AN ENVIRONMENTAL JUSTICE ASSESSMENT OF THE LIGHT RAIL EXPANSION IN DENTON COUNTY, TEXAS

Colleen T. Moynihan, B.S.

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APPROVED:

Donald I. Lyons, Major Professor
Sarmistha R. Majumdar, Minor Professor
Paul Hudak, Committee Member and Chair of the Department of Geography
Sandra L. Terrell, Dean of the Robert B. Toulouse School of Graduate Studies

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This study analyzes the proposed passenger rail line expansion along US Interstate Highway 35 in Denton County, Texas. A multi-dimensional approach was used to investigate potential environmental justice (EJ) consequences from the expansion of the transportation corridor. This study used empirical and historical evidence to identify and prioritize sites for potential EJ concerns. Citizen participation in the decision making process was also evaluated.

The findings of this research suggest that the southeast Denton community has the highest potential for environmental justice concerns. This study concludes by offering suggestions for an effective public participation process. These include the incorporation of a community's local history into an environmental justice assessment, and tailoring the public planning process to the demographics and culture of the residents.

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The simple truth is that the constant support from my husband Daniel Bruce helped sustain my motivation throughout this project.

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CHAPTER 1

INTRODUCTION

The theoretical framework for environmental justice (EJ) is grounded in the environmental justice movement, social injustice and civil rights. Conditions that create an environmental injustice are multi-dimensional. EJ exists if economically disadvantaged and minority populations suffer disproportionate environmental risks or they are excluded or under represented in the environmental decision making process. Another condition includes the influence of past discriminatory policies on a community's current location. This study incorporates empirical and significant historical evidence to identify potential environmental justice sites along the proposed passenger rail line in Denton County. Using data from survey-questionnaires this study will also evaluate the public participatory process.

Over the past 100 years, the United States has focused on economic growth and stability through manufacturing and industrialization. These activities have produced a stronger U.S. economy along with negative externalities. The Federal Highway Act of 1956, created an interstate transit system across the United States, connecting large metropolitan cities with small towns through a matrix of highways (FWHA, 2007). The evolution of transportation has an impact upon land use, racial segregation and energy use. Urban populations grew as a result of the advancement in transportation technology (Yago, 1983). The power of right-of-way acquisition allowed for the construction of freeways through inner city neighborhoods. The lack of public participation and disproportionate burden of environmental risks created an environmental inequality for communities adjacent to the new transportation corridors.

In 1982, an African American community in North Carolina brought national attention to disproportionate burden and the issue of environmental racism. The governor of North Carolina accepted a Polychlorinated biphenyls (PCB) landfill in a district located in close proximity to a low-income, African American neighborhood. Residents in this community were excluded from the decision making process and limited in their access to information about risks.

The North Carolina case cemented the connection between environmental inequity and social injustice and served as a catalyst for the environmental justice movement. In 1987, a landmark report based on a nationwide analysis documented the proximity of communities of color to toxic waste thereby confirming the existence of environmental injustice (UCC, 1987). The attention to EJ broadened the scope of environmental research. Holifield (2001) relates, "by bringing issues of race, class, culture, and gender into the realm of environmentalism, grassroots environmental justice activists challenged the focus of traditional environmentalist on resource conservation, wilderness preservation, population growth, or similar issues" (p. 79).

In 1994, the federal government responded to the EJ movement. President Clinton issued Executive Order 12898 on February 11th 1994, which established environmental justice as a national priority (Clinton Executive Order 12898, 1994). It recognized the existence of environmental justice in society and created an avenue for policy change for low-income and minority communities. Federal agencies were required to formulate an action plan to address environmental justice by defining disproportionate burden and create a methodology to identify environmental justice communities.

The first federal agency to address EJ was the Environmental Protection Agency (EPA). The EPA opened the Office of Environmental Justice to integrate environmental justice into EPA's policies, programs and activities. The guiding principle of EJ is that "everyone, regardless of race or income, is entitled to live in a clean environment" (EPA, 2006). They define EJ as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, culture, education, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (EPA, 2006).

In 1998, The U.S. Department of Transportation addressed EJ concerns in accordance with Executive Order 12898. They established an environmental justice action plan by creating policies and procedures, defining disproportionately high and adverse effect on minority and low-income populations, and integrating environmental justice principles with existing operations (FWHA, 1998).

The focus of this study is to conduct an environmental justice assessment of the proposed commuter rail project expected to run from Carrollton to Denton, Texas. Public transportation is a fairly new concept for the Dallas/Fort Worth metroplex. The Dallas Area Rapid Transit (DART) light rail transit system began service in 1996. It expanded services to surrounding suburbs to the southwest in 2000 and the suburbs of Richardson, Plano and Garland in 2002. It was only recently that DART extended a line to the northern suburbs of Farmers Branch and Carrollton (DART, 2006). The increase in motor vehicle use accompanied with an increase in population along interstate 35 has brought with it a rise in traffic accidents, inconsistent travel times, and deterioration of air quality (DCTA, 2006). According to Denton County Transportation Authority (DCTA), the expansion of passenger rail service will improve mobility and reliability, help reduce

congestion and decrease traffic accidents, and enhance air quality (DCTA, 2006). DCTA will coordinate and construct the regional light rail expansion through Denton County. RailDCTA, the proposed passenger rail line, will connect Denton passengers to Carrollton and existing DART light rail lines.

The proposed project will re-open a 23-mile transportation corridor to accommodate a passenger rail line and five rail stations, two Denton stations, Downtown Denton and South Denton and three stations south of Denton, Highland Village, Downtown Lewisville, and South Lewisville. Each station offers approximately 400 to 1,000 parking spaces and a pedestrian walkway.

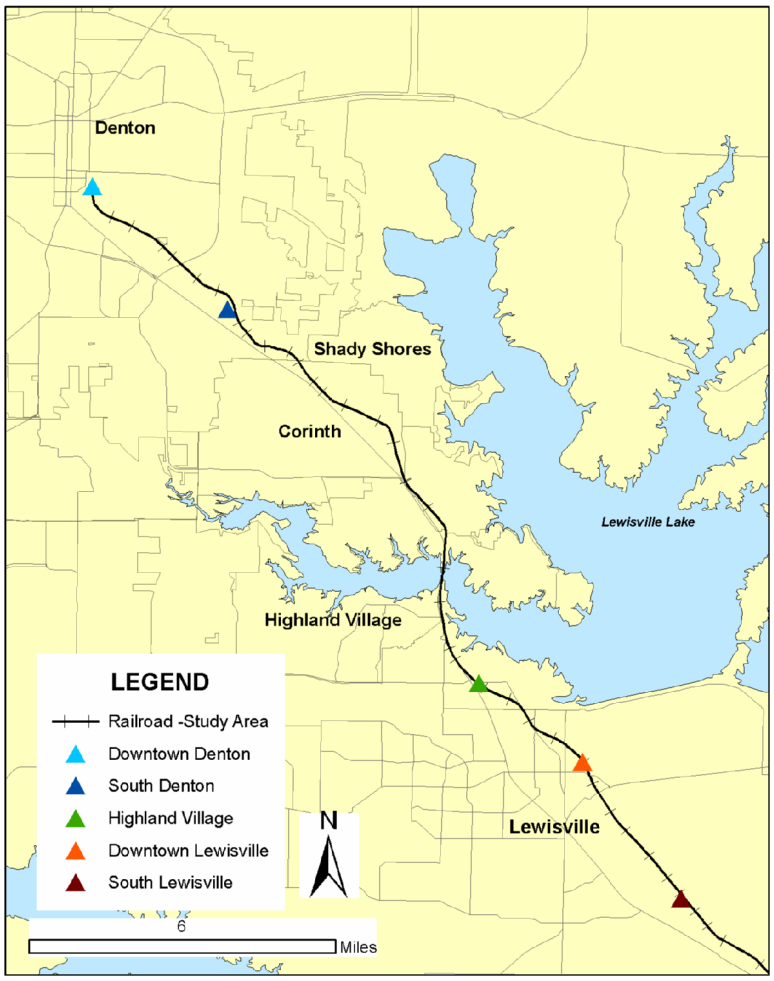

Figure 1. Proposed Passenger Rail Line and Five Station Locations.

The first objective of this study is to identify and prioritize specific sites for potential environmental justice concerns by analyzing empirical and significant historical evidence. The RailDCTA project will increase the environmental risk and exposure to pollutants for all communities in close proximity to the corridor. This study will use a modified version of Larson & Claussen (2004) statistical environmental justice assessment, which incorporates geographic information systems (GIS) technology with the application of analysis of variance, a statistical technique (Larson and Claussen, 2004). GIS based proximity analysis will determine if minority or low-income populations are over-represented in an area compared to the rest of the population in Denton County. In the context of this study, the Federal Highway Administration (FHWA) defines disproportionate impact as an effect that will be suffered predominately by the minority population and/or low-income population compared to non-minority and or non-low income populations (FHWA, 1998). The Southeast Denton neighborhood is one particular community that has a significant history of racial discrimination. A community of freed slaves was relocated with limited access to the public process.

The second objective of this environmental justice assessment evaluates participation in the passenger rail line decision making process. The Southeast Denton case study serves to evaluate the process. Results from the interviews address the method of notification for public meetings and communication between residents and the transit authority. Analysis of responses rank residents concerns and reveal their perception of information sharing and potential impacts from the passenger rail line on their community.

Study Area

The Missouri Kansas Texas (MKT) line was active in the early 1900, carrying crops from the North and cattle from the South. The entire MKT rail line served Iowa, Nebraska, Missouri and Oklahoma in addition to Texas (Cochran, 1992). In 1924, the rail line shared its 32-mile line from Denton to Dallas with the Texas inter-urban railway, which was part of a system of inter-urban electric line serving North Texas. The Denton to Dallas line of the Texas inter-urban operated hourly passenger service. Passengers boarded the trains at stops in Denton and Garza, which is near the present lake cities at Lewisville, Carrollton and points South (Cochran, 1992). A Southeast Denton resident remembers when she was a child and the inter-urban ran through the neighborhood.

> The inter-urban ran from Denton to Dallas when I was a teenager, we lived right across the street from Fred Moore school. The inter-urban would come up and our grandparents lived in Dallas, so we would catch the inter-urban and go to Dallas.

Population in Denton in 1924 was only 7,628. The low population density along the Denton-Dallas line could not sustain the Texas inter-urban transportation corridor (Cochran, 1992).

Rails-with-Trails facilities replaced the empty transportation corridor through out the United States. As of 2002, 65 rails with trails facilities were constructed and 82 proposed (Cochran, 1992). In 1994, the City of Denton received a grant to convert the right-of-way into multi-purpose bike path. The eight-mile Denton Branch rail-trail runs parallel to interstate 35 E from Hickory Street in Denton to Corinth (City of Denton, 2007).

Figure 2. Rails-with-Trails through the City of Denton.

CHAPTER 2

LITERATURE REVIEW

Several disciplines have contributed to the body of environmental justice (EJ) literature; public policy, political science, health, sociology and geography. EJ fits neatly into the field of geography because EJ researchers study the spatial relations between people and pollutants. Sheppard, Leitner, McMaster and Tian (1999) remark that, "studies of environmental equity are inherently spatial in nature. Debates have to do with who lives how far from toxic hazards and why those hazards are located where they are, and the population characteristic" (quoted in p.19; Weinberg, 1998). EJ researchers often use a multi-dimensional approach to identify an environmental justice site, because a standardized method does not exist. They select the appropriate definitions and methodology depending on the source of the environmental hazard. Researchers often select one or two among various EJ indicators to study such as low-income and minority populations, accumulative health risk factors, or the local history information. This portion of the literature review will focus on the predominant literature discourse in EJ research, defining environmental inequality, choosing the correct scale, selecting the tool to determine proximity and the purpose of the public participation process in environmental decision making.

Environmental Injustice

The definition and methodology constructed to understand the formation of environmental injustice must go beyond the empirical evidence and include a socio-historical process (Pellow, 2000). There are numerous explanations as to how environmental injustices formed. The debate between Vicki Been and Robert Bullard examines the force behind the formation of environmental racism (Weinberg, 1998).

Vicki Been argued that the marginal poor and disempowered migrated to high environmental risk areas because it was a place with cheap rent, less resistance by White landlords, and more job opportunities. Therefore, market forces are to blame for the high percentage of minority groups adjacent to toxic sites. Robert Bullard argued that the historical record is clear, Black Houstonians did not follow the garbage dumps and incinerators the waste facilities moved into established African American neighborhoods (Weinberg, 1998). This debate brings up questions about the formation of environment injustice, what are the causes, how and why did this inequality happen. Callewaert (2002) studies long established communities that are struggling with environmental concerns. He stresses the study of the local historical information to understand the development of environmental injustice.

The debate over the intent of environmental injustice is ultimately inconclusive, but Callewaert (2002) contends that to fully understand the formation of environmental injustice, it must be redefined as a "socio-historical process rather than simply viewing it as a result of a simple, historical perpetrator-victim scenario" (p. 258; see also Pellow, 2000). The history of a community is an important environmental justice indicator and plays a role in the formation of environmental injustice. Local history information is often overlooked by U.S. regulatory agencies because federal guidelines often disregard a community's history (Calleweart, 2002). Rhodes (2003) suggested that placement in time is very important when conducting an EJ assessment, "there are three time characteristics of environmental justice; historic, present and future" (p.125). There is a historical dimension where an environmental inequality already happen, present time where the condition is current and ongoing, and finally the future time characteristic,

which allows the opportunity for community groups to influence the environmental decision making process.

Political, economic, historical, and social underlying processes can lead to environmental inequality and should be a part of the environmental justice methodology (Fisher et al. 2005). Numerous EJ researchers stress the need for further investigation into the underlying process that lead to environmental injustice because the methodology should include more than identifying vulnerable populations in close proximity to an environmental hazard. (Weinberg 1998; Callewaert 2002; Fisher, Kelly and Romm 2005). Harner et al. (2002) remarked that, "research into EJ has also confronted such issues as unequal enforcement of environmental laws, exclusionary decision making process and discriminatory zoning" (p. 319). Investigation into the history of a community can reveal issues about past housing or economic development discrimination (Callewaert, 2002). Holifield (2001) contends that, "historical case studies have been more successful than longitudinal studies in exposing the complex geographic processes that generate patterns of inequity" (p.85).

Choice of Scale

Federal agencies are required to investigate EJ concerns to ensure that an agency's decision and implementation plan will not disproportionately impact low-income and minority populations. Clinton Executive Order 12898 served as a catalyst for academic environmental justice research. Common methodological themes in quantitative EJ research are the issue of scale and how the choice of scale can influence EJ results.

County, city, zip code, census tract, and census block are examples of possible units of analysis. The U.S. census bureau reports demographic information in various

units. Census tracks have between 1,500 and 8,000 people, block groups are clusters of census blocks with 600 to 3,000 people (NCTCOG, 2005). Environmental justice has been measured in many different ways with contradictory results (Harner, Warner, Pierce & Huber 2002; Mohai 1996; Weinberg 1998; Lester and Allen 199l; Williams 1999; Holified 2001). The choice of scale, definition, and measuring tools can influence research conclusions. Most et al. (2004) remarked that "a number of authors (Cutter, Holm & Clark 1996; Sheppard et al. 1997; Ringquist and Clark 1999; Williams 1999; Steinberg 2000; Worsham 2000) have cited the confounding effects on EJ research of varying the size and shape (or scale) of the area of analysis" (p. 579). Sheppard et al. (1999) points out that the environmental equity study of Cutter et al. (1996) identified an EJ concern at the county level, but no significant correlation between vulnerable populations and toxic facilities using census tract data. Fisher, Kelly and Romm (2005) emphasized the importance of addressing local level concerns in their research. A closer look at local traffic patterns demonstrated a higher level of diesel truck traffic on economically disadvantaged streets.

The choice of scale can influence the ability to appropriately select protected populations. Most et al. (2004) pointed out that "care should be taken to determine if the percentage of minorities within the affected area is "meaningfully greater than the minority population's percentage in the general population or other appropriate unit of geographic analysis" (p. 578). Researchers agree that a standardized methodology is necessary to allow for comparison between results (Sheppard et al., Harner et al. 2002; Most et al. 2004).

Proximity

The environmental justice movement argues that “poorer people in general and people of color in particular face risks from their proximity to hazardous facilities and waste sites that are disproportionate to their numbers in the population” (Williams, 1999; Callewaert, 2002). The introduction of Geographic Information Systems (GIS) with spatial analysis tools has increased the accuracy of identifying protected populations and calculating the concentration of pollutants.

Geographic Information Systems (GIS) technology and its ability to serve as an analytical tool have increased the validity of EJ results and methodology. Most et al. (2004) indicated that “the power and sophistication of GIS software lends an aura of authority and authenticity to the environmental justice research that it has been lacking” (p. 584). GIS allows for visual representation of complex data by combining layers of information, environmental hazards, and population characteristics analysis and represents the information on a map. GIS spatial analysis tools have served to legitimize EJ results by capturing the true boundaries of EJ communities and the concentration of pollutants, and it serves to create a standard methodology.

The ability to capture the true boundaries of a community is a struggle for every EJ researcher (Sheppard et al., 1999). The GIS buffer tool has augmented the accuracy of capturing the true boundaries of protected populations. Chakraborty (2006) asserted that “buffers are a viable method of EJ evaluation” (p.538). The buffer tool will select census blocks, census tracks, and census block group as a unit of analysis because these are the units at which economic data is reported (Harner et al., 2002). EJ results are sensitive to the shape and size of the buffers.

Advances in GIS have served not only to capture and identify protected populations proximity to environmental risks, but also the capability to calculate the concentration of pollutants radiating from an airport or a non point source such as diesel emissions from trucks or toxic facility. Selecting the appropriate unit of analysis are vital to valid results (Most et al., 2004). The GIS buffer tool is applied to capture the demographics of a community within the distance buffer and calculate their proximity to the hazardous facilities. This analysis selects the population most at-risk from the toxic releases of a facility. Fisher et al. (2005) examined the problem of characterizing non-point source pollution by applying spatial point pattern analysis to reveal a significant cluster of TRI facilities in a community. GIS's spatial analysis extensions can determine the concentration of pollutants. Sheppard et al. (1999) related that, "plume analysis demonstrates toxicity of chemicals emitted, physical characteristic of facilities, and atmospheric characteristics to identify the population impacted by the plume" (p. 19). Dolinoy & Miranda (2004) applied the spatial analysis extension within GIS software to a set of contour lines representing the predicted concentration of emission with defined parameters. This illustrates that GIS is an important tool in conducting spatially based environmental justice research.

The Federal Highway Administration defines minority and low-income persons "who live in geographic proximity" to a proposed transportation project (Chakraborty, 2006, p. 318). A statistical EJ assessment of a transportation corridor relies on the accuracy of the proximity analysis to identify adversely impacted areas. Forkenbrock and Schweitzer (1999) applied Geographic Information Systems (GIS) to blend U.S. Census data with the results from emissions models of vehicle-generated pollutants, and from noise models. The availability of GIS and accessibility of geographically

distributed information such as U.S. census data or the location of highways allows for an increased resolution and ability to characterize populations related to a transportation route (Mills et al., 2000).

The validity of Geographic Information Systems technology is limited by its inability to appropriately select community boundaries that are not defined by the prescribed units of analysis. Chakraborty et al. (1999) remarked that, "the problems lies within the choice of scale and the ability to capture the true community with a buffer, along with the amount of data manipulation that occurs with combining statistical analysis with GIS software" (p. 250). The complexity of defining communities involves an analysis beyond the census block and demographic data. There is a need to address other EJ indicators such as the historical information or public participation to identify EJ communities. This emphasizes the importance of incorporating qualitative methods into an EJ assessment and examining underlying processes that contributed to the current location of the low-income and minority populations. Qualitative methods capture the viewpoints and perspective of the population in question to gain their perspectives on the potential environmental risk that will directly affect their health and quality of life.

Citizen Participation

Numerous studies examine the benefits and disadvantages to citizen participation in the environmental decision making process (Callewaert, 2002; Darnell and Jolley, 2004; Irvin and Stansbury, 2004). Researchers have examined if community participation is an effective policy making tool (Irvin and Stansbury, 2004). The ability of citizens to influence the regulatory decision making process is linked to the participation in a democratic society. Kellogg and Mathur (2003) suggest access to information and the ability of a community to communicate their views to the decision making process

are aspects of environmental knowledge and they are key to democratic participation. The level and kind of access is "a function of both the dissemination practices of the environmental agency and the skill level of the citizens" (Kellogg and Mathur, 2003, p. 573). If citizen views are incorporated in the formulation of a policy, then it is grounded in citizen preferences, therefore the citizens and the agency organizing the public process will benefit (Irvin and Stansbury, 2004). Citizen participation provides an avenue to break gridlock and avoid litigation, and also empowers community members. Some disadvantages are that holding public meetings can be costly and community members might be complacent or unwilling to attend a meeting (Irvin and Stansbury, 2004). These conditions must be taken into consideration when organizing the public participation process.

A breakdown in the communication process leads to a lack of information, which exacerbates the mistrust in the decision makers (Wakefield, 2000). Wakefield (2000) stated that a "lack of trust led to concern that the things they valued most in their communities were in danger" (p.1148). Improvements to the public participation process might decrease the amount of mistrust. Vos, Sapat and Thai (2002) suggest that the formation of environmental injustice is not limited to the disproportionate burden of health risks or sitting of a landfill, but how policies are formulated and implemented. They researched the implementation of the Illinois Solid Waste Management Act of 1988, concluding that local decision makers assumed blacks were not interested in the participating on an advisory committee. Blacks were not involved in the decision making process because they were not invited. Darnell and Jolley (2004) examined the effectiveness of the survey or interviews in assessing environmental problems. They concluded that stakeholders and the scientific community consider environmental risks

differently and that surveys only provide a snap shot and other public involvement avenues may achieve a shared vision. Overall, there are benefits and drawbacks to incorporating public discourse in environmental decision making. Access to information and ability to share concerns are apart of the democratic process. A partnership of stakeholders designing a policy creates a plan that fits the needs of the community and avoids mistrust of the planning agency.

The literature review details the complexity of environmental justice research. Environmental justice problems are a composite of more than one type of problem; therefore more than one methodology must be used to assess or measure the problem (Rhodes, 2003). There is not a standardized EJ methodology and the choice of scale can influence the validity of EJ results. Numerous studies incorporate GIS technology to identify an EJ concern and calculate the proximity of vulnerable populations to an environmental risk. GIS has brought authenticity to EJ results. GIS technology has limitations when a standard unit of analysis does not define a community's boundary. Few empirical EJ researchers includes the characteristic of time in an EJ assessment and the importance of addressing the underlying historical, political or social processes that influenced or currently influence a community's location. Studying local history information may provide a fuller understand into the formation of environmental inequalities. Some EJ research focuses on evaluating the effectiveness of citizen participation in the environmental decision making process. All these methods are used to establish the existence of environmental injustices in our society.

CHAPTER 3

METHODOLOGY

A multi-dimensional approach was used to investigate the environmental justice consequences from the construction and operation of a proposed commuter rail system expected to travel from Carrollton to Denton, Texas. This study used empirical and significant historical evidence to identify potential environmental justice (EJ) concerns. Interviews with Southeast Denton community members will be used to evaluate the public participation process.

This study refers to the federal government for environmental justice guidelines and definitions. Clinton Executive Order 12898 (1994) indicates that each federal agency shall "make achieving environmental justice part of its mission" by (1) identifying minority populations and low-income populations and addressing adverse effects of its programs (2) developing an environmental justice strategy to "ensure greater public participation" of minority populations and low-income populations (Clinton Executive Order, 1994).

This EJ assessment of a transportation corridor follows the U.S. Department of Transportation Federal Highway Administrative (FHWA) action plan addressing Executive Order 12898. The definition of "disproportionate impact" related to the changes in a transportation corridor is outlined in this action plan entitled "FHWA actions to address environmental justice in minority populations and low-income populations" (FHWA, 1998). The definition of a disproportionate high and adverse effect on minority or low-income populations:

> (1) is predominately borne by the minority population and/or low-income population or (2) is appreciably more severe or greater in magnitude than

> the adverse effect that will be suffered by the non-minority population and/or the non-low-income populations (FWHA,1998, section 2).

This approach emphasized the importance of identifying low-income and minority populations prior to policy implementation to avoid disproportionate impact. This led to EJ guidelines addressing proposed changes in a transportation corridor. Early in the development of the policy the FHWA encouraged public involvement from "affected minority and low-income populations, to consider alternative" (Forkenbrock and Schwietzer, 1999, p.97).

Empirical Evidence

Environmental justice assessment of a transportation corridor emphasizes proximity. The GIS-based proximity analysis of the proposed transportation corridor focuses on the location of socio-economically disadvantaged group and their distance from the rail line. This research analyzed two EJ Indicators to identify vulnerable populations, (1) the predominance of economically stressed and/or high percent minority in close proximity to the rail line and (2) local historical information. Other indices such as human health risks, chemical exposure, and accumulative risks were not addressed as a part of this study.

A modified version of Larson and Claussen (2004) methodology analyzes U.S. census data to determine the significant presence of low-income and minority populations adjacent to the proposed station locations, the area with the highest potential for an adverse effect. This methodology uses GIS technology to select potential vulnerable populations who are in close proximity to the proposed passenger rail line.

GIS technology relies heavily on demographic and income data from the U.S. census bureau to determine the location of protected populations with environmental justice concerns. 2000 Census data parameters of income for Denton County were downloaded from North Central Texas COG website (http://www.nctcog.org/ris/census/). The smallest unit of analysis to record income is at the census block group level, which represents 600-3,000 people (NCTCOG, 2005). Median household income was selected from Summary File SF30007. Demographic data was collected from the 2000 Census, Summary File 1. Census blocks are the smallest census geography for Summary File 1 data, (NCTCOG, 2005). Minority or non-white for the purpose of this study is defined as Black, Asian American, American Indian, and other race, two or more races (Census Bureau, 2007). In order to be consistent with the Census Bureau data collection process Hispanic is not considered a race, but an origin and is not included in the definition of minority.

Following the definition of disproportionately high and adverse effects as defined by the FHWA Order, identifying the predominance of low-income and minority populations next to the rail line is a key step in EJ assessment study of a transportation corridor. Demographic and median income data was downloaded in to ArcView to display the distribution of low-income and minority populations in Denton County. Median Income and percent minority are recorded at different units of analysis. The smallest units of analysis provide the most accurate estimates of the population (Sheppard et al., 1999). The smallest units for income and race were used for this analysis.

Median household is registered at the census block group level. The census units, which represent median incomes between 0-30,000 clusters around the

downtown Denton station study area, refer to figure 3. This station is characterized with the lowest median income in Denton County. The median income levels appear to increase south of the Denton station.

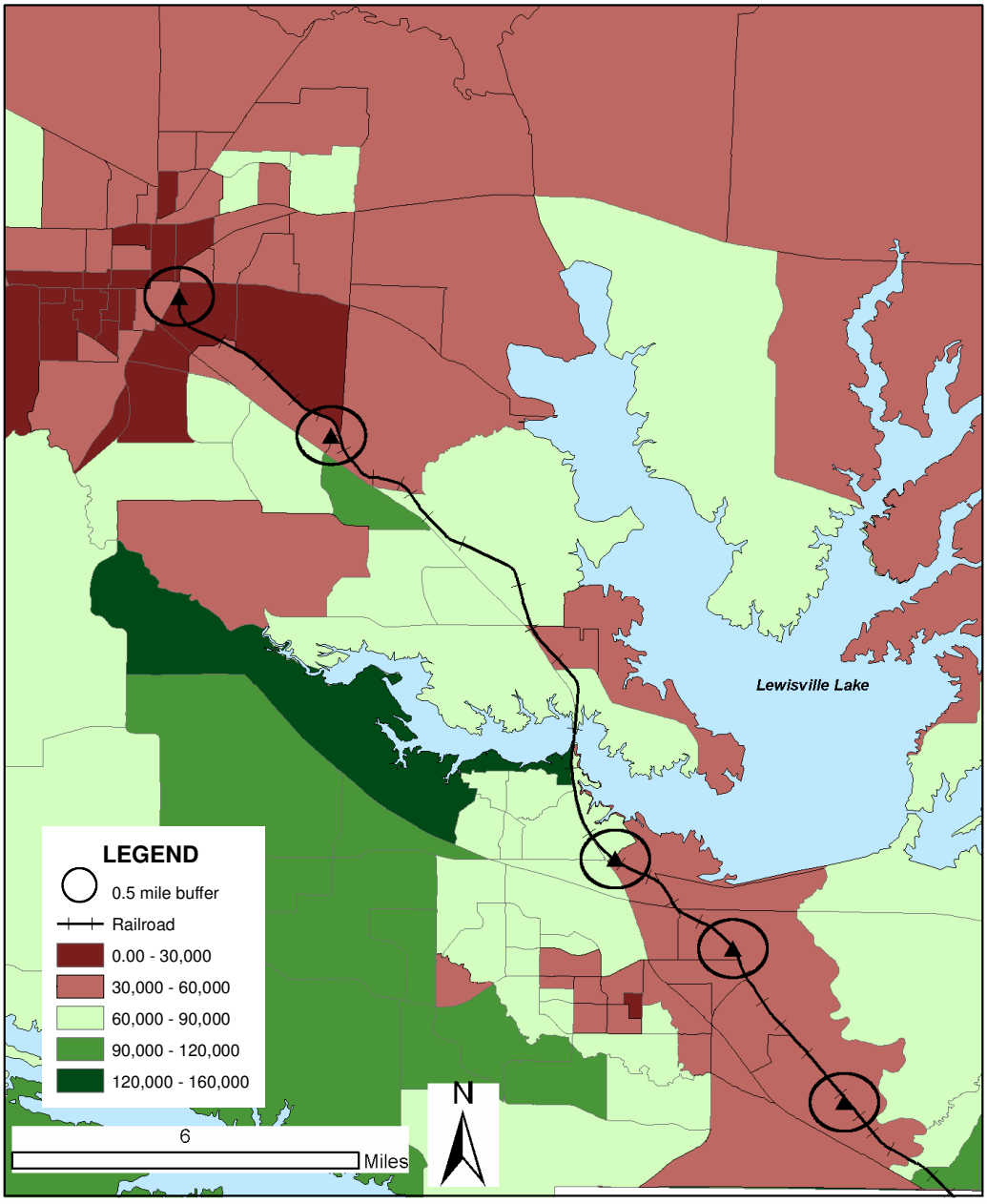

Figure 3. Median Household Income per Census Block Group in Denton County.

Percent minority in Denton County is displayed per census block, refer to figure 4. A high percentage of minorities are located around the downtown Denton station. The census blocks that represent 75.1 percent to 100 percent minority clusters around the station. The number of minorities adjacent to the downtown Lewisville station is also noteworthy. The census blocks near that station represents 50.1 percent to 75 percent minority.

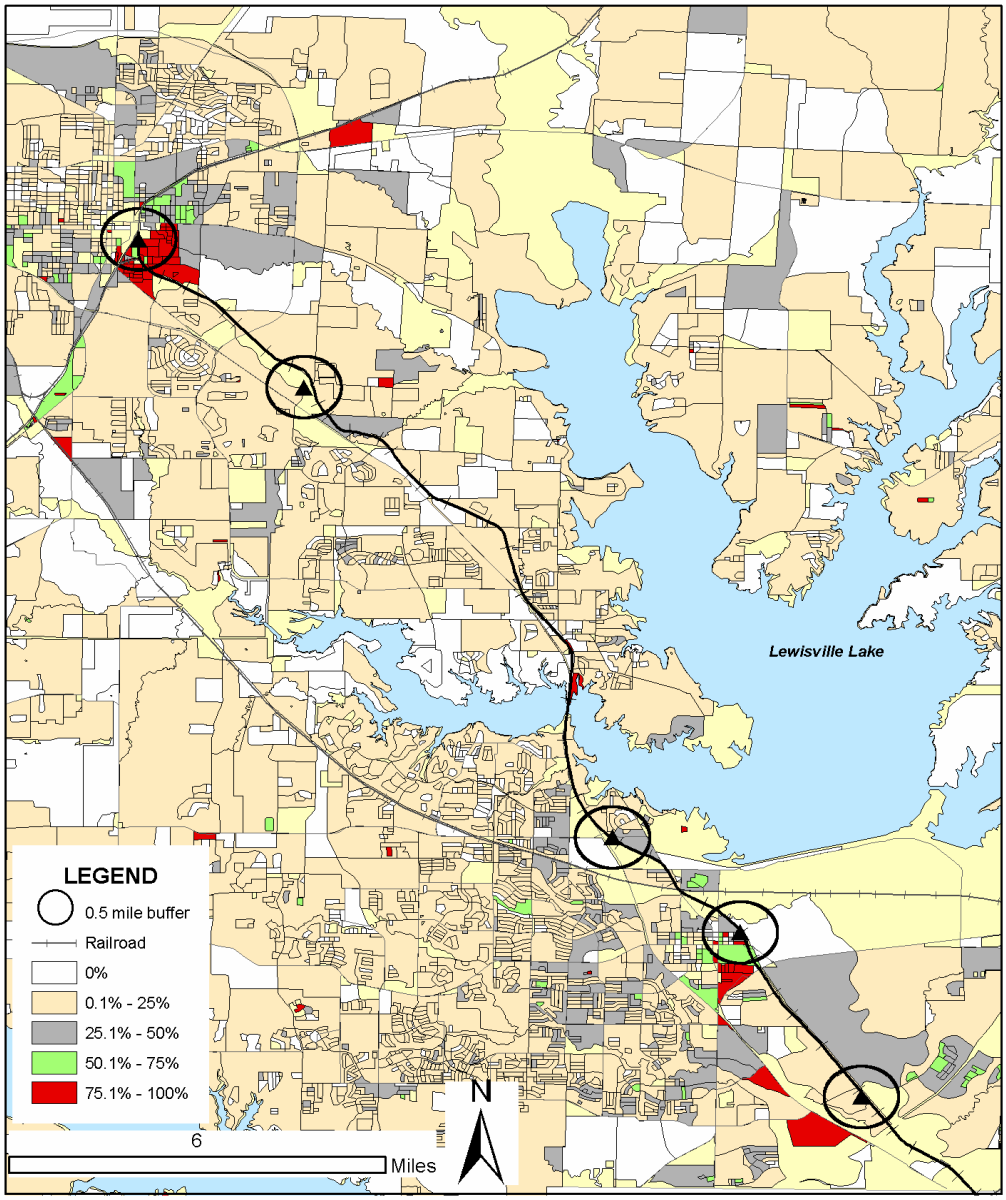

Figure 4. Percent Minority per Census Block in Denton County.

Recognizing that descriptive data alone on a base map is not conclusive in determining “disproportionate impact” or the high concentration of low-income and minority populations living adjacent to the line. Therefore quantitative assessment using a statistical method was performed following Larson and Claussen (2004) methodology to determine the location of an EJ population. A 0.5 mile buffer was constructed around each proposed station and the entire rail alignment. This data was used for comparison to the remaining county data. The census units that entirely or partially intersected the buffer were selected for extraction and represent the community in close proximity to the proposed station or rail line. The buffer zone selected the “at risk population” or the population with the highest potential for environmental justice concerns. The census units not selected by the buffer areas characterize the county data. This was done to avoid double counting data.

A 0.5 mile buffer was chosen based on the information concerning nuisance effects from the proposed station area. Diaz (2007) contends that “property located with in a 500 meter walking distance from a rail line increased in values, yet within the immediate vicinity of the station area negative externalities such as noise and increase in traffic reduced the potential property value” (p.3). A 0.5 mile buffer selects for comparison “at risk” populations in close proximity to the stations and the rail line. The choice of buffer size also took into consideration the units of analysis, and the propinquity between the proposed station locations along the rail alignment. The downtown Denton and South Denton stations are less than a mile a part, therefore a 0.5 mile buffer was chosen to avoid double counting data, refer to figure 4.

The smallest census unit that aggregates income is at the census block group level, Highland and downtown Lewisville stations are located within the same census block group, therefore two stations are represented in one sample size.

An analysis of variance (ANOVA) test was used to determine if there was significant difference between the means of the buffer areas and the remaining county. The F ratio, which measures the difference between and among the groups, was used to test the null hypothesis. The analysis of variance test identified the population with the highest potential to suffer disproportionate effects from the re-opening of the transportation corridor. The percent minority data was not normally distributed, but followed the remaining assumptions of the ANOVA test and the results were analyzed.

> The F-test is said to be relatively "robust" with respect to the deviations from the assumptions of normality and homoscedasticty. This means that results of the F-test may still be used effectively if the assumptions are at least "reasonably close" to being satisfied. If either (a) the assumptions are close to being satisfied, or (b) the F-statistics yields a "clear" conclusion (Rogerson, 2001, p. 71).

The analysis of variance test simply reveals a significant difference in the data between the stations and the county, but does not identify the specific station with the highest percent minority. The Bonferroni adjustment identified which station or stations were significantly different from the county.

The median of the median incomes was calculated for each study area and the county. The 0.5 mile buffer around the downtown Denton station selected six block groups, with a total of 2,486 households refer to table 4.1. The propinquity of the Highland and downtown Lewisville stations resulted in the overlapping of buffer zones. The buffer around Highland and downtown Lewisville station captured the same two census block groups. A robust statistical analysis could not be performed with the

selected median income data because the resulting small sample sizes did not follow assumptions of the analysis of variance test. It is important to note that the severity in the raw numbers allowed for reasonable confidence in results.

Historical Evidence

The history of local communities is the second EJ indicator used to identify an environmental justice problem along the proposed transportation corridor. To fully understand the formation of environmental injustice an EJ assessment must include the social-historical process in the methodology (Pellow, 2000; Callewaert, 2002; Rhodes, 2003). The history of the Southeast Denton community is significant historical evidence detailing exclusion from past policy decisions and racial discrimination. Disregarding the local history of a community can result in an environmental injustice (Callewaert, 2002).

Citizen Participation in the Decision Making Process

As directed by Clinton Executive Order (1994) each Federal Agency shall develop an environmental justice strategy that "ensures greater public participation among low-income and minority populations". EJ strategies include revisions to current programs and policies related to human health or the environment to minimize its effects on minority and low-income populations. This stresses the point that environmental inequality is just not limited to the assessment of human health hazards, but includes the public participatory process. Southeast Denton survey-interviews were used to evaluate public participation in the environmental decision making process of the proposed passenger rail line extension.

Federal Highway Administration (FHWA 2000) emphasizes how environmental justice guidelines can improve transportation decision making. Policy decisions are

enhanced through community partnerships. “Environmental justice is more than a set of legal and regulatory obligations. Properly implemented, environmental justice principles and procedures improve all levels of transportation decision making” (FWHA, 2000). This approach will:

- Make better transportation decisions that meet the needs of all people.
- Design transportation facilities that fit more harmoniously into communities.
- Enhance the public-involvement process, strengthen community-based partnerships, and provide minority and low-income populations with opportunities to learn about and improve the quality and usefulness of transportation in their lives.
- Improve data collection, monitoring, and analysis tools that assess the needs of, and analyze the potential impacts on minority and low-income populations.
- Partner with other public and private programs to leverage transportation-agency resources to achieve a common vision for communities.
- Avoid disproportionately high and adverse impacts on minority and low-income populations.
- Minimize and/ or mitigate unavoidable impacts by identifying concerns early in the planning phase and providing offsetting initiatives and enhancement measures to benefit affected communities and neighborhoods. (http://www.fhwa.dot.gov/environment/ej2000.htm)

Ultimately, the county transit authority is in charge of the engineering and operating the proposed passenger rail line. Denton County Transportation Authority is required to complete an Environmental Impact Statement (EIS) in order to comply with the National Environmental Policy Act (NEPA) and to be eligible for federal funding. “Impacts to be investigated include those on the area’s plant and animal life, water resources, historically and culturally sensitive areas or buildings, homes, businesses, people, communities, and the local economy” (DCTA, 2007). The EIS guidelines indicate that DCTA must hold

meetings and discuss the scope of the study with people directly impacted by the project.

NEPA requires federal agencies to incorporate environmental values into the decision making process. The Environmental Protection Agency reviews EIS documents prepared by federal agencies and defines “meaningful involvement” of minority and low-income populations in the environmental decision making process. For the purpose of this study, “Meaningful involvement” follows the EPA definition and means that:

> people have an opportunity to participate in decisions about activities that may affect their environment and/or health; (2) the publics contribution can influence the regulatory agency’s decision; (3) their concerns will be considered in the decision making process; and (4) the decision makers seek out and facilitate the involvement of those potentially affected” (EPA, 2006).

EPA’s definition of environmental justice recognizes that meaningful involvement of citizens is a “prerequisite to the development of just environmental policies and administrative decisions” (Kellogg and Mathur, 2003 p. 574) Participation in the formulation of a policy and access to information are a part of the democratic process (Kellogg and Mathur, 2003). Qualitative survey-interviews with the Southeast Denton community members were used to address the following objectives: to identify core community concerns, information sharing, and ability to influence policy decisions.

Qualitative Research

Qualitative researchers are encouraged to allow the situation guide their research in order to gain access to the experiences of those directly involved. Baxter and Eyles (1997) stated that “the goal of the researcher is to represent adequately the realities of

groups in such a way that not only does the scientific community but also the people who constructed the reality in the first place understand the (re)construction of that reality" (p.513). Qualitative researchers seek to acquire in-depth and intimate information about a group of people. Ambert, Adler & Detzner (1995) contend that qualitative research aims to learn how and "why people behave, think and make meaning as they do" rather than focusing on actions or beliefs" (p.880).

Qualitative research is evaluated by the "clarity of the research design and the transparency in the derivation of findings" (Baxter and Eyles, 1997, p.506). The researchers' ethnicity, gender and socioeconomic status can be an advantage or limit to their research and should be addressed (Ambert et al., 1995). Qualitative research design stresses rigor, validity and reliability.

The most common ways to ensure rigor in the designing a research plan involves the use of "multi-methods, information on respondent selection and the presentation of verbatim quotations" (Baxter and Eyles, 1997, p.506). Quotations are important because they "reveal how meanings are expressed in the respondents own words" (Baxter and Eyles, 1997, p.508). The criteria of "credibility, transferability, dependability and conformability for establishing rigor are useful general principles for guiding qualitative evaluation" (Baxter and Eyles, 1997, p.521).

Field researchers are concerned with validity and reliability. Validity refers to "the plausibility of connections between data and concepts that appeal to common sense and consensus" (Baxter and Eyles, 1997, p.510). Qualitative research is considered reliable and dependable when making the same measurement multiple times results in the same answer (Babbie, 2004; Robbins, 1999).

Qualitative researchers rely on interviews or surveys for data collections, "questionnaires, if constructed carefully with reliable and valid questions, will result in a predictable relationship between the respondents' answers and what the researcher is trying to measure" (Robbins, 1999, p.87). The researcher must decide on the type of survey interview either mail outs or self-administered along with the proper question format that should be used either open or closed. Closed questions provide respondents with a "uniform frame of reference" and open-ended questions are useful when the researcher wants to "give the respondent a sense of involvement" (Robbins, 1999, p.90). Babbie (2004) explained that, "an interview is a data collection encounter in which one person (a respondent) interviews may be conducted face to face or by telephone and survey interviews typically attain higher response rates than mail survey because respondents seem more reluctant to turn down an interview" (p.263). Robbins (1999) described the characteristics of reliable and valid questions;

- The question should be relevant to the objective of the study
- The question should be clear and unambiguous; what may seem clear to the
- Researcher may be unclear to the respondent.
- Be careful when asking personal questions; do not pry.
- Provide definitions to unfamiliar words or words with multiple meanings.
- The questions should mean the same thing to all respondents; reliable
- Ask multiple questions prior to asking closed questions in order to create an exhausted list of options. (p. 95)

Sampling Methods and Questionnaire Formulation

Random and non random sampling methods were used to generate a total sample population of forty Southeast Denton residents (twenty five non random and fifteen random). Members from the Southeast Denton Neighborhood Association, an established neighborhood community group were selected because of their

accessibility. The non random or convenient sampling strategy directed the selection of participants in the community group. Then the snowball strategy was used in the non random method, which helped to choose relevant participants for this study.

Random sampling methods were included to ensure that every resident within the Southeast Denton neighborhood had the opportunity to participate in this research; GIS software captured every parcel within the neighborhood. The selected parcels in the table of contents were then exported as a .dbf file and finally converted to an excel file. SPSS generated a list of randomly selected parcel numbers, which included vacant lots and businesses. For the purpose of this study, residents who rented or owned property were interviewed. The Denton Central Appraisal Districts' website provided homeowners' name and address by parcel number. Since phone numbers were not provided through the website, the neighborhood was canvassed by knocking on the doors of residents selected by the random sampling method.

The survey-questionnaire included a combination of closed and open-ended questions. It first established if participants lived in the Southeast Denton neighborhood and for how long. This was followed by a series of closed-ended questions asking residents to rank their concerns about the expansion of the commuter rail on a five-point Likert scale. A type of psychometric scale often used in questionnaires to measure respondent's level of agreement to a list of statements, one representing non-important and five representing very important including an option for undecided. A second set of questions asked residents to rank if they agree or disagree with a series of statements pertaining to Denton County Transportation Authority (DCTA) organization of the public process.

Open-ended questions allowed residents to respond freely and detail the process DCTA notified residents and the quality of information allowed resident to respond freely. The answers were recorded and transcribed. Open-ended responses were clustered according to common themes. Personal questions pertaining to income and age and size of family unit were reserved for the end of the questionnaire. Participants reviewed and signed a consent form approved by the Institutional Review Board (IRB) of the University of North Texas. This consent form explained the purpose and benefits of this study and the process of collecting data. In person and phone interviews were recorded with the residents' consent only. Copies of audio interviews, signed consent forms, and any notes from the interview process are stored in a secure area of the UNT Geography Department.

Random and Non Random Sample Groups

This portion of the methodology studies the disparities and similarities between the non random and random sample groups and why ultimately the results were combined and referred as the total sample population throughout the analysis and discussion.

All participants responded "yes" to living in the Southeast Denton neighborhood. It was confirmed that all participants were Southeast Denton residents. Residents were then asked how long they and their families have lived in the neighborhood. The results of the *t* test indicated a significant difference between how long the families from the non random and random sample groups have lived in Southeast Denton with a *p* value of .014 refer to table 3.1. Forty eight percent of non random sample participants have lived in the neighborhood thirty one to fifty years, a vast difference compared to 40 percent of the random sample responding; one to fifteen years. The length of time a person has

lived in a neighborhood is often associated with a stronger attachment to their home or a personal investment into the future of the neighborhood. This is also true for those who have a long family history in the neighborhood. Residents who have recently moved to a neighborhood may feel less attached to the neighborhood and be more willing to relocate

Table 3.1. General Characteristics of Non Random and Random Sample Groups.

	Non Random		Random		P value
	Number	Percentage	Number	Percentage	
Resident					
Yes	25	100	15	100	
Yrs living in neigh.					
1-15	5	20	6	40	
16-30	3	12	3	20	
31-50	12	48	5	33	
51-75	4	16	1	7	
>75	1	4	0	0	
Mean	39 yrs		27 yrs		
Yrs family living in neighborhood					.014
1-15	3	12	6	40	
16-30	3	12	3	20	
31-50	12	48	4	26	
51-75	2	8	2	14	
>75	5	2	0	0	
Plans to move out					
Yes	1	4	3	20	
No	24	96	12	80	
Total	25	100	15	100	

The breakdown in race, age and gender in both sample groups are listed table 3.2. The non random sample represents a population of mostly female African

American senior citizens. Seventy six percent between the ages of fifty one and seventy, 96 percent African American and 84 percent are female. The random sample represents a population of younger, multi-race, equal gender. Forty seven percent are between twenty and forty years old, 46 percent are African American, 27 percent are White and 40 percent are male. These differences do not rise to the level of statistical significance.

Table 3.2. Non Random and Random Breakdown of Demographics.

Questionnaire Results	Non Random		Random	
	Number	Percentage	Number	Percentage
Sex				
Female	21	84	9	60
Male	4	16	6	40
Race/Origin				
Black	24	96	7	46
White	1	4	4	27
Hispanic (Origin)	0	0	4	27
Age				
20-40	1	4	7	47
41-50	1	4	1	7
51-70	19	76	2	13
>71	2	8	4	26
No response	2	8	1	7
Median		60-71		41-50
Martial Status				
Single	2	8	2	13
Married				
w/ kids at home	1	4	4	27
w/out kids	6	24	0	0
Extended Family	9	36	9	60
No response	7	28	0	0
Annual Income				
10-20,000	0	0	3	20
20-30,000	5	20	0	0
30-40,000	4	16	2	13
>40,000	2	8	1	7
No response	14	56	9	60
TOTAL	25	100	40	100

The use of multiple sampling methods results in a larger sample size increasing the accuracy of the data collection process. Responses from the total sample

population represent a broad range of reactions and viewpoints. The random and snowball results offer a nonbiased demographic with a wide range of ages, race, and length of residency in the neighborhood. In order to maintain the validity of the qualitative EJ assessment, responses from the total sample populations were analyzed in table 3.3.

The Southeast Denton total sample population is over 75 percent female and black. Fifty two percent are between the ages of 51-70. The majority of residents live with extended families in the household. Over half of the residents interviewed declined to reveal their annual income.

Table 3.3. Total Sample Population Breakdown of Demographics.

Questionnaire Results	Total Sample Population	
	Number	Percentage
Sex		
Female	30	75
Male	10	25
Race/Origin		
Black	31	78
White	5	12
Hispanic (Origin)	4	10
Age		
20-40	8	20
41-50	2	5
51-70	21	52
>71	6	15
No response	3	8
Martial Status		
Single	4	10
Married		
w/ kids at home	5	12
w/out kids	6	15
Extended Family	18	45
No response	7	18
Annual Income		
10-20,000	3	8
20-30,000	5	12
30-40,000	6	15
>40,000	3	8
No response	23	57
TOTAL	40	100

CHAPTER 4

ANALYSIS AND DISCUSSION

Several methods were used in this study to evaluate environmental justice problems along a proposed transportation corridor. The complexity of an environmental justice assessment requires such an approach. This section discusses the findings of the empirical and historical evidence, and evaluates the responses from Southeast Denton residents about their participation in the passenger rail line decision making process.

Median incomes selected around the five station locations were compared to the remaining county data (Table 4.1). The median incomes resulted in a large disparity between sample sizes, making it unsuitable for statistical analysis. It is important to note that median income is aggregated for each census block group, and the total number of households captured by the buffers represents 1,989 homes. The downtown Denton station is characterized with the lowest median household income compared to the other stations and the county. The median incomes selected around the downtown Denton study area are dramatically lower than the county. There is a thirty two thousand dollar gap in median income between the downtown Denton station and the county. Disparity in the raw data allows for confidence in the results that the community in close proximity to the downtown Denton station is economically stressed and has the highest potential for an environmental justice problem.

Table 4.1. Median Income Selected around each Proposed Station.

0.5 Median Income Buffer	Number of Block Groups	Total Number of Households	Mean Median Income
Downtown Denton	6	2,486	27,367.50
South Denton	5	4,241	39,970.00
Highland	4	2,566	67,921.00
Downtown and South Lewisville	2	1,986	44,920.00
County	205	171,469	59,375.00

The second median income analysis compared the data around the entire rail line to the county, using the nonparametric z test. The null hypothesis states that the buffer mean median income equals the county mean median income. Results indicated a *z* value of 0.76 and critical *p*-value of .444 therefore we can not reject the null hypothesis. The buffer and the county income levels are equal. This corresponds with the median income stations results; there is no significant statistical difference between income levels.

The mean of the percent minority was calculated for each study area and the county, refer to table 4.2. The selected population in the downtown Denton study area has the highest mean percent minority of 60 percent compared to the other stations and the county. Large sample sizes at the block level allowed for the application of a parametric test.

Table 4.2. Percent Minority around each Proposed Station.

0.5 Percent Minority Buffer	Number of Blocks	Total population	Mean Percent Minority	Bonferroni P value
Downtown Denton	66	3,029	60	.000
South Denton	13	2,427	14	1.000
Highland	17	1,620	14	1.000
Downtown Lewisville	27	754	33	.000
South Lewisville	5	2,501	24	1.000
County	5118	422,311	13	

One-way ANOVA; F= 95.7; P= .000

An ANOVA (analysis of variance) test was used to determine if there was significant difference between the means of the study areas and the remaining County data. If the mean of the percent minority are the same then no environmental injustice exists. But if one station has a significantly higher percent minority compared to the county, then there is potential for an environmental justice concerns. The null hypothesis states that the study areas mean percent minorities are not different. Analysis of variance yielded the following, the null hypothesis of no difference was rejected using a robust *p*-value = .000, the result indicates that at least one of the groups means differs from the other. The Bonferroni post hoc test was used for multiple comparisons and can be used to look for specific differences between pairs of groups. In this study the Bonferroni adjustment identified which study area had significantly different mean percent minority compared to the county. The downtown Denton and downtown Lewisville stations are significantly different than the county with a *p*-value of .000. There are high concentrations of minority populations next to these two stations; therefore they have the highest potential for environmental justice concerns.

The second percent minority analysis compared the data around the entire rail line to the county using a nonparametric z test. The null hypothesis states that the

buffer mean percent minority equals the county mean percent minority. Results indicated a *z* value of -7.48 and the critical *p*-value of .000 therefore we reject the null hypothesis. The mean percent minority are not equal. The buffer mean percent minority of twenty five is significantly higher compared to the county mean percent minority. The results emphasize that there is a higher concentration of minorities living adjacent to the proposed rail line.

History of Southeast Denton Neighborhood

The history of the Southeast Denton details how a minority community was excluded from the decision making process. In early 1922 residents of Quakertown, a community of freed slaves, were denied the ability to participate in the decision that relocated their entire community next to the Missouri-Kansas-Texas (MKT) rail line.

In the 1870's, Quakertown was situated near Texas Women's University. The boundaries included Withers Street on the north, McKinney Street to the south, and Vine Street on the east and Oakland Avenue on the west refer to figure 5. Quakertown was a settlement of freed slaves with churches, stores, and community organizations that thrived for several years. Glaze (1991) explains, "Quakertown's Fred Douglas School mysteriously burned on the eve of the 1913 school year, the city rebuilt it on a tract nearly one mile south of the original site between the branches of MKT and T&P railroads" (p.7).

> In March 1921 a petition was presented at the Denton city commission meeting to hold a bond election to purchase all the land encompassed by Quakertown and turn it into a city park. Members of the city commission included the president of Texas Women's university, current students and alumni. It was rumored various city commission members were Ku Klux Klan members. The University was growing and the black residents of Quakertown made them nervous (Glaze, 1991, p.8).

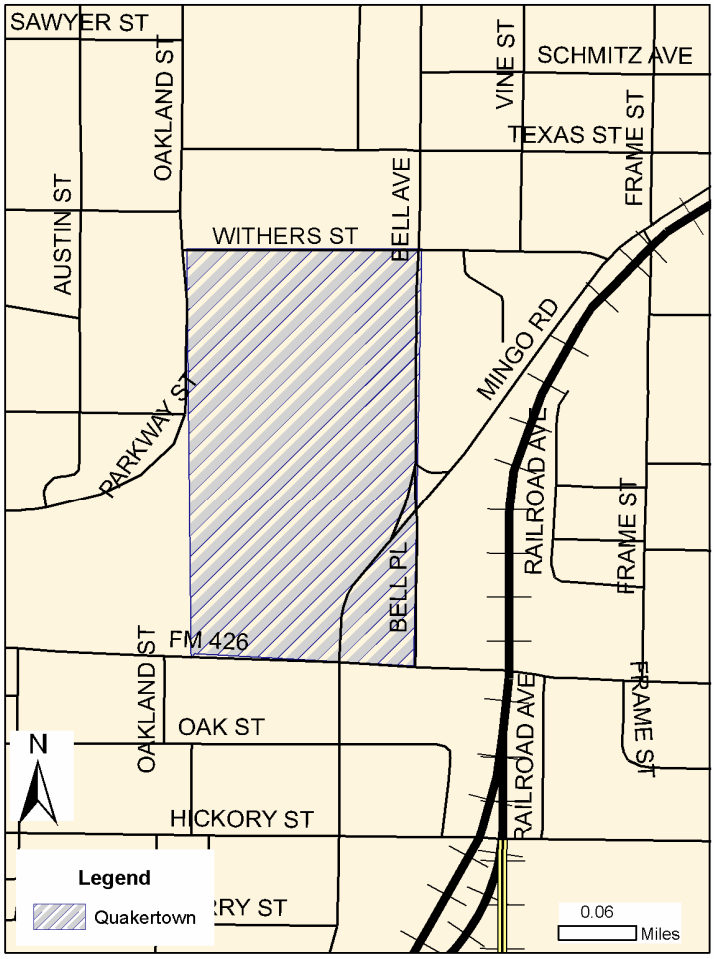

Figure 5. Quakertown.

In May of 1922, the bond election passed and the City of Denton began to purchase Quakertown properties. The election had been limited to property owners and their spouses. Glaze relates, “in 1922 southern blacks [had] little legal recourse” (1991). Residents were given a choice of selling their land and property outright or having their homes moved to Solomon Hill, one mile south next to the railroad tracks as a results “Quakertown soon disappeared” (Handbook of Texas, 2005).

Residents of Quakertown relocated to what is now known as the Southeast Denton neighborhood refer to figure 6. Originally, the MKT railroad ran from Dallas to Denton traveling through the Southeast Denton neighborhood. The rail line closed in

1932 (Cochran, 1992). For over 70 years, the residents have lived next to an innocuous transportation corridor. In 2002, eight miles of track through the City of Denton was converted to a multi-purpose bike path.

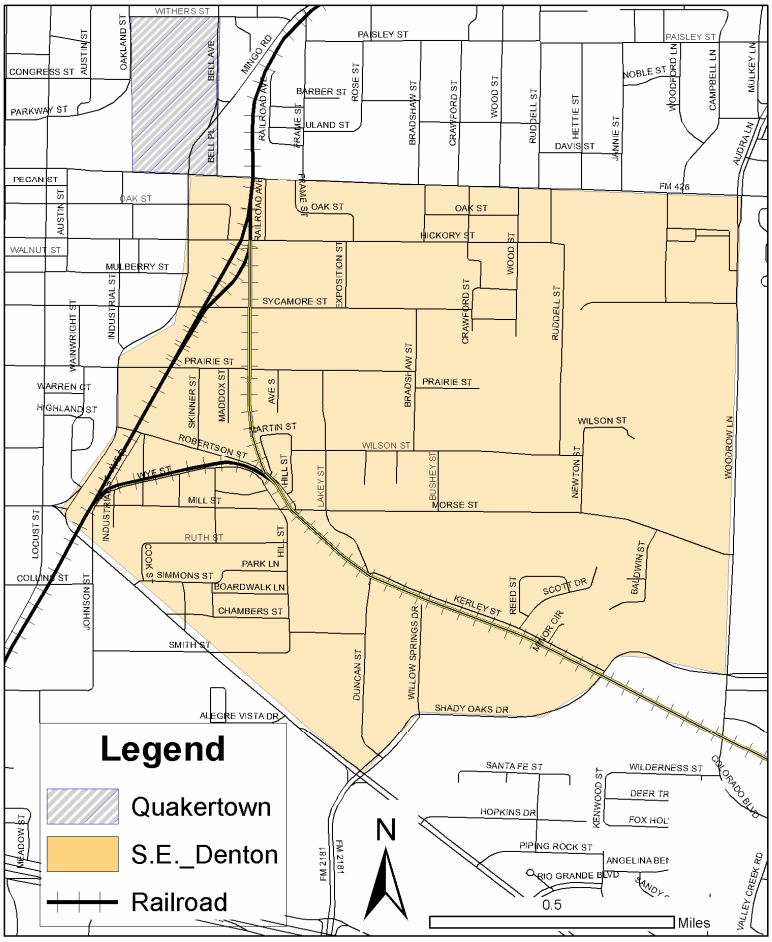

Figure 6. Southeast Denton Neighborhood and Quakertown.

Summary of Empirical and Historical Evidence

The results of an EJ assessment of a transportation corridor rely heavily on the prominence of low-income and minority populations and their proximity to the rail line. Empirical and historical data suggests the Southeast Denton neighborhood is an “at risk” population in close proximity to the downtown Denton station, refer to figure 7.

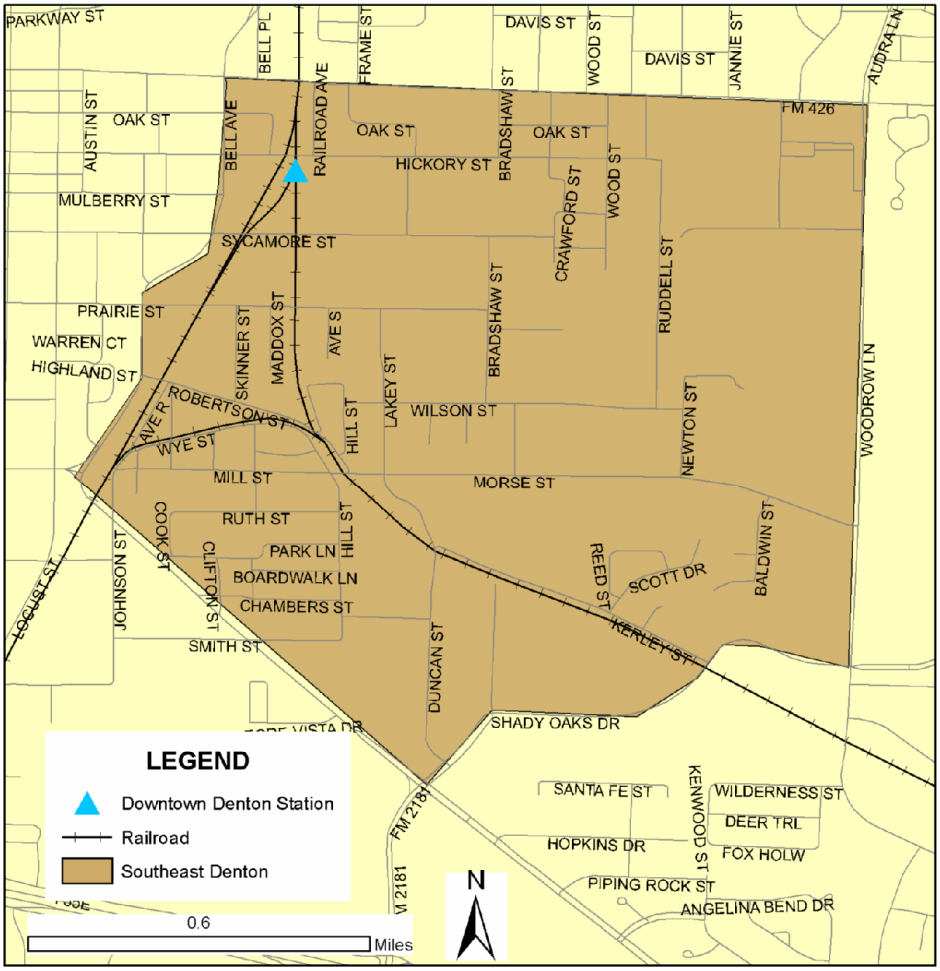

Figure 7. Southeast Denton Proximity to the Downtown Denton Station.

The percent minority statistical analysis indicated that the downtown Denton study area has a significantly higher percent minority compared to the county. The study of median incomes along the rail line resulted in a 30,000 dollar disparity between the downtown Denton station and the county. Based on this empirical evidence the population in close proximity to the downtown Denton station may be subjected to adverse and disproportionate effects from the expansion of the rail line.

The downtown Denton station is located within the boundaries of Southeast Denton neighborhood. The streets that delineate the neighborhood are East McKinney Street to North, S. Woodrow Lane to the East, South Bell Avenue to the West, and Dallas Drive to the South are their described boundaries, refer to figure 7. The history of Southeast Denton and its close proximity to the downtown Denton station suggest this community has the highest potential for environmental justice concerns along the proposed rail line. This evidence identifies a potential EJ community, but it is important to note that the definition of environmental justice also includes the fair and meaningful involvement for all with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. This study further asses environmental justice consequences by investigating the Southeast Denton residents' involvement in the decision making process.

Southeast Denton borders match census block group 0212.002. According to the 2000 census, 77 percent of the population is minority with a median household income of 27,198 dollars. Fifteen percent of the population is over 50 years old, refer to table 4.3.

Table 4.3. Demographics of the Southeast Denton Neighborhood.

Population	Number	Percentage
White	707	23
Minority*	2,110	77
Total	3,049	
Sex		
Female	1,220	40
Male	1,829	60
Age		
Male and Female over 50	485	15
Median Household Income 1999	27,198	

*Minority=African American, American Indian, and Asian alone, Some other race alone, two or more races.
Census 2000 Summary File 3; Block Group: 0212.002

Passenger Rail Line Decision Making Process

This portion of the study analyzes residents' involvement in the decision to locate the passenger rail on the border of their neighborhood. A questionnaire survey was used to convey the residents' perspective about the public process.

Resident participation in the public process begins with public meetings. This section will discuss the number of participants who attended a meeting sponsored by DCTA and the notification process. Responses to these open-ended questions reveal the quality of the communication process at the public meetings, and the verbal discourse between Southeast Denton residents and the transit authority.

Participants then rank issues related to the expansion of the passenger rail line. Responses to these open-ended questions address the quality of information sharing and whether the transit authority has considered their concerns in the decision making

process. Residents' responses demonstrate their perception of DCTA and the potential impacts from the rail line on their community.

Attendance and Notification Method

Public meetings are the setting for residents to communicate with a public agency. This process allows for public values to be articulated and incorporated into a democratic system of policy building. Information sharing and the consideration of citizens' concerns are keys to a successful public process; they can increase support for the agencies final decisions and improve the policy formation process (Kellogg & Mathur, 2003). It is the role of DCTA to manage how information about the construction of the proposed transportation project is distributed to the public.

Analysis of the public process begins with identifying the number of participants that attended a meeting and conveyed their concerns to DCTA. Forty percent of the respondents attended a meeting sponsored by Denton County Transportation Authority. This high percentage reveals that respondents are active participants in their community.

Table 4.4. Number of Participants that Attended a Meeting Sponsored by DCTA.

Attended Meeting	Number	Percentage
Yes	16	40
No	24	60
Total	40	100
N=40		

Through the interview process, residents revealed how they were notified of the public meetings. Participants were asked to rank the statement: "Denton County Transportation Authority provided timely notice of public meetings". It can be interpreted

from the cross tabulation in table 4.5 that 57 percent of those who attended the meeting thought that receipt of timely notice had no impact on their decision or ability to attend the meeting. It appears that timely notice makes a difference of only 7% in attendance of the meeting. This outcome suggests that the decision to attend a meeting was not influenced that much by the timely notification of the public meetings by DCTA.

Table 4.5. Cross Tabulation of Results, DCTA Provided Timely Notice to Public Meetings.

		DCTA provided timely notice of public meetings			
		Disagree	No opinion	Agree	Total
Attend Meeting	Yes	8 57.1%	1 6.7%	7 63.6%	16 40.0%
	No	6 42.9	14 93.3%	4 36.4%	24 60%
Total		14 100%	15 100%	11 100%	40 100%

Participants that felt that DCTA did not provide timely notice of the public meetings were asked to identify how they were notified. Fifty percent were notified by word of mouth. A strong network of community members notified each other about the meetings alerting residents about neighborhood news

Table 4.6. Notification Process.

Method of Notice	Number	Percentage
Word of Mouth	7	50
Paper	2	14
City	1	7
No response	4	29
Total	14	100
N=14		

Communication Process

Twenty seven percent of participants voiced their concerns to DCTA at a public meeting in an attempt to have their concerns considered in the decision making process refer to table 4.7. That the concerns were verbally communicated is reflective of the sample population demographics, 53 percent between the ages of 51-70. They are less likely to communicate concerns via the Internet or email. They prefer an intimate setting where all questions can be addressed and concerns are heard.

Table 4.7. Number of Participants Who Conveyed Their Concerns to DCTA.

Did you convey your concerns to DCTA with reference to the routing of the rail line?	Number	Percentage
Yes	11	27
No	29	73
Total	40	100
N=40		

Table 4.8. How did Residents Express Their Concerns?

Please choose the mode used to express your concern	Number	Percentage
Voice in a public meeting	10	90
By letter	0	0
By electronic email	0	0
By telephone	0	0
All of the above	1	10
Total	11	100
N=11		

Participants who voiced their concerns at meeting revealed the quality of information sharing by detailing the interaction between the residents and DCTA at the public meetings. Residents were asked in an open-ended question to express how

DCTA responded to their questions in table 4.9. Their perspective on the quality of answers provided by DCTA illustrates a break down of communication and limited information sharing. Southeast Denton residents are dissatisfied with the quality of answers they received and the manner in which they received them. Obstacles such as the structure of the meeting and feelings of mistrust interfered with their ability to influence policy.

Table 4.9. Summary of Open Responses, How DCTA Responded to Concerns.

Tell how DCTA responded to your question	Number	Percentage
Rhetoric	2	18
Structure of the meeting	1	9
Decision not finalized	4	37
Mistrust	2	18
No response from DCTA	2	18
Total	11	100
N=11		

One Southeast Denton resident conveyed how the transit authority answered their question. The summation of the statement below is best described as rhetoric.

> In the meeting they responded with very little information and a lot of rhetoric. They talked a lot and said nothing. Well, one specific question was who makes the decision or who is going to make the decisions, because the people talking to us weren't the decision makers. They then said the board will. So then I asked well who is here from the board? Are there any board members?
>
> There happen to be two there, so I asked them, well are you going to address my concerns of eminent domain? There are several places along the track where citizens' homes are very close; they have to have something done to them. The safety issues on Kurley, where kids play in the street all the time, now you are going to have a fast moving train going up and down. There are homes along various roads where they are going to have to signal the train is coming. They did not address that. Are we going to get the lights or not? They specifically said that is a city problem. The city has the decision there because they have to pay for that, if they use a certain lights. About the safety issue, they said "we will look into it", that statement, which I do not like.

This respondents' perspective below demonstrates how the structure of the meeting influenced residents' ability to participate in the public process.

> They would ignore people with hands up. Some meetings had a high turn out rate and they would stop the meeting after a certain time even if questions were not addressed or people did not have time to ask a question. The time amount during the meetings was an issue. The meeting would be cut off no matter how many hands were up.
>
> At the public meetings you would ask a question, then at the next public meeting there would be all new people conducting the meeting with different ground rules and more strenuous rules.

Residents' Concerns and Information Sharing

Citizens' concerns associated with the proposed rail line can aid the public authority in producing a policy grounded in citizen preference, which is more likely to be accepted by the community. The community's perceptions and opinions can identify concerns that public agencies overlook. What residents are most concerned about corresponds to what type of additional information they would like DCTA to provide. Residents believe that the transit authority has provided limited information about their greatest concerns.

Southeast Denton participants were asked to rank the importance of each statement associated with the construction of the proposed rail line. The Likert ranking method starts with the number one representing "not important" and five representing "very important". Each row references the statement and percentages are tallied in each column, and the final column ranks the statement by the mean. The results detail Southeast Denton's principle concerns refer to table 4.10.

Approximately 70 percent of participants' most important concerns were safety at intersections and increases in taxes. These items received the highest rankings. Safety

at intersections with a mean of 4.60 ranked slightly more important than an increase in taxes. Displacement of homes/eminent domain, buffers between homes and the rail line, and impact to future land use are concerns related to property; over 50 percent ranked property concerns as very important and all issues have a mean over 4.22. Overall, property ranked lower than safety at intersections and an increase in taxes.

Table 4.10. Ranking Concerns Related to the Expansion of the Rail Line.

Statement	1 Not Important	2 Slightly Important	3 No Opinion	4 Important	5 Very Important	Mean
Safety at Intersections	0	0	10	20	70	4.60
Increase in Taxes	2.5	0	15	12.5	70	4.47
Displacement of Homes or Eminent Domain	5	0	10	27.5	57.5	4.33
Mitigation or buffers between the rail line and homes	5	0	15	25	55	4.25
Impact to future land use	5	2.5	10	30	52.5	4.22
Air Pollution	2.5	2.5	15	32.5	47.5	4.20
Noise	10	5	12.5	17.5	55	4.03
Property Values	7.5	5	25	10	52.5	3.95
Vibration (shaking)	12.5	10	7.5	15	55	3.9
Diesel Fuel	7.5	10	17.5	25	40	3.8
Use of the Multi-purpose Bike Path	20	15	17.5	17.5	30	3.32
N=40						

Respondents' believe the most important environmental risks related to the expansion of the rail line are air pollution and noise. Air pollution, with a mean of 4.20, ranked the highest of environmental externalities and slightly more important than noise. Vibration/shaking and diesel fuel received the lowest environmental risk ranking.

As few as 30 percent of respondents ranked the use of the multi-purpose bike path as very important, it received the overall lowest ranking. Respondents' reaction to the use of the bike path is reflective of their senior citizen population. Residents ranked concerns according to what they feel are the greatest risk to their neighborhood.

Respondents' principle concerns correspond to the type of additional information they would like DCTA to provide the community. Over 50 percent of participants disagreed with the statement "DCTA has provided accurate information to the community" refer to table 4.11a.

Table 4.11a. Residents Assessment of Information Provided by DCTA.

DCTA has provided accurate information to the community?	Number	Percentage
Disagree	21	52
No Opinion	15	38
Agree	4	10
Total	40	100
N=40		

If they disagreed with the above statement, participants were asked what additional information they would like DCTA to provide for the community (Table 4.11b). An open-ended question allowed residents to detail the type of information.

Table 4.11b. Summary of Responses, Type of Information.

What additional information would you like DCTA to provide?	Number	Percentage
General Information	8	38
Externalities	4	19
Economics	7	33
No response	2	10
Total	21	100
N=21		

They wanted basic information about the proposed rail line.

> Well exactly what is going on with this rail? Where is it going be put and exactly the streets it's going to run through. I want to know how far it is going. We have not been told.

Information about environmental externalities was another theme.

> I would like to know where they are going to park over here is one of our concerns. There are several concerns we mentioned to DCTA and they said they are going to build a station, where is the station is going to be? They are not clear with everything. They have some hidden agenda that they are not bringing it out.

Issues related to property values and how the rail line is financed.

> Whether the tax increase would come about? If they would have to relocate homeowners, would they be willing to put the buffers up? I realize that there may be a tax increase to get it going.

> I think the people should be more informed. What is the financial support of the rail, the financing of it, the inconvenience to the residents, and the total purpose of the rail line? I know it is suppose to be, I guess to take so much traffic from the highway, but I still believe if people don't know the financing of it and the clarification of the total entailment of the route. Even though it is going to be a benefit, there are going to be some people who disagree with riding it. They would prefer driving than to riding the rail. We need to know specifically the route, pick up and let off.

Perception of the Potential Impacts on Their Community

The break down of the communication process and the lack of information pertaining to their greatest concerns can explain why 45 percent of Southeast Denton participants were unsure about the potential impact of the rail line on their community, refer to table 4.12.

> I am unsure at this moment. I am just unsure, because I still think more information needs to be more explicit.
>
> Unsure, it is coming right through our neighborhood; it is splitting houses and everything. Everybody needs to know that the people are going to be protected, all cross ways is going to be protected, the children that have to go across those things, there are a lot of children that ride bicycles and skate boards.

Table 4.12. Open Responses, Potential Impact of the Rail Line on Their Community.

The expansion of the commuter rail will have what kind of potential impact on your community?	Number	Percentage
Negative	9	22
Unsure	18	45
No Impact	0	0
Positive	7	18
No Opinion	6	15
Total	40	100
N=40		

They are unsure because there are potential positive and negative impacts.

> Unsure Pro part, it will cut down on traffic coming out of here as far as the highways, it will also decrease the property values being so close to our neighborhood and also it will be a lot of traffic going towards the downtown area, because people will be trying to get on the rail, to find parking. We really don't know how it is going to work. Around Hickory and Bell there will be congestion, there will be a need for widening for turning lanes.
>
> Negative, I think it is going to have an impact on some of the residents' property. I think there is going to be some eminent domain involved. I oppose eminent domain, because people have worked hard for their property. I just don't think they should put a rail system that close to the neighborhood, because I know exactly where it is going to run, along the bike path. There are residents very close to that particular trail. If I lived

on one of those streets I would not want the rail system to run right in front of my house. If I sit on my porch this is what I have to look at.

Positive, businesses are going to come all in up and down, to pay taxes. It will give poor people a cheap way to Dallas and other areas it runs to. The main thing is the economic impact on land values

Table 4.13. Summary of Why Participants Responded "Unsure" about Potential Impacts on Their Community.

Why did you respond "unsure" to the potential impact on your community?	Number	Percentage
Mistrust	2	11
Safety	1	5
Positive and Negative	7	39
Lack of Information	8	45
Total	18	100
N=18		

Mistrust in the Public Process

A common theme that surfaced throughout the interview process was mistrust in the public process. This interfered with their ability to influence policy. This mistrust has been exacerbated by the lack of information sharing at public meetings. Residents are suspicious of the transit authorities' intentions for the preferred choice of re-opening a transportation corridor through their community.

DCTA is willing to do what it takes to meet the requirements for funding. They come to address concerns at public meetings, but devise ways to dilute the meetings with high resident turn-outs from Corinth and restriction on time of meeting.

Unsure, would it be good for the community or would it be good for DCTA? Most likely it will be good for them. I do not want you think seem like I am against this thing, but I am against the way they are going about it. They are trying to go under cover with everything, then they wait till the last minute then they spring something on you, either they tell you something.

> First they said it the station would be on the other side of the Loop now they are talking about near here, down by the fire station. They are wishy washy, they are not telling the truth.

If residents feel that comments were not addressed at the public meetings and no follow-up meetings were scheduled then rumors replace fact.

> When they first came in they said that they were not going to upset the neighborhood or bother the plan, purchase land. Now, the real estate agents are sending out notices to different people in the neighborhood to sell their land because DCTA is coming through with the railroad. I know that DCTA are misleading the people.

> They have not addressed my comments. Well, I think they need to go into what they have already decided. Because they have a plan, that they have laid out. I think they need to be honest with the people about what they have already planned. I don't think they are being honest. They got the information, but they are just tipping on the surface.

> I asked them about the crime rate, parking and where would they get the land, is the land going to fall out of the sky. DCTA responded by saying they were not going to uproot anyone. I do not agree with what they are saying. I do not trust them.

In this study the environmental justice consequences of the expansion of the light rail line were identified using three strategies. These include analyzing empirical evidence, investigating local history information and evaluating citizens' participation in the decision making process. Analysis of percent minority data revealed a significant number of minorities around the downtown Denton station compared to the rest of Denton County. Median income comparison characterized the downtown Denton station with low income levels compared to the county and other stations. Empirical and significant historical evidence suggests that Southeast Denton residents will be adversely impacted by the expansion of the proposed light rail line. Residents were interviewed about their involvement in the decision making process. Their responses highlighted obstacles that hindered their ability to participate in decisions and contribute

their concerns. Residents were skeptical about the light rail project and dissatisfied in the public process.

CHAPTER 5

CONCLUSION

The study area for this research is the proposed expansion of a 23-mile transportation corridor and the construction of five stations along the rail alignment. Residents have been living adjacent to this inactive rail line for the past 70 years. It was only in 2002 that an 8-mile bike path replaced the abandoned railroad tracks in the City of Denton. Considerable change to a transportation corridor raises questions about environmental equity for those who live close to the line. This environmental justice assessment of a transportation corridor analyzed the number of minority and low-income populations adjacent to the line and evaluated their involvement in the public process.

The first research question of this study asked if the construction and operation of the proposed rail line will have a disproportionate impact on low-income and minority populations. Empirical and historical evidence was analyzed to answer this question. Percent minority analysis indicated that the downtown Denton study area had a significantly higher mean percent minority compared to Denton County. There are high concentrations of minorities adjacent to this proposed station. The downtown Denton study area is also characterized with the lowest median income compared to the other station locations and the county. There is a difference of thirty thousand dollars between the median income of the downtown Denton study area and the county. The disparity between the median incomes allows for confidence in the result that the population in close proximity to the downtown Denton station is economically disadvantaged.

This study stresses the importance of investigating the local history in an environmental justice assessment. Historical and social events are often the underlying processes that led to environmental justice concerns. A historical dimension is an important environmental justice indicator. The history of Southeast Denton is about an African American community excluded from the decision making process. This community has a history of being discriminated against and under represented. One finding of this research reveals that the proximity of the Southeast Denton to the downtown Denton station and its local history suggests that this neighborhood has the highest potential for environmental justice concerns along the proposed rail line.

An important aspect of environmental justice is the meaningful involvement of low-income and minority populations in the planning of a federally funded project. This study examined the process in a historic minority community. The second research question asked to what extent the Southeast Denton residents' involved in the decision is making process. Do they believe they have access to information and ability to influence decisions concerning the routing and planning of the rail line? Participants' responses revealed that obstacles such as the structure of the public meetings and the manner in which DCTA conducted public meetings led to dissatisfaction in the public process. Southeast Denton participants' believe that the transit authority has provided limited information about their principle concerns. The lack of information and the breakdown of the communication interfered with their ability to influence policy and exacerbated feelings of mistrust in the transit authority.

The Southeast Denton case study further emphasizes Robert Bullard's argument that market forces are not to blame for environmental injustice. Southeast Denton neighborhood is an established African American community. The environmental risks

are moving to them with the development of the transportation corridor. The passenger rail line will travel through their community.

Policy Implications

This research emphasizes the significance that history plays in understanding how environmental injustices develop. One policy suggestion is to include the history of a community in the methodology of an environmental justice assessment. The relocation of Quakertown citizens happened during a period in American history marked by the presence of the KKK and the movement for black suffrage. This historic event was not an isolated incident in time. During the qualitative portion of this study, the history of Quakertown and residents' perspective of past events were articulated. Participants believe that African Americans in the City of Denton were pushed to live within the Southeast Denton boundaries. For example one respondent said.

> The mistrust with DCTA is going back to I am sure you read about Quakertown, how they uprooted folks so TWU can because they did not want Quakertown next to TWU, they demanded residents to sell their land, so this rail line coming through is the same thing.
>
> Over 40 years ago, Southeast Denton was the only place African Americans could move
> to in Denton. You did not have a choice.

Residents remember the history of being underrepresented and denied access to the planning process. For example one respondent said.

> City of Denton has a reputation. Quakertown, the city stole the land and moved them out with shot guns here to Southeast Denton.

The second policy suggestion is that the public participation plan should be tailored to the demographics of the community. The transit authority is responsible for engineering and coordination of the regional light rail expansion in Denton County. The

public can get involved by posting a comment, participating in a public meeting, reviewing materials, or receiving e-mail updates. The fact that DCTA did hold public meetings and collected input from the public indicates that DCTA tried to engage the public in its decision making process. There are limitations to the process; meetings must have a time limit and some answers depend on the phase of the engineering. For example in this study the majority of participants who attended the public meeting were notified by word of mouth and voiced their opinions at the public meeting. This is reflective of the preferred mode of communication by a predominant African American, senior citizen community. Posting information on the website is less likely to be viewed by Southeast Denton residents. One resident commented on the quality of information provided at the public meetings.

> There was not a meeting alone specifically with our neighborhood. I would like information about the benefits of the expansion of the rail line for our community. I would like comparative information, on what happen somewhere else. No information was given to make an educated decision.

Residents believed that their concerns were not addressed during the meeting. A follow-up meeting would allow for further communication and information gathering. Improvements to the citizen participation can mitigate the mistrust in the community and empower residents with information. The ability to tailor the public process to the community relies on identifying the characteristics of an environmental justice community early in the planning process. This study has furthered the idea that early identification of an EJ community will build a partnership with the community by effectively involving the public and ultimately creating a transportation plan that fits the needs of the community. A plan grounded in citizen preferences will benefit the transit

authority and the community. Understanding the culture and knowing the history of a community is vital to an effective decision making process.

Research Limitations

Several conclusions surfaced about the limitations and weaknesses of this study. Designing the appropriate methodology to investigate potential environmental injustice concerns is complex. The quantitative portion of this study did not address the safety or health risks associated with the expansion of the passenger rail line. There is no standardized approach and the factors that cause EJ conditions are often multi-dimensional. As discussed in the literature review the results are often debatable. The choice of scale and measuring tools can influence results. The ability to capture the true boundaries of a community is the struggle of every EJ researcher. GIS is limited by its ability to select communities not defined by the Census Bureaus prescribed units of analysis. In this study, GIS tools selected income and minority populations around the proposed station locations for statistical analysis. The smallest unit of analysis for income is the census block group, which represents 600 to 3,000 people. Two of the proposed stations were in the same census block group, resulting in a small sample size and a test for significance was inconclusive. Another limitation to this study is that the passenger rail line public participation process is ongoing, time constraints did not permit scheduling follow-up interviews with the total sample population. Comparison of results may perhaps reveal a change in residents' perceptions of public process over time.

Future Research

The expansion of the transportation corridor generates numerous research questions beyond the scope of this study. Additional research is needed to further

develop the local history from the perspective of the Southeast Denton residents. All the information about Quakertown included in this research was generated from journal articles or open-ended responses. It is important to detail the history of Quakertown from the perspective of the residents. Evaluation of the public process could involve further investigation into the perspective of DCTA. This might provide insight into the restrictions they face when planning the public process such as time lines and budget.

A suggested direction of research is to gather substantial environmental risk data and perform comparative case studies. Conducting a purely environmental engineering or economic approach may demonstrate concrete environmental risks associated with the expansion of the rail line. Noise and traffic pattern data collected at current light rail stations might prove a disproportionate environmental burden. This study used the 0.5 mile buffer to select the characteristics of the population adjacent to the station locations. Suggestions for future research include collecting and comparing data at 0.25 buffer and 1mile buffer to create rigorous empirical EJ results. Expanding the sample population to include residents from Corinth, Lewisville or Highland Heights is another research topic. A comparative study of the ability of difference groups to influence public policy could serve as another avenue to identify environmental injustice.

Recent research has concentrated on the expansion of a light rail line and its impact on property values. The downtown Denton station is located with the boundary limits of Southeast Denton. Studies suggest that property values increase around the station compared to a decrease in property values along the line. This raises questions about future land use changes in Southeast Denton. Residents have raised questions about the lack of land to build homes in the neighborhood.

> This area is land locked no more room to build new homes. What they are going to do is buy land from people who own houses, before you know it. I live up on Park Lane, they want to get some extra land. They said they would not disturb land, but anyone who comes here know they need to take land. They will buy homes and land. They will want to buy people out.

Will market forces push residents out of their neighborhood? How will the expansion of the transportation corridor and the construction of the station impact land use and affordable housing in this community?

The interpretation of residents' responses represents a snapshot in time. Collecting public opinion and creating the environmental impact statement for the proposed RailDCTA line are a work in progress. There needs to be further communication between the residents and the transit authority to ensure transparency in the process.

APPENDIX

QUESTIONNAIRE

Researcher:
Colleen Moynihan, Graduate Student at the University of North Texas in the Department of Geography.

Purpose:
The purpose of this interview is to document the community's response to the expansion of the commuter rail, which is currently a multi-purpose recreational trail.

Confidentiality:
Only the researcher and thesis committee members will view all responses gathered from the interviews.

Thank you for your time!

Questions

What Streets make up the boundaries to your neighborhood?

How long have you lived in your neighborhood?

How long has your family lived in the neighborhood?

How long have you lived in Denton?

Do you have plans to move out of Denton, Texas?
If, yes why
If, no why

Below are lists of statements about the expansion of the commuter rail. Please rank the importance of each statement.

Safety at Intersections

Not Important Slightly Important Undecided Important Very Important

Noise

Not Important Slightly Important Undecided Important Very Important

Air Pollution

Not Important Slightly Important Undecided Important Very Important

Vibration (shaking)

Not Important Slightly Important Undecided Important Very Important

Property Values

Not Important Slightly Important Undecided Important Very Important

Mitigation: Buffers between Rail line and Homes

Not Important Slightly Important Undecided Important Very Important

Displacement of Homes: Eminent Domain

Not Important Slightly Important Undecided Important Very Important

Impact to Future Land Use

Not Important Slightly Important Undecided Important Very Important

Increase in Taxes

Not Important Slightly Important Undecided Important Very Important

The Use of the Multi-purpose Bike Path

Not Important Slightly Important Undecided Important Very Important

Diesel Fuel

Not Important Slightly Important Undecided Important Very Important

Other Concerns

Not Important Slightly Important Undecided Important Very Important

Have you attended a public meeting sponsored by DCTA concerning the expansion of the commuter rail?
Yes Maybe No

Please rank the following statements.

Did Denton County Transportation Authority provide the community with timely notice of the public meeting?
Strongly Disagree Disagree No Opinion Agree Strongly Agree

If you disagree, how were you notified about the meeting?

Denton County Transportation Authority has provided accurate information to the community?
Strongly Disagree Disagree No Opinion Agree Strongly Agree

If you disagree, what additional information would you like Denton County Transportation Authority to provide?

Denton County Transportation Authority has incorporated community ideas into the design plans?
Strongly Disagree Disagree No Opinion Agree Strongly Agree

Do you agree with the proposed Commuter rail station location in Denton?
Strongly Disagree Disagree No Opinion Agree Strongly Agree

If you disagree, what are your concerns with the proposed location of the DCTA stations?

Did Denton County Transportation Authority provide you information, when requested?
Strongly Disagree Disagree No Opinion Agree Strongly Agree

Did you convey your concerns to the Denton County Transportation Authority with reference to the routing of the rail line?
Yes Maybe No

Please choose the mode used to express your concern to DCTA
Voiced in public meeting
By letter
By electronic mail
By telephone
Through a group leader or member representing your concern
All of the above
Not available

Did DCTA respond to your concern?
Yes Maybe No

If your answer is yes, how DCTA responded to your concern
By letter
By electronic email
Verbally by officials at DCTA meeting
Not available
Other

If you chose verbally by officials at DCTA meetings, please explain in detail how the answers were communicated.

The expansion of the Commuter rail to Denton will have what kind of potential impact on your community? Please explain your choice.

Negative Unsure No Impact Positive No Opinion

Will you use the new commuter rail?
Yes Maybe No

Would you accept replacement value of your home from DCTA to relocate?
Yes Maybe No No Opinion

Do you live close to the bike path/ proposed commuter rail?

Address:

Sex:
M F

Race:
White
African American
Native American
Asian
Other

Origin
Hispanic

Age:
20-30
31-40
41-50
51-60
61-70
70+
Not Available

Size of Family Unit:
Single
No kids
Married with kids
Married without kids
Extended family
Not Available

Annual Income:

< $10,000-$20,000

$20,000-$30,000

$30,000-$40,000

> $40,000
Not Available

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