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Impact of Environmental Justice Analysis on Transportation Planning

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TABLE OF CONTENTS

TABLE OF CONTENTS	ii
LIST OF TABLES AND FIGURES	iii
LIST OF ACRONYMS	iv
DISCLAIMER	v
EXECUTIVE SUMMARY	vi
STUDY BACKGROUND, OBJECTIVES AND APPROACH	1
EJ COMMON AND EFFECTIVE PRACTICES	4
ENVIRONMENTAL JUSTICE MATURATION MODEL	10
GDOT INTERNAL ASSESSMENT: FINDINGS	12
GAP ANALYSIS	13
CONCLUSIONS AND RECOMMENDATIONS	19
REFERENCES	21
APPENDICES	
LITERATURE REVIEW	
SUMMARY OF SURVEY RESULTS	
GDOT INTERNAL ASSESSMENT REPORT*	
GAP ANALYSIS REPORT	
EJ TECHNICAL ANALYSIS REPORT	

*Stand-alone/confidential document

List of Tables and Figures

List of Tables

TABLE 1: Macro-Level and Micro-Level EJ Analysis

TABLE 2: Performance Measures for Environmental Justice

TABLE 3: Typology of Environmental Justice Programs and Key Practices

TABLE 4: EJ Maturation Model Phase 1 - Process and Burdens

TABLE 5: EJ Maturation Model Phase 2 – Evaluation of Benefits and Burdens

TABLE 6: EJ Maturation Model Phase 3 – Decision Making: Linkage to Resources

List of Figures

FIGURE 1: EJ Maturation Model Showing Application Phases

List of Acronyms

ARC: Atlanta Regional Council
DOT: Department of Transportation
EJ: Environmental Justice
EO: Executive Order
FHWA: Federal Highway Administration
FTA: Federal Transit Administration
GDOT: Georgia Department of Transportation
NEPA: National Environmental Policy Act
STIP: State Transportation Improvement Program

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 views and policies of the Georgia Department of Transportation. This report does not constitute a standard, specification or regulation.

Executive Summary

This report presents the findings of a study sponsored by the Georgia Department of Transportation (GDOT): Impact of Environmental Justice (EJ) on Transportation Planning. The objectives of the study were to determine the state of the practice of EJ in Transportation, assess the status of EJ implementation at GDOT, and make recommendations for next steps for the agency to enhance its capabilities for demonstrating EJ outcomes.

The study was conducted through a review of the EJ and Transportation literature to determine common and effective practices; an internal assessment of GDOT's policies, programs and activities in EJ; the development of a maturation model based on a comparison of the Federal guidelines for EJ in Transportation with the state of the practice in state Departments of Transportation (DOTs); a targeted survey of state DOTs with common and effective practices, and a gap analysis applying the maturation model to the surveyed state DOTs and GDOT to determine next steps for GDOT to enhance its capabilities for demonstrating EJ outcomes. The maturation model depicts various phases of EJ policies, programs and activities at state DOTs, with respect to achieving EJ outcomes. This model was applied to nine different programs to benchmark GDOT's program along a range of maturing programs and to help identify opportunities to enhance the program at GDOT. The maturation model includes a first phase that focuses on putting policies, processes and tools in place for involving target groups in project development and evaluating the disproportionality of benefits and burdens. The second phase of the model focuses on evaluating the outcomes of EJ actions (in terms of both benefits and burdens) either through technical analysis or evaluation of the general public or target groups. The third phase focuses on linking the EJ analysis results (from the second phase) with resource allocation decisions, and the development of policies to ensure that intended EJ outcomes are being met.

The literature review and survey showed that several state DOTs are operating at a phase I level of maturation, having adopted standard policies for EJ, developed technical capabilities for evaluating the disproportionality of burdens, and implemented public involvement processes. Fewer agencies were found in phase II, evaluating the intended outcomes (i.e., benefits and burdens) of EJ actions. None of the eight DOTs surveyed was operating in phase III by linking EJ analysis results in phase II to resource allocation and policymaking decisions. Two state DOTs however were conducting research to enable them to perform systems evaluation, and assess cumulative impacts, in order to link the outcomes of EJ actions with resource allocation decisions and policymaking.

The gap analysis showed the GDOT is operating at phase I maturation level in maintaining citizen group lists, identifying disproportionate impacts of projects on target groups, and documenting EJ through the National Environmental Policy Act (NEPA) structure. Based on the requirements of the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) EJ guidelines, and the state of the common and effective practices identified, the report recommends that GDOT develop a formal EJ plan or standardized EJ guidelines; include formal guidelines for addressing EJ in the agency's existing public involvement plan, and develop technical capabilities for identifying disproportionate impacts of projects on target groups. The agency can also assess which other phase I actions can enhance its standard operating procedures and adopt them. Beyond phase I, GDOT could apply performance measures and/or survey target groups to measure outcomes of EJ actions (i.e., to measure the benefits and burdens of projects and determine if intended outcomes are being achieved). In moving toward best practice status, GDOT could learn from the research results of such agencies as Arizona DOT and Colorado DOT (and other state DOTs conducting research to help link EJ outcomes with resource allocation and policymaking) to develop capabilities for systems-level EJ evaluation and cumulative impact EJ assessments, in order to link EJ outcomes with resource allocation decision making and EJ policymaking.

1. Study Background, Objectives and Approach

1.1 Executive Order, Laws and Policies

Environmental Justice (EJ) became a national issue in the early 1980s when a North Carolina community protest led to a federal investigation on the location of toxic waste landfills in the South. The resulting study by the United States General Accounting Office revealed that a disproportionately high number of such facilities were sited in low-income and minority neighborhoods throughout the region (Owens et al. 2008). EJ requirements were formally mandated by President Clinton in 1994 with the signing of Executive Order (EO) 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations), which requires that all federally-funded programs develop policies and programs to achieve EJ.

The EO effectively brought together two previous regulations: Title VI of the 1964 Civil Rights Act, which focuses on nondiscrimination, and the 1969 National Environmental Policy Act (NEPA) which focuses on protecting the natural environment. These two Acts established the basis and provided the required authority for the EJ concept. The transportation community however did not outline specific goals and regulations until the subsequent Department of Transportation (DOT) Order 5610.2 in 1997. The Federal Highway Administration (FHWA) issued DOT Order 6640.23 in 1998, and the FHWA and Federal Transit Administration (FTA) issued a memo in 1999, each providing more specific details for regulating and monitoring transportation activities for achieving EJ.

The target groups to be considered in EJ are Black, Hispanic, Asian, American Indian and Alaskan Native, Low-income and more recently Native Hawaiian or Other Pacific Islander. While not explicitly stated in the original EJ EO, the elderly, disabled and child population groups were listed as target groups in the 2004 EO 13330 (Human Service Transportation Coordination) and are considered in practice (FHWA EJ Website).

1.2 Fundamental Principles of Environmental Justice in Transportation

Specifically, the FHWA and FTA define EJ as having three fundamental principles (FHWA EJ Website):

- 1) To avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations.
- 2) To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.
- 3) To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

These principles are applicable for all phases of project development for any agency receiving federal funds, whether the improvement is federally funded or not.

1.3 Evolution of Environmental Justice through Peer to-Peer Benchmarking

It is worth noting that the EJ guidelines do not include quantitative compliance measures to guide federally-assisted agencies in the application of the EJ principles. They require interpretation. For example, how

many advocacy groups must be included for a process to “ensure ... full and fair participation?” The guidance is silent on this matter and leaves each agency to interpret the Order in their own way. At the time of implementation in the mid-1990s, this lack of guidance caused a great deal of confusion and frustration for public agencies (Interviews 2011). However, according to some of the practitioners surveyed in this study this lack of guidance has provided unique opportunities for agencies to develop EJ programs in a manner that best fits agency and customer needs; it has also allowed agencies to be flexible and creative (Interviews 2011). Through peer-to-peer benchmarking (i.e., communication and comparison) among states, agencies can organically develop best-practice models that are context sensitive. This is a different approach from many federally-regulated programs that typically identify compliance measures and means by which agencies must confirm compliance. By 2010, several EJ programs had been in place at state transportation agencies for at least a decade. These programs reflect the benefits of less rigid regulation and the evolving practice of EJ in Transportation.

1.4 Compliance

The lack of explicit guidance does not remove the oversight requirement for the regulating agency. The FHWA and FTA monitor state DOTs' compliance with the EJ regulations. Typically, local agencies align their EJ programs with the state DOT and are, in that way, indirectly connected to the FHWA and FTA. This connection, however, may vary depending on the location and population size of a local community. For example, communities with populations less than 100,000 may adopt their state DOT's EJ policies by adopting the DOT's Title VI Plan (Interviews, 2011). In metropolitan areas, the Metropolitan Planning Organizations (MPOs) may lead most of the planning activities and thus become the primary points of contact for the federal agencies.

Ultimately, all agencies that receive federal funds must comply with the federal regulations of EJ and the oversight requirements of Title VI and NEPA. Each agency must provide a Title VI compliance report annually. This report provides evidence of the activities that the agency has undertaken to meet the requirements of Title VI and EJ. Title VI compliance reporting can often be combined with, or at least aligned with NEPA compliance. The NEPA process requires documentation of all plan development processes undertaken by an agency that receives federal funds. This includes documentation of potential impacts on both natural and human resources, along with measures for mitigating such impacts. Through the NEPA process, state and federal partners can review the impacts and mitigation measures for any federal process and produce one of three types of documents: a Categorical Exclusion (CE), an Environmental Assessment (EA) or an Environmental Impact Statement (EIS). Environmental justice efforts are reviewed for compliance as part of the review of the Title VI and NEPA documents. In addition to document reviews, the federal government can assess the quality of an EJ program at certification reviews for MPOs and when auditing self-certification documentation for state and local agencies.

1.5 Study Objectives and Approach

The purpose of this study is to evaluate the impact of EJ on transportation planning in state Departments of Transportation (DOTs), identify common and effective practices, assess the status of EJ in the Georgia Department of Transportation (GDOT), conduct a gap analysis for GDOT against effective practices, and provide recommendations on next steps to improve the existing capabilities as well as steps to move the existing practice to the status of the most effective practices for achieving EJ outcomes.

The overall approach used for this study was to review the literature to find out (1) the USDOT Guidelines for EJ and what the requirements are for achieving EJ outcomes; and (2) common DOT practices in EJ, with the understanding that there is usually a lag between the literature and actual practice, and several agencies that are active in a particular area may not have published anything on their programs. However, given that EJ is an evolving practice, the intent was to identify how agencies can demonstrate EJ outcomes as they all continue to evolve their programs. This was done in order to identify two things: (1) next steps for GDOT to be able to demonstrate EJ outcomes; and (2) steps to attain similar status with agencies that are farthest along in their ability to demonstrate EJ outcomes. The EJ policies, programs and activities identified were used in conjunction with the Federal guidelines to formulate a maturation framework for achieving EJ outcomes. An internal assessment was also conducted to determine the status of EJ at GDOT, and a targeted survey was used to collect information on EJ policies, programs and activities from eight state DOTs. Subsequently, a gap analysis was conducted to benchmark GDOT against these selected DOTs using the maturation model. Recommendations were then made for GDOT to enhance its capabilities for achieving EJ outcomes, and opportunities identified to move the agency to the status of the most effective agencies with respect to achieving EJ outcomes.

A national survey on the status of EJ in Transportation was not conducted because such a survey was conducted in 2008 and the researchers felt that another national survey would not add significant value given the objectives of the project. Instead, selected agencies that were identified as having EJ activity were surveyed to determine where they fell along the continuum of maturity levels in achieving EJ outcomes in Transportation. Thus, the literature provided material for developing the EJ maturation framework and the survey provided current information on EJ policies, programs and activities from selected state DOTs to assess where these agencies fall along the maturity scale of demonstrating EJ outcomes, and serve as a basis for benchmarking the status of EJ in Transportation at GDOT.

1.6 Report Outline

The report first discusses the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) EJ guidelines, identifies common and effective practices in EJ, and presents and explains a continuum of maturing states in demonstrating EJ outcomes (i.e., the EJ maturation framework). The results of the GDOT internal assessment are summarized to establish a baseline of GDOT's current status in addressing EJ. Next, the results of the gap analysis are presented evaluating GDOT and eight state DOTs to highlight the development of their capabilities for achieving EJ outcomes. The report then concludes with recommendations for next steps that could be used to enhance GDOT's present capabilities for achieving EJ outcomes in Transportation, as well as opportunities to move to the status of agencies that are most effective in achieving EJ outcomes in transportation.

2. EJ Common and Effective Practices

The transportation and environmental justice literature was reviewed to assess the status of state DOT policies and programs for achieving EJ, including common and effective practices and lessons learned since the 1994 EO. The literature discusses a range of policies, public involvement programs, technical analysis methods, before and after studies, and ways to link EJ assessments and outcomes with decision making. The literature review found that several agencies have developed guidance to integrate EJ concerns in their operating procedures (Jerome and Donahue 2002; Grauberg and Van Orden 2003; Owens et al. 2008 and ODOT 2010), and that agencies are continuing to refine their approaches to EJ. Based on the literature review, this study distills a three-phase maturation model that captures the process of continuous improvement through which EJ programs are developing at state DOTs. This section presents common and effective practices in EJ and the next section presents the EJ maturation model.

Considering Burdens and Benefits

The 1994 EO required federally-sponsored agencies to develop policies and programs to ensure full and fair participation of all potentially affected people in decision making; to avoid, minimize or mitigate disproportionate impacts to minority and low-income populations; and to prevent the denial, reduction or delay of benefits to minority and low-income populations. A 2008 national survey of MPOs and state DOTs, sponsored by the USDOT, found that both MPOs and DOTs have a consistent knowledge of EJ concepts across agencies, with several respondents demonstrating a strong commitment to EJ beyond legislative requirements (Owens et al. 2008). Agencies reported EJ compliance strategies including surveying public opinion, GIS-based assessments, and the use of performance measures. Public involvement was found to be a particularly important, highly visible and quantifiable aspect of the EJ process. With respect to performance measures, the survey respondents stressed the need to incorporate decision criteria into measure design. Other lessons learned include that some injustices may be mitigated and others avoided; also, if projects advance due to political influence, despite EJ concerns, the implementing agency risks litigation. The 2008 national survey also identified a number of EJ concerns that affect policy decisions: (i) public participation, (ii) access to transportation, (iii) location of public facilities, (iv) access to health care and (v) transit access. Transit access can be especially important to low-income and elderly populations who may not have other transportation options. Owens et al. (2008) recommend that planners include affected populations early in a transit planning process and build rapport with such communities. Without an inclusive process, it is difficult to achieve truly equitable outcomes (Amekudzi and Dixon 2002; Owens et al. 2008).

Macro-Level and Micro-Level Analyses

The Arizona DOT (ADOT) conducted an analysis of their EJ program in 2002 (Jerome and Donahue 2002). The ADOT study found that while EJ processes always involve identifying disproportionate impacts to minority or low-income populations, “impacts” have been defined in several different ways. They have been associated with (i) the siting of undesirable or environmentally hazardous facilities in areas that are disproportionately populated by minority or low-income residents; (ii) public participation in decision making; (iii) public transportation access, and (iv) funding decisions, in the sense that prioritization of certain projects may have implications for certain communities that receive transportation benefits (Jerome and Donahue 2002). To address all of these important impacts, ADOT’s study distinguished between macro- and micro-level analyses (Table 1). Macro-level analysis refers to the formal incorporation of EJ considerations into agency policies, programs and procedures. The current study found that only a few DOTs have formalized their EJ policies, programs and procedures; however, without such formalization, it

is difficult to track EJ compliance. Micro-level analysis, on the other hand, determines if a project will have disproportionate impacts on minority and low-income populations (Jerome and Donahue 2002). To fully benefit from both macro- and micro-level analyses, the ADOT researchers recommend linking funding decisions with environmental planning and project management. Other organizational recommendations include the formation of community planning groups, transit planning partnerships, and an ongoing EJ task force (Jerome and Donahue 2002).

TABLE 1: Macro-Level and Micro-Level EJ Analysis

Macro- (Policy) Level and Micro-Level EJ Analysis	
Macro-(Policy) Level	
1) Coordinate efforts with other transportation agencies 2) Create detailed, formalized policies, procedures and guidance 3) Communicate policies and procedures with staff and departments 4) Consider the effectiveness of the policies and procedures yearly	
Micro- (Project) Level	
1) Define project study area 2) Develop community profile 3) Analyze Impacts 4) Identify Solutions 5) Document findings	

Source: Arizona DOT (Jerome and Donahue 2002)

Transportation policy decisions ultimately impact the community. For example, some of the policies and procedures defined at the macro-level may have to do with ways to involve the public, or ways to conduct micro-level analysis. Without such guidance in place, an agency might comply with the regulations of the EO and state mandates with respect to the actions taken, but still fail to achieve EJ in the eyes of the public. The experience of ADOT is a prime example. Their study results showed that the agency was on par with peer agencies in terms of EJ actions; however, community groups continued to voice concern over the quantity of transportation options available to low-income and minority communities as well as potential negative impacts to these communities (Jerome and Donahue 2002). Performance-based, policy level EJ programs can help the agency monitor and evaluate EJ outcomes and incorporate these results into future transportation decision making.

Performance Measures for EJ

Performance measurement allows agencies to assess and track the effectiveness of their EJ programs. “Performance management” is the use of performance measurement information to inform decision making, such that performance improves over time relative to agency goals and objectives. The performance management literature recommends measuring inputs (actions and methods), outputs (products and services delivered) and outcomes (consequences of the program outputs) for a comprehensive view (Hatry

and Wholey 2007). Often, each of these categories of measures can be applied at both macro and micro levels of analysis. Table 2 summarizes performance measures that can be used in EJ assessment.

TABLE 2: Performance Measures for Environmental Justice

Goal Area	Performance Measures	Type*		
		Ipt	Opt	Ocm
Safety and Security	Pedestrian and bicycle injuries and fatalities			X
	Vehicle crashes			X
Accessibility	Proximity to transit by type (bus/rail)			X
	Accessibility to regional amenities (health care, education, etc.)			X
Mobility and Efficiency	Level of service (headways, days/hours of service)		X	
	Number of transfers required for trips between select OD pairs			X
	Percent of transit travel time accounted for by transfers			X
	Travel times for selected Origin-Destination (OD) pairs by mode			X
	Percent of congested travel times between select OD pairs			X
Environmental Protection, Energy Conservation, and Quality of Life	Number of households living within X feet of busy highway			X
	Air pollution concentrations by type of pollutant			X
	Incidence rates of respiratory disorders			X
	Number households exposed to noise exceeding X decibels			X
	Number households living within X feet of a bus terminal			X
	Percent of buses servicing area which use alternative fuels			X
	Property takings, household dislocations, access restrictions			X
System Condition	Condition of roads and streets		X	
	Condition of sidewalks		X	
	Average age and condition of transit vehicles		X	
Funding Equity	Transportation capital expenditures per capita	X		
	Transportation operating expenditures per capita	X		
	Identity of users benefiting from new project or program			X
Public Involvement	Number of public outreach events	X		
	Number of participants attending public outreach events			X
	Customer satisfaction ratings			X
Economic Vitality and Competitiveness	Number of and accessibility to jobs by type			X
	Employer accessibility to workers by skill level			X
	Property values by location			X

*Key: Ipt – Input Measures, Opt – Output Measures, Ocm – Outcome Measures

Sources: Environmental Justice in Transportation Toolkit (Robinson 2008); Data and Measure Synthesis, 3rd Edition (Midwest Transportation Knowledge Network 2010)

As shown in Table 2, outcome measures are most commonly used in EJ analysis. Some agencies have begun to measure performance in the areas mentioned in Table 2 above. For example, the Colorado DOT developed a list of qualitative performance measures, addressing issues such as access to jobs, travel time, and environmental quality. CDOT generally compares these measures across population groups (i.e. minority and non-minority) and assesses them before and after the implementation of a transportation project (Grauberger and van Orden 2003). Public involvement and customer satisfaction measures are in use at several DOTs (MTKN 2010), but they are not necessarily being used for EJ

analysis. In other words, customer satisfaction measures may be used without being used to address EJ concerns as outlined in the FHWA/FTA Guidelines for EJ in Transportation.

The FHWA's Environmental Justice in Transportation Guidebook (2011) recommends equity assessment of road pricing projects at an early stage in the planning of the project, including the likely economic and time impacts on households in disadvantaged communities. Economic impacts include the expenses incurred paying road user charges annually, the share of income spent on these charges, and how the consumption of other goods and services may be affected by this loss of income. Time impacts include the time savings for low-income households as a result of congestion charges or the increase in travel time they would face if they shifted to public transportation or to longer or more congested routes that do not have pricing. These economic and time impacts for low-income households must then be compared with those for middle and high-income households. To assess the EJ impact of road pricing programs in a holistic way, the differences between households at the same income level (i.e., horizontal equity issues) must also be taken into account. Because people do not all have similar travel behaviors, they will often be affected differently by road pricing programs.

Technical Analysis Methods and Challenges

The literature discusses a range of technical analysis methods being used to support EJ processes. Most EJ analyses make use of national census data along with geographic information systems (GIS) to determine the distribution of benefits and burdens. Depending on the needs of a particular project, analysis may focus on environmental impacts such as air quality and noise (Forkenbrock and Schweitzer 1999), social impacts such as accessibility, travel opportunity and safety (Chakraborty 2006), or a variety of other effects such as those mentioned in Table 2. NCHRP Report 532 provides a prescriptive overview of analysis methods for several types of impacts (Forkenbrock and Sheely 2004).

EJ analyses often face some definitional challenges, including (i) how to define and apply concepts of equity, such as disproportionality (Duthie et al. 2007, Hartell 2007); (ii) how to identify target populations, given ambiguous census categories (Hartell 2007); and (iii) how to define a study area with appropriate boundaries, given that an affected region will rarely coincide with the boundaries of census units (Chakraborty 2006). Because every method has both advantages and disadvantages, Hartell (2007) recommends that simple statistical tests should be applied to review the characteristics and distributions of the data before choosing the most reasonable methods of analysis. Klein (2007) suggests the use of spatial statistics to enhance GIS analysis in order to overcome some of the definitional challenges associated with drawing boundaries and tracking cumulative impacts over time.

Public Involvement

Public involvement is one of the explicit elements of the EJ regulatory requirements. The Executive Order identifies specific categories of stakeholders to include, in addition to those identified by NEPA. Many agencies have merged the EJ and NEPA public involvement practices by paying special attention to include the low-income and minority populations within the NEPA process (Owens et al. 2008). Other agencies have unique public involvement practices, designed to meet the diverse needs of their particular regions and projects (FHWA EJ Website).

To highlight a few agencies that go beyond the traditional or status quo approaches to public involvement, FHWA compiled a list of ten project and program development efforts across the country (FHWA EJ website, Case Studies). The South Carolina case provides an effective practice example through a nontraditional community outreach approach. Recognizing that their first attempts at public

involvement did not produce much minority input, South Carolina DOT coordinated with local preachers to announce public meetings during church services in a predominately minority neighborhood. Numerous meetings were held in a variety of settings to make attendance convenient, and SCDOT committed to building the trust of the community by maintaining communication as decisions were being made (FHWA EJ Website, Community Impact Assessment and Public Involvement, SC Route 72 EA).

Another best practice case study comes from Wisconsin DOT's proactive needs assessment for two heavily traveled corridors. Given the potential for controversy, WisDOT began public involvement efforts nearly three years prior to formally beginning the NEPA-required assessments in order to get input and support from the affected communities, one of which was made up of predominantly low-income, minority and transient residents. Unlike the South Carolina case described above, well established leadership was difficult to find in this community. In order to reach community members, WisDOT creatively partnered with a local middle school, incorporating transportation and land use planning into the curriculum and having students prepare a portion of the needs assessment. A student team presented their findings in a public meeting to an audience of parents, WisDOT staff, city and county officials, and other interested individuals. This meeting was followed up by a community design charrette, suggestions from which were incorporated into the final project design. Going beyond regulations and following the spirit and intent of the EJ Executive Order, WisDOT addressed both the system and social needs of their community allowing the residents to become more involved in community-based transportation planning (FHWA EJ Website, Verona/West Beltline Needs Assessment Study).

A third effective practices example of public involvement occurs in transit-oriented development in the Bay Area Rapid Transit (BART) Fruitvale Transit Village, an award-winning transit-oriented development project that originated with community opposition to a proposed parking deck. The success of this project in terms of public involvement hinged on the willingness of BART and the City of Oakland to partner with a local community-based organization, The Unity Council, which supported the interests of the majority Latino district of Fruitvale. This partnership took the form of, first, agency grants to the Unity Council to initiate a community planning process, and second, a representative Policy Committee formed using a Memorandum of Understanding between all three organizations. By integrating the community's needs and desires for the proposed project, the agency was able to develop a project that garnered enthusiastic community support, improved pedestrian traffic through the adjacent business district, promoted new investment activity around the transit station, and minimized negative environmental impacts (FHWA EJ Website, Fruitvale Transit Project).

Education and Guidance Materials

The formalization of EJ programs and procedures helps in managing and tracking the effectiveness of EJ activities. The Ohio DOT began to formalize the way it addresses EJ based on the results of a study done in 2002 by an EJ Task Force. The ODOT study was conducted to determine the best approaches for Ohio to address EJ requirements in transportation, to agree on minimal standards for EJ, and to create guidance and education materials on EJ from the Ohio perspective. The guidance provides the current regulations, demographic information, quantitative and qualitative test questions, public involvement recommendations and integration techniques. It also draws from Mid-Ohio Regional Planning Commission (the Columbus MPO) and the results of their EJ task force (ODOT 2002).

The Colorado Department of Transportation (CDOT) has also formalized its EJ procedures, beginning with a list of qualitative performance measures for public involvement (Grauberger and van Orden 2002). This was followed by publishing EJ and Title VI guidelines for NEPA projects in 2004, which prescribe procedures for the project planning phases of projects and include detailed answers to frequently asked

questions regarding EJ processes (CDOT 2004). These resources serve those involved in the transportation decision making process, and they provide information on the regulatory history and background on environmental justice issues including public involvement and planning techniques.

3. The EJ Maturation Model

The literature review results indicate that common elements of EJ programs and initiatives, supporting the implementation of the FHWA/FTA principles, include public involvement programs, project analyses to determine burdens and to identify disproportionate impacts, and documentation. Less common elements include formalized policies; addressing benefits, performance measures to evaluate EJ outcomes; before-and-after studies to determine if EJ outcomes are being met, including timely benefits to impacted groups; surveying of impacted communities to assess investment outcomes; and linking EJ analysis results with decision making. Based on the FHWA/FTA principles and the common EJ elements found in various state DOTs, a framework or model was formulated that shows agencies at different levels of maturity, on a scale of achieving EJ outcomes in Transportation (Figure 1). The literature indicates that a good number of agencies have some level of public involvement and technical analysis to evaluate EJ at the project level; fewer however have formalized policies and a performance-based process for evaluating EJ and incorporating feedback into future decisions and policies. In general then, EJ programs may be categorized into two groups: one focusing on activities, and the other on performance. Performance-based programs exhibit a higher level of maturity in the sense that there is integration of past outcomes of an EJ program with future transportation policies and decisions. Performance-based programs allow the agency to demonstrate how it is achieving EJ outcomes consistent with the FHWA/FTA principles. In performance-based programs, EJ is incorporated in several DOT programs in a manner that allows the agency to be effective in achieving intended outcomes. The EJ Maturation Model allows agencies to demonstrate how different phases of activity demonstrate that agencies are indeed meeting the intended outcomes for their EJ programs.

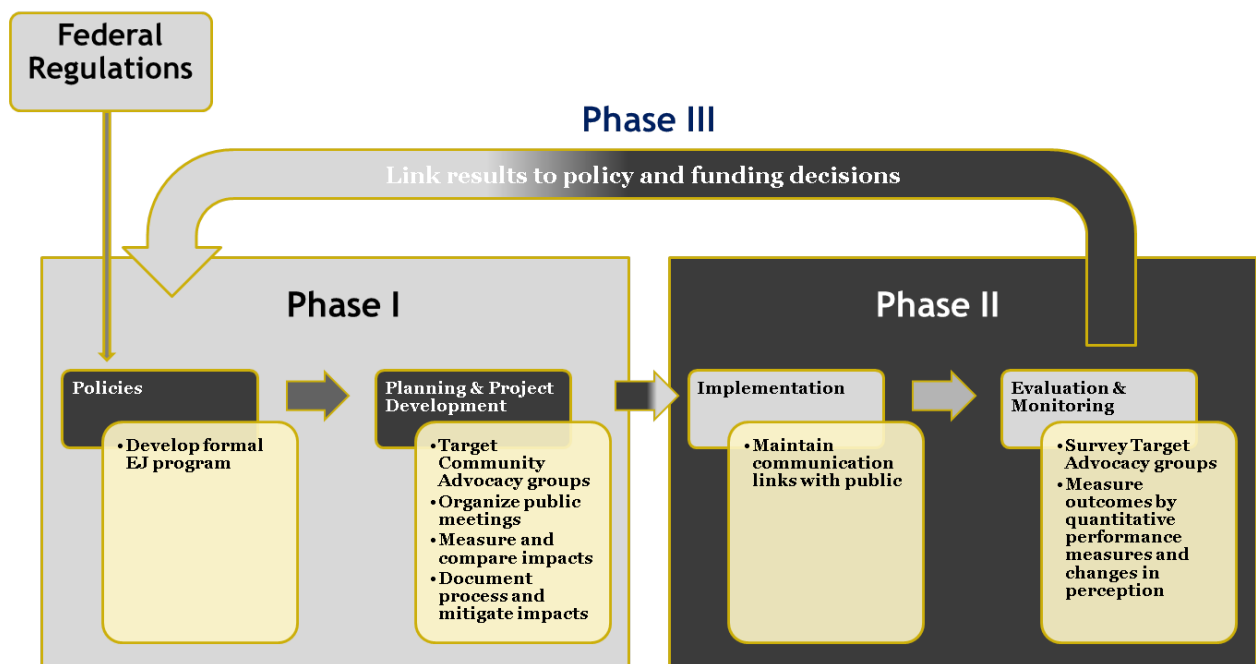


FIGURE 1: EJ Maturation Model Showing Application Phases

Figure 1 summarizes the EJ maturation framework. An agency may be categorized in Phase I, II, or III of the maturity scale. The phases are incremental, which means that Phase III is dependent upon Phase II being in place, and so forth. In the first phase, an agency develops formal policies for EJ, identifies potential target groups and develops public involvement processes. An agency in Phase II builds upon

Phase I activities by implementing long-term evaluation and monitoring systems, to ensure that project burdens are not disproportionately distributed and benefits are not denied, reduced or delayed for any populations. Agencies in Phase II also begin to conduct before and after studies (either through public or technical evaluation) to assess whether the intended EJ outcomes are being met. Phase III agencies take the results from Phase II activities and link them to decision making, both to ensure that EJ outcomes are met in ongoing projects, and to incorporate evidence from past projects in future investments. Phase III also provides a basis for evaluating new policy development regarding equity impacts, considering EJ impacts from more systemic perspective. A performance-based program will cover all three phases.

Programs at the Phase I maturing level, only can be said to be in the early stages of maturity, having EJ activities but being unable to demonstrate whether intended EJ outcomes are being achieved. Phase II programs are able to demonstrate the extent to which outcomes are being met but cannot articulate explicitly how decisions are being made to address any shortcomings detected in phase II. Phase III programs have taken a more proactive and systemic approach toward EJ using EJ public involvement information and analysis results to drive investment decisions, considering EJ at the systems level rather than solely on a project-by-project (or piecemeal) basis, and considering the cumulative impacts of transportation decisions on EJ with a longer term perspective.

The phase being implemented by an agency is an indication of the maturity of their EJ program. However, maturity may also vary within a phase. Specifically, the maturation framework further categorizes three levels of EJ programs within the first phase, as shown in Table 3.

TABLE 3: Typology of Environmental Justice Programs and Key Practices

	Approach	Maturation	Practices
Type 1	Activity-based	Phase I – Level I	Formal guidelines; Identify target groups; Public Involvement process
Type 2	Activity-based	Phase I – Level II	Standardized technical analysis procedures; Maintain citizen group lists
Type 3	Activity-based	Phase I – Level III	Standing citizen committee for feedback; Formal interdivisional process
Type 4	Performance-based (Early stage)	Phase II	Create performance measures; Use survey groups to measure outcomes.
Type 5	Performance-based (Mature stage)	Phase III	Integrate outcomes into policies, planning and programming

4. GDOT Internal Assessment: Summary of Findings

4.1 Introduction

Interviews were conducted to assess current policies, programs and activities in Environmental Justice at GDOT. Key personnel within the Department were interviewed to determine the current state of practice. These interviews were held with staff in various parts of the Department, both those with direct and indirect knowledge, access to and influence over environmental justice efforts in Transportation Planning. This broad net approach proves valuable in capturing the Department's efforts in EJ. The divisions interviewed were Civil Rights, Environment, Planning, and Program Delivery. Key findings are summarized below.

4.2 Summary of Findings

The interview findings showed that the Environment and Planning Divisions work together to address environmental justice. Internally, the agency produces documentation for EJ primarily through the NEPA process (i.e., Environmental Impact Statements (EISs) and Environmental Assessments (EAs)) and through Title VI reports. Impacts are determined on a case by case basis; there is no standard approach. In general, there are discussions within a particular unit, and among multiple units (e.g., including Environment, Construction, etc.) in the Department to determine the impacts. In order to determine if the impact is disproportionate, an investigation of the impacts and options available are considered at the time of the program development.

The agency has adopted a public involvement policy and plan, and maintains an extensive contact list for public comment. Early public involvement limits the potential for unknown impacts becoming evident later in the process. A study conducted by Georgia State University for GDOT determines the potentially affected populations for FY 2007-2012 (GDOT, 2006). There is also a planning tool, the Multimodal Transportation Planning Tool, developed by Professor Karen Dixon that has an EJ module to help get a handle on how to implement the EO.

The Planning Division conducts public outreach meetings and makes every effort to include "special populations" (e.g., bilingual, elderly, etc.). The annual STIP review uses an extensive mailing list (~5,500) to generate public comment. The list is organized by EJ category. The Environmental Division is charged with ensuring that the project development process is NEPA compliant.

In metropolitan areas like Atlanta, the metropolitan planning organization, the Atlanta Regional Council (ARC), conducts the work for initiating projects and planning coordination. GDOT is a stakeholder to ARC. ARC prepares public participation plan for review by FHWA for compliance. Outside of the MPO regions, GDOT is responsible for planning coordination and public participation.

Externally, monitoring of Title VI requires documentation and site visits to partner agencies to determine compliance. A GDOT official is responsible for visiting projects, cities and municipalities to ensure Title VI compliance. The monitoring role involves reviewing the self-surveys of local governments and municipalities, verifying compliance of sub-recipients which includes complaints, summary (of actions taken, etc.), history, training, providing Title VI information (to employees and contractors, vendors, etc.) and proper placement (of Title VI materials). Populations less than 100,000 can adopt GDOT's Title VI plan.

Interview results showed that knowledge of EJ policies and processes within the agency is not uniform among divisions, which may partly be attributed to their roles in the project development continuum.

5. Gap Analysis: Comparative Benchmarking of GDOT against Selected DOTs

5.1. Introduction

This gap analysis was conducted to benchmark GDOT's EJ practice against other DOTs with common and effective practices. To conduct this analysis, multiple agencies were surveyed, a literature review of EJ in Transportation was conducted (results in Section 1) and internal interviews were conducted with GDOT staff members (results in Section 4) to determine policies and programs used in EJ and how GDOT's practices compare. The Gap Analysis table (below) identifies actions and gaps between GDOT and other DOT programs and policies.

5.2 Explanation of Table

The Gap Analysis Table is an illustrative comparison of three documents: a literature review of EJ practices; policies and processes at GDOT (assessed through internal interviews with the GDOT Civil Rights, Environment, Planning, and Program Delivery divisions); and the responses to a survey of selected agencies on the status of EJ implementation. Each of these documents may be reviewed individually (in companion appendices); but as part of the gap analysis table, they illustrate the different approaches to EJ taken by the various agencies. A number of state DOTs with reported EJ activity in the literature were also surveyed.

The table presents three distinct phases of EJ: Phase I – Process and Burdens, Phase II – Evaluation and Benefits, and Phase III – Linkage to Resources. These phases are illustrated in Figure 1, which identifies various phases and elements of EJ applications and how they must work together to achieve the ultimate objectives of EJ in transportation as per the FHWA/FTA principles (i.e., assuring that intended outcomes are being met based on the EO requirements) (See Section 3 for more details). This framework is the basis for evaluating the EJ programs of the selected agencies and GDOT. An analysis of the findings has been conducted to make recommendations to GDOT on the level of maturity of its evolving program and next steps to enhance capabilities for meeting EJ outcomes and the intent of the EJ Executive Order.

Each phase is introduced separately below in a different table for ease of viewing the data. However the full Gap Analysis Table includes all the phases. The actions identified within the table are detailed after the table. A check mark in the table indicates that the corresponding agency listed to the left incorporates this feature in its EJ program. It is important to note that not all the EJ elements in each phase may be required to achieve EJ outcomes. Rather, an agency will exercise judgment in determining a combination of elements (policies, programs, procedures, tools, activities, etc.) that can collectively allow them to demonstrate EJ outcomes. A discussion of GDOT's gaps and opportunities follows the tables.

Phase I (Table 4) has the fundamental EJ program activities to meet Federal guidelines ending with the documentation of the process to achieve non-disproportionate impacts to minority and low-income populations. Effective policies to implement public involvement and data analysis are features of the first phase of EJ application. This phase focuses primarily on objective data and measurable elements of the EJ Executive Order.

Table 4: EJ Maturation Model Phase 1 - Process and Burdens

	Phase I - Process & Burdens									
	Public Involvement Process	Maintain citizen group lists	Standing committee of citizens for feedback	Standardized Technical Analysis Procedures	Formal Internal EJ workgroups	EJ Education program (Internal)	EJ Education program (External)	Formal EJ Plan or Standard Guidelines	ID of disproportionate impacts of projects on target groups	Document EJ through NEPA Structure
DOT 1			X						X	X
DOT 2	X	X		X	X			X	X	
DOT 3	X							X	X	
DOT 4	X								X	X
DOT 5									X	X
DOT 6	X	X	X	X		X	X	X	X	
DOT 7				X				X	X	
DOT 8	X		X	X					X	
GDOT	X*	X							X	X

- GDOT has developed a public involvement plan. Guidelines on how public involvement is conducted to achieve EJ outcomes can be included in the plan to clarify how public involvement is actually used to achieve EJ outcomes, and make this information readily available within the agency.

Create Public Involvement Process (PIP): This action refers to a formal public involvement process that identifies how target groups will be contacted and involved in the transportation decision-making process. This PIP can address issues beyond EJ. Often it is general for an agency but provides guidelines that can be used by any division, contractor or agency representative in order to have a consistent process for including the public.

Maintain Citizen Group Lists: This action refers to the maintenance responsibilities of keeping a citizen group list active and up to date for use in public involvement.

Maintain and Utilize Standing Committee of Citizens for Feedback: This action refers to the Department maintaining and utilizing a committee of citizens for input and feedback on decisions for a specified term longer than the duration of an individual project or review. This committee may provide feedback on a variety of issues, including but not limited to EJ.

Develop Standardized Technical Analysis Procedures: This action refers to the creation of a formalized process for evaluating EJ impacts, usually at the project level. These procedures may include the type of data to collect, one or more analysis methodologies and the criteria for using them, and the thresholds for disproportionate impact.

Develop Formal Internal EJ Workgroups: This action refers to the development of a formal group of department personnel, including staff from multiple divisions, dedicated to working on EJ issues. Such a group could operate on a project basis for a finite period of time, or addressing EJ could be part of their job responsibilities on an ongoing basis.

Develop EJ Education Program (internal): This action refers to the creation of a formally structured program to educate internal staff from all divisions on the EJ requirements and processes of the agency. An effective education program would include refresher programs to maintain a base level of understanding throughout the Department.

Develop EJ Education Program (external): This action refers to the development of a formally structured program to educate the public on EJ objectives and processes. Such a program could be used as part of a public Involvement process to generate feedback.

Develop Formal EJ Plan or Standard Guidelines: This action refers to the development of formal written procedures for an EJ program, including agency actions to accomplish the goals of the EJ Executive Order, as well as how these goals are to be accomplished including the reporting requirements. An EJ Plan may include some discussion of any or all of the previous actions of this phase: the public involvement process, standardized technical analysis, roles and responsibilities of agency divisions, and education programs.

Identify Disproportionate Impacts of Projects on Target Groups: This action refers to the process of determining the disproportionate impacts of projects on target groups. This is the most basic and necessary element of any EJ effort.

Document EJ through NEPA Structure: This action refers to the reporting, location, and timing of EJ actions conducted by the agency. The NEPA process is often used to identify how and when EJ activities take place; however, it is important that agencies identify how Categorical Exclusions will address EJ.

Phase II (Table 5) evaluates the EJ programs after projects have been completed to measure if the deficiencies identified in the analysis stage have been corrected and the public evaluations of the improvements are favorable.

TABLE 5: EJ Maturation Model Phase 2 – Evaluation of Benefits and Burdens

Phase II - Evaluation of Benefits and Burdens		
Agencies	Survey target groups to measure outcomes	Apply performance measures for process and outcomes
DOT 1	X	
DOT 2		
DOT 3		X
DOT 4		
DOT 5		
DOT 6	X	
DOT 7		
DOT 8		
GDOT		

Survey Target Groups to Measure Outcomes: This action refers to the collection of survey data after a project is completed, or non-project specified surveys of target groups to determine their perspectives on how the agency is meeting the EJ goals of providing equitable access to benefits and proportionate distribution of project impacts.

Performance Measures for Process and Outcomes: This action refers to the inclusion of process and outcome of performance measures for EJ. Process-oriented performance measures for EJ measure characteristics of agency actions, such as the number of target groups contacted in a public involvement process. Outcome-oriented performance measures for EJ measure the extent to which the objectives of the Executive Order are being achieved. Both types of performance measures provide information about the effectiveness of EJ programs, and these measures can be tracked over time to gauge the extent to which EJ outcomes are actually being achieved.

Phase III (Table 6) indicates that the findings of Phase II influence and guide new policies and funding decisions to improve the outcomes of EJ efforts. This Phase also provides a basis for evaluating new policy development regarding equity impacts.

TABLE 6: EJ Maturation Model Phase 3 – Decision Making: Linkage to Policy and Funding Decisions

Phase III - Decision Making: Linkage to Policy and Funding Decisions			
	Systems evaluation	Assessment of cumulative impacts	Link measured outcomes to policy and funding decisions
DOT 1*			
DOT 2			
DOT 3			
DOT 4			
DOT 5			
DOT 6			
DOT 7			
DOT 8	X		X
GDOT			

*While few agencies surveyed had implemented any phase III elements in their programs as yet, both Arizona DOT and Colorado DOT were working toward the development of such elements in their respective programs, as reported in the survey.

Systems Evaluation: This action refers to the evaluation of EJ issues and the impacts of transportation decisions from the perspective of the entire network. Such evaluation requires a broadening of the geographical perspective beyond the project level.

Assessment of Cumulative Impacts: This action refers to the analysis of transportation decisions over time to assess EJ impacts. This requires a broadening of the temporal perspective beyond the immediate to the longer term.

Link Measured Outcomes to Policy and Funding Decisions: This action refers to using the results of EJ performance measurement to make policy and resource allocation decisions for the future, assuring that there is a linkage between EJ outcomes and policy and resource allocation decision making. This action may include dedicating funds to meeting performance targets that support the EJ Executive Order outcomes.

5.3 GDOT Gaps and Recommendations

This section discusses areas where GDOT is less active in Environmental Justice efforts than other agencies considered in this study, assesses how important additional activity is for demonstrating EJ outcomes and identifies opportunities for future growth in the Department's EJ program. As shown in the tables above, GDOT is primarily active in Phase I – Process & Burdens actions. In this Phase, GDOT currently implements three of the ten practices identified in this study. In order to be at par with the majority of the agencies interviewed, the Department may need to develop a formal EJ plan or standard guidelines; standardized technical analysis procedures, and introduce

formal EJ guidelines within the existing public involvement plan demonstrating how public involvement is used in achieving EJ outcomes. Other elements of Phase I that are missing from GDOT are less common among best practice agencies at this time. However, as the study has shown that EJ is an evolving practice where agencies progressively move toward more mature systems, it will be worthwhile for the agency to consider how other program elements can help achieve EJ outcomes more effectively, e.g., formal internal workgroups, EJ education programs (internal and external). Considering the opportunity for a head start, GDOT may wish to consider which of these actions would enhance its EJ program most effectively, in order to remain at par with other state DOTs as they mature in demonstrating EJ outcomes.

The Phase II actions were found to be sparser and Phase III actions practically nonexistent, among the agencies surveyed. Part of the reason for less activity in these phases is the cumulative nature of the phases: in order to implement Phase III activities, Phases II and I actions must be in place and operating at a high level. What this suggests is that only a few agencies are at the level of Phase II maturity.

GDOT is in a unique position to develop an enhanced EJ program that improves EJ outcomes for the state. Given the knowledge of EJ programs in other agencies and the direction of GDOT's EJ program development, the agency can create a streamlined program that uses lessons learned from others. For example, GDOT currently does not have a formal EJ plan or specific guidance for EJ; however, by developing such guidance and collecting follow-up information using outcome surveys and performance measures, the agency can move swiftly to a more mature EJ program that measures outcomes. The Department can then build a bridge to Phase III, using these outcomes data to make policy and resource allocation decisions, thereby positioning itself as a leader among transportation agencies in addressing EJ issues.

6. Conclusions and Recommendations

This study evaluates the current EJ practice at the Georgia Department of Transportation (GDOT) in relation to state DOT best practice identified through the literature and agency interviews. The study develops a maturation model that identifies three phases in the development of EJ practice in state DOTs. Phase I is typified by the development of basic elements of the process to assess disproportionate burdens in project investments. Phase II is concerned with evaluating the outcomes of EJ actions through public involvement surveys or technical analysis. Phase III is focused on using EJ analysis results in Phase II to influence resource allocation decision making and policy development to ensure that the intended outcomes of EJ are being achieved.

Based on the analysis conducted, the next steps for advancing GDOT's EJ effectiveness would involve developing capabilities that will allow the agency to better fulfill the process and outcome requirements of the Executive Order: (i) developing formal guidelines to elevate the status of EJ as a standardized process (ii) developing a formal procedures for EJ in the public involvement process to engage appropriate stakeholders in the EJ process as various projects are being considered - formally involving target groups in the planning process for decisions that have the potential of disproportionately impacting them in terms of both burdens and benefits; and (iii) evaluating disproportionate impacts of the burdens and benefits of investments. These recommendations are discussed in more detail below.

1. **Develop a Formal EJ Plan or Standardized Guidelines for EJ:** Developing a formal EJ plan will help the agency crystallize around strategic objectives for EJ. Standardized guidelines will elevate the importance of EJ in the agency, engage appropriate personnel, offices and divisions in the agency, and can be used to educate agency personnel on what constitutes EJ, and how the agency is going about achieving it.
2. **Develop Formal EJ Guidelines within Existing Public Involvement Process:** Formal guidelines addressing EJ in the public involvement process will provide a standard way for engaging target groups and other external stakeholders in decisions that potentially have EJ implications, and fulfill the EJ process requirements of the EO. This process will involve formal identification of target groups and involvement of these groups' desires in decision making as appropriate.
3. **Develop Standard Technical Analysis procedures:** Implementing formalized technical procedures for evaluating the burdens and benefits of projects (and subsequently plans and policies) and determining disproportionate impacts, will enable the agency demonstrate technical capabilities for achieving the basic requirement of EJ (i.e., assuring that the benefits and burdens of transportation decision making are not disproportionate).

Beyond Phase I-level implementation, Phase II elements that follow could help the agency make a formal determination of EJ outcomes of project, program or plan level decisions, through the application of performance measures and survey of target groups.

4. **Apply Performance Measures:** Apply performance measures to assess whether intended outcomes are being met.

5. **Start Surveying Target Groups:** Survey target groups to determine whether customer expectations are being met (Before-and-After studies).

In the longer term, beyond adopting the Phase I and II measures above, GDOT may benchmark against leaders in EJ assessment (such as Arizona DOT and Colorado DOT) to benefit from currently ongoing research and practice in systems evaluation, cumulative impact evaluation, and linking EJ outcomes information to resource-decision making, and progressively build on existing capabilities to achieve best practice status in achieving EJ outcomes in transportation.

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Georgia Department of Transportation Office of Materials and Research:
Research and Development Branch
Project # RP 10-18

APPENDICES

Project Title:

Impact of Environmental Justice Analysis on Transportation Planning

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December 30, 2011

Georgia Department of Transportation Office of Materials and Research:
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Project # RP 10-18

LITERATURE REVIEW

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TABLE OF CONTENTS

TABLE OF CONTENTS	ii
BACKGROUND, REGULATIONS AND REQUIREMENTS	1
CURRENT AND BEST PRACTICES	3
EMERGING ISSUES: TOLLING STRATEGIES FOR ROAD PRICING	13
SUMMARY, RECOMMENDATIONS AND CONCLUSION	16
REFERENCES	19

1. Background, Regulations and Requirements

1.1 Laws, Executive Orders and Policies

The environmental justice (EJ) movement emerged in 1982 with a community protest in North Carolina that led to a federal investigation of the location of toxic waste landfills in the South. The resulting study by the United States General Accounting Office revealed that a disproportionately high number of such facilities were sited in low-income and minority neighborhoods throughout the region (Owens et al. 2008). EJ regulations were formally mandated by President Clinton in 1994 with the signing of Executive Order 12898¹, which explicitly states that all federally funded programs must develop policies and programs to achieve environmental justice.

This Executive Order effectively brought together two previous regulations: Title VI of the 1964 Civil Rights Act, which focuses on nondiscrimination, and the National Environmental Policy Act (NEPA), which focused on protecting the natural environment. These two Acts established the basis and provided power for the EJ concept. The transportation community, however, did not outline specific goals and regulations until the subsequent Department of Transportation (DOT) Order 5610.2 in 1997. The Federal Highway Administration (FHWA) issued DOT Order 6640.23 in 1998, and the FHWA and Federal Transit Administration (FTA) issued a memo in 1999, each of which provided more specific details for regulating and monitoring transportation activities.

The Interagency Working Group on Environmental Justice (EJ IWG) was a federal oversight group established under the Executive Order and was instrumental in previous environmental justice regulation development. This group was reconvened in the fall 2010 by the EPA and the White House Council on Environmental Quality to evaluate the performance of EJ to date. Their intent is to revise, improve and expand the EJ applications. Some of their goals are to promote “green jobs”, share best practices, and identify opportunities for improved EJ (EPA EJ website).

1.2 EJ Target Groups

The target groups to be considered in environmental justice are defined as: Black, Hispanic, Asian, American Indian and Alaskan Native, Low-income, and most recently Native Hawaiian or Other Pacific Islander. While not explicitly addressed in Executive Order 12898, the elderly, disabled and child population groups were listed as target groups in 2004's Executive Order 13330² and are considered in practice (FHWA Website).

1.3 Fundamental Principles of EJ

Specifically the FHWA and the FTA define environmental justice as having three fundamental principles (FHWA Website):

- 1) To avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations.

¹ Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

² Human Service Transportation Coordination

2) To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.

3) To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

These principles are applicable for all phases of project development for any agency receiving federal funds, whether the improvement is federally funded or not.

1.4 Evolution of EJ through Peer-to-Peer Benchmarking

Most notable about regulations to implement EJ principles is what they lack. There are no quantitative compliance measures to guide federal-assisted agencies in the application of the EJ principles. The regulations require interpretation. For example, how many advocacy groups must be included for a process to “ensure... full and fair participation?” The guidance is silent on this issue and leaves each agency to interpret the law in its own way. According to practitioners surveyed, this lack of guidance has provided unique opportunities for agencies to develop environmental justice programs in a manner that best fits agency and customer needs; it has also allowed agencies to be flexible and creative (GDOT Interviews). Through benchmarking (i.e., communication and comparison) among peer states, agencies can organically form best-practice models and develop these through peer-to-peer benchmarking. This is a different approach from many federally-regulated programs that typically identify compliance measures and means to which agencies must conform. By 2010, many environmental justice programs had been in place at state transportation agencies for at least a decade. These programs reflect the benefits of less rigid regulation. However, at the time of implementation in the mid-1990s, the lack of guidance caused a great deal of confusion and frustration for the public agencies (GDOT interviews).

1.5 EJ Compliance

The lack of explicit guidance does not remove the oversight requirement from the regulating agency. For state DOTs, the FHWA and FTA monitor compliance with the EJ regulations. Typically, local agencies align their EJ programs with the state DOT and are, in that way, indirectly connected to FHWA and FTA. This connection, however, may vary depending on the location and population size of a local community. For example, a rural municipality with a population of less than 100,000 may adopt its state DOT's environmental justice policies. However, in metropolitan areas, the Metropolitan Planning Organizations (MPO) may lead most of the planning activities and therefore become the primary point of contact for the federal agencies.

Ultimately, all agencies must comply with the federal regulations of EJ and oversight requirements of Title VI and NEPA. Each agency must provide a Title VI compliance report annually. This report provides evidence of the activities that the agency has taken to meet the requirements of Title VI and EJ. Title VI compliance reporting can often be combined with, or at least aligned with, NEPA compliance. The NEPA process requires documentation of all plan development processes undertaken by an agency receiving federal funds; this includes potential impacts on both natural and human resources and measures for mitigating such impacts. Through the NEPA process state and federal partners can review the impacts and mitigation measures for any federal process and produce one of three types of documents: a Categorical Exclusion (CE),

an Environmental Assessment (EA) or an Environmental Impact Statement (EIS). Environmental justice efforts are reviewed for compliance as a part of the review of Title VI and NEPA documents.

In addition to document reviews, the federal government can assess the quality of an environmental justice program at certification reviews for MPOs and when auditing self-certification documentation for state and local agencies.

2. Current and Best Practices

This section presents findings from various public agencies that are formally addressing EJ across the United States. The subsections below describe policies and policy impacts, analysis methods and implementation challenges respectively. Best practices and lessons learned are identified and discussed in the light of sixteen years of EJ regulations, while acknowledging that Title VI and NEPA have been in effect for a much longer period.

2.1 Policies and Impacts

The 1994 Executive Order required federally-sponsored agencies to develop policies and programs to address disproportionate impacts to minority and low-income populations (FHWA EJ Website). Many agencies have developed guidance to integrate EJ issues into their operating procedures (Jerome and Donahue 2002; Grauberger and Van Orden 2003; Owens et al. 2008; and ODOT 2010). The studies described below were performed either by an internal task force (with input from stakeholders) or from external evaluation. Because EJ is an evolving practice, the process of defining and refining approaches to best achieve goals is an ongoing one.

2.1.1 Colorado Department of Transportation

In 2002, the Colorado Department of Transportation (CDOT) conducted the first phase of research for EJ implementation, in order to improve its existing EJ processes (Grauberger 2002). CDOT interviewed DOTs and MPOs across the country, including GDOT and ARC, to assess the EJ implementation of other states, and created a list of best practices under the following headings: strategies and goals, planning process, public participation and data collection. Interviews were also conducted within CDOT that revealed some flaws in its existing processes. At that time, no systematic approach existed at CDOT for identifying or addressing disproportionate impacts on target populations; there was no standard definition for the target populations. Also there was no uniform application of procedures to ensure that EJ was considered at the project level. However, CDOT has been able to use localized data sources in addition to census data to identify and locate low income and minority populations. Other outcomes of the research included recommendations for enhancing public involvement and updating guidelines to improve EJ implementation.

CDOT also conducted a second phase of research, which built upon the first phase, evaluating the initial results one year later. This second phase primarily focused on the public involvement of target populations. Interviews were conducted with leaders and representatives of various agencies and programs in Colorado to determine their approaches to public outreach. From these interviews CDOT created a list of best practices on strategies, planning processes and public involvement techniques. A list of qualitative performance measures for public involvement is included in Table 1. CDOT generally compares these measures across population groups (i.e. minority and non-minority) and assesses the measures prior to and after the implementation of the transportation project. More detailed quantitative measures to analyze the benefits of transportation projects are in development. These will be used for evaluation at a statewide and regional level.

Table 1: CDOT Performance Measures for Environmental Justice

Performance Measures
Accessibility to jobs
Travel times to selected centers
Provision and quality of transit
Community cohesion
Economic impacts
Safety impacts
Environmental impacts
Distribution of transportation funding

CDOT's 2003 report discusses the creation of a guidebook to enhance CDOT's environmental justice procedures. There is also a discussion on mapping impacts which refers to spatial comparison of impacts and populations (Grauberger 2003). The CDOT Guidebook (Environmental Justice in Colorado's Statewide and Region Planning Process) is a resource intended to provide all units in the Department with a basic understanding of CDOT's responsibilities regarding the consideration of low-income and minority communities in the planning process.

2.1.2 Ohio Department of Transportation

The Ohio DOT developed an EJ Task Force to determine the best approaches for Ohio to address EJ requirements in transportation, to agree on minimum standards for EJ processes, and to create guidance and education materials on EJ from the Ohio perspective. The Task Force's report describes ODOT's current regulations and demographic information and provides quantitative and qualitative test questions, public involvement recommendations and integration techniques. It also draws from learning of the Mid-Ohio Regional Planning Commission (the Columbus MPO) and the results of its EJ task force (ODOT 2002).

2.1.3 Arizona Department of Transportation

Arizona DOT conducted an analysis of its EJ program in 2002 to determine its compliance and to assess the success of their processes in addressing EJ issues (Jerome and Donahue 2002). ADOT determined through interviews with peer agencies and community advocacy groups that its programs were on par with peer agencies. However, the community groups voiced concern over the quantity of transportation options available to low-income and minority communities as well as potential negative impacts to those communities. It is important to note that an agency may meet the mandates of EJ with respect to the actions taken, while still failing to achieve EJ in the eyes of the community that it serves. The success or failure of EJ actions in terms of community outcomes must be gauged by the community. ADOT's research effectively captures the need for using both criteria (i.e., actions and outcomes) to determine the efficacy of an EJ program (Hatry and Wholey 2007). This is in line with the performance management literature which recommends the use of

input, output and outcome measures to determine if actions are actually achieving intended outcomes. ADOT recommends using both macro and micro level analyses, which are discussed in more detail in the subsection on analytical approaches below. Specifically, relevant to policy development, a linkage was recommended between funding decisions, environmental planning and project management, as well as the formation of community planning groups, transit planning partnerships and an ongoing EJ task force (Jerome and Donahue 2002).

Owens et al. (2008) identified several EJ concerns that affect policy decisions as a part of a national survey sponsored by the USDOT. They are: (i) public participation, (ii) access to transportation, (iii) location of public facilities, (iv) access to health care and (v) transit access. Transit access can be especially important to low-income and elderly populations who may not have other transportation options. Owens et al. (2008) recommend that planners include affected populations early in a transit planning process and build rapport. This recommendation aligns well with experiential knowledge showing the difficulty in obtaining equitable outcomes without an inclusive process (Amekudzi and Dixon, 2001). Additionally, the survey responses express the need to incorporate criteria and performance measures for EJ (Owens et al. 2008).

The examples above highlight agencies' need for policy level analysis as they develop EJ programs, and what can be gained from such analysis.

2.2 Surveys on Agency Experiences

Several surveys at the national, state, regional and local levels have been conducted to determine the impacts of EJ practices, the types of applications used, and community opinions of these practices (Jerome and Donahue 2002, Sanchez and Wolf 2005, Owens et al. 2008, Sen 2008).

A 2004 MPO survey, sponsored by the Brookings Institution, focused on measuring the products of the planning process, citizen participation and the representation of diversity on MPO boards (Sanchez and Wolf 2005). The surveyors reviewed MPO websites for documentation of plans and board member rosters; they also conducted phone interviews when information was not available on the website. The review revealed that 1 in 4 MPOs had a specific EJ/civil rights document while most others had language reflecting EJ concepts in their long range plans. Of those with specific EJ documents, most included a distributional analysis of the "protected" populations within their region and indicators of equity relating to, for example, regional employment accessibility, transit accessibility, and congestion levels. However the feedback loop of how these measures would be used in the decision making process, with an evaluation of how these measures had actually impacted target populations, was missing. The review also found that only 15% of MPOs have dedicated staff for civil rights, with public meetings being their primary environmental justice activity. Lastly, the MPO voting board member composition for the 50 largest MPOs (by population) showed on average 25% female, 88% Caucasian, 7% African American, 3% Hispanic, 1% Asian/Pacific Islander, and less than 1% for all other races. According to the U.S. Census Bureau, this is not a representative cross section of the country's demographic composition while it could be more or even less representative of the local population make up (Sanchez and Wolf 2005).

The 2002 Arizona DOT survey (Jerome and Donahue 2002) focused on State DOT's implementation strategies, conducting follow-up telephone interviews with three DOTs (MI, OH, MN). The survey responses indicated that most agencies had EJ concerns/issues with

highway/roadway improvement or upgrades and corridor analysis projects. When asked about the result of recent plans and projects involving EJ issues, the responding agencies reported a variety of outcomes, including litigation and complaints, significant modification or mitigation, and new policy development. About half of the responding agencies had designated their environmental planning departments as responsible for EJ activities, while others had designated specific groups dealing with only civil rights or environmental justice issues. In general, most agencies used a combination of standard technical analysis and structured public involvement to satisfy EJ requirements. However, when asked how they structured their EJ programs, the respondents gave mixed results. Some agencies had formalized detailed programs with standardized and step-by-step procedures while others had not. Many referenced the NEPA process or general planning process as their structure. Likewise, answers regarding public involvement procedures varied. Most respondents had no specified EJ public involvement programs but a few identified how other NEPA and project development public involvement practices address or are being modified to address EJ concerns. Some recommendations and advice from the survey respondents include the following: get planning, transit, community and environmental people together when developing an EJ approach; if it is incorporated into all three departments (Planning, Environment and Transit), there is no need for stand-alone program; educate staff and consultants; and have a non-defensive team approach (Jerome and Donahue 2002).

In a 2008 national survey of MPOs and state DOTs, Owens et al. (2008) found that both MPOs and DOTs have a consistent knowledge of EJ concepts across agencies, with several respondents representing strong commitment to EJ beyond legislative requirements. Specifically, public involvement is a highly visible and quantifiable aspect of the EJ regulation but to meet EJ goals an agency must do more than engage the public; compliance strategies include applying performance measures, GIS-based assessments, and surveying public opinion; there are lessons to be learned through the EJ process; some injustices may be mitigated and others may be avoided; if projects advance due to political influence over indicated EJ matters, litigation may ensue (Owens et al. 2008).

2.3 Analytical Approaches

Executive Order 12898 requires that agencies to “collect, maintain, and analyze information assessing and comparing environmental and human health risks borne by populations identified by race, national origin, or income.” This section discusses effective techniques and best practices on how to accomplish these goals technically.

The challenges in assessing impacts for EJ analysis are centered on the fact that there is not a single nationally accepted method to assess EJ. While this allows agencies to tailor their methods, it can also be a source of confusion for agencies developing EJ programs. Forkenbrock and Sheely (2004) address this by providing guidance for EJ assessments in 13 impact areas related to human health and safety and social, economic, and cultural issues. In the report, each impact area is addressed separately, presenting an overview of the current state of practice, methods for analysis, how to choose a method of analysis, as well as additional resources. The report provides techniques to measure distributive effects of transportation projects, plans or programs on protected populations. Distributive effects are the measurable outcomes of transportation improvements, whether beneficial or burdensome. The methods suggested in the report give agencies a flexible framework that can be adapted to address the needs of specific practitioners or

projects to analyze the effects of transportation improvement projects on target populations. Some of the techniques are currently used to measure effects such as noise pollution, air quality and traffic safety. Other methods are new or have had limited applications in transportation. Each technique is predictive. In addition, they can be integrated into a participation-focused planning process and meet regulatory and legal requirements (Forkenbrock and Sheely 2004).

2.3.1 Macro and Micro Levels of Analysis

The Arizona DOT developed a two-tiered evaluation approach for its EJ procedures: macro and micro level (Jerome and Donahue 2002). At the macro level is a policy approach that incorporates four principles: 1) coordinate efforts with other transportation agencies, 2) create detailed, formalized policies, procedures and guidance, 3) communicate the policies and procedures with staff and departments and 4) consider the effectiveness of the policies and procedures yearly (relative to impacts of policies on transportation services and access of target populations). This macro approach provides a self-evaluating structure for the environmental justice program that includes internal and external communication and a timeframe for reevaluations. The second tier, micro-level analysis, is performed at the project level and incorporates five directives: 1) define project study area, 2) develop community profile, 3) analyze impacts, 4) identify solutions and 5) document findings. At ADOT, micro level analysis for EJ is integrated with the NEPA process for projects, allowing for a systematic approach to EJ (Jerome and Donahue 2002).

2.3.2 Spatial Analysis Methods

Forkenbrock and Schweitzer's research (1999) develops and applies a methodology to overlay noise and air quality impacts spatially, using a census-based mapping approach that employs Geographic Information Systems (GIS), emission and dispersion models, and noise propagation models. The authors use a case study example to determine the effectiveness of their tool. The findings suggest that the proposed methodology sufficiently links the geographical census data to the spatial air quality and noise impacts in an easy to interpret map application. Challenges to this approach include limited access to sufficiently detailed data and the difficulty of quantifying some EJ impacts. (Forkenbrock and Schweitzer 1999).

Chakraborty (2006) summarizes past EJ analyses in transportation, identifying a general focus on accessibility, travel opportunity and safety. The paper formulates a set of indices to analyze the effects of transportation projects on EJ and addresses key challenges in assessing EJ impacts in transportation. The article describes two spatial indices that can be generated using GIS and census data: the Buffer Comparison Index (BCI) and the Area Comparison Index (ACI). Each index is a quotient (ratio of ratios) that can be used to compare race, ethnicity or income of the population affected by a transportation project with a reference population (the overall population for BCI or the unaffected population for ACI). The paper notes two concerns in creating the buffer that delineates affected regions around a transportation project: how to select the buffer distance such that it captures the area exposed to adverse impacts, and how to estimate the socioeconomic characteristics of the population within the buffer, given that the census boundaries do not often coincide with buffer zone boundaries. Chakraborty (2006) describes the three most common methods for estimation population characteristics: polygon containment, centroid containment and interpolation. The polygon containment method was used in combination with each spatial index in Chakraborty's analysis of two transportation projects in the Daytona Beach area. The study results

provide an example of how buffer analysis can be used at the micro level of analysis to screen transportation projects during the planning process. (Chakraborty 2006).

The challenges in assessing impacts for EJ analysis are centered on the fact that there is not a single nationally accepted method to assess EJ. In addition to the methods for estimating the population characteristics of a buffer region, as described by Chakraborty (2006), Hartell (2007) describes methods for defining the reference population and calculating the disproportionality of impact. The reference population and its corresponding reference area often depend on the jurisdiction of the agency performing an analysis, but it may also be defined in terms of an aggregation of larger census units. The choice of a reference population establishes the baseline for determining disproportionality and therefore greatly influences the outcomes of an EJ assessment. In addition to the rational comparison indices described above, disproportionality of impact can also be defined using the standard deviation method and the plus-25% method, each of which compares the percentage of target populations in the study area to those in the reference area. All these methods have advantages and disadvantages. Also, they must all grapple with data issues, such as how to define low-income or impoverished populations (either by the U.S. Department of Human Health and Services guidelines or by an agency-specific definition), and how to interpret census counts with respect to race and ethnicity. Hartell (2007) concludes that the variety of methods can have different effects on EJ assessment and that results can be skewed or obscured. For this reason, it is recommended that simple statistical tests should be applied to review the characteristics and distributions of the data before choosing the most reasonable methods of analysis for the information presented (Hartell 2007).

The spatial analysis methods described above all represent descriptive methods. Klein (2007) demonstrates how spatial statistics can enhance EJ analysis over and above the descriptive methods already employed by some transportation agencies. The paper provides an illustrative application of spatial statistics to analyze the distribution of impacts from the projects in the Delaware Valley Regional Planning Commission's transportation improvement plan (TIP). Specifically, it uses the global G^* and local Getis-Ord G_i^* statistics to measure for spatial clustering of transportation impacts and of target populations. Klein (2007) suggests that the method could be expanded to analyze cumulative impacts of projects in a region as well as changes in project impact over time. Also, spatial statistics could be combined with travel demand modeling to include specific transportation impacts on travelers (Klein 2007).

2.4 Public Involvement Processes

Public involvement is one of the explicit elements of the EJ regulations. The Executive Order identifies specific categories of stakeholders to include, and it is more specific in this area than the long standing NEPA public involvement processes. However, many responsible agencies have merged the EJ and NEPA public involvement practices by paying special attention to low-income and minority populations within the NEPA process. This is apparent from the many EJ-oriented identified responsibilities of project planning and environmental departments (Owens et al. 2008).

There are many examples of unique and comprehensive public involvement practices (FHWA Website). This may be due to the nature of project development. Each project objective may be unique and each location unique; therefore, both the characteristics of impacted populations and the impacts experienced by those populations will vary from one project to another.

To highlight a few case studies that go beyond traditional or status quo approaches to public involvement, FHWA compiled a list of ten project and program development efforts across the country (FHWA EJ Website, Case Studies). The South Carolina case provides a best practices example through their nontraditional community outreach approach. Recognizing that their first attempts did not produce much minority input, South Carolina DOT coordinated with local preachers to announce public meetings during church services in the predominately minority neighborhood. Numerous meetings were held in a variety of settings to make attendance convenient and SCDOT committed to building the trust of the community by maintaining communication as decisions were being made (FHWA EJ Website, Community Impact Assessment and Public Involvement, SC Route 72 EA).

Another best practice case study is Wisconsin DOT's proactive needs assessment for two heavily traveled corridors. Given the potential for controversy, WisDOT began public involvement efforts nearly three years prior to formally beginning the NEPA-required assessments in order to get input and support from the affected communities, one of which is made up of predominately low-income, minority and transient residents. Unlike the South Carolina case described above, well established leadership was difficult to find in this community. In order to reach community members, WisDOT creatively partnered with a local middle school, incorporating transportation and land use planning into the curriculum and having students prepare a portion of the needs assessment. A student project team presented their findings in a public meeting to an audience of parents, WisDOT staff, city and county officials, and other interested individuals. This meeting was followed up by a community design charrette, suggestions from which were incorporated into the final project design. Going beyond regulations and following the spirit and intent of the EJ Executive Order allowed WisDOT to address both the system and social needs of their community, allowing the residents to become more involved in community-based transportation planning (FHWA EJ Website, Verona/West Beltline Needs Assessment Study).

A final best practices example of public involvement is the Bay Area Rapid Transit (BART) Fruitvale Transit Village, an award-winning transit-oriented development project that originated with community opposition to a proposed parking deck. The success of this project in terms of public involvement hinged on the willingness of BART and the City of Oakland to partner with the local community-based organization, the Unity Council, which supported the interests of the majority Latino district of Fruitvale. This partnership took the form of, first, agency grants to the Unity Council to initiate a community planning process, and second a representative Policy Committee formed using a Memorandum of Understanding between all three organizations. By integrating the community's needs and desires for the proposed project, the agency was able to develop a project that garnered enthusiastic community support, improved pedestrian traffic through the adjacent business district, promoted new investment activity around the transit station and minimized negative environmental impacts (FHWA EJ website, Fruitvale Transit Project).

In addition to the process of public involvement, the Executive Order identified intended outcomes of EJ efforts; specifically, "to prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations." This can be interpreted to mean that environmentally just projects will provide equal and timely benefits to all populations. This part of the Executive Order is evaluation-based and therefore cannot be measured prior to implementation. This requires agencies to not only implement the quantifiable efforts but also to measure the impacts and outcomes to their citizens. Arizona DOT and Mid-Ohio Regional Planning Commission

(MORPC) are two agencies that have recorded their efforts to measure the outcomes of their EJ practices (Jerome and Donahue 2002; FHWA EJ Website, MPO Environmental Justice Report).

Arizona DOT found that although their EJ process was sufficient for compliance and similar to partner agency efforts, their constituents did not perceive the outcomes to be equitable for minority and low-income populations (Jerome and Donahue 2002). MORPC has a formalized process that includes community review of the environmental justice report to gauge if the findings presented reflect the neighborhood perceptions (FHWA EJ website, MPO Environmental Justice Report). Both of these examples point to a best practice for engaging the community after implementation is to evaluate if the outcomes of environmental justice efforts indeed align with the intended outcomes of environmental justice actions.

2.5 Methodological and Implementation Challenges

Duthie et al. (2007) examine three challenges to achieving EJ in the context of transportation planning: collecting and analyzing the necessary data, defining and applying concepts of equity, and determining the appropriate unit of analysis. With respect to data, the Census is currently the primary source of data for examining EJ. However, because census data comes at various levels of aggregation, and it is also collected with relative infrequency, its use causes formidable challenges to accurately forecasting population trends. Data issues also make forecasting difficult for trip distributions, network reliability, facility locations, and cost estimates for transportation investments.

Additional challenges are analyzing equity in funding allocations, creating comparison metrics, choosing the unit of analysis (individual, group, or geographic area) and deciding the appropriate scope of measurement. In traditional project development processes, a comparison of current year and future year operations is used to determine the impacts and value of alternatives (i.e. alignments, environmental impacts etc.). The unit of analysis provides a basis for comparison for performance measures; analysts compare impacts on or value to, for example, an individual, a group, or a geographic area. In EJ analyses Duthie et al. (2007) point out, the group should be the unit of analysis because of the focus on equity among vulnerable populations. Research illuminates the difficulty in creating metrics to compare current and future conditions when the data available is not at the level of detail needed or has very high uncertainty with respect to groups, geographic areas are often used instead. (Duthie et al. 2007)

Also challenging is the selection of unit of analysis for EJ: since the impacts and value will differ considering the unit of analysis, this is an important step. Lastly, the challenge of defining equity is a major issue for EJ implementation. Duthie et al.'s (2007) discussion of equity concepts identifies four types of equity: "opportunity," which deals with equal representation in the public involvement process, "equality," which deals with equal benefits from transportation process, "market based," meaning that customers get what they pay for, and "basic needs," which represents a compromise between equal benefits and market based equity. Similar discussions of equity concepts are given by other authors (Khisty 1996, Fischer 2011). Ultimately the literature suggests that these challenges should be addressed differently depending on the agency's goals and resources, and that care should be used because different definitions of equity can lead to different outcomes (Duthie et al. 2007; Khisty 1996).

Another EJ challenge identified by Sanchez and Wolf in their 2004 MPO survey is the membership and voting structure of MPO boards. The typical 'one-area, one-vote' structure used

by most MPOs and other Councils of Governments tends to have suburban bias since the urban area has a greater population but the same voting strength as the less populous suburbs. When additional agencies such as DOTs and transit providers are also involved in voting or even general discussion (Sanchez and Wolf point out that most decisions are made collaboratively), this representative structure becomes more complex. Care must be taken not to further limit the impact of public involvement processes and participation of vulnerable groups based on residential locations (Sanchez and Wolf 2005). This dynamic is corroborated by a series of interviews and surveys of transportation agencies and community focus groups in the Baltimore-Washington metropolitan area, that were conducted to gain an understanding of the views held by stakeholders and practitioners on environmental justice. The results indicate the difficulties that agencies experience when implementing EJ initiatives, such as involving low-income and minority populations by way of public meetings and the lack of federal standards or regulatory guidance. The surveys also revealed different viewpoints on EJ implementation from grassroots and former grassroots activists and other officials. Survey respondents from grassroots backgrounds had a higher level of concern for public involvement than officials that did not have an activist past. It also noted that sentiments of discriminatory practices in transportation persist (Sen 2008).

A UK researcher has found similarities between the US and UK perspectives of the social costs of transport, and the challenge of modal balance. Lucas' (2004) research defines social policy as the role of the state in relation to the welfare of its citizens. This role is often motivated by a mixture of market-driven and welfare-driven intentions, and expressed through either correcting or preemptively warding off imbalances, or some combination of both. An investigation of government's role is important in a transportation context because mobility and accessibility issues affect communities and their quality of life (Boschmann and Kwan 2008), and there are indications that improving the quality of transportation uniformly throughout a region increases the chances of enhanced economic competitiveness for the broader region (Ankner and Meyer 2009). The reason for this relationship is that transportation has important consequences for the employment, education, housing and land use of communities, all of which affect economic activity distribution, the general attractiveness of communities to potential employers, and the willingness of potential employers to locate in various localities or regions. The shaping of a region is often determined by the influence of the transport layout on economic and social life. Lucas (2004) describes transport as a 'merit good,' meaning it is a basic human necessity because of its ability to provide access to essential services as well as leisure activities. However, traditional decision-making paradigms in UK and US favor motorists, often leading to the exclusion of non-motorists. Lucas (2004) notes that there are long-standing regulations in both countries requiring consideration of wider social and community needs (Ministry of Transport and Ministry of Housing and Local Government circular of 1964 in the UK). However, there has been a tendency among transportation professionals to focus on mobility rather than accessibility (Lucas 2004).

3. Emerging Issue: Tolling Strategies for Road Pricing

The practice of environmental justice in transportation is still evolving as practitioners try to apply and implement its principles in more and more varied projects. One issue that has gained much attention as transportation funding becomes scarcer is the equity of tolling strategies in road pricing. Equity concerns (most likely of the critical variety) will present themselves at some stage in a road pricing project. For this reason, planners, officials, and proponents must be proactive in addressing them (Weinstein and Sciara 2006). The Puget Sound Regional Council (PSRC) in Washington State has recently considered equity issues in their innovative program delivery of road pricing (PSRC 2010). They have proactively engaged the public in determining the distribution, timing and alternatives of tolling. The plan develops a sustainable funding strategy that still relies upon the traditional gas tax with geographic and cross-income equitable revenues for implementing their 2040 transportation plan. By engaging the public in the development phase, the potential for litigation slowing or halting the plan is lessened.

Equity concerns can impede road pricing projects regardless of EJ procedures due to public opinion and the corollary political response. Media coverage on HOT (i.e., high occupancy toll) lanes in various regions of the country has been superficial, one-sided, and reflecting a low level of analysis, which has often led to public opposition of road pricing. This opposition then has the potential to influence political decisions to stall or end road-pricing projects (Weinstein and Sciara 2006, Levinson 2010).

In transportation pricing analysis, the geographic unit of analysis has political implications. As discussed in the above section, equity on a geographic level is not necessarily the same as equity on a group or individual level. For example if political jurisdictions receive equal, or even proportional funding for transportation projects, this may or may not lead to equal mobility and accessibility outcomes for the populations in those jurisdictions depending on demographic characteristics and needs (i.e. transit-dependence, LEP,³ etc.). Group and individual equity, as well as efficiency and effectiveness of transportation systems, can be diminished when geographical equity is prioritized through income regressive financing methods such as sales taxes. Where other current financing options like fuel tax and registration fees force drivers to pay for their respective travel, sales taxes do not. As fuel tax contributes less and less to the infrastructure maintenance fees (due to more fuel efficient cars and inflation outpacing taxes), transportation facilities become more reliant on strategies such as the sales tax for financing and less dependent on marginal social pricing of transportation. Road pricing is an option to increase revenue in a more progressive manner; still, the sales tax is politically more acceptable than implementing congestion pricing (Schweitzer and Taylor 2008).

Taylor and Norton (2009) differentiate between the performance of transportation programs and that of transportation systems. Specifically, political concern about transportation funding schemes ("program performance") can distract from how funding actually impacts the movement of goods and people "system performance" (Taylor and Norton 2009). The three main equity concerns in road pricing schemes are that of EJ (disadvantaged communities shouldering disproportionate adverse effects), the equal distribution of benefits (equity of access to facility and equity of allocation of revenue), and the distribution of the financial burden (regressivity of taxes and fees, tax distribution among urban and rural areas, and allocation highway user fees across classes of users based on costs they impose) (Weinstein and Sciara 2006). The focus in most

³ Limited English Proficiency

studies is on distribution of the financial burden. All of these issues can lead to political opposition, but all of them can also be addressed through careful public involvement and engineering analysis when political conditions permit (Levinson 2010).

Analysis of simulation studies in urban road pricing, particularly in cordon or area pricing, has shown that although efficiency is improved through pricing, equity suffers (Levinson 2010). Equity in road pricing has mostly been presented as an income issue, not an issue of race or ethnicity. The equity concern is based around a household's ability to access the benefits of a transportation improvement regardless of their financial status. Low-income households may not be able to afford transponders and lump sum payments needed to buy into a road pricing program. They also may not have credit cards or bank accounts, which are required for access into priced lanes or cordoned areas. In addition, low-income households have fewer funds to use the tollway and in this sense, the tolls may be seen as regressive (Weinstein and Sciara 2006, Levinson 2010).

Progressivity and regressivity are thought of differently in transportation contexts than in the general tax arena. This is because transport pricing measures may impact households differently in terms of both proportion of income and also in non-monetary costs imposed or benefits received. For example, a fuel tax requires a greater proportion of low-income households' income, making it regressive in one sense; however, those who drive more and in (larger) less fuel-efficient cars also pay more. In a sales tax strategy low-income households pay the highest proportion of their income in sales tax, a tax that is distributed across the entire consumer base, thereby penalizing non-users of the roadway facility. (In some instances, this is compounded by findings that several low-income households do not use the transportation facility and harmful side effects (e.g., noise, emissions) affect them.) This was illustrated in a study of Southern California's SR91 HOT lane: accounting for household structure and the likelihood to purchase taxable goods, Schweitzer and Taylor (2008) showed that while households in the lowest-income bracket do not necessarily contribute to the revenue via toll lanes, the contribution per family relative to family income, by sales tax alone, was the greatest in comparison to other income groups. There are limitations to these findings because the study included only one case and did not address mitigation measures such as commuter costs related to urban form or housing choice, congestion reduction or added capacity benefits to low-income commuters, the application of sales tax revenues to public transportation, or provision of discounted congestion pricing for low-income households. It should also be noted that empirical studies of road pricing projects conclude that HOT lanes are generally used by all income groups despite the fact that higher-income travelers have greater benefits and take advantage of them more frequently (Levinson 2010). Still, the study of SR91 shows that using sales taxes for transportation financing is more regressive than road pricing.

There are also spatial equity concerns in road pricing. Longer trips have higher benefits per mile and per traveler, making road pricing more beneficial to travelers from the suburbs or outlying areas. Likewise, limited access can exclude some neighborhoods, favoring some communities over others (Weinstein and Sciara 2006). Distance-based pricing, which could mitigate this equity issue, requires GPS units in vehicles to track time and location, and it necessitates complex charging schemes. Again, this raises the issue of low-income households' ability to purchase the expensive devices that are necessary to reap benefits from the pricing scheme. (Levinson 2010).

Modal equity is another issue. Tolls lower than transit fares may provide advantages to SOV (i.e., single occupancy vehicle) drivers; SOV drivers in HOT lanes may increase congestion for

those using transit or carpools, and SOV trips may become more attractive because of reduced congestion due to tolls. Recycling revenue from tolls by applying it to alternative modes and setting toll minimums to the cost of transit trips can help address these issues (Weinstein and Sciara 2006).

4. Summary, Recommendations and Conclusion

This study shows that significant strides have been made in the implementation of EJ policies and practices; however, there are many opportunities still available for greater integration of EJ principles and to attain the intended outcomes of the Executive Order.

The policies for EJ vary widely across the country in part due to the open language of the federal regulation. This flexibility has pros and cons for EJ policy outcomes. Positive elements include the ability of agencies to customize their policies. A less desirable element is confusion and frustration regarding regulation compliance. This frustration is experienced less by the agencies that have taken the leadership to find approaches and continually refine them in order to deliver environmental justice in transportation outcomes. It is possible that a lack of quantifiable measures for compliance has shifted agency focus, in some cases, to those EJ policy outcomes that are explicit, and do have objective measures of effectiveness. One example might be to measure how many people were contacted in a public involvement process; however, this can be misleading because the EJ policy outcome as defined by the executive order is for full and fair participation which is an implicit and subjective measure of effectiveness.

Another finding from the research is that there needs to be EJ evaluation at multiple levels of analysis: the policy level among stakeholders, the project level with the public and community groups, and ultimately a systems evaluation to find out if project decisions actually have resulted in the intended outcomes within the EJ target communities. A finding from Arizona DOT's research suggests there may be a disconnect or difference in outcomes between an agency's internal evaluation and external public evaluation of EJ efforts (Jerome and Donahue 2002). This illustrates the importance of using both types of evaluation: input- and outcome-oriented analysis. Systematic ways to address these efforts include implementing criteria and performance measures for EJ (Owens et al. 2008).

From a technical perspective there are a number of issues that require additional research: determining land use impacts, determining the appropriate level of detail for population analysis, determining the appropriate geographical unit for analysis, determining social effects, predicting long term results and addressing combined performance factors. However, there has been a tremendous effort to determine target areas, and measure and predict impacts both direct and indirect. Analytical approaches can be considered in the search for a formal, objective, transparent and repeatable approach for determining the target populations for EJ analysis. Ultimately, the effectiveness or appropriateness of various methods can be assessed from their impacts on achieving the transportation goals for target populations if the results are implemented. In other words, if the intent is to improve specific transportation quality deficiencies for target populations, the methods whose results produce the intended improvements when implemented are more appropriate or effective for a particular agency. Some of the more advanced analyses include transit applications, GIS mapping, and social impact analyses (FHWA EJ website Fruitvale Transit Project, Forkenbrock 1999, Lucas 2004). How the EJ analysis findings are connected with project and funding decisions will determine the impact of agency procedures and methodologies on the transportation quality of target groups. To this end, the analysis directives may include a formalized step to link EJ analysis findings with actual project decisions, and another test for decision-making outcomes.

The public involvement best practices discussed achieve the desired product of the process. They are being touted as best practices because they have resulted in the outcomes

intended for the communities to which they were applied. In other words, they were contextually appropriate because they achieved the intended outcomes within the specific environments. It is worth noting that the same practices may not be as effective in different localities. An agency that wants to achieve the intended outcomes of EJ must be committed to identifying the most appropriate public involvement process that will create the intended outcomes in the particular communities under consideration.

In addition, lessons learned from research on HOT pricing provide insights into EJ challenges. Equity concerns can vary greatly among HOT projects and are not predictable; therefore, a standard template to address these issues cannot be crafted. Weinstien and Sciara (2006) produced a practical framework with four general approaches to addressing the varying concerns as follows:

1. Through public education and outreach, misinformation about the nuances of equity in HOT lanes can be cleared. Steps used to provide better information about the equity impacts and garner support for HOT lanes in Minnesota and Florida included creating task forces of government and community leaders and educating officials, reporters and the general public.
2. Empirical analyses of the equity impacts of individual projects can be conducted during the planning process.
3. HOV to HOT conversions can first be run as pilot projects to allow for further study.
4. HOT lane revenue can be distributed to modes of transportation that serve low-income travelers along the facility through revenue recycling (Weinstien and Sciara 2006).

The remaining road pricing inequity concerns can be mitigated across five parameters developed by Levinson (2010): the basis of charging, the area covered by the charge, the time period of the charge, discounts or exemptions, and comparisons to charges for other modes of transportation. Revenue recycling can also be used as a tool to mitigate inequities across the last two parameters. In addition, some studies examined by Levinson (2010) suggested systems for credits or discounts for low-income travelers.

The next steps in environmental justice efforts for several agencies will have to do with ensuring a feedback loop through post-implementation evaluations. There is a need for agencies to assess how well funding decisions reflect the findings from EJ analysis, how well they address any deficiencies revealed by EJ analysis, and how these decisions affect the transportation quality of service for target population communities (Sanchez 2005, Jerome and Donahue 2002). The current best practices end at the documentation phase and it is apparent that EJ in the future will have to integrate the results of EJ analysis into funding allocations for project development. Figure 1 illustrates how the various phases and elements of EJ application must work together for environmental justice in transportation to be achieved.

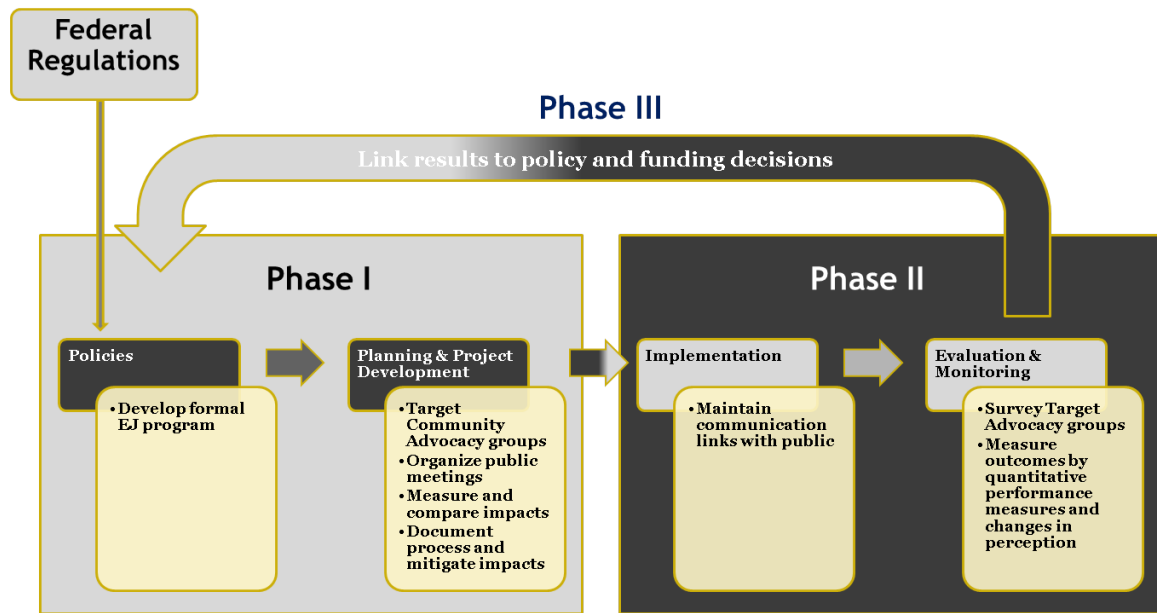


Figure 1: Environmental Justice Application Phases

The phases are incremental, which means Phase III is dependent upon Phase II being in place and so forth. The phase being implemented by an agency is an indication of the maturity of its EJ program. Effective policies to implement public involvement and data analysis are features of the first phase of EJ application. Phase I ends with the documentation of the process to achieve proportionate impacts to minority and low-income populations. Phase II evaluates the EJ programs after projects have been completed to measure if the deficiencies identified in the analysis stage have been corrected and the public evaluation of the improvements are favorable. Phase III indicates that the findings of Phase II influence and guide new policies and funding decisions to improve the outcomes of EJ efforts. Phase III also provides a basis for evaluating new policy development regarding equity impacts.

This emerging outcome-based framework for addressing EJ suggests that best practices in EJ can be defined as those that fulfill the EJ regulatory requirements and meet their intended outcomes in the communities of impact. These outcomes can be assessed both through before-and-after studies: technical (i.e., through analytical studies) and/or non-technical (i.e., through public involvement processes).

In the next phase of this work, this framework is used as a basis for evaluating the EJ programs of selected agencies, and those of GDOT. The findings are analyzed to make recommendations to GDOT on the level of maturity of its EJ program and the next steps for enhancing the programs capabilities to achieve EJ outcomes. Because EJ is an evolving practice, it is reasonable to expect that standards for addressing EJ in transportation agencies around the country will continue to be refined over time.

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Georgia Department of Transportation Office of Materials and Research:
Research and Development Branch
Project # RP 10-18

SURVEY REPORT

Project Title:

Impact of Environmental Justice Analysis on Transportation Planning

Organization:

Georgia Institute of Technology

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TABLE OF CONTENTS

TABLE OF CONTENTS	1
INTRODUCTION	2
SUMMARY OF SURVEY RESULTS	2
APPENDICES	
A: TARGETED AGENCIES/ EJ GUIDANCE DOCUMENTS	
B: RESPONSES TO SURVEY QUESTIONS	
C: RESOURCES FOR ADDRESSING EJ IN STATE DOTs	

Introduction

This report presents a summary of the survey and interviews conducted in Fall 2010 and Spring 2011 for the study “Impact of Environmental Justice on Transportation Planning” sponsored by the Georgia Department of Transportation (GDOT). The purpose of the survey was to identify effective practices in Environmental Justice (EJ) in transportation. The surveyed agencies were identified through a literature review and by recommendation from other state and federal agencies. The survey questions were developed based upon findings from a prior literature review and an EJ assessment of the Georgia Department of Transportation (GDOT), in order to determine how agencies active in EJ are integrating and applying EJ in transportation decision making. The survey consisted of eight questions and was administered by telephone to eight state Departments of Transportation (DOTs). Agencies active in EJ were defined as those addressing the qualitative as well as quantitative elements of the EJ guidelines: ensuring full and fair participation, mitigating disproportionate impacts and providing timely benefits to target populations. Through the literature review, agencies with public involvement processes as well as additional elements that address the other provisions of the EJ guidelines were selected for additional data gathering through the survey. Also, an initial survey with those agencies identified through the literature review and the FHWA helped to pinpoint additional agencies that are making efforts to address EJ comprehensively. The expanded list of agencies was then sent to the Environmental Justice in Transportation Committee of the Transportation Research Board for review and comment. A list of the targeted agencies can be found in Appendix A, and raw data from the respondents are included in Appendix B. Appendix C provides an overview of the EJ plans available from four of the targeted agencies. The following sections review the survey findings.

Summary of Survey Results

Internal Organization

The respondent agencies had various organizational structures, but all those surveyed responded that there was a sharing of responsibility for EJ between Environmental and Civil Rights divisions. Some agencies had a clear delineation of duties; for example, the Louisiana DOT Compliance Division noted that the “Environment section mainly deals with EJ on project level and Compliance section on program level.” Other agencies have a more integral approach, where each department is responsible for the EJ outcomes. The integral approach was less common and requires a clear, specific and established plan for EJ that is a shared priority throughout the divisions of the agency. Also, this approach benefits from a champion at a high level within the agency to ensure its integration into practice.

Many of the survey respondents identified that contractors and consultants were conducting the bulk of the “legwork” for EJ. This practice has worked well with good results. This has been especially valuable for those agencies that are short staffed.

Compliance

Compliance with FHWA guidance is important to all of the respondent agencies. Primarily, these agencies determine compliance through their Title VI documentation and reporting programs. Several of the agencies identified EJ components of their Title VI plan. Most agencies mentioned their role of monitoring complaints; fortunately most had received limited or no complaints in recent years. Some of this may be due to the improvement in public outreach and EJ, but it may also be due to the decline of major impact projects due to budget shortfalls. EJ has not been a major issue for small projects and some of the respondent agencies are bonded out and unable to fund major impact projects. These agencies that are unable to fund major projects plan to focus on 'fix and maintain' type projects for the next 10-20 years with no new highway miles planned.

The relationship between the DOT and its sub-recipients (i.e. Metropolitan Planning Organizations, Regional Planning Organizations, City DOTs, etc.) varies by agency but most identify a strong review process for compliance. Some sub-recipients use the same guidance for EJ as the State organization; this provides consistency through all levels of government and assures compliance. The DOTs also typically provide training for Title VI and EJ.

Populations of Interest

Each agency has its own methodology for determining populations of interest and measuring impacts; however, most of those surveyed used Census data in one way or another. Some agencies had developed customized GIS databases and noted how quickly they go out of date. Some of the agencies had large tracts of federal lands, state land and tribal land, which have unique EJ issues. However the rural nature of those lands makes the EJ impacts likely to be minimal. In other words, any proposed project on such lands can likely be relocated to mitigate detrimental impacts to the impacted population. The rural settings also have small populations, further limiting EJ concerns. One agency noted that their freeway configuration is primarily suburban, not urban, which also minimizes any adverse impacts on the population centers.

Public Outreach Efforts

All respondent agencies described their public outreach efforts as a major element of their EJ efforts. The level of engagement with the public varied. Some agencies provided written documentation and marketing for public involvement in the transportation planning and program development processes, online public opinion surveys to rate agency performance, and ongoing citizen groups to get feedback on EJ issues. However, most agencies focus on public meeting outreach, getting the word out early and to the right people. This approach has shown successful results for most agencies that begin early in project development process and have a constituency that is vocal about their concerns. Some agencies have a specified hierarchical approach to outreach, depending on the size and complexity of the proposed project, the potential impacts, and other criteria. Many agencies have a specified Public Involvement Plan, which is not specific to EJ but provides the agency with a template for conducting public involvement.

EJ Plans and Guidance

EJ plans in general discuss how the agency will address EJ in project development, including the roles and responsibilities of each department. To various extents (see Appendix C for more detailed review of current EJ plans) the plan will describe the desired method to determine target populations, what criteria to use for determining impacts and how to compare those impacts among target and general populations to assess disproportionate impacts. The plans also include various public outreach methods and may encompass public involvement measures, for example which stakeholder groups to market projects to. Most plans also describe the reporting or documentation the agency requires. The plans can also be an education tool to describe and explain the transportation impacts to communities and how proper EJ practices can improve the quality of the transportation services provided by the agency.

The relationship between NEPA and EJ is specific to each agency, and it is complex. The agencies that do not have a stand-alone EJ plan use the NEPA structure for EJ, being sure to add social issue assessments to the analysis. The main source of complexity for including EJ evaluation in the NEPA process is Categorical Exclusions (CEs) which do not require a NEPA analysis but are not excluded from an EJ analysis. This has been addressed by having an EJ element for CEs. However, agencies with EJ plans are able to address more than CEs in the plan. An EJ plan also provides consolidated guidance for routine procedures for information collection and public involvement.

Having an EJ plan does not automatically or immediately provide a best practice program. Some agencies with EJ plans explained that a highly descriptive plan can create a burden for some projects and not be sufficient in other cases. Also, a plan will need to be maintained (i.e., periodically updated) to stay relevant to agency practices, tools and goals. One agency has a detailed data collection plan that provides a detailed methodology for collecting and evaluating data and impacts. This type of information can be a valuable element to an EJ program. Because data collection and analysis methodologies do not have to be as context sensitive as public involvement processes, this plan provides valuable procedural guidance while still allowing a great deal of necessary flexibility.

Appendix A summarizes the guidance documents for the targeted agencies; Appendix B presents agency responses to the survey questions, and Appendix C provides a catalogue of guidance documents for addressing EJ in state DOTs.

Appendix A: List of Targeted Agencies and EJ Guidance Documents

DOT	Department/ Division	Environmental Justice Guidance
Arizona	Environmental Planning Section	Guidance on Title VI and Environmental Justice (for EA and EIS) - 1997
Ohio	Environmental Policy Section	Guidance for Best Practices for Incorporation of EJ into Ohio Transportation Planning and Environmental Processes- 2002
Colorado	Environmental Policy & Community Impacts	CDOT's Title VI and Environmental Justice Guidelines for NEPA Projects - 2004
Tennessee	Environmental Documentation Office/ Civil Rights Office	CH 5 - Impact analysis (Environmental Procedures Manual 2007)
Louisiana	Compliance Division/ Environmental Section	CH 5- NEPA and Related Procedures (Environmental Manual of Standard Practice 2006)
California	Office of Community Planning	Community Primer -2010 & EJ Desk Guide - 2003
Oregon	Civil Rights	Western States Peer Exchange Standards – Uniform EJ Data Collection Standards (no date)
Florida	Civil Rights	Florida Trends and Conditions Report – Transportation and Environmental Justice 2002

Appendix B: Responses to Survey Questions

These responses are presented to provide a general sense of how agencies are addressing various aspects of EJ; hence, they not presented in any particular order.

Question 1 Does your agency have written formalized independent EJ policies or practices? If so what are they? May we have access to them?

No.
Yes, ODOT 2002 Guidebook; will be updated in 6-8mos; all 12 districts use it.
2004 plan is most recent.
EJ Tool is a software program provided to communities to help them understand the process. Community Impact Analysis (CIA) guidance document is under development.
No.
Not a plan per se but guidance is available for internal use and public; Directives; Policy that guides the department with regard to EJ.
Yes. A planning document is available online. It is a working document providing guidelines for how to integrate EJ into the planning process (designed to translate the broader federal guidance to the engineering level).
EJ principles are incorporated into Social Cultural Effects process of department-wide Efficient Transportation Decision Making (ETDM) tool.

Question 2 Does your agency systematically survey selected community groups, the public or other organizations regarding the equity of transportation programs?

Outreach and Public Involvement Plan based on complexity of project which determines which level of outreach to use; five (5) levels available.
Not specifically for EJ, but have Public Involvement Plan and Stakeholder Participation guidance in CH 6 of NEPA Manual.
Public outreach is done on a project level (Also for LRP and STIP – can be considered project level). Additional outreach occurs and must be documented. Demographics information is sometimes collected to enhance quantitative analyses.
Assure Public Involvement Process addresses EJ.
No, but updating Public Involvement Plan.
Not specifically as part of EJ but has Citizen Advisory Group and lots of public meetings.
Project surveys and outreach evaluation surveys.
All projects must have buy in by all agencies and the public. Outreach is tailored to each specific community.

Question 3 Does your agency have multimodal policy groups?

MPO coordination, Multimodal planning.
No
No

Yes
Not to a great extent, but include in FHWA analysis.
No

Question 4 Does your agency use standard NEPA guidelines to conduct EJ processes?

A strong distinction is made between NEPA and Title VI program to emphasize importance of compliance (full NEPA process is not applied to categorical exclusions). The two programs view environmental in different contexts (NEPA does not highlight social impacts).
Yes.
Yes and in Social and Cultural Resources Plan.
Yes, but not pressing review of process because number of substantial projects is dwindling.
Integrated throughout project development including NEPA.
Yes, Quality assurance reviews every 2yrs by Central Office; Also consider EJ and Public Involvement in Categorical Exclusion documents (level 1 & 2); Stand-alone Purpose and Needs statements and 4F evaluations.
Yes, in collaboration with Civil Rights Office.
NEPA is included in ETDM. It does not specifically relate to EJ because of the integration of the overall transportation planning process.

Question 5 What is your current data analysis methodology? For target areas? For determining impacts? Is it written or standardized in any way?

EJ communities >25% of project population; Use block groups in census data and compare to next higher level; subjective determination of impact; GIS format technical analysis, does not use buffer method, member driven analysis.
Quantitative studies are not necessarily done at the state level. ODOT does have comprehensive GIS databases. MPOs and municipalities generally perform technical analyses for EJ (at project level).
Social impacts – long and short term.
ETDM uses a weighted score to determine sensitive areas – using census data, American Community Survey data, and MPO local knowledge. Human checks are also done to ensure that even small populations are not neglected.

Question 6 Does your agency have a citizen advisory group or any other structure for soliciting feedback?

Census, Maps
Yes feedback loop through Primer and Public Participation Contact reach communities; HQ and 12 districts have standing citizen committees (not EJ specific). District level committees reflect priorities of district, ex. Oakland has Ped/Bike citizen committee.
No, however feedback is collected throughout project from Planning – Completion, each division is responsible for its efforts but guided by Public involvement plan, Civil Rights office monitors public meeting transcripts to assure compliance and tracks complaints

Yes
No standing committees but create stakeholder groups for projects; the Central office does not maintain a stakeholder list but districts may
On a project level.

Question 7 How does your agency use information obtained from the public?

Documentation (Foremost is data, public involvement process output and Outreach programs)
Monitor complaints, no EJ issue since 1997
TDOT has online rating tool not project specific for public, the responses are used internally not part of data collection.
Surveys certain sections, Follow-up if relocate families advisory services.
Public outreach is done on a project level (Also for LRP and STIP – can be considered project level). Additional outreach occurs and must be documented. Demographics information is sometimes collected to enhance quantitative analyses.
Public feedback is incorporated into project planning as well as the completion process for individual projects.

Question 8 Does your agency have any examples, information, etc., to show result, outcome or impact occurring as the result of considering EJ on Transportation Planning and Practice? Transportation?

See Appendix C: Catalogue of Resources
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Appendix C: Catalogue of Resources for Addressing EJ in State DOTs

Ohio DOT, *Guidance and Best Practices for Incorporating Environmental Justice into Ohio Transportation Planning and Environmental Processes* 2002

http://www.dot.state.oh.us/Divisions/TransSysDev/Environment/NEPA_policy_issues/ENVIRONMENTAL_JUSTICE/Documents/EJ_Book_Complete.pdf

This document is a guide for the Department to understand regulations, purpose and process of EJ in its state. It also has an MPO section, providing partner agencies with an approach that is consistent with the State's. The document discusses the data needed to conduct a quality assessment, methods to test disproportional impacts to target populations, and public involvement approaches, including the intent of and potential challenges to those approaches. This report also provides a programmatic review of how the DOT and MPOs can incorporate EJ into their planning and environmental processes, with specific opportunities for application. For instance, one opportunity is to prepare and distribute statewide demographic analyses. At the time of the EJ survey, ODOT had a dedicated EJ taskforce that was working toward the goals of this report.

Colorado DOT, *CDOT's Title VI and Environmental Justice Guidelines for NEPA Projects* 2004

http://www.coloradodot.info/programs/environmental/resources/guidance-standards/rev_3_ej_guidelines.pdf/view

This report explains the specific requirements for EJ and Title VI to be conducted on NEPA projects. It identifies the CDOT project staff role and provides a consistent standard for the State to utilize. The report provides CDOT staff with procedures to follow to remain compliant with federal regulations for EJ. It also includes information for locating internal support, lists each division's responsibilities, describes available training, outlines documentation requirements, and discusses how to determine impacts.

Oregon DOT, *Western States Peer Exchange Standards Environmental Justice Data Collection Standards* undated

http://www.oregon.gov/ODOT/CS/CIVILRIGHTS/titlevi/title_vi.shtml#EJ

This report is not a traditional stand-alone report but provides a specific data collection process for EJ. It identifies the intention of EJ and describes how to collect data to determine and mitigate disproportionate impacts and ensure fair and full participation in decision making process. It provides step by step instructions, including how to analyze burdens and compare % benefit or burden to % population by race and income with corresponding examples.

Caltrans, *Community Primer on Environmental Justice & Transportation Planning* 2010

http://www.dot.ca.gov/hq/tpp/offices/ocp/ej_titlevi_files/EJ_Primer_4_10_WEB.pdf

This document is a public outreach marketing document intended to educate the public about EJ and transportation planning, and how they can get involved. It provides a basic overview of EJ issues with emphasis placed on community involvement. It also provides an overview of the role of government in transportation decision making at every level and describes its funding. This primer gives an overview of the entire transportation process and how citizens can become involved.

Caltrans, *Desk Guide Environmental Justice in Transportation Planning and Investments* 2003

http://www.dot.ca.gov/hq/tpp/offices/opar/ejandtitlevi_files/EJDeskGuideJan03.pdf

This document is intended for Caltrans staff to understand the motivations for EJ legislatively, and morally. It describes Economic, Social, and Environmental Impacts of transportation decisions, legal and regulatory issues as well as examples of litigation in California's past. It also gives step by step instruction of how EJ fits in to Long Range Planning and Project Development Process. This guide identifies all roles and divisions involved in the successful implementation of EJ principles; it is not from only one perspective. Lastly it provides case studies that illuminate the public involvement and assessment efforts of previous special case scenarios.

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Georgia Department of Transportation Office of Materials and Research:
Research and Development Branch
Project # RP 10-18

GAP ANALYSIS REPORT

Project Title:

Impact of Environmental Justice Analysis on Transportation Planning

Organization:

Georgia Institute of Technology

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December 30, 2011

TABLE OF CONTENTS

TABLE OF CONTENTS	1
INTRODUCTION	2
EXPLANATION OF GAP ANALYSIS TABLE	2
GDOT GAPS, OPPORTUNITIES AND RECOMMENDATIONS	7

1. Introduction

This internal document for the Georgia Department of Transportation (GDOT) compares the current practices, policies and processes in Environmental Justice of best practice agencies to those of GDOT in order to highlight potential gaps. The review was conducted as part of a study: “Impacts of EJ on Transportation Planning” sponsored by GDOT to determine the best practices in Environmental Justice and its impacts in Transportation Planning, and the status of EJ in Transportation Planning at GDOT. As a part of this analysis, multiple agencies active in integrating EJ in Transportation were surveyed, a literature review of EJ was conducted and internal interviews were conducted with GDOT staff members to determine the policies, programs and procedures being used in EJ and how GDOT’s practices compare. The Gap Analysis Table identifies both best practice actions and the gaps between GDOT and other DOTs.

2. Explanation of Gap Analysis Table

The Gap Analysis Table is an illustrative comparison of three documents: a literature review of current EJ practices, policies and processes at GDOT; internal interviews with the GDOT Civil Rights, Environment, Planning, and Program Delivery divisions; and the responses to a survey of effective practice agencies. Each of these documents may be reviewed individually; but as part of the gap analysis table, they illustrate the different approaches to EJ taken by the various agencies.

The table presents three distinct phases of EJ: Phase I – Process and Burdens, Phase II – Evaluation and Benefits and Phase III – Linkage to Resources. These phases are illustrated in Figure 1, which identifies various phases and elements of EJ applications and how they must work together to achieve the ultimate objectives of EJ in transportation (See literature review for more details). This framework is the basis for evaluating the EJ programs of the selected agencies and GDOT. An analysis of the findings has been conducted to make recommendations to GDOT on the level of maturity of its EJ program and the next steps for advancing it to meet the intent of the EJ Executive Order.

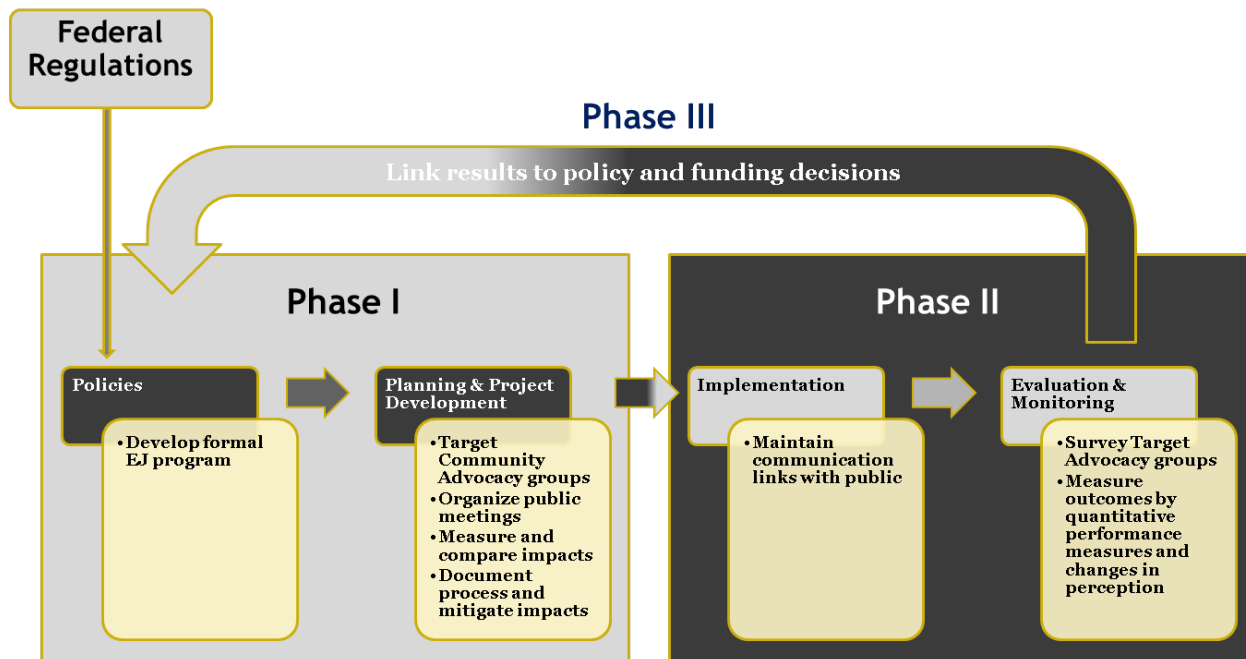


Figure 1: Environmental Justice Maturation Model with Application Phases

Each phase is introduced separately below in a different table for ease of viewing the data. However the full Gap Analysis Table includes all the phases. The actions identified within the table are detailed after the table. A check mark in the table indicates that the corresponding agency listed to the left incorporates this feature in their EJ program. A discussion of the GDOT gaps and opportunities follows the tables.

Phase I (Table 1) has the fundamental EJ program activities to meet federal regulations ending with the documentation of the process to achieve non-disproportionate impacts to minority and low-income populations. The features of the first phase of EJ application include effective policies to implement public involvement and data analysis to identify disproportionate impacts. This phase focuses primarily on objective data and measurable elements of the EJ Executive Order.

Table 1: Phase 1 - Process and Burdens

Phase I - Process & Burdens										
	Public Involvement Process	Maintain citizen group lists	Standing committee of citizens for feedback	Standardized Technical Analysis Procedures	Formal Internal EJ workgroups	EJ Education program (Internal)	EJ Education program (External)	Formal EJ Plan or Standard Guidelines	ID of disproportionate impacts of projects on target groups	Document EJ through NEPA Structure
DOT 1			X						X	X
DOT 2	X	X		X	X			X	X	
DOT 3	X							X	X	
DOT 4	X								X	X
DOT 5									X	X
DOT 6	X	X	X	X		X	X	X	X	
DOT 7				X				X	X	
DOT 8	X		X	X					X	
GDOT	X*	X							X	X

- GDOT has developed a public involvement plan. Guidelines on how public involvement is conducted to achieve EJ outcomes can be included in the plan to clarify how public involvement is actually used to achieve EJ outcomes, and make this information readily available within the agency.

Create Public Involvement Process (PIP): This action refers to a formal public involvement process that identifies how target groups will be contacted and involved in the transportation decision-making process. This PIP can address issues beyond EJ. Often it is general for an agency but provides guidelines that can be used by any division, contractor or agency representative in order to have a consistent process for including public.

Maintain Citizen Group Lists: This action refers to the maintenance responsibilities of keeping a citizen group list active and up to date for use in public involvement.

Maintain and Utilize Standing Committee of Citizens for Feedback: This action refers to the Department maintaining and utilizing a committee of citizens for input and feedback on decisions for a specified term greater than the duration of an individual project or review. This committee may provide feedback on a variety of issues, including but not limited to EJ.

Develop Standardized Technical Analysis Procedures: This action refers to the creation of a formalized process for evaluating EJ impacts. These procedures may include the type of data to collect, one or more analysis methodologies, and the criteria for using them, and the thresholds for disproportionate impact.

Develop Formal Internal EJ Workgroups: This action refers to the development of a formal group of department personnel, including staff from multiple divisions, dedicated to working on EJ issues. Such a group could operate on a project basis for a finite period of time, or addressing EJ could be part of their job responsibilities on an ongoing basis.

Develop EJ Education Program (internal): This action refers to the creation of a formally structured program to educate internal staff from all divisions on the EJ requirements and processes of the agency. An effective education program would include refresher programs to maintain a base level of understanding throughout the Department.

Develop EJ Education Program (external): This action refers to the development of a formally structured program to educate the public on EJ objectives and processes. Such a program could be used as part of a public Involvement process to generate feedback.

Develop Formal EJ Plan or Standard Guidelines: This action refers to the development of formal written procedures for an EJ program, including agency actions to accomplish the goals of the EJ Executive Order, as well as how these goals are to be accomplished including the reporting requirements. An EJ Plan may include some discussion of any or all of the previous actions of this phase: the public involvement process, standardized technical analysis, roles and responsibilities of agency divisions, and education programs.

Identification of Disproportionate Impacts of Projects on Target Groups: This action refers to the process of determining the disproportionate impacts of projects on target groups. This is the most basic and necessary outcome of any EJ effort.

Document EJ through NEPA Structure: This action refers to the reporting, location, and timing of EJ actions conducted by the agency. The NEPA process is often used to identify how and when EJ activities take place; however, it is important that agencies identify how Categorical Exclusions will address EJ.

Phase II (Table 2) evaluates the EJ programs after projects have been completed to measure if the deficiencies identified in the analysis stage (i.e., Phase I) have been corrected and the public evaluations of the improvements are favorable.

Table 2: Phase 2 – Evaluation of Benefits and Burdens

Phase II - Evaluation of Benefits and Burdens		
Agencies	Survey target groups to measure outcomes	Apply performance measures for process and outcomes
DOT 1	X	
DOT 2		
DOT 3		X
DOT 4		
DOT 5		
DOT 6	X	
DOT 7		
DOT 8		
GDOT		

Survey Target Groups to Measure Outcomes: This action refers to the collection of survey data after a project is completed, or non-project specified surveys of target groups to determine their perspectives on how the agency is meeting the EJ goals of providing equitable access to benefits and proportionate distribution of burdensome impacts.

Performance Measures for Process and Outcomes: This action refers to the inclusion of process and outcome of EJ performance measures. Process-oriented performance measures for EJ measure characteristics of agency actions, such as the number of target groups contacted in a

public involvement process. Outcome-oriented performance measures for EJ measure the extent to which the objectives of the Executive Order are being achieved. Both types of performance measures provide information about the effectiveness of EJ programs, and these measures can be tracked over time to gauge the extent to which EJ outcomes are actually being achieved.

Phase III indicates that the findings of Phase II influence and guide new policy and funding decisions to improve the outcomes of EJ efforts. This Phase also provides a basis for evaluating new policy development regarding equity impacts.

Table 3: Phase 3 – Decision Making: Linkage to Policy and Funding Decisions

Phase III - Decision Making: Linkage to Policy and Funding Decisions			
	Systems evaluation	Assessment of cumulative impacts	Link measured outcomes to policy and funding decisions
DOT 1*			
DOT 2			
DOT 3			
DOT 4			
DOT 5			
DOT 6			
DOT 7			
DOT 8	X		X
GDOT			

*While few of the agencies surveyed have implemented any phase III elements in their programs as yet, both Arizona DOT and Colorado DOT are working toward the development of such elements in their respective programs, as reported in the survey.

Systems Evaluation: This action refers to the evaluation of EJ issues and the impacts of transportation decisions from the perspective of the entire network. Such evaluation requires a broadening of the geographical perspective beyond the project level.

Assessment of Cumulative Impacts: This action refers to the analysis of transportation decisions over time to assess EJ impacts. This requires a broadening of the temporal perspective beyond the immediate to the longer term.

Link Measured Outcomes to Policy and Funding Decisions: This action refers to using the results of EJ performance measurement to make policy and resource allocation decisions for the future, assuring that there is a linkage between EJ outcomes and policy and resource allocation decision making. This action may include dedicating funds to meeting performance targets that support the EJ Executive Order outcomes.

3. GDOT Gaps, Opportunities and Recommendations

This section discusses the areas where there are opportunities for GDOT to enhance its Environmental Justice program to achieve intended outcomes. As shown in the tables above, GDOT, like several other agencies, is primarily active in Phase I – Process & Burdens actions. In this Phase, GDOT currently implements three of the ten practices identified in this study. In order to be at par with the majority of the agencies interviewed, the Department may need to develop a formal EJ plan or standard guidelines; standardized technical analysis procedures, and introduce formal EJ guidelines within the existing public involvement plan demonstrating how public involvement is used in achieving EJ outcomes. Other elements of Phase I that are missing from GDOT are less common among best practice agencies at this time. However, as the study has shown that EJ is an evolving practice where agencies progressively move toward more mature systems, it will be worthwhile for the agency to consider how other program elements can help achieve EJ outcomes more effectively, e.g., formal internal workgroups, EJ education programs (internal and external). Considering the opportunity for a head start, GDOT may wish to consider which of these actions would enhance its EJ program most effectively, in order to remain at par with other state DOTs as they mature in demonstrating EJ outcomes.

The Phase II actions are sparser and Phase III actions are practically nonexistent, even among best practice agencies. Part of the reason for less activity in these phases is the cumulative nature of the phases: in order to implement Phase III activities, Phases II and I actions must be in place and operating at a high level. What this suggests is that only a few agencies are at the level of Phase II maturity.

The Phase II actions were found to be sparser and Phase III actions practically nonexistent, among the agencies surveyed. Part of the reason for less activity in these phases is the cumulative nature of the phases: in order to implement Phase III activities, Phases II and I actions must be in place and operating at a high level. What this suggests is that only a few agencies are at the level of Phase II maturity.

GDOT is in a position to develop an enhanced EJ program that improves EJ outcomes for the state. Given the knowledge of EJ programs in other agencies and the direction of GDOT's EJ program development, the agency can create a streamlined program that uses lessons learned from other states. For example, GDOT currently does not have a formal EJ plan or specific guidance for EJ; however, by

developing such guidance and collecting follow-up information using outcome surveys and performance measures, the agency can move swiftly to a more mature EJ program that measures outcomes. The Department can then build a bridge to Phase III, using these outcomes data to make policy and resource allocation decisions, thereby positioning itself as a leader among transportation agencies in addressing EJ issues.

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EJ TECHNICAL ANALYSIS REPORT

Project Title:

Impact of Environmental Justice Analysis on Transportation Planning

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TABLE OF CONTENTS

TABLE OF CONTENTS	1
INTRODUCTION	2
EJ ANALYSIS PROCEDURE	2
EJ ANALYSIS DATA, TOOLS AND EXAMPLE APPLICATIONS	10

1. Introduction

This technical assessment report discusses the basics, advantages and disadvantages of technical analysis approaches being applied to achieve environmental justice in Transportation Planning. It also offers examples of analyses that have been used around the country. The report is one of the deliverables for the Georgia Department of Transportation sponsored project: "Impact of Environmental Justice on Transportation Planning" (2010-2011).

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," outlined requirements for agencies receiving federal funds to address the EJ impacts of their decisions. The Federal Highway Administration and Federal Transit Administration guidance outlines that environmental justice actions must address the *burdens*, *benefits*, and *process* of transportation decision making (FHWA EJ Website):

- (1) To avoid, minimize or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low income populations
- (2) To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process, and
- (3) To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

In general, EJ analysis involves the following: (i) Defining the impacted and target populations; (ii) defining the study area; (iii) defining the geographical unit of analysis; (iv) defining or identifying burdens and benefits; and (iv) defining disproportionality. This report also reviews several analysis tools that have been applied to assess the environmental justice impact of projects, outlining their advantages and disadvantages, and data sources. It concludes with guidance on selecting the most appropriate tools for EJ analysis as well as opportunities for improving existing tools.

2. EJ Analysis Procedure

2.1. Defining Populations

Defining the reference or impacted population and the disadvantaged populations is a pivotal, yet complex step in analyzing the environmental justice impacts of plans, programs and projects. There is no clearly defined procedure for determining a reference population. The population can range from an aggregation of residents in all affected census units to a limited proportion of the populations of the census units contained within the affected area (Most 2004). Other determinants such as Metropolitan Planning Organization jurisdiction or tax service district can be used to define a reference population as well (Hartell 2007).

Executive Order 12898, which mandated formal environmental justice practices, characterizes target populations as: Black, Hispanic, Asian, American Indian and Alaskan Native, Low-income, and most

recently Native Hawaiian or Other Pacific Islander. While the elderly, disabled and child population groups are not explicitly addressed in the environmental justice regulations, these populations are considered as target groups in the 2004 Executive Order 13330: Human Service Transportation Coordination. Definitions of race, ethnicity, and low-income can be found not only on the federal level, but many MPOs and state agencies have also adopted clear verbiage to identify the protected population. Subtle differences in these definitions can complicate the process. The way information is presented can also complicate the application of these definitions. For example, the Census Bureau reports household income below the poverty line and at or above it, while FHWA requirements seek EJ for households at or below the poverty line (Hartell 2007). Interpreting information such as households of multiple races and/or ethnicities also presents a problem because the guidelines for counting these individuals differ based on jurisdiction, and there is a possibility that some racial groups can be undercounted (Hartell 2007).

2.2 Data Availability and Resolution

Data complications can arise when different data sources are used to assign definitions to a population. Data used to determine if a population can be categorized as disadvantaged can be drawn from sources such as the US Census Bureau or local or county tax authorities. Census data is most often used. However, with this there are concerns about resolution of the data. The aggregation of data hinders high resolution applications. Also, the geographic units at which data is aggregated are artificially imposed, with boundaries drawn by the researcher or the data source. This issue is called the Modifiable Areal Unit Problem (MAUP): i.e., boundaries are seen as somewhat arbitrary and modifiable, and they produce artificial spatial patterns (Most et al. 2004). For example, different resolutions can produce different results in analyses; it is possible to identify a disproportionate impact at a county level that is not reflected at a census block level, or vice versa. A similar issue arises in applying statistical correlations across varying scales of resolution (Amekudzi and Dixon 2001). It should also be noted that while race demographics are provided at the census block level of resolution, income is only available to the block group level (Hartell 2007). In terms of general data availability, household travel surveys, activity-based models and microsimulations can reduce some data needs, in turn reducing the pressure on Census data (Duthie 2007).

2.3 Defining Study Area

Methods used to define the study area for an EJ analysis vary and produce a range of results. Judgment must be used to decide the most effective process to define the study area for a given case. The complications lie in identifying the spatial distribution of census data, carefully addressing the MAUP, and drawing reasonable boundaries, beyond which effects are negligible. Aggregation of information into low resolution census blocks or block groups forces demographic information such as race and income to be blanketed across an area, not accounting for the true geographic demographic distribution of the area. Another issue is that the study area assumes the entire population within the given area is affected equally and that the population outside of that area is not affected. Current methods to define the study area grapple with these issues. They include polygon, within, centroid, areal interpolation and cross-area transformation. The methods are described in this section.

2.3.1 Buffer Zone

In order to define the study area by any of the methods outlined below, a buffer zone must first be delineated. This is a zone within a specified distance (or distances) from the transportation project for which the analysis is being conducted. The buffer zone(s) represents the assumed area that will experience actual effects (Hartell 2007). However, because the buffer zone is a constant distance surrounding the project, it is unlikely that Census tracts will correspond exactly. The following analysis methods address this concern.

(A) Polygon Analysis

Polygon analysis can also be referred to as Adjacency Analysis. It is the easiest method to implement. It includes all census units within or intersected by the buffer of the project. Despite the ease in determining the study area for this methodology, it may extend the study area far beyond the bounds of the buffer and also has the possibility of excluding areas close to the buffer (Hartell 2007). **Figure 1** depicts the principle of polygon analysis.

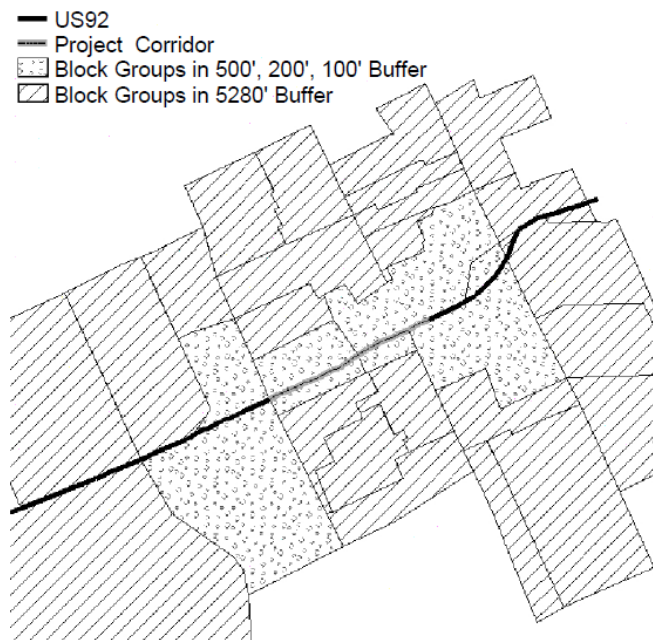


Figure 1: Polygon Analysis showing how some areas close to the project can be neglected while those farther away from the project are included (Source: Hartell 2007)

(B) Within Analysis

Similar in effort level to the Polygon Analysis method is the Within analysis. This method only includes census units contained entirely within the buffer (Most 2004). This leads to obvious disadvantages. Census units in which a majority of the population lives within the buffer may be excluded if a portion of the unit is outside the limits of the buffer. **Figure 2** depicts the principle of “Within Analysis”. Using smaller buffers would exclude many of the surrounding census units. Also, cases like the example depicted show that if the units are not completely contained in the buffer, they will not be included in the analysis.

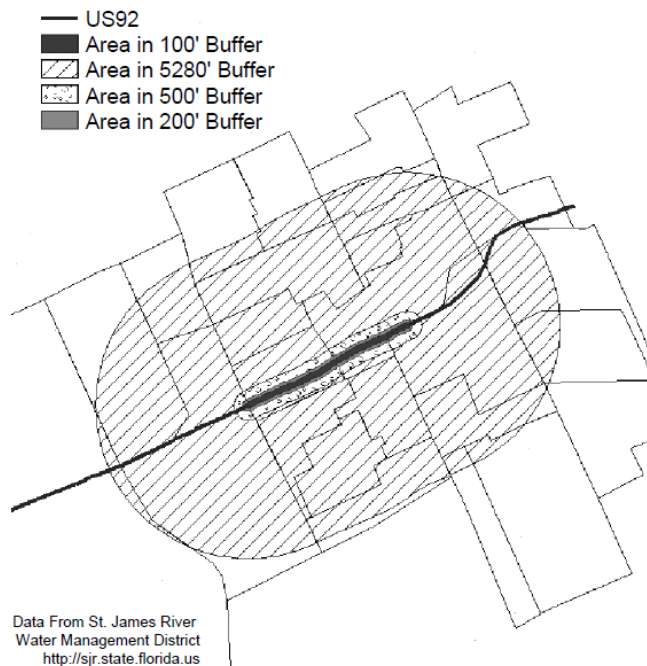


Figure 2: Within Analysis illustrated with different buffers showing that smaller buffers would exclude several of the surrounding census units (Source: Hartell 2007)

(C) Centroid Analysis

Centroid analysis has similar drawbacks to the Within Analysis method. In this method, census units are included in the study area if the geometric centroid of the unit falls within the buffer area. It is possible for this method to exclude areas adjacent to the buffer as well as populations that are actually within the buffer (Hartell 2007). **Figure 3** depicts the principle of centroid analysis.

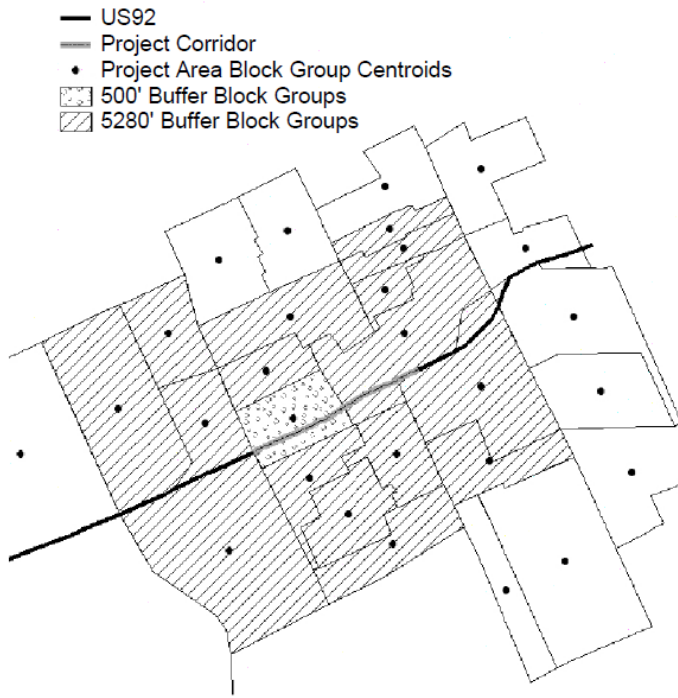


Figure 3: Centroid Analysis depicting units that are included in the study area have their geometric centroid falling within the buffer area (Hartell 2007)

(D) Mathematical Transformations

(i) Areal Interpolation

Mathematical transformation and interpolation techniques apportion demographic information to fractions of census units. These techniques, also referred to as Buffer Containment by Chakraborty (2006), rely on the assumption that demographics are evenly distributed across the census unit. Areal interpolation calculates the percentage of area of an intersected census unit within the buffer. It then assigns that percentage of the unit's demographics to the area contained within the buffer. Most (2004) provides the following formula:

$$P = \sum_{i=0}^n P_i + \sum_{j=0}^m \left[P_j \left(\frac{A_{je}}{A_j} \right) \right]$$

where:

P = total population inferred through the interpolation
 n = number of census units contained entirely within the buffer
 P_i = population of intact census unit
 m = partial census units
 P_j = population corresponding to partial census unit
 A_{je} = the partial area of truncated census unit
 A_j = the total area of the truncated census unit

(ii) Cross-Area Transformation

Another interpolation method is cross-area transformation. This method calculates the percentage of area of an intersected census unit within the buffer and then applies this percentage to the total population of the units completely contained within the buffer. This product is then assigned to the truncated portion of the census unit. Most (2004) provides the following formula:

$$P = \sum_{i=0}^n P_i + \sum_{j=0}^m \left[P_{ix} \left(\frac{A_{je}}{A_j} \right) \right]$$

where:

P = total population inferred through the interpolation
 n = number of census units contained entirely within the buffer
 P_i = population of intact census unit
 m = partial census units
 P_{ix} = population corresponding to partial census unit
 A_{je} = the partial area of truncated census unit
 A_j = the total area of the truncated geographic unit.

Table 1 summarizes the advantages and disadvantages of the methods for determining the study area.

Table 1: Summary of methods for determining study area

Method	Advantages	Disadvantages
Polygon	• Clear and simple method	• May extend the study area far beyond the bounds of the buffer • Has the possibility of excluding areas close to the buffer
Within	• Clear and simple method	• Populations within buffer may be excluded if census unit is not fully contained within buffer.
Centroid	• Less likely to include populations in Census units that extend far beyond the buffer	• It is possible to exclude areas adjacent to the buffer or populations that are within the buffer depending on location of centroid
Mathematical Transformations	• Translate Census units to an area within the buffer zone (for population size, demographics)	• Mathematical requirements • May neglect areas of high concentration outside of buffer

2.4 Determining Impacts

It is necessary to understand the impacts of transportation improvements on the defined population and study area. However, challenges in assessing impacts for EJ analysis stem from the fact that there is not a single nationally accepted method to assess EJ. While this allows agencies to tailor their methods, it can also be a source of confusion for agencies developing EJ programs. Forkenbrock and Sheely (2004) address this by providing guidance for EJ assessments in 13 impact areas related to human health and safety and social, economic, and cultural issues. In the report, each impact area is addressed separately, presenting an overview of the current state of practice, methods for analysis, how to choose a method of analysis, as well as additional resources. The report provides techniques to measure distributive effects of transportation projects, plans or programs on protected populations. Distributive effects are the measurable outcomes of transportation improvements, be they detrimental or beneficial. The methods suggested in the report give agencies a flexible framework that can be adapted to address the needs of specific practitioners or projects to analyze the effects of transportation improvement projects on target populations. Some of

the techniques are currently used to measure effects such as noise pollution, air quality and traffic safety. Other methods are new or have had limited applications in transportation. Each technique is predictive. In addition, they can be integrated into a participation-focused planning process and meet regulatory and legal requirements (Forkenbrock and Sheely 2004).

2.5 Defining Disproportionality

Once the protected population and study area are identified and the impacts are measured, the intensity of the impact upon this population must be determined, in terms of both burdens and benefits. The disproportionality of an impact refers to unequal distribution of benefits or burdens over various populations. Indices are often used to determine if there is a disproportionate impact on one population. These have been referred to as rational methods by Hartell (2007). Two such indices are the Buffer Comparison Index (BCI) and the Area Comparison Index (ACI). Generalized indices are also available as well as methods using fixed proportions.

The Buffer Comparison method “measures whether minority or low-income populations are over-represented in the area that is adversely impacted by a proposed transportation system change, compared to the rest of the population in a given county (Chakraborty 2006).” The following ratio of ratios is used to determine this:

$$BCI = \frac{\text{Protected population in impacted area/Protected population in reference area}}{\text{Unprotected population in impacted area/Unprotected population in reference area}}$$

The Area Comparison method is similar, but it “represents the quotient between the percentages inside a buffer zone and the percentages outside the buffer (Chakraborty 2006).” The following ratio of ratios is used to determine this:

$$ACI = \frac{\text{Protected population in impacted area/Total population in impacted area}}{\text{Protected population outside impacted area/Total population outside impacted area}}$$

Both indices avoid double counting by considering mutually exclusive groups. For both indices, if the ratio is greater than 1, a two-sample test of proportions (one-tailed) can determine the statistical significance of the disproportionality.

Other methods used are based on fixed proportions. The Standard Deviation method determines disproportionality by calculating the percentage of protected populations in the study area and concluding whether it is greater than one standard deviation from the mean of reference areas. Another method based on predetermined proportions is the Plus-25% method. This method defines a census unit with disproportionality as one where the percentage of a protected population is 25% greater than within the reference population (Hartell 2007). Both the standard deviation and Plus-25% have the potential to neglect small highly concentrated disadvantaged groups. In addition, in comparing study areas, the results of these methods can be misleading. A small population containing a certain amount of disadvantaged

households will have a percentage higher than a larger population with the same size of disadvantaged population. This can cause some disadvantaged populations to be neglected. **Table 2** summarizes methods for determining disproportionality, with their advantages and disadvantages.

Table 2: Summary of Methods for Determining Disproportionality

Method	Advantages	Disadvantages
Rational Comparison (BCI & ACI)	• Flexible (ability to compare within study area or to outside area) • Simple mathematical calculations	• Highly sensitive to inaccuracies of data • No defined threshold built into test
Standard Deviation	• Defined threshold through use of fixed proportions • Simple mathematical calculations	• Potential to neglect small, highly concentrated disadvantaged groups • Populations adjacent to the study area can be neglected (higher population with lower percentage) • Mathematical logic could be difficult to explain to those without knowledge of basic statistics
Plus-25%	• Defined threshold through use of fixed proportions • Easily comprehended by non-technical audience • Simple mathematical calculations	• Potential to neglect small highly concentrated disadvantaged groups • Populations adjacent to the study area can be neglected (higher population with lower percentage) • Least rigorous • Arbitrary threshold

3. EJ Analysis Data, Tools and Example Applications

Census data are a useful source of information for EJ analysis, despite some limitations. Other tools used in environmental justice analysis include GIS and a wide range of statistical models. A powerful tool in EJ analysis is GIS. GIS can be used to determine buffer areas, highlight census units containing protected populations, outline study areas and track the impact of projects. Statistical models are also valuable. The choice of model is dependent on the situation (i.e. the available data, the size of the buffer zone). Studies have used chi-square tests, Poisson regressions, Gaussian distributions, ordinary least square regressions, spatial autoregressive models, and a litany of other tools (Schweitzer 2004). These

tools can be used to determine impacts of transportation projects among other application. This section provides an overview of various categories of tools used in EJ analysis and example applications.

Many of the tools used for EJ analyses have been employed in practice by Metropolitan Planning Organizations (MPOs). Several MPOs were examined for their use of these techniques. These MPOs include:

- Metropolitan Transportation Commission (MTC) of the San Francisco Bay area
- Mid-Ohio Regional Planning Commission (MORPC) of the Columbus Metropolitan area
- Puget Sound Regional Council (PSRC) of the Seattle Metropolitan area
- Southern California Association of Governments (SCAG)
- Wilmington Area Planning Council (WILMAPCO) of northern Delaware and northeastern Maryland

Table 3 categorizes uses of tools within the framework outlined within this Technical Assessment and highlights an MPO currently in use of said strategy. Strategies that are not followed by a specified MPO are general uses shared by each of the MPOs listed.

Table 3: EJ Analysis Tools and Example Uses in MPOs

Analysis Element	Census Data	GIS	Statistical Analysis
Defining Population	• Create a baseline demographic profile • Data on income, race, age, etc. to inform analysis on protected populations	• Geographic location of protected populations (MTC; MORPC; WILMAPCO)	• Project future demographics in collaboration with travel demand modeling
Defining Study Area	• Translated to study area dependant on method used (e.g., mathematic transformations for SCAG)	• Map transportation projects/ improvement corridors (PSRC) • Delineate buffer zone (PSRC) • Determine intersection of buffer zone and census units (PSRC) • Delineate geographic units (e.g., • Traffic Analysis Zones (TAZs), census blocks)with relatively high percentage of target population (MORPC; WILMAPCO)	• Regression models used to determine poverty levels at census block level (Forkenbrock)
Defining Disproportionality	• Determine “threshold” for Fixed Proportion comparison (MTC; MORPC; PSRC)	• Map attractions for accessibility analyses • Depict impacts on performance measures	• Statistical tests (e.g., t-test) used to determine if projects provided statistically significantly

	• Evaluate concentration of protected populations in census units based on weighting system (WILMAPCO)	graphically (MORPC) • Graphically assess transit accessibility (WILMAPCO)	greater benefits (MTC)
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Census data is commonly used to inform analysis of target populations. Decennially census data was used by all MPOs for developing baseline demographic profiles and in demographics analysis. Census data can be used with mathematical transformations to define a study area. SCAG translates census data through areal interpolation in its noise assessments to apply demographics information to smaller divisions contained within residential zones to determine the target population within areas that surpass a decibel threshold. Census data is also used in defining disproportionality. Several of the MPOs that were reviewed (i.e. MTC, MORPC, and PSRC) established “thresholds” using fixed proportions based on regional demographics. MORPC and PSRC considered geopolitical units with minority populations greater than the regional average to be target areas. MTC implemented a similar “threshold,” however, increased percentage to account for the high minority population within the region. WILMAPCO created a scoring system to weigh the percentage of target population. Block groups double the regional average are weighted higher than those simply greater than the average.

MTC, MORPC and WILMAPCO geographically interpreted census data with GIS for graphic analysis of target populations. PSRC’s project level EJ analysis relies on geographic information. The analysis follows the Polygon Analysis method. As such, projects are enclosed in a 100 foot buffer zone. If any portion of a census unit is within this buffer zone, the census unit is considered in the study area. This analysis is dependent on the use of GIS. MORPC and WILMAPCO also use GIS to define geopolitical units that qualify for EJ analysis based on their population demographics.

GIS is used by all of the MPOs to map attractions for accessibility analyses. WILMAPCO uses GIS to evaluate transit accessibility. MORPC uses GIS to assess impacts on other performance measures as well. MORPC’s graphically depicts congested vehicle miles traveled (VMT) using GIS to provide a geographic reference for this performance measure. It also allows forecasted congestion increases to be compared visually against TAZs with high percentages of target populations.

Statistical tools are used in collaboration with travel demand analysis to project future demographics that influence EJ analysis. Statistical tools can even be used to interpolate populations within a study area. To define disproportionality, MTC uses t-tests to determine if an improvement in accessibility resulting from implementing a project is statistically significant. “Standard error of difference between means” tests are used to determine if differences in accessibility are significant between disadvantaged and non-disadvantaged neighborhoods.

Travel demand modeling is another tool that influences EJ analyses. Since MPOs focus on regional planning, emphasis is placed on future travel patterns. SCAG uses travel demand modeling to project trip

distributions and mode splits for accessibility analysis. MORPC derives its EJ performance measures from the travel demand forecasting model process (e.g. average number of job opportunities, percent of VMT congested, Average travel time to shopping, pedestrian facilities). Similarly, MPOs use future effects on air emissions, noise, and accessibility modeled by travel demand forecasts in determining the potential impacts on target populations.

The examples above help elucidate the uses of EJ analysis tools in the framework outlined in the Technical Assessment.

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