Title: Developing Community Profiles and Implementing Sociocultural Tools in Transportation GIS

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Paper Abstract

The Indian River County Metropolitan Planning Organization (MPO) conducted a Community Outreach/Community Profiles project to identify communities in Indian River County and to develop a database of information for each identified community. The new data and customized GIS tools will serve as the basis of future analyses, and will enable MPO staff to assess the economic and social impacts of a transportation activities on a community. The data collected for this project will complement the Sociocultural Effects (SC/E) Evaluation of the Environmental Screening Tool (EST) performed in Florida's Efficient Transportation Decision Making (ETDM) process. The resulting toolset, built in the ArcGIS and ArcIMS environment, allows MPO staff and transportation planners to view and evaluate the potential community impacts of alternative transportation improvement projects.

Background

The Transportation Equity Act for the 21st Century (TEA-21), the federal highway authorization bill passed in 1998 to succeed ISTEA, challenged state Departments of Transportation to take a proactive and comprehensive approach to environmental streamlining. According to a Congressional Research Service Report to Congress, "At the time, various stakeholders reported to Congress that the numerous federal environmental approvals and permits needed to build a highway were inefficient and overly time-consuming." Congress attempted to address these concerns by including "Environmental Streamlining" provisions in TEA-21 that required DOT to develop and implement a "coordinated environmental review process" for projects that do or may have a significant impact on the environment (which constitute approximately 10% of all highway projects).1 To address concerns that environmental review would be sacrificed for the sake of expediency, nothing in the streamlining provisions may supercede NEPA (the National Environmental and Policy Act) or any other environmental legislation. Rather, the streamlined review process is intended to encourage full and early participation by all relevant federal and state agencies required to participate in a highway project. These streamlining provisions appear in Section 1309 of the ISTEA Legislation (and in the same section of its successor legislation, TEA-21).

Since many, if not most, critical major highway projects use some federal participation (via formula allocation funding using the 18.4cents/gallon of gas tax levied nationally), addressing the environmental review and streamlining efforts at the state level are the keys to any meaningful reduction in construction delays. Two key elements of Section 1309, as well as a number of executive and legislative actions, encouraqe states to develop environmental streamlining processes. One such element allows state DOTs to require state agencies with environmental review and permitting authority to be subject to the environmental coordination process; another element provides funding for non-transportation agencies to participate in the coordinated review process. While not completely in force even as of today, a number of initiatives have progressed to make environmental streamlining and review a reality. In 2002, President Bush's Executive Order on Priority Transportation Projects mandated environmental coordination under certain circumstances, such as for projects with National Defense considerations. In addition, the Federal Highway Administration has participated in the development of state streamlining programs.

Florida's Approach to Environmental Streamlining

In response to the federal call for state streamlining efforts, the Florida Department of Transportation initiated its Efficient Transportation Decision Making (ETDM) program. The essential elements of ETDM include on-line review of projects using desktop GIS resources; a dispute resolution process modeled on federal guidelines; and local self-evaluation for socio-cultural impacts. Two sets of project screening are involved in the process: a planning level screen is performed on long range transportation plan projects; and a programming screen in performed on those project seeking funding through the annual Transportation Program. In effect, permitting agencies may issue permits at the time of submission to the Programming screen. At the time of final roadway design, alignment, or after major modification, the original issued permit will be amended, resulting in a considerable time savings and eliminating an additional review by permitting agencies. An by engaging in these screening processes, and in particular the socio-cultural effects screening, early and proactive buy-in will prevent problems later on in the process, after considerable time and resources have been expended.

Community Outreach/Community Profiles in Indian River County

Local MPOs in Florida are encouraged to develop individualized approaches to identifying socio-cultural data and populating ETDM databases as well as performing Socio-cultural Effects (SCE) self-assessments. The Community Outreach (CO)/Development of Community Profiles Project in Indian River County is the MPO's answer to satisfying these requirements. While most of the data on the natural environmental is available on a statewide basis from the FGDL (Florida Geographic Data Library), these data are developed on a large scale state-wide level, which needs updated with local data and field verification. In light of these considerations, a three-step process was initiated with respect to developing the Indian River County CO project:

1. Community Focal Point GIS data was collected and validated.
2. Community boundaries were developed, refined, and adopted.
3. Proactive public outreach and public involvement was initiated to verify the boundaries as well as identify community-related transportation concerns.

1- LUTHER, LINDA G. AND BEARDEN, DAVID M., "ENVIRONMENTAL STREAMLINING PROVISIONS IN THE TRANSPORTATION EQUITY ACT FOR THE 21ST CENTURY: STATUS OF IMPLEMENTATION," CONGRESSIONAL RESEARCH SERVICE REPORT FOR CONGRESS (RS 20841), LIBRARY OF CONGRESS, WASHINGTON, DC, MAY 30, 2003.

Step 1. Community Focal Point GIS Data Collection and Verification

GIS data collected for this project included community focal point locations and community information related to the focal points. The database of community information will be used for a variety of planning purposes including future planning and public outreach efforts. In order to describe the community elements located in each community boundary, the GIS data were used to generate a community facility fact sheet summarizing the community focal points that exist in each community. The community facility fact sheets include information such as facility name, address, phone number, contact information, and number of individuals served.

Area Data

Another form of GIS data included in the project is population characteristics in the study area. While community focal point information is valuable in developing a roadway or transportation project alignment that minimizes ROW costs or dislocation, area data is useful in choosing the right project. For example, income and age information are helpful predictors in determining transit dependency similarly, large populations of elderly or impaired citizens may indicate the need for special mitigation measures, such as large font signage or streetlights.

Table 1 illustrates all data layers, data source, and file name of the GIS data created for the Community Outreach/Development of Community Profiles project. GIS data for this project were collected from a variety of existing sources including FGDL (Florida Geographic Data Library), FDEP (Florida Department of Environmental Quality), US Census Bureau, InfoUSA, Indian River County MPO, City of Vero Beach, and the Space Imaging Team generated (SI Generated) data elements that did not exist. If the existing data was not formatted properly, the team may have conducted a series of preprocessing steps to arrive at a final format that was compatible with the Indian River County GIS standard format and projection. Each step in data processing is noted in section "Data_Quality_Information" of the GIS layer metadata. For all data sets that did not currently exist, the Space Imaging team developed the data layer using methodology described in the "Data_Quality_Information" section of the GIS layer metadata.

Table 1. GIS Data Layers Collected for the Community Data Repository

GIS Data Layer	Data Source	File Name
Population and Demographic Data		
1990 Population	Census Bureau	Population1990.shp
2000 Population	Census Bureau	Population2000.shp
10-yr Population Forecast	Generated	Population2010.shp
20-yr Population Forecast	Generated	Population2020.shp
Ages 0-17 years	Census Bureau	Ages0_17yrs.shp
Ages 18-21 years	Census Bureau	Ages18_21yrs.shp

GIS Data Layer	Data Source	File Name
Ages 22-29 years	Census Bureau	Ages22_29yrs.shp
Ages 30-39 years	Census Bureau	Ages30_39yrs.shp
Ages 40-49 years	Census Bureau	Ages40-49yrs.shp
Ages 50-64 years	Census Bureau	Ages50-64yrs.shp
Ages 65+ years	Census Bureau	Ages65_plus_yrs.shp
Avgerage Household Size	Census Bureau	Avg_Household_size.shp
Household Composition - Family	Census Bureau	Household_comp_family.shp
Household Composition - Student	Census Bureau	Hh_composition_bg.shp
Household Composition - Professional	Census Bureau	Hh_composition_bg.shp
Household Composition - Senior Citizen	Census Bureau	Hh_composition_bg.shp
Ethnic/Racial Comp	Census Bureau	Ethnic_comp.shp
Avg. Household Income < $12,000	Census Bureau	Avg_hh_inc.shp
Avg. Household Income $12,000 - $20,000	Census Bureau	Avg_hh_inc.shp
Avg. Household Income $20,000 - $30,000	Census Bureau	Avg_hh_inc.shp
Avg. Household Income $30,000 - $50,000	Census Bureau	Avg_hh_inc.shp
Avg. Household Income $50,000 - $100,000	Census Bureau	Avg_hh_inc.shp
Avg. Household Income $100,000 - $150,000	Census Bureau	Avg_hh_inc.shp
Avg. Household Income $100,000 - $250,000	Census Bureau	Avg_hh_inc.shp
Avg. Household Income > $250,000	Census Bureau	Avg_hh_inc.shp
Economic Characteristics		
1990 Unemployment	SI Generated	Unemployment_1990.shp
2000 Unemployment	SI Generated	Unemployment_2000.shp
Current Unemployment	SI Generated	Unemployment_2000.shp
Forecast 10-year Unemployment	SI Generated	Unemployment_2010.shp
Forecast 20-year Unemployment	SI Generated	Unemployment_2020.shp
Dominant Employment Sector Type	SI Generated	Emp_sector_2000.shp
Work Force	SI Generated	Work_force_2000.shp
Major Employers	InfoUSA	Major_Employers_gr100.shp
Tax Sources	IRC Property Appraiser	Parcels.shp
Property Values	IRC Property Appraiser	Parcels.shp

GIS Data Layer	Data Source	File Name
Crime Rate	IRC Sheriff's Office	Sheriff_zones.shp
Accident Rates and Locations	SI Generated	Accident_locations.shp
Housing Characteristics		
Age of Structures	IRC Property Appraiser	Parcels.shp
Type of Structures	IRC Property Appraiser	Parcels.shp
Average Home Costs	IRC Property Appraiser	Parcels.shp
Condition of Structures	IRC Property Appraiser	Parcels.shp
Vacancy Rates	Census Bureau	Vacancy_Rates.shp
% Residents 5 years in Home	Census Bureau	Residents_5yrs.shp
Type of Occupancy	Census Bureau	Occupancy.shp
Physical Characteristics		
Bus Routes	SI Generated	Bus_routes.shp
Pedestrian/Bike Trails	FDEP	Recreational_trails.shp
Emergency Response Routes/Service Zones	IRC MPO	Emergency_evac_routes.shp
Airport	FGDL	Airport_poly.shp
Rail	FGDL	Railroads_100.shp
Existing Land Use	IRC MPO	ExistingLandUse_Zone.shp
Existing Land Use – Vero Beach	City of Vero Beach GIS	ExistingLandUse_VB
Future Land Use	FDEP	FutureLandUse.shp
Future Land Use – DRI Locations	SI Generated	IRC_DRI.shp
Planned and Approved Future Developments	IRC MPO	FutureDevelop_CompPlan.shp
Environmental Characteristics		
Water Pollution	FDEP	Water_Quality.shp
St. Johns Water Mgt Lands	SI Generated	Sjwmd_lands.shp
Air Pollution	FDEP	Air_Monitoring_Sites.shp
Environmentally Sensitive Lands	SI Generated	Conservation_poly.shp
Endangered Species	NOAA	Biodiversity_habitat.tif
Community Facilities and Institutions		
Hospitals	SI Generated	Hospital.shp
Clinics	SI Generated	Clinics.shp
Doctor's Office	SI Generated	Doctor_offices.shp

GIS Data Layer	Data Source	File Name
Public Health Providers	SI Generated	County_Health.shp
Dental Offices	SI Generated	Dental_offices.shp
Specialty Service Facilities	SI Generated	Specialty_Service_Facilities.shp
Schools	SI Generated	Schools_pub_k_12.shp Schools_pvt_k_12.shp Elementary_school_bnd.shp Middle_school_bnd.shp High_school_bnd.shp
Technical colleges	SI Generated	Schools_vo_tech.shp
Vocational Schools	SI Generated	Schools_vo_tech.shp
Churches	SI Generated	worship.shp
Synagogues	SI Generated	worship.shp
Temples	SI Generated	worship.shp
Retreats and Camps	SI Generated	Camps_retreats.shp
Law Enforcement Facilities	SI Generated	Law_enforcement.shp
Emergency Service Facilities	SI Generated	Emergency_service.shp
Post Offices	SI Generated	Post_offices.shp
Libraries	SI Generated	Libraries.shp
Public Assistant Facilities	SI Generated	Public_assistant_facilities.shp
Maintenance Facilities	SI Generated	Maintenance_facilities.shp
Public Parks	SI Generated	Parks_poly.shp
Community Centers	SI Generated	Community_centers.shp
Private Recreational Facilities	SI Generated	Private_recreation.shp
Playgrounds	SI Generated	Playgrounds.shp
Marinas	SI Generated	Marinas.shp
Boat Ramps	SI Generated	Boat_Ramps.shp
Historical Structures	SI Generated	Historical_structures.shp
Museums	SI Generated	Museums.shp
Art Galleries	SI Generated	Art_galleries.shp
Commercial Centers	SI Generated	Mjr_commercial_centers.shp
Employment Centers	InfoUSA	Employment_centers.shp
Other Facilities and Institutions	SI Generated	Neighborhood_assn.shp Golf_poly.shp

Step 2. Development of Initial Community Boundaries

In order to create initial community boundaries in Indian River County, the team utilized GIS spatial analysis to delineate community boundaries by similar statistical characteristics. In this project a variety of data types consisting of numerous polygon shapes (Census Block, Census Block Group, and Parcels) were analyzed to evaluate variables in the data that create similar geographic clusters of population characteristics. When comparing these different data sets, the size, shape and population in each polygon varies, therefore each polygon needed to be analyzed individually. Due to the nature of the data in this format, the SI team used GIS spatial analysis to identify discriminators in the data that create a cluster (or boundary) of the group that is unique to the area. To keep variables uniform between boundaries, the SI team first identified outliers that were unique from the county average. This helped identify areas unique to a community that separated and defined the area from the rest of the county. The following variables and calculations were used in analysis to ensure the Indian River County community boundaries included all minority, low income, and traditionally underserved populations:

1. Exclude Census blocks with low population density
    - Population density = Census Block Population/Acres
    - Select blocks with population density <0.00

2. Exclude parcels with land use type as agricultural and conservation lands
    - Agricultural and Conservation areas were identified in this project by selecting all parcels with by the Parcel Zoning Code set is used by the Property Appraiser to illustrate city and county zoning codes in a similar code set.
    - Select parcels where, INDLZONE = A-1
    - Select parcels where, INDLZONE = CA1

3. Identify low income populations (Census at the Block Group)
    - Poverty Quotient = (BGb/BGa)/(COb/COa)
      Where,
      BGb: number of people in the Census Block Group below poverty
      BGa: number of people in the Census Block Group above poverty
      COb: number of people below poverty in the county (10325)
      COa: number of people in above poverty in the county (100702)
    - Select Block groups with Poverty Quotient >1.0

4. Identify areas high income populations (Census at the Block Group)
    - Select block groups with a median household income 2 standard deviations above the county mean

5. Identify areas where the unemployment rate populations are greater than the county average (Census at the Block Group)
    - Select block groups with an unemployment rate above the 4.5% county average were selected and used in this layer

6. Identify areas where the predominate age groups are 0-49
    - Ages 0-49 Ratio = ([Age45_gr]/ [Pop_2000] / (60630/112947)
    - Selected all with a ratio >1

7. Identify areas where the predominate age groups are greater than 65
    - Ages >65 Ratio = ([Age65_gr]/ [Pop_2000] / (32972/112947)
    - Selected all with a ratio >1

8. Identify areas where the African American populations are greater than the county average
    - ([Black]/ [Pop_2000] / (9253/112947)
    - Selected all with a ratio >

9. Identify areas where the Hispanic populations are greater than the county average
    - ([Hispanic]/ [Pop_2000] / (7381/112947)
    - Selected all with a ratio >1

10. Identify areas where the Title 6 populations are greater than the county average
    - ((pop2000) - (white)) / (pop2000) *100
    - Selected all with a percentage > 15.74%

11. Identify single family parcels by the year homes were built
    - Built 1898-1949 = (base_yr_bl) <= 1949
    - Built 1950-1969 = (base_yr_bl) >= 1950 and (base_yr_bl) <= 1969
    - Built 1970-1979 = (base_yr_bl) >= 1970 and (base_yr_bl) <= 1979
    - Built 1980-1989 = (base_yr_bl) >= 1980 and (base_yr_bl) <= 1989
    - Built 1990-2002 = (base_yr_bl) >= 1990

12. Identify single family parcels by the value per square foot (Quantile)
    - $0-$4.77 Sq Ft = (value_sf) < 4.77
    - $4.78-6.65 Sq Ft = (value_sf) >= 4.78 and (value_sf) <= 6.65
    - $6.66-8.88 = (value_sf) >= 6.66 and (value_sf) <= 8.88
    - $8.89-14.46 = (value_sf) >= 8.89 and (value_sf) <= 14.46
    - $14.47 = (value_sf) > 14.47

After all community indicators were calculated and extracted, the next step was to analyze the natural clustering and grouping of these variables. The process began by dividing the larger boundaries into smaller polygons. The team used a tiered approach that began with the CENSUS Place polygons as the largest area community polygon. The next step was to perform GIS spatial analysis on all community indicator layers.

This analysis identified areas with similar characteristics that were unique from the neighboring areas. These unique outliers were then selected within the Census Place boundaries to create initial boundaries.

The final step in creating community boundaries included reviewing all clusters, using existing land use data, physical features, and points of interest data to manually divide the areas into final boundaries. It was important to review all clusters of data as some indicating variables may overlap and could be clustered as a single boundary.

After final community boundaries were digitized, the geoprocessing command ***intersect*** was completed with the community boundary GIS layer and all GIS layers described in Table 1. A new shapefile was created including the community name and all GIS variables associated with the community. The geoprocessing command ***dissolve*** was completed on this new shapefile to create a summary of all attributes of interest in a final shapefile. The database from this shapefile was imported as a table into a Microsoft Access database for automated report generation. *Figure 1* illustrates database tables in the Microsoft Access application and one-page summary reports are generated with this application to give a summary of each community.

For easy access to the data and reporting, the team developed a Community Profile Reporting tool using ArcIMS to develop maps included in the PDF report for each community (*Figure 2*). This tool allows the user to select a community of interest and the application will create a community profile report summarizing population, demographics, income, and household information in the community (*Figure 3)*.

Figure 1. Community boundary information is imported for community profile reporting

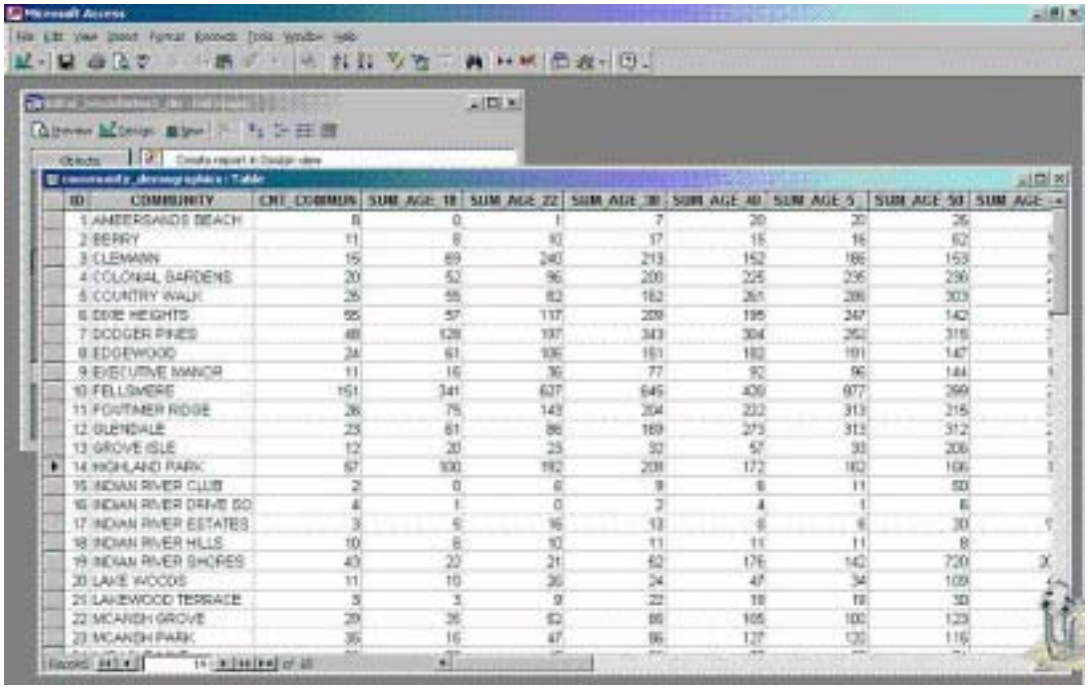
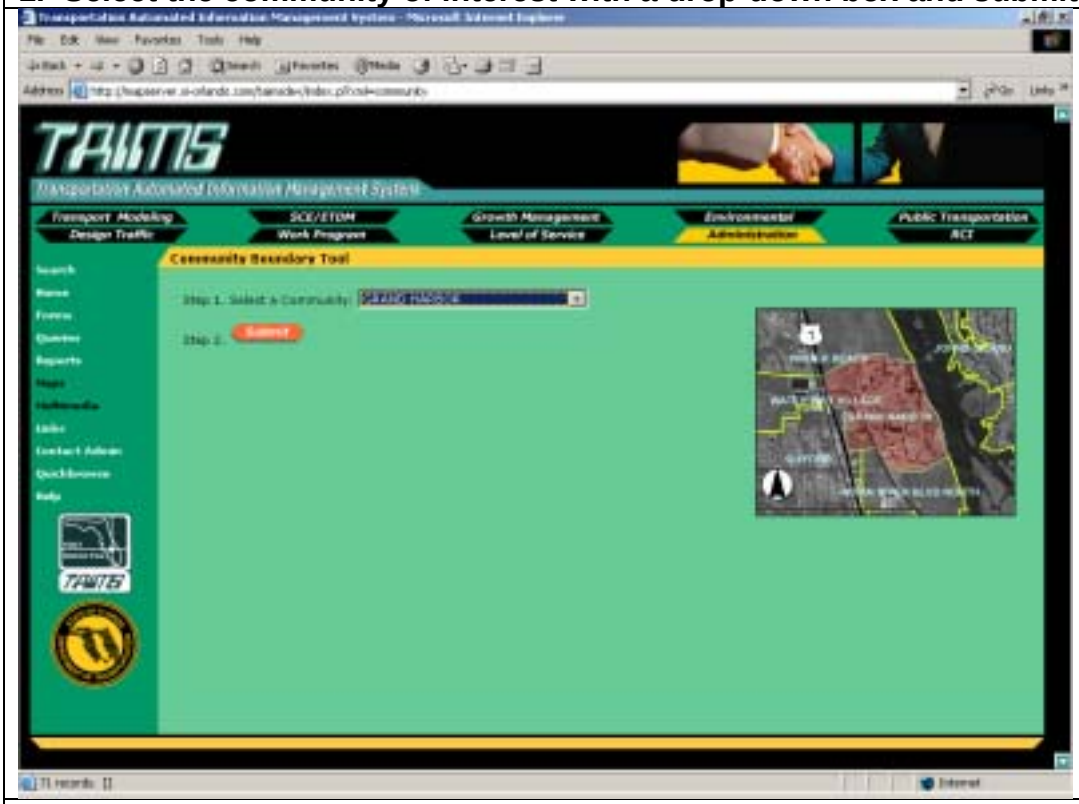


Figure 2. Community Profile Reporting Tool

1. Select the community of interest with a drop-down box and submit.



2. Application generates a summary report an map of the community.

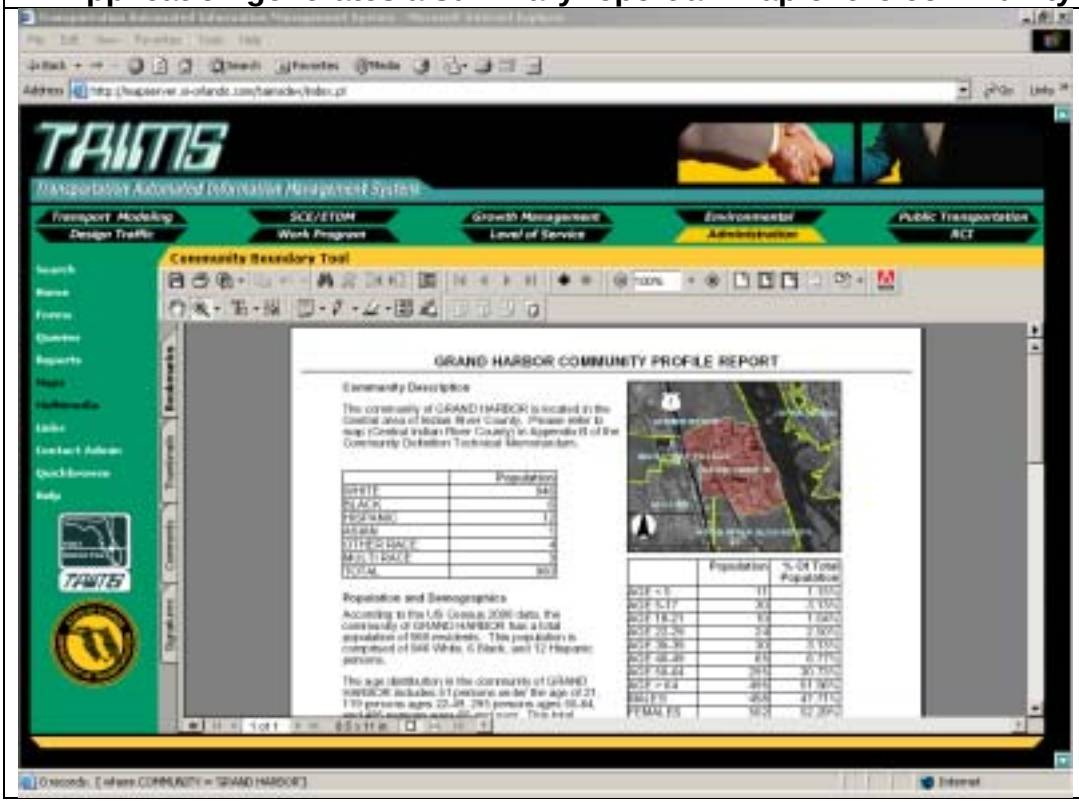


Figure 3. Community Profile Summary Report

GRAND HARBOR COMMUNITY PROFILE REPORT

Community Description

The community of GRAND HARBOR is located in the Central area of Indian River County. Please refer to map (Central Indian River County) in Appendix B of the Community Definition Technical Memorandum.

	Population
WHITE	946
BLACK	6
HISPANIC	12
ASIAN	1
OTHER RACE	4
MULTI RACE	3
TOTAL	960

Population and Demographics

According to the US Census 2000 data, the community of GRAND HARBOR has a total population of 960 residents. This population is comprised of 946 White, 6 Black, and 12 Hispanic persons.

The age distribution in the community of GRAND HARBOR includes 51 persons under the age of 21, 119 persons ages 22-49, 295 persons ages 50-64, and 495 persons ages 65 and over. This total population includes 458 males and 502 females.

	Population	% Of Total Population
AGE < 5	11	1.15%
AGE 5-17	30	3.13%
AGE 18-21	10	1.04%
AGE 22-29	24	2.50%
AGE 30-39	30	3.13%
AGE 40-49	65	6.77%
AGE 50-64	295	30.73%
AGE > 64	495	51.56%
MALES	458	47.71%
FEMALES	502	52.29%

Parcel Characteristics

Single family parcels summarize the physical characteristics indicating where the majority of the citizens reside. The average appraised single family building value in this community is $338,725.80 and the average appraised single family parcel value in this community is $494,376.64. 0.00% of the single family homes in this community were built before 1949, % were built between 1950-1979, and % were built after 1980.

Average Appraised Building Value - Single Family	$338,725.80
Average Appraised Parcel Value - Single Family	$494,376.64
Population Density Persons per Acre	1.04

	Percent of Community
Year Built 1889-1949	0.00%
Year Built 1950-1969	0.00%
Year Built 1970-1979	0.00%
Year Built 1980-1989	0.00%
Year Built 1990-2002	100.00%

Household Characteristics

The average family size in GRAND HARBOR is 1.5507 persons and the average household size is 1.3047 persons.

	Households	% Of Total Households
RENTER	91	10.26%
OWNER	448	50.51%
VACANT	348	39.23%
TOTAL HOUSEHOLD		887

	Households
1-PERSON HOUSEHOLD, MALE	60
1-PERSON HOUSEHOLD, FEMALE	107
FAMILY HOUSEHOLDS, MARRIED-COUPLE FAMILY WITH OWN CHILDREN UNDER 18 YEARS	16
FAMILY HOUSEHOLDS, MARRIED-COUPLE FAMILY WITH NO CHILDREN UNDER 18 YEARS	313
FAMILY HOUSEHOLDS, SINGLE FATHER WITH CHILDREN UNDER 18 YEARS	3
FAMILY HOUSEHOLDS, SINGLE MOTHER WITH CHILDREN UNDER 18 YEARS	8

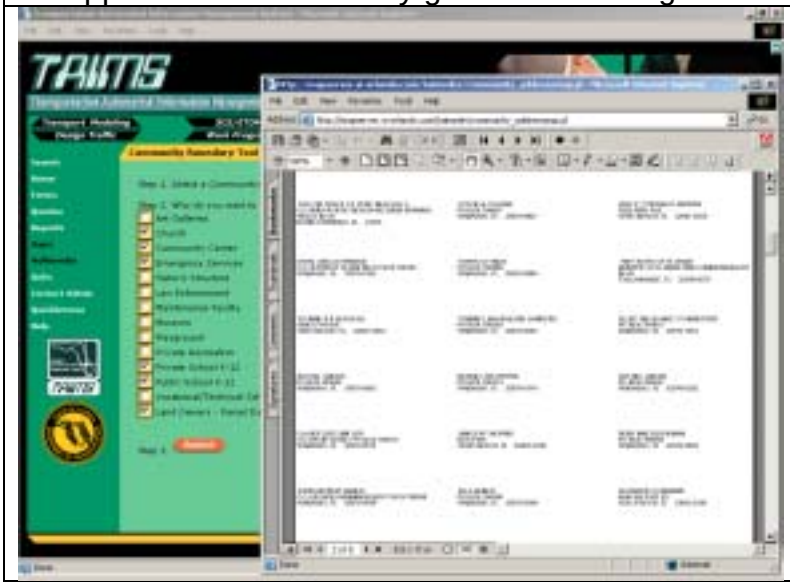
Step 3. Public Outreach and Validation of Community Boundaries

After the GIS analysis was complete, the final boundaries were reviewed by FDOT, IRC-MPO Staff, and designated community leaders. Adjustments to the community boundaries are made as a result of MPO staff feedback, Key Community Leader input and public input. The GIS data can now be used in public outreach efforts for future transportation issues. The SI team developed a Community Contacts Notification Tool that allows users to select a community of interest, then choose who they would like to notify based on categories (Places of Worship, Land Owners, Emergency Service Facilities, Recreation, etc). After the choices are submitted, mailing labels are created for the selected areas (*Figure 4*).

Figure 4. Community Notification Tool uses ArcIMS to generate mailing labels.

1. Select Community name and check mark community facilities of interest.

2. Application automatically generates mailing labels for the selected area.



Project Deliverables

The project is intended to satisfy multiple goals: The project must provide a convenient and easy source of obtaining a community-wide information for planners, engineers, and developers in identifying impacts of a transportation action; and the project had to deliver a Geographic Information System (GIS) data repository that will be used by all MPO transportation planning software and processes. Therefore, the two major project deliverables were 1) Community Profile Fact Sheets summarizing all community features located in each community and 2)a county-wide community data repository. Full metadata reports were developed to provide a summary of the source of collection for each data element, information about the process used to format existing data, and methodology used to calculate derived GIS data sets. Metadata documents are reported in standard Federal Geographic Data Content (FGDC) format and are also available digitally as an .xml file in ArcGIS format.

Other project deliverables include a searchable web-based tool; listings of key community contacts and institutions that will form an "action network" for public notification; and a live-link to the property appraisers database to automatically generate mailing labels for public hearings for residents within selectable buffers.

Conclusion

In Florida, the Efficient Transportation Decision Making (ETDM) system satisfies USDOT requirements for environmental streamlining. All proposed transportation projects are uploaded by MPOs into FDOT's ETDM System for review by State-established Environmental Technical Assessment Teams (ETATs). At this time, and in accordance with established ETDM review procedures, the projects work their way through the review process. Potential degrees of effect include enhanced effects; minimal/no effect; moderate effect; substantial effect; or dispute resolution. Class of action determinations include environmental assessment; effects statement; and categorical conclusions. Through Indian River County's Community Outreach/Community Profile project, Indian River County has accurate data for evaluating impacts of proposed transportation actions and the ability to perform socio-cultural self-assessments on project impact.

References

The following sources were consulted during the development of this paper:

Luther, Linda G. and Bearden, David M., "Environmental Streamlining Provisions in the Transportation Equity Act for the 21st Century: Status of Implementation," Congressional Research Service Report for Congress (RS 20841), Library of Congress, Washington, DC, May 30, 2003.

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