

To: Equity Working Group
From: Regional Agency Staff
Date: December 1, 2011
Subject: Alternative Scenarios Equity Analysis: Methodology Summary

This memorandum summarizes the methodology used to create the equity analysis measures analyzed for the Alternative Scenarios, which are scheduled to be presented at a joint meeting MTC's Planning Committee and ABAG's Administrative Committee December 9.

This summary stems from many months' worth of development work including extensive input from the Equity Working Group and other interested stakeholders on both the identification of target populations (both low-income households and communities of concern) as well as equity performance measures to be analyzed for each of the Alternative Scenarios as well as a base year for comparison.

I. Target Populations

Conducting an equity analysis requires dividing the regional population into different groups on some demographic or socioeconomic basis, so that comparisons between different groups can be made across the same set of measures (performance measures analyzed are described below under the heading **Performance Measures**).

Income-Based Analysis: Low-Income Households

Many of the measures analyzed are able to produce results for all low-income households, or persons living in low-income households, throughout the region, regardless of their residential location. Low-income households are defined in MTC's travel model as having incomes of less than \$30,000 a year 2000 dollars; non-low-income households as a basis for comparison are defined as having incomes of \$30,000 or more per year.

Geographic-Based Analysis: Communities of Concern

In discussing how to define target populations for equity analysis, Equity Working Group members emphasized the importance of spatial location within the region with respect to the impacts of future development and transportation investments. Thus, staff worked with Working Group members to develop a spatial definition of communities of concern, against which performance measure results could be compared with non-communities of concern (typically referred to in the analysis as the "remainder of region"). Except where noted, data used to define communities of concern is from the 2005-09 American Community Survey, the most recent most recent data set available for this analysis compatible with MTC's existing travel-analysis-zone definitions used for spatial analysis.

In response to feedback that the analysis would be more informative with a more focused definition of communities of concern, and a recommendation to consider senior and disabled populations in addition to low-income and minority, staff proposed a revised definition which identifies communities with multiple overlapping potential disadvantage factors relevant to the



Plan Bay Area planning process. The list of factors, reviewed by the Equity Working Group and approved by MTC’s Planning Committee, are as follows (and described in further detail below):

Disadvantage Factor	% of Regional Population	Concentration Threshold
1. Minority	54%	70%
2. Low Income (<200% of Poverty)	23%	30%
3. Limited English Proficiency	9%	20%
4. Zero-Vehicle Households	9%	10%
5. Seniors 75 and Over	6%	10%
6. Population with a Disability	18%	25%
7. Single-Parent Families	14%	20%
8. Cost-burdened Renters	10%	15%

Communities of concern are defined as **those tracts having concentrations 4 or more factors listed above, or that have concentrations of both low-income and minority populations.**

A total of 305 out of 1,405 tracts were identified as communities of concern. These locations were then corresponded to 323 out of the region’s 1,454 travel analysis zones for the purpose of extracting and tabulating travel model output on a geographic basis in order to summarize results for communities of concern. Most TAZs in the region correspond to census tract boundaries, except for some locations in the region’s densest areas where more than one TAZ may “nest” within a single census tract.

An interactive map showing locations of communities of concern with detailed data as of the 2005-09 American Community Survey timeframe can be found at <http://geocommons.com/maps/118675>.

An interactive map showing the varying degrees of overlap among the 8 different population concentrations can be found at: <http://geocommons.com/maps/121158>.

Descriptions of the potential disadvantage factors contributing to the community-of-concern definition are provided below. Generally speaking, to define “concentrations” of various populations, thresholds are established at a value between the regional average (mean) share of a tract’s total population belonging to a given group, and one standard deviation above the mean, and reflect differences between how different populations are distributed spatially throughout the region. Some populations, such as zero-vehicle households, are highly concentrated in a relatively small number of tracts; other populations, such as seniors over 75+, are much more evenly spread out throughout the region.

1. Minority Community

A **minority community** is defined as having 70% or more residents who are members of any of the following groups defined by the Census Bureau: Black or African-American, Asian, American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, some other race, two or more races, or Hispanic/Latino of any race.

2. Low-Income Community

A **low income community** is defined as having 30% or more residents who are identified by the Census Bureau as being below 200% of the federal poverty level. MTC established the 200% of poverty threshold in 2001 to account for the Bay Area's high cost of living; the Census Bureau does not adjust the poverty level for different parts of the continental U.S. with different costs of living to factor into the varying affordability of basic necessities.

The Census Bureau establishes poverty status based on a combination of both household size and income. As of 2010, the 200% threshold represents a household income of roughly \$22,000 a year for a single person living alone, and \$44,000 a year for a family of four. The definition of a **low-income community** based on the Census Bureau's characterization of populations in relation to poverty thresholds is distinct from the definition of a **low-income household** described under "income-based analysis" above.

3. Limited English Proficiency Community

A **Limited English Proficiency community** is defined as a community where 20% or more of residents speak English "not well" or "not at all" according to the Census Bureau.

4. Zero-Vehicle Households

A concentration of **zero-vehicle households** is defined as a community where 10% or more of households do not have access to at least one vehicle according to the Census Bureau.

5. Seniors 75+

A concentration of **seniors** is defined as a community where 10% or more of residents are age 75 and over according to the Census Bureau. Although area-specific data on driving habits, mobility, and travel independence by specific ages is not available, age 75 was chosen to approximate a point at which seniors' mobility and independence may soon begin or have already begun to diminish relative to that of younger adults.

6. Persons with Disabilities

A concentration of **persons with disabilities** is defined as a community where 25% or more of persons over the age of 5 has one or more disabilities according to the Census Bureau. Because the Census Bureau redefined how questions regarding disability are asked in 2008, data for this definition is from the 2000 Census, the most recent year that disability data is available at the tract level.

7. Single-Parent Families

A concentration of **single-parent-family households** is defined as a community where 20% or more of family households are headed by a single parent with children present. Inclusion of this group is intended to capture households with unique economic vulnerability, as well as distinct travel needs and patterns from other household types.

8. Overburdened Renters

A concentration of **overburdened renters** is defined as a community where 15% or more of occupied housing units (including both renters and owners) are occupied by renters paying more than 50% of their income in rent. This definition is also incorporated into the Displacement Risk equity measure described in the following section on performance measures.

II. Performance Measures

This section describes the methodology used to produce results for each of the performance measures across the different scenarios.

1. Housing and Transportation (H+T) Affordability

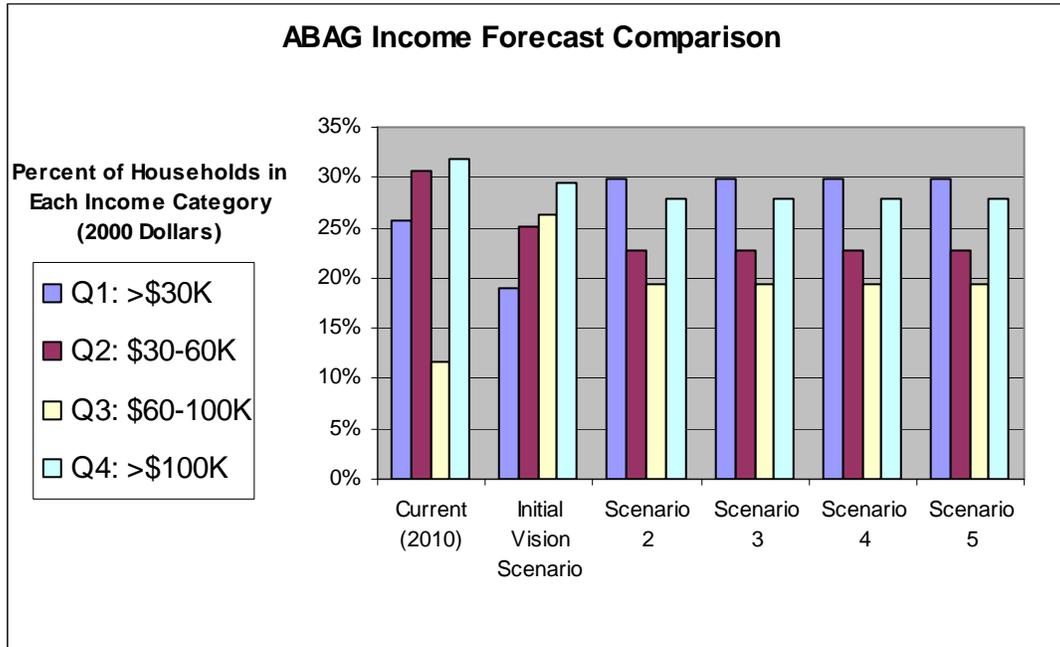
Housing and Transportation Affordability is expressed as the share of average household income spent on housing and transportation costs. Results for this measure are produced for low-income households vs. non-low-income households.

Housing Costs and Income Forecasts

Housing costs are estimated based on household incomes and the share of income spent on housing. Regional housing costs are dependent on a number of factors, including production, land availability, subsidies, policies, building types and other characteristics, but historically housing costs most closely correlate with income levels. ABAG produces a household income forecast for each scenario; combined with the US Census American Community Survey 2005-2009 data on “share of income spent on housing,” this forms the basis for forecasting housing costs.

The income forecast predicts the number of households in 16 US Census-designated household income categories. From that forecast, data is aggregated into the larger household income groups (Very Low, Low, Moderate, and above Moderate, or <\$30K, \$30K-\$60K, \$60K-\$100K and >\$100K), and the mean income is computed for each group, by census tract.

The income forecast strongly characterizes the results of the housing cost forecast and the differences between scenarios. The income forecast that accompanied the Initial Vision Scenario contained a significant shift in the moderate income category from 12% to 26% of the population, as well as a prominent decrease in the number of low-income residents. The income forecast was revised after the IVS and the release of 2010 Census data to reflect more recent trends, which demonstrated that over the last 20 years the region had seen a decrease in the middle-income groups and increases in both polarity (the difference between rich and poor) and in the total number of low income households. The table below illustrates these changes between the 2010 income distribution and the five scenarios.



The housing cost forecast then uses a statistical model to produce numbers of households by tract in different income groups (in 1999 dollars) and then predict what proportion of households will fall into distinct housing cost categories (share of income spent on housing costs). The average income of each group varies by year and by scenario. As the average income for each income group goes up, households within that group tend to have lower percentage housing cost categories from the base year distribution.

Transportation Costs

A household’s estimated transportation costs include fixed costs related to owning automobiles (such as car payments and insurance), and variable costs (such as fuel, parking charges, and/or transit fares) related to how much and what kind of travel people choose to make day-to-day. Travel costs are forecast as out-of-pocket expenses incurred by travelers on a “typical day” for:

- Bridge tolls
- High Occupancy Toll (HOT) lane prices
- Transit fares
- Auto operating costs, which include assumptions about the price of fuel and fuel economy of vehicles
- Parking costs

Out-of-pocket travel costs for a typical day of travel are annualized by multiplying these costs by 300. These annualized costs are then added to a household’s annual auto ownership costs (derived from Bureau of Labor Statistics’ Consumer Expenditure Survey data by household income level), which vary by scenario as different land use and transportation inputs will result in differing levels of automobile ownership per household.

2. Displacement Risk

Displacement risk ties the proposed new development in the scenarios to the probability that current residents may be adversely impacted by changes in the housing market. Very low, low,

and even moderate income renters may experience displacement if new investment in a neighborhood leads to increased desirability, higher demand for housing and rising rents.

This metric captures the number of households currently considered “over-burdened renters” in relationship to the proposed growth. In a given area, if more than 15% of the housing units are occupied by renters who pay more than 50% of their income for housing (as characterized in the community of concern definition described in the preceding section), *and* the projected growth in that area is more than 30% above current conditions, the over-burdened households in that area are considered at risk for displacement.

Thresholds for over-burdened renters are set based on the regional mean and standard deviation from the regional average, identical to the threshold used to define Communities of Concern as described in the preceding section. The 30% threshold for growth highlights those areas whose percent growth exceeds the regional average for the five scenarios. A higher-than-average percentage of growth is assumed to reflect large market interest in the area, which would be expected to yield upwards pressure on housing costs. The number of households at risk for displacement includes over-burdened renters in all income categories, since in many cases moderate-income or even upper income households may move in response to rising rents.

The measure does not predict affordability levels of future housing, nor take into account policies to preserve existing levels of affordability. Bay Area jurisdictions with strong rent protections have still seen large migration shifts in low-income populations. It is also important to emphasize that while the measure focuses on displacement tied to significant increases in development, consistent with regional policies and actions, rising housing costs are may be more significant in places where growth has been constrained.

3. VMT Density

The unit of measurement for this analysis is total VMT per day per sq. km of developed area

Where:

VMT includes vehicular traffic on roadway facilities carrying 10,000 or more vehicles per day

Per day means a “typical” weekday

Developed area includes residential, commercial, or industrial land within 1,000 feet of the centerline of roadway facilities carrying 10,000 or more vehicles per day

Calculating this measure relies on identifying affected roadway links as those carrying 10,000 or more vehicles per day, and identifying areas of developed land proximate to these roadway links, to include areas of residential, commercial, or industrial land within 1,000 feet of the centerline of the selected roadway links. This calculation methodology is consistent with the Bay Area Air Quality Management District’s (BAAQMD) “Recommended Methods for Screening and Modeling Local Risks and Hazards” (May 2011, version 2.0) as part of their California Environmental Quality Act (CEQA) review guidance for proposed land use projects.

The vehicle-miles of travel (VMT) for each affected roadway link are forecasted using MTC's travel model across different scenarios. This estimate provides the VMT Density measure according to the following formula:

$$\text{VMT} / \text{Developed land area} = \text{VMT Density}$$

4. Non-commute Travel Time

This measure provides average travel time per trip for non-mandatory tours by all modes. Non-commute trips are analyzed because:

- Commute travel to work is analyzed separately as a measure of jobs-housing fit.
- Low-income travelers are more likely than higher-income travelers to be non-workers, students, or retirees, who have distinct trip-making patterns.¹
- Non-commute trips outnumber commute trips for low-income travelers² (though commute trips are generally longer than non-commute trips in terms of time and distance). Non-commute trips are also more likely to occur at off-peak travel times.
- Non-commute trips capture a wider variety of travel purposes including shopping, accessing health care and social services, and social and recreational trips, and as such provide a better indication of whether residents live in “complete communities” where a wide variety of daily needs are located nearby.

Results of this measure in average number of minutes per trip are produced for

- Communities of concern and the remainder of the region (all residents of each)
- Low-income travelers vs. non-low-income travelers, regardless of community of residence.

“Non-commute” travel defined for the purposes of this analysis includes travel not associated with a tour involving work or school. For example, going to the grocery store and back home would be included in this definition. These “non-mandatory” tour purposes include such activities as shopping, recreational trips, visiting, escorting others, eating out, and “other” trips.

Factors that go into estimating travel time are similar for both non-mandatory tours as well as commute trips (which are described in the following section). Across all kinds of trips, decisions about how, where, and when to travel are complex; MTC's travel model attempts to represent some of this complex behavior by operating on a synthetic population that includes representative households and persons for each actual household and person in the nine-county Bay Area – both in the base year and in forecast years. Travelers move through a space that is segmented into “travel analysis zones.”³ A series of travel-related choices are simulated for each household and person within each household; these choices are simulated in the following sequence:

¹ Source: Bay Area Travel Survey 2000, as cited in MTC's Snapshot Analysis Development Report, June 2010. <http://www.mtc.ca.gov/planning/snapshot/Snapshot%20Development%20Report-0609.pdf>. Note “Low Income” is defined as travelers living in households with incomes below \$35,000 per year.

² See April 6, 2011 staff memorandum to Equity Working Group “Additional Initial Vision Scenario Data Results,” Figures 4 and 6. http://apps.mtc.ca.gov/meeting_packet_documents/agenda_1649/April_13_Equity_Working_Group_packet.pdf

³ An interactive map of MTC's travel analysis zones is available here: <http://geocommons.com/maps/58264>

- Usual workplace and school location – Each worker, student, and working student in the synthetic population selects a travel analysis zone in which to work or attend school (or one zone to work and another to attend school);
- Household automobile ownership – Each household, given the household location and demographics as well as each members’ work and/or school locations, decides how many vehicles to own;
- Daily activity pattern – Each household determines, together, the daily activity pattern of each household member, the choices being mandatory (go to work or school), non-mandatory (leave the house, but not for work or school), or stay at home.
- Work/school tour frequency and scheduling – Each worker, student, and working student decides how many round-trips they will make to work and/or school, and then schedules a time to leave home for work and/or school as well as a time to return home;
- Joint non-mandatory tour frequency, party size, participation, destination, and scheduling – Each household determines the number and type (e.g. to eat, to visit friends, etc) of “joint” (i.e. two or more members of the same household traveling together) non-mandatory (i.e. not work or school) round trips in which to engage, then determines which members of the household will participate, where and at what time the tour (i.e. the time leaving home and the time returning home) will occur;
- Non-mandatory tour frequency, destination, and scheduling – Each person determines the number and type of non-mandatory (e.g. to eat, to visit friends, to shop, etc) round trips to engage in during the model day, where to engage in them, and at what time to leave and return home;
- Tour travel mode – The tour-level travel mode choice (e.g. drive alone, walk, take transit, etc) decision is simulated separately for each tour and represents the best⁴ mode of travel for the round trip (a “tour” is a round trip from either home or the workplace);
- Stop frequency and location – Each traveler or group of travelers decide whether to make a stop on an outbound (from home) or inbound (to home) leg of a travel tour, and if a stop is to be made, where the stop is made, all given the round trip tour mode;
- Trip travel mode – A trip is a portion of a tour, either from the tour origin to a stop, a stop to another stop, or a stop to a tour destination, and a separate mode choice decision is made for each trip, doing so with awareness of the prior tour mode choice decision;
- Assignment – Vehicle trips for each synthetic traveler are aggregated to build time-of-day-specific matrices (i.e. tables of trips segmented by origin and destination) that are assigned via the standard static user-equilibrium procedures to the highway network (i.e. each vehicle is assigned to his or her shortest cost – both monetary and non-monetary – path between the origin and destination); transit trips are assigned to time-of-day-specific transit networks.

5. Commute Time

This measure provides average travel time per trip for commute trips by all modes, based on the location of a worker’s residence and place of work.

⁴ The choice of travel mode, as well as most other choices represented in the model, is simulated within a random utility theory framework – additional information available here: http://en.wikipedia.org/wiki/Choice_modelling.

Commute travel time is analyzed separately because travel time between home and work generally provides an indication of the proximity of jobs and housing for different socioeconomic groups.

Results of this measure in average number of minutes per trip are produced for

- Communities of concern and the remainder of the region (all residents of each)
- Low-income travelers vs. non-low-income travelers, regardless of community of residence.

Details regarding how travel decisions are made for all kinds of trips, including commute trips, are described above under “**Non-commute Travel Time.**”