problematic. Quantification of GHG reductions from police bicycle patrols, however, is straightforward and reliable data is widely available. Furthermore, cops on bikes represent almost half of quantified GHG reductions attributed to bicycle programs in the CCP campaign.

While highlighting the environmental benefits of bicycle projects through quantitative methods is certainly important, the full benefits of police bicycle patrols, as well as similar projects and other infrastructural measures to promote cycling are unquantifiable. In the case of police bicycle patrols, the demonstration effect of authority figures riding bicycles in the community may be the biggest benefit of all.

Introduction

The original inspiration and much of the data for this paper stem from my work with the Cities for Climate Protection Campaign (CCP) of the International Council for Local Environmental Initiatives (ICLEI).

ICLEI, the “environmental organization for local governments” is an association of local jurisdictions with around 300 members worldwide. Aside from the CCP, ICLEI also runs campaigns dealing with Agenda 21 and water issues. The CCP campaign has over 60 participating jurisdictions in U.S. and over 350 worldwide. The campaign encourages reduction of urban CO_2 both in municipal operations and on a city-wide basis. Such reductions are achieved through municipal building retrofits, renewable energy, waste reduction, and methane recovery projects, as well as alternative transportation measures. Participating jurisdictions are not necessarily ICLEI members, but the town council or equivalent decision-making body has passed a resolution to participate in the campaign and work toward completion of a series of milestones: performing a baseline analysis, setting goals for reductions, drafting a Local Action Plan, and monitoring progress toward the goals. Monitoring progress toward goals means that the CCP is a performance-based campaign and necessitates quantification of reductions due to individual measures.

From 1998 to 1999, I served as the Sustainable Transportation Program Assistant in ICLEI’s CCP U.S. Office in Berkeley, California. For two consecutive years, I performed a survey to collect data on a sampling of various alternative transportation measures being implemented in CCP U.S. jurisdictions. Using the data I had gathered, I then quantified the CO_2 emissions reductions using ICLEI’s Greenhouse Gas Emissions Reductions Software.

As an avid cyclist and bicycle advocate, I was naturally interested in the reductions attributable to bicycle projects. In general, I found the methodology for estimating reductions in motor vehicle miles traveled from bicycle projects problematic and the consequent CO_2 emissions

reductions relatively small in comparison to other transportation projects such as vanpools or alternative fuel vehicle projects. Some jurisdictions were able to use local survey data that allowed a sound estimate of vehicle trips avoided due to the bicycle facility or program, but most estimates were rough guesses, albeit guesses made by local planners who ostensibly had a good feel for their respective communities and projects. Unfortunately, very little literature exists demonstrating with any certainty the connection between increased provision of bicycle infrastructure, increased rates of cycling, and subsequent reductions in motor vehicle travel.

Municipal bicycle law-enforcement patrols, however, represent the biggest exception to the above-mentioned problems. Nearly half of all jurisdictions that reported bicycle measures of any kind included cops on bikes programs. Furthermore, the estimates of VMT reductions stemming from bike patrols were generally very reliable, and the quantified CO_2 emissions reductions from these projects alone amounted to 40% of all successfully quantified reductions by all quantified bicycle projects. These discoveries led me to further research the history and importance of bicycles as law-enforcement vehicles.

The paper that follows begins by outlining the history and background of municipal bicycle patrols, then generally describes their costs and benefits, presents ICLEI CCP CO_2 emissions reductions data, discusses the quantitative framework employed by the ICLEI CCP Greenhouse Gas Emissions Reductions Software, and finally draws conclusions for both bicycle patrols and quantification of the greenhouse gas benefits of bicycle projects in general.

The Bicycle as a Law-Enforcement Vehicle: Background and History

Bicycles have been used as law-enforcement vehicles in cities around the world for over a century. (Perry, 1995) By the 1920s and 30s, however, police patrols in the United States began to rely increasingly on automobiles, and for the next fifty or sixty years, only a handful of police departments continued to use bicycles on patrol. But in the mid-1980s, as mass-produced, sturdily-built and comfortable mountain bikes became widely available, urban police rediscovered the bicycle's value and versatility as a law enforcement tool. Officers in the Seattle Police Department are widely credited as the first to use modern mountain bikes in the line of active duty. Tales of their resounding success cleanly and effectively patrolling congested downtown streets lead an astonishing number of cities across the country to quickly follow Seattle's lead, sparking a nationwide resurgence in police bike patrols.

A national survey by the League of American Bicyclists in 1991 reached 80 bike patrols, but the surveyors suspected that this number, "only approached actual usage." (LAW, 1991) From 1992 to 1993, the number of police bike patrols in the U.S. reportedly jumped from 250 to 400.(Wells, 1993) Today, 2,000 bicycle units have been documented across the country.(IPMBA, 1999) This number includes city and county police agencies as well as military installations, colleges, universities, private security firms and transportation, park and wildlife departments. In 1997, 1,251 cops were patrolling by bike in New York City alone.(Newman, 1997) Police in cities outside the U.S. have mounted large-scale campaigns of law enforcement by bicycle as well. In 1999, Bogot·, Columbia had 440 police bicycles, and were seeking funding for 1,000 more. (Cordero, 1999)

Two organizations exist to promote, support and coordinate the activities of police bicycle units. The Law Enforcement Bicycle Association (LEBA), formed in 1987, is based in New York State and offers training workshops across the United States. The International Police Mountain Bike Association (IPMBA) was formed in 1992 as a division of the League of American Bicyclists with the purpose of providing training, certification, and resources for police on bikes. In January 1999, the group became an independent non-profit organization. IPMBA membership has grown from 600 in its first year to almost 3,000 in 1999. IPMBA also offers standardized training courses that are utilized by police departments worldwide.

IPMBA maintains a directory that includes information on over 650 bicycle patrol units. According to this directory, the average size of North American units is 9 officers, while several departments have over 50 bike officers. Daily mileage of a police bicycle officer in the U.S. averages between 15 and 25 miles. About 85% of bike units operate a patrol at night and 50% operate year round. Most year-round operations are in southwestern or west coast states, but they are becoming more common even in the East and Midwest.(LAW 1991) Bike officers in Dayton Ohio have been known to ride even when temperatures reached -35(Celsius. Half of all units operate in the rain. Three-quarters of units require bicycle training for officers.

No single brand of bike is favored by cycling cops. Some units use refurbished abandoned bicycles, however most have new, multi-geared mountain bikes. Helmets, lights, tires and

other accessories vary according to factors such as personal preference, cost, and local conditions. Most police bikes are equipped with racks and bags; many have computers and other features like aero bars and full suspension. Uniforms range from slightly altered department issue to custom made cycling-specific apparel.

As air pollution and congestion continue to rise in U.S. metropolitan areas, regional planning organizations and air quality districts are awarding grants to a wide variety of alternative transportation projects. The Bay Area Air Quality Management District (BAAQMD) has funded 6 grants for a total of $237,346 to support 195 bikes.(Burch, 1999)

General Costs and Benefits of Bike Patrols

According to IPMBA and most other sources, bike patrols are very cost effective: 10 to 15 bike officers can be fully outfitted for the cost of one patrol car. The average expense to fully equip one bike is about $1,200, with annual maintenance costs of about $200. The average patrol car costs between $23,000 and $28,000 to purchase and has annual maintenance costs that range between $3,000 and $4,000.

IPMBA further reports that bike patrols benefit police departments by lowering health care costs since bike officers are in better physical shape and thus enjoy a lower rate of injury and take fewer sick days. The League of American Bicyclist's 1991 survey revealed that even among night shifts, incidence of accidents was "so low that it has not been a concern."(LAW, 1991) Bike patrols have been found to build morale within the police force as well as the community at large. Unlike foot patrols, which are unpopular enough with cops to have once been frequently used as disciplinary measures, bike patrols are desirable assignments among police. (LAW, 1991) Lower rates of injury and increased officer morale both contribute to increased job productivity, the value of which can be imputed from wages.

Bike officers can travel faster and farther than foot officers, and they can easily patrol many areas unreachable by car. Bicycles give officers a "stealth" advantage because they are silent. When interviewed, bike cops often recount tales of riding quietly up to the scene of a crime without calling attention to themselves, even allowing them to halt drug deals mid-transaction, apprehend both dealer and customer and confiscate the drugs and the money.

Bicycles are also seen by police departments as a great public relations tool. Just like foot patrols, officers on bikes are much more approachable than those sitting in patrol cars. Reliance upon patrol cars inserts a steel and glass barrier between the community and the police. Eliminating this barrier can allow a much more intimate relationship to develop, ultimately making local police officers responsible to, and agents of local neighborhoods, creating circumstances within which police can support community enforcement of local norms and values.(Kelling, 1998) And by improving their relationship with the community, police are able to more effectively do their job. Though useful statistics are difficult to come by, anecdotal evidence of "skyrocketing" arrest rates by bike officers abounds. City after city that introduced bike patrols on a small-scale, trial basis has quickly expanded their program after netting a healthy return on their initial investment.

Many cities have established goals of encouraging bicycle use by employees, commuters and the general public. Police bicycle patrols help promote an image of bicycles as a legitimate transportation alternative, an action with countless environmental benefits.

Traffic laws governing the use of bicycles are often misunderstood and wrongly applied by police officers. Training police officers specifically in laws that apply to cycling helps avoid this kind of ignorance, and putting the police on bicycles themselves gives them a first-hand understanding of the serious threat posed to cyclists by careless motorists. Police bicycle officers are also more likely than their motorized colleagues to call attention to road conditions that present hazards for cyclists and pedestrians.

Quantified Environmental Benefits: GHG Reductions from ICLEI's CCP Campaign

The following table presents the quantified GHG reductions in equivalent tons of CO_2 from bicycle measures during 1998, reported to the CCP in 1999. Seven of the 28 measures are municipal bicycle patrols. Forty percent of all cities reporting bicycle measures reported bicycle patrols. Total quantified reductions from bike programs were 4,005 tons, representing just over two percent of reductions from all transportation measures. Total quantified reductions from police bike programs were 1,442 tons, representing 36% of reductions from all bike measures.

CO2 Reductions from ICLEI's CCP Campaign - 1998 Bicycle Measures

Jurisdiction	Measure Description	Tons of eCO2 Reduced	Energy Saved (mBTU)
Albuquerque	Bikes on Buses	163	
Berkeley	City Employee Bikes	2	
Berkeley	Citywide Bike Rack Installation	2	
Berkeley	**Police Bicycle Patrols**	**8**	103
Berkeley	Bike Station / Bike Lockers	32	
Denver	Bike Promotion Month	12	
Los Angeles	Non-Police Bike Patrols	1,000	
Los Angeles	**Police Bicycle Patrols**	**1,111**	17238
Madison	Bike to Work Week	3	
Madison	Red Bikes - Bike Share	23	
Madison	Yellow Bikes - Bike Share	127	
Miami-Dade	Bike & Ride Program	57	
Miami-Dade	**Police Bicycle Patrols**	**45**	569
Milwaukee	Bicycle Infrastructure	69	
Missoula	Free Cycles Missoula	17	
Mount Rainier	City Transit Links to Ped./Biker Trails	7	
Olympia	Bikes on Loan Program	3	
Olympia	Bike Commute	8	
Overland Park	**Police Bicycle Patrols**	**1**	15
Salt Lake City	**Police Electric Bicycles**	**87**	1350
San Francisco	Increased Commuter Biking	643	
San Francisco	On-street Bicycling Improvements	238	
San Francisco	**Police Bicycle Patrols**	**190**	2948
Santa Cruz	**Police Bicycle Patrols**	**2**	31
Santa Cruz	0% Bike Loan	25	
Seattle	New Bike Lanes	77	
Tampa	Orangecycle Free Bikes	43	
Tucson	Bicycle Loan Program	10	

Total Annual Reductions from Bike Programs:	*4,005*	
% of Total Transporation Reductions from Bike Programs:	2.14%	
Reductions from Police Bike Patrols:	**1,442**	*22254*
% of Total Reductions from Bikes due to Police Patrols:	36%	

Table 1.1

Quantitative Framework: ICLEI's Greenhouse Gas Emissions Reduction Software

In September 1997, ICLEI distributed to its CCP jurisdictions the Greenhouse Gas Emissions Reduction Software, developed under contract by Torrie-Smith and Associates. The CCP software was designed primarily to be used by city staff liaisons to monitor their city's

progress toward fulfilling emissions reductions targets they have set as part of CCP participation. The software prompts users for data inputs by overlaying a user-friendly interface onto an application that performs various mathematical operations and energy conversions that could otherwise be achieved using a more unwieldy spreadsheet application.

The quantification framework for transportation measures (1) is based on the following simple equation:

CO_2 Emissions = (VMT) * (CO_2/VMT)

where:

VMT =(Person Trips/Persons per Vehicle) * (trip length)

(CO_2/VMT)=(fuel consumption per VMT) * (emissions per unit of fuel)

The above equation can be re-written as a five-factor formula that clearly demonstrates the data inputs necessary for quantification of CO_2 emissions and their respective inter-relationships:

CO_2 Emissions = (A/B) * C * D * E

where:

A = the number of person trips made using the mode in question

B = the number of people per vehicle (occupancy factor)

C = the trip length

D = the fuel consumption per vehicle mile

E = the CO_2 emissions per unit of fuel

These factors are not entirely independent of one another and are determined by a number of other factors that may be technological, behavioral, structural or geographical in nature. For example, in the case of transit, factor B may vary widely according to quality of service and urban density, factor D may vary according to average vehicle speed, and, in the case of electric vehicles, factor E may vary widely depending upon the fuel mix in primary electricity generation. Local data is used wherever available; state or national averages are used when necessary. The software is programmed to vary emission coefficients of electricity generation by region.

For the purposes of quantifying emission reductions attributable to a given measure, it is necessary to obtain “before” and “after” values for each the five factors listed above. The reduction is simply the difference between the emissions pre- and post-implementation:

CO_2 Emissions Reductions = ((A 1 /B 1) * C 1 * D 1 * E 1)
- ((A 2 /B 2) * C 2 * D 2 * E 2)

For bikes, which are truly zero-emission vehicles, the “after” case is equal to zero, so the equation can be simplified accordingly:

CO_2 Emissions Reductions =((A 1 /B 1) * C 1 * D 1 * E 1) – (0)

This emission reduction quantification framework is acknowledged by the CCP to be a very simple representation. It fulfills their need for an integrative framework that allows campaign participants and CCP staff to easily identify data inputs that can be used to quantify and compare actual and potential greenhouse gas impacts of various transportation measures.

Example: City of Los Angeles Police Department

Despite its well-earned notoriety as a sprawling, car-dependent mega-city, in recent years the City of Los Angeles has begun to use an impressive number of bicycles to carry out official city business, and not only for law-enforcement purposes. Beginning with traffic enforcement officers from the city’s Department of Transportation, and regular police officers, employees of the city parks, zoo, and department of water and power all use bicycles while on the job, thus reducing motor vehicle use, fuel consumption, and GHG emissions.

In 1988, the Los Angeles Police Department (LAPD) had 250 officers patrolling by bicycle. According to the City of LA, these police bicycles displaced 125 squad cars with 2 officers per car. On average, police squadcars in LA travel 18,000 miles year and have an average fuel efficiency of 20 miles of per gallon. Twenty miles per gallon is equivalent to fuel consumption rate of .05 gallons per vehicle mile. Not counting weekends, the bicycles are estimated to be in service 313 days out of the year. These are enough data to feed into the

CCP Greenhouse Gas Emissions Reduction Software and calculate a reliable estimate of the fuel use and emissions reductions. Once the data are input, the software essentially performs following calculations using the methodology described in the previous section:

five factor formula:

CO_2 Emissions Reductions = ((A 1 /B 1) * C 1 * D 1 * E 1)
- ((A 2 /B 2) * C 2 * D 2 * E 2)

where:

A1 = number of person trips made by car = 250

B1 = officers per vehicle = 2

C1 = trip length = 18,000 miles

D1 = fuel consumption per vehicle mile = .05 gpm

E1 = CO_2 emissions per unit of fuel = +/- 20 lbs./gal

and:

A2 = number of person trips made by bike = 250

B2 = officers per bike = 1

C2 = trip length = 9000 miles (313 days/year = 29 miles/officer/day)

D2 = fuel consumption per vehicle mile = 0

E2 = CO_2 emissions per unit of fuel = 0

therefore:

CO_2 Emissions Reductions = ((250/2) * 18,000m * .05gpm * 20 lbs./gal) – 0
= 2,250,000 lbs.
= 1,111 tons

Conclusions

This paper has shown that police bicycle patrols are nothing new and that they are beneficial in many ways. The number of bicycle law-enforcement officers in the U.S. has grown dramatically in the last two decades, but bicycles were popular as law-enforcement vehicles well before the dominance of motor vehicles. Police have rediscovered bicycles as an inexpensive, flexible, effective and environmentally friendly mode of transportation.

Bicycles represent a small percentage GHG reductions attributed to transportation programs within the CCP campaign thus far, and quantification of reductions from bicycle projects in general is problematic. Quantification of GHG reductions from police bicycle patrols, however, is straightforward and reliable data is widely available. Furthermore, cops on bikes represent more than one-third of quantified GHG reductions attributed to bicycle programs in the CCP campaign.

While highlighting the environmental benefits of bicycle projects through quantitative methods is certainly important, the full benefits of police bicycle patrols, as well as similar projects and other infrastructural measures to promote cycling are unquantifiable. In the case of police bicycle patrols, the demonstration effect of authority figures on bikes in the community may be the biggest benefit of all.

Notes

(1) The following description is adapted from R.D. Torrie, (1997) Quantifying Greenhouse Gas Emissions from Transportation Partners Projects, International Council for Local Environmental Initiatives, Toronto.

References

Burch, David, (1999) Senior Environmental Planner, BAAQMD, personal communication 5/11.

Cordero, Carlos V. (1999) “Police On Wheels” Human Scale Transportation Newsletter, May 1999 CICLORED-Center for Advising and Training for Transportation and Environment.

IPMBA web page: http://www.ipmba.org/factsheet.htm

Kelling, George L. (1988) Foot Patrol, National Institute of Justice, U.S. Department of Justice, Publication No. NCJ 97223, Current Issues Sourcefile CD-ROM, record G017-12.

League of American Wheelmen, (1991) “Police On Bikes: LAW Survey”, Bicycle USA, September/October, p15.

Newman, Andy, (1997) “Officers on Two Wheels Unleashed on Traffic”, New York Times, November 6.

Perry, David B. (1995) Bike Cult: The ultimate guide to human-powered vehicles, New York: Four Wall Eight Windows Press, p334.

Wells, Janet, (1993) “Cops Shift Gears in Crime Fight: Police say bicycle patrols put them closer to the community”, San Francisco Chronicle, Monday, August 30.