I, Jocelyn M Gibson, hereby submit this original work as part of the requirements for the degree of Master of Community Planning in Community Planning.

It is entitled:
The Application of Transit Development Zones in Bangkok: The Laksi Case Study

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The Application of Transit Development Zones in
Bangkok: The Laksi Case Study

A thesis submitted to the
Graduate School
of the University of Cincinnati
in partial fulfillment of the
requirements for the degree of

MASTER OF COMMUNITY PLANNING
in the School of Planning at the College of
Design, Art, Architecture and Planning

by

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B.A. University of Cincinnati 2006

December 2011

Committee Chair: David Edelman, Ph.D.
Abstract

The debate about sustainable forms of transportation has received more attention in recent years as oil reserves are recognized as finite, and carbon emissions contribute to climate change. In Developing Countries (DCs), the rate of automobile ownership is ever increasing, while road capacities remain static, or increase at a much lesser rate. Given that public transportation is largely road-based, this is leading to peak hour gridlock in major cities in the developing world.

Bangkok is no exception, and is notorious for traffic congestion. The government recognizes this problem, and has so far committed to investing in a 247 kilometer expansion of the Mass Rapid Transit (MRT) system. The construction of the system will not in itself ensure that it will be used, or will have the desired effects on congestion.

Transit Development Zones (TDZ) have proven effective in other large, dense Asian cities. This is a concept that, when applied, coordinates land uses and high density developments around largely MRT nodes or transit stations. This paper will evaluate the TDZ concept, and apply it to a study area, the Laksi Sub-District, in Bangkok where a planned transit stop will be located. The study area chosen is a high profile location where a large Government Center was built in 2007.

The application of the TDZ concept throughout Bangkok will optimally lead to higher user patronage, walkable places near residences where people can shop, find entertainment and gather as communities. The Laksi case study will hopefully be indicative of this.
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## Acronyms

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<th>Full Form</th>
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<tr>
<td>ADB</td>
<td>Asian Development Bank</td>
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<td>BMA</td>
<td>Bangkok Metropolitan Administration</td>
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<td>BMA</td>
<td>Bangkok Metropolitan Area</td>
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<tr>
<td>BRT</td>
<td>Bus Rapid Transit</td>
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<tr>
<td>CBD</td>
<td>Central Business District</td>
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<td>GTZ</td>
<td>Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation)</td>
</tr>
<tr>
<td>IGES</td>
<td>Institute for Global Environmental Strategies</td>
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<tr>
<td>MRT</td>
<td>Mass Rapid Transit</td>
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<tr>
<td>NESDB</td>
<td>National Economic and Social Development Board</td>
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<tr>
<td>OCMLT</td>
<td>Office of the Commission for the Management of Land Traffic</td>
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<tr>
<td>OTP</td>
<td>Office of Transport and Traffic Policy and Planning</td>
</tr>
<tr>
<td>PCD</td>
<td>Pollution Control Department</td>
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<tr>
<td>PWD</td>
<td>Public Works Department</td>
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<tr>
<td>SRT</td>
<td>State Railway of Thailand</td>
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<tr>
<td>TDM</td>
<td>Transportation Demand Management</td>
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<td>TDZ</td>
<td>Transit Development Zone</td>
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<td>TOD</td>
<td>Transit Oriented Development</td>
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<tr>
<td>UNESCAP</td>
<td>United Nations Economic and Social Commission for Asia and the Pacific</td>
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<tr>
<td>URMAP</td>
<td>Urban Rail Master Plan</td>
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<td>VTPI</td>
<td>Victoria Transport Policy Institute</td>
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Chapter 1: Introduction

Bangkok is the largest city in Southeast Asia, and is Thailand’s economic engine. It is considered to be a primate city due to its concentration of population and economic activities relative to secondary cities in Thailand. A primate city is several times larger than the next largest city and dominates political and economic life in a particular country (Surinder, 1964). Bangkok is internationally recognized as a severely congested city (Gwilliam, 2002) and although many consultants, development organizations and the City’s own transportation and planning departments have been contracted to inform transportation policy or undertake transportation projects, for various reasons these initiatives have had little effect on the crippling traffic congestion.

Large-scale highway construction has been the predominant form of new transportation infrastructure provision in the past few decades. Private automobile ownership continues to increase at a greater pace than new road construction; therefore, road construction does little to eradicate congestion. Radial highways have opened up once rural agricultural areas for development. Suburbanites in these peripheral areas rely on highways for access to the city, and secondary arterial roads are few. Therefore, peak hour traffic that is highly concentrated on highways is reduced to a crawl. Outside of the central core, public transit is entirely road-based; therefore, the many low-income bus or mini-bus passengers must endure the same congestion as private automobiles (Suthiranart, 2001).
Automobile dependency and massive congestion are responsible for a host of negative economic, environmental and social repercussions throughout the entire Bangkok Metropolitan Area.

The introductory paragraphs have given a very brief overview of the transportation issues facing Bangkok today. Automobile dependence, sprawl and congestion are faced in some measure by both developed and developing countries alike, and the problem therein is understanding the kinds of sustainable solutions that will be feasible within the context of the Bangkok urban environment.

This research is operating on a fundamental belief about sustainable transportation - that mobility and accessibility are inextricably linked to urban form and not only transportation infrastructure. Much of the research in this area advocates compact urban layouts where many uses can be found all within close proximity (Boonlua, 2007). The logic behind this is that people can live, work and play within a smaller physical area, thereby reducing travel demand. Another important consideration is that when people live at high densities within an urban setting, it is more supportive of public transit (Williams, 2005).
1.1 Problem Statement

Over half of the world’s megacities are now in Asia (Gwilliam, 2002). Some cities, such as Seoul, Singapore and Hong Kong have managed to evade automobile dependence through a mix of public transport provision and complimentary land use reform. Other cities, such as Jakarta, Manila and Bangkok are struggling with budget shortfalls, a lack of institutional capacity and political drivers to achieve the kind of transport and land use reforms that have occurred in the former examples. New challenges confront megacities in many developing countries as they now have to accommodate increasingly dispersed populations with adequate transportation infrastructure. Asia will be host to the largest urban population boom, with 1 billion new urban residents, and an additional 100 cities will have more than one million residents (Bangkok Post, 2011). Thus far, in most cases new transportation infrastructure has largely come in the form of highway building.

In Bangkok, transportation infrastructure in recent decades has been primarily focused on the facilitation and management of automobile traffic. This was the case until the Skytrain and underground system were constructed and opened in 1999 and 2002 (there are two skytrain lines and one MRT underground line) to relieve some of the traffic pressures within the inner core. The largest share of public transportation is provided in the form of public bus, or private mini-bus. The average public transportation trip is 64 minutes and significantly increases if any transfers are required (Lobyam, 2006, p. 5). In sum, only those who walk or live close to work or mass transit routes have the opportunity to circumvent traffic, and those living outside the central
core have access to generally only road-based transportation. Thais will own a private motor vehicle, take a public bus, minibus or motorcycle taxi and generally prefer not to walk or cycle, if it can be avoided (Suthiranart, 2001).

Urban form is increasingly characterized by “car-based developments” moving further into surrounding agricultural land (Moor & Rees, 2000, p. 285). It is found that development in the outer areas of Bangkok resembles suburbanization in the west as there are an increasing number of large single-family housing developments (although regulations do allow a mix of uses) and limited access to arterial roads. These families, similar to suburban residents in North America, are dependent on vehicles to get to other urban areas (Chirapiwat, 2005). Bangkok has grown at a phenomenal rate, and many developments have spread across flood-prone agricultural land (Moor & Rees, 2000, p. 285).

Long commutes and bottlenecks for even short trips are affecting the quality of life of Bangkok residents through severe environmental degradation, loss of quality time with family and economic losses. The cost of congestion, not including environmental costs, is roughly USD $6.52 billion per year. The largest proportion of this, USD $4.64 billion, is attributed to commuter’s time loss (Lobyem, 2006, p. 5).
1.2 Research Question and Research Objectives

It is known that the topic of this research is a rather large, complex and interconnected problem. Thus, this research will specifically assess whether it is possible to apply the concept of Transit Development Zones (TDZ) within the Bangkok study area of Laksi; it is a concept which applies land use and transportation integration in an already built-up area, with a particular focus on access to mass transit. It has been found to reduce car dependence and the number and distance of trips for urban populations. The area of Laksi has been chosen due to its appropriateness for the concept application. There are five main TDZ characteristics – density, mix of use, size of neighborhood, transportation infrastructure and connectivity – most of which Laksi already fulfills. This concept has been applied to other megacities in Asia and has proven to be an effective tool to achieve sustainable transportation (Boonlua 2007).

The objectives of this research are as follows:

1. To understand the context of urban transportation in Bangkok;
2. To explore the concept of urban transportation, especially within the context of megacities in developing countries;
3. To apply the Transportation Development Zone concept to the Laksi study area and focus on area-specific recommendations to maximize accessibility.

The research question, then, is twofold. First can the TDZ concept be successfully applied in Laksi, and if so, can this be duplicated elsewhere in Bangkok?
The structure of the document will be as follows:

- The second chapter will outline the general patterns of transportation planning in developing countries before providing an in-depth context analysis of the state of transportation planning in Bangkok;
- The third chapter explores sustainable transportation and the Transit Development Zone concept;
- The fourth chapter outlines the methodology used to analyze Laksi’s appropriateness for TDZ application;
- The fifth chapter is the analysis of Laksi as TDZ; the study area will be broken down into focus areas for analysis;
- The sixth chapter concludes the analysis, draws conclusions about the wider application of the TDZ concept in Bangkok and gives practical recommendations derived from the analysis.
Chapter 2: Transportation Planning in Bangkok

2.1 Urban Transportation in Developing Countries

Many of the problems that are facing Bangkok are common to large cities in developing countries. Although the context is different in every location, the problems that have arisen from the large-scale adoption of the automobile and road-based transportation are common throughout the world, in both developed and developing countries alike. This section will introduce the transportation-related problems that are currently facing developing countries.

2.1.1 Urbanization

In almost all developing countries, rural to urban migration has been occurring at staggering rates over past decades. Primate cities have formed in many developing countries, and large proportions of national population are concentrated in one metropolitan region, as is the case with Bangkok. It is estimated that by 2020 in Asia “the proportion of urban residents will have increased by 50%, with the urban population reaching 2 billion. At least 153 cities in Asia will have a population exceeding 1 million persons” (Jraiw, 2003). Internal migration is endemic in developing countries where rural populations come to cities in search of employment, a higher standard of living and educational opportunities (GTZ, 2002).

The economies of these megacities and primate cities grow disproportionately when compared to the rest of the country as rural populations and investment flood
into urban areas; “In most countries the urban sector accounts for at least 50% of GNP; in some countries that number is over 70 percent” (Gwilliam, 2002, p. 22).

As a country’s overall economy grows, personal incomes grow accordingly. As urban populations have more disposable income, car ownership rises at a rate that far exceeds the construction of new roads; “The growth of urban road space with income is likely to be slower than that of traffic volume with income” (Gwilliam, 2002, p. 36). On average, the number of motor vehicles present in megacities is doubling every five years (Cervero & Sperling, 1998).

At the same time, many low and middle-income residents move to the periphery of the city as they are priced out of land in the inner city. This lends itself to the creation of squatter settlements, and also forces more people to commute from fringe areas. Additionally, developers capitalize on cheap or spacious lots on the periphery and market subdivisions to middle and higher income households. Weak land use regulation and policy enforcement and the inefficient use of land in fringe areas can enhance this problem. The movement of people in and out of the city during an average workday is often more than the road network can handle, and traffic slows to a halt during peak hours. This is especially pronounced in Bangkok where land has been inefficiently utilized, and mixed urban and rural uses extend along highways for 30 or 40 kilometers in an outward direction. Bangkok showed consistently rising densities between 5 and 25 kilometers from the city from 1970 onward (Murakami, Zain, Takeushi, & Yokota, 2005). Development patterns are not concentric, but markedly linear.
The urbanization of a country’s population is not in itself negative, but rather the effects that continuing urbanization can have if it occurs in unmanaged ways are. It has actually been found that city dwellers often consume less energy per capita, walk more and enjoy a vibrant social setting (Chairatananon, 2006). However, the result of excessive or an unmanaged concentration of people can come with excessive costs, such as traffic accidents, health costs from exposure to high levels of air and water pollution, time lost to long commutes and environmental degradation that stretches beyond the city boundaries. In developing countries, traffic curbing measures and transit oriented development are growing in popularity as effective ways of reducing automobile dependency (GTZ, 2002).

2.1.2 Roads and Traffic Curbing Strategies

Most urban transport, whether it is public or private, motorized or non-motorized, uses the road system. Traffic congestion has become a way of life for commuters in many major cities, in both developed and developing countries. Traffic relief strategies can address either the supply or demand-side. The supply-side includes new construction, traffic system management, improved technology and alternative modes of transportation. Demand-side management includes policy measures, such as fuel pricing, parking supply/fees, regulatory mechanisms, and also carpooling, HOV lanes and ownership restriction. Barriers to the implementation of the aforementioned strategies include inadequate inter-agency coordination, no established policy, budget shortfalls and insufficient information (Flora, 1998).
As stated, road networks often cannot meet the demand from private vehicles. For example, in the United States, there are roughly 25,300 kilometers of roads per million inhabitants, whereas there are about 1,100 kilometers per million in China and 1,800 kilometers per million in India. Traffic volume per square kilometer is estimated to be 80% greater in dense Asian cities than in North America, which results in lower average roadway speeds – 52 mph in the United States urban areas versus 26 mph in Asian urban areas. This is all within the context of persistent, increasing automobile ownership (Jraiw, 2003).

Regardless of the economic significance of the system of roads, it is often managed in a fragmented or uncoordinated way. Even once new roads are built, maintenance is often neglected. A common problem is a dearth of local distribution capacity, given that the main focus is often on expressways and major ring roads (Gwilliam, 2002). Roadways should be supplied using a hierarchy format to manage different functions, which is outlined in the flow chart derived from information in the World Bank publication *Cities on the Move: A World Bank Urban Transport Strategy Review*.

**Figure 1: Typical Functional Classification of Road and Path Networks**

(Pwilliam, 2002)
2.1.3 Public Transportation

The promotion of public transportation is an effective means to curb an urban population’s reliance on motor vehicles. Public transport is delineated based on mode, technology used and the type of service provided, with the most basic distinction between road- and rail-based transport. In developing countries, road-based transport can take varying forms (like shared taxi, minibus and bus), and public transport is usually comprised of some mix of road-based solutions. One problem with road-based services is that they are subject to enduring the same traffic congestion as private vehicles unless there are High Occupancy Vehicle (HOV) lanes or bus lanes. Although public bus services are usually provided by the public sector, there has been a shift toward private sector service delivery. In some developing country contexts, service delivery from the private sector was found to be cheaper and more efficient, with fewer vehicles off the road at a time, higher passenger load factors, quicker turnarounds and less overstaffing (Simon, 1996).

Other large, dense Asian cities have found that efficient mass transit systems are integral to a well functioning transportation system. Hong Kong, Tokyo and Singapore all have robust mass transit systems, particularly rail-based, and have avoided motorization and automobile dependency within their populations. Urban rail is an exceedingly viable solution in particular situations where a certain threshold of corridor demand has been reached (Flora, 1998). Urban rail can carry a large number of passengers, both in sheer numbers and in frequency. However, many barriers exist in the construction of rail systems in CBDs and inner cities, especially in such countries.
Inner cities and CBDs in developing countries tend to be the densest part of the urban area, and the construction of rail systems requires the clearing of extensive swathes of dense urban land. The cost of expropriating land varies, and can contribute significantly to the cost of a project. Urban rail can come in the form of conventional railways, metros and light rail transit (Simon, 1996).

Financing is a large barrier to the introduction of mass rapid transit systems; in developing countries, the “decline in both the quality and quantity of public transport has resulted partly from the absence or disappearance of a secure fiscal basis for support” (Gwilliam, 2002). This is especially true for urban rail-based solutions, which are more expensive than road-based solutions, and can consequently put strain on a city’s budget.

2.1.4 Non-Motorized Transportation

Non-motorized forms of transportation such as walking and biking are often overlooked in their importance. A person’s decision to walk is usually based on the load they must carry with them, trip purpose and distance (data taken from select developing countries). It has been found that the average walk to a destination for city dwellers is between 1.2 and 1.7 kilometers. A person’s decision to cycle is also based on similar criteria; however, average trips are between 2 and 8 kilometers (Simon, 1996). Deterrents to walking and cycling are unsafe facilities and pollution. Without proper cross walks or bike lanes, pedestrians and cyclists can account for a disproportionately large share of road accidents and injuries (Simon, 1996).
2.1.5 Urban Form

With regard to urban form, developing countries are following a spatial development trajectory similar to that in developed countries, and their inhabitants are dispersing over much larger metropolitan areas. Internal migration patterns follow the dynamic of rural to urban and also intra-urban migration, and it is often the poorest residents that are forced to live at the periphery and spend a significant proportion of their income on travel costs. The widely held belief that urban fringe residents are primarily low-income and rural-to-urban migrants has however been challenged in recent years; a study of Jakarta, Santiago and Bangkok concluded that many residents in peripheral areas are middle income and have relocated from the central city or other fringe areas. This study found that the urban fringes were more heterogeneous than previous research had indicated (Browder, Bohland, & Scarpaci, 1995). It also seems intuitive that the incomes of those purchasing new homes in subdivisions and gated communities would be relatively high.

When cities in the developed world were experiencing increased economic and population growth, it occurred through very high city densities. For example, the City of London was at its peak with 9 million people in the 1930s with little sprawl. There are now 7 million in the City and a total of 12 million in the greater metropolitan area. In developing countries, megacity populations are still increasing at speedy rates, but sprawl has already taken hold, as seen in Bangkok (Jones, 2000). The trend of outward growth fueled by more widespread automobile access is further exacerbated by a leapfrog development or the creation of superblocks. Superblocks are tracts of land
bounded by highways with adjacent higher density development, and much less dense
development occurring within the interior of the block. This leads to tracts of vacant
land existing within the city boundaries, while land with highway access is being
developed further outward (Sintusingha, 2006).

A potential solution could be sustainable compaction, where accessibility is high for
all segments of the population. Achieving compactness in megacities will involve
appropriate policy to plan higher densities/infill development, mixed-use development
in central areas and in urban extensions along corridors that are served by public
transport. When jobs and diverse uses are found within a smaller area, trips are easily
combined.

Sustainable compaction can be induced through various tools available to policy-
makers. It has been found that “public ownership of building land is potentially the
most powerful tool for sustainable development. It can allow the municipality to bank
and release land for development in response to market forces” (Jones, 2000, p. 49).
Other tools to achieve sustainable compaction include local development taxes, floor
space bonuses combined with plot ratio planning requirements, and site development
briefs.

2.2 The Bangkok Context

The Bangkok urban area is expanding into the 5 neighbouring provinces of Samut
Prakarn, Samut Sakhorn, Nakhon Pathom, Nonthaburi and Pathum Thani, which
together make up the Bangkok Metropolitan Region (BMR). The maps below display the
Bangkok Metropolitan Area, which falls under the purview of the Bangkok Metropolitan
Administration and the broader Bangkok Metropolitan Region, which includes neighboring provinces that have their own governing bodies.

Figure 2: Bangkok Metropolitan Area and the Bangkok Metropolitan Region

According to the Bangkok Metropolitan Administration, Bangkok’s total area is 1,568.7 km² and consists of 50 districts and 154 sub-districts. The official density of the city is roughly 4,038 people per km². (Vajiranivesa, 2008). The entire region covers an area of 7,758 km². Although the overall density of the metropolitan area is low when compared to other developing countries, land within a 10km radius of the city center has a much higher density than the average – 14,738 people per km² (Boonlua, 2007). As of 2007, the population of Bangkok province was around 10,061,726; however, recent estimates indicate the population to be closer to 12,000,000. Due to undocumented immigrants and migrant or seasonal workers, the exact population is difficult to ascertain (Vajiranivesa, 2008). The figure below gives a visual representation of how the population has grown from 1950 onward.
Rapid population growth, in addition to long term economic growth, has culminated in unmanageable automobile ownership and congestion; as of 2002, weekday traffic speeds in Bangkok were reported to average 10 kilometers per hour (km/h) or less in Bangkok (Gwilliam, 2002). The next section will deal with how the city got to this point, and how the system has evolved into its present form.

### 2.2.1 A Brief History

This history will begin with the point at which Bangkok became a city whose previous circulatory system of canal-based travel was superseded by a system of roads. The Litchfield Plan, which was created by an American consulting firm, Litchfield, Whiting, Browne and Associates in 1960, emphasized a shift toward road building. Although the plan was not officially adopted, some American funding was contributed
to realize some of the goals of the plan. By the 1970s, only the main canals were still in existence. Homes were shifted from locations along the canals, to along roadways (Askew, 2002).

The initial highways served to bring goods to and from Bangkok, which was the center of trade, and connected the capital with other major cities. The inner city became a magnet for foreign investment, and exports and the service industry grew rapidly as well. Expensive and scarce land in the central core was used quite efficiently by vertical construction; however, the government could not afford infrastructure provision for the rapidly developing new structures. Consequently, local streets, called ‘sois’ are narrow, broken and difficult to navigate (Chirapiwat, 2005).

In 1962, the government began creating National Economic and Social Development (NESD) Plans that were to guide the development of the country, and focused largely on economic development and road construction in earlier periods. These plans would sometimes have a separate component applying to transportation. The first comprehensive transportation document was part of the Third Plan; the German Agency for Technical Cooperation created a transportation study for Bangkok in 1971. The recommendations made in this plan called for mass transit investment, polycentric development around the city and major expressways under a policy that would favor public transportation. Unfortunately, the only component of the aforementioned recommendations that came to fruition was the expressway construction (Rujopakarn, 2003).
Many of the NESD plans after this set out goals to implement better and more extensive bus services, build more primary and secondary roads in the outer area, expand the expressway network, complete missing road links, provide bus-ways, mass transit lines and some traffic management measures in the city center, however delay or failure in implementation was always noted (Rujopakarn, 2003).

Commuters began living in outer areas and driving into the city at increasing rates. Bridges over the Chao Phraya – Rama IV, Krung Thonburi Bridge, the Pra Pin Krao Bridge, the Praputayadfa Bridge and the Krung Thep Bridge facilitated the connection between central area and suburbs. The river had previously acted as a barrier to large-scale development in the western reaches of the city. The bridges over the Chao Phraya paved the way for the development into the relatively untouched western and northern fringes. For those who could not afford to live in the central city, or preferred single-detached homes, commuting became more viable (Chirapiwat, 2005).

At this point, demographics also affected commuting rates:

- In the period from 1960 to 1980, the number of school aged children was steadily increasing;
- Women were entering the workforce at higher rates;
- The proportion of the population employed in the agricultural sector has been steadily decreasing for many decades;
- The need for skilled workers has been steadily rising, in Bangkok predominantly;
• As the need for skilled workers increased, so did university enrollment. In 1990, half of the universities students in the country could be found in Bangkok (Punpueng, 1999);

• Average household sizes steadily decreased in the BMA from 6.32 people in 1960 to 3.9 in 1995 (Suthiranart, 2001, p. 42).

All of these demographic factors were increasing the number of commuters in the city. With regard to school children, Bangkok has no busing system for schools, which means that parents generally drive their children to school, further increasing the number of private vehicles on the road (Punpueng, 1999).

As these new dynamics began to affect the way people moved within the city, many plans were created to guide transportation in this post-canal period: the Bangkok Transportation Study (1971-1975), the Short Term Urban Transport Review (1984-1985) and the Seventh Plan for Urban and Regional Transport. Although many of these plans proposed various ideas for relieving congestion, planning, aside from highway building, was generally not followed through to implementation stages. Some congestion could be relieved by this means, but this solution proved to be a short-term band-aid for a complex problem (Suthiranart, 2001).

URMAP, or the Urban Rail Transportation Master Plan is the initial plan aimed at providing widespread mass transit and commuter rail lines, and was released in 2000 by the Office of Commission for Management of Land Transport (OCMLT). This plan proposed to develop 5 new transit lines for a total distance of 376 kilometers. This was the main effort to revive the hope for mass transit systems after the failed Hopewell
Project, an elevated train system initiated in 1990 that was halted in 1997 when the Asian Financial Crisis hit. The Hopewell project has already been under construction at the time the project was shut down, and concrete pillars that were to support the tracks and train can be seen throughout the city (Chirapiwat, 2005).

1999 marked the year of the first mass transit system in Bangkok with the opening of Bangkok’s Skytrain system, which includes two lines and in 2004, one line of underground subway system was opened. These initiatives have successfully reduced some congestion within the urban core; however, it is evident from average traffic speed figures that there is still much work to be done to achieve access to mass transit on a larger scale. An airport rail link began operation in August of 2010. The rail link consists of two services – one express service, which is non-stop and more expensive, and a regular service that makes 6 stops (SRT, 2010). The State Railway of Thailand (SRT) does provide a commuter line, but service is infrequent and unreliable. The average number of passengers per day on this line is 45,000 (Boonlua, 2007).

In 2004, URMAP was reviewed and adapted to its current form, under the Study Project for Conversion or Urban Rail Transportation Master Plan in Bangkok and Vicinity to Implementation (URMAP 2). This new plan consists of 7 lines for a total of 291 km, which would consist of the existing 44 km and an additional 247 km. The construction of several lines under this plan is currently underway.
2.2.2 Land Use Effects

This section will discuss planning efforts and responses to sprawl in the Bangkok Metropolitan Region.

2.2.2.1 The Decentralization of Growth and Regional Planning

As stated previously, there have been many efforts to promote polycentric or sub-center growth as well as the growth of secondary cities. Decentralization and the growth of secondary cities were intended to relieve overcrowding and growth pressures in Bangkok. Most reviews of this policy state that it has been unsuccessful. However, seemingly little literature exists in the way of comprehensive policy evaluation. Average traffic speeds, and their unimproved status, indicate that even if there has been some sub-center development, it is not having the desired effect on congestion (Denpaiboon, 2008).

The following table was extracted from a document prepared by the National and Economic and Social Development Board for a conference about regional and spatial development held in Seoul, South Korea in 2008. It is an overview of what each NESD plan envisioned for national development and urban and spatial development guidelines. It is evident that urban and spatial policy has attempted to steer development and economic activities away from Bangkok.
Table 1: Overview of National Economic and Social Development Plans

<table>
<thead>
<tr>
<th>National Plans</th>
<th>Characteristics of Plans and Development Guidelines</th>
<th>Urban and Spatial Development Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>The 1st Plan (1961–1966)</td>
<td>Established economic base of the country as single objective. Focused on infrastructure-led development; for example, transportation networks, irrigation dams, power supply, and utilities etc.</td>
<td>Not given priority.</td>
</tr>
<tr>
<td>The 2nd Plan (1967–1971)</td>
<td>Continued strengthening economic base of the country and began to emphasize human resources development. Emphasis on economic and social infrastructure development, including distribution of benefits to the regions especially rural and remote areas. Launched sector analysis as the frameworks for projects’ development.</td>
<td>Recommended decentralization to expedite rural development in the Northeastern Region.</td>
</tr>
<tr>
<td>The 3rd Plan (1972–1976)</td>
<td>Still focused on economic growth with more emphasis on monetary stability. Highlighted social aspects in the National Plan for the first time, mainly in area of population, for example, family planning, reduction of population growth rate. Emphasized on distribution of income, economic and social services to rural and remote areas. Also recommended improvement of agricultural institutions, agricultural credit, and agricultural product prices.</td>
<td>Emphasized on measures to control population size and migration from rural area to Bangkok, a Primate City of the country. Recommended development of New Towns as satellite towns of Bangkok.</td>
</tr>
<tr>
<td>The 4th Plan (1977–1981)</td>
<td>Because of political uncertainty at that time, the 4th Plan, emphasized on broad policies and measures to tackle development problems. Focus on economic rehabilitation, especially, expansion of agricultural production, restructuring in manufacturing sector aimed to enhance export earnings. Implemented stimulating measures to counter industrial slowdown, coupled with measures to distribute income and job opportunities to the region. Recommended natural resource management in the National Plan for the first time, with emphasis on land use management, water resources provision, and energy development in the Gulf of Thailand.</td>
<td>Developed regional cities as centers for rural-regional decentralization. Developed Bangkok as the self-contained polycentric metropolis so that the inner zone, the suburbs, and the outer zone could have economic and social centers of their own.</td>
</tr>
<tr>
<td>National Plans</td>
<td>Characteristics of Plans and Development Guidelines</td>
<td>Urban and Spatial Development Guidelines</td>
</tr>
<tr>
<td>---------------</td>
<td>----------------------------------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>The 5th Plan (1982 – 1986)</td>
<td>Shifted planning approach from project-oriented to program-oriented. Launched area-based planning approach to be implemented by both public and private sectors, i.e. identified target areas for rural development program, Eastern Seaboard development program, regional cities development program, etc. Emphasized solving poverty in 288 poverty-stricken districts and sub-districts.</td>
<td>Initiated development of economic area in Eastern Seaboard to diverse economic activities from Bangkok Metropolitan Region (BMR). Formulated structural plan of Bangkok Metropolitan Region (BMR) and identify specific roles for each community. Developed 5 regional cities, namely, Chiang Mai, Khon Kaen, Nakhon Ratchasima, Chon Buri, and Songkhla-Hat Yai.</td>
</tr>
<tr>
<td>The 6th Plan (1987 – 1991)</td>
<td>Initiated program-based National Plan and reviewed roles of the government in national development administration through state enterprises’ development plans. Emphasized the importance of economic growth and maintaining fiscal and financial stability. Emphasized the roles of private sectors in development, and increased the roles of local people organizations in conservation and development of natural resources and environment.</td>
<td>Formulated development policies on urban and specific areas e.g. growth management of Bangkok through fiscal &amp; legal measures, and Regional Cities development program. Accelerated development in Eastern Seaboard area, and preparation for new economic zones in Upper Southern Region, Songkhla Lake Basin, and Pakpanang Basin.</td>
</tr>
<tr>
<td>The 7th Plan (1992 – 1996)</td>
<td>Initiated Sustainable Development by emphasizing balanced development in 3 aspects namely, economic growth, distribution, and development of human resources, quality of life, &amp; environment. Focused on shaping Thai economy to be the regional economic forefront in terms of economic, trade, financial &amp; tourism.</td>
<td>Formulated development guidelines for Bangkok Metropolitan Region (BMR) by coordinating infrastructure investments together with land &amp; environmental management. Continued development in Eastern Seaboard area. Launched industrial development policy in Upper Central Region with Saraburi province as the center.</td>
</tr>
<tr>
<td>The 8th Plan (1997 – 2001)</td>
<td>Shifted development paradigm from emphasizing economic growth to people centered development. Emphasized the bottom-up planning approach, and encouraged people in every sector of society to participate in the country’s development from the plan formulation process onward. Emphasis on balanced development between various aspects such as economic, social, natural resources and environmental.</td>
<td>Continued development in Eastern Seaboard area, Southern Seaboard area, Western Seaboard area and BMR. Emphasized on economic cooperation with neighboring countries under the framework of IMT-GT, GMS and BIMSTEC (Bay of Bengal Initiative for Multi Sectoral Technical and Economic Cooperation).</td>
</tr>
</tbody>
</table>
A shortcoming noted in previous regional planning efforts is that Bangkok is not viewed as a region, and surrounding provinces need to be more integrated into planning efforts, even though growth has undoubtedly moved far beyond regional borders. The 7th Plan mentioned the need to coordinate infrastructure spending along with environment and land management. There is some mention of creating new towns in the 3rd and 4th Plans, but this is difficult to achieve without following through with regional planning exercises (Kmonwatananisa, 2008). Although Master Plans for subcenters could not be located, Suthiranart notes that:

Decentralization policies to establish new urban settlement centers have been studied by several national and local agencies. The basic planning concepts underlying all the plans are similar but locations, spatial settings and function plans differ, depending on the nature of the study or agency that conducts the study. The planning coordination and collective effort among the central and local governments are needed immediately; otherwise potential economic resources of both the public and private sectors will not be integrated in an appropriate direction, which could cause large economic waste. The government and consultants have proposed

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<table>
<thead>
<tr>
<th>National Plans</th>
<th>Characteristics of Plans and Development Guidelines</th>
<th>Urban and Spatial Development Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>The 9th Plan (2002 – 2006)</td>
<td>Launched “Sufficiency Economy Philosophy” as the administration mechanism for the country. Continued from the 8th National Plan, in emphasizing people-centered development. Emphasized on reviving economic and building immunity through grass-root economic development and expand social protection. Shifted from quantity-based development to quality-based development, coupled with enhancing social justice and competitiveness.</td>
<td>Formulated strategy on restructuring of sustainable rural and urban development through empowering community; developing livable city &amp; community; reducing rural &amp; urban poverty; developing benign urban-rural linkage; and formulating strategy on regional, sub-regional and community development. Launched provincial cluster development policy.</td>
</tr>
<tr>
<td>The 10th Plan (2007 – 2011)</td>
<td>Emphasized the action-oriented implementation of “Sufficiency Economy Philosophy” carried on from the 8th &amp; 9th National Plans, in emphasizing people-centered development. Formulated country-development vision to attain “green &amp; happiness society”. Emphasized on using economic capital, social capital, and environmental capital in country development.</td>
<td>Emphasized on strategy to empower community as country’s foundation. Focused on participation of all partners in every steps of development, especially in clarifying roles of development partners to be used as guidelines in formulation of action plans. Continued provincial cluster development policy.</td>
</tr>
</tbody>
</table>
several decentralization plans in the BMR. The important decentralization plans are the master plan of subcenters, multipolis system, new city projects, and new town development. Each agency tries to promote their plans so that the government will commit to implement them. The problem is that politicians who benefit from one project are likely to obstruct the other projects. Therefore, the plans are still undergoing study, and no schedule to implement any of them has yet been seen (Suthiranart, 2001, p. 97).

Decentralization policy has not been notably successful, and a new approach to offset monocentric urban form is warranted. This is where urban compaction and transport development zones could prove an effective means to effectively and efficiently increase densities in areas with access to mass transit and develop a more polycentric growth pattern. If transit-supportive compaction within the BMR can be achieved, it has the potential to significantly reduce both sprawl and automobile dependency, and make better use of infrastructure spending. This will be especially beneficial if attempts to decentralize prove ineffective.

2.2.2.2 Bangkok City Planning

The past few decades have seen an explosive growth of suburb creation. In 1987, land converted to urban uses in the BMA was 302 km². By 1995, this figure more than doubled to 614 km². It is of note that in 1987, 53% of this land was in the outer zone of the city and in 1995, 74% was in the outer zone. Land in the outer reaches of the city, generally agricultural land, was being increasingly converted to urban uses.
The first official comprehensive plan for Bangkok commenced in 1983 and was completed in 1992. This plan was revised in 1997 and passed into law in 1999. It became the first comprehensive plan, entitled *1999 Comprehensive Plan*. This same plan was revised into the 2006 Plan as well (Chirapiwat, 2005).

The 1999 Plan was based on five principles, which entailed improving mobility and accessibility, imposing a standstill on new road infrastructure, the development of transport zones in the city Center and the concentration of urban development within an expanded Central Business District (CBD), aiming to balance jobs and housing (Boonlua, 2007).

### Table 2: Land Converted to Urban Use in Bangkok

<table>
<thead>
<tr>
<th>Zone</th>
<th>Total Area (km²)</th>
<th>Land Converted to Urban Use (km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1987</td>
</tr>
<tr>
<td>Inner</td>
<td>59.5</td>
<td>44.1</td>
</tr>
<tr>
<td>Middle</td>
<td>165.1</td>
<td>96.9</td>
</tr>
<tr>
<td>Outer</td>
<td>1344.1</td>
<td>161.3</td>
</tr>
<tr>
<td>BMA</td>
<td>1568.7</td>
<td>302.3</td>
</tr>
</tbody>
</table>

(Choiejit, 2002, p. 64)
Enforcement of land use plans has been a continuing problem. Building codes and land use regulations are often enforced jointly when an application for a building permit is received and land subdivisions need to be approved before one can apply for a building permit. Land uses in the Comprehensive Plan are not clearly defined and cover broad land areas. An illustration of this is within the 1999 plan for the northeastern region where “low-density residential” zoning, which entails dwelling units with at least 30% open space and buildings less than three stories high, accounts for as many as ten districts. Although the 1999 plan was made into law, it still lacks specific legal instruments for proper enforcement (Chirapiwat, 2005, p. 32).
With regard to construction permits, the Public Works Departments (PWD) in district offices are responsible for reviewing permit applications with no coordination with the Urban Planning and Development Division, that is, planners do not participate in this activity. Much of the literature about land use controls in Bangkok state that enforcement often lacks consistency, and there is little follow up to ensure that building permits have been respected (Chairatananon, 2006).

The problems pertaining to enforcement have been outlined. The results of unmanaged development have been touched on in previous sections, but it has largely carved out “superblocks” in the urban areas, which are characterized by automobile dependency. Large swaths of land are bordered by major highways and within the superblock, roads are broken and haphazard. Highways are the only roads that are navigable for any significant distance. Plots of land remain undeveloped within the superblock and densities are low. It is of note that some arguments have been made that agricultural land mixed with urban uses can provide some function, such as water retention, micro-climate control and visual quality (Murakami, et al., 2005). However, these lands usually become severely environmentally degraded. Regardless, agricultural land retention has not been properly planned, and these development patterns have contributed to unfettered sprawl, given that land is not used efficiently.

Some research has pegged new development as occurring some 50 kilometers from the symbolic center of the city, the King’s Palace (Hara, Takeuchi, & Okubo, 2004). Without intervention, it is likely that development will continue to occur in an outward direction, forcing an even larger population to become car dependent.
2.2.3 Poor Connectivity

Connectivity within a transportation network can refer to both the physical street patterns and the degree to which various modes of transportation are connected to each other for easier mode transfer, although the latter definition is more often referred to as integration. This section will deal with street patterns. The main goal of a street network is connectivity, and it involves the number of nodes, intersections, distance between points of access into and out of a neighborhood (Boonlua, 2007).

2.2.3.1 Road Connectivity

Most literature about transportation in Bangkok cites the fact that it has a smaller proportion of land devoted to roadways when compared to international standards (Gwilliam, 2002). Roads are typically short and narrow, especially in the inner core. Another cause for concern is that there are almost no arterial roadways aside from highways. In a lengthy exploratory analysis evaluating the causes of transportation woes in Bangkok, Suthiranart notes that:

The Bangkok Metropolitan Region has a unique historical pattern of development. In Bangkok, traditionally, roads were created by paving over canals or by extending existing roads outward as need arose. This strategy eliminated the need for expropriating residential land for roads, and also allowed commercial enterprises to maintain existing client relationships. As a result, connecting streets between the main roads are few, and most are narrow; many are dead-end residential lanes (sois). Little has been done to develop a secondary distributor road network despite almost universal recognition on the part of analysts that the lack of connecting roads contributes greatly to traffic problems (Suthiranart, 2001, p. 62).
The private sector has almost exclusively provided residential, non-highway road-building.

2.2.4 Automobile Dependency

Throughout this document, automobile dependency has been noted as one of the biggest obstacles facing policy-makers. Most research about transportation in Bangkok will list automobile ownership statistics to illustrate the degree to which ownership is continually expanding. The most recent statistics found indicate that there was an average car registration rate of 58,061 cars per month in 2006, or around 1,935 car registrations per day (Charoentrakulpeeti, Sajor, & Zimmermann, 2006, p. 697). If these rates have continued since 2006, this would equate to a total addition of 2,784,768 vehicles. Below is a comparison of car ownership in various Asian cities.

**Figure 5: Car Ownership in Asian Cities**

<table>
<thead>
<tr>
<th>Cities</th>
<th>Unit per 1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tokyo</td>
<td>372</td>
</tr>
<tr>
<td>Singapore</td>
<td>182</td>
</tr>
<tr>
<td>Seoul</td>
<td>201</td>
</tr>
<tr>
<td>Kuala Lumpur</td>
<td>407</td>
</tr>
<tr>
<td>Bangkok</td>
<td>599</td>
</tr>
</tbody>
</table>

(IGES, 2007)

Only Kuala Lumpur has surpassed Bangkok in terms of car ownership per 1,000.
2.2.5 Public Transportation

Public transportation services can be categorized in different ways – line haul transit systems and paratransit services, which are more personalized. There is also a distinction between rail, which will always fall into the former category, and road-based, which can be either. The transit systems usually entail a fixed route bus or train with a fixed schedule. Conversely, paratransit usually consists of smaller vehicles like vans, taxis or shuttle buses, and service is flexible (UNESCAP).

The largest proportion of public transit in Bangkok exists in the form of road-based transportation. This is provided by the public and private sectors, and as transit systems and paratransit services. The categorization of services is more challenging in developing countries due to a greater variety of vehicle types and greater flexibility in public transport services. Another difference is the presence of “informal transport”, where entrepreneurs and small-scale operators will offer transport services to the public, which are omnipresent in Bangkok. These services are often poorly regulated or sometimes entirely unregulated. Informal transport can be important to the entire system given that it usually fills gaps where there are no existing services in a particular area, or the provided services are too expensive for some (Chairatananon, 2006).

As stated previously, the only mass public transit system exists in three urban rail lines – one underground and two lines of elevated rail. A bus rapid transit system opened to the public on June 5th, 2010 and the results from this project are yet to be seen ("BRT Starts Operation Today," 2010). These lines cover a small portion of the inner city. The Skytrain’s 2007 ridership was roughly 380,000 in 2007 and a daily
passenger ridership of 500,000 is needed to attain a break even point. Since the Skytrain’s opening in 1999, ridership has increased yearly, and it is expected to further increase. Revenues from advertisements displayed on trains have also been steadily increasing (IGES, 2007).

The map below displays the Skytrain and underground lines, the BRT and the Airport Link, in addition to one future extension of the Skytrain as the dotted line in the lower right-hand corner.

**Figure 6: Map of Existing Public Transit**

[Map of Existing Public Transit](www.bts.co.th, 2010)
Public road-based transit services exist in the form of city bus and airport bus, and many micro or mini-buses cover fixed routes. The private paratransit services in the city are mini-buses, motorcycle taxis, regular taxis, river boats and tuk-tuks. The figure below displays the passenger kilometers traveled in 2005 for each mode choice. The greatest number of passenger kilometers was traveled by city buses by a significant margin, followed by private cars, microbuses, the Skytrain and motorcycles.

Figure 7: Passenger Kilometer Travel per Year in Bangkok in 2005

(IGES, 2007, p. 101)

There was marginal use of express boats, and the only other non-road travel was by BTS and Skytrain.

The research in the table below displays public versus private modes of transport; data from the year 2000 show that the share of private transport trips increased from 1997 to 2001, and it was projected to increase further. 2009 statistics from the National Economic and Social Development Board list the proportion as 44:56 and it would
therefore appear that the share of private trips has not increased since 2001 (NESDB, 2009). These figures will always be subject to a margin of error given that some informal transportation cannot be captured by these statistics.

Table 3: Overall Travel Demand in the Bangkok Metropolitan Region

<table>
<thead>
<tr>
<th>BMR Travel Demand</th>
<th>1997</th>
<th>2001</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Daily Person Trips (million trips/day)</td>
<td>17.94</td>
<td>21.72</td>
<td>26.22</td>
</tr>
<tr>
<td>Total Daily Truck Trips (million trips/day)</td>
<td>3.11</td>
<td>3.71</td>
<td>4.48</td>
</tr>
<tr>
<td>% Private Transport Trips</td>
<td>54</td>
<td>57</td>
<td>61</td>
</tr>
<tr>
<td>% Public Transport Trips</td>
<td>46</td>
<td>43</td>
<td>39</td>
</tr>
<tr>
<td>Average Trip Rate incl. Truck (trips/person)</td>
<td>1.73</td>
<td>1.84</td>
<td>1.95</td>
</tr>
<tr>
<td>Average Trip Rate excl. Truck Trips (trips/person)</td>
<td>1.48</td>
<td>1.58</td>
<td>1.66</td>
</tr>
</tbody>
</table>

(Rujopakarn, 2000)

It should be noted that the share of public transportation trips in Bangkok is high, especially when compared to cities in developed countries where larger proportions of the population are able to afford a car (Suthiranart, 2001). This fact emphasizes that mass rapid transit investments will provide the current large proportion of public transit users with a higher level of service.

Motorcycle taxis are quite common in Bangkok. Their main role is to provide a link between a neighborhood or soi and the main transit line. Given the poor connectivity of local streets, walking is less feasible. Motorcycle taxis play a vital role in connecting people to public transportation (Chairatananon, 2006). Boats are generally not a major factor in everyday travel, but largely provide tourists and residents with a recreational experience, as many appreciate the city vistas from the river. Vans and private buses, according to the chart below, account for the largest share of public transport trips. These routes can be either flexible or fixed. Public buses account for the next largest share of trips (NESDB, 2009, p. 8).
2.3 The Externalities of Transportation Policies in Bangkok

The problems caused by congestion have permeated all facets of life in Bangkok. Not only is the health of the environment and residents compromised, but there are economic losses and social repercussions as well. The recognition of the importance of losses due to congestion are well recognized by many policy-makers as they try to address problems and move forward as a modern and efficient city. This section outlines the main externalities brought about by city-wide automobile congestion.

2.3.1 Social Costs

Congestion is always a travel consideration during the waking hours of the day because it is no longer limited to peak hours. It has become a fact of life for Bangkok residents, and the impacts on social, cultural and public health are not entirely measurable. The amount of time spent commuting means individuals have less time at
home to spend with families and friends, to rest, carry out household responsibilities and recreational activities. It is felt that family and community cohesion has deteriorated as a result of time spent away from home (Suthiranart, 2001).

One eye-opening example of the health risks of exposure to vehicle emissions comes from a study of traffic police in Bangkok. In the 1990s one study found that out of 1,758 traffic police in Bangkok, 753 of them suffered from respiratory illness (43%), and 420 among them had been sick for over five years (24%) (Suthiranart, 2001, p. 56). Thai life goes on in public places; there is an active and sleepless street culture adjacent to streets – food vendors, shops, markets, etc. It is certain that those working in environments adjacent to car-saturated thoroughfares will be affected by emissions especially, but all studies unanimously show that ambient air quality is below international standards (Praditphet, 2009).

The most serious air pollutants are suspended particulate matter (SPM), carbon monoxide and lead (Choiejit, 2002). SPM has been measured at two or three times above accepted World Health Organization (WHO) standards, and lead found in children is higher than even Mexico City. Lead has developmental effects on children, and those who have nutritionally deficient diets are especially at risk (Suthiranart, 2001, p. 5). Some research has noted modest improvement in air quality since the 1990s (IGES, 2007), but it is likely that the public health costs are still great.

In 2001, Ross and Punpuing published a study on the human side of Bangkok’s transport problems. The study showed how traffic, and its effects on noise and air pollution, has a diverse set of social impacts on health, stress, families and communities.
This study found that Thais are not particularly stressed by commuting, but rather adapt to the situation, although they might not like it. Other factors, such as socio-economic status and mode choices, affected the way in which Thais dealt with long commuting times. Bus users and those traveling in an inward direction endured the longest commuting times (Ross & Punpuing, 2001).

It should be noted that personal stress levels and attitudes toward congestion are likely to be difficult to measure because of cultural factors. Thais typically want to appear/aim to stay relaxed and worry-free in even the direst of circumstances, and this will affect any qualitative analyses of commuters.

Another effect of automobile dependency, that has already partially caused an obesity epidemic in North America, is the tendencies of automobile dependent populations to adopt sedentary lifestyles. From 1991 to 1998 the prevalence of obesity increased in the United States for people from all demographic groups. A 1999 survey indicated that approximately 61% of adults in the United States are overweight and 26% are classified as obese. The proportion of overweight children has tripled since 1980 (Kantachuvessir, 2005, p. 555). Early studies in Thailand showed that obesity was on the rise for affluent populations, but weight issues are on the rise for the general population, and for rural and urban residents. In 1991, 13% of men and 23.2% of women were overweight, and in 2004 22.4% of men and 34.3% of women were considered overweight (Aekplakorn & Mo-Suwan, 2009).

Although other factors such as rising income and greater ability to provide food for a family will also increase the prevalence of obesity, during the time frame of the study,
automobile and motorbike ownership was also rising steeply. It is clearly noted by many scholars that walking is seen as an activity undertaken by the poor, and Thais will avoid this activity if at all possible (Boonlua, 2007).

2.3.2 Economic Costs

Bangkok’s congestion woes have led to a great deal of economic losses; GDP is reduced by freight congestion, delays and unpredictability, difficulties of conducting business and increasing signs of disarticulation of the labor market (Gwilliam 2002). In the late 1990’s Bangkok was losing one-third of gross city product each year, which is estimated at 4 million dollars per day, or 1.46 billion dollars per year (Flora, 1998).

More recent figures estimate that the cost of congestion, not including environmental costs, is roughly US$ 6.52 billion per year. The largest proportion of this, US$4.64 billion, is attributed to commuter’s time loss (Lobyaem, 2006, p. 5).

2.3.3 Environmental Costs

Automobile pollution has the largest effect on air quality, although pollution in water sources due to runoff can be attributed to automobiles as well. The largest concern for human health comes from Suspended Particulate Matter (SPM) which can cause premature mortality, bronchitis and asthma attacks, while smaller particles cause respiratory problems, especially in children, the elderly and people with existing conditions. Section 2.3.1 outlined some of the human effects of poor ambient air quality, which are three or four times accepted WHO standards in Bangkok. In 2001
emission levels were 329,161 tons per year of nitrogen oxides, 463,775 tons per year of carbon monoxide and 38,192 tons per year of particulate matter (PM) (Praditphet, 2009).

Greenhouse gases (GHGs) are also of particular concern because of their contribution to global warming. It has been found that in Bangkok, the transportation sector is the largest contributor of CO₂ emissions by a significant margin.

<table>
<thead>
<tr>
<th>Sector</th>
<th>CO₂ emissions (million ton p.a.)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>14.86</td>
<td>34</td>
</tr>
<tr>
<td>Transportation</td>
<td>21.18</td>
<td>50</td>
</tr>
<tr>
<td>Waste</td>
<td>1.13</td>
<td>3</td>
</tr>
<tr>
<td>Other sources</td>
<td>5.58</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>42.75</td>
<td>100</td>
</tr>
</tbody>
</table>

(BMA, 2007, p. 6)

The pollution control department of Bangkok also provides daily air quality reporting for various parts of the city. The various pollutants reported are Sulfur Dioxide (SO₂), Nitrogen Dioxide (NO₂), Carbon Monoxide (CO), Ozone, Particulate Matter Ø < 10 μm (PM₁₀), and the cumulative Air Quality Index (AQI). The scale for the AQI is Good (0-50), Moderate (50-100), Unhealthful (100-200), Very Unhealthful (200-300), and Hazardous (300-500). The following daily air quality data was taken from the Pollution Control Department website in February of 2011. According to these monitoring stations, none of the specified areas have exceeded a rating of 50.0 – the upper limit of the “good” air quality classification. This is at odds with most international assessments that do not rate Bangkok air quality as favorable (Suthiranart, 2001).
2.4 Recent Initiatives

There have been numerous planning documents submitted recently that will have significant effects on the Bangkok cityscape. URMAP 2 discussed in Section 2.2.1 will deeply transform transportation dynamics within the entire metropolitan region, and, judging from past experience, also the pattern of development. Private sector investment has already followed the expected expansion of the Skytrain, which is clearly visible along the planned line, and given that URMAP 2 has put forth an extensive expansion of the entire urban rail network, investment near planned new lines will surely follow. Bangkok is gearing itself to undertake massive investment in urban mass transit projects.

2.4.1 Mass Transit Expansion

The Mass Rapid Transit Authority website gives an overview of mass transit plans on their main page. The information states that the Commission for the Management
of Land and Traffic approved that Mass Rapid Transit Master Plan in February of 2004. It provides a framework for the implementation of a mass rapid transit network that will total 291 km, including the existing 43.7 km.

2.4.2 Major Plans Affecting Transportation

This list includes all accessible documents that will affect transportation systems in the near future. Some plans are only available in Thai, or were not accessible via the author’s means of document acquisition – collaboration with other researchers, email requests for documents, web searches, personal visits to OTP, Laksi District Office and the City’s foremost transportation consultants.

URMAP 2

URMAP 2 is the revised version of URMAP, the Urban Rail Master Plan created in 2002. URMAP 2 was completed in 2004 and recommends a total of 296 kilometers of rail network to be completed over the next 20 years. Information, or a copy of either URMAP document was not obtainable; therefore, information about these documents is sparse (ADB, 2005).

M-MAP: Mass Rapid Transit Master Plan in Bangkok Metropolitan Region

The M-MAP document acquired from OTP and completed in November of 2009 is the Mass Rapid Transit Master Plan in Bangkok Metropolitan Region. It provides physical maps and completion timelines for the 12 routes of the network. The routes are divided into Major Trunk Routes and Minor Trunk Routes.
Some portions of various lines have been expedited according to cabinet resolution. At present, portions of the Light Red Line, the Pink Line, the Dark Green Line, the Dark Blue Line and the Purple Line have been expedited. The next timeline is within 2019, and the remaining sections are set to be completed by 2029.

The Plan states that the net present value of the 30 year plan is 437,692 million baht, with an Economic Internal Rate of Return (EIRR) of 19.67% and a Benefit/Cost Ratio (B/C) of 2.09. The amount of fuel efficiency will equal 1.5 trillion baht, with the social rate of return far higher than the loss of resources or social capital. All of these indicators suggest the financial sustainability of the project (OTP, 2009).
Various stations throughout the planned mass transit system have been chosen for area development with the goals of increased mobility, accessibility and sustainability. The Laksi study area was not chosen for area development. The general master plan concepts are stated to be intermodal integration, density, identity and sustainability. The intermodal transfer facilities at each station are stated to be park and ride, kiss and ride, taxi parking, bus stop, footpath and road.

In a section entitled “Station Plaza Development for Station Area Development”, it is stated that:

Station Plaza Development Area will be one of the most recommended area development needed in the station area plan and Intermodal Facility design. Not only it will increase the catchment area of a station considerably but it also provided the pedestrian accessibility in the intermodal station. The proposed functions at station plaza are park and ride, commercial development opportunities, car parking, bike parking, bus bays as well as taxi bays will also add to the station plaza development (OTP, 2005, pp. 2-56).

The land uses planned for the station areas are transport hub facilities, high rise high density residential, office spaces, conference and exhibition centers, commercial and retail stores, and large scale shopping centers. Specific commercial development opportunities are discussed in detail (OTP, 2005).
Plan Improvement for the Red Line Mass Transit: Bang Sue – Rangsit and Bang Sue Station: Executive Summary

This document is largely a technical document that covers the technical considerations for the new Red Line Mass Transit Line tracks that will run from Rangsit to Bang Sue, which is outside the scope of this research. This document does, however, display the anticipated location of the Laksi train station, as well as other stations on this line. It will be located on the northwest corner of the intersection of Chaeng Wattana and Vibhavadi Rangsit Highway. The expected ridership of the line is 50,520 in 2012. It is also expected that an airport link running from Suvarnbhumi to Don Muang will operate in conjunction with the Red Line.


This document applies two traffic models to two case study areas in Bangkok. The two case studies are the Bang Kapi – Lam Sali area and Chaeng Wattana Road, from Khlong Pra Pa Intersection to Laksi Intersection, which is within the study area of this research project. These areas are considered to be high traffic and high priorities for traffic improvement. The most relevant parts of this document are those which assess the Chaeng Wattana study area.

Section 8.1.2 notes the predominant land uses in the area, which are slightly different than what was noted at field visits. This document states land uses as:

Mainly medium density residential development and commercial in some intervals (where shopping mall and supermarket are located). In addition, the
main road and secondary road network have created travel activities from the roadside development and other distant areas (OTP, 2010, p. 8.1.2).

At field visits, it was noted that uses bordering Chaeng Wattana were either office space or ground level commercial space, with apartments in the upper levels. This is a common form of development in Bangkok, and these structures are often referred to as “shophouses”. The photograph below displays a portion of Chaeng Wattana with several machine shops on the ground floor, and the apartments with street facing balconies on the upper floors.

**Figure 9: Shophouses Along Chaeng Wattana Road**

This pattern of development is also visible on the local streets that feed into Chaeng Wattana. There is more of a residential character, with apartment buildings
interspersed with shophouses. Density appears to be quite high, given that this is considered a suburban area.

This document also mentions that there are commercial uses in the form of large commercial retailers, like Big C, Carrefoure and IT Square. Bus stops are located throughout the length of Chaeng Wattana, with a concentration of stops at the Government Complex. The document also lists sidewalks on both sides, as well as “shady trees”. The overpass at the government complex “has the objective to serve for thru traffic between Pak Kret on the west side and Bang Khen/Min Buri on the east side without having to wait at the traffic signal in front of the Government Complex (OTP, 2010, pp. 8-11).

The traffic in the study area along Chaeng Wattana was evaluated based on two scenarios – with the added dynamic of the Pink Line train along Chaeng Wattana, and without, as per present conditions. In both cases, it was deemed that there needed to be greater vehicular access to the government complex. The document states that this can be achieved through another road access point connecting Kamphaengphet Road to a road internal to the complex (OTP, 2010).
Chapter 3: Sustainable Urban Transportation

Innovations in transportation technologies have consistently changed urban form in the wake of their adoption. Arguably, the largest changes in city building came in the period subsequent to the widespread adoption of the private automobile and the construction of highways systems. Distances too far to walk or bike became easily surmountable by car, and there was no longer a need for compactness and human scale construction. Now that varying levels of automobile dependence have been established throughout the globe, the ills of this phenomenon are becoming all too clear. The now staggering challenge facing urban planners is to reverse 60 odd years of automobile-centered city building.

3.1 Objectives

In past decades, the objective of transportation planning has been mobility, which “assumes that city dwellers will gain access to services required to support their daily needs through transport systems based on high levels of mobility by car, to some extent regardless of the relative location of land uses” (Curtis & Scheurer, 2010, p. 54). The new focus for transportation has shifted toward accessibility; “By planning for accessibility, the approach incorporates a need to consider proximity of land use activities as well as the network itself” (Curtis & Scheurer, 2010, p. 54).

Urban sprawl is seen as the antithesis of urban sustainability, because it creates vast spatial extents with a scattered pattern of urban activities. This directly translates into more frequent and longer distance person trips. It also creates settlements that are
not supportive of public transportation, because generally a concentration of population is needed to make public transportation financially feasible and to provide enough user patronage. In sum, sprawl creates automobile dependent populations.

In many developing countries, the goal is first to facilitate economic development and industrial production, which means building roads for the transportation of materials and commodities. In the case of Bangkok, this has manifested itself into a well developed primary road network and a neglected secondary and tertiary network. As stated, Bangkok development follows highways outward along the primary road network and has created a sprawled urban landscape (Gwilliam, 2002).

So, what then is the goal, if we understand that sprawling developments are counter-productive in terms of sustainable transportation? More sustainable forms of transportation are public transit, walking and cycling. The goal is to facilitate the use of these alternative modes of transportation, which means creating an urban environment that supports them, and also to maximize uses within the immediate vicinity of residential areas.

The term accessibility describes the shifting focus of transportation planning and it is what planners are now trying to achieve within the urban environment as there is a movement away from automobile-dominated travel. The definitions of accessibility are numerous, and stress four factors in varying degrees: land use, transportation, the temporal and the individual.

In the book Access to Destinations, Krizek writes:
As has been well described elsewhere, measures of accessibility represent the spatial distribution of potential destinations, the ease of reaching each destination, and the magnitude, quality, and character of the activities found there. Any reputable interpretation of the concept requires defining at least two basic tenets:

1. The pattern of potential activities – their quantity, quality and variety – commonly referred to as the attractiveness of a place. This could include the spatial distribution of people, of socioeconomic opportunities (especially jobs), or retail opportunities.

2. The connectivity between activities as provided by the transportation system. This is commonly referred to as the resistance or impedance function measured in terms of distance or time by particular modes (Krizek, 2005, p. 110).

The Victoria Transport Policy Institute (VTPI) has been used as a resource throughout this research and provides a comprehensive definition of accessibility, so the VTPI definition will be used for reference purposes:

Accessibility refers to people’s ability to reach goods, services and activities, which is the ultimate goal of most transport activity. Many factors affect accessibility, including mobility (physical movement), the quality and affordability of transport options, transport system connectivity, mobility substitutes, and land use patterns. Accessibility can be evaluated from various perspectives, including a particular group, mode, location or activity (Litman, 2011, p. 3).

Historically, the previous goal of transportation planning was creating a system of transportation infrastructure that increased mobility. Mobility, generally, refers to a person’s ability to move or be moved. It applies to transportation infrastructure irrespective of land uses. Accessibility, alternatively, considers not only the ease with which someone can travel to a destination but the degree to which the built environment provides opportunities for activities.
Policy directives that increase accessibility are either demand or supply-side measures. The next sections will review the array of policies that are available to planners.

3.2 Supply-Side and Demand-Side Policy Measures

In the battle to reduce automobile dependency, policy can come in the form of supply or demand-side measures. Quite simply, supply-side transportation policy measures include the provision of any kind of transportation infrastructure – light rail, additional highways, a metro system, public buses, bike lanes, etc. Demand-side measures are policies which affect the way or degree to which people use this infrastructure. In recent years, most demand-side measures come in the form of stick or carrot incentives to use alternative modes of transport (GTZ, 2002).

3.2.1 Demand-Side Measures

Transportation Demand Management (TDM) has received increasing attention in recent years as the means to induce people to forego the private vehicle for other options and dissuade single occupancy vehicle travel. Demand can be adjusted to coincide with the supply of infrastructure, or focus activity toward a particular infrastructure. Bhattacharjee et, al., in their document pertaining to public responses to TDM in Bangkok, broadly categorized measures into four approaches: increasing vehicle occupancy, peak period diversion, route diversion to a less congested network and reduction of overall demand in the system (Bhattacharjee, Haider, & Tanaboriboon, 1997).
The Victoria Transport Policy Institute (VTPI) provides a more comprehensive list in their online TDM Encyclopedia. Various land use management approaches are included in the TDM measures.

**Table 6: TDM Strategies from VTPI**

<table>
<thead>
<tr>
<th>Improves Transport Options</th>
<th>Incentives</th>
<th>Land Use Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit improvements</td>
<td>Road pricing</td>
<td>Smart growth</td>
</tr>
<tr>
<td>Nonmotorized improvements</td>
<td>Distance-based fees</td>
<td>New urbanism</td>
</tr>
<tr>
<td>Rideshare programs</td>
<td>Commuter financial incentives</td>
<td>Location-efficient development</td>
</tr>
<tr>
<td>Flextime</td>
<td>Parking pricing</td>
<td>Parking management</td>
</tr>
<tr>
<td>Car sharing</td>
<td>Pay-as-you-drive vehicle insurance</td>
<td>Transit oriented development</td>
</tr>
<tr>
<td>Telework</td>
<td>Fuel tax increases</td>
<td>Car free planning</td>
</tr>
<tr>
<td>Taxi improvements</td>
<td>Nonmotorized encouragement</td>
<td>Traffic calming</td>
</tr>
<tr>
<td>Bike/transit integration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guaranteed ride home HOV Priority</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(VTPI, 2010)

One problem with TDM strategies is that they are often met with public opposition in that they can force a change in behavior, and add costs or inconvenience to automobile usage. Any increase in costs for road use, or reduction in parking spaces, is seen as an unnecessary burden on individual citizens or an assault on individual freedoms. However, research shows that these demand measures almost always yield positive results, such as reduced congestion and increased use of alternative modes (GTZ, 2002). The 1997 study by Bhattacharjee et al. assessed the attitudes of Bangkok residents toward various measures. The results are congruent with usual consumer attitudes; supply-side measures are met with approval, while demand-side measures are generally met with disapproval (by automobile owners to a greater degree). The chart below illustrates this point.
Table 7: Responses for Ten Different TDM Strategies by Bangkok Residents

<table>
<thead>
<tr>
<th>Strategies</th>
<th>% of response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly support</td>
<td>Support</td>
</tr>
<tr>
<td>Rail rapid transit</td>
<td>50.30</td>
</tr>
<tr>
<td>Bus lanes</td>
<td>32.64</td>
</tr>
<tr>
<td>School bus</td>
<td>30.63</td>
</tr>
<tr>
<td>Staff bus</td>
<td>37.22</td>
</tr>
<tr>
<td>Car pooling</td>
<td>21.35</td>
</tr>
<tr>
<td>Staggered work hours</td>
<td>27.43</td>
</tr>
<tr>
<td>Staggered school hours</td>
<td>19.98</td>
</tr>
<tr>
<td>Increase annual road tax</td>
<td>15.45</td>
</tr>
<tr>
<td>Reduce on-street parking</td>
<td>17.85</td>
</tr>
<tr>
<td>Parking fee in government offices</td>
<td>10.78</td>
</tr>
</tbody>
</table>

(Bhattacharjee, et al., 1997)

In Bangkok, the lack of alternative options to the private automobile has outlined the importance of supply-side measures in advance of TDM policy enforcement.

Supply-side Measures

As stated, supply-side measures include the provision of any kind of transportation infrastructure. This is self-explanatory; supply-side measures can either facilitate automobile traffic, or try to provide people with an alternative to this mode.

An addition to road capacity usually pulls some traffic away from public transport to individual transport. This may increase the average cost of travel by public transport because reduced demand leads to reduced frequencies of service and increased waiting times. When the capacity of the road network is increased, the supply curve for individual transport shifts to the right. Changes in supply and demand of infrastructure
will always lead to a shift in the equilibrium of public versus private transport costs (Lee, Lee, & Lee, 2006, p. 92).

One interesting and unique example of a supply-side measure was the removal of a major highway that connected to the CBD in Seoul, South Korea. This initiative was a supply-side measure, with a clearly stated goal to reduce demand for private vehicles by making travel to the CBD more costly in terms of time and distance. This policy, in addition to some other supply and demand measures, had a positive overall effect on the system; it reduced problematic congestion by inducing people to take public transportation (Lee, et al., 2006).

New supply-side measures in Bangkok will come in the form of the oft mentioned 244 km expansion of the mass transit systems that will occur over the next few decades.

3.3 Transit and Development

Planned development can be harmonized with transportation infrastructure to optimize complimentary supply and demand-side measures. This is where urban form, transportation infrastructure, as well as supply and demand side policies converge with the goal of sustainable transportation.

High density urban environments are associated with lower average trip distances for all modes, improved public transport through higher potential patronage around each stop and greater capacity for walking and cycling trips. High density, compact areas tend to be more mixed in their land use, rather than heavily zoned and segregated as in low density suburban areas. This can further decrease trip lengths and the viability
of transit and non-motorized modes. Density and land use are, therefore, key factors in the pursuit of sustainable urban developments. Most literature on trends in urban development to reduce automobile use and improve physical and social amenities stresses the density/land use mix issue. High mix and proximity of uses are considered to create an environment with high accessibility (Kenworthy & Laube, 1996).

Figure 10: Urban Density Versus per Person Car use in World Cities.

![Graph showing Urban Density Versus per Person Car use in World Cities.](image)

(Kenworthy & Laube, 1996)

In planning practice, there are two integrated Land Use Transport (LUT) planning concepts that are widely in use today – Transport Oriented Development (TOD) and Transportation Development Zones (TDZs). A general term that espouses many of the goals of TOD and TDZs is smart growth, which has been used primarily used in the United States.

The TOD and TDZ concepts are similar in their objectives, but vary in their application. The following sections will explain these distinctions.
3.3.1 Transit Oriented Development

The most recognized form of LUT coordination policy is Transport Oriented Development (TOD). This has a neighborhood focus, and coordinates density, mixed uses, connectivity and high walkability around a transport node. It is an especially popular concept in North America and can be used in both high and low density areas. This term was originally conceived by Peter Calthorpe in 1993. In his book *The Next American Metropolis*, he describes TOD in the following terms:

A Transit-Oriented Development (TOD) is a mixed-use community within an average 2,000-feet walking distance of a transit stop and core commercial area. TODs mix residential, retail, office, open space, and public uses in a walkable environment, making it convenient for residents and employees to travel by transit, bicycle, foot, or car (Calthorpe, 1993, p. 56).

Robert Cervero, one of the foremost scholars on the LUT issues, gives a similar definition of TOD, but assigns transit stops, which can also be referred to as hubs or nodes, a more robust social function within the city:

The way I envisage TOD is as a compact, mixed use, walking-friendly development oriented around transit stations - mainly train stations. Ideally, these transit hubs become a focal point around which community planning and design is organized. It's a centerpiece for the community that often includes a civic square, where people gather for celebrations, public events and holidays, and these public squares are ringed by day-to-day services and retail outlets so people can combine their transit trip with after-work shopping or a daycare center. They play a mobility function, but they're also a way to organize community planning and development (Benfield, 2009).

Other scholars who have contributed to the body of TOD literature draw reasonably parallel conclusions about the characteristics of TODs. The contexts within which a TOD will be applied are areas of new development, redevelopment sites or infill sites
(Boonlua, 2007). The exact details of a TOD will vary based on local planning guidelines, and planning authorities will post informative literature on their websites. For example, the Maryland Department of Transportation states that a TOD covers a 15 minute walk from a transit station, while the City of Sacramento states that a TOD covers a $\frac{1}{4}$ to $\frac{1}{2}$ mile radius.

**Figure 11: TOD Ottawa, Ontario**

(“Transport-Oriented Development Guidelines,” 2011)

Figure 11 is a conceptual drawing of how TOD appears in practice, from a bird’s eye view. This is a North American example from Ottawa, Ontario where parking has been integrated into the design, a common component for TODs that serve a commuter
population. This graphic displays high density development around the bus and light rail stations, with graduated densities at greater distances from the transit stops.

The following section will outline the Transport Development Zone concept and the main differences which distinguish it from TOD.

3.3.2 Transit Development Zones

The concept of a Transit Development Zone (TDZ) was first conceived in the United Kingdom in 1998 by the Royal Institution of Chartered Surveyors (RICS) and the Department of Energy Transportation and Regions (DETR). The concept focuses on several facets of urban form: density, mix of use, size of neighborhood, transportation infrastructure and connectivity. TOD has tended to be more popular in North America and Australia, while the TDZ concept is more popular in Europe and Asia where cities are older and densities are higher, on average (Boonlua, 2007).

3.3.2.1 Characteristics and Requirements of a TDZ

The following table describes the five key characteristics of a TDZ. Five elements of urban form are optimized with a TDZ. These five elements are Density, Mix of Use, Size of Neighborhood, Transportation Infrastructure and Connectivity.
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>TDZ Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>Usual densities within an inner city normally reach roughly 80 dwellings per hectare, but densities as high as 150 dwellings per hectare can be achieved within a TDZ. It is thought that higher densities can be achieved within a developing context.</td>
</tr>
<tr>
<td>Mix of Use</td>
<td>Uses should include residences, offices, parks, retail – in sum, TDZs should incorporate work, home, shopping and recreation. Although this is not stated in TDZ literature, it is also important that grocery shops are included; otherwise, a food desert will be created within the TDZ.</td>
</tr>
<tr>
<td>Size of Neighborhood</td>
<td>TDZ characteristics including appropriate size and density thresholds, the use of boundaries, and the degree of self-compatibility between a TDZ and adjacent areas are important. Upon evaluating a potential TDZ site, these variables have to ensure integration into the surrounding city fabric.</td>
</tr>
<tr>
<td>Transportation</td>
<td>It is important that there is a transport node within a TDZ. In almost all cases, TDZs have high access to a Mass Public Transit node.</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>High connectivity is the key to the proper functioning of a TDZ; perhaps it can be seen as the glue that holds it together. This ensures that public transportation is in most cases the best option, and incentive to forego a private vehicle trip.</td>
</tr>
</tbody>
</table>

(Boonlua, 2007)

Density, although it needs to be a consideration to improve accessibility, is generally already high within the context of large Asian cities; therefore it is difficult to give density criteria. The only guideline is that it should be as high as possible in the areas within walking distance of a transit stop so that accessibility will be maximized.

The size of neighborhood and boundaries of the TDZ are also quite case-specific. If there is high connectivity, or particular conditions warrant it, the TDZ boundaries are adjusted to include a larger area.

### 3.3.2.2 TDZ versus TOD

There are significant similarities between TDZs and TOD in that they focus on improving areas immediately surrounding transport nodes. However, they use different...
approaches for different urban contexts. TOD sprang out of an environment where the aim was to increase existing low density around transport nodes, while the TDZ was developed in the United Kingdom where the aim is to redevelop around a transport node. Within the application of TOD, there will almost always be low density development in adjacent areas. Therefore, TOD is still associated with a measure of car dependence and parking is often integrated into station design. Additionally, TODs occur in patterns of higher density than normal, but building still generally occurs in a more horizontal manner. Within a TDZ, on the other hand, existing high density areas become more varied in uses and development occurs vertically, as we’ve seen where TDZs have been implemented in Europe and Asia. Walking and cycling are more feasible due to decreased distances (Boonlua, 2007).

Another variable of TDZ associated with increased density is the greater suitability of Mass Public Transit. The transportation infrastructure found within a TDZ is mass public transit in all cases, while TODs can employ buses, paratransit or taxis; this is why TODs are considered to be a more road dependent concept in application.
Table 9: TOD versus TDZ

<table>
<thead>
<tr>
<th>The Elements of Urban Form</th>
<th>TOD (Examples in Portland)</th>
<th>TDZ (Examples in Kowloon)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>High and low density</td>
<td>Very high density</td>
</tr>
<tr>
<td></td>
<td>Basic public transport</td>
<td>Mass public transport</td>
</tr>
<tr>
<td></td>
<td>Still has car dependence</td>
<td>Overcomes car dependence</td>
</tr>
<tr>
<td>Mix of uses</td>
<td>Horizontal mixed use</td>
<td>Vertical mixed use</td>
</tr>
<tr>
<td></td>
<td>A need to extend the area</td>
<td>Within the area</td>
</tr>
<tr>
<td>Size of neighborhood</td>
<td>5-10 mins walk, 400m./radius</td>
<td>5-10 mins walk, 400m./radius</td>
</tr>
<tr>
<td></td>
<td>New urban area</td>
<td>Existing urban area</td>
</tr>
<tr>
<td></td>
<td>More in suburbs</td>
<td>Typically in city Center</td>
</tr>
<tr>
<td>Transport infrastructure</td>
<td>Road infrastructure</td>
<td>Mass rail transport infrastructure</td>
</tr>
<tr>
<td></td>
<td>Some rail</td>
<td></td>
</tr>
<tr>
<td>Connectivity</td>
<td>Access to facilities</td>
<td>Access to more facilities</td>
</tr>
<tr>
<td></td>
<td>Needs car transport</td>
<td>Less need for car transport</td>
</tr>
</tbody>
</table>

(Boonlua, 2007)

Given the density in Laksi, the natural mixing of uses that occurs in an organic fashion and the massive investments in an elevated train mass transit system, many areas of this district will already possess many of the components of a TDZ - a concept that has proven to be effective in Asian urban contexts. The following section will highlight successful examples of TDZs in practice.

3.3.2.3 TDZs in Practice – Kowloon Station Hong Kong

The density of the whole territory of Hong Kong is 6,380 persons per km², and it has one of the highest population densities in the world. The total population of Hong Kong is 6.9 million, with a total land area of 1,104 km². Only 60% of the land is developed, and the rest is devoted to parks and nature reserves. Because of the high number of pedestrians in the relatively small land area, there is separation of vehicle traffic, trains
and pedestrians; and there are above grade walkways that connect to buildings (Boonlua, 2007).

The Kowloon Station TDZ was created along reclaimed land on the western coast of Kowloon, which is on the southern boundary of mainland Hong Kong, across Victoria Harbor from Hong Kong Island. It is the largest TDZ development in the world, and it borders the water on a 13.4 hectare site at the southern edge of the west Kowloon reclamation (Boonlua, 2007).

The project includes access to the airport express, car parks, public transportation, high density and extensive mixed-use development (102,193 m²) including 5,126 residential units, shopping malls, offices, hotels and recreation facilities along with 22 mixed-use towers. It has been noted that “The guiding principle at Kowloon Station TDZ was the establishment of a high quality area, connected both locally through pedestrian bridges via the transit interchange station and globally via the new international airport” (Boonlua, 2007, p. 61).

The development around Kowloon station has ensured that uses are varied, and residents can find most of their daily needs within close proximity of the many high rise apartment buildings. There are many high profile buildings in the area, such as high end apartments, the International Commerce Center (ICC) Ritz Carlton and the Cullinan, which is the tallest high rise apartment building in Hong Kong. The Kowloon Station has not achieved notable ridership, because it is outside of the main Center of Kowloon, but it nonetheless provides residents of the nearby high rises and ICC patrons with access to
mass public transit. Kowloon station is on the Tung Chung Line and the Airport Express Line (Lau, 2004).

This example is also relevant to Laksi, because Kowloon is a relatively high profile area both nationally and internationally, with direct airport connections. This will also be critical for Laksi and the Government Complex, as Don Muang will deliver visitors on domestic flights and Suvarnabhumi will deliver international and domestic visitors (SRT, 2010).

3.3.2.4 TDZs in Practice – Tampines Regional Center, Singapore

Singapore changed planning practices in the late 1960s as the People’s Action Party took control with the goal of transforming Singapore into a modern, western-based, global metropolis. The first Concept Plan in 1972 established transportation as a primary concern, while the revision of this plan in 1991 brought attention to land use transportation integration. Decentralization became a goal, as there was a focus to create employment centers outside of the CBD. The Tampines Regional Center (TRC) is an effective example of a TDZ; “TRC provides a good example of the integration of land use and transport planning in Singapore. High-density housing and a complementary mix of commercial activities are integrated with an efficient transport system” (Sim, Malone-Lee, & Chin, 2001, p. 402).

There were originally 173,300 dwelling units, increasing to 226,500 by 2010. Most residences are high rise public housing. TRC offers a wide range of shops, offices and entertainment facilities. There are 243,000 m² of total commercial space, which includes CPF Tampines Office, Century Square, Tampines Mall, Telepark, Finance Park,
HDB Branch Office and a Regional Library. There has been a special effort to provide employment within walking distance of the local MRT station and bus interchange. Public transportation for work travel is extremely high, at 78.6%, and 10.5% of people walked to work. Only 5.2% of people traveled by private vehicle (Sim, et al., 2001). Singapore also has quite stringent car restraint policies which affect usage.

This example is especially relevant to Laksi, particularly because the goal of the creation of the TRC was to create an alternative employment center, and to ensure that connectivity from transport nodes and employment is high. Laksi is already a significant employment center; therefore, the development of a TDZ in this area could use the TRC example with regards to high accessibility for the Laksi Government Complex.

### 3.3.2.5 TDZ as a Lifestyle

In places like Singapore and Hong Kong, dense and mixed use environments have occurred quite organically over time. These places are also space-limited, so space is used efficiently out of compulsion. Automobile dependency would be a catastrophic situation, given that land for roads is limited, and density is so high that there is simply not enough room for cars and car parks. Unlike in North America, the challenge in these Asian nations has not been changing a car dependent suburban landscape into a dense, transit dependent one, but rather optimizing existing development patterns to compliment mass transit, and curbing automobile ownership.

Transit use is now being promoted to previously car dependent populations as the “Transit-Oriented Lifestyle” in places like California, where sprawl and congestion are
acute problems. The website MetroRiderLA states that a Transit Oriented Lifestyle Means:

That the citizens of Los Angeles must accustom themselves to public transit as a lifestyle in order to break free of the “car culture” that supposedly exists and flourishes in the city. Once we view public transit as a way of life that connects us as an urban community we can free ourselves of the shackle of the automobile and all the negative baggage that it carries. The Transit Oriented Lifestyle is one where walking, bicycling, mass transit, and car-sharing all take precedence over the personal automobile (MetroRiderLA, 2011).

Bangkok is an interesting case, because it follows North American suburbanization patterns at the fringe, yet there are high density pockets within the suburban landscape, especially along highways. The inner two rings of Bangkok are quite high density, although highly unplanned. The third ring has lower densities, but high density at particular locations primarily along busy thoroughfares (Charoentrakulpeeti, et al., 2006).

Bangkok, just as anywhere else, will face difficulties in challenging the transportation norms and altering the habits of the population. One difference to North American norms is that Thais are more predisposed and habituated to living at high densities. Also, automobile ownership is still not feasible for those of lower socioeconomic status (Jenks, 2003). At this point in time, the less affluent proportion of the population is accustomed to taking public transit. Section 2.2.5 states that the greatest number of passenger kilometers, including all modes, was by bus by a very significant margin, and 62% of the population is still traveling by public transportation.

A study of middle class residents in Bangkok found that the private car was the most favored mode of transportation by 92% of respondents, followed by private
motorcycle at 8% (Charoentrakulpeeti, et al., 2006, p. 699). The main reasons cited for preferring the private automobile are the exposure to pollution and less accessibility than with other modes. The automobile dependency of the middle class has been facilitated, instead of deterred, by policy:

A lenient financial lending policy promoting, among others, easy car purchases; the absence of auto-restraint features in car and fuel taxes; a ‘supply-fix’ approach of increasing city road construction; low toll-way pricing; and a lack of comprehensive and effective land-use measures and planning that, in turn, de-links the goal of efficient transport in the city and land development, and fails to regulate urban sprawl (Charoentrakulpeeti, et al., 2006, p. 708).

The deathly slow crawl of rush hour traffic will hopefully induce some automobile owners to embrace mass transit, as it will ostensibly save them a significant amount of time, money and frustration. In the Hong Kong and Singapore examples above, land use and transportation coordination has been supplemented by strict and enforced car restraint policies. This will be a necessary condition to coerce as many people as possible to use the anticipated mass transit expansion and keep the CBD and inner highways from vehicle-saturation. Some of the main social conditions that will need to be altered are:

- The perception that public transportation is for the poor;
- The perception that public transportation is inconvenient;
- The acquisition of a private vehicle as a highly visible and sought after status symbol; and
- The perception that walking is for the poor, unhealthful or unsafe.
For transit to become a way of life for Bangkok residents, an array of policy and marketing measures will need to accompany the construction of MRT systems. The goal will be to promote a lifestyle change that endorses the use of transit. The TDZ lifestyle will highlight the following principles:

- **MRT as Mainstream**
  Campaigns should market MRT as sleek, efficient and suitable for professional individuals as well as the average individual.

- **Alternative Modes are Sustainable**
  Using public transit promotes more walking, and it is also more environmentally friendly, and schools should implement education programs.

- **World City Status = Efficient Public Transportation**
  If Bangkok is going to emerge as a Global City, its population will need to embrace mass transit.

- **Attack on the Private Automobile**
  Associated automobile restraint policies will need to accompany mass transit promotion.

The next section will describe the methodology of the examination of the Laksi study area, which is based on the TDZ concept.
Chapter 4: Methodology and Context for Analysis

The TDZ Concept, which was summarized in the previous section, will form the basis for the analysis in Chapter 5. Its application to the Laksi Sub-district then forms the methodology of this study. The phases of analysis are broken down as follows:

4.1 Data Gathering,
4.2 Laksi Profile (geographic location, demographics, land use),
4.3 Inventory of Transportation Infrastructure in the study area,
4.4 Laksi as a Transit Development Zone,
4.5 Area-Specific Evaluation and

The subsequent sections will describe each step.

4.1 Data Gathering

Data gathering has involved utilizing various resources. Initially books, articles and other electronic resources were gathered from the University of Cincinnati libraries. Through this, a preliminary understanding of the planning system, the responsible organizations and the relevant plans was gained. The websites of organizations such as the Office of Transport and Traffic Policy and Planning, Mass Rapid Transit Authority, Bangkok Metropolitan Administration, the Department of City Planning, etc. were scanned for any useful information. One limitation to this is that a large proportion of information is posted in Thai, most of which was not translated. Through site visits and access to government offices, some plans English-translated plans were acquired.
4.1.1 Acquisition of Plans and Documents Affecting Laksi

There is a large quantity of land use and transportation documents that affect Laksi, or will be affecting Laksi in the future. These plans have been acquired to the greatest extent possible through online resources and visits to various organizations in Bangkok. At times, portions of these plans have been translated by staff at Maha Sarakham University. The acquisition of these plans has established an understanding of how Laksi is and will be affected by public projects. The process of gathering plans for Laksi has been vital to understanding the context of the sub-district.

4.1.2 GIS and Other Data

Acquiring GIS data that contained the required metadata associated with land uses and building locations proved difficult. Initially, 2006 Bangkok GIS data were acquired, but they were found to have no metadata attached. 2002 data containing land uses were available, but given that the Laksi area was transformed in 2006/2007 with the construction of the extensive government complex, these data were found to be out-of-date with the current uses in the study area. Finally, 2007 data were obtained in a ‘.map’ format, which had to be converted. ‘.Map’ file extensions are useable within MapInfo, but only ArcView was available for use in this project, so files were then converted.

Building and land use information was acquired from the Department of City Planning. This information provided a great deal of useful population information, land use information and facts about the employment characteristics of the district.
4.1.3 Field Research

Several site visits were undertaken in October and November 2010 to further evaluate land uses and to gain an understanding of traffic flow and dynamics within the sub-district. Various modes of transportation were used when traveling to and within the district to better understand movement. These included the current long distance train that serves the district (soon to be the Red Line Commuter Train), private vehicle, taxi, bus and by foot. Extensive field notes and photographs were taken at the time of the site visits, which appear throughout the document.

4.2 Laksi Profile

This section establishes the Laksi profile based on the information gathering described in Section 4.1.

4.2.1 Geographical Location

Laksi

Laksi is located in the north of Bangkok, and it is roughly 6.5 kilometers east of the winding Chao Phraya River. It is directly south of Don Muang, the location of the previous primary international airport in Bangkok. Although Suvarnabhumi is now the principle international commercial airport, Don Muang still serves domestic commercial airlines and other civilian and military functions. Other adjacent districts are Bang Khen to the east, Lat Yao to the south and to the west of Laksi is the boundary with Nonthaburi province.
Transportation within this district is of the utmost importance due to the presence of the government complex, which, according to the BMA is estimated to employ over 20,000 people. The study area entails all land that falls within an 800 meter radius of...
the Laksi Red Line transit stop, which is planned to be located at the corner of Chaeng Wattana and Vibhavadi Rangsit Road/Don Muang Tollway (the Tollway runs above Vibhavadi Rangsit).

Figure 13: The Study Area

(ESRI, 2010)

As of early 2010, the Pink Line mass transit project has been set to run along Chaeng Wattana, although it has not yet been determined whether it will be an elevated rail system or monorail system. The M-Map document discussed in Section 2.4.2 states
that the Pink Line will serve the government complex; however, the transit station is yet to be decided. This document also states that there will be an interchange between the Pink Line and the Red Line station within the study area. The area will be expanded to include particular areas of interest that are adjacent to Chaeng Wattana. The impetus for expanding the study area is to ensure that the government complex and other significant areas are considered for access to the transit station, given that it will be the only local transit stop for some time. This will ensure that Mass Transit is as accessible as possible to Laksi residents.

4.2.2 Demographics

Demographic statistics were received from the Department of City Planning and translated at Mahasarakham University. These are the most recent available statistics. There seems to be a discrepancy between registered residents of Laksi, and those surveyed from the 2010 census. The census also gives figures from Laksi residents employed in manufacturing and by the government. An explanation for the holding capacity calculation could not be found, but it is assumed to be the estimated capacity of residential dwellings versus the actual population within the district.

<table>
<thead>
<tr>
<th>Population Statistics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Register&quot;</td>
<td>155,518</td>
</tr>
<tr>
<td>Census</td>
<td>128,572</td>
</tr>
<tr>
<td>Working population</td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>78,412</td>
</tr>
<tr>
<td>Government</td>
<td>35,746</td>
</tr>
<tr>
<td>Remaining Holding Capacity</td>
<td>-40,958</td>
</tr>
</tbody>
</table>

(Bangkok Metropolitan Administration, 2010)
4.2.3 Land Use

According to the Bangkok Metropolitan Administration, the most common land uses in the Laksi district are residential (47.11%), government (16.34%), transportation (13.84%), recreation (8.96) and commercial (8.02%). Land uses existing in smaller proportions are education (2.35%), industrial (1.86%), warehouse (1.06%) and religion (0.14%).

Figure 14: Land Uses in Laksi

(Bangkok Metropolitan Administration, 2010)

The image below was taken from the 2006 comprehensive plan, which is the most recent available plan. Site visits revealed a much more complex land use situation than is indicated in this plan. This plan asserts that there are great swathes of low-density residential land uses in Laksi. The largest oversight on this map applies to the north side of Chaeng Wattana Road; although there are pockets of exclusively residential land in the north of the district, it is largely a mixed use area where one will find dwellings,
commercial areas and office space in the area immediately adjacent to the road. Based on site visits, it is estimated that the directly abutting land to the north side of Chaeng Wattana Road is predominantly commercial land and office space with few residences.

Figure 15: Laksi Land Uses from the 2006 Comprehensive Plan

(Department of City Planning, 2006)
4.3 Inventory of Transportation Infrastructure in the Study Area

This inventory has been completed through information received via plans, various planning agencies and site visits to the study area.

Table 11: Transportation Infrastructure Inventory

<table>
<thead>
<tr>
<th>Mode</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Bus</td>
<td>There are several bus stops along Chaeng Wattana, with many along the length of Chaeng Wattana that serves the government complex, on both sides of the road. OTHER?</td>
</tr>
<tr>
<td>Minibus</td>
<td>The exact numbers of minibuses serving the area is not documented, nor were any observations made at the time of site visits.</td>
</tr>
<tr>
<td>Taxi</td>
<td>Taxis line up along Chaeng Wattana Road at the end of the work day, and are fixtures at IT Square, Big C and Carrefour.</td>
</tr>
<tr>
<td>Motorcycle Taxi</td>
<td>Motorcycle taxis are numerous outside of the government complex, at the current Laksi long distance train station.</td>
</tr>
<tr>
<td>Private Vehicle</td>
<td>Private vehicle is the primary form of transportation at present. The presence of several major highways in the sub-district promotes the use of private vehicles. In total, Chiang Wittana sees a capacity of 90,000 vehicles per day and Vibhavadi Rangsit Rd., which sees 245,300 vehicles per day (Department of Highways, 2010).</td>
</tr>
<tr>
<td>Pedestrian Infrastructure</td>
<td>There are sidewalks along the length of Chaeng Wattana, and pedestrian overpasses at intervals so that this busy thoroughfare can be crossed. At the major intersection of Chaeng Wattana and Vibhavadi Rangsit, there are some elevated pedestrian-ways. There are no pedestrian connections to the current Laksi SRT railway station.</td>
</tr>
<tr>
<td>Red Line Commuter Train*</td>
<td>The Red Line Commuter Train is planned to open within a five-year time frame. It will be managed by the SRT, and will run alongside the long distance commuter train. The planned stop is expected to be directly adjacent to IT Square to the east.</td>
</tr>
<tr>
<td>Pink Line Commuter Train*</td>
<td>The Pink Line Commuter Train is set to become a high priority to the government, but is planned for construction sometime after the red line is operational. It will intersect with the Red Line Commuter Train, and also have a stop directly on the Government Center grounds along Chaeng Wattana.</td>
</tr>
</tbody>
</table>

* Indicates planned infrastructure 

(Gibson, 2010)
4.4 **Laksi as a Transit Development Zone**

This section will review all of the TDZ; i.e., Density, Mix of Uses, Size of Neighborhood, Transportation Infrastructure and Connectivity, and discern whether Laksi fits these criteria. The Laksi profile given in Section 4.2 will provide much of the information needed to complete this assessment.

4.5 **Area-Specific Evaluation**

Given that the Comprehensive Plan provides little guidance with regard to actual land uses within the study area, the area will be sub-divided based on proximity to transit, use and degree of connectivity. Actual land uses on parcels were noted to the greatest degree possible at the time of site visits. In Chapter 5, each area will be presented with a description, and analysis of connectivity and integration issues will follow.
Chapter 5: Analysis

5.1 Laksi as a Transit Development Zone

Section 3.3.2 has outlined the key components of a TDZ, which are Density, Mix of Uses, Appropriate Size of Neighborhood, Transit Infrastructure and Connectivity, while Section 4.2 provided an understanding of the context of the Laksi Sub-district. This section explores the application of the TDZ elements to the proposed study area in the Laksi Sub-district.

Table 12: Laksi TDZ Evaluation

<table>
<thead>
<tr>
<th>Laksi TDZ Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Density</strong></td>
</tr>
<tr>
<td>- Shophouses, which are a prevalent development pattern throughout the study area already provide the high/medium-high density required</td>
</tr>
<tr>
<td>- There are many multi-story apartment buildings within the TDZ</td>
</tr>
<tr>
<td>- There are multiple sites (outlined in the next section) where it would be feasible to develop high density housing to maximize transit patronage (these development opportunities will be explored further in later sections)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Mix of Uses</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Shophouses are found in historical/organic growth areas in Asia, and typically contain commercial establishments on the ground floor, with apartments on upper floors</td>
</tr>
<tr>
<td>- IT Square contains a variety of shopping opportunities and a grocery store</td>
</tr>
<tr>
<td>- There is a large and nationally significant employment center within the study area. Connectivity to this employment center will be of the utmost importance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Size of Neighborhood</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- The boundaries of the TDZ will be drawn based on standard walking distance; it will also consider the surrounding area given that there are several important points of interest in the immediate vicinity of the Laksi TDZ</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Transportation Infrastructure</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- The Mass Rapid Transit station will provide the necessary transportation infrastructure to ensure that Laksi is appropriate for TDZ application</td>
</tr>
<tr>
<td>- There also several complimentary bus routes running along Chaeng Wattana</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Connectivity</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Connectivity is poor in terms of street connectivity, which will be explored in depth in the next sections</td>
</tr>
</tbody>
</table>
• Motorcycle taxis act as a gap-filler, largely from soi to main transit route (Chairatanon, 2006)
• Once the transit station is built, connectivity will be of utmost importance to ensure that the largest possible population is provided with transit access
• Given that Laksi satisfies all other criteria, the next sections will explore how connectivity to the transit station can be improved.

(Gibson, 2010)

5.2 Area-Specific Evaluation

Figure 16 below displays how the sub-district has been broken down for further evaluation, and the following section assesses each sub-area individually. The evaluation of these areas will draw heavily from information gathered during site visits by the researcher during her field work.
Figure 16: Significant Areas in the Laksi Study Area

(ESRI, 2010)
5.2.1 Area 1: The Bangkok Government Center, Laksi

This area will be very significant. Although there is a planned transit stop on-site via the Pink Line, which would run along Chaeng Wattana Road, it is likely that the construction of this line will not take place for many years. Transit accessibility will first need to be focused on the Red Line transit stop until the completion of the Pink Line.

Not only is the Government Center a destination for thousands of workers on a daily basis, it also attracts daily visitors who make use of the government services offered there. The visitor population will be likely candidates to travel to the district via MRT, especially if there is a parking fee increase on the grounds. It should be well-advertised that visitors dealing with visa issues, passport issues, going to meetings/events, etc. can take the Red Line train and conveniently make their way to the Government Center.

Parking and traffic curbing measures will be required within the area. There should be an increase in the cost of parking, and a decrease in the overall supply of parking. This will be met with opposition, but these reforms are necessary to induce habit-changing behavior. An employee campaign should commence to endorse transit use once the Red Line is completed and the transit station is open.

A large portion of the Government Center is further than 1km away from the transit stop. It is likely that many will prefer not to walk this distance, so frequent bus or paratransit links should be provided. Paratransit and motorcycle taxis, which are provided by the private sector in Bangkok, are highly responsive to demand. If there is a
market for paratransit from the transit stop to the government center, it is likely that there will be a response from providers. The facilitation of private sector integration is an option if public buses cannot meet demand.

5.2.2 Area 2: Commercial/TK Palace/Residential/Light Industrial

There are several uses present in this area. There is some, although an unknown amount, of light industrial uses immediately adjacent to Chaeng Wattana – like Prachan Osot Ltd., which is a small pharmaceutical company. There are other known commercial venues such as the TK Palace hotel and Indy Seabar. There is an apartment building, and the rest of the district is either vacant, or composed of single-detached homes. There are also bands of undeveloped land and one retention pond. Facilitating transit usage is challenging in a low density, car-supportive environment such as this. The only possibilities for this district are to 1. Ensure that there is a bus stop along Chaeng Wattana that can serve this area, and 2. Facilitate access to this trunk line. As stated above; motorcycle taxis often fill this gap, given that it is not feasible to run a bus route through an area of such low density.

It is possible that the TK Palace Hotel and associated commercial venues have a large enough client base to warrant some sort of public transportation in this area. Further study should be undertaken.

5.2.3 Area 3: Single-Family, Low-Density Residential

This area is composed of largely single-family homes and is low-density. Site visits identified a small number of apartment buildings. There is a large retention pond that is
considered to be a lake. There are walkways and landscaping around the lake, and it serves a recreational function, although there is no actual greenspace of any substantial size. The residential blocks are shaped like oblong rectangles, with the longest side being roughly 100m. This is not optimal for pedestrian connectivity, as excessively long blocks are perceived as onerous to walk. In some cases, there are forty structures on a single block. It also appears that these single-family homes are large, which indicates a more affluent population. If this is the case, it will be a car dependent population as well. Affluent populations will also be more impervious to parking cost hikes and other monetary-based efforts to dissuade automobile usage. Further study should evaluate whether there is any public transportation operating within Area 3, or if there would be any substantial demand for the MRT service.

5.2.4 Area 4: Development Adjacent to Chaeng Wattana

Ideally, Chaeng Wattana will see a great deal more pedestrian traffic. Thus far, construction along this road is not human-scale as it is composed of large, modern buildings encircled by parking lots. New construction should adhere to design guidelines appropriate for pedestrian districts. Building entrances should face major routes and pedestrian traffic flows, in contrast to the current practice of building entrances to face parking and swathes of asphalt. This road is already highly built-up, so the means to change existing patterns should be explored, if any.

There are some sections of Chaeng Wattana, largely to the east of Area 4, that have shophouses and sidewalks in front. This type of development should be encouraged.
To the west of Area 4, along Chaeng Wattana, there is a Big C and Carrefour, both of which are large-scale 'big box' retail venues. This type of development is not considered to be pedestrian-friendly. However, the areas further to the east of Area 4, near the transit station, will be a much higher priority for human-scale design.

To ensure that pedestrians feel comfortable, trees should shade walkways to the greatest extent possible. This will also break up the monotony of the cement-laden character of Chaeng Wattana. Lighting should also be provided to give pedestrians a feeling of safety.

The intersection of Don Muang Tollway, Vibhavadi Rangsit and Chaeng Wattana highways has created a fractured eyesore from the pedestrian level. Sidewalks or safe crossings are few (and it should be noted that this is immediately outside the transit station), and it is possible that the most feasible way to pedestrianize around the transit stop will be via elevated walkways. There is already one walkway that brings pedestrians from the east side of Vibhavadi Rangsit to IT Square on the west side.

5.2.5 Area 5: Adjacent to Transit Station with a 500m Radius

The land inside of this radius is considered to be within walking distance from the transit station. The redevelopment of the land within this radius will be essential to ensure that a critical threshold of users will be established. It is an advantage that IT Square is located directly next to the planned transit station, as it is a destination within the city. Given that each corner of this intersection is distinctive, Area 5 will be broken
down into its separate corners at the intersection of Vibhavadi Rangsit and Chaeng Wattana.

**Figure 17: Four Corners of Intersection Adjacent to Planned Transit Stop**

(GoogleEarth, 2010)

### 5.2.5.1 Northwest Corner

This is the corner of the intersection where the transit stop will be located. There should be pedestrian access, in some form, from each of the corners to the transit stop, and it is safe to assume that there will be a walkway directly from IT Square. This particular corner will be dominated by the presence of IT Square. There

(Figure 18: IT Square, Northwest Corner of Area 5

(Gibson, 2010)
is a complex of several temples (wats) to the north of IT Square, and pedestrian links should be improved.

Directly behind IT Square is a canal with seemingly low-income housing constructed at its banks. This housing appears to be quite dense. This canal and abutting housing will act as a pedestrian barrier given that there are no bridges or walkways across. It is highly likely that residents in this ribbon of residences do not own a vehicle, and utilize public transportation for their trips. It is hoped that they will use the mass transit, but in Bangkok, it has been found that low-income residents cannot afford the current skytrain and underground train in the CBD (Jenks, 2003). The issue of affordability for low-income populations such as this one should be explored further.

The Laksi District Office, which was visited numerous times during site visits, is located directly west of the canal. This building is a significant employer. Staff park on the surrounding streets, and there is one parking lot on site. When the transit station is operational, a decrease in parking supply should be considered given the proximity of this site to the transit stop.

It has been noted throughout that secondary and tertiary roads in Bangkok have poor connectivity, and this is true of Laksi as well. Around the transit station, a policy of
only pedestrian way improvement (and neglect of the car-based street system) should be considered. If it is inconvenient it is to drive a car, more people will switch to walking/MRT usage.

5.2.5.2 Northeast Corner

The Northeast corner is predicted to have vast redevelopment potential, as the areas immediately adjacent to the corner are used for bus parking, and small-scale industrial uses (although the latter point cannot be unequivocally confirmed).

Figure 20: Aerial Photo of Northeast Corner

(GoogleEarth 2010)

The areas beyond the corner seem to be a mix of mostly industrial use with some residences present as well. The Comprehensive Plan asserts that this area is “low-density residential”, but this is clearly not the case. A proper inventory of uses on this land should be completed in advance of the area planning process. In keeping with the desire to have an adequate ridership threshold within the immediate walking distance, it is recommendable that this area be developed into high-density residential. There are sufficient commercial developments in the near vicinity, such as IT Square and Talat
Bang Khen Market and other small-scale vendors to the east. Residences at this location will provide riders for the Red Line, support commercial investment in the area and perhaps can be a viable housing option for workers at the Government Center.

5.2.5.3 Southeast Corner

At this corner, uses are difficult to ascertain. Roads appear to informally stretch through structures that appear to have a light industrial use. A land use inventory should be conducted on this land to discern what is currently there. It is not accurately indicated on the Comprehensive Plan. Pedestrian movement will be challenging given that most streets come to dead ends.

It is assumed that redevelopment potential will be high. Oftentimes in Bangkok, when construction of a transit line begins, private sector interest flock to the land around transit stops. It is possible that the development of this land into a higher use will happen without public sector intervention, however, development proposals should be thoroughly evaluated and ensure that they complement the TDZ plans and goals.

5.2.5.4 Southwest Corner

At the southwest corner is where the Government Center begins. There is a strip of land between Thanon Kamphaeng Phet 6, a well-traveled thoroughfare, and Vibhavadi Rangsit Highway, and beyond this is the Government Center. There are hopes to create a road connection between the Center and Vibhavadi Rangsit Highway (OCMLT, 2010). At present, there are several obstructions connecting the Government Center – a canal, Thanon Kamphaeng Phet 6 Road and the long distance train tracks (refer to Figure 21),
which is also where the Red Line train tracks will be installed. If a connection over these obstructions cannot be found, pedestrian traffic will be required to take the sidewalks at Chaeng Wattana. The strip of land between Vibhavadi Rangsit and Kamphaeng Phet 6, where the current SRT Laksi Train Station is located, is quite thin and redevelopment does not offer many alternatives, given space constraints. If the aforementioned obstructions cannot be bridged, all traffic should be steered toward Chaeng Wattana.

There is a large vacant parcel of land to the west of the current Laksi Train Station. Development potential should be investigated.

Figure 21: Aerial Photograph of Southwest Corner

(GoogleEarth, 2011)
5.2.6 Area 6: Low Density Residential, Vacant Land and Industrial

Site visits revealed inconsistent patterns of land use. There appears to be a great deal of undeveloped land, while present uses appear to be light industrial and single-family detached homes. Street connectivity is particularly poor in this area, as there are few intersections and a great deal of dead end streets. Two studies are necessary to properly assess this area: a proper land use inventory and an assessment of need for public transit.

If sufficient land could be acquired, this area could become a Planned Unit Development. The entire area could be planned in advance, with all transportation infrastructure geared toward maximum use of mass transit. This possibility should be further explored. Redevelopment potential appears to be high.

5.2.7 Area 7: Educational and Commercial, South of Study Area

This area deserves mention due to two notable structures – the Chulabhorn Research Institute, founded by the Thai Princess Chulabhorn, and the Miracle Grand Hotel and Convention Center. These locations should be integrated into local transit plans, as they are large employers and destinations and are located directly adjacent to the Red Line (OCMLT, 2010). If there is no transit stop in the immediate vicinity, frequent bus or paratransit services should be provided to these locations.
5.2.8 Area 8: Muang Thong Thani – Hotel, Conference and Performance Venue

Area 8 is quite distant from the planned transit stop, but if no other transit stops serve this venue, then connectivity to the transit stop should be considered. This is a very significant high-rise housing complex, and the Impact Performance Venue is one of the most significant in the City (Boonlua, 2007). It is located several kilometers from the transit stop, so this will not be an immediate concern. The integration of public transit to this location should be studied.
Chapter 6: Conclusion and Recommendations

The preceding chapters have presented a guided appraisal of dynamics within the study area. Being cognizant of these dynamics will not be sufficient in that policy changes and more stringent planning measures will need to be enforced. Given the scale of the investment and expansion of mass rapid transit, there will be many other districts like Laksi, where initially access to transit stations will be poor, especially given the condition of minor road systems. This document can act as one piece in a dialogue about how the city and Metropolitan Administration can manage growth and new transportation nodes. Officials in Bangkok have made significant steps forward in the evolution from private vehicle-centered travel, back to a pedestrian and public transit focus. Private sector investment will follow the train tracks, and regulation of these private-sector forces will ensure a more sustainable future for Bangkok and can act as a model for other megacities in the developing world.

The following section will give specific recommendations to be applied at the sub-district and city levels, as well as for further study. Those for further study could lead to research projects for local Thai Universities. With regard to the study area, where there is a tangible timeframe for construction, recommendations will be categorized as high, medium and low priority. In practice, prioritizing projects usually entails attaching a corresponding time horizon for completion. These designations will appear as below, next to the recommendation as noted below.
Recommendations for Bangkok City, however, and those for further study, are not prioritized because they are more general and will apply to future TDZ throughout the City.
## 6.1 Recommendations for the Laksi Sub-Center

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete an analysis of parking demand, and parking requirements within the new TDZ, with specific attention to the Government Center.</td>
<td>High</td>
</tr>
<tr>
<td>At present, the northeast corner of Chaeng Wattana/Vibhavadi Rangsit has a very low level use – commercial bus parking. Based on site visits, it would seem that the redevelopment potential on the northeast and southeast corner is high. If this is not city-owned or SRT-owned, then the development of this land should be facilitated and further guided through zoning regulation.</td>
<td>High</td>
</tr>
<tr>
<td>Upon opening the Red Line, ensure the highest degree of integration with transit infrastructure connecting the Government Center with the transit stop.</td>
<td>High</td>
</tr>
<tr>
<td>Pedestrian-oriented design should be implemented in the areas within a 500m radius of the transit stop.</td>
<td>High</td>
</tr>
<tr>
<td>As soon as the transit stop location plans are solidified, begin area plans for the TDZ.</td>
<td>High</td>
</tr>
<tr>
<td>Undertake a campaign to promote transit at employment centers, particularly the Government Center. Highlight the environmental and health benefits of transit and walking. Given the stigma associated with public transit as being for the poor, it should be marketed as the way professionals travel to work, as in Europe, Japan, Singapore, Hong Kong, etc. Additionally, the time savings gained through transit use will be attractive, and a marketable attribute.</td>
<td>Medium</td>
</tr>
<tr>
<td>Street connectivity is consistently poor in the sub-district. Focus on pedestrian pathways within walking distance from the transit stop, and neglect street connectivity, which will hopefully induce more walking.</td>
<td>Medium</td>
</tr>
<tr>
<td>At present, the mode of building construction in Laksi is to position entrances toward parking lots. Entrances should be oriented toward the street network and directly toward pedestrian flow. This should be applied to all new construction.</td>
<td>Medium</td>
</tr>
<tr>
<td>Ensure widespread advertisement to visitors that the Government Center is highly accessible via MRT.</td>
<td>Medium</td>
</tr>
<tr>
<td>Assess currently undeveloped plots, which are numerous within the sub-district. Development of these plots could add additional housing units and a larger ridership base, thereby maximizing resources and contributing to the viability of new commercial investments.</td>
<td>Medium</td>
</tr>
<tr>
<td>Do not discount the effectiveness of motorcycle taxis in connecting residential areas to major transit trunk routes. If deemed to be a worthwhile alternative to public transportation, regulate and facilitate motorcycle taxis where needed. It is likely that they are the most economically feasible way to connect residents of low-density areas to the Red Line, given that low density development does not contain a high enough transit user threshold.</td>
<td>Medium</td>
</tr>
<tr>
<td>The Muang Thong Thani site, where there are multiple high-rise apartments and an exceptionally successful entertainment/exposition venue, should be considered as a site where connectivity with the transit stop should be established. The Pink Line, once complete, will be closer but residents and visitors of this venue should be able to consider taking the Red Line conveniently until the Pink Line is completed.</td>
<td>Medium</td>
</tr>
</tbody>
</table>
### 6.2 Recommendations for Bangkok City

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrianize Chaeng Wattana Road to the greatest degree possible; this includes providing tree cover, sufficient walkways over Chaeng Wattana’s busy lanes, lighting and other safety considerations.</td>
<td>Medium</td>
</tr>
<tr>
<td>In the immediate vicinity of the planned transit stop, there is a canal where a significant amount of low-income housing built on stilts above its banks. Will this population be able to afford transit (MRT in Bangkok is generally not affordable to the poor). Consider this issue.</td>
<td>Medium</td>
</tr>
<tr>
<td>If Laksi proves to be a vibrant subcenter within the City, it could feasibly become a district where airport travelers might want to stay before flights, given its proximity to Don Muang Airport. This possibility should be explored.</td>
<td>Low</td>
</tr>
<tr>
<td>Bangkok streets are inhospitable for cyclists; the integration of cycling infrastructure should be considered, and the need/demand for this should be periodically assessed.</td>
<td>Low</td>
</tr>
<tr>
<td>Assess connectivity to the Muang Thong Thani Complex. It is a focal point in the City, and connectivity to the closest transit stop should be facilitated.</td>
<td>Low</td>
</tr>
</tbody>
</table>

- **Recommendation**
  
  There are a great many problems with the street network in Bangkok. Focus instead on improving pedestrian circulation around transit. The benefits of this are twofold; increasing street capacity will continue to facilitate automobile traffic (which is undesirable), and pedestrian connections are much less expensive to plan and construct.

- **Recommendation**
  
  If it is found that institutional capacity is low in dealing with city-wide development proposals, ensure that development around transit stations is a primary focus.

- **Recommendation**
  
  Ensure that there is high density development within a walking distance radius of all transit stations. This will ensure adequate ridership and maximization of resources.

- **Recommendation**
  
  Station designs should come equipped with area plans to ensure that density, mix of uses, parking and pedestrian access are maximized. They will also delineate TDZ boundaries and focus planning efforts.

- **Recommendation**
  
  Assess whether there is good job/housing balance within station TDZs. Perhaps research projects such as these can be done in conjunction with local universities.

- **Recommendation**
  
  This issue has been given little attention throughout this document, but parkland should be developed in TDZs wherever possible. There is a vast dearth of green space within the city. Explore innovative means to fund park and greenspace projects. For example, individuals or organizations who donate to park development can officially name the park.

- **Recommendation**
  
  Create implementation plans as part of TDZ plans.

- **Recommendation**
  
  Identify specific users at stations, and station types. For example, if Rangsit station serves a large commuter population, it is likely that some park and ride facilities will be needed. Make adjustments appropriate for local patrons.

- **Recommendation**
  
  Greenery should be used wherever possible to enhance the pedestrian experience, and also serve a crucial cooling function on pedestrian ways.

- **Recommendation**
  
  Ensure that vehicular access for buses, motorcycle taxis, or drop-off does not interfere with pedestrian access.
6.3 Recommendations for Further Study

- **Recommendation**
  
  It is necessary to determine if the TK Palace Hotel and associated commercial enterprises have a large enough client base to warrant public transportation in Area 2: Commercial/TK Palace/Residential/Light Industrial (Section 5.2.2).

- Further study should evaluate whether there is any public transportation operating within Area 3: Single-Family/Low-Density Residential, or if there would be substantial demand for the MRT service (Section 5.2.3).

- There is a large vacant parcel of land to the west of the Laksi Train Station whose development potential should be investigated (Section 5.2.5.4)

- The integration of public transit to Area 8: Muang Thong Thani Hotel, Conference and Performance Venue should be studied.

- Assess whether there is good job/housing balance within TDZ’s in Bangkok City.

6.4 Conclusion

Bangkok is a vibrant world city and the hub of Southeast Asia. There is a sleepless energy where the entrepreneurial spirit abounds. With the exception of the Asian Financial Crisis and the recent 2008 recession, GDP growth rates are positive. As this economy continues to grow, the importance of Bangkok on a national and international scale will expand.

Traffic congestion is proving a hindrance to economic growth, a high standard of living and a healthy environment. TDZs have been a key to the realization of sustainable urban transportation in other Asian countries, and could be appropriately applied to Bangkok. Small changes to pedestrian facilities, and plans for development around nodes can have a very significant impact on the appeal and patronage of public transit.
Concurrently, policy will need to take a strong stance against private automobile use and negative perceptions about public transit. To maximize the impact of the planned MRT, Bangkok will need to devote sufficient resources to the future land use and transportation integration within the City.
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