Technical Report Documentation Page

1. Report No. FHWA/TX-07/0-5208-1	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Identifying, Measuring, and Mitigating Environmental Justice Impacts of Toll Roads: Executive Summary Report		5. Report Date May 2006; Revised February 2007 6. Performing Organization Code
7. Author(s) Jolanda Prozzi, Isabel Victoria, Gerald Torres, C. Michael Walton, and Jorge Prozzi		8. Performing Organization Report No. 0-5208-1
9. Performing Organization Name and Address Center for Transportation Research The University of Texas at Austin 3208 Red River, Suite 200 Austin, TX 78705-2650		10. Work Unit No. (TRAIS) 11. Contract or Grant No. 0-5208
12. Sponsoring Agency Name and Address Texas Department of Transportation Research and Technology Implementation Office P.O. Box 5080 Austin, TX 78763-5080		13. Type of Report and Period Covered Technical Report: 9/1/2004–6/30/2006 14. Sponsoring Agency Code
15. Supplementary Notes Project performed in cooperation with the Texas Department of Transportation and the Federal Highway Administration.		
16. Abstract In 2004 the Texas Department of Transportation (TxDOT) funded the Center for Transportation Research at The University of Texas at Austin to develop a methodology to evaluate the environmental justice (EJ) impacts of toll roads given four scenarios: (a) the construction of new toll road(s), (b) converting existing non-toll roads to toll roads, (c) the tolling of capacity enhancements (e.g., additional main lanes or frontage roads to existing facilities), and (d) the conversion of planned non-toll roads to toll roads upon completion. This document presents an executive summary of the research performed in developing the EJ evaluation methodology to identify, measure, and mitigate disproportionately high or adverse impacts imposed on minority and low-income (EJ) communities by toll roads compared to non-toll roads.		
17. Key Words Environmental justice, toll roads, demographic profiles, environmental justice communities, toll road impacts, mitigation options, public participation techniques	18. Distribution Statement No restrictions. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161; www.ntis.gov.	

19. Security Classif. (of report)	20. Security Classif. (of this page)	21. No. of pages	22. Price
Unclassified	Unclassified	38	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Identifying, Measuring, and Mitigating Environmental Justice Impacts of Toll Roads: Executive Summary Report

Jolanda Prozzi
Isabel Victoria
Gerald Torres
C. Michael Walton
Jorge Prozzi

CTR Technical Report:	0-5208-1
Report Date:	May 2006; Revised February 2007
Project:	0-5208
Project Title:	*Evaluation of Environmental Justice Aspects of the Tolling of Existing Non-toll and Toll Roads*
Sponsoring Agency:	Texas Department of Transportation
Performing Agency:	Center for Transportation Research at The University of Texas at Austin

Project performed in cooperation with the Texas Department of Transportation and the Federal Highway Administration.

Center for Transportation Research
The University of Texas at Austin
3208 Red River
Austin, TX 78705

www.utexas.edu/research/ctr

Disclaimers

Author's Disclaimer: The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the Federal Highway Administration or the Texas Department of Transportation (TxDOT). This report does not constitute a standard, specification, or regulation.

Patent Disclaimer: There was no invention or discovery conceived or first actually reduced to practice in the course of or under this contract, including any art, method, process, machine manufacture, design or composition of matter, or any new useful improvement thereof, or any variety of plant, which is or may be patentable under the patent laws of the United States of America or any foreign country.

Engineering Disclaimer

NOT INTENDED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES.

Project Engineer: Jorge Alberto Prozzi
P. E. Designation: Research Supervisor

Acknowledgments

The authors wish to acknowledge the guidance and direction of the Texas Department of Transportation Project Monitoring Committee, which includes Project Director Jimmy Tyree (ENV), Project Coordinator Dianna Noble (ENV), and Project Monitoring Committee members Sarah Stroman (ENV), Chuck McLendon (ENV), Steve Wright (PIO), Amy Lamson (FHWA), and Mitch Batuzich (FHWA). Special thanks are also due to Megan Walters, Vanessa Rosales, Julie Wilke, and Michael Seifert for their enthusiasm and assistance during various stages of this research study. Finally, special thanks are due to Jan Slack (CTR) who provided administrative and word processing support in the production of this document.

Table of Contents

List of Figures

List of Tables

1. Introduction

Highway funding constraints have in recent years resulted in the financing of new roads and the modernization of existing roads through investments that will be recovered by toll charges. In Texas, toll equity and Regional Mobility Authorities (RMAs) are voter-approved financial tools to leverage limited state transportation funds. Potential benefits for the Texas Department of Transportation (TxDOT) include savings as RMAs take responsibility for developing infrastructure projects, reduced maintenance expenditures associated with reduced traffic on department facilities, and additional revenue sources (TxDOT, Regional Mobility Authorities: Proposed Preamble). On December 16, 2003, the Texas Transportation Commission thus unanimously approved a policy that directed the TxDOT, RMAs, private developers, counties, and regional toll authorities to evaluate the feasibility of tolling all controlled-access mobility projects in any phase of development or construction (TxDOT, 2004). This directive applied to the following: new facilities, increased capacity (for example, adding frontage roads to existing main lanes), the conversion of existing non-toll roads to toll roads, and the conversion of planned non-toll roads to toll roads. However, this directive has raised some questions about environmental justice (EJ) and its relationship to tolling.

EJ is an issue when minority or low-income communities (referred to as EJ communities) receive fewer benefits and either are or may be disproportionately burdened by transportation investments. The burdens may be the result of negative social, economic, or environmental impacts imposed on those living in the impacted toll project area. The objective of TxDOT research study 0-5208 was to present an approach for the identification, measurement, and mitigation of disproportionately high or adverse impacts imposed on minority and low-income (EJ) communities by toll roads compared to non-toll roads.

2. Background

EJ is "fundamentally about fairness toward the disadvantaged and often addresses the exclusion of racial and ethnic minorities from decision-making" (Cairns, Greig, and Wachs, 2003). In essence, the goal is thus to ensure that the benefits and burdens (i.e., air pollution, noise, injuries, fatalities, division of communities) are distributed in a manner that will promote a just and equitable society (Cairns, Greig, and Wachs, 2003).

2.1 Environmental Justice: A Legal Requirement and Administrative Directive

On February 11, 1994, President Bill Clinton signed Executive Order (EO) 12898 entitled "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." EO 12898 requires federal agencies to achieve EJ by identifying and addressing disproportionately high and adverse human health and environmental impacts on minority and low-income populations caused by proposed federal actions[1]. Specifically, the EO pointed agencies to the existing regulations contained in the National Environmental Policy Act of 1969 (NEPA), Title VI of the Civil Rights Act of 1964, and the laws that require public input and access to information (Hicks & Company and Rust Environment and Infrastructure, 1997). EO 12898 thus did not create new legal rights. It is not enforceable in a court of law, but an administrative procedure exists to ensure compliance. Figure 2.1 summarizes these three legal developments.

EO 12898 (1994)	**NEPA** (1969)	**Title VI of the Civil Rights Act** (1964)
Requires federal agencies to achieve EJ by identifying and addressing disproportionately high and adverse human health and environmental impacts on minority and low-income populations caused by proposed federal actions	Sets policy goals for the protection, maintenance, and enhancement of the environment	Prohibits discrimination on the basis of race, color, or national origin in participating in, or being denied benefits under any programs or activities that receive federal funding

Figure 2.1. Summaries of EO 12898, NEPA, and Title VI

In response to EO 12898, the U.S. DOT[2] and the Federal Highway Administration (FHWA)[3] issued their own EJ directives. EJ thus requires that a transportation agency determine whether a program, policy, project, or activity will impact minority or low income populations disproportionately and that these communities are:

---

1 Executive Order 12898. 1994. Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 59 Fed. Reg 7629 (section 1-101) (1994), 3 C.F.R. S 859, reprinted in 42 U.S.C. S4321. Available at http://www.epa.gov/fedsite/eo12898.htm.

2 DOT Order 5610.2 entitled "Department of Transportation Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (February 3, 1997).

3 FHWA Order 6640.23 entitled "FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (December 2, 1998).

- afforded an opportunity under Title VI to participate in the planning process to ensure a non-discriminatory process,
- involved in the identification of impacts associated with the project in an effort to determine if the effects suffered by these populations are disproportionately high, and
- involved in identifying mitigation and enhancement measures associated with a particular project (Novak and Joseph, 1996).

These requirements apply to both projects that receive federal funding or require a type of federal permit. EJ is a concern when:

- some communities benefit from improved access, faster trips, and congestion relief, while minority or low income communities receive fewer benefits,
- minority or low income communities are disproportionately impacted by transportation projects in terms of social, economic, and environmental burdens, or
- minority or low-income communities are less represented in decisions (Cairns, Greig, and Wachs, 2003).

The FHWA policy defined the EJ population groups as follows:

Minority	Black, Hispanic, Asian American, American Indian, or Alaskan Native person
Minority Populations	Any readily identifiable group of minority persons who live in geographic proximity, and if circumstances warrant, geographically dispersed/transient person (such as migrant workers or Native Americans)
Low-Income Person	An individual with a household income at or below the Department of Health and Human Services poverty guidelines
Low-Income Population	Any readily identifiable group of low-income persons who live in geographic proximity, and, if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who would be similarly affected by a proposed FHWA program, policy, or activity.

Note: According to the FHWA, the two terms minority and low-income populations "should not be presumptively combined" when conducting EJ analysis. There are minority populations of all income levels, and low income populations may be minority, non-minority, or a mix in a given area (Cambridge Systematics, Inc., 2002).

2.2 Toll Road Scenarios

Transportation pricing strategies irrespective of the objectives—whether it is to reduce traffic congestion, protect the natural environment, increase transportation revenues, or facilitate

the adding of capacity—generally raise equity concerns. Whether a toll has a disproportionate impact on EJ communities, however, is a function of how many lower-income drivers use the toll facility, how many are discouraged or prevented from using the toll facility, how many low-income drivers are priced out of discretionary trips (e.g., shopping trips and recreational trips), the quality of available alternative transportation options, and how toll revenues are used (Litman, 2005; Litman, 1996; Giuliano, 1994). The EJ analysis of toll roads is complex, as is evidenced by Table 2.1, which summarizes the relevant features of a toll road that may potentially impact EJ outcomes.

Table 2.1. Toll Road Features Relevant for EJ Analysis

Features	Examples
Type of facility	Toll roads with adjacent frontage roads as "free alternatives"
Demographic characteristics of the commuter population	High percentage of low-income/minority travelers and low percentage of high-income travelers
Demographic characteristics of the neighborhood adjacent to the facility	Facility to divide low-income African American neighborhood
Corridor alternatives, including non-auto mode	No non-toll road available Non-toll roads available as "frontage roads" Low frequency of public transit service
Access control	Limited access to local minority neighborhoods Improved access to sensitive places (i.e., hospitals)
Toll pricing structure	Flat rate Dynamic rate Differential rate (e.g., low-income commuters pay less than high-income commuters)

Different ecological, social, and economic impacts may result depending on the features of the toll road. For example, the conversion of an existing non-toll road into a toll road is more likely to have a disproportionate impact on a low-income community living adjacent to the road, especially if residents commute to work by car, than a new location facility. Four toll road scenarios (see Table 2.2) were conceptualized considering the tolling policy adopted on December 16, 2003 by the Texas Transportation Commission. The Commission's tolling policy applies to new location facilities (Scenario 3), capacity enhancements (for example, additional main lanes or frontage roads to existing facilities—Scenario 4), the conversion of existing non-toll roads into toll roads (Scenario 1), and the conversion of planned non-toll roads to toll roads upon completion (Scenario 2). The pricing structure for all four scenarios assumed a flat rate (i.e., constant toll irrespective of the day of week, time of day, level of congestion, or number of passengers in the vehicle).

Table 2.2. Toll Road Scenario Characteristics

Scenario Characteristics	Scenario 1	Scenario 2
Funding	Federal funding	Federal funding
Location	Existing location (existing road)	New location (new road)
Alternative non-toll road within the same right-of-way	No	Not applicable
Planned/Constructed	As a non-toll road	As a toll road
Operated	Initially operated as a non-toll road. Non-toll road converted into a toll road after a period of time.	As a toll road
Scenario Characteristics	**Scenario 3**	**Scenario 4**
Funding	Federal funding	Federal funding
Location	New location (new road)	Existing location (existing road)
Alternative non-toll road within the same right-of-way	Not applicable	Yes (frontage roads)
Planned/Constructed	As a non-toll road	As a non-toll road
Operated	As a toll road	Initially operated as a non-toll road. After a period of time, (a) the existing lanes are tolled and adjacent frontage roads are added as non-toll alternatives or (b) the new lanes built in the grass median are tolled and the existing lanes are kept as non-toll alternatives. In both cases, the new capacity is provided within the same right-of-way.

Texas law prescribes that the Texas Transportation Commission cannot convert a non-toll road segment into a toll road unless the public has "a reasonable alternative non-tolled route" (Texas Transportation Code Ann. § 370.035(2), Vernon 1999 & Supp. 2004). Since it is still unclear what this provision entails, scenario 1 was conceptualized with no non-toll road alternatives within the same right-of-way (ROW). Scenario 4 assumes adjacent frontage roads as the non-toll alternative within the same ROW. Finally, this provision does not apply to scenarios 2 and 3 as these represent new facilities.

3. Methodology for Assessing EJ Impacts of Toll Roads

In general, an EJ analysis is required when one of the following two conditions exists:

1. there is an EJ community in the impacted area, or
2. the adverse impacts caused by a transportation project could impact the EJ community disproportionately.

When one of these two conditions is met, the scoping part of the NEPA process has to be expanded to ensure that low-income and minority populations participate in project decisions and that opportunities are provided for them to become informed, and to voice their concerns. This research describes an EJ evaluation methodology (EJEM) to identify, measure, and mitigate EJ concerns associated with four defined toll road scenarios relative to non-toll roads. The methodology has two equally important components: an analysis/quantitative and an effective EJ participation component (see Figure 3.1).

3.1 Analysis/Quantitative Component

3.1.1 Who Would Be Impacted?

The first step is the identification of the population potentially impacted by the proposed toll road. When identifying impacted population groups at the project level, the scale of geographic analysis[4] selected is very important, because the geographic scale selected when identifying EJ communities (i.e., census tract, block, block group, and traffic analysis zone [TAZ]) could potentially affect the demographic profiles of the impacted area. For example, the identification of EJ communities using the conventional approach, which classifies communities into target (EJ) and non-target (non-EJ) populations using threshold values[5], is influenced by the geographic scale of analysis used. Figure 3.2 illustrates that the classification of target and non-target minority/low-income populations in the study area changed when the scale of geographic analysis (i.e., tracts, block groups, blocks, and TAZs) changed. The figure shows that the coarse scale of TAZs used in travel demand modeling might overlook smaller minority/low-income population groups and prevent the calculation of local impacts (e.g., calculate access to sensitive sites). A more complete classification of the EJ communities was obtained at the block level. It is therefore considered more appropriate to assess EJ concerns of toll-road projects when (a) the impacts are not uniformly distributed over the impacted area, (b) there is a possibility that

[4] Forkenbrock and Sheeley (2004) recommended the following scale of geographic analysis when using U.S. Census Data:

- states, counties, and census tracts for the initial assessment of corridor studies and when the impacts are assumed to be uniform over the affected area, and
- block, block group, and TAZs for detailed corridor-level and project-level assessment and when the impacts require a high degree of demographic resolution.

[5] When identifying EJ communities using the threshold approach, the demographics of the impacted area are compared with the demographics of a more general area (referred to as the community of comparison or COC).

smaller low income and minority communities might be overlooked at more aggregate levels of geographic analysis, and (c) the proposed toll project is perceived to be highly controversial.

The Technical Report 0-5208-2 entitled "Identifying, Measuring, and Mitigating Environmental Justice Impacts of Toll Roads" lists the variables captured by the census products that can be used for the identification of EJ populations. An income model—the *block-low-income model*[6]—was calibrated for conducting EJ analyses of toll-road projects that require a high degree of demographic resolution. For a detailed explanation of the model, see TxDOT Technical Report 0-5208-2.

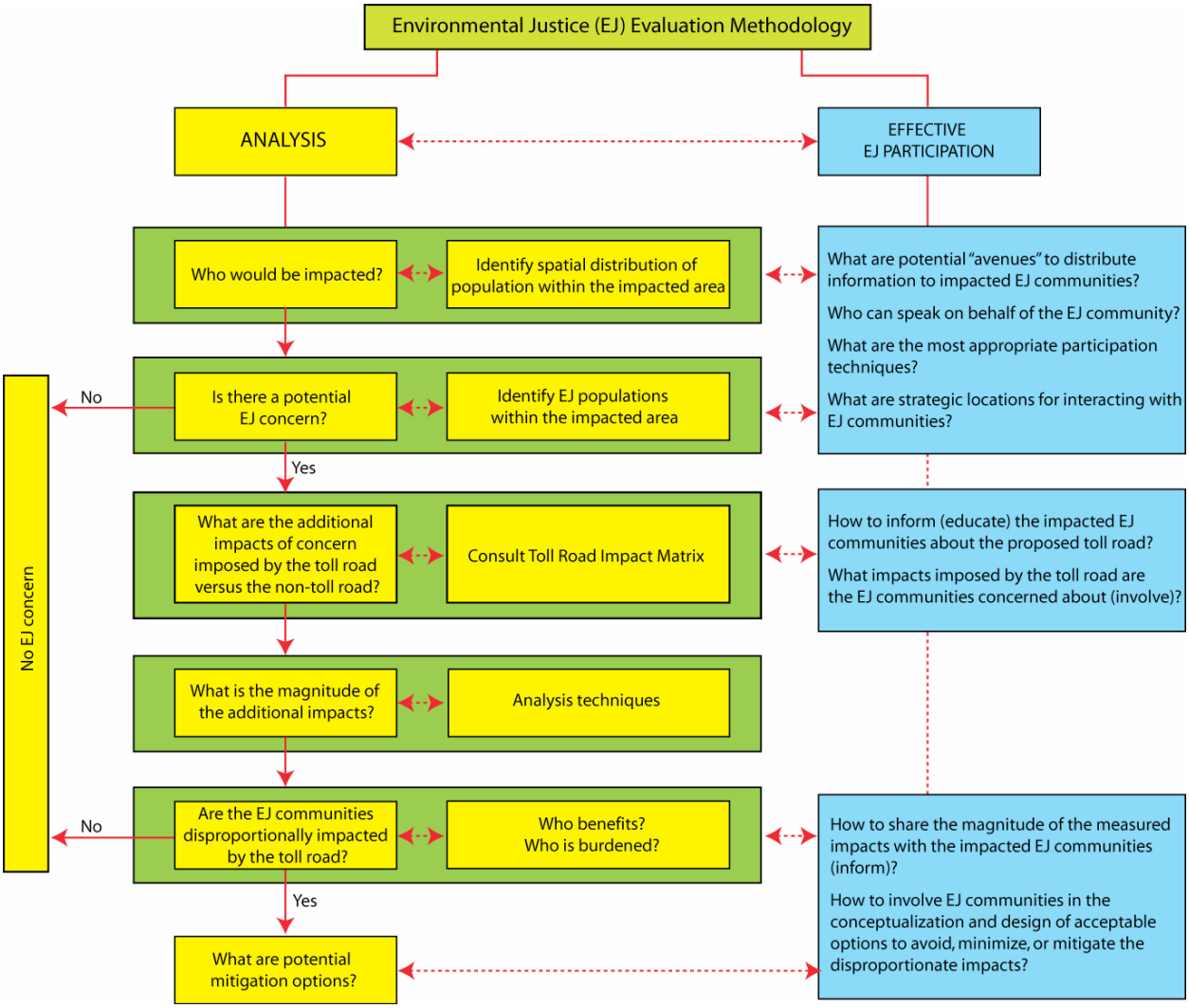

Figure 3.1. Environmental Justice Flowchart for Toll-Road Projects

[6] The block-low-income model was estimated using housing characteristics that are highly correlated with household-income. The model was built at the block group level, using available U.S. Census Data, to estimate low-income populations at the block level. This is possible because block groups are made up of blocks.

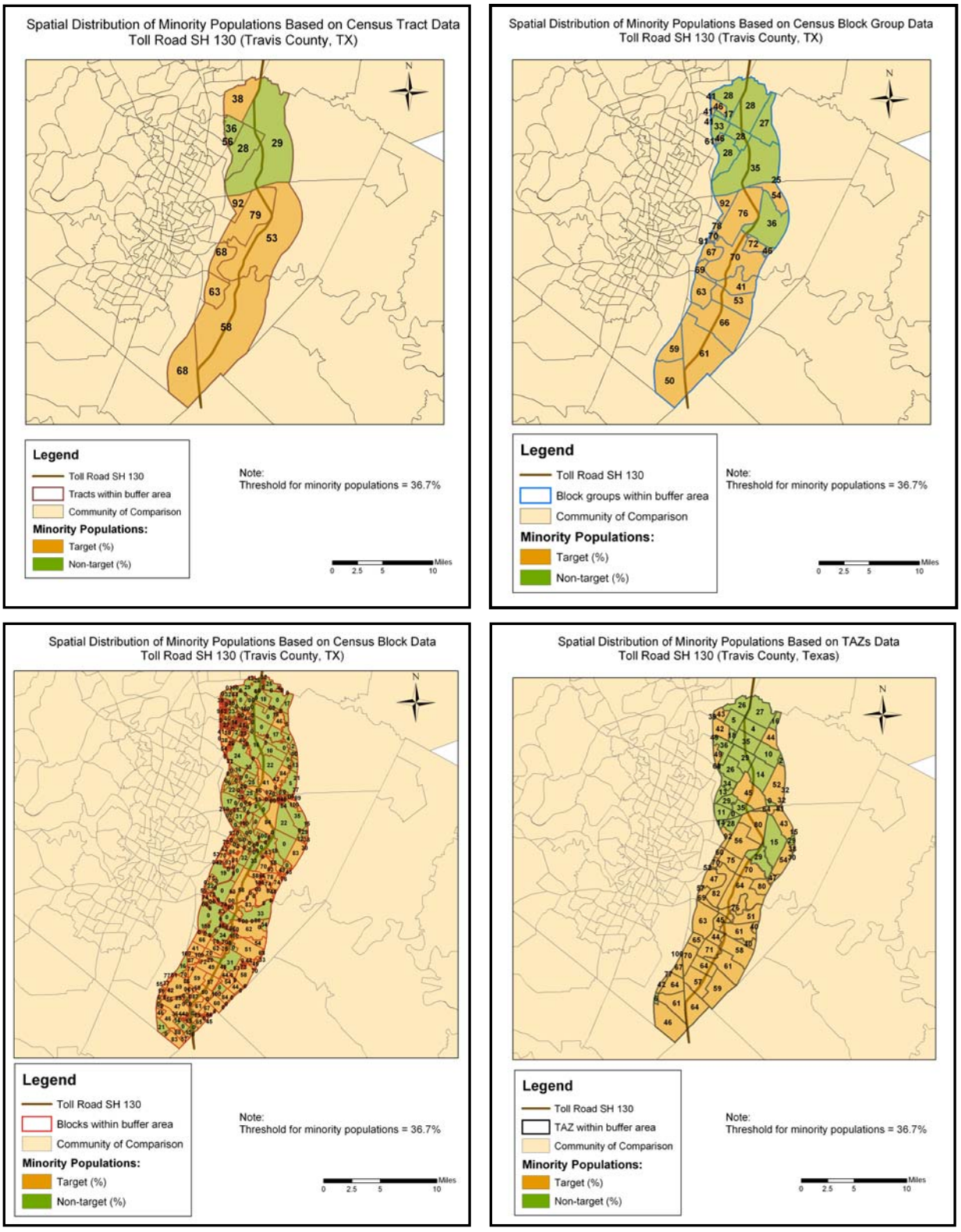

Figure 3.2. Spatial Distribution of Minority Populations Given Different Geographic Scales

3.1.2 Are EJ Concerns Present?

Step 2 identifies the EJ communities in the area impacted by the toll road. The Council on Environmental Quality (CEQ) guidelines (1997) states that an EJ community exists if one of the following conditions is present:

- The minority or low-income[7] population exceeds 50 percent in the impacted area.
- The minority or low-income population percentage in the impacted area is "meaningfully greater" than the minority or low-income population in the general population or other appropriate geographic area.
- There is more than one minority or low-income group present and the minority or low-income percentage, as calculated by summing all minority or low-income persons, meets one of the thresholds presented above.

The USDOT and the FHWA require minority populations to be examined separately from low-income populations, but they do not specify exact thresholds for distinguishing minority or low-income communities. In response to the limitations of the threshold approach—e.g., the influence of the geographic scale of analysis, the socio-demographic characteristics of the community of comparison (COC), and ultimately the geopolitical unit chosen (e.g., state, county, etc.) as the COC—this research proposed an innovative approach for compiling zones with small, medium, high, and extremely high levels (concentrations) of EJ populations within the impacted area (see Figure 3.3). The approach consists of the following three steps: First, the analyst calculates the percentage of EJ individuals in each geopolitical unit chosen by dividing the number of EJ individuals by the total population in the geopolitical unit. Second, the analyst determines concentration levels (e.g., small, medium, high, and extremely high) by ranking and grouping the percentages calculated in Step 1 by these categories. For example, if four concentration levels are specified, the geopolitical units with the lowest 25 percent of the percentages calculated would be considered units with small EJ population concentration levels. Finally, EJ concentration zones are compiled by grouping geopolitical units together that have the same value (i.e., low, medium, high or extremely high) and that share a boundary.

This approach overcomes some of the limitations of the threshold analysis. If notwithstanding the threshold approach is used, it is recommended that the COC specified is only one level more aggregate than the geopolitical unit chosen for developing the demographic profiles of the impacted area. Ultimately, the demographic profiles developed need to be validated through visual inspection techniques (e.g., windshield surveys) of a sample of geopolitical units.

[7] A low-income person is defined as an individual in a household whose median income is at or below the Department of Health and Human Service (HHS) poverty guidelines, but FHWA allows a state or region to adopt a higher income-threshold if it is not selectively implemented and if it includes all persons at or below the HHS poverty guidelines.

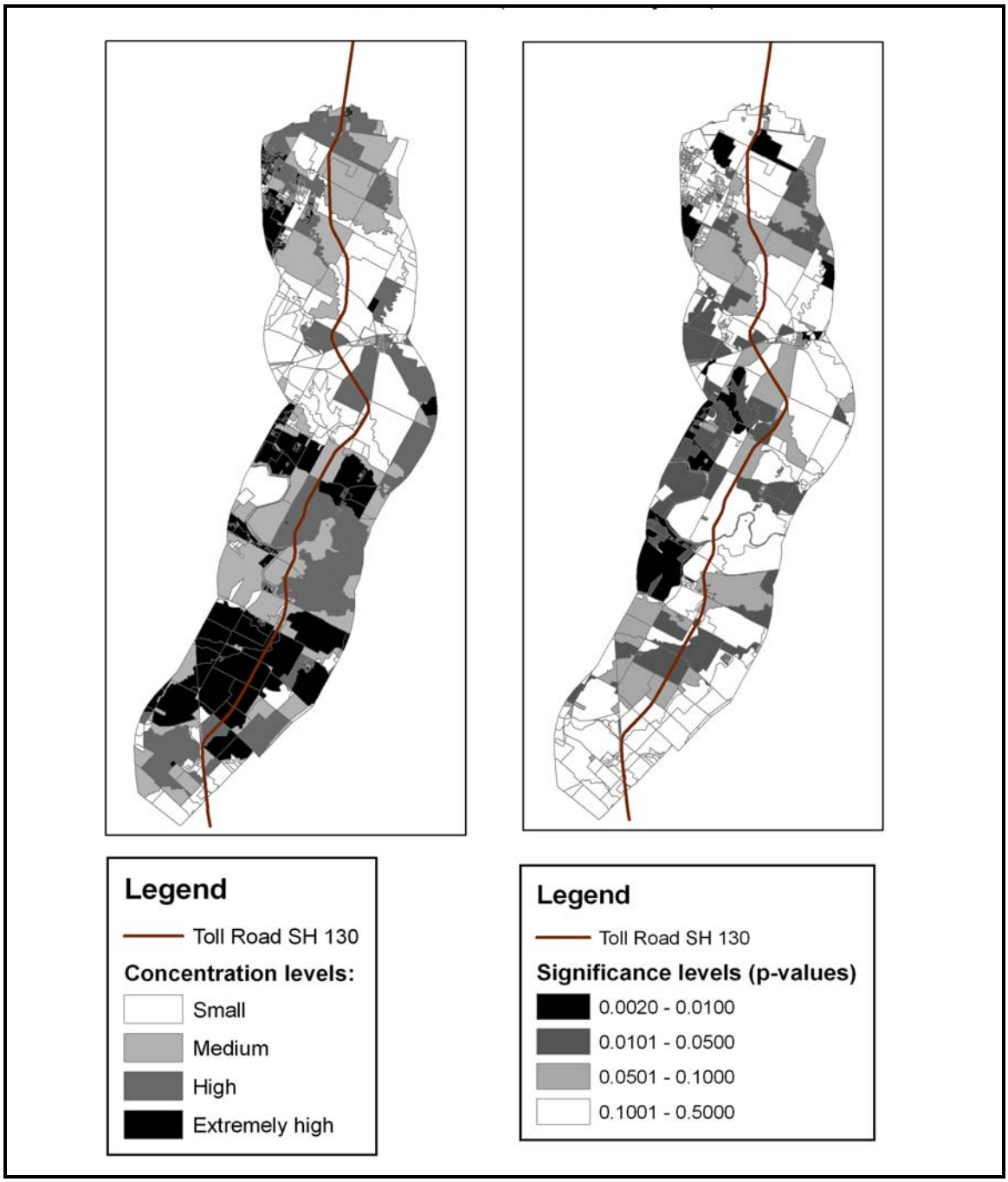

Figure 3.3. Minority Population Concentration Levels within the Impacted Area

3.1.3 What are the Additional Impacts of the Toll Road versus the Non-Toll Road?

Step 3 of the EJEM identifies the additional impacts of concern imposed by a toll road (alternative 2) compared to a non-toll road (alternative 1) given the four conceptualized scenarios (see Figure 3.4).

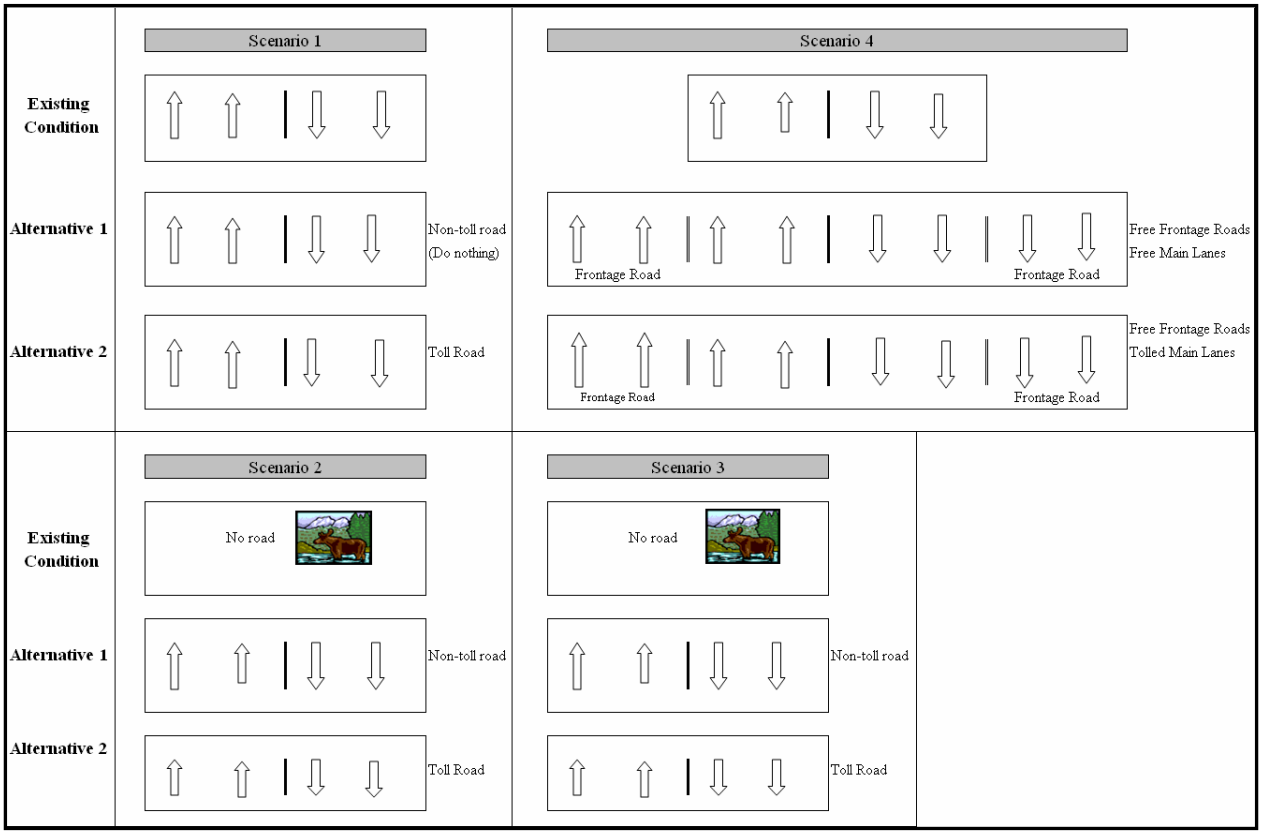

Figure 3.4. Schematic Representation of the Compared Alternatives Given the Four Studied Scenarios[8]

The following questions and sub-questions are examples of what needs to be answered when determining the additional impacts (i.e., benefits and burdens) imposed by toll roads on EJ communities compared to non-toll roads:

- What are the additional physical environmental quality impacts?
  - Will the toll road result in a substantial amount of traffic being diverted through an EJ community? If yes, what are the additional air pollution impacts? If yes, what are the additional noise impacts?
- What are the additional mobility and safety impacts?
  - Will the toll result in low-income drivers being "priced out" of certain trips?
  - What reasonable alternative transportation modes are available to those that cannot afford the toll?
  - Will EJ individuals be forced to use less desirable (to them) modes or routes to satisfy their mobility needs?
  - Are there adequate/reasonable non-tolled north/south and east/west corridors to serve as alternative roads?

[8] See Table 2.2 for an explanation of the toll scenarios.

  - Will diverted traffic through EJ communities impose a higher safety risk to local pedestrians and bicyclists?
  - How will the toll road impact transit (e.g., altered bus routes, transit times/schedules)?
- What are the additional social and economic impacts?
  - Will the non-toll alternatives be equitable in terms of travel time or distance?
  - How will the toll road impact business access for both customers and deliveries?
  - Will the toll road displace a larger number of residents and businesses compared to the non-toll roads?
  - How will the toll road impact property values (i.e., commercial vs. residential)?
  - How will the toll road impact the access of EJ communities to work, schools, hospitals, etc.?
- What are the additional cultural impacts?
  - How will the toll road impact access to cultural and recreational resources (e.g., historic sites, historic landmarks, etc.)?

The answers to these and other questions were the basis of a detailed *Toll Road Impact Matrix* included in TxDOT Technical Report 0-5208-R2 that may be used by the analyst as a reference when identifying the additional benefits and burdens associated with toll roads (alternative 2) as compared to non-toll roads (alternative 1).

3.1.4 What is the Magnitude of the Additional Impacts?

The objective of the EJEM is to determine whether a toll road would burden EJ populations disproportionately as compared to non-EJ populations. This requires the measurement of the additional impacts—both positive and negative—that minority and low-income populations are most likely to experience as a result of the proposed toll road. Step 4 of the EJEM thus measures the additional impacts associated with toll roads compared to non-toll roads. TxDOT Technical Report 0-5208-R2 provides guidance on the use of a number of analytical tools to measure the additional impacts of toll roads in terms of accessibility, air and noise quality, residential and commercial property values, and pedestrian and bicycle safety as conceptualized in the Toll Road Impact Matrix (see Table 3.1). The study further evaluated the proposed tools in terms of data needs, robustness, assumptions, required expertise, and cost.

Table 3.1. Analytical Tools to Measure the Additional Impacts

Effect	Impact	Recommended Tool
Mobility	• Access to work • Access to educational facilities • Access to healthcare facilities • Access to shopping centers	✓ TransCAD ✓ UrbanSim
Physical Environmental Quality	Air quality	✓ CALRoads View (CALINE4 + CAL3QHC + CAL3QHCR) ✓ MOBILE 6.2 ✓ EPA's CAMx ✓ SURFER (contours of pollutant concentrations)
	Noise quality	✓ FHWA's Traffic Noise Model (TNM)
Economic Development	Residential property values	✓ Property comparison (Appraiser's Opinion) ✓ UrbanSim
	Commercial property values	
Social	Pedestrian safety	✓ Pedestrian Danger Index
	Bicycle safety	✓ Bicycle Safety Index

3.1.5 Are the EJ Communities Disproportionately Impacted by the Toll Road?

This is arguably the least well-defined aspect of EJ analysis. No guidance is available from Title VI or EO 12898 as to the criteria for adverse or disproportionate and limited guidance is provided by the CEQ. Step 5 of the EJEM thus determines whether the impacts imposed by a toll road on zones with medium and high concentrations of EJ populations are statistically significantly higher compared to zones with low concentrations of EJ populations. This requires two sub-steps:

- *First,* the analyst needs to determine whether the measured impacts (Step 4) with the toll road (alternative 2) are statistically significantly higher than the measured impacts with the non-toll road (alternative 1) by EJ concentration level (i.e., vertical comparison).
- *Second,* if a statistically significant impact is imposed by the toll road, the analyst needs to determine whether the impact imposed on zones with high and medium concentrations of EJ populations are statistically significantly higher than the impact imposed on zones with no or low concentrations of EJ populations (i.e., horizontal comparison). Figure 3.5 provides a graphical representation of the vertical and horizontal comparisons that need to be undertaken.

Alternatives	EJ Concentration Zones					
	Low		Medium		High	
1 (non-toll road condition)	MI_{01}	↕ ↔	MI_{02}	↕ ↔	MI_{03}	↕ ↔
2 (toll road condition)	MI_{11}		MI_{12}		MI_{13}	

Notes: ↕ = comparison between the toll and non-toll alternative
↔ = comparison between impacted EJ concentration zones given a statistically significant impact
MI = measured impact

Figure 3.5. Comparisons Required to Determine Significant Impacts

The statistical test to determine whether there is a statistically significant difference between the impacts imposed by alternatives 1 and 2 (i.e., vertical comparison) is the "paired *t* test" based on paired data analysis. Given a statistically significant impact, the statistical test to determine whether the impact on zones with high and medium concentrations of EJ populations is significantly higher than on zones with no or low concentrations of EJ populations is a "large-sample test" based on differences between population proportions.

3.1.6 Are Potential Mitigation Options Available?

Step 6 of the EJEM identifies actions to mitigate or offset identified disproportionately high and adverse impacts imposed on zones with high and medium concentrations of EJ populations. Mitigation or enhancement measures comprise (1) avoiding or minimizing impacts by reducing the degree or magnitude of the implemented action, (2) mitigating or eliminating the impact by repairing, rehabilitating, or restoring the impacted environment or community resource, (3) reducing or eliminating the impact over time by long-term preservation and maintenance operations, and (4) compensating for the impact incurred. Table 3.2 lists a number of documented mitigation strategies that have been found acceptable by EJ communities to reduce or eliminate the impacts of highways and tolled facilities on their communities.

Table 3.2. Actions to Mitigate or Offset the Burdens Imposed by Toll Projects on EJ Communities

Impact	Mitigation Options
Neighborhood Effects	
Displaced	Temporary or permanent relocation of housing units Construction of new housing units Fair relocation benefits
Remaining residential properties	Renovation of housing units
Neighborhood cohesion, social interaction	Relocation of the entire community Renovation of public areas used for community activities
Disruption of areas of unique significance (cemeteries)	Relocation of graves
Neighborhood safety	Crossing guards at local schools during project construction
Neighborhood traffic patterns	Ban heavy vehicles from neighborhood streets
Access to work	Relocation site accessible by primary neighborhood transportation mode Use of toll revenue to finance transportation improvements, such as new or expanded transit services that benefit low-income travelers Increase the quantity and quality of low-cost transportation alternatives Provide toll exemptions to low-income travelers
Access to community facilities and services	Conversion of former buildings to community centers Construction of parks and community centers
Noise effect	Noise barriers to reduce highway noise levels Soundproofing systems at sensitive sites (e.g., churches)
Local Business Effects	
Displaced	Permanent relocation of businesses
Effects on employment	Fair share of contracts generated by the project earmarked for local businesses
Effects on business access	Maintain or enhance access to local businesses
Economic Development Effects	
Job creation	Fair employment opportunities for local residents during construction phase
Effects on income	Return toll revenue to low-income households in the form of reduced regressive taxes and improved social services Reduce general taxes or other user fees Redistribute toll revenues according to income (i.e., lowest-income individuals receive the largest compensation)

Sources: Litman (1999), FHWA (2000), Lee (2003), DeCorla-Souza and Skaer (2003), and Litman (2004)

Ultimately, however, mitigation actions have to be determined in consultation with the impacted EJ communities.

3.2 Effective Public (EJ) Participation

One of the core principles of EJ analysis is the "meaningful" involvement of minority and low-income communities potentially impacted by a proposed investment in the decision-making process surrounding the proposed investment. In general, transportation agencies recognize the need for and the clear benefits of EJ community participation in the decision-making process surrounding toll projects, but the tasks are often times more challenging than anticipated at first. This research outlines some of the key considerations in informing and involving EJ communities in toll road decisions, as well as guidance on which stages of the EJEM require EJ participation.

3.2.1 EJ Participation: General Approach

Public participation techniques have been well researched, but the meaningful involvement of EJ communities requires a new perspective and emphasis. Partly because conditions needs to be created that encourage the participation of people who likely do not have technical backgrounds, do not speak English, or do not have previous knowledge of toll road issues. A distinct approach is thus needed. The general approach to ensure meaningful participation at each step of the EJEM can be outlined as follows:

- Understanding the EJ community, including the barriers faced by EJ communities and options on how to overcome these barriers,
- Defining the goals of the EJ outreach/participation effort,
- Identifying and selecting the most appropriate participation technique(s), and
- Managing and implementing the selected participation technique(s).

Effective and meaningful EJ participation should, in principle, result in a win-win situation for both the impacted EJ communities and the transportation agency.

Understanding the EJ community

First and foremost, the analyst should gain a true understanding of the impacted EJ communities. Understanding the impacted EJ communities is critical to reaching out to these communities effectively and to distinguish the effort from public participation efforts in general. Without a true understanding of the impacted EJ communities and the barriers that prevent meaningful participation, the analyst risks selecting an inappropriate participation technique or event location. The U.S. Census captures information about a number of variables that can help the analyst to understand the community and identify potential barriers that might prevent participation in the outreach activities. However, besides basic demographic information, the analyst should also gain an understanding of the lifestyles and daily activities of minority and low-income populations potentially impacted by the proposed toll road to ensure that selected public participation techniques fit into their lives and, with proper management, get the most useful results. The analyst should be asking questions such as "How do members of this community live?" and "What do they do from day-to-day?" Although each community impacted by a proposed toll road would have unique barriers to participation, there are some common

barriers that might be expected (see Table 3.3). However, these barriers should be viewed only as a starting point.

Table 3.3. Typical Barriers Faced by EJ Communities

Barrier	Resulting Challenges
Individuals holding multiple jobs/unusual job hours	Time constraints prevent participation in community outreach activities
Low levels of education/ literacy issues	Less understanding of potential impacts of toll roads Less understanding of rights Unable to provide written responses/comments
Unique family structures (e.g., single parents, multi-generational families)	Time constraints prevent participation due to family obligations, such as caring for children and elderly
Less likely to have modes of personal transportation (i.e., private car)	Greater difficulty getting to community outreach activities Less concerned about toll road projects if they do not intend to use them
Less access to internet/technology/computer literacy issues	Use of Web sites and e-mails to inform and involve EJ communities would be ineffective
Language barriers	Less ability to participate in public involvement efforts Less aware of opportunities to influence toll road project outcomes
Distrust of government agencies	Less likely to participate in community outreach activities
Limited understanding of how a project will affect their lives and how participation in the process would benefit them	Less likely to participate in community outreach activities Need to convince people of their power to influence decisions
Cultural differences	Techniques need to be adapted to consider how cultural groups interact with one another and make decisions

TxDOT Technical Report 0-5208-2 and Product 0-5208-P2 list a number of measures that can be implemented to overcome the barriers listed in Table 3.3. Finally, it is important for the analyst to determine "How does the EJ community currently receive information?" Greater knowledge of the typical lives led by people in these communities enables planners to determine the community outreach efforts through which residents can best be reached.

Defining the goals of the EJ outreach/participation effort

The next step is to define the goals for the public participation efforts. The goals and what can be gained will vary depending on the community and the particular stage in the EJEM. This is an important step, because the analyst should be clear about the information provided to the community and the decisions they can impact to ensure a trusting relationship. Public participation efforts can be divided into "inform and involve" techniques (Creighton, 2005). In the case of EJ communities, it is foreseeable that more time will be required "informing" EJ communities as their interest in toll projects and their willingness to participate may not come as quickly as in other communities. Finally, the analyst must be aware of the difference between public consultation and public participation. Public consultation implies that the community is, for example, presented a plan with alternatives and then asked for their views and comments. The analyst takes these results and then decides which plan to put forward, bearing all of the responsibility for the decision. This is a much more passive way of involving the public and does not necessarily indicate that they have participated in the decision making. They have been considered but they essentially have no ownership or responsibility concerning the project decisions (Tyler, 2003).

Public involvement techniques

In selecting the most appropriate technique(s), the analyst has to consider everything learned about the community and select techniques that will overcome most of the barriers identified. These might be:

- proven techniques used in other projects,
- completely new techniques, or
- previously used techniques adapted to overcome the barriers to participation of the specific EJ community.

Table 3.4 lists a number of techniques and their strengths and weaknesses as EJ participation techniques.

Table 3.4. Public Participation Techniques

Participation Technique	Details	Strengths	Weaknesses
Personalized Involvement			
Walkabouts	• Door-to-door canvassing of neighborhoods • Inform and involve • Opportunities for surveys/interviews • Opportunities to distribute flyers	• Immediate communication with EJ community members • Takes the project and participation opportunities to the EJ communities • More likely to fit into lives of EJ people	• Large time commitment by agency • Relatively small number of people involved
Personalized Letters	• Send letters addressed to specific individuals • Send personal invitations to events • Send personal informative letters	• Makes an impact on community members if they think their opinions are important to the agency • More likely to capture public interest in the project	• Costly • Might not significantly increase attendance at events
Outreach Booth	• Similar to "info booths" • Set up stands at popular locations within the community • Provide information and involve community members	• Brings participation opportunities to the community • Flexible in terms of time and location • May overcome language barriers	• Not many people may take the time to learn about project and get involved
Local Teams			
Create a local team	• Team formed by local community members concerned about the project • Team help to inform and involve	• Increase attendance at community outreach activities • More personal • Community members relate to other community members better than to agency staff	• Requires substantial resources in terms of time, manpower, and funding • If the community is transitional or too divided, it may be hard to find leaders who are able to bring a strong effort to the community
Meeting Variations			
EJ Public Meeting	• Integrate in the activities people already partake in, such as church activities and community or school events • Increase attendance by having interpreters, refreshments, and staff available to care for children • Multiple meetings at varying times	• Facilitate a large number of community members to get together • Good attendance may produce a lot of results	• Risk low attendance • May not represent full spectrum of EJ community members
Open House	• Similar to public meeting but no speeches/lectures	• Lots of opportunities for feedback	• Risk low attendance • May not represent full

Participation Technique	Details	Strengths	Weaknesses
	• Lots of visual aids • Agency staff speaks to attendees on a one-to-one basis • Opportunities to do surveys/interviews	• Overcomes language barriers • Flexible in terms of time • Not as strict as public meeting	spectrum of EJ community members
Deliberative Polling®	• Representative sample of community participate in deliberations about proposed project • Exposed to continuing dialogue with experts and stakeholders • Participants are surveyed before and after deliberations	• Lots of opportunities for feedback • Informed judgments about toll projects	• Requires substantial resources in terms of time, manpower, and funding • Participants are required to meet at a specified location for a significant period of time (e.g., weekend) • Risk low participation if participants are not compensated • Significant number of barriers to participation (e.g., transportation to location, available time, etc.)
School Programs			
Create School Programs	• Programs to educate the children about the project and then parents receive information from children • Parents attend a school event where children present information and parents participate	• Flexible • Far-reaching • Overcomes language barriers • It can be designed to fit the specific community	• Not all community members connected to school
Media			
Using the Media	• Advertise events/information regarding project using the most popular media resources in area: newspaper, radio, TV, flyers, community news boards, etc.	• Flexible • It can reach a lot of people	• It does not guarantee increased involvement • It can be expensive

For a detailed discussion of various special techniques to enhance public participation, consult the FHWA document entitled "Public Involvement Techniques for Transportation Decision-Making" (FHWA and FTA, 1996).

Manage and implement the selected participation technique(s)

While the analyst might experience some level of success by simply getting the EJ community together, informing them about the toll project, and getting basic feedback, the process will be much more meaningful when managed well. This does not necessarily require the involvement of management experts but rather careful planning, organization and preparation.

Each of the public participation techniques listed in Table 3.4 will have specific management requirements, but there are several general concepts to keep in mind:

- Everything about the technique and the subsequent participation event needs to be well thought through and planned ahead of time. Any disorganization, down to the set up of seating or the position of posters, can lead to wasted time and effort on the day of the event.
- The location must be well prepared. Handout materials must be ready and translated into the languages spoken in the EJ community if English is not the only language spoken.
- Staff must be well trained and prepared in terms of what they have to say and ask, in order to give the best impression to the EJ community and extract the most useful contributions from those attending.
- Time management is essential and allotting time for different components of the event will be helpful in making the best use of the little interaction time the agency staff typically has with those participating.
- The analyst could demonstrate to the EJ communities that their inputs are important by showing EJ participants what was gained from past public participation efforts and how it affected the project outcome. This is especially important when the EJ community distrusts the agency.

3.2.2 Effective EJ Participation Component

EJ outreach efforts are foreseen in various stages of the EJEM to ensure that (1) all EJ communities are identified and given the opportunity to participate in a meaningful way, (2) all the adverse impacts are identified and prioritized, (3) the measured impacts are shared with the impacted EJ communities, and (4) effective mitigation options are designed in consultation with the impacted EJ communities to lessen or offset identified disproportionately high or adverse impacts.

Who would be impacted? Are EJ concerns present?

EJ communities should be invited to participate as early as possible. The goals of the EJ outreach effort during this step of the EJEM are to:

- Validate the U.S. Census data used to identify EJ communities within the impacted area.
- Identify potential "avenues" that can be used to distribute information about the proposed toll project to minority and low-income people living in the impacted area.
- Obtain input from those that can speak on behalf of the EJ community. In other words, identify and engage individuals that can speak on behalf of the impacted EJ communities, such as presidents of neighborhood associations, religious/community leaders, school district officials, environmental group leaders, leaders of charity organizations, elected local government representatives, and local health officials.

- Identify the most appropriate participation technique(s) for informing and involving the impacted EJ communities.
- Identify strategic locations for liaising with EJ communities.

A telephone survey and/or personalized letter and mail survey might be appropriate participation technique(s) to contact and engage individuals from community-based organizations that can speak on behalf of the impacted EJ community. During the survey, the analyst should ask questions that can help the analyst gain a better understanding of the impacted EJ communities and questions that can help in the development of future outreach activities.

What are the additional impacts of the toll road versus the non-toll road?

The goals during this step of the EJEM are to inform the EJ community about the proposed toll road project (educate the community), and to involve the community by obtaining their views and concerns about the impact the proposed toll project will have on their trips and community.

It is very important that the EJ community and representatives of the community are educated about the proposed toll project and understand the potential impacts to ensure an informed and meaningful discussion and prioritization of the impacts of concern surrounding toll roads relative to non-toll roads. The EJ analysis of toll road projects is especially complex, because toll roads may impose additional burdens as well as benefits on EJ communities compared to non-toll roads. Furthermore, EJ community residents might be unsure of how a toll road will impact them, especially if they do not have their own cars and tend to use public transportation. These benefits and burdens need to be identified and discussed with the impacted EJ communities.

Once the communities understand the technical issues and can articulate how they think the proposed toll road would impact their activity space (i.e., the places where they live, work, shop, and partake in other activities) meaningful and informed participation can be accomplished.

A number of avenues exist to share information about the proposed toll project, such as personalized letters, outreach booths, church bulletins, neighborhood organization newsletters, public meetings, open houses, and the media. On the other hand, focus groups, mail questionnaires, personal interviews, and walkabouts can be used to obtain the input of impacted EJ communities. At least two techniques, school programs and Deliberative Polling® can be used to both inform and involve the community.

Are the EJ communities disproportionately impacted by the toll road? What potential mitigation options available?

The goals of the EJ outreach effort during this step of the EJEM are to inform the EJ community about the magnitude of the additional impacts (benefits and burdens) associated with the proposed toll road project compared to the non-toll road (educate the community), and to involve the EJ community in the conceptualization and design of acceptable options to avoid, minimize, or mitigate any disproportionate impact on the community.

The analyst should present up front the measured benefits and burdens imposed by the toll road project on the EJ communities calculated in steps 4 and 5 of the analytical component of the EJEM. Once the EJ communities have gained an understanding of how they will be

impacted by the toll road, appropriate mitigation options can be designed. EJ communities should actively participate in problem solving to mitigate or remediate the adverse impacts imposed on their communities. Ultimately, these mitigation options should help ensure that the toll road project is designed, built, and operated without disproportionate burdening the EJ community.

A number of avenues exist to share information about the impacts of the proposed toll project, such as personalized letters, outreach booths, public meetings, and open houses. On the other hand, focus groups and Deliberative Polling® may be appropriate tools to obtain the input of community members regarding potential mitigation option.

4. Concluding Remarks

The reports and products developed in this research study provide TxDOT transportation planners and environmental coordinators with a robust and defendable methodology to address EJ concerns associated with toll road projects in Texas. It is thus recommended that TxDOT pilot this proposed methodology in one or two districts considering toll road projects to test and validate the proposed approach.

References

Cairns, S., J. Greig, and M. Wachs. *Environmental Justice and Transportation: A Citizen's Handbook*. Institute of Transportation Studies, University of California Berkeley, 2003.

Cambridge Systematics, Inc. *Technical Methods to Support Analysis of Environmental Justice Issues*. NCHRP Project 8-36(11). Transportation Research Board, National Research Council, Washington, D.C.: National Academic Press, 2002, pp 3-11.

Council on Environmental Quality. *Environmental Justice Guidance under the National Environmental Policy Act*, 1997, pp. 25. Available at http://ceq.eh.doe.gov/nepa/regs/ej/ej.pdf

Creighton, J.I. *The Public Participation Handbook: Making Better Decisions through Citizen Involvement*. John Wiley & Sons, Inc., San Francisco, CA, 2005.

DeCorla-Souza, P. and F. Skaer. "Mainstreaming Pricing Alternatives in the NEPA Project Development Process." *Transportation Research Record 1859*, 2003, pp 1-8.

Executive Order 12898. *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, 59 Fed. Reg 7629 (section 1-101) (1994), 3 C.F.R. S 859, reprinted in 42 U.S.C. S4321. Available at http://www.epa.gov/fedsite/eo12898.htm.

Federal Highway Administration and Federal Transit Administration. *Public Involvement Techniques for Transportation Decision-Making*. Publication No. FHWA-PD-96-031. Available at http://www.fhwa.dot.gov/reports/pittd/cover.htm, 1996.

Federal Highway Administration. *FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, DOT Order 6640.23. U.S. Department of Transportation, Federal Highway Administration, 1998.

Federal Highway Administration. *Transportation and Environmental Justice. Case Studies*. Available at http://www.fhwa.dot.gov/environment/ejustice/case/index.htm. December, 2000.

Forkenbrock, D.J. and J. Sheeley. *Effective Methods for Environmental Justice Assessment*. NCHRP Report 532. Transportation Research Board, National Research Council. Washington, DC: National Academic Press, 2004, pp 31.

Giuliano, G. "Equity and Fairness Considerations of Congestion Pricing." *Curbing Gridlock*. Vol. 2. Transportation Research Board, 1994.

Hicks & Company and Rust Environment & Infrastructure. *Preliminary Draft Environmental Impact Statement: State Highway 130 – Segment B from U.S. 290 East of Austin to the*

Intersection of U.S. 183 and F.M. 1185. Prepared for the Texas Department of Transportation, Austin District, 1997.

Lee, D.B. Distribution Impacts of Congestion Pricing. International Symposium on Road Pricing. 2003. Online. Available at http://trb.org/Conferences/RoadPricing/Presentations/Lee.ppt.

Litman, T. "Using Road Pricing Revenue: Economic Efficiency and Equity Considerations." *Transportation Research Record 1558*, Transportation Research Board, 1996, pp. 24-28.

Litman, T. *Using Road Pricing Revenue: Economic Efficiency and Equity Considerations*. Victoria Transportation Policy Institute, 1999. Online. Available at www.vtpi.org/revenue.pdf.

Litman, T. *Evaluating Transportation Equity*. Victoria Transportation Policy Institute, 2004. Online. Available at www.vtpi.org/equity.pdf. Accessed February 3, 2005.

Novak, W.J., and E. Joseph. *Environmental Justice: Methodologies Used to Assess Disproportionate Impacts.* Paper presented at the 75th Annual Meeting of the Transportation Research Board, National Research Council, Washington, D.C., January 1996.

Texas Department of Transportation. *Regional Mobility Authorities: Proposed Preamble*. Available at http://www.dot.state.tx.us.

Texas Department of Transportation. *Guidance on the Environmental Process for Toll Roads*, 2004.

Texas Transportation Code Ann. § 370.035(2). Vernon 1999 & Supplement 2004.

Tyler, N. "Practical Experience of Public Participation: Evidence from Methodological Experiments," *European Journal of Social Science Research*. Vol. 16, No. 3, 2003, pp. 267-284.