

PEDESTRIAN AND BIKE PLANNING:
DOWNTOWN OF THE CITY OF GRANBURY, TX

By

SARASWATI BHANDARI

A Professional Report Proposal Presented to the Faculty of the

Graduate School of the University of Texas at

Arlington in Partial fulfillment of the

Requirements for the Degree of

MASTERS IN CITY AND REGIONAL PLANNING

The University of Texas at Arlington

NOVEMBER, 2012

Masters in City and Regional Planning

School of Urban and Public Affairs

University of Texas at Arlington

SIGNATURE SHEET FOR

PROFESSIONAL REPORT

NAME OF CANDIDATE: SARASWATI BHANDARI

TITLE OF PROJECT: PEDESTRIAN AND BIKE PLANNING:

DOWNTOWN OF THE CITY OF GRANBURY, TX

DATE: OCTOBER 2012

COMMITTEE MEMBERS' APPROVAL

TYPED NAME

SIGNATURE AND DATE

Dr. ARDESHIR ANJOMANI

.....

Dr. ANDREW WHITTEMORE

.....

Dr. JIANG LI

.....

ABSTRACT

PEDESTRIAN AND BIKE PLANNING:

IN THE CITY OF GRANBURY, TX

Saraswati Bhandari (MSCIRP)

The University of Texas at Arlington, 2012

Supervising Professor: Dr. Ardeshir Anjomani

Walking is the fundamental form of transportation system. The mode of transportation plays a vital role in the physical form of the city. Before innovation of the automobile, cities were planned in a compact form, and anyone can cross the city by foot. But, innovation of the automobile has brought a drastic change in the urban form and the mode of transportation. City started to developed without sidewalk and people forced to use automobile. Due to energy consumption, environmental concern and household expenses on automobile, auto culture has been a costly mode of transportation. So, urban planners has developed different types of urban theories like, new urbanism, transit oriented development, multimodal transportation system to encourage walking and biking in future and present cities. There are several policies and programs have been implementing in federal, regional and city level government to encourage walking and biking in the city. Therefore, it is the time that each US city has to be aware about pedestrian and bike planning in the city.

The city of Granbury is a small city located in North Central Texas Region, and it does not appear to be aware about the need of walking and biking facilities in the city. Even though, the city has mentioned requirement of sidewalk in new residential development, it does not discuss necessity of sidewalk in existing built-up area. Therefore, this professional report has proposed a pedestrian and bike planning in the city of Granbury. In addition, it has divided pedestrian and bike planning in four major areas of the city, and recommended to implement in phases. Due to the time constrain, this project proposal is limited as an academic propose, and was not able to do financial analysis. A detail survey, financial analysis and coordination are essential to implement this project proposal.

TABLE OF CONTENTS

TITLE PAGE	i
SIGNATURE PAGE.....	ii
ABSTRACT	iii
TABLE OF CONTENT	v
LIST OF FIGURES	vi
LIST OF MAPS	vii
LIST OF PICTURES	viii
Chapter	Page
1. INTRODUCTION.....	1
1.1 Background	1
1.2 Rational of the study	3
1.3 Limitations of the study	3
2. LITERATURE REVIEW	4
2.1Introduction.....	4

2.2 Some facts	4
2.3 Existing policies	5
2.4 Best practices	6
2.5 Walking distance	8
2.6 Characteristics of a good sidewalks	9
3. METHODOLOGY.....	11
4. ANALYSIS	12
4.1City introduction	12
4.2 Travel time to work	13
4.3 Existing condition	13
4.3.1 City’s policy	13
4.3.2 Central downtown	13
4.3.3 West side of downtown	14
4.3.4 East side of downtown	14
4.3.5 Surroundings of the lake	16
4.3.6 Commercial pockets	16
4.3.7 New residential pockets	17
4.4 Walking Distance Analysis	17

5	PROJECT PROPOSAL	18
5.1	Introduction.....	18
5.2	Objective of the proposal	18
5.3	Proposed types of pedestrian and bike facilities	19
5.4	Proposed width of sidewalk	21
5.5	Proposed width of bike lane	22
5.6	Sidewalk at downtown area	22
5.7	Share path for pedestrian and bike	23
5.8	Downtown square	24
5.9	Commercial pocket	24
5.10	New residential pockets	25
5.11	Other requirements	
5.11.1	Traffic speed calming	25
5.11.2	Traffic signal	25
5.11.3	Education program	26
5.12	Implementation strategies	26
6	CONCLUSION.....	33
	BIBLIOGRAPHY	34

LIST OF FIGURES

Figure	Page
Figure 1: percent of people and willingness to walk in mile.....	8
Figure 2: Granbury location map.....	12
Figure 3: Travel time to work.....	13
Figure 4: Mode of transportation in the city	13
Figure 5: ADA requirement sidewalk width	21
Figure 6: Normal sidewalk width.....	21

LIST OF MAPS

Map 1: Existing and proposed pedestrian layout plan in the city of Portland	6
Map 2: pedestrian and bike lane layout plan of the city of Sacramento.....	7
Map 3: Proposed area for pedestrian planning	15
Map 4: Walking distance analysis	17
Map 5: Sidewalk layout map at downtown core and surrounding area	22
Map 6: Share path for pedestrian and bike	23

LIST OF PICTURES

Picture 1: School children are walking .source: safety guide	9
Picture 2: Down town; existing side walk and crossing	14
Picture 3: Existing condition of downtown; parking allover	14
Picture 4: Pedestrian sharing the road	14
Picture 5: Existing sidewalk at front of apartment building	15

Picture 6: Lake Granbury	16
Picture 7: New residential pocket	16
Picture 8: Sidewalk with buffer	19
Picture 9: Sidewalk with ADA requirement	19
Picture 10: Access Way	20
Picture 11: Share Use Path	20
Picture 12: Bike Lane	20
Picture 13: Share Lane Marking	20
Picture 14: Grade-Separated Crossing	21
Picture 15: Intersection improvement	21
Picture 16: Speed bumps	25
Picture 17: Pedestrian and bike traffic signal	25

CHAPTER 1

INTRODUCTION

1.1 Background

Walking or pedestrian travel is a traditional and most primary form of transportation system. Before the innovation of the automobile, the settlements were planned and layouts of residences, markets and jobs were done based on the walking distances. Only a very large city could not cross on foot in less than one hour. In the late 1800s and early 1900s, side walk were paved before road surface (Ridhway at.al, 2009), so that walking and biking were the major forms of the transportation system in the past centuries.

After the innovation of the automobile, automobile became a major mode of transportation, people could travel a long distance in a short time. Therefore, human settlements became more scattered after auto culture. Ownership of an expensive car and larger lot houses became a proud for an American. Therefore, pedestrian and bike lane became a lesser priority in transportation planning, and US cities started to develop without side walk and bike lane.

Now, due to the environmental concern, energy consumption and household expenses on automobile, auto culture has been an expensive mode of transportation for people in 21th century in the USA. A median income (\$21,587) household with 2 car spends 19% of its income on vehicle ownership, and approximately 2,300 pounds of carbon equivalent per person are released into the atmosphere each year (Ridhway at all, 2009). Therefore, walking and biking can play a greater role in transportation system to reduce the pollution, to provide alternate mode of transportation and to save our household income.

In recent years, planning for pedestrian and bicycling has become a priority in transportation planning again. The U.S. Congress appropriated \$1 million for the pedestrian of a national walking and bicycling study in 1990 (Ridhway at all, 2009).This study found that walking and bicycling has significant benefit in terms of health and physical fitness, the environment and transportation related effects. In addition, The Transportation Efficiency Act (ISTEA) of 1991 has encouraged all states and metropolitan planning

organizations (MPOs) to consider facilities for bicycling and pedestrian as part of their transportation plans. After this Act, many state and local agencies prepared combined bicycling and pedestrian master plan. Since 1999, federal statutes have mandated that MPOs include pedestrian and bicycling facilities in the overall metropolitan plan. In 2005, the Safe, Accountable, Flexible, Efficient Transportation, Equity Act: a Legacy for Users (SAFETEA-LU), mandated the metro planning process for Metropolitan Planning Area shall provide for consideration of projects and strategies that will increase the safety and security of the transportation system for non-motorized users and enhance the integration and connectivity of the transportation system. The Federal Highway Administration (FHWA) has produced designing sidewalk and trails for access a two-part design guide for designing bicycle and pedestrian.

North Central Texas Council of Government (NCTCOG) also has encouraged for pedestrian and bicycling facilities in its region. The Mobility-2035 of NCTCOG has prepared different types of plans and programs to include the pedestrian and bicycling facilities in transportation planning. Mobility-2035 Plan mentioned different types of guideline, funding and technical support to encourage pedestrian and bicycling in North Texas Central Region.

Dallas, Fort Worth, Denton, Plano, and many other cities in North Central Texas region has prepared plan with giving preferences on walking and biking in their cities. Now, walking and biking is coming back. And several cities, regions and states have promised to provide walking and biking facilities in their transportation plan. A city can do major contribution with providing walking facilities inside the city area, especially in major neighborhood and downtown area. Even though, cities are trying to include walking and biking facilities, there are challenges of connectivity of walking trail in major nodes and crossing inside the city.

The city of Granbury is a small city located in NCTCOG region. The city has a comprehensive plan, and there is no literally mentioned about transportation planning and its connectivity in the comprehensive

plan. This professional report will propose a physical plan for walking and biking facilities in the downtown and its surrounding of the city of Granbury.

1.3 Rationale of the Project

The main propose of this professional report is (1) to analyze the existing policy and plan on pedestrian and bike planning in the federal level, in the region and the city of Granbury and (2) to propose a physical plan of pedestrian and bike planning of downtown of the city of Granbury. There are two main reasons to select this city, (1) I am living and working inside the city and I am very familiar with the city and the downtown area, and (2) the city is located in North Central Texas Region, and still seemingly is unaware about plan and policy about bike and pedestrian planning.

Pedestrian and bike planning is a popular topics in 21 century, and there are federal, regional and city level policies existed to encourage pedestrian friendly urban environment. Even though, several cities in the North Central Texas Region have prepared pedestrian and bike plan and consent about this new movement, the city of Granbury is still silent about it. Therefore, this project proposal may encourage the city to think about its pedestrian and bike planning in future.

1.4 Limitation of the Study

This project proposal is based on analysis of best practices, existing legislations and wind-shield survey of the city. A detail site survey and study is essential to prepare a master plan of pedestrian and bike planning, and this is an academic proposal prepared in a semester, therefore, it is not possible to do a detail analysis that a city does. So, this proposal is limited on academic purpose. This professional report also does not discuss on financial analysis of the project. The project proposal is limited to propose the sidewalk rather than bike lane layout.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This professional report is a project proposal; therefore the literature review is focused on best practices and real world experiences in the pedestrian and bike planning. In addition, I also have reviewed the existing polices and guideline in the federal level, the policies plan and program of NCTCOG and the best practices in some US cities.

2.2. Some Facts

According to 2001 National Travel Survey, in urban areas 50 percent of all trips were less than three miles and 28 percent of all trips were less than one Miles (NCTCOG, 2012). Therefore, these shorter trips can be travelled with walking and biking facilities.

The National Survey on Pedestrian and Bicyclist Attitudes and Behaviors (2002) found average walking trip distances were in excess of one mile. According to this survey: 25% willing to walk 0.25 mile or less, 19% willing to walk 0.26-.5 mile, 22% willing to walk 0.51-1 mile, 18 % willing to walk 1.1-2 miles and 15% willing to walk more than 2 miles. Therefore, if there are favorable walking environment (safe and comfortable) people are willing to walk more than 2 miles too.

Average 32 % of US population do not have driver license and average 36% of Texas population do not have driver license (NCTCOG, Mobility-2035). So that bike and pedestrian planning is an essential issues for every city. Every city, (small or big,) should take initiatives to plan and implement the pedestrian and bike facilities.

There are several US cities and states have adopted pedestrian and bike master planning. The city Bellevue (WA) 1999, Boulder-2003, Cambridge (MA)-2000, Chapel hill (NC)-2004, Denver-2004, Madison(WI) -1997, Marina (CA)-2003, Oakland (CA)-2002, Phoenix(AZ)-1999, San Diego (CA)-2002 and Seattle (WA)-2002. Similarly several states have adopted pedestrian and bike planning: Arizona-

2003, California-2004, District of Columbia-2002, Florida-1999, Georgia-2003, New Jersey-2004, North Carolina-1996 Oregon- 1995, Vermont- 2002, Virginia-2004, Washington-1997 and Wisconsin-2001 (Walkinfo.org, 2011).

2.3. Existing Policies

State legislatures and federal level legislature have mandated pedestrian safety and have made easier to fund non-motorized infrastructures projects. For example, the Intermodal Surface Transportation Efficiency Act and the Transportation Equity Act for the 21st Century (FHWA, 2010, pedestrian and bike planning) and a number of laws and regulations now mandate certain planning activities and design standards to guarantee the inclusion of bicyclists and pedestrians.

Federal Highway Administration (FHWA) has also published guideline for bike and pedestrian planning. The American Association of State Highway Officials (AASHO) also published a bicycle manual in 1999 and still working on it.

The Texas department of Transportation (TxDOT) also has supported the integration of bicycle and pedestrian facilities into the overall transportation system. In 2001, TXDOT appointed district bicycle coordinators to ensure the bicycle and pedestrian facilities in state level and facilitate to encourage pedestrian and bicycle facilities. This is also a mandated by the Intermodal Surface Transportation Efficiency Act, 1991. TxDOT also has updated design manuals which included pedestrian and bicycle requirements and recommendations.

North Central Texas Council of Government (NCTCOG) also conducts several programs with coordination with local cities in pedestrian and bicycle planning. It helps to determine the feasibility and ensure implementation of said pedestrian and bicycle planning. According to NCTCOG several local governments in Dallas-Fort Worth region have adopted bicycle master plans. NCTCOG is coordinating some of the cities to implement the pedestrian and bicycle master plan. NCTCOG has highlighted the pedestrian and bicycle planning as a major part of its mobility 2035 plan.

3.4 Best Practices

3.4.1. Portland

The city of Portland had adopted pedestrian guideline at 1998. The main principles of the master plan of pedestrian and bike planning of the city are: pedestrian safety, accessible, connectivity, easy to use, attractive (aesthetic/good environment), encouraged public activities and economic.

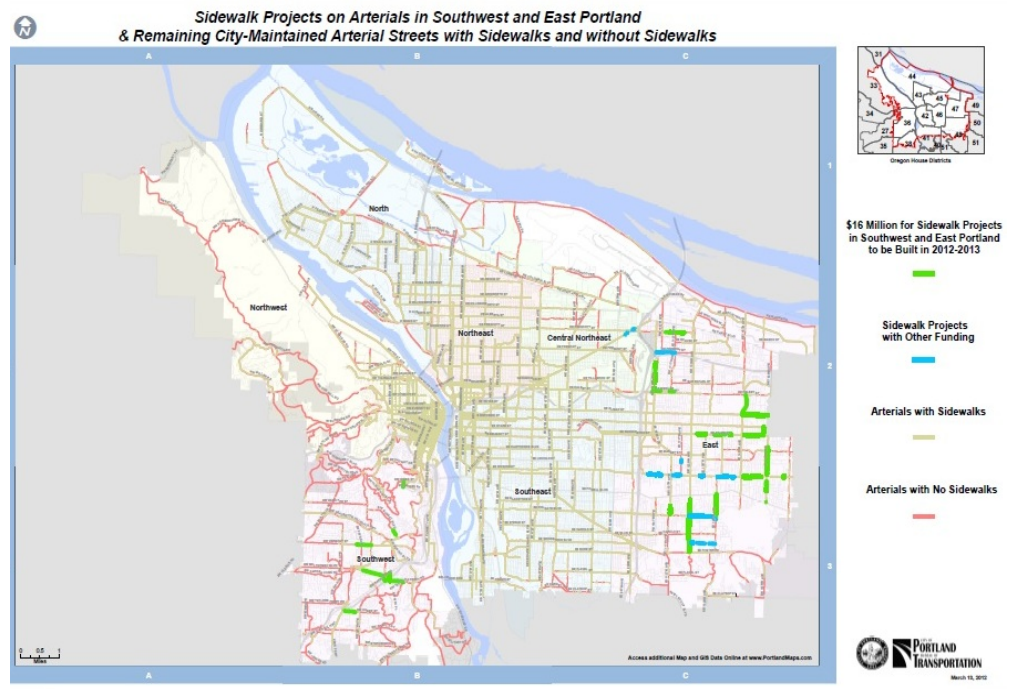
The city has considered the pedestrian safety is an important part of pedestrian planning. Pedestrian planning should be considered diverse pedestrians (Children/young/older, mobility impaired), so that width of the sidewalk should consider accordingly.

The detail planning of bike and pedestrian plan has followed the mandated principle. For example: the route has multi-use paths,

the routes are paved for both walkers and cyclists, there are both shares and off-street paths and trails, and there are many parks offer chance to view nice scene and greenery. City's most dense part has sidewalks, and it has proposed another 16

millions five years project in south and east of Portland.

The city is a best example for pedestrian friendly planning.

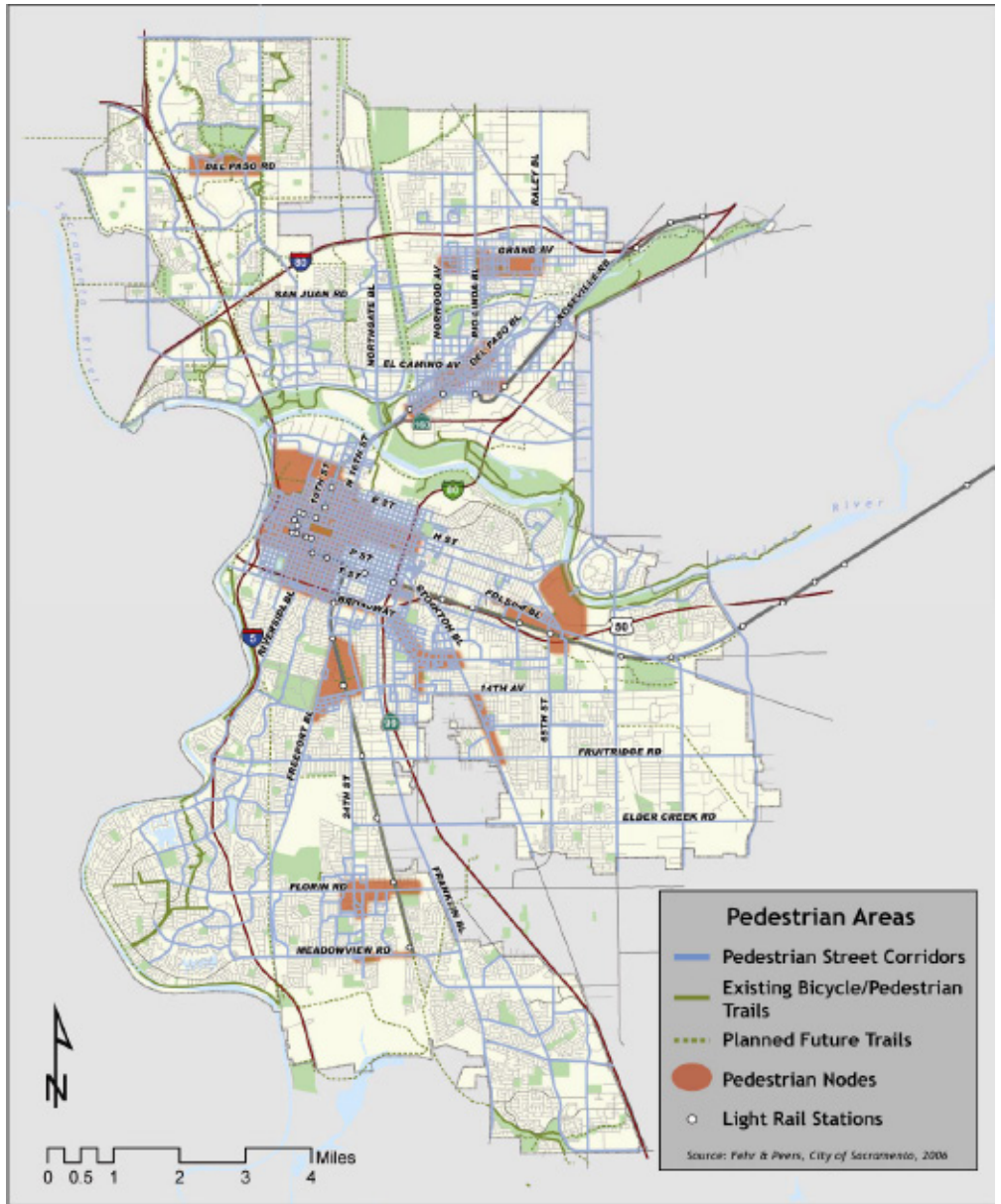


Map 1: Existing and proposed Pedestrian layout plan in the city of Portland. (Source: www.portland.gov)

3.4.2 Sacramento

The city of Sacramento had prepared a Bicycle and Pedestrian Master Plan in October 1991 and adopted in 1994. The city of Sacramento updated and prepared a new pedestrian master plan in 2006. This master plan has two major action plans, first sidewalk improvement and second, construction of new sidewalk in identified locations. The city has a significant number of sidewalks and bike lane, and planning to extend more in future.

The city has education program in school and community about the walking safety. The city also has prepared bike and pedestrian safety map in five other languages (Somali, Nepali, Russian, Burmese & Arabic) along with English (www.sacramento.gov, 2012). The city has prepared pedestrian and bike safety tips for both walker, biker and auto drivers in five languages.



Map 2: Pedestrian and Bike lane layout plan of the city of Sacramento. (www.sacramento.gov)

3.5. Walking Distance

According to best practices and research, it has found that compact built area is good for pedestrian planning, because relationship of side walk and building plays a greater role in pedestrian planning. Adjacent sidewalk with building is better than separated by open spaces or seating area. The pedestrian planning of the city of Sacramento recognized the comfortable walking distance. According to this master plan, excellent walking distance is 1325 feet and time is approximately 5 minutes. In addition, 2650 feet distance and 10 minutes walking time is good, and 3975 feet distance and 15 minutes walking time is acceptable. There are 5280 feet in a mile distance.

Recent research has indicated a walking trip of ¼ mile is an acceptable distance for errands (Pedestrian Master Plan, Sacramento, 2006). The time to walk this distance is about 6 minutes, given that the average walking speed is three to four feet per second (or 2 to 2.7 miles per hour). Many people will accept 1/8 of a mile as an incidental component of a trip that includes travel by another mode such as driving.

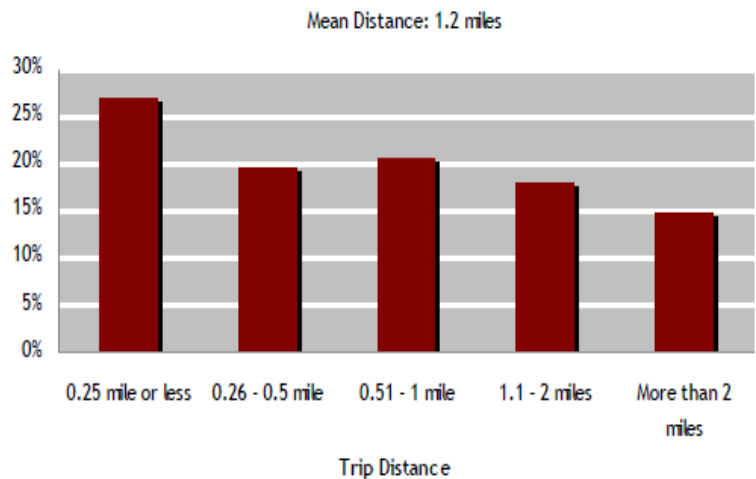


Fig 1: percent of people and willingness to walk in mile. Source: (Pedestrian Master Plan, Sacramento, 2006)

The research shows that people may even be willing to walk further if the pedestrian environment is safe and comfortable. The National Survey on Pedestrian and Bicyclist Attitudes and Behaviors (2002) found average walking trip distances were in excess of one mile.

Mean walking distance was found to be 1.2 miles (on a typical day in the summer), and respondents on average took 1.7 walking trips per day. The 2001 National Household Travel Survey found median walking trip distance to be somewhat lower at 0.45 miles. While there is some variation in average trip lengths, these studies indicate walking to destinations as far as one mile away is an attractive travel option for many people (Nation Household Travel Survey, 2001).

3.6. Characteristics of a Good Sidewalk

According to previous experience in Pedestrian Master Plan the width of a sidewalk or walkway needs to comfortably accommodate the volume of pedestrians normally using it. Therefore, the width of sidewalks should be designed accordingly. For example, on a neighborhood collector that provides a high volume of pedestrian access to a school, park, or other popular destinations, it may be desirable to provide wider sidewalks. In high use areas, such as central business districts, sidewalks can be 10 to 15 feet widths. Therefore, width of sidewalk should be planned based on pedestrian volume.

The Sidewalk Corridor should be easily accessible to all users (all age, ability and group of people). Side walk safety is another important feature of the sidewalk, so that Sidewalk Corridors should allow pedestrians to feel a sense of safety, comfortable and confident. Safe road crossing and vehicle speed also play a greater role in pedestrian safety. Sidewalk users should not feel threatened by adjacent traffic (Pedestrian master Plan, Sacramento, 2006). Another important component of sidewalk is continuity. The walking route along



Picture 1: School children are walking .Source: safety guide book, <http://safety.fhwa.dot.gov>

a Sidewalk Corridor should be noticeable and should not require pedestrians to travel out of their way unnecessarily, or sidewalk should be connected each other. Landscaping is another, but an important component of sidewalk. Sidewalk Corridor should create desirable micro-climates and should contribute

to the psychological and visual comfort of sidewalk users. Social Space also an important in a sidewalk corridor. It should provide places for people to interact, for example place for standing, visiting, and sitting. Finally, the sidewalk corridor should contribute to the character of neighborhoods and business districts, and strengthen their identity with enhancing the physical environment.

“Walking is the oldest and most basic form of human transportation. It requires no fare, no fuel, no license, and no registration.”(Portland Pedestrian Master Plan, 1998). Therefore, pedestrian planning has become an essential concern in urban area.

CHAPTER 3

METHODOLOGY

Pedestrian and bike lane layout planning proposal for downtown of the city of Granbury is the expected outcomes of my professional report. To achieve this outcome, I first reviewed the existing policies plans and programs in the federal level, the state/regional level and the city level. I extracted the necessary information from these documents as a guideline for my project proposal. In addition, I also reviewed the related academic and professional articles, best practices in real world, and local level masters plans in bike and pedestrian planning.

The secondary data was collected from the city of Granbury. This secondary data helped to explore the ideas about the requirement, location and actual lengths and area coverage of the pedestrian and bike lane planning. In Addition, I visited the downtown and surrounding area of the city of Granbury and experienced about the existing road networks and mobility in the downtown area. In addition, photographs and sketches during the visit helped to identify significant points, nodes and intersections that need special consideration in pedestrian and bike-lane planning. The site visit helped to explore the ideas that how the pedestrians and bike lane can be fit in the existing roads network. I had discussed with city planner about their plans, policies and programs on the bike and pedestrian planning. Literally, there is no mention of the future plan of the bike and the pedestrian planning in the city website and comprehensive plan of the city. The discussion with city planner helped me to propose a suitable side walk and bike-lane planning in the downtown area.

After collection primary and secondary data from the city office and site visit, I prepared a layout plan of pedestrian and bike lane facilities in the downtown area. This layout plan is a product of revision of the existing policies, guidelines, lessons learn from the real world practices and data analysis from the city of Granbury.

CHAPTER 4

ANALYSIS

4.1 City Introduction

The city of Granbury is located in Hood County of Texas; one of the sixteen county located in NCT Region. The city was founded in 1825, and was started as a square and log cabin court house. It is generally considered to be a suburb of Fort Worth. Many of the buildings on the square are now registered historic landmarks, were built in the late 1800s. According to the census of 2010, there are 21.0% under the age of 18 and 40% population are 65 and older and 24% are 75 and older in downtown area. Generally, this age group of population are depends on other driver, therefore pedestrian access is good for shorter destination. Downtown Granbury is surrounded by residential buildings, apartment, retire homes, hotels and government offices. In addition, it is a cultural center and celebrates over 10 regular events in a year. City of Granbury is also a tourist place and a significant number of tourists visit here from outside of the city. Pedestrian access to local shop and lake Granbury and local parks would be better for tourist also, who visit in the city and live for short time.



Fig 2: Granbury Location Map
(source: www.Granbury.gov)



Picture 2: Downtown Granbury
Courthouse (Source: City of Granbury)

4.2. Travel Time to Work

Mean travel time to work for city of Granbury is 23.1 minutes in downtown area. The chart shows that maximum percent of working people travel 10-20 minutes from residence to work place. Even though walking to work is not possible for more than 10 minutes driving distance, pedestrian and bicycle facilities would be better alternatives mode of transportation for other (shopping) short trips.

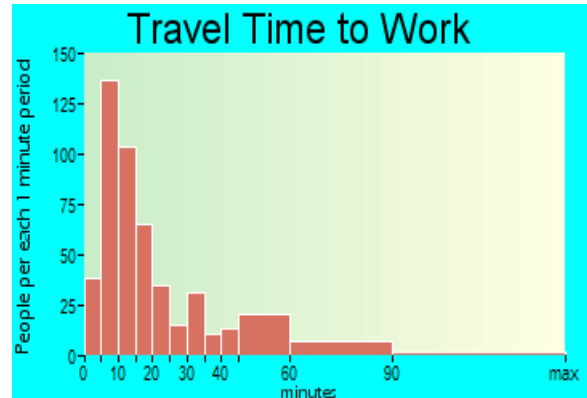


Fig 3: Travel time to work. Source: www.censusata.gov)

4.3 Mode of Transportation

The data shows that 82.09% city’s people drove alone to work, 10.10 % does carpool, and 4.31% worked at home 1.83% people walked and 1.17 % other. Comparing to national data, the city of Granbury has less people walked to work. Lack of sidewalks is a major factor of less people walk in the city.

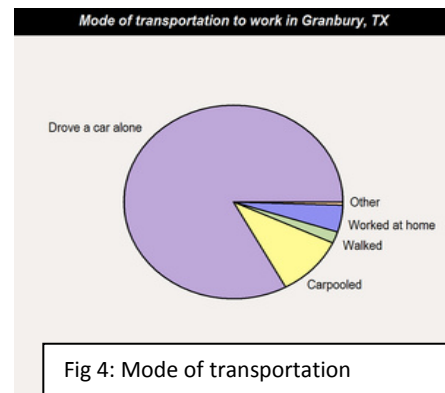


Fig 4: Mode of transportation (Source: www.census.gov)

4.3. Existing Condition

4.3. 1.City’s Policy

City prepared a comprehensive plan at 2008. Comprehensive plan of the city of Granbury said that “Encourage neighborhood and pedestrian friendly systems by requiring neighborhood pocket-parks, trails and sidewalks on new developments. This shall be required through platting, site design and any other permit, application or request for approval on new construction” (Comprehensive plan, 2008, 13). It literally did not mention the pedestrian improvement on existing development and downtown area.

4.3.2. Central Down Town

Downtown of the city of Granbury is located approximately center of the city and nearby the lake Granbury. The downtown Square has 3.5' pedestrian access, and this pedestrian width does not sufficient for existing pedestrian volume. In addition, pedestrian crossings are not visible and located in necessary locations. Therefore, following improvement is necessary on existing sidewalks in the downtown square:



Picture 2: Down town; existing side walk and crossing

- Expansion of existing sidewalks
- Designation of crosswalk
- Crossing improvements
- Relocated of parking area
- Improvement sidewalks connections



Picture 3: Existing condition of downtown; parking allover

4.3.3. West Side of the Down Town

West side of the downtown is dominated with residential buildings. Along with the residential buildings, church, convenience store, city office, police office and some other institutional offices are located in further west side of the downtown. There are no sidewalks along the residential area. The city office, library and downtown square are located less than 1000 ft. from residential areas. Due to lack of sidewalk, people are forced to share a road to walk. Therefore, a safe and appropriate sidewalk is necessary along main road and all arterial roads in the west part of the downtown.



Picture 4: Pedestrian sharing the road

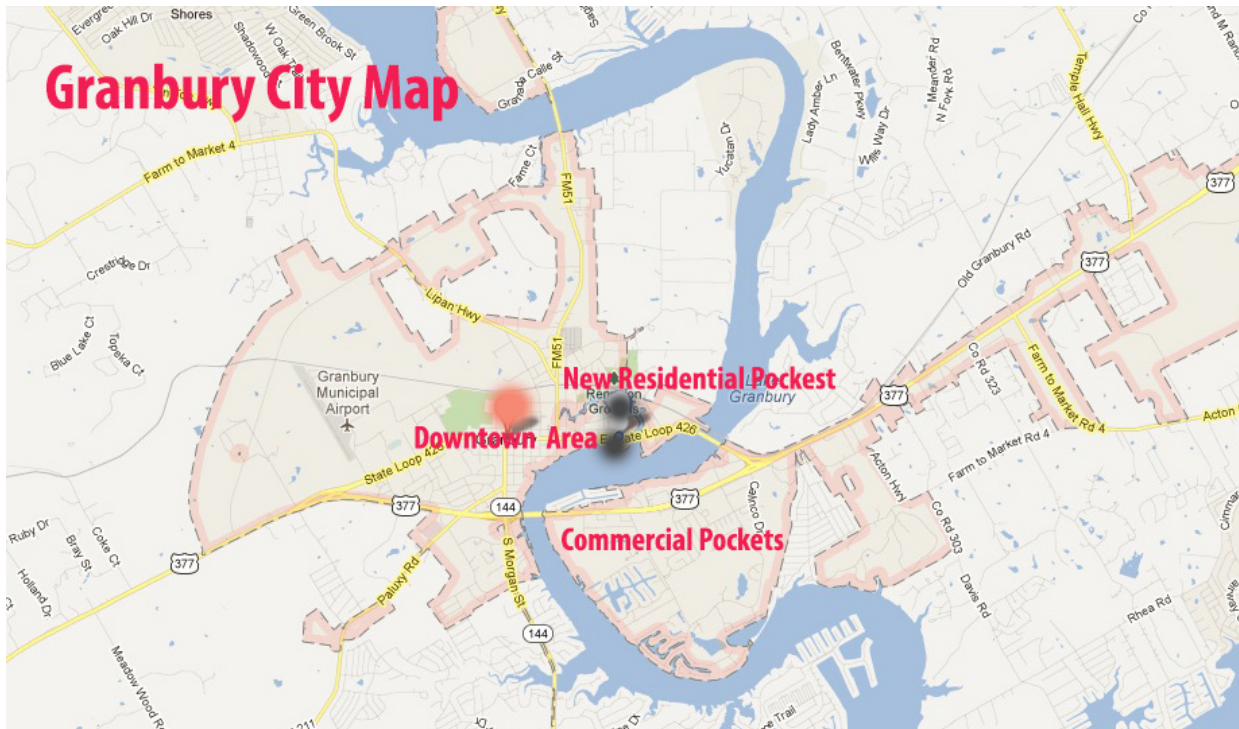
4.3.4. East Side of the Down Town

East side of the down town is dominated with public housing and apartment buildings. Retirement home and apartment buildings are located within 1000 ft from the down town square and some restaurants' residential buildings, city beach, City Park and Lake Granbury is located within 1000-2000 ft from the down town square.



Picture 5: Existing side walk at front of apartment building

Existing sidewalk on east part of downtown is not sufficient. Therefore, improvement of existing sidewalk and addition of new sidewalk is necessary. Even though the walking distances are less than 2-5 minutes, people are forced to use car to visit close restaurant, parks, city beach and Downtown Square. Safe and appropriate sidewalks are necessary along the main road and arterial roads in the east side of the downtown.



Map 3 : Proposed area for pedestrian planning

4.3.5. Surrounding of the Lake

The Lake Granbury is an important amenity of the city and people love to walk as a recreational purpose along the lake in leisure time. City



has built city beach near lake, but due to lack of sidewalk people have not been taking benefit from the lake. Improvement of existing beach and layout of a share path for both pedestrian and bike lane along the lake can help to attract people in the city, and it will also enhance the city environment and increase the land value. Therefore, it will be economically beneficial for the city too.

4.3.6. Commercial Pocket

This pocket is dominated with commercial development (grocery, restaurants, services, hotels) along the highway 377, and the residential areas are located on the further away. There are no pedestrian access and sidewalks in this area. The residential pockets near commercial area are located within 1000ft- 1 mile distance, and this distances is a walkable distances. Therefore, if there is safe sidewalk and bike lane, more than 50% trips to commercial area would be possible by walking or biking. Pedestrian connection between residential area and commercial area will help to reduce the car trips.

4.3.7 New Residential Pockets

There are several new residential pockets in the city. Even though, there is policy to encourage sidewalk in new residential pockets and neighborhoods, sufficient sidewalks and connections have not been built. Therefore, improvement in sidewalks and its connections is essential in these areas. In addition, some residential pockets are

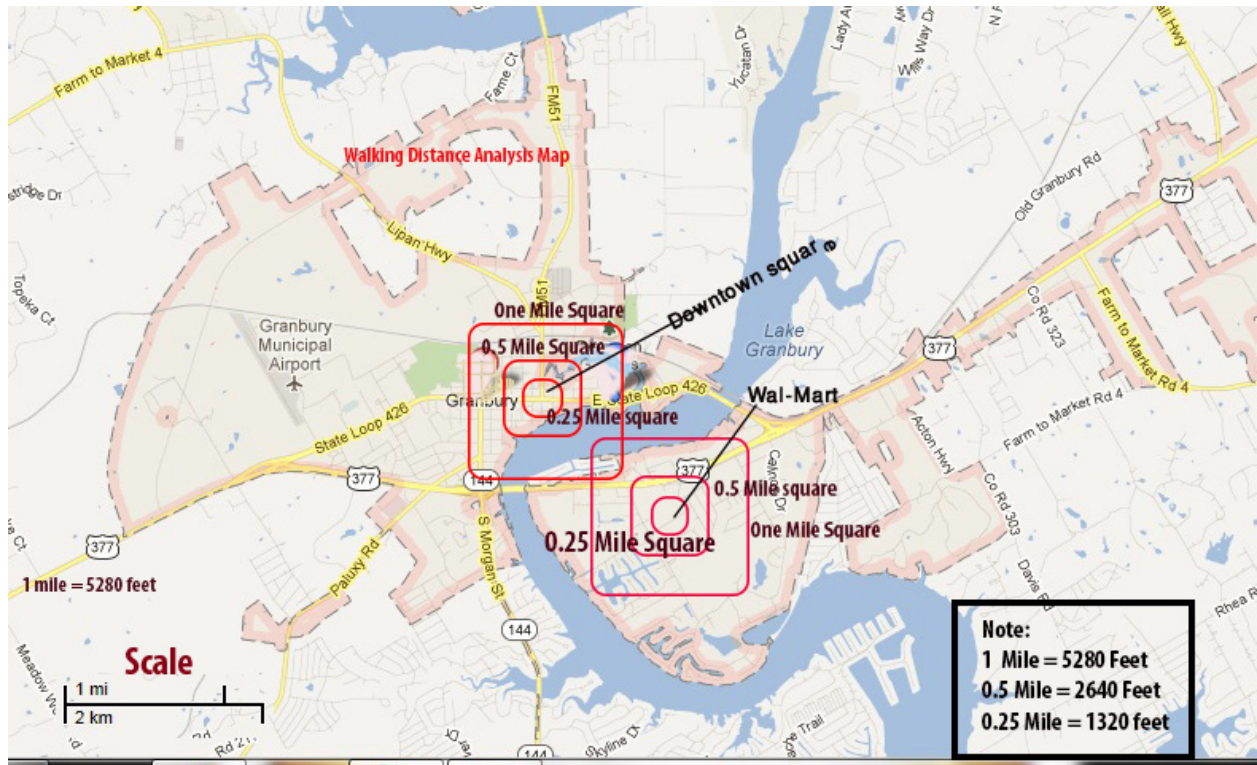


Picture 7: New Residential pockets (Source: Google map)

located between 1-2 miles distances from commercial area. According to national survey, 18% people willing to walk 1.1-2 miles distances, so provision of side walk and bike lane is helpful to connect new residential pockets to commercial area.

4.4 Walking Distance Analysis

Downtown town area is divided by one mile square area, 0.5 miles square area and 0.25 mile square area (see map 4). This division is done with keeping the downtown and Wal-Mart as center point. According to research done by City of Sacramento (Pedestrian Master Plan, Sacramento, 2006), approximately 0.75 mile or 3975 feet is acceptable walking distance. Based on this analysis most of the people who live near the Downtown and Commercial Pockets can walk easily to nearby shopping or other trip if there is safe sidewalk.



Map 4: walking distance analysis

CHAPTER 5

PROJECT PROPOSAL

5.1. Introduction

The city of Granbury is a small city; especially the downtown of the city covered approximately one square mile area. According to national survey 15% people in the United States are willing to walk more than two miles too. Therefore, if there are safe side walks, most of the area inside the downtown area can be reached without driving. Less driving means less energy consumption, less pollution and less expenses. Old age people and children under age of 16 are unable to drive, so that sidewalks and biking facilities provides an alternatives mode of transportation for them too.

This project proposal is based on analysis of the existing roads and sidewalks conditions of the city. Based on the existing condition analysis, I have divided four areas in the proposal: downtown core area, Granbury lake area, new residential pockets and commercial pocket at Highway 377. The proposed plan is prepared accordingly, and has proposed implementation's phases of the projects.

Downtown square and surrounding areas are proposed in first phase, commercial pocket is on second phase, lake and its surroundings is on third phase, and new residential pockets is on fourth phase.

5.2 Objective of the Proposal

The main Goal of this proposal is “to provide alternatives mode of transportation with a walkable environment for healthy living, which contributes to reduce air pollution and energy consumption. Detail **objectives** are as follows:

Objectives:

- To improve in individual health and wellness
- To reduced traffic congestion and exposure to crashes

- To enhance downtown area as a exciting places to visit and enhance local economy
- To help to reduce air pollution and lower levels of carbon emissions
- To contribute in higher quality of life
- Lower costs for roadway maintenance
- More equitable access to community resources for all age and group of people
- To attract visitors with enhancing walking environment.

5.3 Proposed type of pedestrian and bike facilities:

Sidewalks: Sidewalks are paved walkways adjacent to roadways (see Picture 8). Sidewalks are particularly important for basic mobility of open with disabilities (see picture.9). A buffer between the side walk can create more and safety walking. Following types of sidewalks are appropriate for this project.



Picture 8: Side Walk with Buffer. (Source: www.smartergrowth.net)



Picture 9: The sidewalk with ADA requirements (Source: www.guide.saferritesinfo.org)

Access ways: Access ways are connectors, and these connectors provide direct routes between residential areas, retail and office areas, institutional facilities, and neighborhood activity centers. This type of ways is helps to make shorter the trips and less drive.



Picture 10: Access Way (Source: Eugene BPMP, 2012)

Shared Use Paths: Shared-use paths are paved paths separate from the roadway network that are designed for both walking and bicycling. This type of path is proposed along the Lake Granbury.



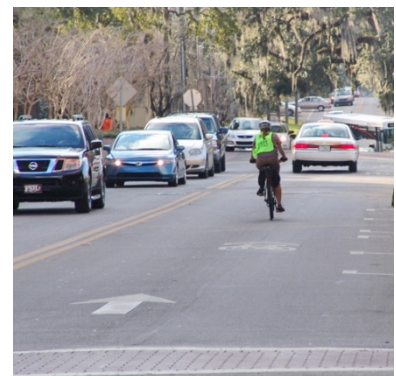
Picture 11: Shared use path (Source: www.bicyclinginfo.org)

Bike Lane: Marked space along a length of roadway designated for use by bicyclists. Wheelchair users and some motorized scooters are allowed in bike lanes. This type of lane is proposed along the Highway business 377 and Highway 377 at commercial pocket.



Picture 12: Bike lane (Source: <http://chicagoist.com>)

Shared Lane Marking: Also called “sharrows,” shared lane markings are pavement markings used to indicate shared space for bicyclists and motorists on low and medium volume streets that don’t have room for bike lanes. This type of lane is proposed to connect residential and commercial area as well as along all residential area.



Picture 13: Share lane marking (Source: www.cyclingsavvy.org)

Grade-Separated Crossing: When an intersection crossing is not safe, a below- or above-grade crossing for pedestrians and bicyclists may be needed. Grade separated crossings include bridges and tunnels that bypass a river, railroad tracks, a highway, or another large roadway. To allocate this type of graded pedestrian crossing, more detail study is needed.



Picture 14: Grade-separated Crossing (Source: www.walkinginfo.org)

Intersection Improvements: Intersection improvements can take many forms, but all improve the ease, comfort, and safety of bicyclists and pedestrians at intersections.



Picture 15: Intersection Improvement Oregon (Source: <http://www.iseoregon.com>)

5.4 Proposed Width of Sidewalks:

The minimum desirable width for sidewalks is 1.5 meters (5 feet) on neighborhood streets, and 1.8 meters (6 feet) in downtown area and commercial area, which meets the ADA (the Americans with Disabilities Act) requirement.

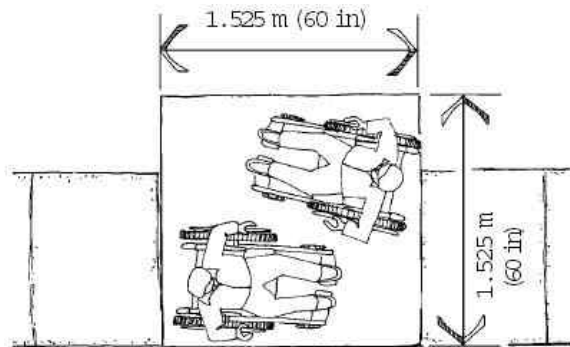


Fig 5: ADA requirement width (source: <http://mutcd.fhwa.dot.gov>)

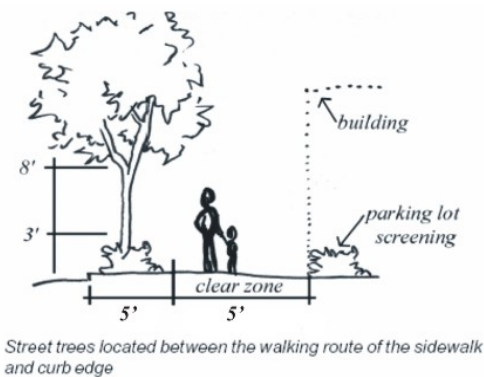


Fig 6: Sidewalk width (source: <http://www.spokanecity.org/services/docume>)

Minimum clear width of 0.9 meters (3 feet) is necessary for single passing. If there are spaces less than 1.5 meters (5 feet) a passing areas should be provided. Grades greater than 5 percent are typically undesirable. Where steep terrain exists, grades of 5 to 10 percent can be tolerated for short segments less than 500 feet.

5.5 Proposed Width of Bike Lane

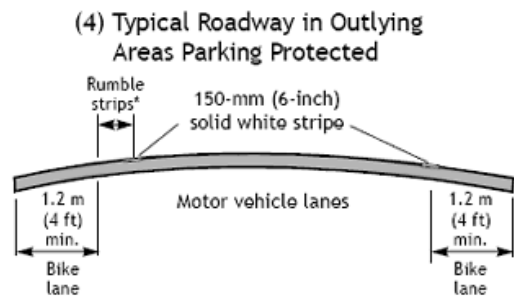
The minimum width of a bike lane should be 1.5 meters (5 feet) against a curb or adjacent to a parking lane.

On streets where the bike lane is adjacent to the curb and the curb

includes a 1-foot to 2-foot gutter pan, bike lanes should be a minimum of 4 feet wide (width does not include the gutter pan, since bicyclists are typically unable to use this space) (FHWA, 2010). Therefore, bike lane should be between 4-5 feet based on design of adjacent road.

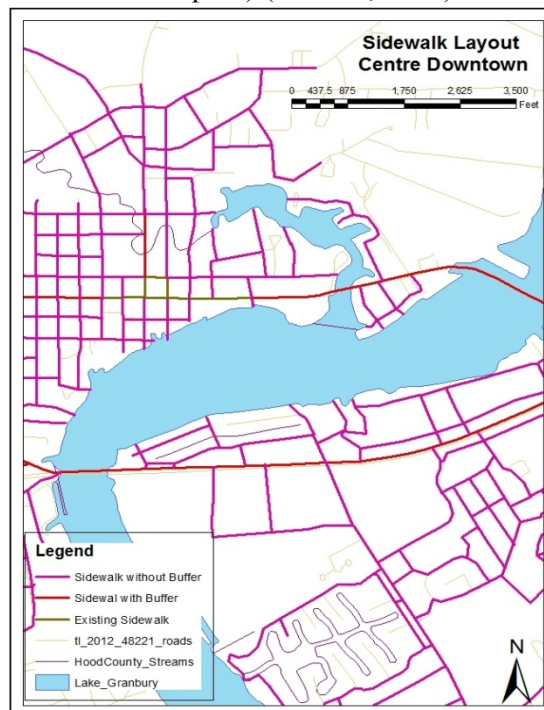
5.6 Sidewalk at Downtown Area

This map illustrates the sidewalk layout in the downtown area. The width of the side walk is 5 feet and passing space is proposed in every 100 feet. This layout plan is proposed as a first phase pedestrian planning in the city. In this phase, 2 miles sidewalks with buffer, 8 miles sidewalk without



* If rumble strips exist there should be 1.2 m (4 ft) minimum from the rumble strips to the outside edge of the shoulder.

Fig: 7 Bike lane widths (Source: www.fhwa.dot.gov)



Map 5: Sidewalk Layout Map at Downtown Core and Surrounding

buffer and one mile new connection sidewalks are proposed in the downtown area. Sidewalk with buffer is proposed along the major highway that passes through the downtown.

5.7 Share Path for Pedestrian and Bike

A Shared Path for pedestrian and bike is proposed around the lake Granbury. This path includes a two way bike lane and sidewalks with ADA requirement. Approximately four miles shared path is necessary to complete the proposed area.

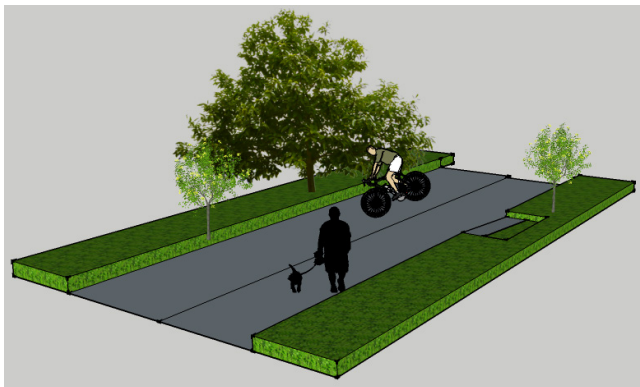
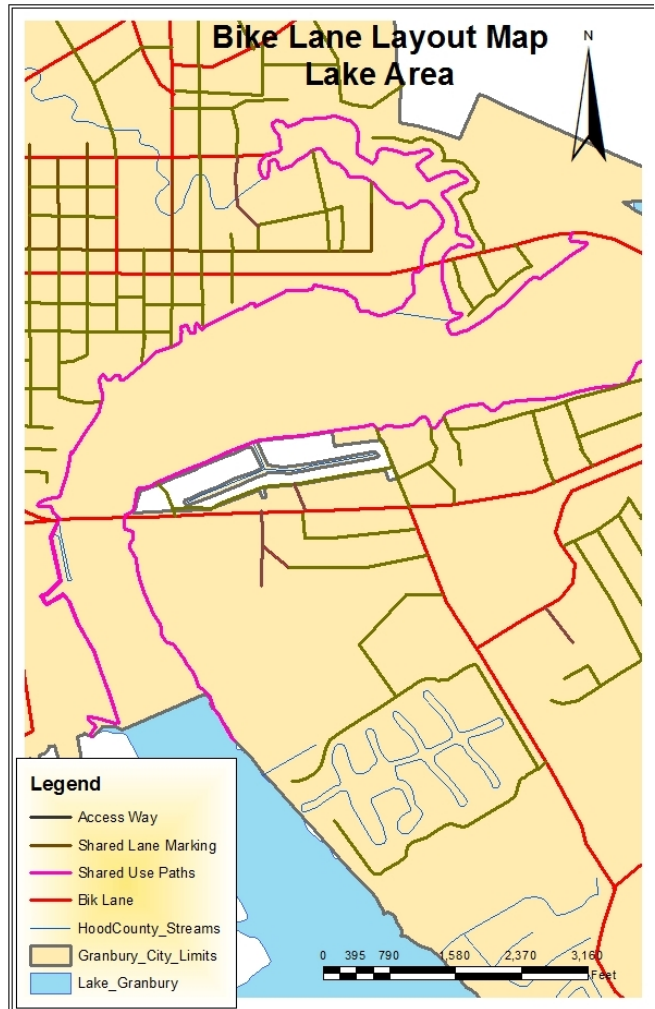


Fig 6: proposed shared path along the lake

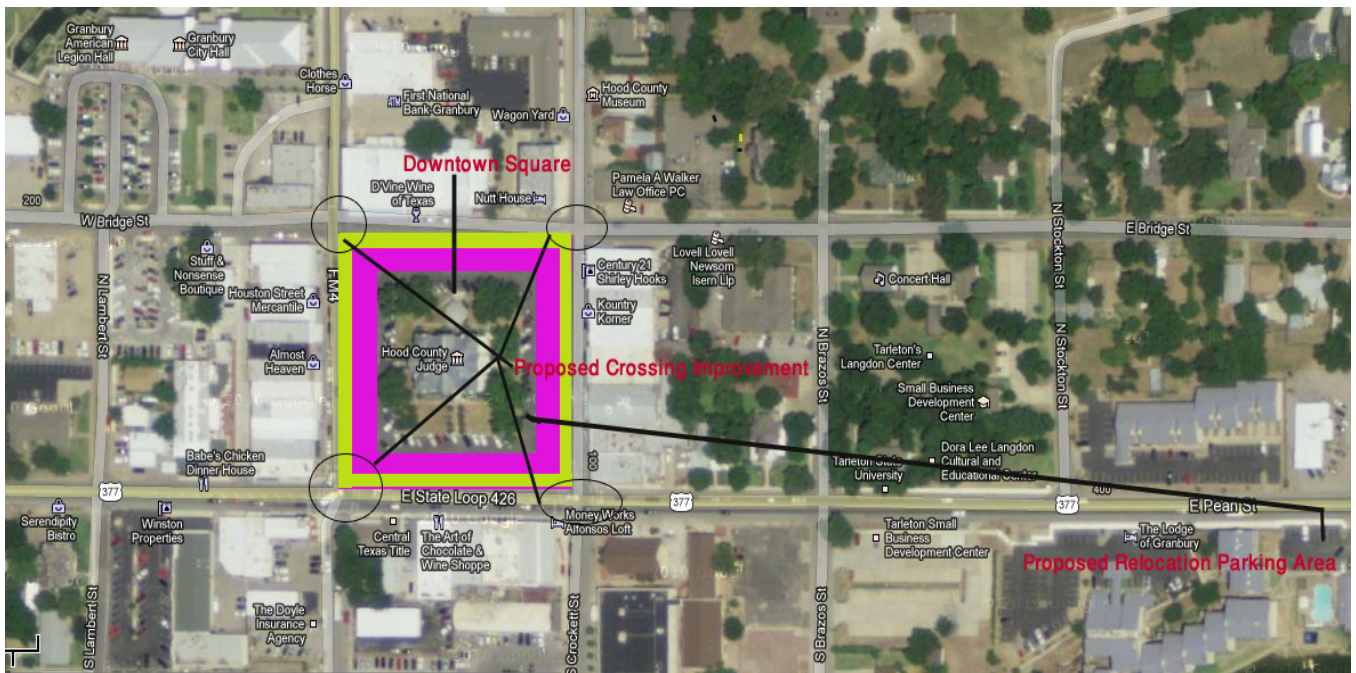


Map 6: Share Path for Pedestrian and Bike

5.8 Downtown Square

5.8.1 Relocation of On-street Parking

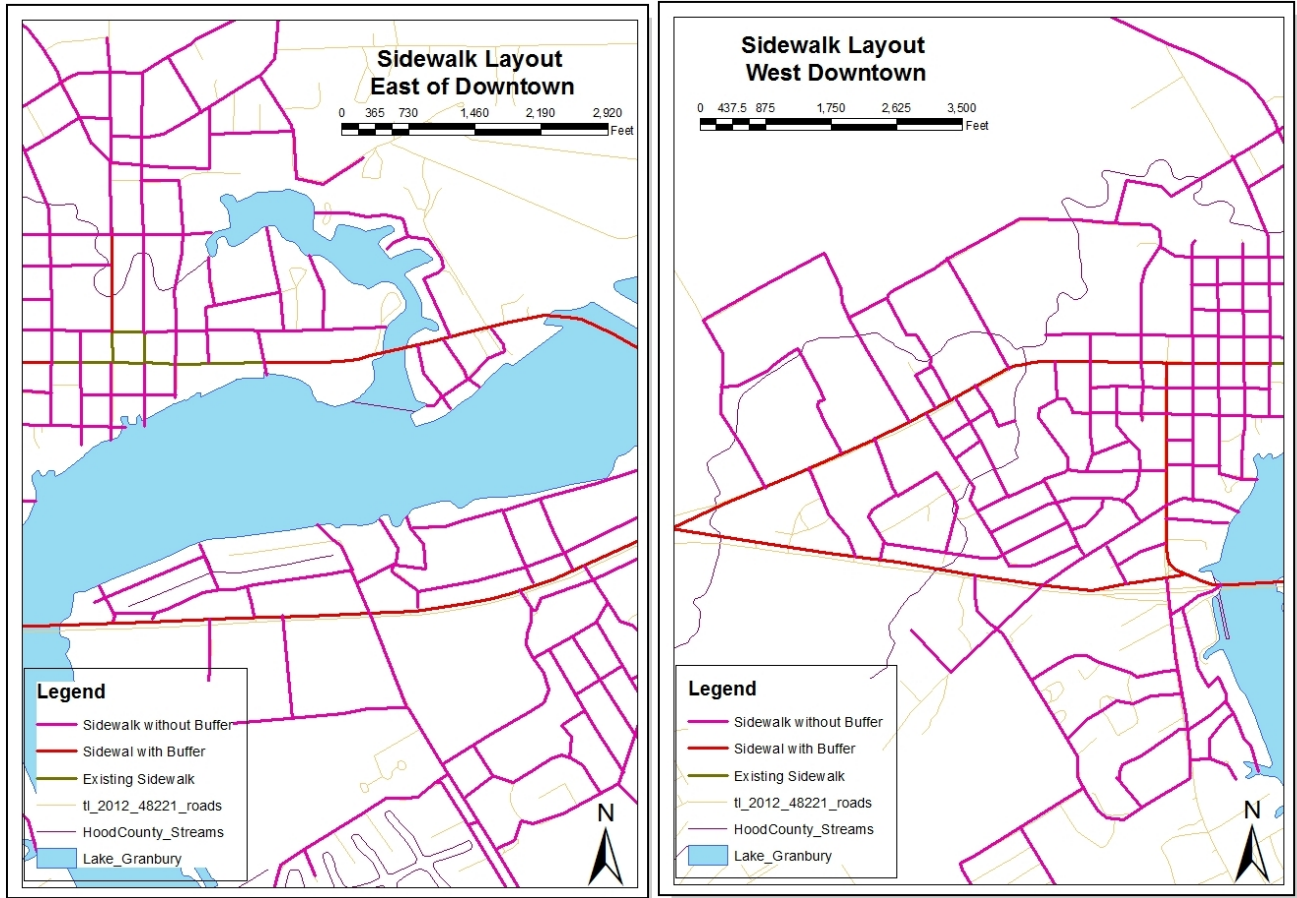
The existing sidewalks in the downtown square should be repaired and extended based on ADA requirement. Now, downtown square has significant space designated for on street parking. On street parking at the downtown square has decreased the visual value of the downtown. In addition, on-street parking has disturbed the pedestrian and consumed a valuable space of the square. Therefore, this parking should be relocated outside the square. I have proposed to relocate this parking near the beach, where, public parking space has been provided, and half of the parking has proposed to relocate near city hall. Relocation of the parking makes easy to adjust all street users (pedestrian, bike and vehicular access) in the existing road in the square.



Picture: Relocation of parking and location of crossing improvement

5.8.2 Crossing Improvement

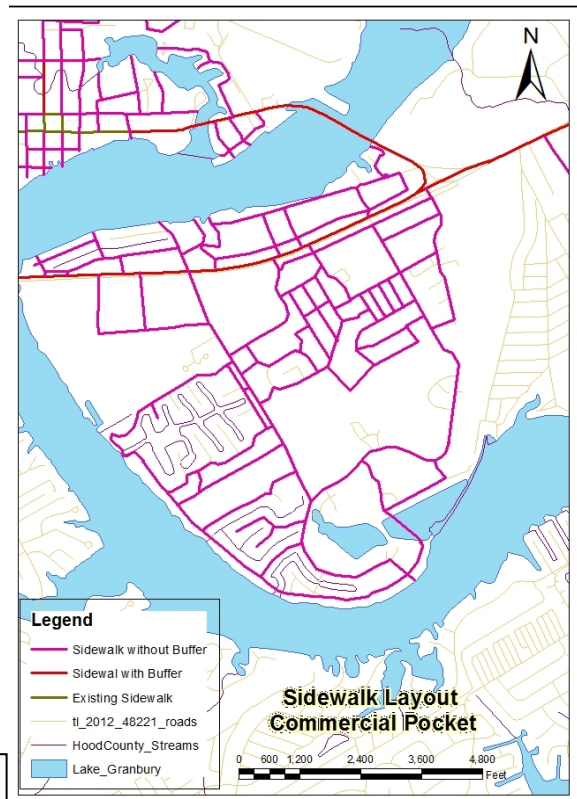
Existing pedestrian crossing is not sufficiently safe for pedestrian. There is no traffic signal for pedestrian crossing. I have proposed a necessary lighting traffic signal (a detail about traffic signal is explained on following paragraph) at all four crossing at the square. In addition, pedestrian cross marking on the road and traffic calming (speed bumps) is necessary.



Map: 7 sidewalk layout

5.9 Commercial Pocket

Commercial pocket is located along the Highway 377, and this pocket is dominated with major grocery shops, pharmacy, and other service (drycleaner, salon, coffee shops) related stores. In addition, there are several hotels and restaurants that are located in this area. This commercial pocket is adjoining with multifamily houses and single family residential houses. Therefore, if there is alternatives travel mode (sidewalks and bike), people do not need to drive for



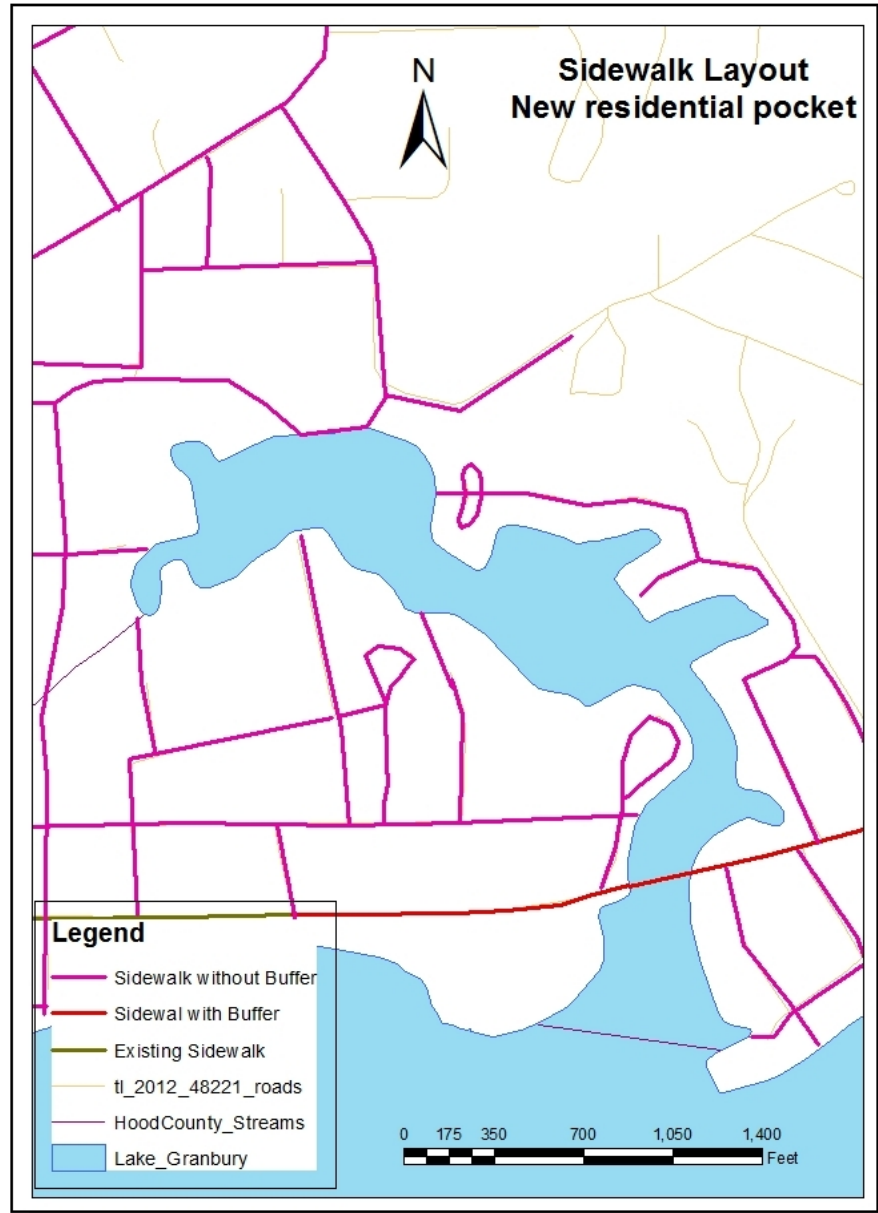
Map: 8 sidewalk layout

short trip to commercial area from the residential area. I have proposed sidewalks and bike lane connections between commercial and residential area (see map 7,12).

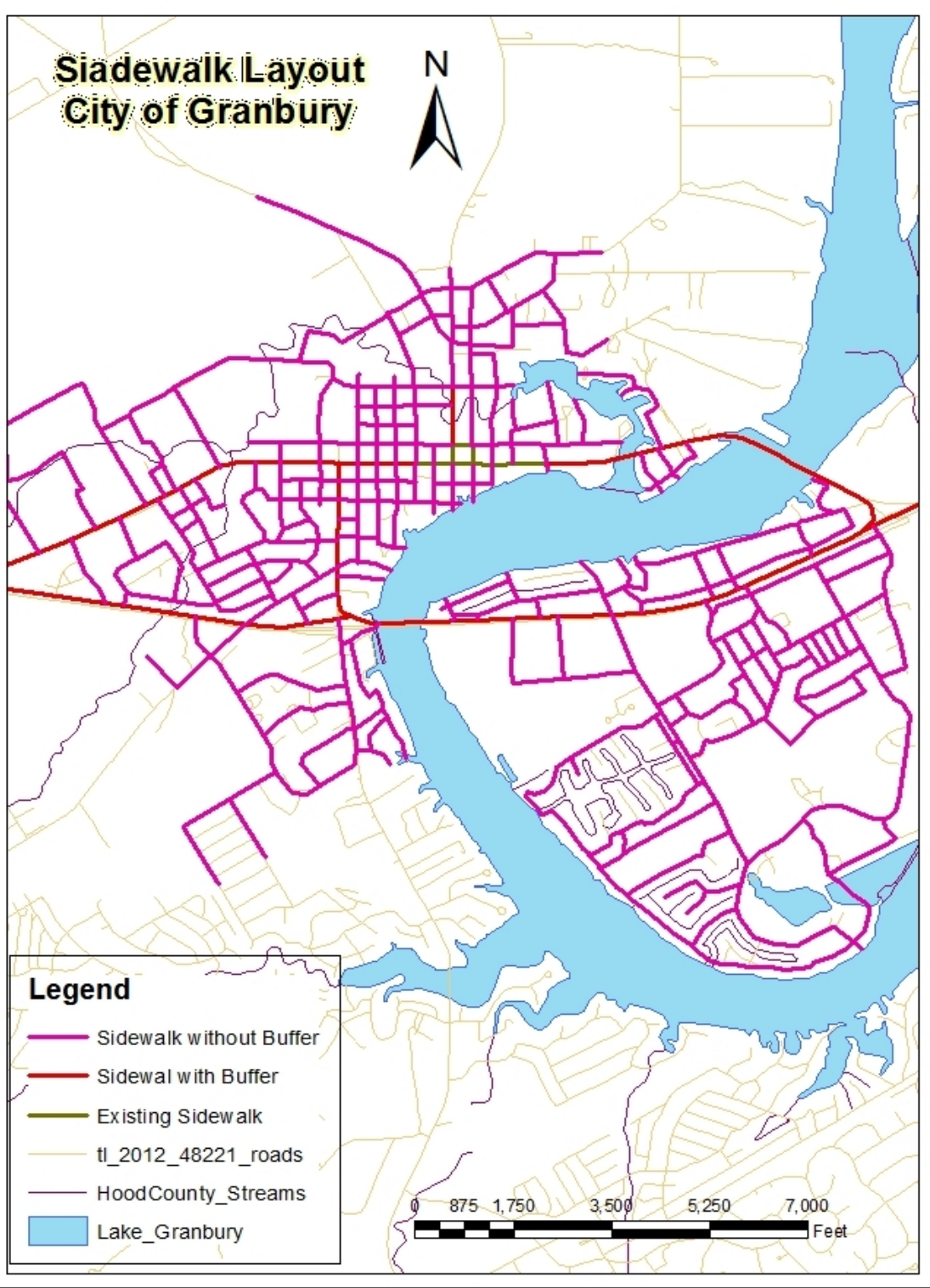
5.10 New Residential

Pockets

There are several new residential pockets are coming up. Even though, city has encouraged building side walk within the new residential area, there are still lack of proper sidewalks connection. Therefore, I have proposed sidewalk improvement in the new residential pockets, and a bike lane connection with commercial area.



Map 9: Sidewalks Layout

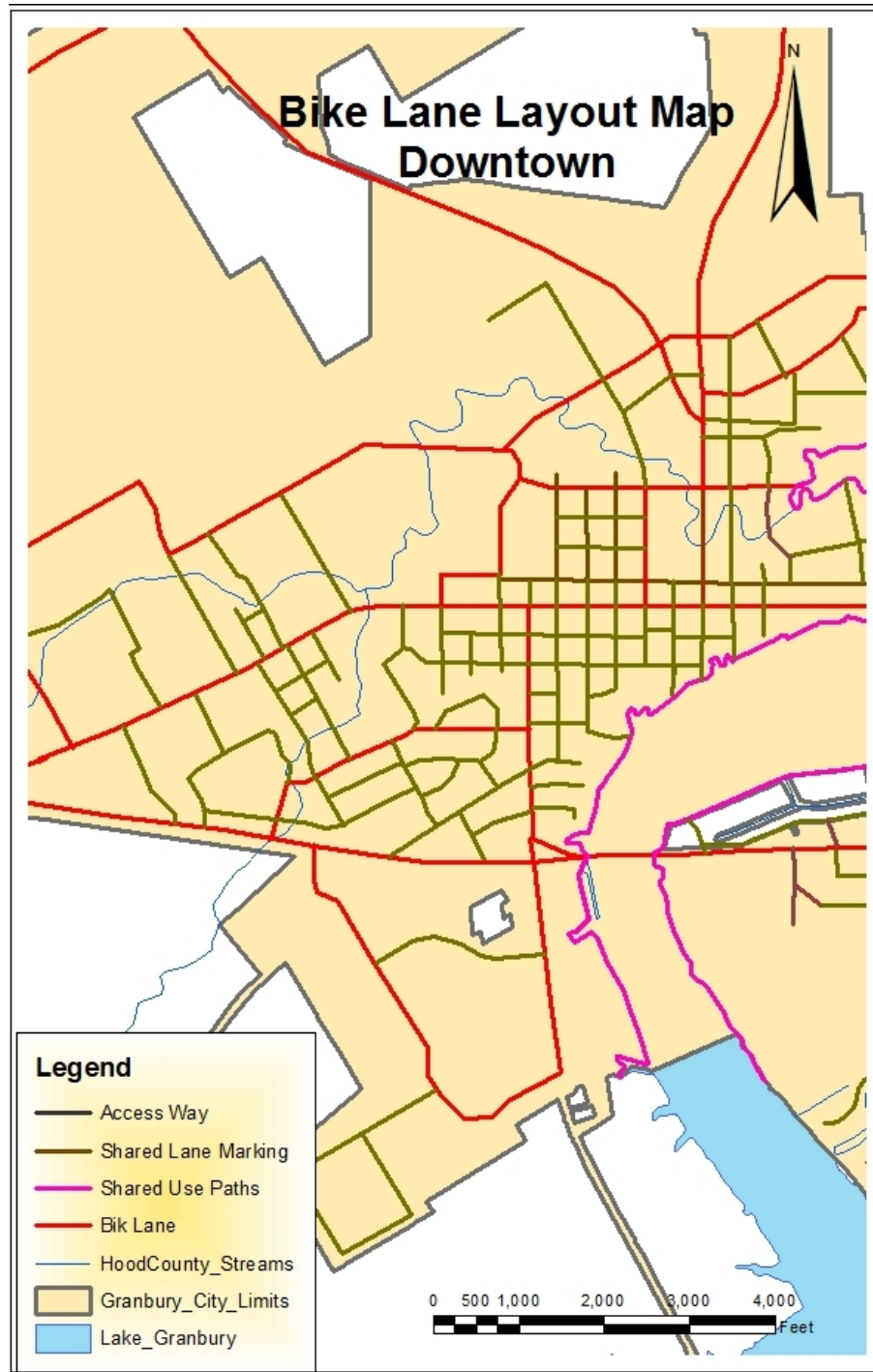


Map 10: Sidewalk Layout

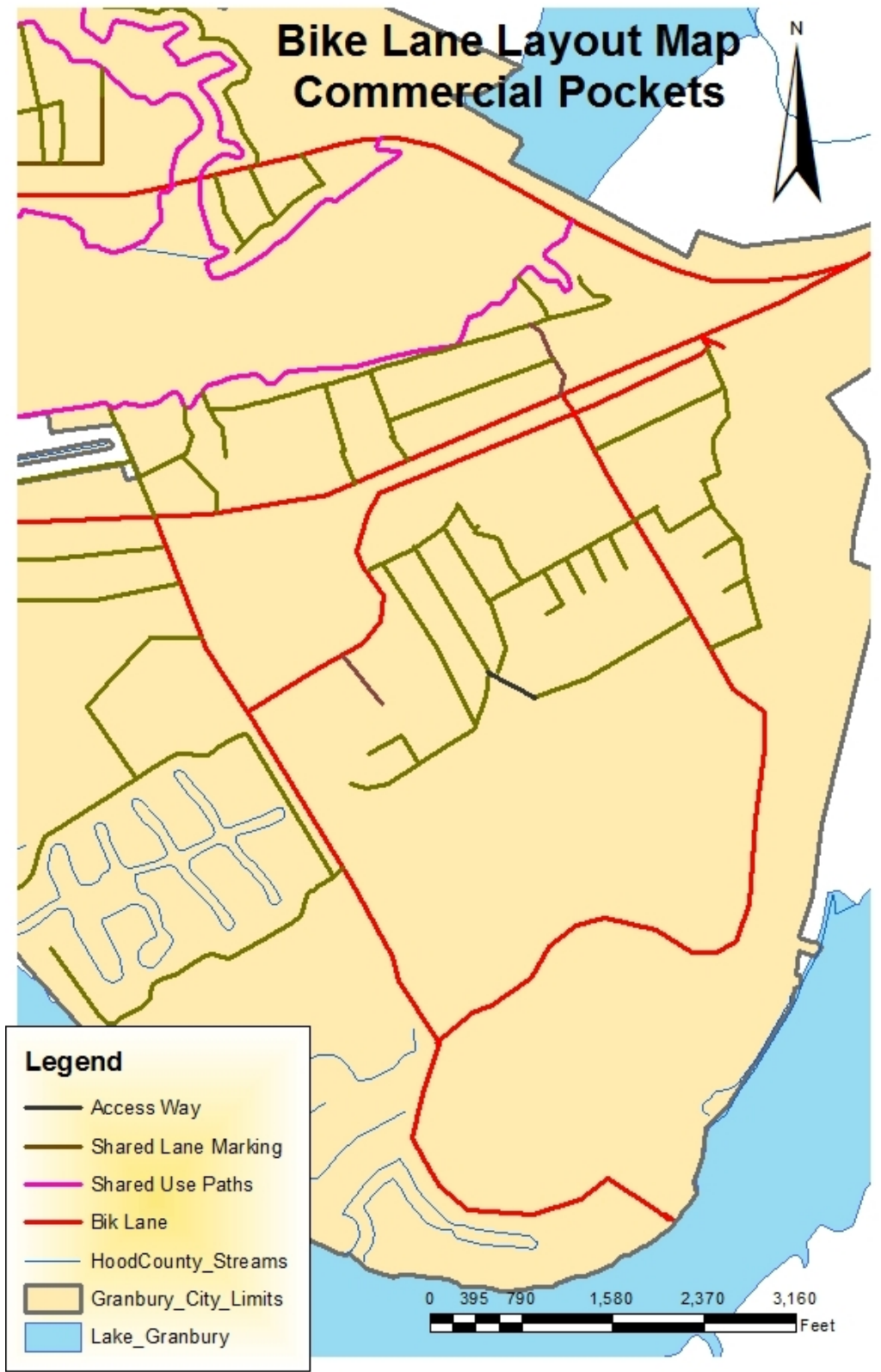
5.13 Bike Lane Maps

As discussed in the previous chapter bike lane is proposed in the downtown area, commercial area, and new residential pockets. A separate bike lane is proposed along the major highways and long distances, and marking paths

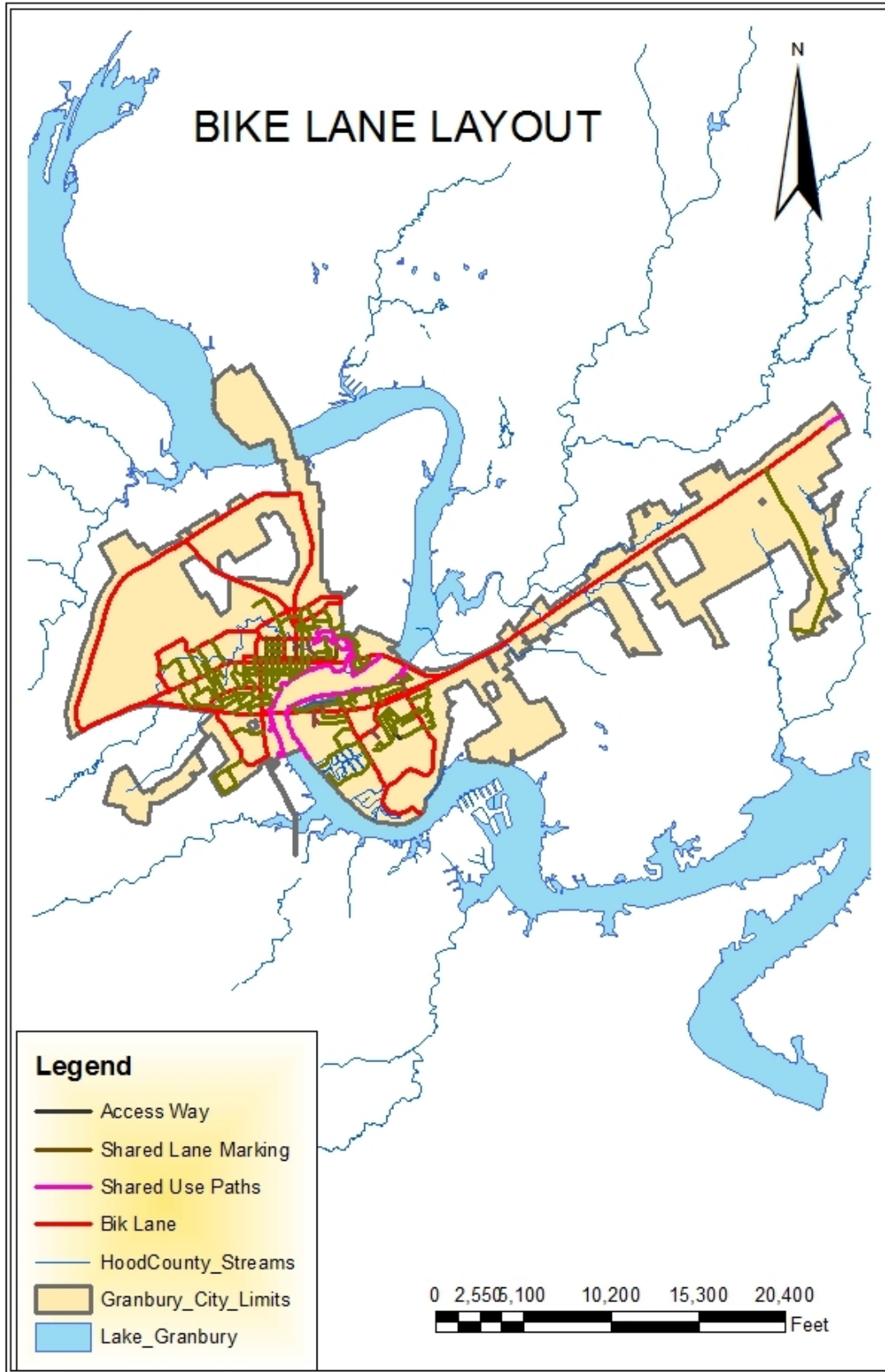
(share with other vehicle) are proposed in most of entire arterial road in residential area. Due to the low volume share lane marking is a good option to save money to build new and separate bike lane.



Map 11: Bike Lane



Map 12: Bike Lane



Map 13: Bike Lane

5.11 Other Requirement

6. 11.1 Traffic Speed Calming

Traffic calming is essential for safety of pedestrian and bike user. There are different types of traffic calming has been using to reduce the traffic speed. For example; speed bumps, speed humps, special design of street and traffic signal. Specially residential and downtown area, where sidewalks have proposed, these types of traffic calming is necessary. Therefore, I have proposed further detail survey and investigation to find out the exact point to build the traffic calming.



Picture 16: Sped bumps before pedestrian crossing (Source: sinoconcept.com)

5.11.2 Traffic Signals

There is no traffic signals related to pedestrian and bike user in the city of Granbury. Even though there are existing sidewalks in downtown square, there is no traffic signal related to pedestrian users. So, I have proposed pedestrian light/non-light signal in each vehicular crossing, obviously, bike signal in bike lane, sharing space and each bike access crossing. Pedestrian and bike signal should be placed based on further detail survey and study.



Picture 17: Pedestrian and bike traffic signal (source: ledtrafficlight.cn)

5.11.3 Education Programs

Education programs are essential to educate people about pedestrian and bike use. Both auto users and pedestrian/bike users should educate equally. Education program can be done with partnering local school, churches and other non-profit organization (house ownership association, neighborhood organization). Distribution of local travel network map (pedestrian and bike), booklet including

awareness, safety tips and traffic signal about pedestrian and bike safety is very important during and after the implementation of the pedestrian and bike plan.

5.12 Implementation Strategies

This pedestrian and bike planning is long term projects and will take a long time to implement. I have proposed following strategy to implement this project.

- Coordination with community organizations (neighborhood organizations), community leaders to aware about the project and encourage and convinced them to involve in the project.
- A detail survey to find out the exact need of improvement, construction, connections of the sidewalks in each proposed area.
- A detail survey to find out the bike route, connection, sharing with other mode of transportation.
- Financial analysis to implement the project in each phase.
- Find out the funding sources (city, region, federal, other)
- Prioritized the project to implement first.

I have proposed to implement downtown area in first phase, commercial pockets in second phase, lake area in third phase and new residential in fourth phase.

7. CONCLUSION

Biking and walking is an important alternatives mode of transportation in 21st century. Due to the increasing environmental concern, changing demands and extra individual expenses in private auto, auto culture has been a costly mode of transportation in the United States. Therefore, there are federal, regional and local level legislations are coming up to encourage walking and biking for shorter trips. Several US cities and states have been implemented bike and pedestrian plan, and its coming up in other cities as well. A city can do a better job with providing alternatives mode of transportation through biking and pedestrian planning. Therefore, this pedestrian and bike planning proposal for the city of Granbury can encourage to implement bike and pedestrian planning in future. This project proposal is based on existing legislation and existing condition of the city. Even though this project proposal is an integrated proposal for walking and biking, a separate physical map for bike and pedestrian planning has proposed to make a clear map. This proposal also has recommended the types of sidewalks and bike facilities with its size. Different types of sidewalks and bikes lanes have proposed based on traffic volume and locations of the city. In addition this proposal has also recommended traffic calming, traffic signal and education program to implement this project. Implementation strategies will help to implement the proposal.

BIBLIOGRAPHY

FHWA, 1994. *Bicycle and Pedestrian Transportation Planning Guidance*. <http://www.fhwa.dot.gov>

(Accessed, September, 2012)

FHWA, 2000. *A Supplementary Design Guidance for Bicycle and Pedestrian Project*.

<http://www.fhwa.dot.gov> (Accessed, September, 2012)

FHWA, 2009. *How to develop a pedestrian safety action plan*. <http://www.fhwa.dot.gov> (Accessed,

September 2012)

NCTCOG, 2011. *Mobility 35*. www.nctcog.org (Accessed, September 2012)

Ridgway et al., 2009. *Transportation Planning Handbook. Pedestrian and bicycle Planning*, Institutes of Transportation Engineers, Washington DC, USA.

The city of Portland, 1998. *Pedestrian Master Plan*. <http://www.portlandoregon.gov>. (Accessed, September, 2012).

The city of Sacramento, 2006. *Sacramento Pedestrian Master Plan*. <http://www.cityofsacramento.org> (Accessed, September, 2012)

The city of Granbury, 2008. *Comprehensive plan of the city*. www.granbury.gov (Accessed, September, 2012).

The city of Granbury, 2012. *Demographic Data*. <http://www.city-data.com>. (Accessed October, 2012)

US Census Bureau, 2010. *Demographic data*. www.census.gov (Accessed October, 2012)