Beyond Maps:
GIS Support of Transit-Oriented Development Planning

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Abstract

This White Paper describes the GIS tools used to support the development of Smart Growth and Transit Oriented Development (TOD) policies in the San Francisco Bay Area region. Emphasis is placed on one key project; The Bay Area Transit Oriented Development (TOD) Study. The overall goal of this project is to develop effective public policy using a comprehensive set of information that can be used as a foundation for supporting the implementation of transit-oriented development at Bay Area transit stations. The study has collected data in GIS format that describes the regions existing and future demographic characteristics, future development plans, and land use status in the vicinity of transit stations/corridors. This White Paper outlines how GIS is used to facilitate this process and promote public policy development and decision-making.

Figure 1: Regional Map

SAN FRANCISCO
BAY AREA REGION

Regional Statistics

Total Area: 7,100 Square Miles

Total Population: 6,783,760

Largest Cities: San Jose, San Francisco, Oakland

Smallest Cities: Colma, Belvedere, Ross

Largest City Population: 894,943 (San Jose)

Smallest City Population: 1,191 (Colma)

Population figures based upon the latest U.S. Census, PL94–171 (March 2001)

What is Smart Growth?

"Smart growth" means different things to different people. There is no single definition of smart growth; its meaning depends on context, perspective and timeframe. The common thread among different views of smart growth is development that revitalizes central cities and older suburbs, supports and enhances public transit, promotes walking and bicycling, and preserves open spaces and agricultural lands. Smart growth is not no growth; rather, it seeks to revitalize the already-built environment and, to the extent necessary, to foster efficient development at the edges of the region, in the process creating more livable communities.[1]

Smart growth meets the key goals of sustainable development through community design. Focusing new housing and commercial development within already developed areas requires less public investment in new roads, utilities and amenities. Investment in the urban core can reduce crime, promote affordable housing and create vibrant central cities and small towns. By coordinating job growth with housing growth, and ensuring a good match between income levels and housing prices, smart growth aims to reverse the trend toward longer commutes, particularly to bedroom communities beyond the region's boundaries. People who live within easy walking distance of shops, schools, parks and public transit have the option to reduce their driving and therefore pollute less than those living in car-dependent neighborhoods.(1)

Smart growth is NOT no growth; rather it seeks to revitalize the already-built environment and, to the extent necessary, to foster EFFICIENT DEVELOPMENT at the edges of the region, in the process CREATING more LIVABLE communities.

Any effort that strives to communicate effective strategies for promoting sustainable development requires the ability to review a vast array of data to discover patterns that can be presented to the public in a way that is easily understood. Urban Planners are attracted to GIS because it has the ability to link an unlimited amount of information to a geographic place, and present this information in a meaningful way to those who develop public policy (Urban Planners) and those who make decisions (Elected Officials). The role of GIS as both an analytical and visual tool, has allowed urban planners to quickly develop alternative solutions to the many problems associated with rapid urban growth in our communities. GIS has become a fundamental planning tool that has had a significant impact on how leaders in the public and private sectors in the Bay Area Region implement "Smart Growth" strategies that seek to change unsustainable patterns of growth, and move toward more livable communities.

The Metropolitan Transportation Commission (MTC) has embraced a number of programs and policy goals that foster livability and enhance alternatives to auto travel, two important principles of Smart Growth planning. In the fall of 2000, MTC joined forces with four other regional agencies -- the Association of Bay Area Governments (ABAG), the Bay Area Air Quality Management District (BAAQMD), the Bay Conservation and Development Commission (BCDC) and the Regional Water Quality Control Board (RWQCB) -- as well as the Bay Area Alliance for Sustainable Development to investigate smart growth and sustainable development in the Bay Area. One goal is to develop consensus on a set of "best practices" and financial incentives to spur similar efforts. The agencies also intend to work with local governments to identify environmentally important areas that should be

preserved or enhanced, as well as to define appropriate land-use patterns for those areas deemed suitable for development.(2)

This effort led to the development of a five-point Transportation/Land Use Platform adopted by the Commission (3), that reconfirmed its commitment to conditioning regional discretionary funds on supportive land use projects. This policy direction seeks to generate new transit riders and make the region's transit investments more cost-effective.

Background: Regional Agencies Implementation Efforts

There are three projects that essentially form the framework for the TOD Study and Smart Growth implementation efforts in the Bay Area: The Interregional Partnership, The TLC-HIP program, and the Smart Growth Vision. Each project introduced policy framework and analytical research methods that aim to promote Smart Growth development in the Bay Area region. The following section describes the primary objective for each of these Smart Growth projects, and explains how GIS was used to support Smart Growth policy development.

Inter-regional Partnership (IRP)

The IRP is a partnership between fifteen elected officials representing five counties—Alameda, Contra Costa, San Joaquin, Santa Clara, and Stanislaus. Through the IRP, local representatives sought to bridge jurisdictional boundaries to forge cooperative solutions to shared problems, such as the geographic separation of housing and employment, mounting traffic and air pollution, and growth. Three councils of governments (COGs)—the Association of Bay Area Governments, the San Joaquin Council of Governments, and the Stanislaus Council of Governments—provided staffing, financial support and regional expertise. A major component of the IRP project was the creation of the IRP State Pilot Project which served as an inter-regional laboratory that served to create, implement and evaluate various incentive programs designed to change development patterns to improve the quality of life in the Bay Area and Central Valley by working to balance jobs and housing in the region. (4) The project defined public policy and incorporated incentives that could encourage the development of jobs or housing in areas where an over-balance exists.

How GIS was used to Support Smart Growth Policy Development

GIS was identified in the enabling IRP law as "…a crucial tool for use in determining the location of jobs housing opportunity zones." With this in mind, ABAG staff worked to develop a GIS database and process that could be used to evaluate the Jobs/Housing Opportunity Zone applications received from the participating jurisdictions within the partnership. The IRP project staff used GIS to analyze and compare the relationships between jobs and housing for the jurisdictions within the IRP region, and identify five to ten jobs/housing opportunity zones to serve as either job or housing opportunity sites. The GIS analysis methods used considers available data that can be described in map form as well as be used in a scoring system.

Layers, Measures and Thresholds used in the GIS Analysis

Each layer of information used in the GIS analysis incorporates baseline data collected from the local jurisdictions, counties and the COGs. The data was built into a measurable and "mappable" layer, which is used by the GIS. Four measures were identified for this study:

1. Jobs/Housing Balance: Demographic data was obtained from each Council of governments that described the housing and employment conditions for the study area.
2. Existing Transportation Infrastructure: Transit accessibility was measured based upon proximity to multi-modal transit stations and freeway interchanges.
3. Level of Existing Urbanization: Areas were measured based upon existing population and employment density and proximity within defined urbanized boundaries.
4. Land Use and Environmental Characteristics: Areas were measured based upon their zonal characteristics. Layers associated with general plan land use, brownfields, flood zones, wetlands, slope and environmentally sensitive species habitats were collected and assigned specific values based upon a scheme that identified each layers relative importance defined by the intent of the IRP law.

Measurements of each layer were developed by reviewing the available data and determining how best to apply it. For example, a particular layer might measure jobs/housing relationship for a given area. A unit of measurement such as jobs/housing balance for each Transportation Analysis Zone (TAZ) is identified. The measure is used to compare each proposed Zone against the existing condition of the area in which it is proposed.

Once the layer and measurement device was identified, a threshold was applied to each layer. GIS overlay and buffer techniques were used to assign thresholds based upon proximity to specific geographic locations and value ranking assignments based upon demographic attributes such as the ratio of jobs per household. Thresholds for each GIS layer were designated to determine whether a Zone met the IRP intent. A maximum or minimum threshold requirement was established for each Zone. This threshold was used to compare each proposed Zone identified in the RFP process.

Evaluation Approach

This study identified two methods that could be used to perform the evaluations pursuant to intent identified in the IRP state law. They are described below:

1. Use GIS mapping as a "preview" of the IRP study area (all five counties): The pre-view would show, in general terms, where Jobs/Housing Opportunity Zones might best be located using the results of the GIS analysis.
2. Use the GIS layers to evaluate and score each proposed Zone against a set of criteria identified by the Partnership and the State law as important in the selection of Zones.

Figure 2. IRP Jobs-Housing Diagram

Jobs/Housing Diagram
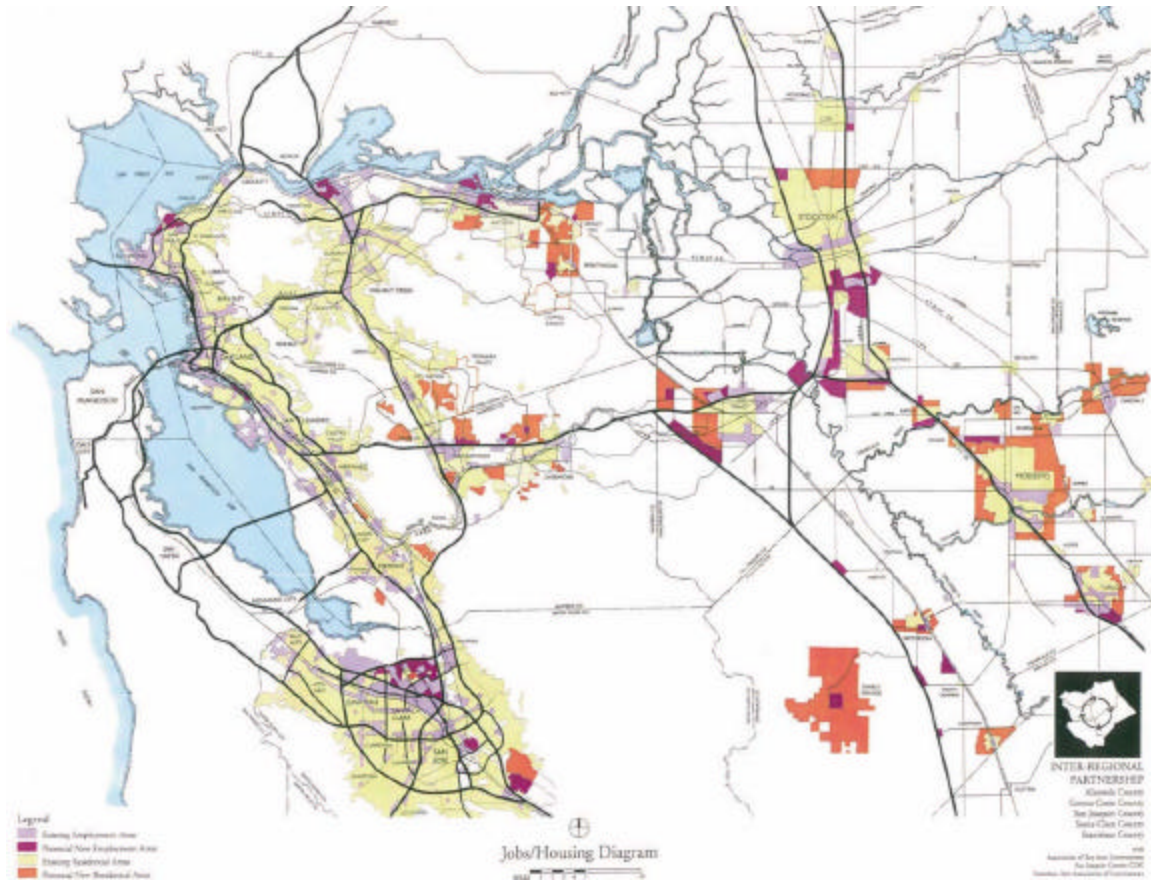
Previewing Method

The previewing tool and the evaluative layers were developed based on concepts developed by the Partnership. The IRP identified goals that promote housing near jobs, jobs near housing, and an improvement of the transportation relationships and opportunities between them.

The previewing exercise was useful in reviewing the IRP study area as a whole. While Zones may be proposed anywhere in the study area, the previewing method helped to show applicants and the Partnership what areas best reflect the goals and intent of the IRP law.

Scoring Method

Three options for scoring proposed zones were developed for Partnership review. These scoring options were applied to the GIS layers, and were effectively used to assign one-third of the total points possible for the Jobs/Housing Opportunity Zone application (50 of 150 points). The following bullets outline these options.

❑ Weight each GIS layer as to its relative importance in the Zone selection process. For example, the IRP may wish to assign proximity to transit a higher value than availability of infrastructure. Grouping layers into headings that reflect the IRP goals, and then weighting the groups allows the scoring to be guided by the goals.

- Each layer could be given equal weight, and the sum of the layers would determine the Zone's potential GIS score. In this instance, each layer could be valued. If the proposed Zone meets the layer threshold it would receive maximum points; if it did not meet the layer threshold, the proposed Zone would receive no points for that layer.

- Identify certain layers as "fatal flaw" thresholds, in similar fashion to the State law requiring a minimum and maximum Zone size. For example, the maximum distance of a population center from a proposed Jobs Zone could be identified as a strict criterion. If the proposed Zone is outside the maximum threshold, then the Zone is not eligible.

Figure 3. IRP Preview Analysis
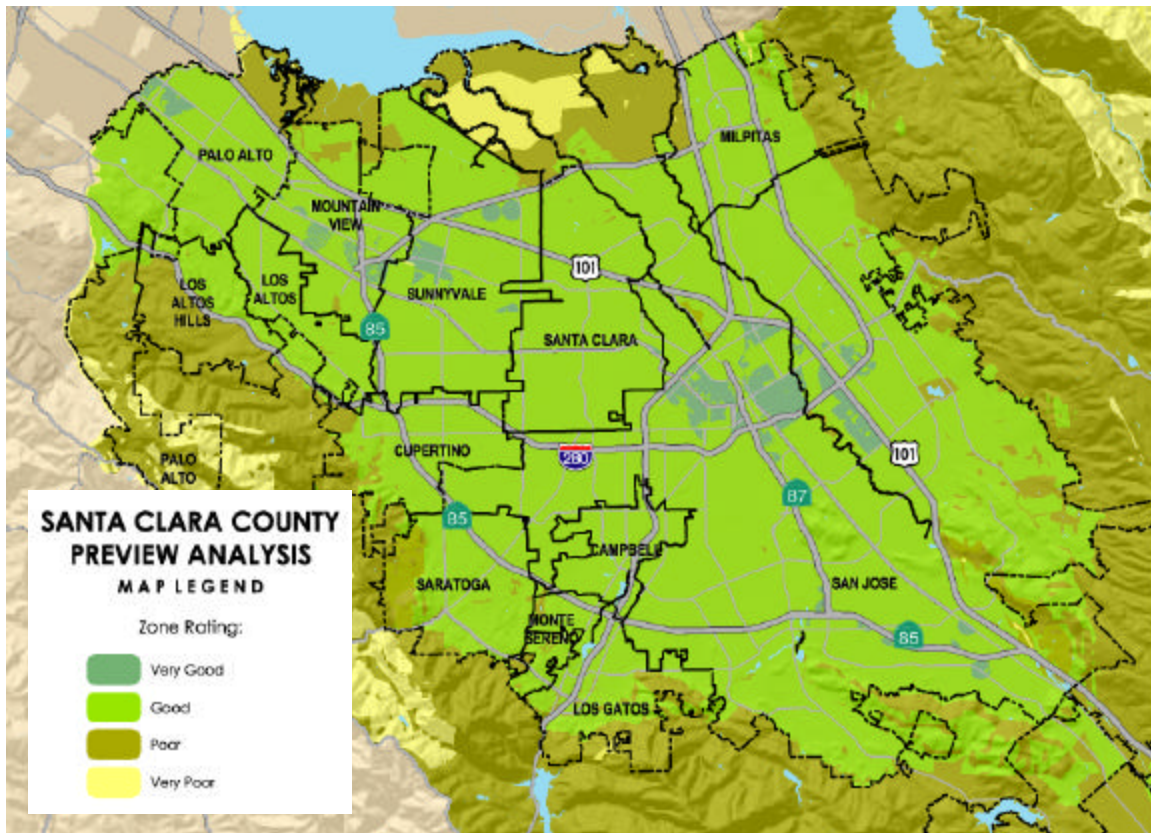
Project Status/ Final Outcome

The IRP staff ultimately used both approaches to make recommendations to the elected officials representing the five counties participating in this effort. Ten zones were selected to serve as either job or housing opportunity sites. A range of incentives were developed for each zone, particular to its needs, in order to encourage appropriate development, i.e. housing development in "job-rich" areas and employment centers in "housing-rich" areas. The incentives identified would require significant investments and changes to state law.

The incentives that were selected as a priority for the Jobs/Housing Opportunity Zones include:

- ❑ Tax Increment Financing

- ❑ Designate each Opportunity Site as an Enterprise Zone

- ❑ Raise the priority status for each Opportunity Site in Select State Programs
  - o Priority in state bond allocations through the California Debt Limit Allocation Committee (CDLAC)
  - o Tax credits for housing as issued through the Tax Credit Allocation Committee (TCAC)
  - o Cash Grant
  - o Priority for Inter-regional Improvement Program funds

ABAG staff is actively pursuing legislation that would enable these programs and incentives as viable options to implement the development strategies identified by the IRP State Pilot Project.

## Transportation for Livable Communities (TLC) and the Housing Incentive Program (HIP)

In 1998, MTC launched the Transportation for Livable Communities program. The program's acronym, "TLC," is no accident: It indicates MTC's intent to lavish some tender loving care on town centers, public transit hubs, key streets and the like as a way of fostering community vitality and recapturing some of that small-town atmosphere that has been lost in many Bay Area cities. Initially, the program provided planning grants, technical assistance and capital grants to help cities and nonprofit agencies develop transportation-related projects fitting the TLC profile.(2)
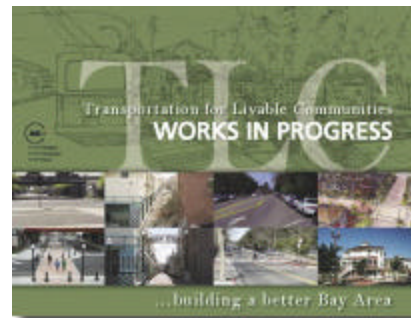
The purpose of the Transportation for Livable Communities (TLC) Capital and Planning Program is to support community-based transportation projects that bring new vibrancy to downtown areas, commercial cores, neighborhoods, and transit corridors, enhancing their amenities and ambiance and making them places where people want to live, work and visit. TLC provides funding for projects that are developed through an inclusive community planning effort, provide for a range of transportation choices, and support connectivity between transportation investments and land uses.(5)

As part of the TLC program, MTC's Housing Incentive Program (HIP) rewards local governments that build housing near transit stops. The key objectives of this program are to increase the housing supply in areas of the region with existing infrastructure and services in place; locate new housing where non-automotive transportation options are viable transportation choices, and establish the residential density and ridership markets necessary to support high-quality transit service.(6)

HIP funds are intended to be used for transportation capital projects that support Transportation for Livable Communities (TLC) goals. Typical capital projects include pedestrian and bicycle facilities that connect the housing project to adjacent land uses and transit; improved sidewalks and crosswalk

Street Smart Sebastopol

linking the housing to a nearby community facility such as a school or a public park; or streetscape improvements that support increased pedestrian, bicycle, transit activities and safety.(6)
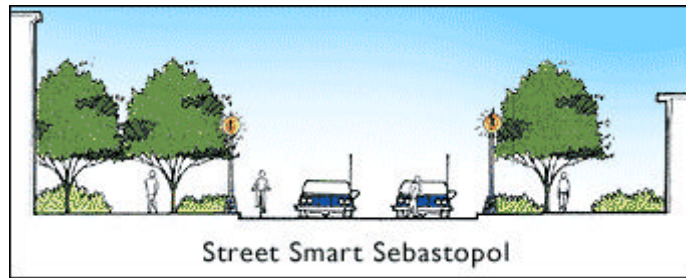
The dollar amount of HIP funds that may be requested is determined by the density of the qualifying housing development and the number of affordable and market rate bedrooms that will be provided. The maximum grant amount per jurisdiction is $3 million. (6)

How GIS was used to Support Smart Growth Policy Development

GIS was originally used to keep track of where MTC's investments in the TLC/HIP program were located within the region. See Figure 4. GIS layers for each of the TLC program cycles were created, and maps produced to show the geographic extent of the program.

GIS is now used to map project applications prior to making a funding decision, such that preliminary analyses can be taken into account in choosing which projects to fund. The TLC project review committee reviews applications using selection criteria that are based upon GIS analyses that include characteristics such as demographics, proximity to transit, proximity to the regional bikeways network, and proximity to future transportation projects as mapped in the Regional Transportation Plan (RTP) or the Transportation Improvement Program (TIP). GIS is also used to show which locations are receiving the most funding, and to determine if a particular location is new to the program.

Figure 4. TLC/HIP Project Locations

Regional TLC/HIP Projects

- ● HIP Projects
- ● TLC Capital Projects
- ● TLC Planning Projects
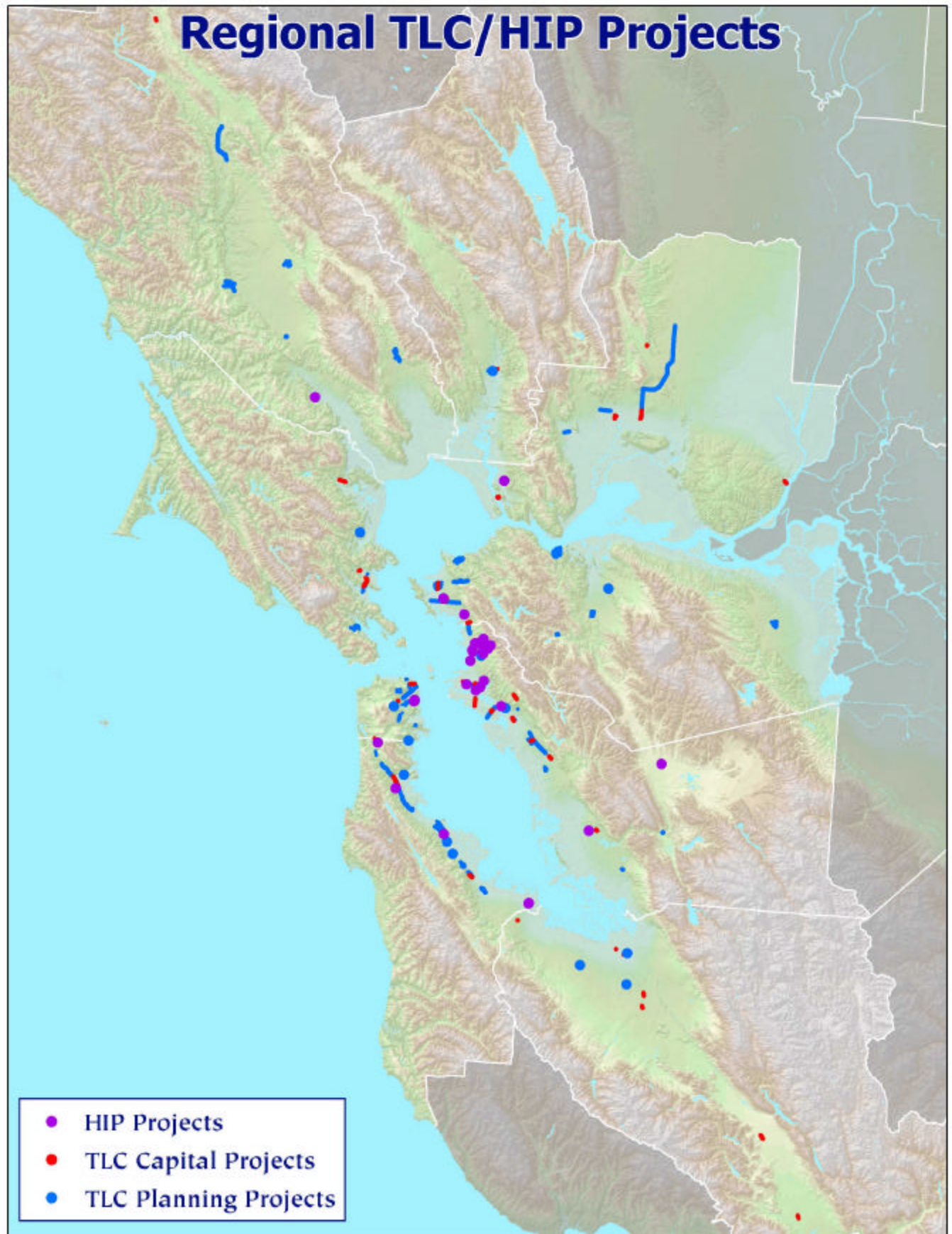
Smart Growth Vision

Elected officials, planners, developers, environmentalists, business leaders, social equity advocates and representatives of neighborhood groups from each of the nine bay area counties gathered together in their respective counties to engage in a regional effort to plan for their communities' future. Specialized GIS Tools were developed as a means to gather public input, in a workshop setting, to determine a preferred land use alternative that could be used to decide how the region would grow. The outcome of this effort led to the formulation of a policy based regional forecast of population, households, and employment for the 2030 planning horizon.
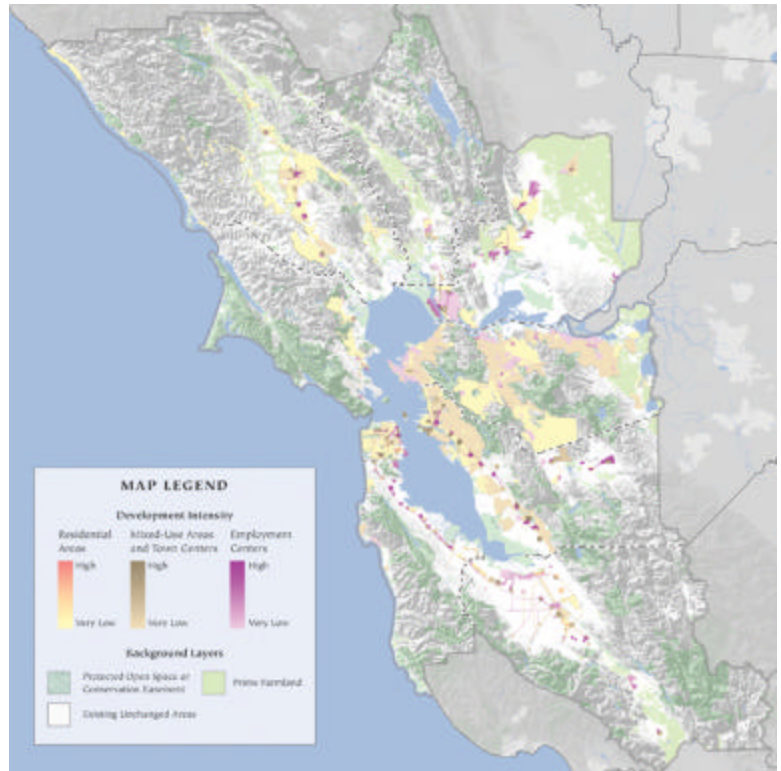
The principle sponsors of this effort were the Association of Bay Area Governments (ABAG), Metropolitan Transportation Commission (MTC), Bay Area Air Quality Management District, Bay Conservation and Development Commission, and the Regional Water Quality Control Board. These regional agencies have legislative mandates for transportation planning, environmental protection and local government coordination.

Project History

In 1999, these five regional agencies came together to discuss how to nurture "smart growth" across the Bay Area's nine counties and 101 cities. As part of their work, this group sought to identify and obtain the regulatory changes and incentives that would be needed to implement a new growth vision in the Bay Area.

Meanwhile, the Bay Area Alliance for Sustainable Development (now known as the Bay Area Alliance for Sustainable Communities) embarked on an ambitious public participation exercise to reach consensus on, and generate support for, a "regional livability footprint" – a preferred land-use pattern to suggest how the Bay Area could grow in a smarter and more sustainable way.

Although the two efforts represent diverse interests, they share a common, urgent goal: to address the region's mounting traffic congestion, housing affordability crisis and shrinking open space. In 2000, they merged their respective efforts. Thus was born the Bay Area Smart Growth Strategy/Regional Livability Footprint Project.

Project Goals

The joint Project sought to engage locally elected officials and their staffs, private developers, stakeholder group representatives, and the public at large throughout the nine-county Bay Area to:

1. Create a smart growth land use vision for the Bay Area to minimize sprawl, provide adequate and affordable housing, improve mobility, protect environmental quality, and preserve open space.

2. Identify and obtain the regulatory changes and incentives needed to implement this vision.

3. Develop 20-year land use and transportation projections based on the vision and the likely impact of the new incentives – projections that will in turn guide the infra-structure investments of the Metropolitan Transportation Commission and other regional partners.

The Smart Growth Visioning Process

To achieve its bold goals, the Project embarked on a campaign to engage decision makers and the public from the far reaches of the region, to participate in two rounds of public workshops in each Bay Area county.

Following the workshops, the results were compiled to create a single region wide land-use vision. The Vision incorporates the choices and decisions made by participants in the county workshops. It reflects their selections of mixed-matched and changed alternative growth scenarios appropriate for each county. The resulting portrait of the Bay Area's future was unveiled as the Region wide Smart Growth Vision in the Smart Growth Strategy/Regional Livability Footprint Project's Final Report.

How GIS was used to Support Smart Growth Policy Development

During the spring and summer of 2001, more than 1,000 residents participated in Saturday workshops held in each of the nine counties. These "planners for a day" held lively discussions and negotiations about the pace, character and shape of development in their communities. Using large maps of their counties, they identified promising locations for various types of new development. Their suggestions were then fed into a specialized GIS planning support system known as PLACE[3]s which then illustrated the impacts of decisions on the county's housing supply, open space, transit accessibility and other measures of livability, and allowed participants to adjust their maps accordingly.

PLACE[3]S, an acronym for PLAnning for Community Energy, Economic and Environmental Sustainability, is a GIS tool developed as public domain software, and packaged as an extension to ArcView GIS (Version 3.2). It is designed to support smart growth planning in regions, cities, and communities, and to be easily accessible to planners, policy makers, citizens, and students. Together, the PLACE[3]S methodology and the GIS tool allow an interactive, participatory, analytical process to evaluate land use planning scenarios and their impact on a community and region.(7)

The PLACE³S Model / GIS Tool

The PLACE³S model uses a real-time, state-of-the-art GIS tool to analyze and display the results of different land use scenarios in an easily understood geographical format. PLACE³S can be used to create multiple future scenarios and present the information in a series of digital maps, data tables, and bar charts that effectively communicate results to the public and decision-makers. The data and maps help to clarify the trade-offs a community must make, and provide a common yardstick for measuring land use plans. (7)

The strength of the PLACE³S GIS tool lies in its ability to easily and quickly create alternative land use scenarios and calculate how well each scenario performs based on one or more sets of "indicators" (also called "predictors") for the values held important by the community and decision-makers.

Some of the indicators that can be quantified using PLACE³S include:

Vehicle Miles Traveled Per Household	Jobs/Housing Match
Jobs And Housing Units Created Through Redevelopment	Parks & Open Space Per 1,000 People
	Access To Open Space
Air Pollution Per Capita	Farm Land Consumption
Dwelling Units Per Acre	Transit Friendliness
Employees Per Dwelling Unit	Access To Transit
Jobs Per Capita	Pedestrian Friendliness
Retail Uses Supported By A Scenario	Proximity Of Jobs & Housing To Transit
Density As FAR	Access To Schools
Density As People/Acre	Total Employment Uses By Subtype
Jobs And Housing By Subcategory	Redevelopment Potential
Tenure Of Housing Stock	Water Consumption

Each of the indicators above may be customized for an individual PLACE³S application.

Neighborhood Versus Regional Application

PLACE³S has the ability to function at either a neighborhood or regional scale, and both applications of the model have been developed as a single extension to Arcview. Depending on the application, Neighborhood PLACE³S and Regional PLACE³S can be used simultaneously and interactively, or independently of each other.(7)

In Regional PLACE³S, the Analysis Area of a PLACE³S application may include a county, a regional subarea, a part of a county, or a city. Regional PLACE³S is able to function at this level by using Place Types that are associated with a particular Unit of Analysis, such as a Planning Area or Transportation Analysis Zone (TAZ). A Place Type represents a specific (mixture of) land use typically defined by some density of people or households and jobs, which characterizes a place, such as a downtown or a neighborhood. Place Types are the major means for describing land uses and are the analytical foundation for regional applications of PLACE³S. (7)

In Neighborhood PLACE³S, the Analysis Area of a PLACE³S application may include a group of neighborhoods, a single neighborhood, a road/transit corridor or a part of a neighborhood. Neighborhood PLACE³S is able to function at this scale by using Development Types that are associated with individual parcel polygons. A Development Type is an individual building or "development", such as a townhouse, a mixed -use building with retail below and housing above, a multi-family apartment building, or an office building. Development Types are defined by their physical and economic attributes.

They are the major means for describing land uses and are the analytical foundation for neighborhood applications of PLACE^{3}S. (7)

What's unique about Regional PLACE^{3}S and Neighborhood PLACE^{3}S is their ability to create, save, analyze, and compare the effects of multiple land use scenarios from the very smallest scale to very largest scale. (7)

The PLACE^{3}S operator takes information from citizens and transforms it into a digital map. The operator gives the land use vision, or scenario, a name and stores it for reference in a PLACE^{3}S file. At the request of participants, the operator can analyze the impacts of the scenario by selecting one or more "indicators" (performance measures). Further, the operator can compare the performance of different scenarios to one another by displaying selected indicators in graphic form.

The Smart Growth Visioning Process used the Regional PLACE^{3}S model to define the land use scenarios identified by the workshop participants.

Project Status/ Final Outcome

In August of 2002, the project Steering Committee adopted the narrative Vision that came out of the workshops, which described a smart growth pattern of development for the Bay Area. The steering committee also accepted the jobs and housing numbers that came out of the public workshops as a starting point for the development of policy-based projections. Before beginning the projections development process, the jobs and housing numbers were further revised to reflect analyses submitted by BART, the Bay Area Alliance for Sustainable Communities, and others. The next step involved converting the workshop materials into a form that could be used as input to ABAG's formal socio-economic and land use modeling system.

The policy-based modeling process makes assumptions about future incentives for housing production, as well as land use and regulatory changes conducive to smart growth. The new assumptions are tempered by many economic and demographic factors ABAG considers in its standard biennial projections process. One of the key steps in developing the projections is to factor in the land available for development, including infill and redevelopment potential. Once the available land is estimated, the process takes into account expected demand, based both on existing economic and demographic conditions, and potential incentives.

Draft policy-based *Projections 2003* were sent out in December of 2002 for review to all local governments and interested parties in order to provide an opportunity to make specific comments on the draft projections. Additional points of contact with government officials and the public occurred throughout the projections process, and many of their suggestions were incorporated in the final forecasts.

In March of 2003 the ABAG Executive Board adopted *Projections 2003*. This Smart Growth forecast is also used as a basis for MTC's Regional Transportation Plan and the Bay Area Air Quality Management District's Air Quality Plan. It also established a benchmark for future projects to be measured against when considering funding for transportation and housing development projects in the region. The forecast essentially paved the way for the development of public policies that seek to promote future development patterns that achieve the goals defined by Smart Growth. The Transit Oriented Development Study was the first such effort at determining an effective approach to developing these policies.

Transit Oriented Development Study

The $11.8 billion Regional Transit Expansion Program that MTC adopted as Resolution 3434 in 2001 was accompanied by a strong directive to develop a policy that would condition the allocation of regional discretionary funds for transit expansion projects on supportive local land use plans and policies. The Transit Oriented Development (TOD) Study looks closely at the opportunities, benefits and barriers for increased levels of TOD along transit corridors affected by this resolution. The analysis performed as a part of this study has formed the framework used to define MTC's policies in support of Bay Area TODs. This study plays an instrumental role in defining and implementing this policy, and was conducted in close partnership with the Association of Bay Area Governments (ABAG), transit agencies, local governments and other interested stakeholders.(2)

Key Questions and Study Approach

The following key questions were addressed by this study:

Question 1 - How much opportunity for TOD exists in the Bay Area, what kinds of opportunities are there, and where are they? What does the Smart Growth Vision suggest for growth around transit? What different types of opportunities for TOD are there in the region?

❑ Work with ABAG to estimate the potential regional size and impact of TOD in the Bay Area. Summarize current, future and "best case TOD" conditions next to transit stations and in transit corridors in the Bay Area, including demographics, land use conditions, local policies, and transit ridership impacts. Identify types of TOD opportunities in the Bay Area by transit mode and other characteristics.

Question 2 – What policies that support transit-oriented development are being used in other areas of the country, as well as within the Bay Area?

❑ Summarize regional policies to support TODs, including different regional policy approaches and incentive programs from outside the Bay Area, and relevant policies from within the region.

Question 3 – What are the components of an effective regional policy to support TOD in the Bay Area?

❑ Assess the lessons learned from other regions and from within the Bay Area.
❑ Assess the existing transportation and land use planning processes within our region, and the unique characteristics and diversity of the Bay Area.
❑ Propose policy-planning approaches that more closely link regional transit investments with corresponding levels of local land use development policies.

<u>Question 4</u> – How do we test and evaluate the potential policy approaches as proposed?

❑ Develop and review the proposed approach with technical advisors, policy advisors, and the public.
❑ Conduct case studies with local jurisdictions to analyze the effectiveness of the proposed policies in detail. Refine the policy approach based on partner feedback and further analysis.
❑ Refine the policies based on the feedback and findings from the case studies.

<u>Question 5</u> – What is the objective of the TOD Study?

❑ Recommend policies for conditioning regional discretionary funds under MTC's control for Resolution 3434 transit expansion projects on the demonstration of supportive land use policies by local government around transit stations and along key transit corridors.

How GIS was used to Support Smart Growth/TOD Policy Development

ABAG and MTC staff used GIS analytical methods to answer these questions, as well as to provide a basis for determining the best approach to developing a strategy for implementing Smart Growth development patterns in the Bay Area. The following section describes the method and approach used to perform the following tasks:

1. Define the geographic extent for this study
2. Determine the current level of land development and demographic characteristics around existing and future transit stations/ key transit corridors
3. Define existing and future land use patterns around existing and future transit stations/ key transit corridors

Defining the Geographic Extent of this Study

The San Francisco Bay Area region has nine counties with over 100 cities. The geographic extent of the bay area encompasses approximately 7,100 square miles. The focus of this study was to determine locations where TOD opportunities currently exist, and ways to promote TOD style development patterns in areas adjacent to existing and future transit stations within the region. In order to accomplish this task, it was necessary to define the geographic locations in a discreet enough way to develop statistical information that could be used to support public policies that promote TOD. The project used GIS to define zones or units of analysis to be used as a part of the study. These zones were defined using an existing GIS database of Smart Growth Planning station areas and corridors utilized in the Smart Growth Strategy Regional Livability Footprint Project. GIS buffers were created to identify subsets of this database for analysis of areas by transit mode (e.g., heavy rail, light rail, bus rapid transit corridors, and ferry terminals).

In order to describe the demographics of the TOD Study Zones, U.S. Census blocks were selected from areas that intersect the TOD Study Zones. The following selection criteria are used:

1. Heavy Rail Stations/ Ferry Terminals

    ❑   ½ mile buffer area around designated stations or terminals, including both complete and partial census tracts, where at least 35 % of the tract falls within the zone.

2. Light Rail Stations/ Select Bus Areas and Bus Rapid Transit Corridors and Terminus Locations

    ❑   ¼ mile buffer area around designated stations or terminals, including both complete and partial census tracts, where at least 35 % of the tract falls within the zone.

Determining Existing and Future Demographic Characteristics

The TOD Study Zone existing demographics are primarily based upon the collection of census blocks selecting using the criteria discussed above. While the population and housing characteristics describing these areas are reported at the block level, the employment and income characteristics are defined at the block group level. Therefore, it was necessary to develop a process in order to parse out the employment and income characteristics from the larger block group level to the TOD Study Zones.

Existing Demographic Characteristics Methodology

The project used GIS to disaggregate the employment characteristics reported in the *2000 Census Transportation Planning Package* at the block group level, into the TOD Zones using an existing land use database. To calculate zonal employment totals, a constant average density was determined within the TOD Zones for only those areas where acres of existing employment generating land use were identified. This average density was determined by the following calculation.

Average Density =   Total Jobs in each block group by divided by gross acres of
                       employment generating land use

The average density was then multiplied by the total area of the TOD Study Zone to determine the employment estimate.

Future demographic conditions were defined by using the *Projections 2003* demographic forecasts prepared by the Association of Bay Area Governments. ABAG's *Projections 2003* forecast is disaggregated into individual estimates for each of the Bay Area's 1405 census tracts. This level of specificity makes it a good basis for determining the forecast for the TOD study areas. However, because the geography of the TOD study areas, which are principally groupings of several census blocks, is different from the census tract geography of the *Projections 2003* forecast, a method is needed to recast the population, households and employment forecast from the census tract level to the TOD study area.

<u>Future Demographic Characteristics Methodology</u>

After a careful analysis of the TOD study areas, it was determined that TOD areas can be portions of a single tract, aggregations of multiple census tracts, and most often portions of multiple census tracts. Since the forecast identifies population, households and employment attributes for each TOD study area, it would be a vast oversimplification to use a single measure, like the proportion of a census tract's total area contained within the TOD study area, or the proportion of a tract's 2000 population in a TOD area, to construct the TOD study area forecasts. In order to account for the disparate geography between the *Projections 2003* census tracts, and the TOD Study Zones, and to appropriately assign future growth to the TOD Study Zones based upon the *Projections 2003* census tract forecast, a methodology was developed that considered policy and land use based assumptions based upon the follow to three factors:

1. Local Development Potential obtained from ABAG's Local Policy Survey Database
2. The Smart Growth Vision Growth Assumptions
3. Existing Conditions (Census 2000)

Assumptions: ABAG Local Policy Survey– Defining Development Potential
A key determinant of the location for future growth is described as development potential, or the amount of land that is available for future residential, commercial and industrial development. The availability and purpose of that land is controlled by factors like local general plans and zoning, and can differ significantly from existing land use.

Development potential is the original factor used in assigning the *Projections 2003* forecast from the more general to more specific geographic areas. The development potential is differentiated between residential, commercial and industrial land uses, and quantified by each five year time period in the forecast. This development potential is collected, and assigned to a census tract in ABAG's Local Development Policy Survey database.

Assumptions: Smart Growth Vision – Policy Based Assumptions for Future Growth
The *Projections 2003* forecast incorporates policy-based assumptions determined by the Smart Growth Vision. These assumptions reflect the impact of smart-growth related policies and incentives that could be used to shift development patterns from historical trends toward better jobs-housing balance, increased preservation of open space, and development of urban and transit-accessible areas.

Assumptions: Existing Conditions– Timing of Policy Change Impacts
The *Projections 2003* forecast assumes that any effect of policy changes to the forecasts will not occur for a number of years. Therefore, changes in land use and/or transportation policies that would impact development in the region must occur in the context of the existing conditions and policy frameworks.

A correspondence between census tracts and the TOD Study Zones was developed based upon the above assumptions. This correspondence is used to disaggregate the population, employment and household growth identified in the *Projections 2003* census tract forecast to each TOD Study Zone. GIS tools are then used to identify the proportion of population, households, and employment for Existing Conditions (Base Year 2000), *Projections 2003*, and the Smart Growth Vision, within the combined geography of census tracts, and TOD Study Zones. This proportion or split of total population, households and employment by the combined census tract + TOD Study Zone area is weighted in a formula that is used to assign growth to the Base Year totals. See Figure 5.

Figure 5. Formula for Calculating TOD Study Zone Forecast Totals

The results of this analysis are then summarized by TOD Study Zone to determine the total population, households and employment in 2030.

Current and Future Land Use Patterns

A summary of the current land uses within the TOD Zones has been identified for this study. Every five years, ABAG creates an existing land use database for the entire Bay Area region. Data from the 2000 existing land use database was used to describe the current land uses within the TOD Study Zones. Existing Land Use classifications were generalized so that each land use class could be compared with future land use patterns in an effort to determine the degree of change for each of the TOD Study Zones.

Data was collected from multiple jurisdictions in the Bay Area region, and delivered in a variety of different formats. GIS was used to construct a database that was in a consistent and useable format for easy comparison.

TOD Study Analysis Results

A personal geodatabase was used to store all relevant data for this project. Included in this database are the GIS layers describing the TOD Study Zones for the region, the existing land uses within each TOD Study Zone, as well as the demographic tables containing the existing and future demographic characteristics. In addition, the entire transit system, both existing and future was digitized and included in this database. Tables describing the mode of transit service (e.g., heavy rail, light rail, and rapid bus) were attributed to each TOD Study Zone. Microsoft Access was used to prepare several tabular summaries that were used to provide the general direction for policy development that addresses the MTC adopted five-point Transportation/Land Use Platform.

The proposed TOD policy includes three key elements. The first is corridor-based performance measures to quantify minimum levels of development around transit stations. The minimum thresholds will be based on the transit mode — there will be a higher threshold for more capital-intensive modes, such as BART.

Secondly, MTC will help to fund station area plans for jobs and housing, station access, design standards, parking and other amenities based on unique circumstances and community character.

The third element of the proposed TOD policy is the creation of corridor working groups to bring together local government staff, transit agencies, county congestion management agencies (CMAs) and other key stakeholders along the corridor to help develop station area plans to meet MTC's corridor-wide land-use thresholds.

Case studies have been conducted along five *MTC Resolution 3434* corridors — BART to San Jose, e-BART to east Contra Costa County, Sonoma-Marin Rail Transit (SMART), the Dumbarton rail corridor and the Richmond ferry — to help evaluate the varying demands and capacities for both housing and jobs, and to determine potential paths to success. MTC staff has presented the initial draft TOD policies throughout the region and particularly in above-mentioned corridors, and has received significant feedback. Details on application of the policy, corridor level thresholds, and station area plans currently are being developed in response to these comments.

Conclusion: Lessons Learned

The Smart Growth Visioning effort in the Bay Area region has shown us that developing policies that strive to create sustainable development patterns requires a great deal of participation and input from the public. This participation often provides policy makers with a wealth of detailed information that is often expressed in geographic terms. An effective GIS allows policy makers and their support staff to collect this information and use it in a meaningful way to support public policy and decision-making. While the GIS database provides a structure for storing and collecting this information, it is the ability of a GIS to disseminate this information to the public in an easy to understand medium that is tremendously valuable to decision makers. GIS has the ability to both define the issues and determine any associated impacts in a consistently measurable form.

The TOD Study has made great use of these benefits offered by GIS. When policy makers present information to the public regarding potential changes in how transportation projects are funded, having visual information and data that supports these changes are crucial to achieving buy in from the public, as well as the decision-makers. The collection of data used as a part of this study, along with the experience gained from the three projects that introduced GIS analysis methods to the urban planners in the bay area region has so far been a successful endeavor.

The approach taken by the TOD methodology has generated a great deal of ancillary information that will be used in future projects at MTC. While we have discovered that some information, such as land use and zoning, is very difficult to collect, the effort we have made, has established interest from upper management as well as the elected-officials who establish policy direction. The continuing support of these two groups enable GIS staff to begin forging relationships with the local governments to build a more complete set of data that can be used more effectively in promoting Smart Growth development in the region.

References:

(1) What is Smart Growth? Association of Bay Area Governments. August 2004
< http://www.abag.ca.gov/planning/smartgrowth/whatisSG.html >

(2) Smart Growth/ Transportation for Livable Communities. Metropolitan Transportation Commission. May 2005 < http://www.mtc.ca.gov/planning/smart_growth/index.htm >

(3) Metropolitan Transportation Commission, Transportation 2030: Mobility for the Next Generation, February 2005.

(4) IRP Pilot Project. Association of Bay Area Governments. December 2003 < http://www.abag.ca.gov/planning/interregional/pilot_proj.htm >

(5) Transportation for Livable Communities (TLC). Metropolitan Transportation Commission. June 2005 < http://www.mtc.ca.gov/planning/smart_growth/tlc_grants.htm >

(6) Housing Incentive Program (HIP). Metropolitan Transportation Commission. May 2005 < http://www.mtc.ca.gov/planning/smart_growth/hip.htm >

(7) Parsons Brinkerhoff Quade and Douglas, Regional PLACE3S User Guide, August 2001.