Improving Public Health through Urban Design: the case of Delano, California

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ABSTRACT

Improving Public Health through Urban Design: the case of Delano, California

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Emerging research shows a clear relationship between urban design and public health. Major issues effecting public health include cardiovascular disease, high rates of obesity, and associated diseases like Type 2 diabetes. These conditions can be attributed, in a large part, to personal habits, including diet and physical activity. Certain elements of urban design have an impact on personal habits and therefore affect health. This report explores the relationship between urban design and public health, first broadly, and then at a micro-scale, examining the relationship in the context of the City of Delano, California.

This exploratory study begins with an in-depth literature review examining the links between urban design and public health. The literature review is followed by a Community Healthy Assessment, a tool that was used to gather data on existing conditions of urban design and public health in Delano. Based on findings from the Community Health Assessment, a series of policy and urban design recommendations are made, with the intent of aiding in improving overall health in Delano. Policy recommendations are mentioned in this paper, but not addressed further. Urban Design recommendations were developed into a document for the City of Delano to use as a reference, titled *Healthy Delano Design Guidelines: a guide to health-oriented planning*.

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Chapter 1: Introduction

Contemporary literature suggests a relationship between urban design and public health. The built environment is linked to a wide range of health issues including levels of physical activity, respiratory health, and overall quality of life. Fifty years ago the American Public Health Association (APHA) declared, “it has been clearly recognized that the effect of substandard environment extends beyond direct threats to physiological health, and that it involves quite as significant detriments to mental and emotional well-being” (Frumkin, 2005 p.258). Today the relationship between urban design and public health, both physical and mental, is more complex than ever. The current state of our built environment and natural world, and unhealthy human behavioral patterns all interact to greatly influence man’s physical and mental state.

This study explores the complexity of the relationship between urban design and public health, first through a review of relevant literature, and then in the context of the City of Delano, California. The core of the Delano study is a Baseline Community Health Assessment (Appendix A). This assessment follows guidelines outlined in *How to Create and Implement Healthy General Plans*, published in 2008 by Public Health Law & Policy and Raimi + Associates. The document *How to Create and Implement Healthy General Plans* provides an in-depth list of data to be gathered about the community being studied. This list is designed to guide research on public health and urban design in the study area, and findings are intended to provide insight into current health conditions and the urban design features that impact lifestyle choices and public health. For this study, research efforts were guided by this list, but altered to suit Delano. All of the findings were used to form goals for a healthy community vision in Delano. These goals were used to inform urban design guidelines for Delano, which are attached as an appendix to this document (Appendix B).

Chapter 2: Literature Review

Literature suggests a clear relationship between urban design and public health. Extensive research has been conducted to explore this relationship, and make clear connections between elements of the built environment and physical activity levels, feelings of safety, methods of transportation and even eating habits. This study examines that research and aims to provide a summary of the most significant and controllable links between urban form and public health.

2.1 Obesity, Diabetes and Cardiovascular Disease

According to the World Health Organization (WHO) (2003), rates of obesity, diabetes and cardiovascular disease have reached epidemic levels in the United States, and these diseases can be largely attributed to personal habits, including diet and physical inactivity. In 2003 the World Health Organization reported that there were over one billion overweight adults in the world, and at least 300 million of them were obese. Obesity and overweight “pose a major risk for serious diet-related chronic diseases, including type 2 diabetes, cardiovascular disease, hypertension and stroke, and certain forms of cancer” (WHO, 2003). The health consequences of these obesity-related diseases range from “increased risk of premature death, to serious chronic conditions that reduce the overall quality of life” (WHO, 2003).

Obesity and overweight are commonly measured using body mass index (BMI). Merriam Webster Dictionary defines BMI as “a measure of body fat that is the ratio of the weight of the body in kilograms to the square of its height in meters defined as one’s weight in kilograms divided by the square of one’s height in meters (kg/m^2). According to the WHO (2003), a BMI over 25 kg/m^2 is defined as overweight, and a BMI over 30 kg/m^2 as obese. Adult BMI levels of $25\text{-}27 \text{ kg/m}^2$ are prevalent across North America, and the distribution of BMI is shifting upwards in many populations (World Health Organization, 2003). Body mass index “increases amongst middle-aged elderly people, who are at the greatest risk of health complications” (World Health Organization, 2003).

Obesity has become a serious health concern for children and adolescents. According to the Surgeon General, the number of overweight children in the United States has doubled since 1980 and the prevalence of obese children between the ages of six and 11 has more than doubled since 1960 (World Health Organization, 2003). Obese children and adolescents are “more likely to have risk factors associated with cardiovascular disease (such as high blood pressure, high cholesterol, and Type 2 diabetes) than are other children and adolescents” (Centers for Disease Control and Prevention, 2009). Obese children are also more likely to be obese as adults. One study found “approximately 80 percent of children who were overweight at age 10-15 years were obese adults at age 25 years” (Centers for Disease Control and Prevention, 2009). Similarly, another study found that 25 percent of obese adults were also obese as children (Centers for Disease Control and Prevention, 2009). This study also found “if overweight begins before 8 years of age, obesity in adulthood is likely to be more severe (Centers for Disease Control and Prevention, 2009).

Data collected by the CDC between 2006 and 2008 shows a higher prevalence of obesity among African Americans and Hispanics than non-Hispanic whites (CDC, 2008). The Active Living Research (ALR) program of the Robert Wood Foundation presents findings from studies on physical activity levels among residents of low-income neighborhoods and communities of color in a 2008 research summary titled *Designing for Active Living Among Adults*. According to the report, studies found “neighborhoods with high concentrations of Hispanic and African-American populations or high concentrations of low-income residents” are less likely to have public parks and private recreation facilities (ALR, 2008, p.6). Research has also found a connection between neighborhood safety and physical activity. According to a study of 1,180 predominantly Hispanic and African American adults in low-income housing projects near Boston, women who considered their neighborhood to be safe took 20 percent more steps per day than women who reported their neighborhood as unsafe (ALR, 2008, p.5). This research demonstrates residents of low-income neighborhoods and communities of color may face unique barriers that limit physical activity and a healthy lifestyle, contributing to higher rates of obesity.

There are many health problems related to having excess body fat. These problems can be non-fatal but debilitating conditions such as respiratory difficulties, chronic musculoskeletal problems, skin problems and infertility. They can also be life-threatening illnesses including cardiovascular disease, Type 2 diabetes, certain types of cancers and gallbladder disease (World Health Organization, 2003).

Only recently has Type 2 diabetes emerged as a health-related problem among children and adolescents, and the disease is “increasingly being reported among children and adolescents who are obese” (Centers for Disease Control and Prevention, 2009). In both adults and children, “the likelihood of developing Type 2 diabetes rises steeply with increasing body fatness” (World Health Organization, 2003). Approximately 85 percent of those suffering from diabetes have Type 2, and 90 percent of those with Type 2 diabetes are overweight or obese (World Health Organization, 2003).

Life-threatening diseases like Type 2 diabetes and cardiovascular disease are directly related to overweight and obesity, conditions that have reached epidemic proportions in the United States. High rates of overweight and obesity contribute to unusually high rates of Type 2 diabetes and cardiovascular disease, which has become the number one cause of death for Americans. Physical inactivity and poor diet are the major factors contributing to overweight and obesity.

2.2 Physical Inactivity

In 1996 the U.S. Surgeon General conducted a study on physical activity and health for the U.S. Department of Health and Human Services and the Centers for Disease Control (CDC). The report found people who engage in regular physical activity face a reduced risk of coronary heart disease, hypertension, colon cancer, and non-insulin dependent diabetes (CDC, 1996). According to the study, those engaging in regular physical activity also had “improved maintenance of muscle strength, joint structure, and joint function; reduced body weight and favorable redistribution of body fat, improved physical functioning if they suffer from poor health; and healthier cardiovascular, respiratory, and endocrine systems” (CDC, 1996). According to the

study, “Americans can substantially improve their health and quality of life by including moderate amounts of physical activity in their daily lives,” and the “health benefits appear to be proportional to the amount of activity; thus, every increase in activity adds some benefit” (CDC, 1996) The surgeon general found physical activity “produces important psychological benefits...it relieves symptoms of depression and anxiety, improves mood, and enhances psychological well-being” (CDC, 1996).

According to the Center for Disease Control and Prevention (CDC) “only 25 percent of American adults engage in the recommended levels of physical activity, and 29 percent engage in no leisure-time physical activity... The numbers for children and adolescents are similar: only 27 percent of students in grades 9 through 12 engage in moderate to intensive physical activity” (The Trust for Public Land, 2006, p.7). Research suggests even moderate levels of physical activity can make a significant impact to public health. “The CDC estimates that a difference of 100 calories of exercise per person per day—a 20-minute walk—could eliminate the nation’s obesity epidemic” (The Trust for Public Land , 2006, p.12). Moderate physical activity can also come in the form of incidental exercise. “Health professionals promote the benefits of incidental exercise, such as gardening, climbing stairs, or biking to do errands, and they note that, whereas people might not maintain enthusiasm for a dedicated exercise program, incidental physical activity requires less motivation” (The Trust for Public Land , 2006, p.12). Charlene Burgeson, health scientist in CDC’s Division of Adolescent and School Health, points to lifestyle changes as a major contributing factor to a lack of physical activity. She explains, “exercise, such as walking or bicycling to work or school, is no longer a natural part of a daily routine, largely because communities are not designed to facilitate it” (CDC Foundation). “In many communities, there are no sidewalks at all, only roads, so often it is not safe to walk” she explains.

The Active Living Research (ALR) program of the Robert Wood Johnson Foundation presents a series of studies about the subject of physical activity and obesity in a 2009 report titled *Active Transportation: Making the Link from Transportation to Physical Activity and Obesity*. The report provides substantial evidence connecting physical activity, particularly moderate physical activity

such as walking and biking, to the presence of sidewalks. According to the report, “more and better-quality sidewalks are associated with adults having both higher rates of walking and of meeting physical activity recommendations” (ALR, 2009, p.4). Active Living Research (2008) also reports residents living in neighborhoods where sidewalks exist on the majority of streets “were 47 percent more likely to get moderate-to-vigorous physical activity at least five days per week for at least 30 minutes each day” than were residents living in neighborhoods with few or no sidewalks on the streets (p.4). Similarly, ALR (2008) cites a number of studies finding people with access to sidewalks were 20 percent more likely to be physically active than people who reported having no access to sidewalks (p.4).

Children have the opportunity to get incidental exercise by walking or biking to school, however, the urban environment is often too dangerous or poorly designed to provide children with safe routes to school. The HealthStyles Survey conducted by the CDC in 1999 revealed that the majority of U.S. school children do not walk or bike to school. According to the CDC, approximately one third of school children ride the school bus and half are driven in a private vehicle (CDC, 2002, p.701). Respondents of the study were asked to report barriers that kept their children from walking to school. Barriers included long distances, traffic danger, adverse weather conditions, crime danger, and opposing school policy. Of the 16 percent of respondents who reported no barriers, 64 percent reported children walking, and 21 percent reported children biking. Children with no barriers were six times more likely to walk or bike to school than the rest of their peers with one or more barriers (CDC, 2002, p.702).

Active Living Research (2007) suggests transportation improvements can “either support or impede walking and bicycling in neighborhoods and near schools, depending on how they are implemented” (ALR, 2009, p.1). The report focuses on children walking and biking to school, and links “efforts promoted by programs such as Safe Routes to School, including building sidewalks, crosswalks and traffic-control devices around schools” to “both increases in the percentage of students who walked to school and reductions in the percentage of students being driven to school” (ALR, 2007, p.3).

2.3 Nutrition

According to a number of studies, discussed in detail in this section, access to good nutrition has an impact on health, and barriers related to urban form and policy can impede healthy eating habits among a community's residents.

2.3.1 Access to Healthy Food

Poor dietary habits are another major contributor to the obesity epidemic and the rise of type 2 diabetes and cardiovascular disease. William Dietz, director of CDC's Division of Nutrition and Physical Activity, explains changes in eating habits impacting obesity rates. According to Dietz, "people are drinking more sodas, skipping more meals, eating out more. Restaurants are serving larger portions. Busy people have little time to cook healthy meals for their families, and grocery stores offer hundreds of time-saving prepared foods containing high levels of sugar and fat" (CDC Foundation). According to the Joint Center for Political and Economic Studies (JCPES) (2004), "less than one-fourth of adults eat the recommended daily five or more servings of fruits and vegetables" (p.3). People's preferences and the availability of healthy food are equally important when it comes to improving nutrition. A lack of healthy food options is a major barrier to public health, especially in low-income neighborhoods. "Corner stores and convenience stores that sell alcohol, other beverages, and processed food have filled the void left by the exit of supermarkets in many low-income communities" (JCPES/PolicyLink, 2004, p.6). Nutrition is an aspect of public health in which policy efforts will have the most significant impact.

Policy efforts can impact nutrition by improving availability of healthy food sources in neighborhoods. In Oakland, California, a public policy and advocacy program called California Food Policy Advocates ran a pilot project designed to improve access to healthy food in one low-income African American neighborhood. "Aimed at turning the corner grocery store into a distribution network for fresh produce, the project provided technical assistance on purchasing and handling produce" and "helped the store with refrigeration and signage" (JCPES/PolicyLink,

2004, p.6). As a result of the effort, sales in the program's pilot store rose from zero to \$600-700 per week (JCPES/PolicyLink, 2004, p.6). Changes in policy can also improve nutrition in schools.

2.3.2 Poor Nutrition and Youth

Poor dietary habits are having major health impacts on the youth population. Research conducted by JCPES (2004) found "over 60 percent of young people eat too much fat, and less than 20 percent eat the recommended five or more servings of fruits and vegetables each day" (p.3). According to research conducted for support of Senate Bill 12 (2005) (SB 12) and Senate Bill 965 (2005) (SB 965), only two percent of California youth between the ages of 12 and 17 consume foods that meet national dietary recommendations (SB 12, §1, 2005). Similarly, an estimated 70 percent of U.S. children between the ages of two and 11 consume foods exceeding current dietary recommendations for fat intake, and only 21 percent of California children eat recommended servings of fruits and vegetables per day (SB 12, §1, 2005). Research for support of SB 12 and SB 965 also found soft drinks to be the leading source of added sugar in a child's diet, and each additional serving of a soda sweetened by sugar increases a child's risk for obesity by 60 percent (SB 12, §1, 2005).

The school day "accounts for a significant portion of a child's food intake, with some children obtaining up to two meals and two snacks each day at school" explains JCPES (2004, p.4). Some community mobilization efforts regarding nutrition in schools have "compelled some states and school districts to develop policies that address a number of issues affecting good nutrition" (JCPES/PolicyLink, 2004, p.4). These efforts have included "improving the quality of school meals, setting nutritional standards for foods sold outside the school meal programs, mandating nutrition education, allowing adequate time for meal periods, and improving cafeteria surroundings and menu offerings to increase appeal to students (JCPES/PolicyLink, 2004, p.4).

In addition, recent legislature has established regulations mandating schools offer healthier food and drink options to students. Senate Bill 12 and Senate Bill 965, passed in 2005, mandate nutrition standards for all food and drink items sold to students during the school day. Senate Bill

12 limits total calories, percentage of calories from fat, percentage of sugar by weight (excluding fruit), and percentage of calories from saturated fat (SB 12, §3, 2005). Senate Bill 965 limits the types of beverages that can be sold on school premises during school hours to: fruit-based drinks composed of no less than 50 percent fruit juice and have no added sweetener; vegetable-based drinks composed of no less than 50 percent vegetable juice and have no added sweetener; drinking water with no added sweetener; and two-percent-fat milk, one-percent-fat milk, nonfat milk, soy milk, rice milk, and other similar nondairy milk (SB 965, §1, 2005). These regulations, made effective in 2007, have the potential to impact dietary habits among school children, however, the regulations have no control over food students bring from home. Policy efforts to improve availability of affordable healthy food options, previously described in *Section 2.3.1*, can help to improve the quality of food children are consuming at home.

Community gardens can be a successful way of getting healthy food, specifically fresh produce, to underserved communities. Community gardens not only provide incidental exercise, they can produce significant amounts of healthy produce as well. “In 1999, 15 community gardens in New York City grew 11,000 pounds of fresh produce, of which they donated 50 percent to local soup kitchens and food pantries” (The Trust for Public Land, 2006, p.10). Smaller garden programs can be equally successful. During the same year, “a single garden in the South Bronx grew 200 pounds of tomatoes and 75 pound of peppers” and at gardens throughout the New York City, “gardeners give away their produce to neighbors and passersby” (The Trust for Public Land, 2006, p.10). Studies show gardeners eat vegetables more frequently than those who don’t garden (The Trust for Public Land, 2006, p.10). Currently there are no community garden programs serving Delano’s residents.

2.4 General Urban Form

General Urban form is the larger scale element of design that encompasses everything from buildings to transportation. There is sufficient evidence that urban design has a significant impact on public health. Building forms, land use patterns, transportation patterns and the overall urban arrangement of places all impact health in one way or another. “Where people live, where they

work, how they get around, how much pollution they produce, what kinds of environmental hazards they face, and what kinds of amenities they enjoy are a direct product of how communities are designed” (Frank et al., 2003, p.1). Good urban design can play a powerful role in altering the overall mental and physical well-being of a community.

Urban form can greatly influence human behavior, which in turn directly impacts public health. For instance, urban design choices can lead to sprawl and research suggests the behavioral patterns created by sprawl have health implications. Sprawl forces people to be dependent on their cars, and heavy use of motor vehicles “contributes to air pollution, which increases respiratory and cardiovascular disease as well as overall mortality” (Frumkin, 2005, p.263). Furthermore, this reliance on cars decreases physical activity and an auto-oriented community discourages walking. This contributes to “obesity, diabetes, and related ailments” (Frumkin, 2005, p.263). Urban design can be a detriment to public health by producing sprawl, but it also has great potential to improve public health.

2.4.1 Mixed-Use and High Densities

Mixed-use communities and compact development can affect public health in a positive way. Research shows that mixed-use communities, where commercial and retail uses are available near residences, have the potential to reduce obesity levels by encouraging physical activity (Frank, Engelke, Schmid, 2003, p.185). Research has shown that mixed-use development in which retail is located near employment districts “gives employees an opportunity to substitute pedestrian-based mid-day shopping trips for vehicle based after work shopping trips” (Design, Community & Environment, 2006, p.21). The U.S. Department of Health and Human Services (DHHS) suggests that adults need at least thirty minutes of moderate-intensity physical activity at least five times a week. Evidence reveals that individuals gain health benefits even if this exercise is accumulated in ten-minute intervals, which can be achieved by walking to and from work, to run errands, or, in the case of children, walking to school (Design, Community & Environment, 2006, p.70). Urban form can influence transportation patterns by providing public transit, encouraging

compact development and mixed-use, and requiring pedestrian-friendly streets that make walking safe, easy and enjoyable.

2.5 Building Design

Building design can impact health in a number of ways. Interior architecture can affect the health of those who spend time inside. Buildings designed with “green building” concepts can have health impacts on a broader scale, affecting environmental quality through energy consumption and the use of sustainable materials. Building design can also have an impact on physical activity. Areas with a good building and street interface can create a pedestrian-friendly atmosphere and actually encourage walking. All of these aspects of buildings impact public health in one way or another.

2.5.1 Interior Architecture and Green Buildings

Evidence shows “choosing building materials, furnishings, and cleaning agents that minimize indoor emissions, designing and operating effective ventilation systems, and maintaining air circulation and humidity at optimal levels” are valid ways to protect public health through design (Frumkin, 2005, p.260). Most modern buildings with more than two or three stories have “conspicuous elevators in their lobbies and staircases that are concealed and unappealing” (Frumkin, 2005, p.261). This common design feature promotes inactivity, and makes the healthy choice, in this case walking up the stairs, the least appealing option. Literature suggests “the most healthful architecture exposes inhabitants to natural light and ventilation, views of greenery, and close proximity to outdoor green space” (Jackson, 2003, p.192). These design features can greatly impact the way one feels when inside the building.

Building design can have less direct, broader health implications as well. Buildings designed to be environmentally sustainable “may reduce the demand for energy, in turn reducing the emission of air pollutants from power plants” (Frumkin, 2005, p.260). In the same way, such buildings may use sustainably harvested wood, which may help reduce deforestation, slow climate change and maintain biodiversity (Frumkin, 2005, p.260). Although seemingly distant, insights into these

health implications of building design may add great value to the overall well-being of a community.

Rooftop gardens, or green roofs, are an emerging trend in big cities because of their ability to reduce the heat island effect common in urban areas. Randolph Hester (2006) discusses the heat island effect in Tokyo in his book *Design for Ecological Democracy*. According to Hester, urbanization in Tokyo has increased the City's mean temperature by 5.7 degrees Fahrenheit, a rate five times faster than the temperature change caused by global warming (Hester, 2006, p.272). This type of temperature increase can change local ecosystems, increase deadly pollution, and alter the seasons (Hester, 2006, p.272). To combat this temperature change, decision-makers in Tokyo now require "that every new building on a plot over a quarter acre provide a roof garden of vegetation (Hester, 2006, p.272). Research on rooftop gardens in Chicago found if the roof surfaces in the City were changed into vegetated roofs, nearly 25 percent of the whole City would change from a heat sink to a "citywide cooling system" (Hester, 2006, p.273). This research suggests that, along with the aesthetic value associated with rooftop gardens, the gardens also have much broader environmental impacts at the local level as well as globally.

2.5.2 Building Design and the Pedestrian Environment

While building interiors impact the health of those inside, and sustainable building practices have global environmental implications, building design in relation to a City's street network can directly impact the health of that City's population. The Active Living Research Program (ALR) of the Robert Wood Johnson Foundation created a manual to measure urban design qualities and their ability to improve the pedestrian experience. The manual describes five urban design qualities shown to have significant relationships to walkability. These qualities are; imageability; enclosure; human scale; transparency; and complexity. The manual suggests these design factors impact overall walking quality, which in turn impacts an individual's walking behavior.

2.5.2.1 Imageability

Imageability is the first urban design quality capable of improving the pedestrian experience identified by the ALR (2005). Imageability is “the quality of a place that makes it distinct, recognizable, and memorable” (Design, Community & Environment, 2006, p.S226). A street or area has high imageability “when specific physical elements and their arrangement capture attention, evoke feelings, and create a lasting impression” (Design, Community & Environment, 2006, p.S226). Many elements can give a street imageability. The presence of features like parks, plazas and outdoor dining areas affect the pedestrian experience because they invite people to sit, stand and stroll, and people’s presence provides visual interest and improves walkability. Prominent landscape features act as landmarks and help in way-finding. Building design, type and signage also impact imageability, creating a sense of character and identity (ALR, 2005).

Parks, plazas and courtyards provide visual interest and places for people to gather, and the presence of people is an important part of imageability (ALR, 2005, p.6 & 7). Outdoor dining areas provide visual interest to pedestrians, even if there are no occupants at a particular dining spot (ALR, 2005, p.12). All of these features can bring people to an area, and the presence of people helps make a street walkable.

Major landscape features are a key component to imageability. “Prominent landscape views such as bodies of water, or man-made features that incorporate the surrounding natural environment” can serve as natural landmarks, providing a “reference point for orientation” or “directions to visitors” (ALR, 2005, p.8).

Building design, type and signage affect the pedestrian environment and are considered valuable elements of imageability. The ALR manual identifies buildings with non-rectangular shapes as buildings providing visual interest and imageability (ALR, 2005, p.11). “A building with a basically rectangular shape but with a pitched roof or ornamental trim” can be considered non-rectangular (ALR, 2005, p.11). Historic buildings give a street imageability by creating a sense of character and providing visual interest. Architecture “that can be determined to have originated before

World War II” is considered historic (ALR, 2005, p.9). Buildings with identifiers also generate imageability. Identifiers are building features that indicate a building’s use. For example, “a church can be identified by a steeple” and “stores can be identified by signs that can be easily read” (ALR, 2005, p.10).

2.5.2.2 Enclosure

According to the ALR manual, enclosure is another important element of a walkable street. Active Living Research defines enclosure as “the degree to which streets and other public spaces are visually defined by buildings” (ALR, 2005, p.14). “Spaces where the height of vertical elements is proportionally related to the width of the space between them have a room-like quality,” creating a feeling of enclosure (ALR, 2005, p.14). The number of long sight lines, the presence of a “street wall” and the proportion of one’s field of view that is sky all impact feelings of enclosure (ALR, 2005, p.17).

Long sight lines affect enclosure. The “lack of an enclosed environment” with low rise buildings, open plazas, wide avenues and an ill-defined street wall all allow pedestrians to see far ahead, diminishing the feeling of enclosure (ALR, 2005, p.15). The “street wall” also impacts enclosure. The street wall can be considered as “portions of the block that are occupied by continuous facades or walls adjacent to the sidewalk” (ALR, 2005, p.16). To maximize the feeling of enclosure, building facades or walls should not be set back from the sidewalk more than 10 feet. If walls or facades are set back more than 10 feet, they “do not contribute to the street wall” (ALR, 2005, p.16). Finally, the proportion of one’s view that is sky contributes to feelings of enclosure. If too much of a pedestrian’s view is sky, feelings of enclosure are diminished.

2.5.2.3 Human Scale

The ALR manual lists human scale as another important component of a walkable street. According to ALR, human scale “refers to the size, texture, and articulation of physical elements that match the size and proportions of humans and, equally important, correspond to the speed at which humans walk” (ALR, 2005, p.18). The number of long sight lines, the proportion of windows

at street level, average building height, number of small planters and the number of street items, including street furniture, all contribute to human scale (ALR, 2005, p.18-23).

As with enclosure, the number of long sight lines impacts human scale. The lack of an enclosed environment, in which long sight lines exist, diminishes human scale, while elements including building heights and mature street trees shorten sight lines and bring a street down to the human scale. Similarly, a street with a high proportion of windows at street level, and fronting the sidewalk, provide the pedestrian with visual interest at eye level (ALR, 2005, p.19-20). Building height can impact human scale as well, and height, along with the amount of the street a building takes up vertically can enhance or reduce human scale and walkability.

Small planters and street furniture are other important elements of human scale. According to ALR, a small planter is “any potted arrangement ...that is less than 10 square feet at the base” (ALR, 2005, p.22). To enhance human scale, these planters should be exclusive of in-ground planters or trees, and should not be the type that can easily be transported indoors (ALR, 2005, p.22). Small planters that are permanent aspects of the streetscape can enhance walkability by increasing a sense of human scale. Similarly, street furniture, including benches, tables, chairs, and lamp posts, as well as other street items, including newspaper boxes, parking meters, bike racks, and bollards, contribute to human scale and enhance walkability (ALR, 2005, p.23).

2.5.2.4 Transparency

Transparency is the fourth element of urban design listed by ALR as impacting walkability. According to ALR, transparency “refers to the degree to which people can see or perceive what lies beyond the edge of a street or other public space and, more specifically, the degree to which people can see or perceive human activity beyond the edge of a street or other public space” (ALR, 2005, p.24). The proportion of windows at street level, the proportion of street wall along the sidewalk and the proportion of active uses in the street wall all impact transparency and affect walkability.

As with human scale, the proportion of windows at street level affects transparency. Similarly, active uses at street level impact transparency. Active uses are defined as “shops, restaurants, public parks, and other uses that generate significant pedestrian traffic” (ALR, 2005, p.27). Inactive uses, including “blank walls, parking lots, vacant lots, abandoned buildings, and offices with no foot traffic” reduce transparency and make an area less pleasant for pedestrians (ALR, 2005, p.27). A sidewalk with “few windows at street level, much reflective glass and concrete, and no active uses that are inviting to pedestrians” is not considered to be pedestrian friendly by ALR (ALR, 2005, p.24). A continuous street wall is also an important element of transparency. A continuous street wall with “active uses and many windows at street level” makes a sidewalk very inviting for pedestrians (ALR, 2005, p.24).

2.5.2.5 Complexity

Finally, ALR lists complexity as the fifth urban design element needed to make a street walkable. Active Living Research defines complexity as the “visual richness of a place” (ALR, 2005, p.28). A variety of factors contribute to a street’s complexity, including “the numbers and kinds of buildings, architectural diversity and ornamentation, landscape elements, street furniture, signage and human activity” (ALR, 2005, p.28). A complex street with these elements is considered by ALR to be walkable, when combined with the aforementioned urban design features.

Building colors and the number of buildings along a street contribute to complexity and walkability. A street is visually complex when it contains many different buildings, both in the foreground and in the distance, with interesting primary and accent colors (ALR, 2005, p.28). Outdoor dining contributes to complexity as well by creating visual interest and increasing street traffic. The presence of people makes a street visually complex (ALR, 2005, p.28, 31). Finally, public art makes a street complex by providing distinct visual interest. Public art can include “monuments, sculptures, murals, and any other artistic display that has free access,” all of which can enhance the pedestrian environment and improve walkability.

Imageability, enclosure, human scale, transparency, and complexity are all elements of urban design believed to improve a street's walkability. If present along a street, these elements are believed to improve overall walking quality, which may in turn influence one's walking behavior. These urban design features can be worked into a city's streetscape through building codes, sign ordinances, and land use ordinances. Building design features have the potential to improve walkability and increase levels of physical activity among a City's residents, which can improve the overall health of a population.

2.5.3 The Prospect-Refuge Theory and Pedestrian Comfort

The concept of prospect and refuge is used to explain human environmental preferences, and can be combined with the ALR urban design elements to create an ideal pedestrian streetscape. Jay Appleton developed the theory of prospect and refuge in his book *The Experience of Landscape*, and author Ned Crankshaw further explains the idea in his book *Creating Vibrant Public Spaces*. At the root of the theory is the idea that humans "feel most comfortable in an environment that allows them partial concealment and protection (refuge) while affording views into surrounding and adjacent spaces (prospect)" (Crankshaw, 2009, p.12). Crankshaw provides the example of a clearing in a wooded area to best explain prospect-refuge theory. Crankshaw (2009) writes, "a preferred place for a person in that environment might be just inside the edge of the trees, offering concealment and views into the clearing" (p.12). Prospect-refuge theory can be applied to an urban environment, and give insight into urban design features that can enhance a streetscape by making the environment feel more comfortable for pedestrians.

Crankshaw (2009) explains that most people are interested, consciously or subconsciously, in feeling comfortable, and feelings of comfort "occur to us as aesthetic preferences" (p.15). These aesthetic preferences can reflect degrees of refuge and prospect along a street. For example, a street with a high degree of refuge "would have a street wall that appears to be easily penetrated and a sheltering edge that continues with few interruptions" (Crankshaw, 2009, p.15). Similarly, a street with a high degree of prospect "would have reasonably open views along its length and would perhaps connect into other open spaces" (Crankshaw, 2009).

2.5.3.1 Refuge

A permeable street wall is the key component to refuge in an urban environment. Crankshaw (2009) describes a permeable street wall as “punctuated with alcoves, doorways, windows, and window displays,” with doors that actually allow a person to “slip out of the street and into a building at many locations” (p.15). “More importantly,” Crankshaw (2009) writes, “they and the other openings contribute to a sense that one is not isolated in the clearing of the street but has connections with the space of the buildings” (p.16). Variations in building setbacks enhance feelings of refuge. Variations do not need to be great, in fact, according to Crankshaw (2009), “even the space created by a recessed doorway is enough to create comfortable edge variation” (p.16). Monolithic buildings without openings create no sense of refuge, and “reflective or deeply tinted windows that allow those inside a building to look out without permitting views into the interior” can amplify pedestrian discomfort by increasing feelings of exposure. The street corner is an important area to develop feelings of refuge. According to Crankshaw (2009) completely open street corners “create a loss of refuge at the precise place where pedestrians are most likely to be standing still and reacting to environmental comfort” (p.16).

Continuity in the street wall is another important component to refuge. Continuity is “most simply provided by a compact pattern of buildings adjacent to the pedestrian paths” (Crankshaw, 2009, p.16). Where there are breaks in buildings or significant setbacks, the street edge can be reinforced with planting, walls, fences, or other methods (Crankshaw, 2009, p.16). When combined with permeability, continuity can greatly enhance the pedestrian environment.

The amount of refuge in a street’s edge “builds up in layers” (Crankshaw, 2009, p.16). Crankshaw (2009) describes these layers, and explains how the edge begins with a foundation of vertical elements, including buildings and curbs (p.16). The next layer providing refuge to the edge includes “elements that extend over the person on the sidewalk” (Crankshaw, 2009, p.16). These elements, including awnings, overhanging signs, and other building projections, “begin to create a sense of being contained within the edge space” (Crankshaw, 2009, p.16). Street trees also enclose the pedestrian, “and in some places could be considered a substitute for lost building

awnings” (Crankshaw, 2009, p.16). Finally, elements on the street side of the pedestrian path create feelings of refuge by “creating a variable visual edge and separating pedestrians from moving vehicles” (Crankshaw, 2009, p.16). Parked cars, parking meters, bollards, planters, street lights, trash containers and other street furnishings all contribute to the edge on the street side of the pedestrian path, enhancing feelings of enclosure and refuge.

Refuge is created by a continuous, permeable street wall, providing the pedestrian with environmental comfort by creating feelings of enclosure and connection to building interiors. Refuge is one part of the prospect-refuge theory. When combined with prospect, the ideal pedestrian environment can be created.

2.5.3.2 Prospect

Prospect “allows clear observation of one’s surroundings” (Crankshaw, 2009, p.18). A street “with a high level of prospect has few hidden areas” (Crankshaw, 2009, p.18). Prospect not only contributes to psychological comfort, but enhances levels of physical safety, as well (Crankshaw, 2009, p.18). According to Crankshaw (2009) prospect is enhanced when pedestrians have views into adjacent spaces, “such as the view from a street into a town square” (p.19). Such views put the observer in control of a larger clearing (Crankshaw, 2009, p.19). Similarly, a view “along a downtown street into a tree-lined residential area affords a sense of environmental connection and an understanding of the links between districts” (Crankshaw, 2009, p.19). Monuments and landmark buildings can further enhance one’s sense of prospect “by pulling one’s view farther into the distance and by giving meaning to special zones” (Crankshaw, 2009, p.19).

Prospect and refuge are important elements of a pedestrian friendly environment. The prospect-refuge theory explains human preferences for an environment that, above all, invokes feelings of comfort. According to the theory, this comfort can be created in an urban setting when pedestrians are made to feel protected and partially concealed, yet still have the ability to view the surrounding environment.

2.5.4 Form-Based Codes and the Urban Environment

A form-based code (FBC) is a regulation plan that provides standards for buildings and streetscapes in greater detail than traditional zoning. In 2008 architects and urban planners Daniel Parolek, Karen Parolek and Paul Crawford published the book *Form-Based Codes: A guide for Planners, Urban Designers, Municipalities, and Developers*. The book provides valuable insight into the effect FBC's can have on an urban environment, and the pedestrian experience in particular. According to Parolek, Parolek and Crawford (2008), an FBC is a "method of regulating development to achieve a specific urban form" (Parolek, et al., 2008, p.4). Form-based codes differ from traditional zoning in that they are "vision-based and prescriptive, requiring that all development work together to create the place envisioned by the community" (Parolek, et al., 2008, p.11). Form-based codes address private and public spaces "to create a whole place, including buildings, streets, sidewalks, parks, and parking" (Parolek, et al., 2008, p.11). They "regulate private development for the impact it has on the public realm" (Parolek, et al., 2008, p.11). Form-based codes provide a good example for regulations of urban space that can vastly improve the pedestrian experience by creating a pleasant pedestrian environment.

2.5.4.1 Building Placement Regulations

Form-based codes address building placement as a method for improving the pedestrian environment. Building placement regulations include built-to-line standards (BTL), setbacks, maximum lot width, and minimum lot width. BTLs establish where the building facade is to be located in relation to the property line, and are used where a consistent plane of buildings is desired (Parolek, et al., 2008, p. 43). Regulating the location and size of building facades fronting public spaces helps to define and form edges (Parolek, et al., 2008, p. 40), and can be used to improve the pedestrian experience by creating feelings of enclosure.

2.5.4.2 Building Form Regulations

Form-based codes often provide regulations on building facades, frontages and entrances. Building facade regulations include minimum and maximum building heights and ceiling heights.

These regulations ensure public spaces are well-proportioned (Parolek, et al., 2008, p. 44). Setting standards for building height ensure a building is tall enough to create feelings of enclosure and is appropriately scaled to suit its surroundings (Parolek, et al., 2008, p. 45). Ground floor finished level height is an important regulation because it establishes an “appropriate relationship between the public and private realm” (Parolek, et al., 2008, p. 45). This standard should be higher for residential buildings, to ensure privacy, and lower in commercial buildings to “convey their semi-public status” (Parolek, et al., 2008, p. 45).

Form-based codes can be used successfully to create public spaces that encourage walking. They can create aesthetically pleasing urban environments that are safe and interesting, with the capacity to improve overall public health in an area.

2.6 Public Spaces

Impacts can be made to public health through the careful design of public spaces. This includes parks and public sports facilities, as well as public urban spaces like plazas. The locations of these amenities, as well as their actual design, can impact how frequently they are used. Parks and plazas can also be useful as destinations for pedestrians who are walking to get moderate levels of physical activity.

2.6.1 Parks

Literature discussed in this section suggests a relationship between availability of parks and physical activity. Not only does park space encourage physical activity, it also “provides restoration from the mental fatigue caused by modern urban life” (Ryan, 2006, p.62). Well-planned, plentiful public spaces can impact the health of those who live near these spaces. Parks provide places for outdoor exercise, such as jogging or walking. They provide places for reflection and relaxation and are also ideal sites for social interaction and community gatherings. While parks don’t necessarily facilitate physical activity, literature does suggest a relationship between the presence of park space in a neighborhood and levels of physical activity among its residents. A group of studies reviewed in the American Journal of Preventive Medicine (AJPM) showed that

“creation of or enhanced access to places for physical activity combined with informational outreach” produced a 48.4 percent increase in the frequency of physical activity (The Trust for Public Land, 2006, p.13). The same studies showed that easy access to a place to exercise results in a 5.1 percent median increase in aerobic capacity, along with weight loss, a reduction in body fat, improvements in flexibility, and an increase in perceived energy (The Trust for Public Land, 2006, p.8-9).

Distance to sources for outdoor recreation, such as parks, significantly impacts the use of such spaces. A study of 360 adolescent girls found levels of moderate-to-vigorous physical activity were significantly related to the number of parks within one mile of the homes of participants (Kaczynski, et al., 2008, p.345). Another study of 59 children between the ages of four and seven found an association between neighborhoods with a greater proportion of park area and increased levels of physical activity among children (Kaczynski, et al., 2008, p.345). A third study, conducted in 2004, focused on eight parks in Los Angeles. Results revealed 43 percent of observed park users lived within a ¼ mile of the park, 21 percent lived within a ½ mile of the park, and only 13 percent traveled over one mile to get to the park (Cohen, et al., 2007, p.512).

The National Recreation and Park Administration (NRPA) addresses distances between residences and parks in a set of standards for different types of parks (Berke, et al, 2006). The NRPA suggests developing a hierarchal system of recreational facilities, ranging from miniparks to regional and linear parks. The NRPA recommends a standard of 6.5 to 10 acres of park space per 1,000 persons, but suggests this standard be flexible, realistically attainable, and tailored to the needs of each community (Berke, et al., 2006).

Evidence clearly shows a correlation between location and frequency of sites for outdoor recreation and levels of physical activity among residents. Evidence also suggests a relationship between physical features such as vegetation, pathways, park amenities, and aspects affecting feelings of safety and the use of parks. Well-designed, aesthetically pleasing parks are more likely to be used by residents, and safety is a major design factor affecting use. According to a

CDC study of 12,767 people, designed to analyze levels of physical activity, higher levels of perceived neighborhood safety were associated with higher levels of physical activity (CDC, 1996, p.143). A summary of research from ALR (2010) found adults who felt somewhat safe “were 60 percent more likely to encourage children to use local playgrounds than were adults who felt safe” (p.6). Active Living Research (2010) also found adults associated the presence of graffiti, litter and overgrown vegetation with a lack of safety (p.6).

Not only can parks improve one’s physical health by encouraging moderate levels of activity, they can also have an impact on one’s mental health. Numerous studies have shown that trees and open land can have a significant effect on the human psyche. Architect Ernest Moore conducted a study on the inmates of the State Prison of Southern Michigan. He found that prisoners who had a view of rolling farmland and trees made sick calls 24 percent less frequently than inmates whose cells looked out into the prison courtyard (Frumkin, 2005, p.256). Similarly, Roger Ulrich found that postoperative patients in a Pennsylvania hospital who were randomly assigned to rooms with tree views had shorter overall hospitalization times, required less pain medication and had fewer negative nurses notes (Frumkin, 2005, p.257). Studies like these show a direct relationship between mental health and contact with nature. Well-designed parks scattered through an urban landscape can provide people with space for physical activity as well as reflection and relaxation.

2.6.2 Plazas

Public spaces in an urban landscape can impact public health by enhancing feelings of community and safety. They can also impact public health by encouraging walking through improving the aesthetics of an environment and offering places of rest and refuge for pedestrians. Public urban spaces are also important sites for community gatherings and chance encounters with neighbors, and offer a “ ‘neutral’ or common ground for social interaction, intermingling and communication” (Carmona, et al., 2003, p.109). Public spaces also exist as “a stage for social learning, personal development and information exchange” (Carmona, et al., 2003, p.109). Author Hannah Arendt (1958) believed the public realm satisfied three criteria. She believed, “by

outlasting mortal lives, [the public realm] memorialized the society and thereby conveyed a sense of its history; it was an arena for diverse groups of people to engage in debate and oppositional struggles; and it was accessible to, and used by, all” (Carmona, et al., 2003, p.109). Although public spaces are not always used for these purposes, their presence ensures the opportunities for such uses, and the design of these spaces plays an integral part in how they are used.

Author William Whyte (1988) reports his observations about the design of public plazas in his book *City: Rediscovering the Center*. During his observations, Whyte (1988) discovered about 80 percent of users of a public plaza came from within a radius of three blocks (p.108). Therefore, the effective radius of a good public plaza is about three blocks. A well-used plaza must also have sufficient seating to allow visitors space to rest, socialize, and people watch. During his observations, Whyte (1988) found in many cases the most basic kind of seating, particularly steps and ledges built into a space, provided the most versatile and appealing seating options (p.112). He found people would sit almost anywhere between a height of one to three feet, and if a ledge or bench was at least 30 inches deep and accessible on both sides, then the length of either side of it could be used for seating (Whyte, 1988, p.114-115). Movable chairs also have a certain appeal for plaza users, allowing visitors to choose where they sit and what direction they face (Whyte, 1988, p.119). Grass, Whyte (1988) observed, “also has the great advantage of offering people the widest possible choice of sitting arrangements” (p.123). Grass is considered to have a psychological benefit as well, offering “a refreshing counter to granite and concrete” and space for “napping, sunbathing, picnicking, and Frisbee throwing” (Whyte, 1988, p.123). Sight lines into a public space are important to draw users in, and Whyte (1988) observed that, ideally, the transition from the street to the plaza “should be such that it’s hard to tell where one ends and the other begins” (p.130). Of done successfully, one shouldn’t “have to make a considered decision to enter; it should be almost instinctive” (Whyte, 1988, p.130). All of these factors impact how a public space is used, and a well-designed plaza in a good location can offer significant aesthetic, social and psychological value to a community’s residents and visitors.

2.7 Circulation and Transportation

Literature suggests a city's circulation system can play a vital role in public health. A city's circulation system can impact public health by encouraging physical activity through pedestrian-friendly streets. Traffic-calming strategies and well-designed intersections improve pedestrian and bicycle safety, as well as driver safety, and a circulation system that encourages walking can improve public health by reducing levels of air pollution.

2.7.1 Walkability and the Pedestrian Environmental Quality Index (PEQI)

High rates of obesity, cardiovascular disease and diabetes have been linked to low levels of physical activity, and there is evidence that walking “both as an alternative to driving and as a leisure activity, can be beneficial for human health” (San Francisco Department of Public Health, 2008, p.1). In 2008, the San Francisco Department of Public Health (SFDPH) created the Pedestrian Environmental Quality Index (PEQI) to measure the quality of the pedestrian environment along San Francisco's streets, or, a street's “walkability.” The index establishes factors associated with pedestrian environmental quality. These factors cover intersection safety, vehicle traffic, street design, land use and perceived safety. Evidence suggests that certain design features of all of these factors can improve safety and environmental quality for the pedestrian, which in turn can encourage physical activity and improve human health.

2.7.1.1 Intersection Safety

Intersection safety is the first measurement in the PEQI. Intersections can be designed to provide “access and mobility for pedestrians while providing awareness to oncoming traffic at pedestrian crossings” (SFDPH, 2008, p.2). There are many features of crosswalks that accomplish this. PEQI lists crosswalks as an important factor in creating a welcoming pedestrian environment. Crosswalks are important because their absence “can be a movement barrier for pedestrians who want to walk from one side of the street to the other and may deter pedestrians from walking in an area” (SFDPH, 2008, p.3). Streets without crosswalks may also “contribute to conflicts between pedestrians and motor vehicles” (SFDPH, 2008, p.3). Traffic signals with countdown timers and

no turn on red signs also improve pedestrian safety by allowing sufficient time to cross the street and reducing potential conflicts between pedestrians and motor vehicles (SFDPH, 2008, p.3). Pedestrian and bicycle signs are also important features for a pedestrian-friendly street network. Well-placed pedestrian signs “can serve to inform pedestrians of wayfinding and changes in traffic control” (SFDPH, 2008, p.4). Pedestrian signs can also increase driver awareness “by bringing attention to the presence of pedestrians and assisting pedestrians in safely crossing an intersection or walking on the sidewalk” (SFDPH, 2008, p.4).

Traffic calming measures are another method for improving pedestrian safety at intersections, and can be incorporated at intersections as well as along street segments. Traffic calming strategies have been shown to reduce rates of traffic-related accidents, increasing safety for those in automobiles as well as pedestrians and bicyclists. A number of methods can be used to make streets and sidewalks safer for pedestrians, bicyclists and people travelling in cars.

According to the Federal Highway Administration (FHWA), reliance on speed limits, stop signs and police enforcement does not fully achieve desired speed reductions. The FHWA describes the idea of the “environmental reference speed” in a study conducted in 2001 on the design practices of European roads. Environmental reference speed is a “speed used in designing roadways in such a way that it is difficult to drive above this speed (FHWA, 2001, p.13). On streets without environmental features designed to slow traffic, stop signs and speed limits are not effective in reducing speeds because these roadways are “not conveying the intended message and are not forcing the driver to slow down” (FHWA, 2001, p.31).

The presence of street trees and other roadside features are proven to be effective in slowing traffic. One study, conducted in 2003, examined safety impacts of streetscape elements such as trees and concrete planters placed along the roads and in the medians of five arterial streets in downtown Toronto. The study found the inclusion of streetscape elements resulted in statistically significant reductions in traffic accidents. Results showed between five to 20 percent reductions in the number of mid-block crashes along all five arterials. The study’s author believes the presence of a well-defined roadside edge likely caused drivers to “exercise greater caution” while travelling

down the arterial streets (Dumbaugh, 2005, p.285). Similarly, another study found the number of sign supports and the presence of miscellaneous fixed objects like mailboxes were associated with crash reductions while wider lanes and shoulders were associated with an increase in crash frequencies (Dumbaugh, 2005, p.283).

Traffic calming tools for intersections are different than those for slowing traffic along streets. Specific methods for intersections include curb extensions or bulb-outs, which “create shorter crossing distances for pedestrians and may slow motorists at intersections” (SFDPH, 2008, p.3). Partial mini-circles, speed tables, pavement treatment and semi-diverters are other traffic calming measures designed to improve pedestrian safety at intersections.

Roundabouts are another effective method for slowing traffic at intersections. In its study of design practices on European roads, the FHWA examined data on roundabouts in several European countries. The FHWA found roundabouts designed with a single-lane approach could easily handle peak flows of 2,500 vehicles per hour. Data also revealed significant safety gains in intersections where roundabouts were used instead of conventional intersections (FHWA, 2001). All of these methods can be used in conjunction with traffic calming measures designed to slow street traffic, which are discussed in section *2.5.1.b Vehicle Traffic*.

2.7.1.2 Vehicle Traffic

Vehicle traffic is another measurement for walkability in the PEQI. Street features regarding vehicle traffic that impact pedestrians include the number of traffic lanes, whether traffic is one or two-way, vehicle speed and traffic volume. These measures can influence rates of pedestrian injuries and can impact pedestrian mobility. The number of traffic lanes in a street “correlates with traffic volume, posted speed limits, noise and air pollution levels” and pedestrian activity (SFDPH, 2008, p.4). Pedestrian injuries increase as the number of lanes increases, and a “reduction in the number of lanes can reduce crossing distances, thus reducing exposure of a pedestrian to vehicle interaction” (SFDPH, 2008, p.4). Decreasing the number of lanes can make streets better

places for social interaction by slowing traffic and increasing feelings of safety (SFDPH, 2008, p.40).

Lane widths are correlated with the number of lanes in a street, and studies link wider lanes with a greater incidence of traffic-related accidents. Examinations of literature on the subject reveal little “evidence to support the assertion that widening lanes beyond 11 feet enhances safety” (Dumbaugh, 2005, p.285). Instead, literature suggests crash frequencies increase as lanes widths approach the common standard of 12 feet (Dumbaugh, 2005, p.285). Lane widths directly impact vehicle speed, which is another factor included in the PEQI.

Vehicle speeds is a major indicator of pedestrian safety. According to SFDPH, the fatality rate of a pedestrian hit by a car travelling 20 mph is five percent. This rate increases to 45 percent if the car is travelling 30 mph and to 85 percent at 40 mph (SFDPH, 2008, p.4). Traffic volumes also impact the quality of the pedestrian environment. High traffic volumes discourage pedestrians from crossing the street and can also be a predictor for pedestrian injuries (SFDPH, 2008, p.4). The presence of traffic calming features can improve the pedestrian experience by slowing vehicle speeds and increasing pedestrian safety. Traffic calming methods specific to vehicle traffic include chicanes, speed humps, street medians, textured pavements and street enforcements (SFDPH, 2008, p.5). Chicanes are extensions of the curb that alternate from one side of the street to another, forming S-shaped curves (trafficalming.org). Speed humps are rounded raised sections of asphalt stretching across the roadway (trafficalming.org). Textured pavements are strips of a textured or colored surface intended to create an uneven surface for pedestrians to cross and vehicles to traverse (trafficalming.org). Vehicle traffic is a major indicator for the quality of the pedestrian environment, and lane widths, number of lanes, vehicle speeds, vehicle volume and the presence of traffic calming features can all have an impact.

2.7.1.3 Street Design (Sidewalks)

The PEQI addresses street design as another important indicator for walkability. Sidewalk design features can improve public safety as well as enhance the pedestrian experience. Sidewalk width,

sidewalk impediments, the presence of a curb, driveway cuts, trees, seating and the presence of a buffer can all impact a street's walkability and, if designed well, can encourage moderate physical activity.

Studies show sidewalk width should be a minimum of five feet, but that eight feet is needed for two pairs of pedestrians to pass each other (SFDPH, 2008, p.5). Buffers shielding pedestrians from vehicle traffic can enhance pedestrian quality. Buffers can come in the form of parallel parking, planter strips, and bicycle lanes (SFDPH, 2008, p.5 & 6). Buffers should be between two and three feet to "create a level of comfort for the pedestrian" (SFDPH, 2008, p.6). Sidewalks also need to be well-maintained to "provide a safe walking environment for pedestrians" (SFDPH, 2008, p.5). Sidewalk obstructions include "bumps, cracks, or holes in the sidewalk" as well as "out-of-place poles or signs, parked cars, trees and garbage cans" (SFDPH, 2008, p.5). These obstructions can make it difficult for pedestrians to pass each other on the sidewalk, and may cause them to "walk into the street where motorists could pose a threat" (SFDPH, 2008, p.5).

Curbs protect pedestrians from street traffic by providing a "physical separation between motor vehicles and pedestrians" (SFDPH, 2008, p.5). They also prevent vehicles from parking on the sidewalk. Driveway cuts break up the curb, eliminating a sidewalk's protective barrier. The more driveway cuts there are along a sidewalk, "the greater the potential for vehicles to cause an obstruction to pedestrians and create a potential conflict point with pedestrians" (SFDPH, 2008, p.5). Driveway cuts are particularly dangerous for children. "Studies show children aged four and under account for 80% of driveway-related injuries" (SFDPH, 2008, p.5). Curbs, buffers and wide sidewalks all create walkable streets by improving pedestrian safety. Other elements, including seating and vegetation, create walkable streets by enhancing the pedestrian environment with visual elements and elements to improve physical comfort.

Trees, planters and gardens provide natural elements that enhance the pedestrian experience. Trees are visually pleasing and can also provide a buffer between cars and pedestrians, while planters and gardens "beautify a street and make it more aesthetically pleasing" (SFDPH, 2008, p.5). Public seating can "encourage leisure walks, especially for the elderly and disabled"

(SFDPH, 2008, p.6). According to the PEQI, benches should be located every 200 feet, and business owners should be encouraged to place public seating or benches in front of their businesses where the sidewalk is wide enough (SFDPH, 2008, p.6). Seating, vegetation and well designed sidewalks with curbs and buffers can all enhance the pedestrian environment and have the potential to increase physical activity.

2.7.1.4 Land Use

Land use is addressed as an indicator for a street's walkability in the PEQI. The main areas of focus in the PEQI regarding land use are commercial uses and street aesthetics. According to the PEQI, mixed land uses are associated with fewer vehicle emissions and higher rates of walking (SFDPH, 2008, p.6). "Mixed land uses, along with the presence of historical or unique architecture can improve aesthetic quality for pedestrians and encourage walking" (SFDPH, 2008, p.6). Neighborhoods in which residential uses are mixed with employment and goods and services can reduce vehicle trips and increase "active transportation such as walking and biking" (SFDPH, 2008, p.6). The quality of the pedestrian experience can be further enhanced by the presence of public art, and historical or visually interesting buildings. "Providing a range of artistic and cultural amenities for pedestrians can create a visually interesting environment that attracts pedestrians" (SFDPH, 2008, p.6). More research regarding building design and land uses is discussed in *Section 2.3 General Urban Form*.

2.7.1.5 Perceived Safety

Perceived safety is the final factor included in the PEQI. According to PEQI, perceived safety "is informed by how physical features of an environment shape people's perceptions of safety and therefore their willingness or comfort with walking" (SFDPH, 2008, p.6). Building design can impact pedestrian safety by providing "eyes on the street" (SFDPH, 2008, p.6). Cleanliness of the street, including graffiti, garbage and broken glass, also impact how safe someone feels walking down a street. In addition, pedestrian scale street lighting is a key factor in perceived safety for pedestrians.

Construction sites and abandoned buildings also impact how safe one feels. “Construction zones can pose safety issues for pedestrians by blocking the sidewalk with heavy machinery and creating alternate routes that are less accommodating for pedestrians” (SFDPH, 2008, p.7). Construction sites can also produce excessive noise pollution that discourages pedestrians (SFDPH, 2008, p.7). Abandoned buildings may “increase feelings of pedestrian discomfort, including fears of increased crime or delinquency” (SFDPH, 2008, p.7).

Literature reveals many connections between urban design and public health. The physical form of an urban area can impact rates of obesity, cardiovascular disease, and other related health issues. Physical form can also increase or decrease feelings of community, safety and security. The urban environment is also connected to nutrition, which directly relates to overall health. Building design has the capacity to encourage moderate levels of physical activity, which can greatly reduce rates of obesity and cardiovascular disease. The presence of public spaces like parks and plazas can also encourage physical activity, and strengthens communities by improving social networks. Street design is another major component affecting public health. A city’s circulation system can play a role in methods of travel, and has wider implications for respiratory health and physical safety. These connections make planning an ideal tool for improving overall health in a time and place where rates of chronic illnesses have hit an all-time high.

Chapter 3: Problem Definition

Evidence suggests a clear relationship between urban design and public health. Rates of obesity have reached epidemic proportions in the United States, and obesity is linked to a number of serious illnesses, including diabetes and cardiovascular disease. The CDC estimates if every person in America walked for 20 minutes a day, the obesity epidemic would be eliminated (The Trust for Public Land , 2006, p.12). Urban form can have a direct impact on rates of physical activity, and can encourage the moderate levels capable of reducing rates of obesity. For example, in many communities there are no sidewalks, and residents don't have the option of walking to and from school, or to run daily errands (CDC Foundation). Similarly, an urban area designed primarily for automobiles is likely to have increased air pollution, which in turn can contribute to high levels of respiratory and cardiovascular disease (Frumkin, 2005, p. 263). Urban form and public health connect in a number of ways, interacting in ways that directly affect residents' daily habits.

This study explores the complex relationship between urban form and public health in the context of a real community. The focus of this study is the City of Delano. Professionals involved in the city's general plan update, with the help of professionals in the medical field, hope to target community form to make Delano a place where daily activities can easily be done in a healthy way. The objective of this study is to address the question: what urban design patterns can significantly impact public health in the City of Delano? This study explores which planning decisions could contribute to a healthier city, and proposes policies and urban design options based on existing studies.

Chapter 4: Methodology

This exploratory study examines a variety of data sources to establish existing conditions for a number of factors impacting public health in Delano. Decisions on data to gather were informed by the document *How to Create and Implement Healthy General Plans*, published in 2008 by Public Health Law & Policy and Raimi + Associates. Data is organized into six categories, and a series of policy and physical planning recommendations for improving public health in Delano are made from the baseline conditions. Recommendations are based on ideas from the literature review. Recommendations are divided into issues that can be addressed through policy efforts and issues that can be addressed through urban design. Further discussion on policy efforts is beyond the scope of this project. Issues that can be addressed through urban design are further developed in a set of design guidelines for the City. The design guidelines are based on finding from the review of relevant literature.

4.1 Baseline Community Health Assessment

The Baseline Community Health Assessment, attached as Appendix A, is a guide for finding a wide array of data on health and urban design in Delano. This data gives insight into the current conditions regarding overall public health and urban design patterns in Delano. Public Health Law & Policy and Raimi + Associates' document *How to Create and Implement Healthy General Plans* provides key suggestions for conducting this type of assessment. Public Health Law & Policy and Raimi + Associates (2008) suggest numerous questions to guide data collection for the community being studied (p.13-15). The questions are sorted in the following topics:

- Overall Health of the Community
- Physical Activity
- Nutrition
- Transportation
- Respiratory Health
- Mental Health and Social Capital

For the purpose of this study, these topics were adjusted to appropriately address health related planning issues in Delano. As research for the assessment progressed, the subjects were further adjusted based on available data. The original list of topics suggested by Public Health Law & Policy was altered in three ways to form the final list used in this study. First, the Physical Activity section was renamed to Land Uses. Public Health Law & Policy suggests including information on land uses in the Physical Activity section, but because physical activity data for the City is limited, and land uses are very important to this study, land uses were made the primary focus of the section. Second, because air quality in Delano is so poor, respiratory issues are considered a primary health concern for the City. Instead of making the subject a separate topic, it was included in the section addressing overall community health, where other primary health problems including main causes of death and obesity rates are discussed. Finally, because in-depth coverage of mental health issues was beyond the scope of this study, the topic was removed from the assessment. It was replaced with Community Safety, which addresses urban design and planning features related to broad mental health issues including stress, anxiety and fear. With these adjustments, the final lists of subjects covered by the Baseline Community Health Assessment in this study are:

- Overall Health of the Community
- Nutrition
- Land Uses
- Transportation
- Community Safety

Public Health Law & Policy recommends a number of subtopics to guide data collection for each subject. For this study these subtopics were tailored to fit Delano's health and planning issues. In this study, subtopics covering information for the Overall Health of the Community section include data on population, primary causes of death and obesity rates, air quality and respiratory health, and access to healthcare. Subtopics in the Nutrition section include access to healthy food, and

schools and fast food restaurants. Park space and mix of uses are subtopics discussed in the Land Uses section. In the Transportation section, subtopics include traffic injuries and fatalities, and commuting. Finally, the subtopic in the Community Safety chapter is crime rates. Details on how data was gathered for each section are discussed here.

4.1.1 Overall Health of the Community

Data regarding the overall health of Delano's population was gathered from a number of internet sources and gives a broad perspective on population changes and major health issues in the City.

4.1.1.1 Population

Basic information on population provides valuable insight into age groups that should receive specific planning attention. For this study, U.S. Census data was used to show Delano's population in 2000, broken down by age cohorts. The 2000 Census data was then used to project the City's population for 2010 and 2020. Population projection calculations took into account survival rates for both males and females, migration rates for both males and females, and the birthrate per 1000 females. Delano's 2000 population and the 2010 and 2020 projections were put into population pyramids to display population changes by age cohorts. This information provided valuable insight into age groups the City should focus planning efforts towards.

4.1.1.2 Primary Causes of Death and Obesity Rates

Information on primary causes of death and obesity rates offers insight into lifestyle patterns of a city's residents. Such data can also inform a city about the presence of higher than normal levels of some sort of harmful chemical or high levels of air pollution that may be risk factors for certain diseases. For this study, data on primary causes of Death in Delano came from the California Department of Public Health. The Department has statistics on causes of death for Delano's population in 2006, reported by number of deaths. These numbers were turned into percentages, and the two highest percentages were taken from the Department for use in the baseline assessment. Obesity rates are reported by the National Center for Chronic Disease Prevention

and Health Prevention (CDC) for Kern County. For this study, obesity rates in Kern County were compared with average rates for the State of California. Statistics for the State were also taken from the CDC.

4.1.1.3 Respiratory Health

Air pollution and respiratory health were included in the Overall Health of the Community section because respiratory issues are a primary health concern in Delano. Data on air quality was taken from the San Joaquin Air Resources Board and the California Air Resources Board. Ozone data for the San Joaquin Valley Air Basin for 2008 was compared to the other four major air basins in California, which are the Sacramento Valley Air Basin, the San Diego Air Basin, the San Francisco Bay Area Air Basin and the South Coast Air Basin (CARB). Detailed information on the San Joaquin Valley Air Basin was found at the National Association of Clean Air Agencies (NACAA).

4.1.1.4 Access to Healthcare

For the healthcare portion of the Overall Health of the Community section, data was gathered to determine the type and location of Delano's healthcare facilities. This information was taken from the California Department of Public Health California Nutrition Network Geographical Information System (CNNGIS). The California Nutrition Network database displays locations and types of healthcare facilities for any area of California.

4.1.2 Nutrition

4.1.2.1 Access to Healthy Food

A site visit to the City provided information on the locations of grocery stores in Delano. These locations were recorded and then mapped in GIS. Research indicates the presence of a supermarket in a neighborhood is linked to higher fruit and vegetable consumption (Public Health Law & Policy, 2008, p.B4). The City's supermarkets and grocery stores were mapped in relation to residential areas. A 1/4 mile buffer was applied to the supermarkets and grocery stores to

show the proportion of residential parcels outside of that buffer. This allowed for an assessment of the accessibility of healthy food sources for Delano residents. A ¼ mile buffer was chosen based on research, which suggests destinations to which planners expect people to walk should be no further than ¼ mile distance (Ewing, 1999).

4.1.2.2 Schools and Fast Food Restaurants

A similar method was used to assess ease of access to fast food restaurants and healthy food sources for school children. School locations were taken from the City of Delano's General Plan and mapped in GIS. Sites of the City's fast food restaurants were taken from CNNGIS, in the same manner as healthcare facilities. These sites were included in the same GIS map containing the City's schools. Using this map, it was possible to pick out schools located within a half mile of a fast food restaurant. Using the same method but applying it to grocery stores, it was possible to locate the City's schools within half a mile of a healthy food source.

4.1.3 Land Uses

Information on land uses was gathered in for the Baseline Community Health Assessment because land uses have the most direct impact on lifestyle patterns. Land uses impact everything from commuting patterns to where people shop for food, and can be altered to improve health through planning efforts.

4.1.3.1 Park Space

Access to space for recreation is shown to be a direct indicator for the amount of physical activity one gets. For this study, the locations of parks in the City were taken from the Delano General Plan and mapped into GIS. A quarter mile buffer was applied around the City's parks to show the proportion of residential parcels living within a quarter mile of a park. Residential parcels within a quarter mile of a park were highlighted in a second map to further emphasize the proportion of residents not living a short distance to a park. The distance of a quarter mile was used in this study because research found people living within a quarter mile of a park were 25 percent more

likely to meet minimum recommended levels of weekly exercise (Public Health Law & Policy, 2008, p.B4).

4.1.3.2 Mix of Uses

Land Use mix correlates to physical activity rates and is an important indicator for a study on public health. Land uses were mapped for this study using The City of Delano Planning Department GIS data on land use designations.

4.1.4 Transportation

4.1.4.1 Traffic Injuries and Fatalities

Data on traffic injuries and fatalities was taken from the California Highway Patrol Statewide Integrated Traffic Records System (SWITRS) 2007 Annual Report of Fatal and Injury Motor Vehicle Traffic Collisions. This record system was found on the California Highway Patrol website. Data included statistics on collisions by county, city and road classification. For this study, data was converted into per capita rates to allow for a comparison to Kern County's major cities. Per capita rates were calculated for the cities of Arvin, Bakersfield, California City, Delano, Ridgecrest, Shafter and Taft. Bear Valley and Stallion Springs were excluded from the comparison because of limited population data. Taft was the smallest city included in the per capita comparison, with a 2008 population of 9,147. The same process was used to generate a per capita comparison for crime rates, discussed in *Section 4.1.5 Community Safety*.

4.1.4.2 Commuting

Statistics on commuting patterns in Delano were taken from the 2000 US Census. The US Census provided data on the number of persons working in their place of residence, the number of persons working outside of their place of residence, and means of transportation to work by number of persons and by percentage of working population for working residents in the City over the age of 16.

4.1.5 Community Safety

4.1.5.1 Crime Rates

Statistics on crime rates were taken from the California Department of Justice, Criminal Justice Statistics Center. Data from the source included the number of crimes by jurisdiction, organized into violent crimes, property crimes and larceny-theft. For the purpose of this study, statistics were converted into per capita rates so a comparison could be made between Delano and Kern County's other major cities.

4.2 Recommendations for a Healthy Delano

This study proposes a series of recommendations for improving public health in the City. These recommendations are based on findings from the literature review and the existing conditions of the City, established by the baseline assessment. In an effort to address all of the issues discussed in the literature review and covered by the baseline assessment, recommendations include both physical planning options as well as policy suggestions. Existing studies found in related literature were examined for each category in the Baseline Community Health Assessment, which are 1) overall health of the community, 2) nutrition, 3) land uses, 4) transportation, and 5) community safety. An additional category covering issues of low impact development was added.

The recommendations are made in the form of general goals, and include suggestions for ways to achieve those goals. Public Health Law & Policy and Raimi + Associates' document *How to Create and Implement Healthy General Plans* suggests a number of planning options to improve the conditions examined through the assessment. These suggestions were studied, compared to findings from the literature review, and then applied in a way that would appropriately address Delano's specific issues. Policy suggestions were found to be beyond the scope of this project and were not discussed further. Physical planning suggestions were developed in greater detail in a set of urban design guidelines.

4.3 Healthy Delano Urban Design Guidelines

The Healthy Delano Urban Design Guidelines were formed based on the recommendations for a healthy Delano. Recommendations that could be addressed through physical planning were taken from the list and developed into a more detailed document, designed to be used by the City as a guide for future development. The Design Guidelines are based on findings from literature and include suggestions for street design and traffic calming measures, land uses, building design and low impact development.

Chapter 5: Findings and Recommendations

According to Public Health and Law Policy's document *How to Create and Implement Healthy General Plans*, analyzing existing conditions of a study area will "provide critical data and insight when including health considerations in any land use plan" (p.11). Public Health and Law Policy recommends this analysis should focus on characteristics of the built environment proven to be connected to health (p.12). Suggested topics include overall health of the community, nutrition, land use, transportation, respiratory health and social capital. For this study these topics were tailored to fit the issues most relevant to public health issues in Delano, and were divided into the following categories: 1) Overall Health of the Community, 2) Nutrition, 3) Land Uses, 4) Transportation, and 5) Community Safety. A discussion of environmental protection and low impact development was also included in this chapter.

Findings from existing conditions revealed areas in which well-crafted planning efforts could make significant impacts to the overall health of the community. Therefore, each major section in this chapter concludes with a series of policy and physical planning recommendations for improving public health in Delano. Recommendations are separated into issues that can be addressed through policy changes, and issues that can be addressed through urban design. Issues to be tackled through policy are suggested here, but not discussed further in this study. Issues that can be addressed through physical planning efforts are explored in greater depth in the Urban Design Guidelines for a Healthy Delano, presented in Appendix B.

Summary tables outlining findings and recommendations are provided in *Section 5.7 A Quick Guide to a Healthy Delano*. These tables also include a brief summary of the literature to provide a rationale for each recommendation. The summary tables are separated into policy recommendations and design guideline recommendations. Design guideline recommendations include a reference to their related section in the Urban Design Guidelines for a Healthy Delano, attached in Appendix B.

5.1 Overall Health of the Community

5.1.1 Population

Figure 5.1.a shows Delano's population in the year 2005, broken down by age cohorts. Figure 5.1.b shows the City's projected population for 2010, 2015 and 2030. In 2000 the largest percentage of Delano's population was between the ages of five and nine and a very small proportion of the population was over the age of 79 (U.S. Census, 2000). Figure 5.2 shows Delano's population in relation to the other major cities in Kern County. Delano has the second largest population in the County. Bakersfield, the largest city in the County, has a significantly larger population than Delano (U.S. Census, 2000).

Planning officials in Delano are in a position to significantly impact public health due to the City's large youth population (under the age of 14). Public health initiatives impacting urban design can change behavior patterns of the City's young population, and establish healthy lifestyle habits benefitting them for the rest of their lives. To serve Delano's large youth population, youth-friendly services and retail should be developed in accessible areas of the City. These amenities should be linked by pedestrian and bicycle routes and should connect to transit stops, healthy food sources, schools, and parks to encourage physical activity and social interaction.

Figure 5.1.a Population by Age Cohorts, Delano 2005.

Source: U.S. Census, 2000

Figure 5.1.b Population Projections by Age Cohort, Delano 2010, 2015 and 2030

Figure 5.2 Populations of Cities in Kern County, 2008

Source: U.S. Census, 2000

5.1.2 Primary Causes of Death and Obesity Rates

In 2005, the leading causes of death in Delano were coronary heart disease (34%) and cancer (15%) (California Department of Public Health). According to the CDC, between 1996 and 2000 Kern County was one of the California counties with the highest number of deaths per 100,000 persons caused by heart disease. Deaths caused by heart disease and various cancers are often preventable, meaning they are caused by behaviors that can be altered (Frank, et al., 2003, p.38). A study conducted by the CDC in 1990 found a sedentary lifestyle was the most common “modifiable risk factor for coronary heart disease” (Frank, et al., 2003, p.43). The risks of dying from heart disease and various cancers can be minimized through changes in one’s lifestyle, and aspects of the built environment directly affect many lifestyle patterns.

Obesity is also linked to lifestyle patterns, which in turn can be linked to the built environment. The prevalence of obesity in the United States increased by roughly 60 percent in the 1990s, and the trend continues today (Frank, et al., 2003, p.45). For adults, ranges of overweight and obesity are established by calculating the body mass index (BMI) using height and weight. According to the CDC, an adult with a BMI between 25 and 29.9 is overweight and an adult with a BMI of 30 or

higher is obese (CDC). Figure 5.3 shows obesity rates for the State of California and Kern County in 2001. In 2001 obesity rates for the state of California were between 20 and 24 percent. Kern County obesity rates (BMI greater than or equal to 30.0) for the same year were slightly higher than the state average, reaching 25.6 percent (California Department of Public Health, 2001). Studies show a direct correlation between obesity rates, physical activity levels and eating habits.

Figure 5.3 Obesity Rates for California and Kern County, 2001

Source: CDPH, 2001.

High rates of coronary heart disease and obesity can be attributed, in part, to low levels of physical activity. Planning efforts can impact individuals' levels of physical activity. According to one study, those who are sedentary are more likely to respond to "lifestyle interventions that encourage the adoption of moderately intense, inexpensive, and convenient forms of physical activity" (Frank, et al., 2003, p.51). Two common types of such activity include walking and bicycling, both of which "are easily incorporated into people's lives when the built environment is properly structured to encourage them" (Frank, et al., 2003, p.39).

New policies and physical planning can structure the built environment in a way that allows individuals to easily incorporate physical activity into their daily lives. Such changes can reduce the high rates of coronary heart disease and obesity in Delano. New development of retail and transit stops should be prioritized to residential areas located more than a half mile from existing amenities serving everyday needs. Safe, pleasant pedestrian and bicycle connections linking

neighborhoods to major activity nodes, parks, and schools will encourage physical activity in the City, providing simple ways for individuals to alter their lifestyle patterns.

5.1.4 Air Quality and Respiratory Health

Air quality plays a major factor in overall health. Concentrations of ozone over 80 parts per billion “sustained over an eight hour period has been found to reduce lung capacity, increase instances of severe asthma, and in certain cases, impact life expectancy” (Design, Community & Environment, 2006, p.4). Excessive exposure to fine particulate matter has been shown to “trigger heart attacks amongst the elderly and other at risk populations” (Design, Community & Environment, 2006, p.4).

Delano is located in the San Joaquin Valley Air Basin. The San Joaquin Air Basin is characterized by an inland Mediterranean climate, with hot, dry summers and cool, foggy winters. The air basin is classified as a serious non-attainment area for the health-based eight-hour federal ozone (smog) standard, a serious non-attainment area for the PM-10 (fine particulate matter) standard, and a non-attainment area for the new PM-2.5 (ultra-fine particulate matter) standard (California Air Resources Board, 2009).

Figure 5.4 shows the number of days above the State one-hour standard for ozone in 2008 for California’s air basins. In 2008, the San Joaquin Valley Air Basin had 95 days above the State one-hour standard. This is only seven days fewer than the South Coast Air Basin, the basin with the worst air quality in the State. It is also 53 days more than the air basin with the next worst air quality in the State. Air quality in the San Joaquin Valley Air Basin is significantly worse than air quality in the majority of California.

Figure 5.4 Number of Days in California Air Basins Above State 1-Hour Standard for Ozone, 2008

Source: California Air Resources Board, 2009

Dairies are a major source of Volatile Organic Compounds (VOC), which cause smog, and of fine particulate matter in the San Joaquin Valley Air Basin. Volatile Organic Compounds are emitted directly from the Valley's approximately 2.5 million dairy cows, and also from the decomposition of hundreds of millions of pounds of dairy waste excreted each day from dairy cows in the San Joaquin Valley (NACAA, 2005). These dairies are one of the largest sources of VOCs in the Valley, and the smog-forming emissions "have a significant adverse impact on efforts to achieve the health-based air quality standards" (NACAA, 2005). Efforts to improve air quality in Delano have the potential to make a major impact on the overall health of the City's residents.

5.1.5 Access to Healthcare

Access to adequate healthcare is an important aspect of community health and well-being. Almost 40 percent of Delano's male population works in the agriculture, forestry, fishing and hunting industry. This industry employs six times more employees than the public administration industry, the industry employing the second highest percentage of Delano's workforce (U.S.

Census, 2000). Delano is a rural community with the vast majority of the workforce employed as farmworkers. This has implications for healthcare needs in the City.

According to the National Center for Farmworker Health (NCFH), migrant farmworkers often face higher frequency and intensity of health problems than the general population. Studies show “farmworkers suffer from higher rates of infectious disease, tuberculosis, parasitis infection, and diarrhea than the general population” (NCFH). Farmworkers also suffer from respiratory conditions caused by exposure to dust and pesticides, as well as dehydration and heat stroke due to a lack of safe drinking water (NCFH).

There are seven healthcare facilities in Delano, including five clinics, one long-term care facility and one major hospital (CDPH, 2009). The long-term facility and Delano Community Hospital are adjacent to one another and across the Garces Highway from two clinics. Three more clinics are located in Delano’s commercial district. Although there are adequate facilities in the City, farmworkers often cannot afford services from private healthcare providers, or are unaware of social service healthcare programs they may be eligible for (NCFH).

The National Center for Farmworker Health suggests innovative methods to provide necessary health services in areas with large farmworker populations. Programs may include extending clinic hours to include evenings and weekends (NCFH). Another suggestion is to develop programs to operate mobile van units, delivering health care to workers on or near the job site (NCFH). Health care planners can also work to develop outreach techniques including health education and awareness programs.

5.1.6 Recommendations

Delano has a large youth population, which makes the City an ideal candidate for health-conscious planning. Planning efforts can alter habits of this young population, targeting factors related to causes of the most common serious illnesses affecting the population. For Delano, these illnesses include coronary heart disease and obesity. Coronary heart disease was the leading cause of death in Kern County in 2005, and in 2001 obesity rates in the County were

higher than the State average. Risks for these health conditions can be minimized through moderate levels of daily physical activity, and incentive planning efforts can impact physical activity levels. Planning recommendations for improving the overall health of the community include creating easily accessible youth-friendly services, establishing uses serving everyday needs of the community within walking distance of all neighborhoods, and designing safe pedestrian and bicycle routes throughout the City to encourage daily physical activity.

P.1 Develop easily accessible youth-friendly services linked by safe, convenient pedestrian and bicycle routes to encourage physical activity. Connect these amenities to transit stops, schools and parks.

P.2 Establish uses serving everyday needs within walking distance of underserved neighborhoods. To increase activity levels, new development of retail and transit stops should be prioritized to residential areas located more than a 1/2 mile from existing amenities serving everyday needs.

DG.1 Develop safe, convenient pedestrian and bicycle routes that connect residents to everyday conveniences like shopping, commercial cores, employment districts and schools, as well as places for residents to exercise, such as parks. *See Design Guidelines Sections 2.1 and 2.3.*

5.2 Nutrition

Healthy eating plays an important role in reducing obesity rates and risks of heart disease and cancers. Unhealthy eating habits are “a primary risk factor for five of the top ten causes of death in California”, and the state has “four times as many ‘unhealthy’ food outlets (e.g., fast food chains, restaurants, and convenience stores) as ‘healthy’ food outlets (supermarkets, produce vendors, and farmers’ markets)” (Public Health Law & Policy, 2008, p.A2). Because an individual’s food choices are impacted by what is most easily accessible and affordable, a wide variety of affordable, healthy food options are integral to a healthy community.

5.2.1 Access to Healthy Food

Studies show a direct relationship between access to healthy food sources and public health. A report published in 2002 by the American Public Health Association found, in low-income neighborhoods, each additional supermarket increased the likelihood of residents meeting nutritional guidelines by one third (Morland, et al., 2002). Furthermore, studies have linked the presence of a supermarket in a neighborhood to higher fruit and vegetable consumption and a reduced prevalence of obesity (Public Health Law & Policy, 2008, p.B4). These findings have important implications for creating a healthy Delano.

There are only three supermarkets in the City where Delano residents can purchase healthy food. These sources are Save Mart Supermarket, Vallarta Supermarket and Delano Ranch Market. Figure 5.5 illustrates the locations of these markets relative to residential parcels. All three markets are located east of Highway 99 and the majority of residential parcels are located further than one quarter of a mile from these sources. Figure 5.6 shows fast food restaurants in the City. As of June 2009 there were eight fast food restaurants in Delano. Sources for healthy food are outnumbered in Delano two to one (CDPH).

Steps should be taken to balance the food environment in the City. On the policy level, efforts should be made to avoid concentrations of fast food restaurants and convenience stores, including liquor stores, in or near residential neighborhoods. Policies should be put in place to require that new development projects with eateries and markets meet certain nutrition standards. These new development projects should be prioritized to neighborhoods not near existing supermarkets and neighborhoods with a high concentration of liquor and convenience stores.

Figure 5.5 Proximity of Healthy Food Sources to Residential Parcels

In existing neighborhoods with limited healthy food options, programs should be put in place to require a certain percentage of fruits and vegetables and higher quality food be sold in convenience stores and liquor stores. Community garden programs should be focused on existing neighborhoods with a poorly balanced food environment.

On the physical planning level, the City should construct safe, convenient bike and pedestrian linkages between underserved residential neighborhoods and healthy food sources. Until new healthy food options are developed in underserved neighborhoods, such linkages can make it easier for residents to access existing healthy food sources.

5.2.2 Schools and Fast Food Restaurants

More than nine million children and adolescents in the US are obese and studies show a direct relationship between fast food consumption and obesity in young adults (Davis & Carpenter, 2009, p.505). One study reports “weekly consumption of fast food by young adults is directly associated with a 0.2-unit increase in body mass index (BMI)” (Davis & Carpenter, 2009, p.505). A study conducted in 2009 found California students attending schools within one half mile of a fast food restaurant consumed fewer servings of fruits and vegetables, more servings of soda, and were more likely to be obese” (Davis & Carpenter, 2009, p.505). This study has major implications for planning in Delano.

There are eight fast food restaurants in Delano, the majority of which are clustered in an area east of Highway 99 and north of Highway 155. Figure 5.6 shows the locations of these fast food restaurants in relation to Delano’s schools. Figure 5.7 shows the locations of Delano’s schools in relation to healthy food sources, namely grocery stores. These maps illustrate that a number of the City’s fast food restaurants are within half of a mile of a school yet only slightly more than half of the City’s schools are within half of a mile of a grocery store offering healthy food options.

Fast food restaurants and other unhealthy options greatly outnumber sources for healthy food in the City. Although existing fast food restaurants are likely to stay where they are, policy efforts can be made to prioritize the location of the development of new, healthy food sources in close

Figure 5.6. Fast Food Restaurants and Schools

Figure 5.7. Proximity of Schools to Grocery Stores

proximity to schools. Although most schools in Delano are closed-campus, students may stop for food on their way to and from school. For this reason, pedestrian-friendly linkages between schools and healthy food sources should be developed to enhance ease of access for students. Finally, nutrition education programs should be set up in schools to educate students about healthy options and the impacts of food choices on their health.

5.2.3 Recommendations

Studies show a direct relationship between public health and access to healthy food sources. The presence of a supermarket in a neighborhood has been linked to reduced levels of obesity and higher levels of fruit and vegetable consumption. There are only three sources for healthy food in Delano and the majority of residential parcels are not within walking distance (1/4 mile) of these sources. Studies also show a direct relationship between fast food consumption and obesity in young adults. Although fast food restaurants are clustered in one area of the City, all of Delano's schools are within a half-mile of a fast food restaurant while at school.

Policy planning efforts regarding food systems in the City can improve public health by limiting the number and controlling the locations of new fast food developments. Policy planning can also increase the number of healthy food sources and improve access to these sources, especially for underserved neighborhoods. Physical planning efforts focusing on access to healthy food sources also have the potential to improve health in the City. Planning recommendations regarding nutrition focus on increasing healthy food options and improving access to healthy sources. Recommendations are as follows:

- P.3 Create a balanced food environment** in which healthy, affordable options can be found at the majority of food stores and restaurants. Access to healthy food directly impacts obesity rates, and high levels of obesity are a major health concern in Delano. Fast food restaurants in the City greatly outnumber sources for healthy food. To improve the food environment in the City, increase the number of healthy food sources. This may include a farmer's market and community gardens. To further

improve the food environment, avoid concentrations of fast food restaurants and convenience stores, including liquor stores, in or near residential neighborhoods.

P.4 Prioritize new healthy food options to underserved neighborhoods to provide for residents not currently living within walking distance of a supermarket. Also focus on neighborhoods with a high concentration of convenience and liquor stores.

P.5 Prioritize new healthy food sources in close proximity to schools, preferably along common routes to and from school.

5.3 Land Uses

Land use designations have a significant impact on lifestyle patterns, which in turn greatly impact health. Ample park space located in residential areas of a city encourages outdoor recreation, and a mix of uses has been shown to increase physical activity by making it easier for residents to walk from place to place. Improvements to land use in Delano can have a significant impact on the day-to-day choices of the City's residents.

5.3.1 Park Space

Parks provide space for active recreation, and increased levels of physical activity reduce risks for major health problems including heart disease and diseases related to obesity. A study published in 2005 found people living within one quarter of a mile of a park were 25 percent more likely to meet the recommended minimum amount of weekly exercise of 30 minutes three times per week (Public Health Law & Policy, 2008, p.B4). The presence of open spaces, greenery and trees has also been shown to reduce feelings of stress, and shared open spaces have been "associated with stronger social ties among neighbors" (Public Health Law & Policy, 2008, p.B4). Ample park space is a key component to a healthy city.

The National Recreation and Park Association (NRPA) recommends cities adhere to a standard of at least 6.5 to 10.5 acres of parks space per 1,000 persons. There are approximately 135 acres of park space in Delano. This equals approximately 2.5 acres of park space per 1,000

residents, a ratio significantly lower than recommended by the NRPA. Figure 5.8 shows Delano's parks, and includes a buffer of a quarter mile to illustrate the proportion of residential parcels within walking distance of a park. Figure 5.9 highlights residential parcels within one quarter mile of park space. Only 41 percent of residential parcels in the City are within one quarter mile of a park, indicating the majority of residential parcels are more than a short walking distance from a park.

New policies and well-structured physical planning efforts can raise levels of physical activity in Delano by increasing park space and improving access to parks. All residential parcels should be within one quarter mile of a park. To accomplish this, new developments should be required to include neighborhood-serving park space in their plans. In-lieu fees, which let developers skip the requirement and instead pay a fee to be used for construction of a park somewhere else in the City, should not be allowed as a replacement for building green space. Where appropriate, new commercial development should include public gathering spaces such as plazas. New parks should be built in underserved neighborhoods first (neighborhoods more than one quarter of a mile from a park), and a greenway system should be developed, connecting parks with safe, shaded pedestrian and bicycle recreation trails. Parks should be well designed, with shade trees, seating, lighting, and sufficient amenities appropriate for the park's size and purpose. Amenities should serve residents of a variety of ages, and to conserve water, trees and landscaping in parks should be drought-tolerant.

5.3.2 Mix of Uses

A mix of uses can impact health by shortening the distances between where someone lives, works and runs everyday errands. This can increase the amount of time an individual spends walking to and from these places, decreasing the amount of time they spend in a car. Evidence suggests people living in walkable, mixed-use areas are twice as likely to get 30 minutes or more of daily exercise than people living in auto-oriented areas (Public Health Law & Policy, 2008, p.A2). Mixing uses can also reduce traffic, which has broad health impacts, including reducing air

Figure 5.8. Parks with 1/4 Mile Buffer

Figure 5.9. Residential Parcels within a ¼ Mile of a Park

pollutants and traffic related accidents. Mixing uses can occur horizontally, with a residence or office located next to a commercial use, and it can also occur vertically, with residences built above commercial uses. Utilizing either type of mixed use can increase levels of physical activity, decrease levels of air pollution and reduce other traffic-related accidents. Figure 5.10 shows the land use mix in Delano, which is very limited. There are some residential parcels located within walking distance to commercial areas and schools. However, there is no vertical mix of land uses.

The majority of residential areas are low density, but a small, high-density residential zone exists near the commercial core, and a few high-density residential parcels are scattered throughout the City. Low density residential is appropriate for neighborhoods, particularly when linked to activity nodes, retail centers and employment districts by safe, convenient pedestrian and bicycle routes. However, higher density residential and mixed-use residential areas can be incorporated near the City's Downtown Core and major activity nodes.

Policies encouraging a mix of uses, specifically in the City's downtown district, should be established. Educational facilities, office buildings, restaurants and taverns, parks, neighborhood-scale retail establishments, civic uses and grocery stores are the land uses most strongly linked to the percentage of household trips made on foot (Public Health Law & Policy, 2008, p.B2). Policies encouraging the development of these uses within reasonable walking distance to residential neighborhoods will be most effective in reducing the number of daily trips made by car and increasing levels of physical activity. Land use designations in the General Plan should ensure densities in downtown areas, commercial corridors, and employment districts are high enough to support walking, biking and public transit use.

Figure 5.10. Land Use Mix in Delano, 2009

5.3.3 Building Design and the Pedestrian Environment

Building design can affect public health by impacting physical activity levels, especially when combined with mixed-use land uses. Mixed-use areas designed with a good building and street interface can create a pedestrian-friendly atmosphere, and actually encourage walking. Urban areas designed in this way are considered to have high levels of walkability, and can become destinations for leisurely walks.

Active Living Research (ALR) describes five urban design qualities shown to have significant relationships to walkability. These qualities are 1) imageability, 2) enclosure, 3) human scale, 4) transparency and 5) complexity. These qualities can create a pedestrian environment that is likely to actually encourage walking as a means of improving overall health through moderate levels of physical activity. Many building design and land use factors play a role in developing these qualities, including parks, plazas, courtyards, building type, building design and signage all impact the pedestrian experience (ALR, 2005, p.12).

Delano's Downtown Core, Main Street between 9th Street and 13th Street, has some elements of ALR's suggested urban design qualities, making it a pleasant downtown for pedestrians. Building design is somewhat varied and provides a moderate level of visual interest for the pedestrian. However, the core lacks areas inviting pedestrians to sit and relax, such as plazas, parks and outdoor cafes. The Downtown Core has moderate feelings of enclosure as well, particularly because of the minimum setbacks on the buildings along Main Street. Street trees and on-street parking also enhance feelings of enclosure, however, building height variation is limited, which may have a negative effect on feelings of enclosure. Feelings of human scale and complexity also exist in Delano's Downtown Core. Buildings along Main Street vary with color and texture. Pedestrian-scale awnings and streetlights improve the experience for those walking along the street, and signage varies in size and height. All of these aspects of Main Street in Downtown Delano should be emulated and enhanced throughout the City, particularly in new mixed-use and commercial developments. Redevelopment projects in the Downtown Core can incorporate more of ALR's urban design qualities to augment existing conditions on Main Street.

Design guidelines regulating allowable uses, density of development, building height, location and placement, and parking lot placement should be established. Guidelines should also address building facades, building transparency, sidewalk design and pedestrian access. Creating more health-friendly land uses by creating mixed-use districts and establishing urban design guidelines is critical to improving the overall health of the City. For this study, the focus for analyzing the pedestrian experience based on ALR's urban design qualities was limited to Delano's downtown core. Although not addressed here, the accompanying Urban Design Guidelines in Appendix B address ALR's urban design qualities for residential uses as well.

5.3.4 Recommendations

Land use mix is one of the most significant planning factors impacting lifestyle patterns. The location of residential uses in relation to all other uses, including commercial, industrial, community facilities and park space directly affects people's daily lives. The amount of park space and the mix of uses in the City are major factors impacting the health of Delano's residents.

Studies show people living within a 1/4 mile of a park are 25 percent more likely to get the recommended minimum levels of physical activity. In Delano, only 41 percent of residential parcels are located that close to a park. Evidence also suggests people living in mixed-use areas where walking is the easiest mode of transportation are twice as likely to get recommended levels of daily physical activity as those living in areas where land uses are segregated. Land use mix in Delano is very minimal. Some residential parcels are within walking distance to community uses however, the majority of residential areas are isolated from other uses. Planning recommendations for improving land use mix cover a range of issues and include:

- P.6 Establish a standard of between 4.5 and 6 acres of park space per 1,000 residents.** Differentiate requirements by park type, such as mini-park, community park, or regional park.

- P.7 Establish a minimum requirement for open space in all new residential developments**, and minimize the option for in-lieu fees, which allow a developer to skip the open space requirement and instead pay a fee to help pay for construction of a park somewhere else in the City.
- P.8 Prioritize new parks to underserved neighborhoods.** New parks should be built in neighborhoods more than a 1/4 mile from a park to ensure all residents have easy access to recreation space.
- P.9 Develop a greenway system** to provide a continuous stretch of open space for active recreation and transportation. Focus on entrances to the greenway, and create access points near major services and amenities.
- P.10 Encourage mixed-use developments** within a 1/4 to 1/2 mile of residential neighborhoods, and allow a mix of uses in existing commercial areas. Ensure these mixed-use developments are walkable by providing pedestrian-friendly linkages to adjacent residential districts, employment districts and schools. Allow land use designations in the General Plan that ensure densities in downtown areas, commercial corridors, and employment districts are high enough to support walking, biking and public transit use.
- DG.2 Create mini parks, neighborhood parks and community parks** designed and located based on the accompanying Design Guidelines. *See Design Guidelines Sections 3.1.*
- DG.3 Develop plazas in downtown** designed and located based on the accompanying Design Guidelines. Convert the City's downtown alleys into pleasant pedestrian routes between major streets. *See Design Guidelines Sections 2.2 and 3.2.*

DG.4 Promote pedestrian-scale mixed use, with well-placed signage, appropriate building facades, entrances, street lighting and vegetation. Incorporate design principles targeted at improving pedestrian safety. *See Design Guidelines Sections 2.3 and 4.1.*

5.4 Transportation

Circulation in a City can have a great impact on public health. There are many aspects of the built environment that impact health. Commuting patterns impact the number of cars on the road, which in turn affects traffic accident rates. Urban areas with designated bike and walking paths can encourage the use of alternative modes of transportation, resulting in fewer cars on the road and greater rates of daily physical activity. Not only can circulation improvements increase physical activity rates, but they can also impact air quality by reducing the number of cars on the road.

5.4.1 Traffic Injuries and Fatalities

Well-designed circulation systems in a city can impact public health by reducing rates of traffic accidents. Studies show traffic accidents increase exponentially with street width (Public Health Law & Policy, 2008, p.B3). Traffic calming measures that slow traffic down from 30 miles per hour to 20 miles per hour can reduce the chance of pedestrian fatalities by 75 percent (Public Health Law & Policy, 2008, p.B3). Major improvements to public health in Delano can be achieved through the creation of a safe, pedestrian-friendly street network.

According to the California Highway Patrol, there were 116 traffic injuries and seven traffic fatalities in Delano in 2007. Of those incidences, 30 involved alcohol, three of which ended in fatalities. Twenty-two of the incidents involved pedestrians and eight involved bicyclists (The California Highway Patrol). Figure 5.11 shows number of collisions per capita for Kern County cities in 2007. Delano had the third highest number of traffic accidents per capita and the second highest number of alcohol-related traffic accidents per capita.

Figure 5.11. Number of Traffic Accidents Per Capita for Kern County Cities, 2007

Source: California Highway Patrol, SWITRS, 2007

5.4.2 Commuting

Land uses generally have the biggest impact on commuting patterns in a city. High levels of commuters mean there are more cars on the road to cause accidents and create high levels of noise and pollution. These issues can be remedied through creating a well-designed circulation system.

Delano has a cash economy, which makes it very difficult to determine commuting patterns of its citizens. According to the 2000 US Census only 23 percent of the population had registered jobs. Because of this, Census data only reflects the commuting patterns of a very small proportion of the City's population. Figure 5.12 shows the percentage of registered workers who worked and lived in Delano compared to the percentage living in Delano and working elsewhere. In 2000, the majority of the registered working population (57 percent) worked outside of the City.

Figure 5.12. Number of Persons Working in and Outside of Delano, 2000.

Source: US Census 2000 Summary File 3 (SF 3) P27.

The vast majority of those commuting to work get there by means of a private automobile. In 2000, 93 percent of those with registered jobs traveled to work by car while less than one percent took public transit. Figure 5.13 illustrates the distribution of transportation methods for Delano.

Figure 5.13. Means of Transportation to Work, Delano, 2000

Source: Census 2000 SF3, P30

The majority of Delano's registered working population drives to work outside of the City. Of these commuters, more than one third drives over 30 minutes. Commuting increases the number of cars on the road, which in turn increases the amount of air pollution residents are exposed to. High numbers of cars on the roads also increase rates of transportation-related accidents. Policy changes and physical planning efforts can enhance the City's capacity for people to live and work within Delano, which in turn will alleviate health-related issues caused by high rates of commuting.

On the policy level, Delano should pursue an improved regional public transportation system, allowing residents to take transit to jobs outside City Limits. Planners should also create Pedestrian and Bicycle Master Plans to switch the focus to alternative modes of transportation.

On the physical planning level, design standards for streets and sidewalks should be established to improve pedestrian safety. These standards should address street width, sidewalk width, bike lanes, vegetation for shade and aesthetics, signage, lighting, parking and traffic calming measures. Guidelines regulating the City's circulation system will improve pedestrian and bicycle safety, and make the experience of using alternative modes of transportation much more enjoyable.

5.4.3 Recommendations

A city's transportation system greatly impacts daily habits. Public transportation systems impact commuting patterns, which have wide health implications, and transportation systems with well-designed bicycle and pedestrian paths encourage the use of alternative modes of transportation, increasing physical activity rates. Carefully designed circulation systems can improve public health by encouraging physical activity and can also improve public health by reducing risks of traffic injuries and fatalities. Streets designed with traffic calming measures have been shown to reduce the chance of pedestrian fatalities by up to 75 percent. Recommendations for policies and physical planning efforts regarding transportation include:

P.11 Improve the City’s public transportation, allowing more residents to take transit to jobs outside City Limits.

P.12 Create pedestrian and bicycle master plans to improve safety and access for pedestrians and bicyclists, and to bring the focus directly to the needs of those user groups.

DG.5 Create street design standards to improve pedestrian and bicycle safety.
Incorporate traffic calming measures and elements of low impact development. Design standards can be applied to new projects and redevelopment or improvement of existing sites. *See Design Guidelines Section 2.1 and 2.3.*

5.5 Community Safety

Community safety is an important factor for a healthy community. Stress and high blood pressure are linked to more serious health conditions including obesity, cardiovascular disease, stroke and diabetes, and anxiety is linked to increased risk of aggression, depression and substance abuse (Public Health Law & Policy, 2008, p.A4). Studies show fear of being assaulted is a major reason people choose not to walk, use public recreation spaces or let their children play outdoors (Public Health Law & Policy, 2008, p.A5). Urban design features, including aspects of building design, can improve public safety in a community, and alleviate stress and anxiety caused by living near unsafe environments.

Strategies for improving public safety include adapting requirements for building design to promote the “eyes on the street” philosophy, or natural surveillance. The eyes on the street philosophy describes “the natural community surveillance that people provide for each other in public spaces” (Public Health Law & Policy, 2008, p.61). The presence of people generally enhances feelings of safety in a public space. Busy sidewalks “enhanced by a diversity of activities and functions” not only increase the number of eyes on the street, but also “induce people in buildings along the street to watch the sidewalks” (Carmona, et al., 2003, p.121). Buildings with large windows facing the street and appropriate pedestrian-scale lighting

encourage the natural surveillance that prevents crime (Public Health Law & Policy, 2008, p.61). These strategies can all be used to combat crime and enhance the feeling of safety in Delano.

5.5.1 Crime Rates

In 2007 there were 282 violent crimes in the City, 226 of which were aggravated assault. These numbers are up from 2005, in which there were 207 violent crimes, 105 of which were aggravated assault (California Department of Justice). In 2007 there were 1,341 property crimes and 650 crimes of larceny. Figure 5.14 shows 2007 per capita crime rates for Kern County cities. In 2007 Delano had the second highest number of violent crimes per capita and the highest number of property crimes per capita, drastically higher than Bakersfield. Figure 5.15 shows 2007 per capita adult felony arrests for Kern County cities. In 2007 Delano had the second highest number of adult felony arrests per capita.

Figure 5.14. Number of Crimes per Capita, Kern County Cities, 2007

Source: California Department of Justice

Figure 5.15. Number of Adult Felony Arrests Per Capita for Kern County Cities, 2007

Source: California Department of Justice

Policies and physical planning efforts can improve public safety in the City and reduce risks of diseases caused by stress and anxiety. The City should strive for well-designed spaces inducing feelings of calm. Mixed-use development provides the round-the-clock surveillance that is key to reducing crime. Appropriate changes to land use designations in the General Plan should be made to encourage this type of development.

Places susceptible to crime should be designed to be overlooked by buildings with a high level of transparency or uses that are busy throughout the day and night. Buildings facing streets should have active frontages rather than blank walls. Transparency, facade and entrance requirements should be established for all new projects, and efforts should be made to eliminate existing inactive frontages and corners. All public spaces and sidewalks should be well lit, and lighting should be at an appropriate pedestrian scale.

5.5.2 Recommendations

Community safety is an important factor for a healthy community. Well-designed places have the potential to reduce stress levels, while poorly-designed places can actually increase stress and

high blood pressure. Studies show people often choose not to walk or use public spaces out of fear of being assaulted. In 2005 there were over 200 violent crimes in Delano, making it the city with the second highest rate of violent crimes in Kern County.

Planning efforts have the potential to reduce crime rates and improve public safety in the City. The City should strive to create places inducing feelings of calm. Planning recommendations for improved safety in Delano include:

DG.6 Establish building design standards aimed to improve pedestrian safety.

Incorporate design principles like building transparency and active frontages. For commercial areas, focus on creating active uses on the ground floor to . For mixed-use, focus on creating active storefronts on the ground floor, with private, secure residential on the upper floors. For residential areas, focus on making streets walkable while ensuring privacy for residents. *See Design Guidelines Section 4.1.*

5.6 Environmental Protection and Low Impact Development (LID)

Low Impact Development (LID) is a design strategy that aims to restore the stormwater system of a site to how it operated before development. LID manages stormwater storage, infiltration and groundwater recharge through micro-scale retention and detention areas called bioswales or rain gardens, and increased permeable surfaces (Environmental Protection Agency, 2000, p.1). LID also addresses environmental protection through preservation of sensitive site features including wetlands, steep slopes, riparian buffers, valuable trees, flood plains, woodlands and highly permeable soils (EPA, 2000, p.1).

LID methods improve environmental quality by removing pollutants from stormwater as it returns to the water table. LID methods also reduce stormwater runoff volumes, help preserve the natural environment, can add significant aesthetic value to urban areas, and are often less costly than traditional methods of stormwater management. Because LID principles often enhance the aesthetics of an area, they are an ideal method for helping improve overall health in an urban

area. If used properly, LID methods can greatly improve the pedestrian experience along a City's streets, which may in turn inspire residents to walk more and drive less.

5.6.1 Recommendations

LID methods improve public health by enhancing environmental quality. LID methods remove pollutants from stormwater as it returns to the water table, reduce stormwater runoff volumes, help preserve the natural environment, and can add significant aesthetic value to urban areas. Well-executed LID methods also have the potential to greatly improve the pedestrian experience along a City's streets, which may in turn inspire residents to walk more and drive less.

UD. 7 Incorporate LID principles into streets, streetscapes and sidewalks, alleys and parks to help improve environmental quality in the City. *See Design Guidelines Section 2.2.*

5.7 A Quick Guide for a Healthy Delano

Recommendations based on the research findings are summarized in the following Quick Guide for a Healthy Delano. Tables 5.7 a-e summarize findings of existing conditions in Delano, policy or design guideline recommendations related to the findings, and the rationale from literature behind these guidelines and recommendations. The Quick Guide tables are intended to visually present this study, and directly relate the major components. Each row in the tables connects the findings to the rationale behind each recommendation proposed in this document. Recommendations in the Design Guideline tables (Tables 5.7 d and e) provide the basis for the attached Healthy Delano Design Guidelines (Appendix B).

Table 5.7 a. Quick Guide for a Healthy Delano

POLICY RECOMMENDATIONS				
	#	Finding	Recommendation	Rationale
Overall Community Health	P.1	Delano's youth population (under the age of 15) is projected to grow significantly over the next 20 years, between 2010 to 2030 (U.S. Census, 2000).	Develop easily accessible youth friendly services linked by safe, convenient pedestrian and bicycle routes to encourage physical activity. Connect these amenities to transit stops, schools and parks.	Research shows childhood obesity rates are on the rise, as are rates of related diseases like Type 2 diabetes in children (WHO, 2003 & CDC, 2009). Children can substantially improve their physical health by incorporating moderate levels of physical activity in their daily lives (Geis, 2006), and safe pedestrian and bicycle routes connecting schools, parks, and services provide the space for this type of activity. Studies show recreation and open space areas close to home can increase the likelihood that youths will engage in some form of active transport (ALR, 2010).
	P.2	Coronary heart disease and cancer were the leading causes of death in Delano in 2005, and in 2001 obesity rates in Kern County were significantly higher than the State average (CDPH, 2005).	Establish uses serving everyday needs within walking distance of under-served neighborhoods. To increase activity levels, new development of retail and transit stops should be prioritized to residential areas located more than a 1/2 mile from existing amenities serving everyday needs.	Research suggests even moderate levels of physical activity, a 20 minute walk per day, could eliminate the world's obesity epidemic (CDC, 2006). Health professionals promote incidental exercise, such as walking to run errands, as a means for achieving moderate levels of physical activity on a daily basis (Geis, 2006).
Nutrition	P.3	There are three supermarkets in Delano, and these sources for healthy food are outnumbered by the City's fast food restaurants (cnngis.org).	Create a balanced food environment in which healthy, affordable options can be found at the majority of food stores and restaurants.	Studies show unhealthy eating habits are a primary risk factor for five of the top ten causes of death in California. Studies also link the presence of a supermarket in a neighborhood to higher fruit and vegetable consumption and a reduced prevalence of obesity (Public Health Law & Policy, 2008).
	P.4	The majority of residential parcels in the City are not within walking distance (1/4 mile) of a grocery store (cnngis.org).	Prioritize new healthy food sources to under-served neighborhoods to provide for residents not currently living within walking distance to a supermarket.	Research has found a 1/4 mile to be a reasonable walking distance for the average American (CITE). Studies show unhealthy eating habits are a primary risk factor for five of the top ten causes of death in California. Studies also link the presence of a supermarket in a neighborhood to higher fruit and vegetable consumption and a reduced prevalence of obesity (Public Health Law & Policy, 2008).

Table 5.7 b. Quick Guide for a Healthy Delano

POLICY RECOMMENDATIONS				
	#	Finding	Recommendation	Rationale
Nutrition	P.5	Every school in Delano is within a 1/2 mile of a fast food restaurant, but not within a 1/2 mile of a grocery store (City of Delano General Plan and GIS Data, 2005). Although most schools in the City are closed campuses, students may stop for food on their way to and from school.	Prioritize new healthy food sources in close proximity to schools , preferably along common routes to and from school.	According to research, childhood obesity rates are on the rise, as are rates of related diseases like Type 2 diabetes in children (WHO, 2003 & CDC, 2009). Studies link the presence of a supermarket in a neighborhood to higher fruit and vegetable consumption and a reduced prevalence of obesity (Public Health Law & Policy, 2008).
	P.6	Delano has 2.5 acres of park space for every 1,000 residents (City of Delano General Plan and GIS Data, 2005).	Establish a standard of between 4.5 and 6 acres of park space per 1,000 residents . Differentiate requirements by park type, such as minipark, community park, or regional park.	The National Recreation and Park Association (NRPA) suggests developing a hierarchal system of recreational facilities, ranging from miniparks to regional and linear parks. The NRPA recommends a standard of 6.5 to 10 acres of park space per 1,000 persons, but suggests this standard be flexible, realistically attainable, and tailored to the needs of each community (Urban Land Use Planning, 2006).
Land Use	P.7	Only 41% of residential parcels in the City are within a 1/4 mile of a park (City of Delano General Plan and GIS Data, 2005).	Establish a minimum requirement for open space in all new residential developments , and minimize the option for in-lieu fees, which allow a developer to skip the open space requirement and instead pay a fee to help pay for construction of a park somewhere else in the City.	The presence of open spaces, greenery and trees has been shown to reduce feelings of stress, and shared open spaces have been associated with stronger ties between neighbors. Research also suggests people living within a 1/4 mile of a park are 25% more likely to meet recommended amounts of daily exercise than those living further away (Public Health Law & Policy, 2008).
	P.8	Only 41% of residential parcels in the City are within a 1/4 mile of a park (City of Delano General Plan and GIS Data, 2005).	Prioritize new parks to under-served neighborhoods . New parks should be built in neighborhoods more than a 1/4 mile from a park to ensure all residents have easy access to recreation space.	Research suggests people living within a 1/4 mile of a park are 25% more likely to meet recommended amounts of daily exercise than those living further away (Public Health Law & Policy, 2008). Similarly, according to research, creating, promoting and improving places to be physically active can result in a 25% increase in weekly exercise for residents living near these places (ALR, 2008).

Table 5.7 c. Quick Guide for a Healthy Delano

POLICY RECOMMENDATIONS				
	#	Finding	Recommendation	Rationale
Land Use	P.9	Coronary heart disease and cancer were the leading causes of death in Delano in 2005, and in 2001 obesity rates in Kern County were significantly higher than the State average (California Department of Public Health, 2005).	Develop a greenway system to provide a continuous stretch of open space for active recreation and transportation. Focus on entrances to the greenway, and create access points near major services and amenities.	Living near trails has been associated with a 50% increase in the likelihood of people meeting recommended amounts of physical activity, and a 70-80% increase in the likelihood that people will bicycle. Trails are beneficial in promoting physical activity among women and people in lower-income areas (ALR, 2009).
	P.10	Existing zoning regulations in Delano segregate land uses, therefore increasing distances between different uses. This increases the amount of walking required to travel from one use to another (City of Delano General Plan Land Use Map, 2005).	Encourage mixed-use developments within a 1/4 to 1/2 mile of residential neighborhoods, and allow a mix of uses in existing commercial areas. Ensure these mixed-use developments are walkable by providing pedestrian-friendly linkages to adjacent residential districts, employment districts and schools. Allow land use designations in the General Plan that ensure densities in downtown areas, commercial corridors, and employment districts are high enough to support walking, biking and public transit use.	According to studies, people living in walkable, mixed-use areas are twice as likely to get 30 minutes or more of daily exercise than people living in auto-oriented areas (Public Health Law & Policy, 2008). Similarly, walking for transportation is most strongly linked to high density, mixed land use and short distances to destinations (ALR).
Transportation	P.11	In 2000, 93% of Delano residents commuted to work by means of a private automobile (U.S. Census, 2000).	Improve the City's public transportation system allowing more residents to take transit to jobs outside City Limits.	Research shows a direct link between public transit use and physical activity. According to one study, 29% of those who use transit were physically active for at least 30 minutes per day, and transit users spent 8.3 more minutes walking per day than people who relied on cars (ALR, 2009).
	P.12	In 2000, 93% of Delano residents commuted to work by means of a private automobile (U.S. Census, 2000).	Create Pedestrian and Bicycle Master Plans to improve safety and access for pedestrians and bicyclists, and to bring the focus directly to the needs of those user groups.	According to research, the presence of bicycle paths and bicycle lanes is positively related to adults meeting recommended daily amounts of physical activity, and cities that invest in bicycle facilities generally exhibit higher levels of bicycle ridership (ALR, 2009).

Table 5.7 d. Quick Guide for a Healthy Delano

URBAN DESIGN RECOMMENDATIONS					
	#	Finding	Recommendation	Rationale	Design Guideline
Overall Community Health	DG.1	Coronary heart disease and cancer were the leading causes of death in Delano in 2005, and in 2001 obesity rates in Kern County were significantly higher than the State average (California Department of Public Health, 2005).	Develop safe, convenient pedestrian and bicycle routes that connect residents to everyday conveniences like shopping, commercial cores, employment districts and schools, as well as places for residents to exercise, such as parks.	Research shows the presence of bicycle paths and bicycle lanes is positively related to adults meeting recommended daily amounts of physical activity, and cities that invest in bicycle facilities generally exhibit higher levels of bicycle ridership (ALR, 2009).	Section 2.1 Section 2.3
	DG.2	Only 41% of residential parcels in the City are within a 1/4 mile of a park (City of Delano General Plan and GIS Data, 2005).	Create mini parks, neighborhood parks and community parks designed and located based on the accompanying Design Guidelines.	Research suggests people living within a 1/4 mile of a park are 25% more likely to meet recommended amounts of daily exercise than those living further away (Public Health Law & Policy, 2008). Parks are more likely to promote physical activity when users consider them to be aesthetically pleasing, and adults who feel safe in parks are 60% more likely to encourage children to use local parks than those who felt unsafe (ALR, 2010).	Section 3.1
Land Use	DG.3	There are a number of vacant parcels in Delano's downtown, and the City's downtown alleyways are under utilized (City of Delano General Plan Land Use Map, 2005).	Develop plazas in downtown designed and located based on the accompanying Design Guidelines. Convert the City's downtown alleys into pleasant pedestrian routes between major streets.	Research shows plazas can play an important role in establishing a sense of community, and provide common ground for social interaction (Pratt, et al, 1979, and Carmona, et al, 2003).	Section 2.2 Section 3.2
	DG.4	Existing zoning regulations in Delano segregate land uses, therefore increasing distances between different uses. This increases the amount of walking required to travel from one use to another (City of Delano General Plan Land Use Map, 2005).	Promote pedestrian scale mixed-use , with well-placed signage, appropriate building facades, entrances, street lighting and vegetation. Incorporate design principles targeted at improving pedestrian safety.	People living in walkable, mixed-use areas are twice as likely to get 30 minutes or more of daily exercise than people living in auto-oriented areas (Public Health Law & Policy). Regulating building form can control elements of urban design that contribute to pedestrian comfort and improving the pedestrian experience (Parolek, et al., 2008).	Section 2.3 Section 4.1

Table 5.7 e. Quick Guide for a Healthy Delano

URBAN DESIGN RECOMMENDATIONS					
	#	Finding	Recommendation	Rationale	Design Guideline
Transportation	DG.5	In 2007 Delano had the third highest number of traffic accidents per capita in Kern County (U.S. Census, 2000).	Create street design standards to improve pedestrian and bicycle safety. Incorporate traffic calming measures and elements of low impact development. Design standards can be applied to new projects and redevelopment or improvement of existing sites.	Studies show traffic calming measures can reduce the risk of crashes involving pedestrians. Traffic calming measures have been associated with 11% to 15% lower rates of automobile crashes with injuries (ALR, 2009).	Section 2.1 Section 2.3
Community Safety	DG.6	In 2007 Delano had the second highest number of violent crimes per capita and the highest number of property crimes per capita, drastically higher than Bakersfield (Department of Justice, 2009).	Establish building design standards aimed to improve pedestrian safety. Incorporate design principles like building transparency and active frontages. For commercial areas, focus on creating active uses on the ground floor to . For mixed-use, focus on creating active storefronts on the ground floor, with private, secure residential on the upper floors. For residential areas, focus on making streets walkable while ensuring privacy for residents.	Research shows urban design can be used to combat crime and enhance pedestrian safety. Principles like natural surveillance and “eyes on the street” emphasize building transparency, facades, building orientation and lighting to improve pedestrian safety (Carmona, et al., 2003, and Public Health Law & Policy, 2008).	Section 4.1
Low Impact Development	DG.7	Delano has the opportunity to incorporate Low Impact Development (LID) principles into redevelopment projects, as well as new development. These principles can be incorporated into parks, streets and streetscapes, and in the City’s numerous downtown and residential alleys.	Incorporate LID principles into streets, streetscapes and sidewalks, alleys and parks to help improve environmental quality in the City.	According to research, principles of Low Impact Development can improve environmental quality by removing pollutants from stormwater as it returns to the water table. LID methods also reduce stormwater runoff volumes, help preserve the natural environment and can add significant aesthetic value to urban areas (EPA, 2000).	Section 2.2

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Appendix A

Baseline Community Health Assessment

Baseline Community Health Assessment Questions	
Topic	Data Source
Overall Health of Community	
Causes of Death	
Primary causes of death	Kern County Department of Public Health Services
causes related to the built environment	CDC
Vulnerable Populations	
population breakdown by age	US Census
geographic distribution of pop.	US Census
How many community clinics, hospitals, or nursing facilities are there?	GIS
where are they located?	GIS
Obesity Rates	
How many adults are overweight or obese?	California Center for Health Statistics
how many youth are overweight or obese?	California Center for Health Statistics
Physical Activity	
Proximity to Parks, Open Space and Rec. Facilities	
what percentage of the residential population is located within a quarter-or-half-mile of parks?	GIS
open spaces?	GIS
recreational facilities?	GIS
What is the parks-to-people ratio?	GIS
Do these vary by neighborhood?	GIS
Mix of Uses	
What is the mix of land uses?	GIS
Job-housing Balance and Match	
What percentage of residents live and work within the City limits?	US Census
Land Use Density	
What is the density of the residential and nonresidential development in different parts of Delano?	GIS
Overall Level of Physical Activity	
What percentage of the community meets the minimal recommended weekly activity levels?	
How do these rates differ in different neighborhoods?	
Nutrition/Food Systems	
Access to Healthy Food	
Where are these sources located?	GIS
Number of Fast Food Restaurants and Offsite Liquor Retailers	
What is the retail food environmental index (RFEI)? (This is the number of fast food restaurants and convenience stores in a geographic area divided by the total number of supermarkets and produce vendors)	California Nutrition Network
Does the RFEI vary by neighborhood?	California Nutrition Network
Is there a geographic concentration of liquor stores or convenience stores that sell liquor?	California Nutrition Network
Local Agricultural Resources	
How much food do local farms produce for the community?	California Department of Food and Agriculture
What portion of the local farms are organic?	California Department of Food and Agriculture
Transportation	

Traffic Injuries and Fatalities	
How many traffic injuries and fatalities are there per year?	Statewide Integrated Traffic Records System
Where are the largest number of injuries and fatalities occurring?	Statewide Integrated Traffic Records System
What is the percentage of traffic accidents that involve pedestrians or non-motorized vehicles?	Statewide Integrated Traffic Records System
Mode Split	
What are the rates of driving, walking, biking, and public transit?	US Census
What is the average annual vehicle miles traveled (VMT) per capita for different areas of the jurisdiction?	US Census
Commuting	
What are the average commute times and distances?	US Census
What percentage of the population leaves the area for work?	US Census
Transportation Network	
What percentage of roads have sidewalks on one or both sides of the street?	GIS
What are the block lengths in different areas of Delano?	GIS
Respiratory Health	
Asthma and other Respiratory Ailments	
What are the rates of asthma and other respiratory ailments?	National Center for Health Statistics
Are there concentrations of cases of asthma?	National Center for Health Statistics
What is the proximity of neighborhoods, schools, and employment centers to roadways and other pollution sources?	GIS
What percentage of the population is located within 500 feet of major roadways, heavy industrial uses, or warehouse/distribution uses?	GIS
Air Quality/Toxic Contaminants	
What is the quality of outdoor air?	California Air Resources Board
What are the main toxic contaminants?	EPA Toxic Release Inventory
What are the sources of toxic contaminants?	EPA Toxic Release Inventory
What is the air quality of air in households and offices?	California Air Resources Board
What is the air quality in public housing units?	California Air Resources Board
Where are the sources of air or water contaminants located, and what types of development are around them?	EPA Toxic Release Inventory, California Air Resources Board, GIS
Where are the contaminants concentrated?	EPA Toxic Release Inventory, California Air Resources Board, GIS
Social Capital	
Participation	
What are the voting rates in different neighborhoods?	US Census
Stability	
How affordable is housing?	US Census, Interview
What proportion of their income do residents in different neighborhoods pay for housing?	US Census
Where are the geographic concentrations of poverty?	US Census
What percentage of residents in different communities have served time in jail?	US Census

Appendix B

Healthy Delano Design Guidelines:
A guide to health-oriented planning

HEALTHY DELANO DESIGN GUIDELINES

A guide to health-oriented planning

October 2010

Prepared as part of a Masters Thesis for the California Polytechnic State University Department
of City and Regional Planning.

October 2010

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Chapter 1 Introduction

■ Rates of obesity, diabetes and cardiovascular disease have reached epidemic proportions in the United States, and these diseases can be largely attributed to personal habits, including diet and physical inactivity. Recent research links these diseases to urban design. According to literature, urban form can greatly influence human behavior, which in turn directly impacts public health. Urban features like building design, streetscapes, and park design can all work together to create an environment that is conducive to physical activity and a healthy lifestyle.

The purpose of this document is to address the relationship between public health and urban form through a series of urban design guidelines. The guidelines recommended in this document are based on findings from an extensive review of literature, and findings from an assessment of the project site, including health statistics and urban conditions.

HOW TO USE THIS GUIDE

Following this introduction is A Quick Guide for a Healthy Delano (Tables 1a-c), which lists all of the recommendations for the City related to urban design, as well as the findings and literature support that led to the creation of each guideline.

Guidelines and recommendations in this document are organized into three sections: Transportation and Circulation Strategies, Land Use Strategies, and Building Design Strategies.

Each section begins with a summary of existing conditions in Delano related to the section's guidelines. Following the summary of existing conditions is a summary of related literature, which was used to develop the urban design recommendations. Recommended design guidelines follow the literature summary. At the top of each guideline page is a box identifying the design guideline recommendation number and the actual recommendation from the Quick Guide tables.

Additional information that might be required for understanding the details of each urban design recommendation are in the Appendix.

Table 1a. A Quick Guide for a Healthy Delano

URBAN DESIGN RECOMMENDATIONS					
	#	Finding	Recommendation	Rationale	Design Guideline
Overall Community Health	DG.1	Coronary heart disease and cancer were the leading causes of death in Delano in 2005, and in 2001 obesity rates in Kern County were significantly higher than the State average (California Department of Public Health, 2005).	Develop safe, convenient pedestrian and bicycle routes that connect residents to everyday conveniences like shopping, commercial cores, employment districts and schools, as well as places for residents to exercise, such as parks.	Research shows the presence of bicycle paths and bicycle lanes is positively related to adults meeting recommended daily amounts of physical activity, and cities that invest in bicycle facilities generally exhibit higher levels of bicycle ridership (ALR, 2009).	Section 2.1 Section 2.3
	DG.2	Only 41% of residential parcels in the City are within a 1/4 mile of a park (City of Delano General Plan and GIS Data, 2005).	Create mini parks, neighborhood parks and community parks designed and located based on the accompanying Design Guidelines.	Research suggests people living within a 1/4 mile of a park are 25% more likely to meet recommended amounts of daily exercise than those living further away (Public Health Law & Policy, 2008). Parks are more likely to promote physical activity when users consider them to be aesthetically pleasing, and adults who feel safe in parks are 60% more likely to encourage children to use local parks than those who felt unsafe (ALR, 2010).	Section 3.1
Land Use	DG.3	There are a number of vacant parcels in Delano's downtown, and the City's downtown alleyways are under utilized (City of Delano General Plan Land Use Map, 2005).	Develop plazas in downtown designed and located based on the accompanying Design Guidelines. Convert the City's downtown alleys into pleasant pedestrian routes between major streets.	Research shows plazas can play an important role in establishing a sense of community, and provide common ground for social interaction (Pratt, et al, 1979, and Carmona, et al, 2003).	Section 2.1 Section 3.2

Table 1b. A Quick Guide for a Healthy Delano

URBAN DESIGN RECOMMENDATIONS					
	#	Finding	Recommendation	Rationale	Design Guideline
Land Use	DG.4	Existing zoning regulations in Delano segregate land uses, therefore increasing distances between different uses. This increases the amount of walking required to travel from one use to another (City of Delano General Plan Land Use Map, 2005).	Promote pedestrian scale mixed-use , with well-placed signage, appropriate building facades, entrances, street lighting and vegetation. Incorporate design principles targeted at improving pedestrian safety.	People living in walkable, mixed-use areas are twice as likely to get 30 minutes or more of daily exercise than people living in auto-oriented areas (Public Health Law & Policy). Regulating building form can control elements of urban design that contribute to pedestrian comfort and improving the pedestrian experience (Parolek, et al., 2008).	Section 2.3 Section 4.1
	DG.5	In 2007 Delano had the third highest number of traffic accidents per capita in Kern County (U.S. Census, 2000).	Create street design standards to improve pedestrian and bicycle safety. Incorporate traffic calming measures and elements of low impact development. Design standards can be applied to new projects and redevelopment or improvement of existing sites.	Studies show traffic calming measures can reduce the risk of crashes involving pedestrians. Traffic calming measures have been associated with 11% to 15% lower rates of automobile crashes with injuries (ALR, 2009).	Section 2.1 Section 2.3

Table 1c. A Quick Guide for a Healthy Delano

URBAN DESIGN RECOMMENDATIONS					
	#	Finding	Recommendation	Rationale	Design Guideline
Community Safety	DG.6	In 2007 Delano had the second highest number of violent crimes per capita and the highest number of property crimes per capita, drastically higher than Bakersfield (Department of Justice, 2009).	Establish building design standards aimed to improve pedestrian safety. Incorporate design principles like building transparency and active frontages. For commercial areas, focus on creating active uses on the ground floor to . For mixed-use, focus on creating active storefronts on the ground floor, with private, secure residential on the upper floors. For residential areas, focus on making streets walkable while ensuring privacy for residents.	Research shows urban design can be used to combat crime and enhance pedestrian safety. Principles like natural surveillance and “eyes on the street” emphasize building transparency, facades, building orientation and lighting to improve pedestrian safety (Carmona, et al., 2003, and Public Health Law & Policy, 2008).	Section 4.1
	DG.7	Delano has the opportunity to incorporate Low Impact Development (LID) principles into redevelopment projects, as well as new development. These principles can be incorporated into parks, streets and streetscapes, and in the City’s numerous downtown and residential alleys.	Incorporate LID principles into streets, streetscapes and sidewalks, alleys and parks to help improve environmental quality in the City.	According to research, principles of Low Impact Development can improve environmental quality by removing pollutants from stormwater as it returns to the water table. LID methods also reduce stormwater runoff volumes, help preserve the natural environment and can add significant aesthetic value to urban areas (EPA, 2000).	Section 2.2

Transportation & Circulation Strategies

■ A City's circulation system can play a major role in a population's overall health. Circulation systems impact how frequently people walk, and how many cars are on the road. Well-designed circulation systems can increase levels of physical activity, reduce air pollution and reduce rates of traffic accidents.

EXISTING CONDITIONS IN DELANO

Obesity

A major health problem afflicting a large portion of Delano residents is obesity. Obesity is associated with other serious health issues including diabetes and coronary heart disease. Delano's has high rates of obesity and coronary heart disease are conditions that can be alleviated through moderate levels of daily physical activity.

Circulation System

The City's circulation system does little to encourage physical activity, and consists of minimal bicycle lanes and pedestrian friendly streets. Bike linkages in the City are limited, and few streets cater to the pedestrian. Figure 2.1 illustrates existing bike lanes in Delano's street network. All existing bike lanes in the City are Class II Bike Lanes, located on the street and delineated by a striped lane.

Figure 2.1 Existing Bike Lanes and Street Types, Delano, 2009

Delano Strategic Plan

The Delano Strategic Plan proposes a series of nodes to serve as activity hubs for the City, with neighborhood-commercial uses surrounded by progressively less dense residential uses for all but one node. The node located in the downtown core is intended to be mixed-use. The Delano Strategic Plan proposes these nodes be connected by improved public transit, as well as a network of pedestrian and bicycle friendly streets. Figure 2.2 illustrates proposed nodes in the Delano Strategic Plan. Design guidelines for improved pedestrian and bicycle circulation are focused on these proposed nodes and routes, and can be found in Section 2.1.

Safety

Pedestrian, bicyclist and vehicle passenger safety is also an issue in Delano. In 2007 Delano had the third highest number of traffic accidents per capita in Kern County (U.S. Census, 2000). These issues are addressed in the design guidelines for traffic calming measures in Section 2.3.

Low Impact Development

Low Impact Development (LID) methods are being used more and more in streetscape design as a means for enhancing visual quality while improving the environment. Currently Delano does not incorporate methods of LID in the City's circulation system and streetscapes. Low Impact Development recommendations are in Section 2.2.

SUMMARY OF RELATED LITERATURE

Streetscapes

Many studies link the use of alternative modes of transportation, including walking and biking, to reduced levels of obesity. One such study found each additional hour an individual spent in a car per day was linked to a six percent increase in the likelihood of being obese, while each additional kilometer an individual walked per day was associated with a 4.8 percent reduction in the likelihood of being obese (Frank, et al., 2006, p. 75).

Proposed Nodes and Routes, Delano Strategic Plan

Figure 2.2 Proposed routes in the Delano Strategic Plan, 2009

Design efforts of streetscapes can decrease the amount of time it takes to travel by foot or bicycle to certain destinations while keeping the time to travel to the same destination by car constant. Such design techniques can make travel by foot or bicycle the easiest, most efficient choice for a community's residents. According to the Active Living Research program (2008), the presence of bicycle paths and bicycle lanes is positively related to adults meeting recommended daily amounts of physical activity, and cities that invest in bicycle facilities generally exhibit higher levels of bicycle ridership (ALR, 2009).

Traffic Calming

Studies show traffic calming measures can reduce the risk of crashes involving pedestrians. Traffic calming measures have been associated with 11 percent to 15 percent lower rates of automobile crashes with

injuries (ALR, 2009). According to research, pedestrian injuries increase as the number of lanes increases, and a “reduction in the number of lanes can reduce crossing distances, thus reducing exposure of a pedestrian to vehicle interaction” (PEQI, 2008, p.4). Decreasing the number of lanes can make streets better places for social interaction by slowing traffic and increasing feelings of safety (PEQI, 2008, p.40).

Traffic calming measures, streetscapes and street design can improve the pedestrian environment, encouraging walking and the use of alternative modes of transportation, potentially having a positive effect on physical activity rates and overall health.

Low Impact Development

Low Impact Development (LID) is a design strategy that aims to restore the stormwater system of a site to how it operated before development. LID manages stormwater storage, infiltration and groundwater recharge through micro-scale retention areas and detention areas called bioswales or rain gardens, and increased permeable surfaces (Environmental Protection Agency, 2000, p.1). LID also addresses environmental protection through preservation of sensitive site features including wetlands, steep slopes, riparian buffers, valuable trees, flood plains, woodlands and highly permeable soils (EPA, 2000, p.1).

LID methods improve environmental quality by removing pollutants from stormwater as it returns to the water table. LID methods also reduce stormwater runoff volumes, help preserve the natural environment, can add significant aesthetic value to urban areas, and are often less costly than traditional methods of stormwater management.

Because LID principles often enhance the aesthetics of an area, they are ideal for Delano’s street network. If used properly, these methods can greatly improve the pedestrian experience along the City’s streets, which may in turn inspire residents to walk more and drive less.

Walking and bicycling “are easily incorporated into people’s lives when the built environment is properly structured to encourage them”
-Frank, 2003

Section 2.1

Street Design Standards

DG.1

DG.3

DG.5

Guidelines addressing the design of proposed pedestrian and bicycle connections focus on widths of bike lanes, traffic lanes and sidewalks, as well as vegetation, lighting and elements of Low Impact Development (LID). Suggestions aim to create “green streets” by using design elements to enhance feelings of safety for pedestrians and bicyclists, and make the experience of using non-motorized transportation easier and more enjoyable.

The proposed street improvements are designed to have minimal environmental impact and LID elements are included with the intention of actually improving environmental quality along Delano’s streets. Design guidelines are organized by right-of-way (ROW) widths. In Delano right-of-ways tend to be either 80 feet, 60 feet, 40 feet or 20 feet alleyways. These right-of-ways have been divided into categories and specific design suggestions are applied to each street type. Categories of street types include:

- 80 ft ROW
- 80 ft ROW with a median
- 80 ft ROW with public transit routes
- 80 ft ROW green pedestrian connections
- 60 ft ROW residential streets
- 40 ft ROW green pedestrian connections
- 20 ft ROW downtown alleyways
- 20 ft ROW residential alleyways

Section view drawings illustrate dimensions of traffic lanes, bike lanes and sidewalks, as well as planter widths and whether or not the street type includes on-street parking and vegetation. Additional details for street design guidelines can be found in Appendix A, which includes illustrations to clarify certain terms and definitions, and Appendix B, which provides detailed written descriptions of the various ROW standards.

DG.1	Develop safe, convenient pedestrian and bicycle routes that connect residents to everyday conveniences like shopping, commercial cores, employment districts and schools, as well as places for residents to exercise, such as parks.
DG.5	Create street design standards to improve pedestrian and bicycle safety. Incorporate traffic calming measures and elements of low impact development. Design standards can be applied to new projects and redevelopment or improvement of existing sites.

Street Design Standards

80 Ft. Right-of-Way

Right-of-Way	
Width	80'
Lanes	
Traffic	
Number of Lanes	2
Direction	Two-way
Width	11'
Turn Lane	
Type	Center Left Turn
Width	11'
Parking	Type 1
Median	
Type	Vegetated, with shade trees and bioswales, present where there is no need for left turn lane
Width	11'

Bikeway	
Type	Class II
Sidewalk	
Width	10' min.
Streetscape	
Planters	Type 1
Lighting	Type 1 and 2
Miscellaneous	
Curbs and sidewalks must comply with ADA regulations	
Where appropriate, use textured pavements, including permeable pavers and porous asphalt (refer to section 2.2)	
Refer to traffic calming measures (section 2.3) for ideal pedestrian crossing types and intersection designs	
Lighting and street trees should be appropriately spaced to avoid tree overgrowth blocking light	

DG.1	Develop safe, convenient pedestrian and bicycle routes that connect residents to everyday conveniences like shopping, commercial cores, employment districts and schools, as well as places for residents to exercise, such as parks.
DG.5	Create street design standards to improve pedestrian and bicycle safety. Incorporate traffic calming measures and elements of low impact development. Design standards can be applied to new projects and redevelopment or improvement of existing sites.

Street Design Standards

80 Ft. Right-of-Way with Median

Right-of-Way	
Width	80'
Lanes	
Traffic	
Number of Lanes	2
Direction	Two-way
Width	11'
Turn Lane	None
Parking	Type 3
Median	
Type	Vegetated, with bioswales, shade trees
Width	4'
Bikeway	
Type	Class II

Sidewalk	
Width	10' min.
Streetscape	
Planters	Type 1
Lighting	Type 1 and 2
Miscellaneous	
Curbs and sidewalks must comply with ADA regulations	
Where appropriate, use textured pavements, including permeable pavers and porous asphalt (refer to section 2.2)	
Refer to traffic calming measures (section 2.3) for ideal pedestrian crossing types and intersection designs	
Lighting and street trees should be appropriately spaced to avoid tree overgrowth blocking light

DG.1	Develop safe, convenient pedestrian and bicycle routes that connect residents to everyday conveniences like shopping, commercial cores, employment districts and schools, as well as places for residents to exercise, such as parks.
DG.5	Create street design standards to improve pedestrian and bicycle safety. Incorporate traffic calming measures and elements of low impact development. Design standards can be applied to new projects and redevelopment or improvement of existing sites.

Street Design Standards

80 Ft. Right-of-Way Public Transit Route

Right-of-Way	
Width	80'
Lanes	
Traffic	
Number of Lanes	4
Direction	Two-way
Width	11'
Turn Lane	None
Parking	None
Median	
Type	Vegetated, with bioswales, shade trees
Width	4'
Bikeway	
Type	Class II

Sidewalk	
Width	10' min., with 4' between bus stop and curb, and 1.5' at curb for lighting, bus stop signs
Streetscape	
Planters	Type 2
Lighting	Type 1 and 2
Miscellaneous	
Curbs and sidewalks must comply with ADA regulations	
Where appropriate, use textured pavements, including permeable pavers and porous asphalt (refer to section 2.2)	
Refer to traffic calming measures (section 2.3) for ideal pedestrian crossing types and intersection designs	
Lighting and street trees should be appropriately spaced to avoid tree overgrowth blocking light	

DG.1	Develop safe, convenient pedestrian and bicycle routes that connect residents to everyday conveniences like shopping, commercial cores, employment districts and schools, as well as places for residents to exercise, such as parks.
DG.5	Create street design standards to improve pedestrian and bicycle safety. Incorporate traffic calming measures and elements of low impact development. Design standards can be applied to new projects and redevelopment or improvement of existing sites.

Street Design Standards

80 Ft. Right-of-Way Green Pedestrian Connections

Right-of-Way	
Width	80'
Lanes	
Traffic	
Number of Lanes	2
Direction	Two-way
Width	11'
Turn Lane	
Type	Center Left Turn
Width	11'
Parking	Type 2
Median	
Type	Vegetated, with shade trees and bioswales, where turn lane is not needed
Width	11'

Bikeway	
Type	Class I, on one side of the street
Sidewalk	
Width	10' min., 9' min. on side of street with bikeway
Streetscape	
Planters	Type 3
Lighting	Type 1 and 2
Miscellaneous	
Curbs and sidewalks must comply with ADA regulations	
Where appropriate, use textured pavements, including permeable pavers and porous asphalt (refer to section 2.2)	
Refer to traffic calming measures (section 2.3) for ideal pedestrian crossing types and intersection designs	
Lighting and street trees should be appropriately spaced to avoid tree overgrowth blocking light

DG.1	Develop safe, convenient pedestrian and bicycle routes that connect residents to everyday conveniences like shopping, commercial cores, employment districts and schools, as well as places for residents to exercise, such as parks.
DG.5	Create street design standards to improve pedestrian and bicycle safety. Incorporate traffic calming measures and elements of low impact development. Design standards can be applied to new projects and redevelopment or improvement of existing sites.

Street Design Standards

60 Ft. Right-of-Way Residential Streets

Right-of-Way	
Width	60'
Lanes	
Traffic	
Number of Lanes	2
Direction	Two-way
Width	10'
Turn Lane	None
Parking	Type 2
Bikeway	
Type	Class III

Sidewalk	
Width	10' min., with curvilinear pattern where space allows, to enhance visual interest
Streetscape	
Planters	Type 3
Lighting	None
Miscellaneous	
Curbs and sidewalks must comply with ADA regulations	
Where appropriate, use textured pavements, including permeable pavers and porous asphalt (refer to section 2.2)	
Refer to traffic calming measures (section 2.3) for ideal pedestrian crossing types and intersection designs	

DG.1	Develop safe, convenient pedestrian and bicycle routes that connect residents to everyday conveniences like shopping, commercial cores, employment districts and schools, as well as places for residents to exercise, such as parks.
DG.5	Create street design standards to improve pedestrian and bicycle safety. Incorporate traffic calming measures and elements of low impact development. Design standards can be applied to new projects and redevelopment or improvement of existing sites.

Street Design Standards

40 Ft. Right-of-Way Green Pedestrian Connections

Right-of-Way	
Width	40'
Lanes	
Traffic	
Number of Lanes	2
Direction	Two-way
Width	10'
Turn Lane	None
Parking	None
Bikeway	
Type	Class III

Sidewalk	
Width	10' min., with curvilinear pattern where space allows, to enhance visual interest
Streetscape	
Planters	Type 3
Lighting	None
Miscellaneous	
Curbs and sidewalks must comply with ADA regulations	
Where appropriate, use textured pavements, including permeable pavers and porous asphalt (refer to section 2.2)	
Refer to traffic calming measures (section 2.3) for ideal pedestrian crossing types and intersection designs	
Lighting and street trees should be appropriately spaced to avoid tree overgrowth blocking light

DG.3

Develop plazas in downtown designed and located based on the accompanying Design Guidelines. Convert the City's downtown alleys into pleasant pedestrian routes between major streets.

Street Design Standards

20 Ft. Right-of-Way Downtown Alleys + 20 Ft. Right-of-Way Residential Alleys

Right-of-Way

Width 20'

Streetscape

Vegetation	Shade trees, small planters with bioswales
Lighting	Type 2
Pavement	Permeable pavers to add visual interest
Furniture	Alleys should include options for seating, in the shade and in the sun

Miscellaneous

- Bollards at entrances can be used to block automobiles from entering
- Curbs and sidewalks must comply with ADA regulations

Lighting and street trees should be appropriately spaced to avoid tree overgrowth blocking light

Right-of-Way

Width 20'

Streetscape

Vegetation	Small bioswales, and groundcovers can be used with permeable pavers
Lighting	None
Pavement	Permeable pavers to improve drainage

Miscellaneous

- Garage access for automobiles should be through the alleys.
- Individual house lights can provide sufficient lighting for residential alleys

Section 2.2

Low Impact Development Recommendations

DG.7

LID methods improve environmental quality by removing pollutants from stormwater as it returns to the water table. LID methods also reduce stormwater runoff volumes, help preserve the natural environment, can add significant aesthetic value to urban areas, and are often less costly than traditional methods of stormwater management.

Because LID principles often enhance the aesthetics of an area, they are ideal for Delano's street network. If used properly, these methods can greatly improve the pedestrian experience along the City's streets, which may in turn inspire residents to walk more and drive less.

Bioswales and permeable pavers are the elements of LID suggested for Delano in these guidelines. These LID design strategies can improve environmental quality in the City and offer significant aesthetic value. Bioswales and permeable pavers can improve the pedestrian environment, which in turn may improve public health by reducing obesity levels and increasing rates of physical activity.

Guidelines for the City's street network, outlined in the previous pages of this section, include both bioswales and permeable pavers. Bioswales are suggested for planter strips in almost all of the street types, and are also suggested for the medians in all of the 80 ft right-of-way streets. Permeable pavers are recommended for both residential and downtown alleyways.

Low Impact Development Methods

Bioswales

Bioswales, or rain gardens, are systems for bioretention, designed to partially treat water quality, reduce flooding and increase biodiversity. They are often used as an alternative to traditional stormwater piping. In a bioswale, low-water, native vegetation and permeable subsurfaces filter pollutants from stormwater before it penetrates the water table.

Bioswales can be placed in parking lots, medians, or parallel to roadways. In parking lots, as shown in Figure 2.3, bioswales add elements of visual interest while improving environmental quality, all without eliminating the amount of available parking. Bioswales can be incorporated in center medians on busy roads (Figure 2.4), or in traffic calming features such as bulb-outs or roundabouts (Figure 2.5). These guidelines propose bioswales be considered for sidewalk planters along Delano's streets, as well as in center medians and along Class I Bikeways.

Figure 2.3. Source: Lowimpactdevelopment.org.

Figure 2.4. Source: Lowimpactdevelopment.org.

Figure 2.5. Source: Lowimpactdevelopment.org.

Low Impact Development Methods

Permeable Pavers

Traditional asphalt pavement produces large volumes of stormwater runoff that requires treatment. Permeable pavement allows for stormwater to drain into underlying soils, where it is filtered for pollutants before it recharges into the water table. Permeable pavement can come in the form of pavers or porous asphalt and concrete.

Permeable pavers improve drainage in alleyways, and Delano has a number of alleyways, both residential and in the City's downtown. They also add visual interest (Figure 2.6). Permeable pavers can be used in place of traditional asphalt to add aesthetic value to residential streets (Figure 2.7) or downtown streets with heavy pedestrian traffic.

Porous asphalt and porous concrete have the same benefits as permeable pavers, but can look identical to traditional paving methods. Porous concrete can be used on low impact roads such as small residential streets (Figure 2.8) while porous asphalt is ideal for streets with higher traffic volumes (Figure 2.9).

These design guidelines recommend porous pavements for Delano's alleyways. The City has many alleyways, and this LID method can have a significant impact on the City's drainage. Permeable pavers can save money in the long run by reducing the need for traditional drainage systems, which can be very expensive. These guidelines also recommend Delano explore the use of porous asphalt as a street surface throughout the City's street network,, and, over time, aim to transform its street network to a more sustainable system.

Figure 2.6.
Source: Lowimpactdevelopment.org.

Figure 2.7.
Source: Lowimpactdevelopment.org.

Figure 2.8. Source: Lowimpactdevelopment.org.

Section 2.3 Traffic Calming Strategies

DG.1

DG.4

DG.5

Traffic calming strategies have been shown to reduce rates of traffic-related accidents, increasing safety for those in automobiles as well as pedestrians and bicyclists. A number of methods can be used to make streets and sidewalks safer for pedestrians, bicyclists and people travelling in cars.

The presence of street trees and other roadside features are proven to be effective in slowing traffic. Lane widths also impact road safety, and studies link wider lanes with a greater incidence of traffic-related accidents. The use of design elements is another method for improving traffic safety in an attractive, effective way. Roundabouts, chicanes, center island narrowings, raised crosswalks and textured pavements can be used to alert drivers that they are in an area of higher pedestrian or bicycle activity, and therefore should slow down. These design elements can also improve the pedestrian and bicycle environment, making those modes of transportation more appealing.

Streets designed with traffic calming measures have been shown to reduce the chance of pedestrian fatalities by up to 75 percent.

Traffic calming strategies, combined with improved bicycle and pedestrian routes, have the potential to increase the use of alternative modes of transportation, resulting in higher rates of physical activity and improved public health in a City's population.

Traffic calming strategies included in these design guidelines are chicanes, center islands, chokers, bulbouts, raised intersections, raised crosswalks, traffic circles, roundabouts, speed humps and textured pavement.

DG.1	Develop safe, convenient pedestrian and bicycle routes that connect residents to everyday conveniences like shopping, commercial cores, employment districts and schools, as well as places for residents to exercise, such as parks.
DG.4	Promote pedestrian scale mixed-use , with well-placed signage, appropriate building facades, entrances, street lighting and vegetation. Incorporate design principles targeted at improving pedestrian safety.
DG.5	Create street design standards to improve pedestrian and bicycle safety. Incorporate traffic calming measures and elements of low impact development. Design standards can be applied to new projects and redevelopment or improvement of existing sites.

Traffic Calming Strategies

	Plan View	Description	Advantages	Disadvantages	Example
Chicanes		Chicanes are curb extensions that form s-shape curves in the streets.	Chicanes discourage high speeds by forcing horizontal deflection. Large vehicles such as fire trucks can easily travel through them, except under heavy traffic conditions.	Must be designed to keep drivers from deviating outside of lanes. Curb realignment can be costly. May eliminate some on-street parking.	Source: www.trafficcalming.org
Center Islands		A center island narrowing is a raised median located along the center line of a street, narrowing the travel lane. Center islands are often planted to add an element of visual quality. They can be designed with a paved gap to allow pedestrians to cross through them.	They increase pedestrian safety. They can have positive aesthetic value. They reduce traffic volumes	They do not have any horizontal or vertical deflection, so their speed-reduction effect can be limited. They eliminate some on-street parking.	Source: www.trafficcalming.org
Bulbouts		Bulbouts are curb extensions at intersections that reduce the roadway width from curb to curb.	They improve pedestrian circulation and space. They create protected on-street parking bays. They reduce speeds, especially for right-turning vehicles.	They do not have any horizontal or vertical deflection, so their speed-reduction effect can be limited. May eliminate some on-street parking. May require bicyclists to briefly merge with auto traffic.	Source: www.trafficcalming.org

	Plan View	Description	Advantages	Disadvantages	Example
Raised Intersections		Raised intersections are flat areas of pavement, usually textured materials, that cover an entire intersection. They have ramps on all approaches.	<p>They increase pedestrian and vehicle safety.</p> <p>They can have positive aesthetic value.</p> <p>They calm two streets at once.</p>	<p>They can be expensive.</p> <p>Their impact on drainage must be considered.</p>	Source: www.trafficcalming.org
Raised Crosswalks		Raised crosswalks are speed tables designed to be pedestrian crossings. Signage and crosswalk markings make pedestrians more visible to approaching traffic.	<p>They increase pedestrian and vehicle safety.</p> <p>They can have positive aesthetic value.</p>	<p>They can be expensive if they use textured materials.</p> <p>Their impact on drainage must be considered.</p>	Source: www.trafficcalming.org
Traffic Circles		Traffic circles are raised islands at intersections. They slow traffic by forcing automobiles to circulate around them.	<p>They can have positive aesthetic value.</p> <p>They calm two streets at once.</p> <p>They are very effective in slowing traffic and improving safety.</p>	<p>They are difficult for large vehicles such as fire trucks to circumnavigate.</p> <p>May eliminate some on-street parking.</p> <p>They must be designed so traffic does not encroach on crosswalks.</p>	Source: www.trafficcalming.org
Chokers		Chokers are similar to Chicanes, except curb extensions are located at midblock locations directly across the street from one another.	<p>They can have positive aesthetic value.</p> <p>Large vehicles such as fire trucks can easily travel through them, except under heavy traffic conditions.</p> <p>They reduce speeds and traffic volumes.</p>	<p>They do not have any horizontal or vertical deflection, so their speed-reduction effect can be limited.</p> <p>May eliminate some on-street parking.</p> <p>May require bicyclists to briefly merge with auto traffic.</p>	Source: www.trafficcalming.org

	Plan View	Description	Advantages	Disadvantages	Example
Roundabouts		Roundabouts are circular islands placed in the middle of intersections, forcing traffic to travel around the island. They are ideal for higher volume streets to designate right-of-way.	<p>Can have positive aesthetic value.</p> <p>Can moderate traffic speeds on an arterial.</p> <p>Are less expensive to operate than signals.</p> <p>Can minimize traffic back-ups at a signal.</p>	<p>They may be difficult for large vehicles such as fire trucks to circumnavigate.</p> <p>May eliminate some on-street parking.</p> <p>They must be designed so traffic does not encroach on crosswalks.</p>	<p>Source: www.trafficcalming.org</p>
Speed Humps		Speed humps are raised areas stretched across the entire roadway, and are rounded to allow traffic to cross them smoothly.	<p>They are relatively inexpensive.</p> <p>If well designed, they are relatively easy for bicycles to cross.</p> <p>They are very effective in slowing traffic speeds.</p>	<p>They force large vehicles such as fire trucks to travel at slower speeds.</p> <p>They don't necessarily add aesthetic value.</p> <p>They cause a rough ride for drivers,</p>	<p>Source: www.trafficcalming.org</p>
Textured Pavement		Textured pavements create an uneven surface for vehicles to traverse. They are used to emphasize intersections and crosswalks, and can also be used for entire street blocks.	<p>They can reduce vehicle speeds over an extended length.</p> <p>They can add positive aesthetic value.</p> <p>They can calm two streets at once if placed at an intersection.</p>	<p>They can be expensive, depending on the type of pavement used.</p> <p>If used on a crosswalk, they can make crossing more difficult for wheelchairs and the visually impaired.</p>	<p>Source: www.trafficcalming.org</p>

Land Use Strategies

Chapter 3

Land uses impact public health because they are a determinant for people's daily habits. Well-planned downtowns with a mix of uses can encourage walking, increasing levels of physical activity and reducing vehicle emissions. Parks and public plazas can also improve public health by encouraging walking and biking. They are also important sites for community gatherings and chance encounters with friends and neighbors.

EXISTING CONDITIONS IN DELANO

Parks

The presence of park space plays an important role in the overall health of a community. Nearly 60 percent of residential parcels in Delano are more than one quarter mile from a park (Delano General Plan, 2005). These guidelines propose a number of new parks for the City. The locations for these new parks are the same sites proposed in the Delano Strategic Plan. The Delano Strategic Plan suggests new pedestrian connections, mixed-use areas and activity nodes. The park sites were chosen due to their proximity to these areas. Park sites were also chosen in underserved neighborhoods, located more than a 1/4 mile from an existing park.

Plazas

Delano's urban fabric is unique in that it has an extensive network of alleyways connecting its downtown streets. These alleyways present a great opportunity for improving the area's pedestrian environment. If turned into pedestrian corridors, the City's downtown alleyways could become sites for rest and relaxation for shoppers, employees of local businesses or pedestrians.

SUMMARY OF RELATED LITERATURE

Parks

The presence of park space plays an important role in the overall health of a community. Parks provide places for outdoor exercise, such as jogging or walking. They provide places for reflection and relaxation and are also ideal sites for social interaction and community gatherings (ALR, 2008).

Distance to sources for outdoor recreation, such as parks, significantly impacts the use of such spaces. Research suggests people living within a 1/4 mile of a park are 25 percent more likely to meet recommended amounts of daily exercise than those living further away (Public Health Law & Policy, 2008). Parks are more likely to promote physical activity when users consider them to be aesthetically pleasing, and adults

who feel safe in parks are 60 percent more likely to encourage children to use local parks than those who felt unsafe (ALR, 2010). Studies have also found only a small percentage of park users will travel over one mile to get to a park (ALR, 2008). According to research, there is also an association between neighborhoods with a greater proportion of park area and increased levels of physical activity among children (ALR, 2008).

The National Recreation and Park Administration (NRPA) addresses distances between residences and parks in a set of standards for different types of parks. The NRPA suggests standards for mini parks, neighborhood parks and community parks, all designed to improve the use of such places. Along with distances to parks, the standards address size, use, and acres per 1,000 residents. The three types of parks have different characteristics and serve different purposes in a community.

Plazas

Public spaces such as hard-scaped plazas can also impact public health by enhancing feelings of community and safety. They can encourage walking and biking by improving the aesthetics of the environment, and offering places of rest and refuge for pedestrians. Public urban spaces are also important sites for community gatherings and chance encounters with neighbors.

The design of public spaces greatly impacts how frequently they are used, and what purpose they are used for. Texture, color, pattern, and other design elements contribute to a plaza's atmosphere. It is this atmosphere that dictates how people use a plaza and how much it is enjoyed. Lighting, vegetation, benches, and location also impact a plaza's usage.

A well-used plaza must also have sufficient seating to allow visitors space to rest, socialize, and people watch. Observations show people in a plaza will sit almost anywhere between a height of one to three feet, and, if space allows, will sit back to back on objects

where seating is accessible from both sides (Whyte, 1988, p.112). Moveable chairs hold a certain appeal, allowing users to choose to sit in the shade or the sun, in groups or alone.

Grass also offers users a wide choice of seating options, and is believed to have a psychological benefit as well. Grass can offer a refuge from the concrete of a City's downtown, and allows not only for sitting, but encourages lounging, picnicking, napping and more active recreation like frisbee throwing.

Guidelines setting standards for public open spaces including parks and plazas have the potential to impact public health by providing places for residents to exercise. They can also provide space for family and social gatherings, improving feelings of community among a City's residents.

Section 3.1 Parks

DG.7

Parks provide places for outdoor exercise, such as jogging or walking. They provide places for reflection and relaxation and are also ideal sites for social interaction and community gatherings. New parks connected by pedestrian-friendly transportation corridors are intended to encourage physical activity and interaction with nature. Smaller parks are also proposed in underserved residential neighborhoods to improve access to outdoor recreation space for a greater number of Delano residents. New mini parks, neighborhood parks and community parks are suggested for a number of locations throughout the City.

Studies show people living within one quarter mile of a park are 25% more likely to get recommended levels of daily exercise. Only 41% of residential parcels in Delano are within one quarter mile of a park (ALR, 2008).

Guidelines include standards addressing size, use, and acres per 1,000 residents for each type of park. Figure 3.1 illustrates the proposed locations for each new park, and what type of park is suggested. Table 3.1 provides details for each type of park, including intended use, common amenities, desirable size, service area, acres per 1,000 population and desirable site characteristics.

Land Use Strategies

Table 3.1 Recommended Park Types

	Use and Common Amenities	Service Area	Desirable Size	Acres per 1,000 pop.	Desirable Site Characteristics	Examples
Mini Park	<p>Specialized facilities that serve a concentrated or limited population.</p> <p>They can have amenities such as a playground, or can simply be green spaces where locals can spend time outside. They can have lawns, or can be flower gardens with benches interspersed throughout.</p>	Less than 1/4 mile radius	1 acre or less	0.25 to 0.5	Within neighborhoods and close to apartment complexes, townhouses or housing for the elderly.	<p>Source: www.wfrc.org</p>
Neighborhood Park	<p>Intended for intense recreational activities such as field games, court games, crafts, skating and picnicking.</p> <p>Amenities may include paved areas for court games, sports fields, benches and picnic tables, community events areas, playgrounds and trails or pedestrian paths.</p>	1/4 to 1/2 mile radius to serve up to 5,000 pop.	15+	1 to 2	Easily accessible to a neighborhood population; geographically centered with safe walking and biking access; may be developed as a school-park facility.	<p>Source: atlanta-midtown.com Source: greensboro-nc.gov</p>
Community Park	<p>Area for diverse environmental quality that may include areas suited for intense recreational facilities such as athletic complexes or swimming pools.</p> <p>Amenities may include athletic complexes, paved areas for court games, sports fields, picnic and community events areas, and playgrounds.</p>	Several neighborhoods, 1 to 2 mile radius	25+	5 to 8	May include natural features, such as water bodies.	<p>Source: www.bluespringsgov.com</p>

Land Use Strategies

Figure 3.1 Proposed Locations for New Parks

Section 3.2

Plazas

DG.3

These guidelines propose new plazas in Delano, primarily in the City's downtown area. Table 3.2 outlines various types of plazas that may be appropriate to integrate into Delano's downtown area. Figure 3.3 suggests locations for the various types of plazas.

These plazas are intended to encourage pedestrian activity by improving the pedestrian experience. Plazas can offer destinations for pedestrians, and having these destinations to walk to may inspire residents to achieve increased levels of moderate physical activity.

The proposed locations for these plazas were chosen for their proximity to proposed green pedestrian connections and major shopping areas in the City (see Section 2.1).

Planners in Delano should focus on the City's numerous downtown alleys, which offer ideal sites for pedestrian-only thoroughfares, or pedestrian corridors. These corridors can have shade trees and benches offering shoppers places for rest and refuge. Redevelopment projects adjacent to these alleys can have entrances and frontages along the corridors as well as on the street side.

"We gain identity as a community through our public spaces for them, as much as our individual buildings and activities, represent us to the world"

-Pratt, et al., 1979

Land Use Strategies

Table 3.2 Recommended Plaza Types

Street Plaza		A Street Plaza is a widened area of sidewalk with seating and usually with vegetation. It may be designed around a bus stop or a busy street corner that receives significant foot traffic. It may also be designed around the primary entrance of a large building
Public Plaza		A Public Plaza is a large plaza designed for a variety of public uses. It may include a large lawn, a water feature and shade trees.
Pedestrian Corridor		Pedestrian Corridors run through city blocks, providing a pedestrian-only connection from one street to another. Alleyways connect the sidewalk to a central plaza, usually with seating and shade
Urban Oasis		An Urban Oasis is a sheltered plaza surrounded on three sides by buildings, or three facades of a single building. It usually has plenty of shade and seating. An Urban Oasis provides a cool escape to pedestrians on hot sunny days. It may include a water feature to enhance the feeling of being away.
Pedestrian Mall		A Pedestrian Mall is a stretch of street with widened sidewalks on both sides. It is usually a common attraction, with pedestrian-oriented services. The street running through a Pedestrian Mall can be either just for pedestrians or can have traffic-calming measures and allow cars..
Public Square		A Public Square is a major focal point for community gatherings and activities. A Public Square usually occupies an entire city block and is highly visible from surrounding streets and buildings.

Figure 3.3 Proposed Locations for New Downtown Plazas

Building Design Strategies

■ Building design and public health connect in a variety of ways, and careful consideration for how buildings are designed, what materials are used, and where they are placed can have an impact on health conditions in a City. Building design can affect public health by impacting physical activity levels. Areas designed with a good building and street interface can create a pedestrian-friendly atmosphere, and actually encourage walking. Urban areas designed in this way are considered to have high levels of walkability, and are so pleasant for pedestrians that they become destinations for leisurely walks.

EXISTING CONDITIONS IN DELANO

Delano's Downtown Core, Main Street between 9th Street and 13th Street, has some elements of ALR's suggested urban design qualities, making it a pleasant downtown for pedestrians. Building design is somewhat varied and provides a moderate level of visual interest for the pedestrian. However, the core lacks areas inviting pedestrians to sit and relax, such as plazas, parks and outdoor cafes.

The Downtown Core has moderate feelings of enclosure as well, particularly because of the minimum setbacks on the buildings along Main Street. Street trees and on-street parking also enhance feelings of enclosure, however, building height variation is limited, which may

have a negative effect on feelings of enclosure. Feelings of human scale and complexity also exist in Delano's Downtown Core. Buildings along Main Street vary with color and texture. Pedestrian-scale awnings and street lights improve the experience for those walking along the street, and signage varies in size and height.

All of these aspects of Main Street in Downtown Delano should be emulated and enhanced throughout the City, particularly in new mixed-use and commercial developments. Redevelopment projects in the Downtown Core can incorporate more of ALR's urban design qualities to augment existing conditions on Main Street.

SUMMARY OF RELATED LITERATURE

The Active Living Research Program (ALRP) of the Robert Wood Johnson Foundation created a manual to measure urban design qualities and how they improve the pedestrian experience. The manual describes five urban design qualities shown to have significant relationships to walkability. These qualities are 1) imageability, 2) enclosure, 3) human scale, 4) transparency and 5) complexity. These qualities, when combined with a theory known as the prospect-refuge theory, can create an ideal pedestrian environment; one that is likely to actually encourage walking as a means of improving overall health through moderate levels of physical activity.

Imageability

Imageability is “the quality of a place that makes it distinct, recognizable, and memorable” (Ewing et al., p.226). Building design, type and signage also greatly affect the pedestrian environment and are considered valuable elements of imageability. The ALRP manual identifies buildings with non-rectangular shapes as buildings providing visual interest and imageability (ALR, 2005, p.11). Buildings with identifiers also generate imageability. Identifiers are building features that indicate a building’s use. For example, “stores can be identified by signs that can be easily read” (ALR, 2005, p.10).

Enclosure

The ALRP defines enclosure as “the degree to which streets and other public spaces are visually defined by buildings” (ALR, 2005, p.14). “Spaces where the height of vertical elements is proportionally related to the width of the space between them have a room-like quality,” creating a feeling of enclosure (ALR, 2005, p.14). The “lack of an enclosed environment” with low rise buildings, open plazas, wide avenues and an ill-defined street wall all allow pedestrians to see far ahead, diminishing the feeling of enclosure (ALR, 2005, p.15). The “street wall” greatly impacts enclosure. The street wall can be considered as “portions of the block that are occupied by continuous facades or walls adjacent to the sidewalk” (ALR, 2005, p.16).

Human Scale

Human scale “refers to the size, texture, and articulation of physical elements that match the size and proportions of humans and, equally important, correspond to the speed at which humans walk” (ALR, 2005, p.18). The number of long sight lines, the proportion of windows at street level, average building height, number of small planters and the number of street items, including street furniture, all contribute to human scale (ALR, 2005, p.18-23). Street furniture, including benches, tables, chairs, and lamp posts, as well as other street items, including newspaper boxes, parking meters, bike racks, and bollards, also contribute to human scale and enhance walkability (ALR, 2005, p.23).

Transparency

Transparency “refers to the degree to which people can see or perceive what lies beyond the edge of a street or other public space and, more specifically, the degree to which people can see or perceive human activity beyond the edge of a street or other public space” (ALR, 2005, p.24). As with human scale, the proportion of windows at street level affects transparency. Similarly, active uses at street level can improve walkability. Active uses are defined as “shops, restaurants, public parks, and other uses that generate significant pedestrian traffic” (ALR, 2005, p.27). Inactive uses, including “blank walls, parking lots, vacant lots, abandoned buildings, and offices with no foot traffic” reduce transparency and make an area less pleasant for pedestrians (ALR, 2005, p.27).

Complexity

The ARLP defines complexity as the “visual richness of a place” (ALR, 2005, p.28). Building colors and the number of buildings along a street contribute to complexity and walkability. A street is visually complex when it contains many different buildings, both in the foreground and in the distance, with interesting primary and accent colors (ALR, 2005, p.28). Outdoor dining contributes to complexity as well by creating visual interest and increasing street traffic, and public art, including “monuments, sculptures, murals, and any other artistic display that has free access,” can enhance the pedestrian environment and improve walkability (ALR, 2005, p.28).

Imageability, enclosure, human scale, transparency, and complexity are all elements that can be worked into the urban landscape through building design. These elements, when combined with design concepts from the prospect-refuge theory, can potentially improve walkability and increase levels of physical activity among a City’s residents, which can improve the overall health of a population.

Building Placement

Building placement regulations include built-to-line standards (BTL), setbacks, maximum lot width, and minimum lot width. BTLs establish where the building facade is to be located in relation to the property line, and are used where a consistent plane of buildings is desired (Parolek, et al., 2008, p. 43). Regulating the location and size of building facades fronting public spaces helps to define and form edges (Parolek, et al., 2008, p. 40), and can be used to improve the pedestrian experience by creating feelings of enclosure.

Building Form

Building facade regulations include minimum and maximum building heights and ceiling heights. These regulations ensure public spaces are well-proportioned (Parolek, et al., 2008, p. 44). Setting standards for building height ensure a building is tall enough to create feelings of enclosure and is appropriately scaled to suit its surroundings (Parolek, et al., 2008, p. 45). Ground floor finished level height is an important regulation because it establishes an “appropriate relationship between the public and private realm” (Parolek, et al., 2008, p. 45). This standard should be higher for residential buildings, to ensure privacy, and lower in commercial buildings to “convey their semi-public status” (Parolek, et al., 2008, p. 45).

Regulating building design through a series of standards can have an impact on public health by improving the pedestrian environment, making it more likely residents will chose alternative modes of transportation and receive incidental exercise. Building standards can set broad regulations, and improve conditions without having a detrimental effect on property owners and developer.

Section 4.1

Building Design Standards

DG.4

DG.6

Building design can affect public health by impacting physical activity levels. Areas designed with a good building and street interface can create a pedestrian-friendly atmosphere, and actually encourage walking.

Guidelines in this chapter address a number of standards for building form in an effort to encourage an urban area that includes the theories of pedestrian comfort previously discussed. The guidelines include suggestions for mixed-use and commercial buildings, as well as low, medium and high density residential areas. They focus on building placement, building footprint, pedestrian access, articulation and transparency

DG.4	Promote pedestrian scale mixed-use , with well-placed signage, appropriate building facades, entrances, street lighting and vegetation. Incorporate design principles targeted at improving pedestrian safety.
DG.6	Establish building design standards aimed to improve pedestrian safety. Incorporate design principles like building transparency and active frontages. For commercial areas, focus on creating active uses on the ground floor to . For mixed-use, focus on creating active storefronts on the ground floor, with private, secure residential on the upper floors. For residential areas, focus on making streets walkable while ensuring privacy for residents.

Building Design Standards Mixed Use

Key: Property Line - - -

Build-to-Line (BTL) - - -

Building ■

Building Placement		
Built-to Line (distance from property line)		
Front	0'	a
Side	0'	b
Building Facade as BTL		
Front	80% min.	
Side	30% min.	
Building Form		
Height		
Building Height (max.)	36'	c
	3 stories	
Building Height (min.)	22'	d
Ground Floor Ceiling Height (min.)	12'	e
Ground Floor Finished Level (max.)	6" above sidewalk	f
Articulation		
Vertical: Any buildings wider than 60' should be designed to look like a series of buildings, each no wider than 60'		
Horizontal: Setbacks on upper floors are encouraged. Balconies on upper floors may encroach public ROW.		

Transparency (percentage of window and door surfaces)		
Ground Floor		
Minimum	80%	g
Upper Floor(s)		
Minimum	30%	h
Miscellaneous		
Awnings, galleries and arcades are encouraged. Awnings can encroach 10 ft into the sidewalk ROW. Galleries and arcades can also encroach into the public ROW.		
i		
Pedestrian Access		
Main Entrance Location	On primary street	J
Upper Unit Entrance Location	On primary street	
Access from Parking: Pedestrian alleyways between buildings should provide access from rear parking to front building entrances. Entrances on rear of buildings should be limited.		
Allowed Use Types		
Ground Floor	Service, Retail, Office, Recreation, Community Facility, and other allowable commercial uses listed in zoning ordinance	
Upper Floor(s)	Residential, Service or Office	

DG.4	Promote pedestrian scale mixed-use , with well-placed signage, appropriate building facades, entrances, street lighting and vegetation. Incorporate design principles targeted at improving pedestrian safety.
DG.6	Establish building design standards aimed to improve pedestrian safety. Incorporate design principles like building transparency and active frontages. For commercial areas, focus on creating active uses on the ground floor to . For mixed-use, focus on creating active storefronts on the ground floor, with private, secure residential on the upper floors. For residential areas, focus on making streets walkable while ensuring privacy for residents.

Building Design Standards Mixed Use

Streetscaping	
Pavement	
Street	Permeable asphalt where possible
Sidewalk	A mix of materials to create visual interest
Pedestrian Crossings	Textured pavement to enhance visual quality and improve pedestrian safety

Lighting	
Type 1	
Purpose	Street Lighting
Height	20'
Type 2	
Purpose	Pedestrian Lighting
Height	12'
Street trees should be carefully placed around lighting so trees don't block light, especially when they mature.	

Signage	
Signage should be at the pedestrian scale. Signs should not be mounted below 3' above the finished floor level for close-up reading, and should not be mounted below 6' for distance reading.

DG.4	Promote pedestrian scale mixed-use , with well-placed signage, appropriate building facades, entrances, street lighting and vegetation. Incorporate design principles targeted at improving pedestrian safety.
DG.6	Establish building design standards aimed to improve pedestrian safety. Incorporate design principles like building transparency and active frontages. For commercial areas, focus on creating active uses on the ground floor to . For mixed-use, focus on creating active storefronts on the ground floor, with private, secure residential on the upper floors. For residential areas, focus on making streets walkable while ensuring privacy for residents.

Building Design Standards Commercial

Key: Property Line - - - - - Build-to-Line (BTL) - - - - - Building ■

Building Placement		
Built-to Line (distance from property line)		
Front	0'	a
Side	0'	b
Building Facade as BTL		
Front	80% min.	
Side	30% min.	
Building Form		
Height		
Building Height (max.)	36'	c
	3 stories	
Building Height (min.)	22'	d
Ground Floor Ceiling Height (min.)	12'	e
Ground Floor Finished Level (max.)	6" above sidewalk	f
Articulation		
Vertical: Any buildings wider than 60' should be designed to look like a series of buildings, each no wider than 60'		
Horizontal: Setbacks on upper floors are encouraged. Balconies on upper floors may encroach public ROW.		

Transparency (percentage of window and door surfaces)		
Ground Floor		
Minimum	80%	g
Upper Floor(s)		
Minimum	30%	h
Miscellaneous		
Awnings, galleries and arcades are encouraged. Awnings can encroach 10 ft into the sidewalk ROW. Galleries and arcades can also encroach into the public ROW.		
i		
Pedestrian Access		
Main Entrance Location	On primary street	j
Upper Unit Entrance Location	On primary street	
Access from Parking: Pedestrian alleyways between buildings should provide access from rear parking to front building entrances. Entrances on rear of buildings should be limited.		
Allowed Use Types		
Retail, wholesale, service and office		

DG.4	Promote pedestrian scale mixed-use , with well-placed signage, appropriate building facades, entrances, street lighting and vegetation. Incorporate design principles targeted at improving pedestrian safety.
DG.6	Establish building design standards aimed to improve pedestrian safety. Incorporate design principles like building transparency and active frontages. For commercial areas, focus on creating active uses on the ground floor to . For mixed-use, focus on creating active storefronts on the ground floor, with private, secure residential on the upper floors. For residential areas, focus on making streets walkable while ensuring privacy for residents.

Building Design Standards Commercial

Streetscaping	
Pavement	
Street	Permeable asphalt where possible
Sidewalk	A mix of materials to create visual interest
Pedestrian Crossings	Textured pavement to enhance visual quality and improve pedestrian safety

Lighting	
Type 1	
Purpose	Street Lighting
Height	20'
Type 2	
Purpose	Pedestrian Lighting
Height	12'
Street trees should be carefully placed around lighting so trees don't block light, especially when they mature.	
Signage	

Signage should be at the pedestrian scale. Signs should not be mounted below 3' above the finished floor level for close-up reading, and should not be mounted below 6' for distance reading.

DG.4	Promote pedestrian scale mixed-use , with well-placed signage, appropriate building facades, entrances, street lighting and vegetation. Incorporate design principles targeted at improving pedestrian safety.
DG.6	Establish building design standards aimed to improve pedestrian safety. Incorporate design principles like building transparency and active frontages. For commercial areas, focus on creating active uses on the ground floor to . For mixed-use, focus on creating active storefronts on the ground floor, with private, secure residential on the upper floors. For residential areas, focus on making streets walkable while ensuring privacy for residents.

Building Design Standards High Density Residential

Key: Property Line Setback Line Building

Building Placement and Form		
Setbacks		
Front (min.)	5'	a
	0' for porches	
Side (interior) (min.)	3'	b
Side (street) (min.)	5'	c
Height		
Building Height (max.)	35'	
Ground Floor Finished Level (min.)	18" above sidewalk	
Lot Coverage		
Lot Coverage (max.)	60%	

Miscellaneous
Articulation
Vertical: Any buildings wider than 60' should be designed to look like a series of buildings, each no wider than 60'
Horizontal: Balconies and setbacks on upper floors are required to enhance visual quality. Balconies on upper floors may encroach public ROW.
Greenspace
Require a minimum greenspace requirement to ensure residents have opportunities for fresh air and exercise. Consider 1 sf per each sf of gross floor area. Include balconies as part of this standard to encourage developers to build such spaces. Don't allow in-lieu fees.

DG.6

Establish building design standards aimed to improve pedestrian safety. Incorporate design principles like building transparency and active frontages. For commercial areas, focus on creating active uses on the ground floor to . For mixed-use, focus on creating active storefronts on the ground floor, with private, secure residential on the upper floors. For residential areas, focus on making streets walkable while ensuring privacy for residents.

Building Design Standards Medium Density Residential

Key: Property Line Setback Line Building

Building Placement and Form

Setbacks

Front (min.)	10'	a
	5' for porches	
Side (interior) (min.)	3'	b
Side (street) (min.)	10'	c

Height

Building Height (max.)	35'
Ground Floor Finished Level (min.)	18" above sidewalk

Lot Coverage

Lot Coverage (max.)	50%
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DG.6

Establish building design standards aimed to improve pedestrian safety. Incorporate design principles like building transparency and active frontages. For commercial areas, focus on creating active uses on the ground floor to . For mixed-use, focus on creating active storefronts on the ground floor, with private, secure residential on the upper floors. For residential areas, focus on making streets walkable while ensuring privacy for residents.

Building Design Standards Low Density Residential

Key: Property Line Setback Line Building

Building Placement and Form

Setbacks

Front (min.)	15'	a
	5' for porches	
Side (interior) (min.)	5'	b
Side (street) (min.)	10'	c

Height

Building Height (max.)	3 stories
Ground Floor Finished Level (min.)	18" above sidewalk

Lot Coverage

Lot Coverage (max.)	40%
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Appendix

	Type	Width or Height	Description	Illustration
Parking	Type 1	7' wide	One side of the street, with vegetated bulb-outs separating every two or three spaces.
	Type 2	8' wide	One side of the street, with vegetated bulb-outs separating every two or three spaces.
	Type 3	7' wide	Both sides of the street, with vegetated bulb-outs separating every two to three spaces.
Bikeways	Class I	8' wide, with 2' shoulders	A separate, two-way bike path, isolated from street traffic, with an adjacent 8' minimum pedestrian path.
	Class II	6' wide	A striped lane for one-way travel on the street.
	Class III	n/a	Shared use of the traffic lane with motor vehicles, no designated bike lane.

	Type	Width or Height	Description	Illustration
Lighting	Type 1	20' high	Type 1 lighting is designed to light the street. It is much larger and often arches over the roadway.	
	Type 2	12' high	Type 2 lighting is designed to light the sidewalk, and is at the pedestrian-scale. It is more attractive lighting and can be chosen to suit a particular style of downtown.	
Vegetation	Type 1	5' wide	5' wide planters with bioswales and shade trees, with a 3' wide paved strip between the curb and planter for lighting and extra pedestrian space.
	Type 2	4' wide	4' wide planters with bioswales and shade trees, with a 1 1/2' wide paved strip between the curb and planter for lighting and extra pedestrian space.
	Type 3	5' wide	5' wide planters with bioswales and shade trees, and street lights located within the 5' strip.

80 Ft. Right-of-Ways

80 ft right-of-ways are wide streets intended for higher speed traffic on major thoroughfares. Although these streets tend to be busy, design features can make them pleasant for pedestrians and safe for bicyclists without diminishing their efficiency for motor vehicles.

These guidelines suggest two lanes for traffic, with a center lane for left-hand turns. On-street parking on only one side of the street allows for a bike lane in each direction. Planters placed three feet from the curb give space for lighting and extra room for pedestrians. Planters can be strips with bioswales, with paved pathways spaced every few feet to allow for access to the sidewalk on either side of the planters or bioswales.

80 Ft. Right-of-Ways with Medians

80 ft right-of-ways with medians are similar to regular 80 ft right-of-ways, but they have a center median running the length of the street where there is no left turn lane. A median in a wide street can reduce the heat effect caused by the asphalt and make the street more pleasant for all users. If planted well, medians add significant aesthetic value to a wide street. These guidelines suggest bioswales be planted in the median, to help with drainage and introduce a visually appealing element of sustainability to Delano's street system.

80 Ft. Right-of-Way Public Transit Routes

80 ft right-of-way public transit routes are major thoroughfares designed to accommodate busses and bus stops. They have no on-street parking. Instead, they have four lanes of traffic with a Class II bikeway on both sides of the street. 80 ft. right-of-way public transit routes also have a planted median to reduce the heat effect and enhance aesthetics. Sidewalks are wide enough to accommodate bus stops, and where there are no bus stops, bioswale planters, street trees and lights are included. These guidelines suggest bioswales be planted in the median, to help with drainage and introduce a visually appealing element of sustainability to Delano's street system.

80 Ft. Right-of-Way Green Pedestrian Connections

80 ft right-of-way green pedestrian connections are for high use roads that connect major destinations. They include a bike and pedestrian path separated from the street to encourage biking and walking as physical activity, and as a method of transport to and from work, or to run local errands. The path is curvilinear to enhance visual interest, and shade trees planted along the path are extremely important.

Green Pedestrian routes have a sidewalk on the opposite side of the street from the path. They also have parking on one side of the street, and a center turn lane that can be a planted median where a turn lane is not necessary. A planted median will further enhance aesthetics along the pedestrian corridor, and reduce the heat effect. Bioswales in the median help with drainage and introduce a visually appealing element of sustainability to Delano's street system.

60 Ft. Right-of-Way Residential Streets

60 ft right-of-way residential streets have narrower lanes to slow traffic, in order to create a safer street system in residential neighborhoods. The streets include on-street parking on one side and have no designated bike lane. Because the street is designed for slower speeds, bikes can share the road with motor vehicles. These streets also don't have lighting, but the option for lighting can be explored, based on resident's desires. The sidewalk is designed to be a minimum of five feet. Where space allows, the sidewalk should take on a curvilinear pattern. This enhances visual interest for the pedestrian, which in turn may encourage increased levels of physical activity among a neighborhood's residents.

40 Ft. Right-of-Way Green Pedestrian Connections

40 ft right-of-way green pedestrian connections are for lower use roads that connect to 80 ft right-of-way green pedestrian connections. They are intended to link 80 ft. green pedestrian connectors to residential neighborhoods. The streets have narrower lanes to slow traffic and improve pedestrian and bicycle safety. They don't have on-street parking or a separate bike lane. Instead, bike traffic shares the road with automobiles. 40 ft. green pedestrian routes have sidewalks on both sides of the street with pedestrian-scale lighting to improve safety. Shade trees are important for the streets, because they are designed for heavy pedestrian use. Signs indicating their linkage to 80 ft green pedestrian routes and the Class I bike and pedestrian path are important to encourage the use of alternative modes of transportation.

20 Ft. Right-of-Way Downtown Alleys and Residential Alleys

20 ft right-of-way downtown alleys connect main streets in the City's downtown core. The alleys provide pleasant shortcuts for pedestrians. Vegetation, seating, lighting, and textured pavements make downtown alleys ideal spots for rest and relaxation, for pedestrians running errands, or employees of local businesses on lunch breaks. Downtown alleys can have mini bioswales and permeable pavement surfaces, and information signs in the alleys can explain the City's sustainable design features.

20 ft. right-of-way residential alleys are designed to be the main access to garages behind homes. The presence of residential alleys enhance visual quality along residential streets because they move the garage from the front of the house to the back. A greater portion of the house can front the street, improving pedestrian quality. Residential alleys should have permeable pavers to improve drainage and environmental quality.