ASSESSMENT OF MODAL SHIFT AND INSTITUTIONS IN THE IMPLEMENTATION OF THE MARIKINA CITY BIKEWAYS

Krystel P. SORIANO
B.S. Civil Engineering Program
Department of Civil Engineering
University of the Philippines
Diliman, Quezon City
Email: krystel_soriano@yahoo.com

Karl N. VERGEL
Associate Professor
Department of Civil Engineering
University of the Philippines
Diliman, Quezon City
Email: knvergel@gmail.com

Sheila Flor T. DOMINGUEZ-JAVIER
University Extension Specialist
U.P. - National Center Transportation Studies
University of the Philippines
Diliman, Quezon City
E-mail: sdjavier@gmail.com

Abstract: Transport-related problems include traffic congestion, air pollution, and accidents. A new approach to these problems is the promotion of environmentally sustainable transport (EST). EST policies and measures include the use of alternative fuels, promotion of use of public transport and the promotion of non-motorized transport such as walking and use of bicycles (cycling). One of the key cities in Metro Manila, Marikina City, was recently hailed as the "Philippines' Bicycle Friendly City" as it continues to promote the use of bicycles as a mode transport. This study aims to present a report on Marikina City's achievement and implementation of the Marikina City Bikeways Project. It also deals with identifying the problems or barriers encountered in the implementation of the Marikina City Bikeways Project and estimate shift from motorized transport to non-motorized transport. Identification of the barriers and barrier removal measures are obtained from secondary data. Prominent results identify the presence of policy-related, culture-related and information awareness-related barriers. However, due to the unwavering political support of the City Government of Marikina, barriers are thus mitigated. Significant institutions are also identified in their respective contributions to pursue the implementation of the Marikina City Bikeways. With regards to the assessment of progress of modal shift, a household interview survey (HIS) was conducted in all of the barangays of Marikina City. The estimated share of cycling increased from 2% in 1996 to 36% in 2007. Economic benefits, faster travel and improved mobility thru the presence of bikeways are the major factors affecting the increase. On the other hand, the present road conditions and safety issues are identified as reasons why people do not use bicycles as a major mode of transport. Results of the study can contribute to the possible replication of this project to other urban areas not only in Metro Manila but throughout the Philippines as well.

Key Words: Bikeways, non-motorized transport, modal shift, Marikina City

1. INTRODUCTION

1.1. Background

As Metro Manila becomes populated, comprising 17 local government units and accommodating over 10 million people, urban quality of living continues to degrade further. It is evident in the

presence of transport-related problems such as road traffic congestion and specifically, air pollution due to vehicles emissions.

The promotion of environmentally sustainable transport (EST) is a new approach to alleviate these transport-related problems. The introduction of non-motorized transportation (NMT) is one of the recognized ways in promoting EST. Non-motorized transportation includes walking, cycling, and other forms of human or animal-powered transportation.

Marikina City, one of the LGUs in Metro Manila, jumpstarted with the promotion of NMT through the use of bicycles. As early as 1992, government officials began Marikina City's physical reform and social reorientation. Physical reforms in Marikina involved the sidewalk clearing operation and improvement of public places. Through these changes, Marikina City was chosen for the implementation of a pilot project aimed to promote non-motorized transport component of the Metro Manila Urban Transport Integration Project (MMURTRIP) in 1997.

The NMT component includes the construction of a 66-kilometer bikeways network that aims to reduce air pollution and traffic congestion problems in the area. Through the exceptional dedication and effective management of the administrators & officials of Marikina City, World Bank Global Environment Facility (WB-GEF) noticed and offered the facilitation of a grant, amounting to US$ 1.3 M, to finance 19 kilometers of the Marikina City Bikeways.

To date, there are 52 kilometers of cycle lanes comprising the bikeways network. Through these developments, it has certainly paved the way for the promotion and inclusion of non-motorized transport throughout Marikina City's transport network.

1.2 Statement of the Problem

How was it possible for the city government of Marikina to pursue the construction of Bikeways project with the presence of transport-related problems and barriers? Did the development of the Marikina City Bikeways bring about changes in terms of the travel pattern of the residents? Did the implementation of the Marikina City Bikeways project become successful or otherwise? These questions thus clearly state the problem of this study. Specifically, this study intends to provide responses to these questions.

1.3 Objectives and Significance of the Study

The main objectives of this study are to identify the ways and means of the city government in establishing the Marikina Bikeways and to present a descriptive study on its accomplishment as well. It is useful to determine the ways and the methods used or implementing procedures by the city government in planning and developing this kind of project. In the long run, these ways/methods will be essential in paving the way for possible replication of this project to other Metro Manila cities and urban areas in the Philippines as well.

The secondary objective is to identify problems encountered during the implementation of the project. It is relevant to know the impediments of the Bikeways project from the early stages of planning through its implementation to further educate the transport planners and governing officers and to help them in preparing ample solutions to these encountered problems.

It also aims to assess the progress on the promotion of shift of usage of non-motorized transportation throughout Marikina City. It is most helpful to determine whether the shift from

motorized transport (PUVs, cars, etc.) to non-motorized transport (Bicycles, Pedicabs, walking) became a success or a failure for this specific urban area. Also, results of the assessment of the progress of shift from motorized to non-motorized transport will be substantial for identifying the accomplishment of this MMURTRIP component.

Also, this study aims to establish detailed trip information of household members in the study area. It is an objective of the person-trip (PT)/ Household Interview survey (HIS) to determine this kind of information so as to obtain the detailed travel pattern of the residents in Marikina City. Also, in order to determine the future trip patterns that will represent modal shift and modal share of usage of transport.

Lastly, this study also aims to identify the significant help and contributions of government and private institutions in the promotion of the Marikina City Bikeways Project.

1.4 Scope and Limitations of the Study

This study focuses on determining the progress of modal shift from Motorized Transport to Non-Motorized Transport within Marikina City Bikeways system. External trips (i.e. all trips outside Marikina City, from Zone 9 to Zone 9) generated are not to be considered since obtaining trip patterns for this Zone requires extended survey period.

Also, this research attempts to comprehensively determine and analyze the different factors involved in the implementation of the Bikeways project. This study is not geared to quantify and assess the environmental impact of the Bikeways project since the nature of that study is of a different branch. This study concentrates in addressing the objectives, as stated earlier.

1.6 Definition of Terms

Environmentally Sustainable Transport (EST)

- is all transport that functions within the limits set by nature

  "At an early stage, participants in the EST project defined an environmentally sustainable transport system as one where: *transport does not endanger public health or ecosystems and meets needs for access consistent with (a) use of renewable resources below their rates of regeneration, and (b) use of non-renewable resources below the rates of development of renewable substitutes."* (EST!)

Non-motorized transportation (NMT)

- consists of walking, cycling, and other forms of human or animal-powered transportation (SGP).
- is a transportation system which establishes and supports non-motorized vehicles such as bicycles for greater efficiency, equity and environmental quality (Guillen

Bicycle

- is a pedal-driven, human-powered vehicle with two wheels attached to a frame, one behind the other.

Bikeway

- is a bicycle route or traffic lane with facilities designed for the exclusive use of bicycles

Household Interview Survey

- also known as Person-Trip survey, is a survey conducted to acquire information on the travel characteristics and socio-economic profile of the residents in the study area.

2. REVIEW OF RELATED LITERATURE

2.1 Environmentally Sustainable Transport projects of the Global Environment Facility

World Bank Global Environment Facility provides financial support for projects promoting environmentally sustainable transport. The Global Environment Facility (GEF) is an independent entity that merges 176 member governments---in partnership with the international institutions, non-governmental organizations, & private sector---to help solve global environmental issues while supporting sustainable development initiatives.

There are types of community initiatives which aim to improve transportation while providing local and global environment benefits. These initiatives are demonstration, networking and policy dialogue, capacity building, information/awareness raising, and applied research and policy analysis. GEF SGP provides support to projects promoting cycle and pedestrian-friendly city infrastructure and policy initiatives (SGP).

Marikina Bikeways project is noted to be the demonstration type of community initiative.. A demonstration type of initiative is depicted by the implementation of novel or experimental technology or practice at a small scale with the aim of proving benefits to users in public or private sectors. Hence, the technology is through the use of bicycles and utilization of bikeways.

2.2 Importance of Non-Motorized Transportation

In order to address transport-related problems such as greenhouse gas emissions, thematic focus on approaches to minimize transport-related problems are introduced. One of the project themes is the Non-motorized transportation.

As stated earlier, Non-motorized transportation consists of walking, cycling, and other forms of human or animal-powered transportation (SGP). It is a transportation system which establishes and supports non-motorized vehicles such as bicycles for greater efficiency, equity and environmental quality (Guillen).

Walking is the most familiar form of non-motorized transportation (NMT). Other common forms of NMT include bicycles/pedicabs; human porterage; handcarts/wheelbarrows; animal-drawn carts; and other human powered vehicles. In fact, the definition of NMT includes any form of transportation that provides personal or goods mobility by methods other than the combustion motor. Non-motorized transport is the prime means of transportation for people in developing countries and is vital to consider in the design and reconstruction of transportation systems (Guitink, et.al).

NMT not only provides a healthy form of mobility but also promotes environmentally sustainable transport. NMT offers low cost transport, emits no pollution, uses renewable energy, and is well suited for short trips.

Through this, it can improve the living conditions of the people and revitalize core urban areas economically as well. This information on NMT helps to further understand the characteristics of Non-Motorized Transportation that is explored in this study.

2.3 Barriers to promotion of Non-Motorized Transport

There are general barriers identified from the WB GEF SGP projects around the globe. These include institutional/cultural, policy, financial, technical, and information/awareness barriers (SGP).

Institutional/cultural barriers are related to customs regarding gender and discouraging women to use certain transport modes especially in the field of non-motorized transport (bicycles, cycling). Policy barriers, in the context of non-motorized transport, contain policies on road widening and removal of pedestrian walks. Financial barriers focus on limited funding in initiating projects promoting EST. Technical barriers include technologies that require adaptation to new conditions in project areas or the lack of new technologies to promote such projects. Information/awareness barriers are common since the sustainable transport issues require experimentation and demonstration to the skeptical community (SGP).

Evidently, in Metro Manila, the more eminent barriers in the utilization of NMT are the unfriendly and dangerous street conditions, lack of cycling lanes and cycling routes, lack of appropriate physical structure for NMT, frenzied traffic management system, extreme dependency on road-based (motorized) public transportation modes, increasing number of private vehicles, lack of national policies that aims to address the need for a sustainable, environment-friendly mode of transportation, lack of awareness among various sectors about the use of NMT, lack of political commitment of the government to develop the transportation sector and integrate NMT with other modes of transportation and lastly, the ill repute that the use of NMT is a sign of economic backwardness (FILCONWILL).

These barriers are very important in this study since they provide specific information and in turn, policy makers may be able to remove these barriers to further promote related projects.

2.4 NMT in Other Countries

It is common for other countries to promote sustainable transport and include bikeways in their transport network. In the context of non-motorized transport, a number of countries have established bicycle routes serving different purposes (SGP).

In Lithuania, development of a bicycle eco-tourism route encouraged the utilization of bicycle routes, upscaling activities from local and European Union funds and other route improvements. Bicycle tourism became a success since bicycle network has been integrated in the transport system in Lithuania. Cooperation among various groups was also established. Partnerships were identified to be very essential to the success of this project.

In Iran, promotion of the culture of utilizing bicycles as an alternative means of transport increased access and mobility throughout the community. Thus, bicycle promotions programs also provide benefits to community members. Sample programs include community member trainings that aim to promote safe cycling practices and basic bicycle repairs.

In Thailand, bicycle routes established serve to promote cycling for traffic calming and energy - saving. Chiang Mai Sunday Bicycling Club (CMBC) promotes recreational rides along the bike routes. The development of bike routes has also helped to portray cycling as a serious, effective and environment-friendly urban transport mode. Thus, it became a success.

In Egypt, bicycle loan programs were designed to increase the bicycle ownership among the poorest and marginalized sectors specifically in Beni Sweif governorate. Through this, the use of

bicycles gained acceptance as a mainstream and effective form of land transportation. Partnerships with organizations have been helpful in the implementation of the project.

In Bogotá, Colombia, an extensive and comprehensive bike paths network has been designed and built. This network was then integrated with the bus system and was also provided with bicycle parking facilities (Bogota).

Development of bicycle eco-tourism, utilization of bicycles as an alternative means of transport, bicycle loan programs, and bicycle parking facilities are some of the activities that were performed by other countries to endorse the use of NMT. These activities serve as examples that other countries may be able to perform to encourage the people to use NMT. Marikina City Bikeways have also promoted similar initiatives executed by the countries mentioned.

2.5 NMT in the Philippines: The Case of Marikina City Bikeways

The Marikina City Bikeways project is considered to be a pioneer accomplishment with regards to the promotion of NMT in the Philippines. Although, the use of bicycles and cycling has long been present in other parts of the country, the establishment and construction of the Marikina City Bikeways still holds the lead.

To further improve the promotion of bikeways, the City Government of Marikina commissioned the I-ce (Interface for Cycling Expertise), Utrecht the Netherlands, to provide technical assistance to the Marikina City Bikeways project. I-ce is an international non-government organization (NGO) for low cost mobility and integrated cycling planning; it is an interface to the Dutch cycling culture and capabilities. I-ce hosts Locomotives, the Low Cost Mobility Initiatives Support network; the Bicycle Partnership Program for cycling inclusive cities in developing countries; and cycling, the professional practitioners' network for non-profit technical assistance (I-ce). One of the predicted complementary measures proposed by the I-ce is the design and implementation of a system of bikeways and lanes designated for non-motorized transport (NMT) in the city of Marikina, a municipality of about 400,000 situated at the east border of the Metro Manila administrative area. (MCB Final Report).

An involvement of I-ce in bicycle policy development and bikeway planning in Marikina City included chapters on the development of the bikeway network and the technical assistance provided by I-ce.

Procedures for the development of the network consists of five different task which are research, capacity building and institutionalization, promotion and education, monitoring and physical planning. I-ce technical assistance focused on the bikeway planning as part of the network. For a successful bicycle policy, it is important that all the new bikeways form a logical part in the whole network to be considered. Also, professionalization of transport planning and capacity building are decisive factors recommended to the success of the Bikeways project and policies in Marikina City (MCB Final Report).

A detailed project description presents incremental component of the overall MMURTRIP project that demonstrate the benefits of this alternative mode of transport. Non-motorized transport includes bicycle lanes for both bicycles and pedicabs (non-motorized passenger transport) and facilities for walking trips.

As stated earlier, the Non-motorized Transport component includes the following: network of about 66 km of bikeways of which 50 kilometers will be developed along existing roads and 16 kilometers of bikeways along the Marikina River banks, traffic calming and pedestrianization measures and facilities around schools and market areas and provision of bicycle parking facilities, street lighting where necessary to ensure safety after hours, training and capacity building of the Marikina bicycle officials working staffing the Bikeway Program Office, with particular focus on planning capacity and management and enforcement activities, education and public awareness campaigns targeted to potential users as well as car users and city's traffic management/enforcement personnel, and replication campaigns targeted to neighboring municipalities and other cities that are suitable for bikeways development (MMURTRIP).

According to this project appraisal report, the proposed GEF component would promote a shift from motorized transport to non-motorized transport (bicycles) in Marikina City. Cost of the NMT system is estimated to about US$1.8 million. The bikeway system is expected to create modest benefits by reducing motorized traffic congestion and, in turn, will decrease in pollutant emissions. The project will also present the viability of other NMT transport and encourage the development of similar facilities in Metro Manila.

Monitoring and evaluation of this GEF component was also performed and results state that the GEF component will be monitored over a five-year period and will be focused on the progress with physical awareness, safety and dissemination aspects, use of facilities by alternative NMT modes, impact on motorized transport volumes, congestion, travel times and costs, resulting GHG emission impacts and local pollutant levels and local environment benefits.

Comprehensive analysis on the Marikina City Bikeways Project thru the Marikina City Bikeways Feasibility Study proposed that there are anticipated negative impacts of the program which are manageable to solve. Positive impacts of the project during the operation are identified to aid reduction in air pollution, reduction in traffic congestion, less travel cost for short distance trips within the city, better accessibility by local residents and better recreation facilities. (UP-NCTS).

Marikina Bikeways Program Accomplishment Report states that the gradual construction and operation of the bikeways system has seen positive results in terms of the increasing modal share of 4.25% in 1999 to 9.54% share in March 2006 (MCBO). From these figures, it can be deduced that the percentage in modal share does not necessarily identify the shift from motorized to non-motorized mode of transport. It is inadequate in terms of assessing the progress on the promotion of bicycle use throughout Marikina City.

Modal share of bicycle only shows the quantity of non-motorized transport users (bicycle users) but it does not directly identify what are the factors that influenced the modal shift and whether these users really shifted from motorized transport to non-motorized transport. Thus, the figures only presented positive results in terms of modal share but this data cannot be connected directly to the improvement of air quality (i.e. reduction in GHG emissions) in Marikina City.

Policies and city ordinances are also legislated within Marikina City to address the issues regarding the promotion of cycling and utilization of the bikeways. It aims to further increase information awareness among the residents of Marikina City.

2.6 "A Rationalized Local Planning System in the Philippines" (Serote) ---Procedures in project planning and implementation

The local planning system is viewed holistically as a system consisting of at least four (4) components: planning structure, plans mandated to produce, planning process and the Local Government Units (LGUs) authority levers which it can use to carry out its plans. From this, LGU projects are carefully planned according to this rational procedure. According to Serote, the local planning structure in the Philippines is both a proactive policy-making and a reactive problem-solving body. Included are the two components of planning structure: political component that concentrates on taking decisions and laying down policies and the technical component that comprises the Comprehensive Land Use Program (CLUP) and the Comprehensive Development Program (CDP). CLUP is coined to be a long-term guide for the physical development of a local area within the local territory. CDP is a program wherein LGUs are able to promote the general welfare of its inhabitants in its capacity as a corporate body. As part of the CLUP of Marikina City, the Bikeways Project experienced extensive planning and implementation stage which is then common for a pioneer demonstration project. With the determination and effective leadership of its administrators, the project is implemented and maintained. Marikina City was thus recognized as Bicycle Friendly City.

2.7 Marikina City Bikeways Feasibility Study---UP NCTS Foundation, Inc.

A feasibility study is conducted by UP National Center for Transportation Studies for the Marikina City Bikeways Project which aims to promote low-cost transport and environment-friendly transport within Marikina City. The study projected future travel demand of bicycle use in the area. Travel demand with and without the implementation of the bikeways project are estimated. It is predicted that total bicycle travel demand will increase due to the implementation of the bikeways and the construction of the LRT station. It is expected that share of bicycles will be noticeable for access or feeder trips to the LRT station. Projected future travel demand is predicted for years 2004, 2009 and 2014.

The study also assumes that there will be a significant switch to bicycles. Bicycle trip purposes will probably vary. Short-distance trips within Marikina City, recreational trips, shopping trips and access or feeder trips are the trips that will most likely be affected by the switch. Percentage of shift to bicycles depends on the socio-economic features of the residents in Marikina City. The development and implementation of the bikeways project is predicted to promote environmentally sustainable transportation system in the area.

The feasibility study also proposes a design for the bikeways network, projections for bicycle parking requirements, physical barriers and types of bike lanes, economic evaluation and environmental impact assessment of the project. Aside from these, UP NCTS FI conducted a social analysis based on the five focus group discussions (FGD). FGD results are vital in identifying the negative attitudes of the public, in general, towards issues related to the Marikina City Bikeways Project.

Horrible traffic situation, safety issues, environmental issues, economic factors and barriers to cycling are some of the concerns and implications identified in the FGD. However, in general, the participants of the FGD are aware of the positive impacts of the bikeways project as they believe it to encourage more people to be cyclists like in other foreign cities and promote cycling in Marikina City.

Positive impacts of the bikeways project during its implementation are identified in the feasibility study. Reduction in air pollution, reduction in traffic congestion, less travel cost for short distance trips within the city, improved accessibility for the residents and improved recreation

facilities such as parks and plazas are some of the positive impacts predicted. Negative impacts are few and manageable and can be mitigated through the integrated measures in the project's design and implementation. Economic evaluation of the project indicates development benefits can be noticed. Investments will tend to motivate and stimulate the recreation sector and property values to a better condition. Basically, the feasibility study concludes that the Marikina City Bikeways Project can be considered as environmentally sound and economically justifiable.

3. METHODOLOGY

3.1 Conceptual Framework of the Study

Figure 1 best describes the theory for this study. Transport modes (consist of initial and existing) are present in Marikina City as well as to other urban areas. Initial mode of transport can be categorized into Motorized transport (MT) which consists of public mode of transport (i.e. PUJs, buses, tricycles, FX/taxi) and private mode of transport (i.e. privately owned cars, vans) and Non-Motorized Transport (walking, bicycling, pedicabs). A cyclic process is assumed to occur between the initial and existing modes of transport.

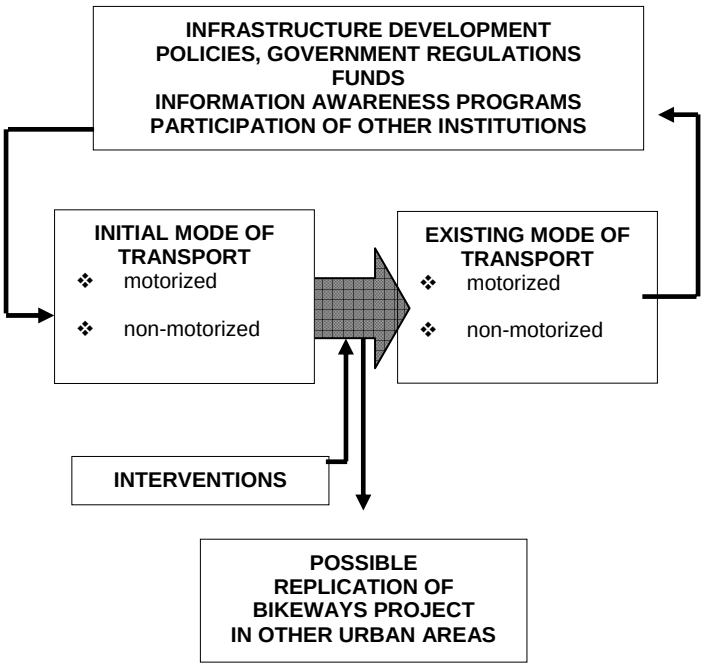

Figure 1. Conceptual Framework

Infrastructure development, policies, funding, information awareness and participation of other institutions are factors that play important roles in the process. Infrastructure developments consist of sidewalk clearing operations and construction and maintenance of bikeways. Policies and government regulations are the rules and ordinances that were established in Marikina City to implement the bikeways project. Funding/funds is essential and is the lifeline of the project. Also, information awareness programs are needed to disseminate information and educate residents of Marikina City on the policies and law enforced around the area. Moreover, the participation and contribution of other institutions and organizations is also considered to be a factor for the realization of the bikeways project.

Factors such as car restraints, intensive promotion of bikeways, market-based investments such as incentives and health/air quality improvement are included. These are necessary interventions assumed to affect the promotion of shift of mode of transport in Marikina City.

Possible replication and expansion of this bikeways project in other Metro Manila cities is assumed to be the end product of this cyclic process.

In the context of this study, confirmation of such assumed process, results of the modal shift, and detailed trip pattern of the residents would be determined and analyzed comprehensively.

3.2Analytical Framework of the Study

Figure 2 presents a descriptive and explanatory nature of the method of this study. This is to further understand the significance of this study. Reviewing previous studies are done wherein concepts and policies are analyzed in relation to this study. HIS is performed to achieve the goals and objectives of this study.

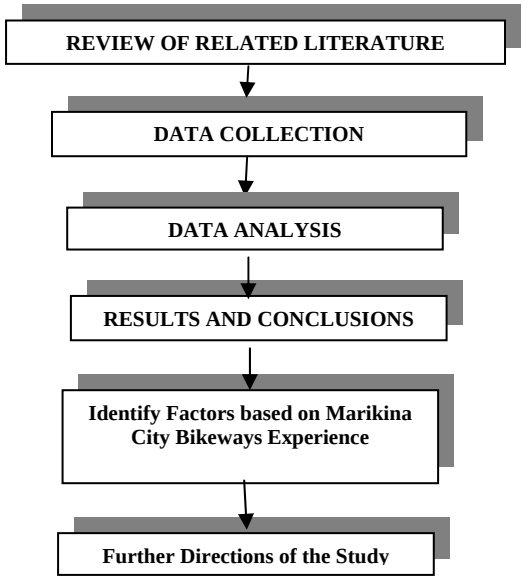

Figure 2. Analytical Framework

3.2 Secondary Data Compilation

This study makes use of the secondary data provided by the Marikina City Bikeways Office (MCBO) and deductions from the reports, such as Marikina City Bikeways Final Report, Marikina City Bikeways Feasibility Study, and other related materials.

Among the secondary data are the results from the Bicycle Ownership Survey. The survey started in 2005 with a 17.18% of the total households in Marikina as sampling size. Fifteen (15) barangays were covered by the household bicycle ownership survey conducted by the Marikina City Bikeways Office (MCBO). A total of 17,073 respondents have been interviewed. Results showed that 55% of the respondents have an access to bicycles. 53% of the respondents use their bicycle daily especially in going to work. 47% of the respondents believed that reckless drivers and road accidents are the main reasons why other people refuse to bike

Aside from the Bicycle Ownership Survey, a Traffic Volume Count in Marikina City was also conducted. It is a 14-hour Traffic Volume Count that is annually conducted in 17 major intersections in Marikina City aimed to determine the share of bicycles in the total traffic volume.

Table 1 .Summary of Traffic Data from 1999-2006

YEAR	1999	2002	2005		2006
			MARCH	DECEMBER	
Total Number of Intersections Counted	11	17	17	17	17
Total Traffic	310,424	451,935	498,913	503,692	503,183
Number of Bicycles	13,183	25,546	37,710	41,382	48,005
% of Bicycle (Modal Share)	4.25%	5.56%	7.56%	8.22%	9.54%

Source: MCBO, Marikina Bikeways Accomplishment Report (Dec. 2001-Dec. 2006 Facts and Figures)

Results above indicate that there is a significant increase in the share of bicycles in traffic. In the year 1999, there is a 4.25% share of bicycles while in 2006 it has increased to 9.54 %. It can be deduced that the percentage in modal share does not essentially identify the shift from motorized to non-motorized mode of transport.

3.3. Travel Demand Data Collection

3.3.1 Formulation of Survey Questionnaire

Transport and traffic surveys are conducted in the analysis of travel demand. One of these is the Household Interview Survey (HIS). As defined earlier, HIS is also known as Person-Trip (PT) Survey. This survey aims to obtain the socio-economic characteristics of households in a survey area. It also intends to establish detailed trip information of household members in the study area. The survey questionnaire for this study is patterned from the MMUTIS Study in 1996 (Technical Report 01).

The questionnaire is divided into 2 parts. Part I (Household Information) centers on the household information of the survey respondent. This contains personal information such as age, sex, residence, occupation, income, vehicle ownership, etc. This will account for the socio-economic background of the respondent.

Subheading Part I.A. (Development of Marikina City Bikeways) focuses on the development of Marikina City Bikeways with timeline indicated as Before/After. Baseline year for the Before part is in 2001 which is the start of the development of the bikeways and for the After part is in 2006 which is the completion of the construction of the bikeways. Major mode of transport before and after, frequency of mode used before and after, bicycle trip purpose before and after, and other relevant questions are also included in this part.

Part 2 (Detailed Travel Information) concentrates on the detailed trip information per day of the survey respondent. This contains the weekday travel diary, the trip purpose, time of start of the travel, arrival time, origin and destination of zone. Transfer points during a trip is also included in order to account for the changes in mode from the 1st transfer point to the next transfer point.

3.3.2 Zoning Design

The study area is divided into zones. For the conduct of the HIS, Marikina City is divided into 8 zones. Places outside Marikina City are designated as Zone 9. For the data analysis of the study, 9 zones are established (i.e. Zones 1-8, within Marikina City and Zone 9, outside Marikina City). This is according to the previous MMUTIS zones established in the 1996 MMUTIS Study.

Table 2. Zones according to 1996 MMUTIS Study

ZONE	BARANGAY
1	Nangka
2	Parang and Fortune
3	Tumana and Concepcion I
4	Concepcion II and Marikina Heights
5	Malanday
6	Sto. Niño
7	Barangka, Tañong, Jesus dela Peña, and IVC
8	Kalumpang, San Roque and Sta. Elena
9	Areas outside Marikina City

3.3.3 Sampling Size

Sampling intends to ensure that data to be examined provide useful information at lowest possible cost. Simple random sampling is employed in this study.

An optimum target of 2.5% of total households in the study area was chosen to present a more valid and reliable data respondents. An expansion factor for each zone is needed in order to represent the whole population of Marikina City. This is computed as the ratio of the total number of respondents in each zone over the population of each zone.

Sampling error is always present in dealing with samples, however, it does not affect the expected values but influences the variability and confidence level.

3.3.4 Conduct of Household Interview Survey

To cover all the 16 barangays of Marikina City for the HIS, weekday survey was performed from last week of May 2007 to 1st week of July 2007**.**

Barangay Sta. Elena was the first barangay to be surveyed. Overall, a total of 720 samples were gathered or 0.8% of the estimated total households in Marikina City. Due to constraints in the conduct of the HIS and lack of manpower, an average of 45 respondents per barangay in the study area were gathered. Even though the optimum target of 2.5% was not achieved, the data gathered is deemed relevant since each barangay was represented.

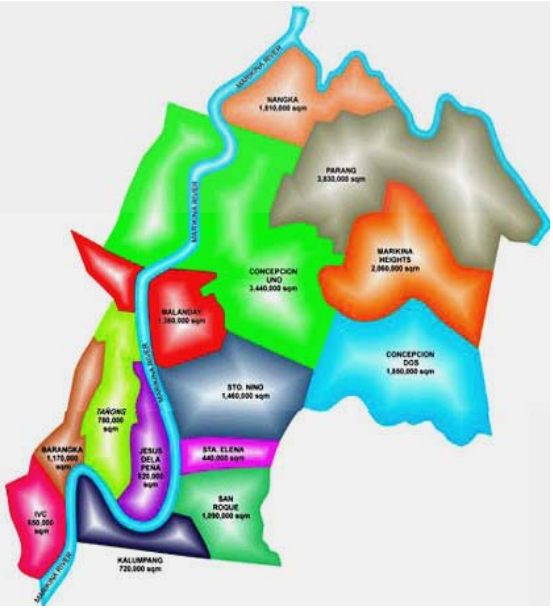

Figure 3. Marikina City Map

Marikina City is a valley bounded by mountain ranges and by river. It is one of the local government units (LGUs) comprising Metro Manila. It is approximately 21 kilometers from Manila, and lies within 14˚ 35’ latitude and 14˚ 41’ longitude. It has a total land area of approximately 21.50 square kilometers (2,150 hectares). This represents about 3.44% of the total land area of Metro Manila.

At present, the city is composed of sixteen (16) barangays. It is a first class city and is a highly urbanized city. On the north, Marikina City is bounded by the Municipality of San Mateo and Antipolo City, City of Pasig and Municipality of Cainta on the south, the towering peaks of Sierra Madre on the east and Quezon City on the west. It has two (2) political subdivisions: District I and District II (http://www.marikina.gov.ph).

Table 3. Land Area in hectares per Barangay

Land Area By Barangay	
Barangay	**Area (has)**
DISTRICT 1	**850.53**
Sto. Niño	145.55

Malanday	138.03
Barangka	116.96
San Roque	108.79
Jesus Dela Peña	82.34
Tañong	77.83
Kalumpang	72.24
Industrial Valley Complex	64.5
Sta. Elena	44.29
DISTRICT II	**1,299.47**
Concepcion I	344.22
Concepcion II	184.25
Marikina Heights	205.76
Nangka	181.68
Parang	164.2
Fortune	219.36
Total	**2,150.00**

Source: http://www.marikina.gov.ph/facts.gen.geography.htm

4.1 SOCIO-ECONOMIC FEATURES OF THE STUDY AREA

4.1.1 Population and Number of Households

Based on the data gathered, basic demographic features of the study are estimated in order to obtain the expansion factor needed in data analysis.

Table 4. Total Population and Household of the Study Area

	2007 (Estimated)	
	Total Population	**Household**
ZONE 1	40,819	7,942
ZONE 2	74,476	15,094
ZONE 3	96,123	20,046
ZONE 4	65,703	12,745
ZONE 5	47,057	9,908
ZONE 6	33,109	6,531
ZONE 7	48,353	10,145
ZONE 8	33,046	6,896
	438,685	**89,306**

4.1.2 Population By Age Group and Gender

Based on the data analyzed, basic features of the study area have been compiled. Results shown in Figure 4 show that the 35-39 years old age group is the major age group.

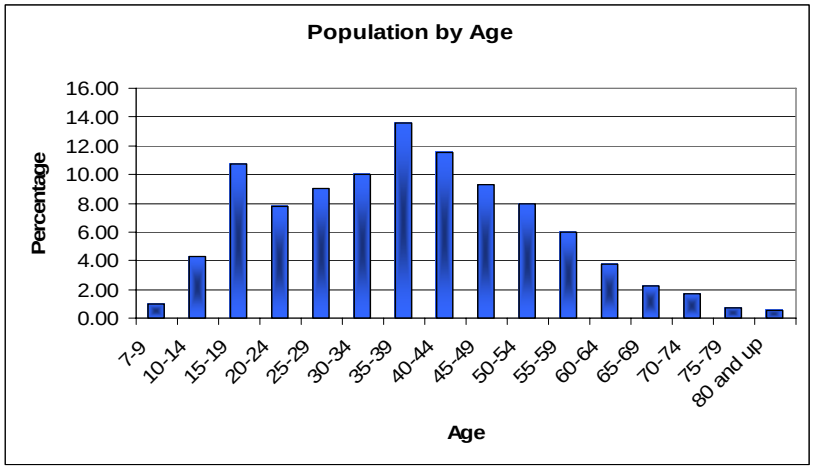

Figure 4. Age Group

Ages are ranged according to the Marikina City Government's CLUP. These are ranged starting from 7 years old up to 85 years old and above. Below is a graph representing the sample population extracted from the survey. All of the survey respondents indicated their age in the survey form. Breakdown of the results is shown below in the following manner (Age range – Count (%)).

- 7 – 9 years old – 7 (1%)
- 10 – 14 years old – 31 (4%)
- 15 – 19 years old – 77 (11%)
- 20 – 24 years old – 56 (8%)
- 25 – 29 years old – 65 (9%)
- 30 – 34 years old – 72 (10%)
- 35 – 39 years old – 98 (14%)
- 40 – 44 years old – 83 (12%)
- 50 – 54 years old – 67 (9%)
- 55 – 59 years old – 57 (8%)
- 60 – 64 years old – 27 (3.75%)
- 65 – 69 years old – 16 (2.22%)
- 70 – 74 years old – 12 (1.67%)
- 75 – 79 years old – 5 (0.69%)
- 80 years old and up – 4 (0.56%)

According to the analyzed data, 378 (52.5%) are males and 342 (47.5%) are females. Figure 5 below represents the detailed graph of population by gender according to 8 zones in the study area.

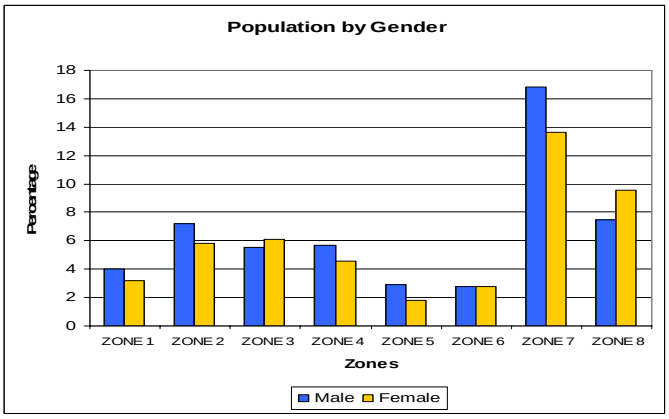

Figure 5. Sample Population by Gender according to 8 MMUTIS Zones

4.1.3 Monthly Household Income

Monthly Household income for the survey ranges from below PhP 8,000 to above PhP 30,000. Options such as none/do not work and student (not working) are included in the range. Not all of the respondents placed their respective monthly household incomes. From Figure 6 below, sample data's dominant income range group is below PhP 8,000.

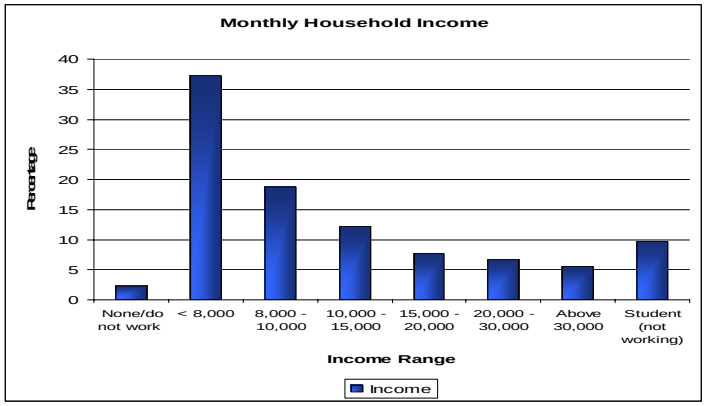

Figure 6. Monthly Household Income

4.2. Vehicle Ownership

From the mini HIS survey, respondents have access to vehicles. Majority of the households in the study area own bicycles and have access to bicycles.

4. 3 Bicycle Utilization

From the total households, approximately 30% utilize bicycles as a major transport mode. 78% of bicycle users are male and approximately 22% are female bike users. Table 5 below shows the breakdown of results according to the zones in the study area.

Table 5. Bicycle Utilization according to Gender

ZONE	NO. OF HOUSEHOLDS WHO USE BICYCLES AS A MODE OF TRANSPORT		TOTAL
	MALE	FEMALE	
ZONE 1	85	24	109
ZONE 2	87	22	109
ZONE 3	146	46	192
ZONE 4	114	43	157
ZONE 5	68	24	92
ZONE 6	55	6	61
ZONE 7	303	100	403
ZONE 8	137	21	158
TOTAL	995	286	1,281

4.4 Bicycle Trip Purpose

Table 6 shows the composition of bicycle trip purposes in the study area. Internal bicycle trips are considered in this study. As predicted in the Marikina City Bikeways Feasibility Study,

majority of the bicycle travel demand by trip purpose are home-based. This can be due to the use of bicycles for short distance trips, recreational and shopping trips.

Table 6. Comparison of Number of Bicycle Trips by Purpose

CODE	BICYCLE TRIP PURPOSE	Mini HIS (2007)		HIS (1996)	
		COUNT	%	COUNT	%
1	TO HOME	205	46.80	36	33.33
2	TO WORK	56	12.79	14	12.96
3	TO SCHOOL	7	1.60	34	31.48
4	BUSINESS ENGAGEMENT	50	11.42	6	5.56
5	PRIVATE BUSINESS	41	9.36	17	15.74
6	ACCOMPANY HOUSEHOLD MEMBER	17	3.88	1	0.93
7	OTHERS	62	14.16	0	0.00
TOTAL		438	100.00	108	100.00

5. MODAL SHIFT

5.1 Internal Origin Destination Trip Matrix

As predicted in UP NCTS Marikina City Bikeways Feasibility Study, there will be gradual increase in the modal share of bicycles and pedicabs. Observations also pointed that modal share of jeepney will not be affected. Also, the increase in the shift of other modes to bicycle is attributed to their use as being access modes to jeepney, bus and LRT modes. In order to verify this assumption, analysis of this modal shift is addressed in this study. An origin-destination table is obtained from the data. Tables 7 and 8 show the representative OD of 1996 MMUTIS HIS and mini HIS of this study.

Table7. Raw OD Matrix (Internal Trips) from this Study (2007)

ORIGIN	D / O	DESTINATION								
		1	2	3	4	5	6	7	8	Grand Total
	1	36	4	10		1	1	2	16	70
	2	7	125	2	2	3			8	147
	3	7	4	112	11	13	3	11	10	171
	4		2	11	65		3		13	94
	5	1	4	11		28	2	8	3	57
	6	1	1	4	3	1	9	13	49	81
	7	1		11		9	12	176	64	273
	8	15	8	11	11		4	65	191	305
	Grand Total	68	148	172	92	55	34	275	354	1,198

Table 8. Raw OD Matrix (Internal Trips) from 1996 MMUTIS Study

ORIGIN	D / O	DESTINATION								
		208	209	210	211	212	213	214	215	Grand Total
	208	482		9			7	5	2	505
	209	1	816	7	1	20	8	7	9	869
	210	10	6	1,574	20	84	41	16	21	1,772
	211		1	21	304	81	7	3	5	422
	212		19	87	82	879	31	22	17	1,137
	213	7	9	36	6	30	292	13	8	401
	214	5	8	16	2	19	14	82	28	174
	215	2	9	21	4	13	4	27	378	458
	Grand Total	507	868	1,771	419	1,126	404	175	468	5,738

Zones 208-215 are the 1996 MMUTIS Zones designated to be the areas in Marikina City. The tables are raw data extracted.

5.2 Factors promoting shift

In Table 9, Economic benefits, faster travel and improved mobility thru the presence of bikeways are the major factors affecting the increase. On the other hand, the present road conditions and safety issues are identified as reasons why people do not use bicycles as a major mode of transport**.**

Table 9. Factors Promoting Shift to Bicycles as a Mode of Transport

FACTORS	**%**
ECONOMIC SAVINGS	48.3
FORM OF INCOME	1.5
CAN AVOID TRAFFIC, LESS DISTANCE TRAVELED DUE TO SHORTCUTS, FASTER TRAVEL TIME	5.5
PRESENCE OF BIKEWAYS	2.5
FORM OF EXERCISE, HEALTH BENEFITS	16.6
SAFER TRAVEL	12
LESS POLLUTION CONTRIBUTED, ENVIRONMENT-FRIENDLY	6.6
NO ANSWER, NO IDEA	7

5. 3 Identified Modal Shift from Motorized Vehicles to Bicycles

Based on the results of the Household Interview Survey performed, 9% of the total samples presented modal shift from motorized to non-motorized transport. The majority of the shift is produced in Zone 7 (BARANGKA, TAÑONG, IVC and JESUS DELA PEÑA).

Table 10. Percent Modal Shift from Motorized to Non-Motorized Transport

ZONE	SHIFT	RESP_	% SHIFT OVER RESP_	TOTAL SHIFT%
ZONE1	12	52	23.08	18.46
ZONE2	3	94	3.19	4.62
ZONE3	8	84	9.52	12.31
ZONE4	8	74	10.81	12.31
ZONE5	3	34	8.82	4.62
ZONE6	1	40	2.50	1.54
ZONE7	27	219	12.33	41.54
ZONE8	3	123	2.44	4.62
TOTAL	65	720	9.03	100.00

6. IMPLEMENTATION OF THE MARIKINA CITY BIKEWAYS

6.1 Barrier mitigation measures

Identification of the barriers and barrier removal measures are obtained from secondary data. Prominent results shown in Table 8 below identify the presence of policy-related, culture-related and information awareness-related barriers. However, due to the unwavering political support of the City Government of Marikina, barriers are thus mitigated. Based on the document research and evaluations, local policies and ordinances have been legislated in order to address almost all of the issues raised in the planning and implementation of the Bikeways project. Also, through the Marikina City Bikeways Office, said ordinances have been implemented throughout the area.

Table 11. Identified Barriers in Bikeways project implementation

Type of Barrier	Marikina City Bikeways Experience	Barrier removal measures implemented
Policy	Constraints in the recovery and designation of sidewalks as bikeways and as a NO PARKING zone	Creation of necessary city regulations and policies, creation of Marikina City Bikeways Office to implement such approved rules and legislation
Financial	Bikeways construction under the GEF grant started in 2004 (more than 2 years after the grant effectivity date). The GEF supported bikeways is 19 kilometers.	City Government of Marikina's continuous provision of budget allowed the construction of bikeways from 2002 to its maintenance at present.
Technical	Design and engineering acceptance to local condition of the bicycle lane physical barriers and separators for safety	Installed steel and conrete bollards were then removed due to accidents.
Information awareness	Negative reactions of the residents such as safety issues, reduced road capacity	Creation of Marikina City Bikeways Office to carry out Marikina Bikeways Programs geared to address issues
Cultural	Not all people can bike, women and children are discouraged to use bicycles due to safety issues and present road conditions	Safe cycling education programs, bicycle clinics, bike-to-school, bike-to-work and bike tours were conducted to eliminate these barriers.

6.2 Helpful Institutions

Local government institutions and international institutions contributed significant roles in the planning, implementation and maintenance of the Marikina City Bikeways project. Listed below in are the identified contributions of said institutions.

Table 12. Identified Institutions and their contributions to the project

Institution	Contributions	Year
DPWH	Proposed NMT Pilot project to be implemented in Marikina City through the MMURTRIP	**1997**

UP NCTS	Performed an extensive feasibility study for the Marikina City Bikeways, provided a local background on the transportation planning and future projections of travel patterns in Marikina City - Feasibility study served as a guide to the implementation of the bikeways project.	**May 2000**
I-ce (Interface for Cycling Expertise, Utrecht-Netherlands)	Provided assistance in the development of cycling policies in Marikina City, focused on the infrastructure design and routing of the bikeways	**June 2001**
World Bank Global Environment Facility	Noticed the NMT initiative in Marikina City, offered financial support to the construction of the Marikina City Bikeways, additional components of the NMT included traffic calming measures, trainings, education campaigns and replication campaigns	**2001**

7. CONCLUSIONS AND RECOMMENDATIONS

With the development of bicycles as a transport mode, there is a need to analyze and update the progress of modal shift from motorized transport to non-motorized transport. It is substantial to determine the travel patterns of the residents in Marikina City so as to determine the implications of the implementation of the Bikeways Project. Assessing modal switch to bicycles is vital in the estimation of future travel demand patterns within Marikina City and to other areas as well. An assessment of the said modal shift was estimated. Based on the discussed results, there is gradual increase in the number of bicycle users from 2% to 36% as shown in this study. Factors have been identified with economic savings, which comprises 48% of the total, as the major influential factor.

Economic savings consist of savings in transport fare especially for short distance trips and savings in using vehicle fuels. This factor is followed by health benefits and safer travel. Health benefits are the benefits from bicycle use such as a form of exercise for individuals and benefits from minimized air pollution. Safer travel pertains to the better traffic situation wherein cycle lanes are given right of way in major highways within Marikina City. Indeed, these factors can be also related as predicted impacts of the presence of bikeways in Marikina City.

Also, a number of relevant institutions were identified. It can be concluded that constant and collaborative effort of government and institutions is needed in the implementation of such pioneer endeavors as the Marikina City Bikeways Project. Local policies and ordinances promoting bicycles are also required for the success of the bikeways project. It is an important tool in the inclusion of non-motorized transport, to the promotion of modal shift to bicycles and to the promotion of environmentally sustainable transport.

To further improve this study, it is suggested that additional time must be allotted to the conduct of the household interview survey in order to comprehensively determine and describe the characteristics of the whole population of Marikina City. Aside from additional time allotment, it is recommended to increase the number of samples in the data collection. By doing so, there will be increased accuracy in the results of the study and will be able to capture the characteristics of the actual population in Marikina City. Proper measures are also recommended in the encoding and analysis of the data. Accurate data encoding of the samples is also vital in minimizing errors in the data analysis. It must involve checking and rechecking the exact figures inputted by the encoder.

REFERENCES

Crane-Droesch, Andrew (November 2006) GEF Small Grants Programme. Environmentally Sustainable Transport and Climate Change.

Guillen, Marie Danielle V. (April 2000) A Study of Non-Motorized Public Transportation in Urban and Urbanizing Areas: The Case of Pedicab Operations in the City of Manila and in the Municipality of Los Banos, Laguna. Dissertation. University of the Philippines. School of Urban & Regional Planning: Quezon City.

Marikina City Bikeways Office (MCBO). (2006) Accomplishment Report (March 2006)**.** City Government of Marikina

Metro Manila Urban Transportation Integration Study (MMUTIS) (1999) Japan International Cooperation Agency. **Technical Report 2**: MMUTIS Database. Manila, Philippines

Metro Manila Urban Transportation Integration Study (MMUTIS) (1999) Japan International Cooperation Agency. **Technical Report 4**: Transportation Demand Characteristics based on person trip survey. Manila, Philippines

Serote, Ernesto M. Rationalized Local Planning System in the Philippines. Bureau of Local Government Development, DILG.

UP NCTS Foundation, Inc (2000) Marikina City Bikeways: Feasibility Study. Final Report.

Vergel, Karl N.(2006) **Notes in CE 141 Transportation Engineering I. Travel Demand Forecasting**

http://en.wikipedia.org/wiki/Bogota's_Bike_Paths_Network [Accessed May 2, 2007]

http://www.marikina.gov.ph/citygov.dept.home.do. [Accessed January 17, 2007]

http://www.oecd.org/dataoecd/15/29/2388785.pdf [Accessed May 2, 2007]

EST! Environmentally Sustainable Transport. Synthesis Report of the OECD Project.

http://www.healthbridge.ca/Assets/Images/PDF/Ecocities/year1.NMT.Phils.pdf [Accessed May 2, 2007] Filipino Consumers Will (FILCONWILL)/ Bilin ng Mamamayang Konsyumer. Promoting NMT in 2005.

http://www.worldbank.org/html/fpd/transport/publicat/td-ut4.htm [Accessed May 3, 2007] Guitink, Paul, Susane Holse & Jerry Lebo. Non-Motorized Transport: Confronting Poverty through Affordable Mobility. Infrastructure Notes. April 1994. Transport No. UT-4.

http://www.i-ce.info/frameset.htm [Accessed May 2, 2007] Interface for Cycling Expertise (I-ce).

http://www.ice.info/download/publications/Summary_Marikina_City_Bikeways.pdf [Accessed January 17, 2007] Marikina City Bikeways Final Report

http://www.gefweb.org/COUNCIL/GEF_C15/WP/PhilippinesMarikina.doc [Accessed January 18, 2007] Philippines: Metro Manila Urban Transport-Marikina Bikeways Component