Trip-Generation Rates for Urban Infill Land Uses in California

Phase 1: Data Collection Methodology And Pilot Application

FINAL REPORT

Prepared For:

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Abstract

This report presents the results of the first phase of a two phase research project undertaken by the California Department of Transportation (Caltrans) to study travel characteristics of infill development in California's metropolitan areas. This research was guided by goals to establish a database of empirical trip generation studies for various types of infill development, to standardize a data collection and analysis methodology, and to coordinate this research with the Institute of Transportation Engineers (ITE) with an objective to integrate the findings into a future ITE publication. The specific objectives of this research were to:

- Develop a methodology for identifying and describing urban infill locations suitable for collecting infill trip rate data,
- Define and test a methodology for collecting trip generation rate data in urban infill areas,
- Develop trip generation rates for common infill land use categories in urban areas of California,
- Establish a California urban infill land use trip generation database, and
- Supplement ITE trip generation data.

The first phase of this research project can be considered a pilot study for one of the nation's first comprehensive efforts to collect trip generation data for urban infill land uses. As a pilot study, it has been successful in identifying and testing data collection methods and determining ways to resolve challenges. A limited amount of data was collected in this first phase, and the lessons learned have strengthened the knowledge and techniques for continuing data collection in the second phase of this research.

The preliminary data collected and evaluated to date from 13 sites indicate that the studied land use categories have lower trip generation characteristics in urban infill contexts than ITE trip generation rates. More data points are required for the full set of selected land uses to substantiate and validate this preliminary conclusion and to establish statistical correlations between urban contexts and trip generation characteristics.

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Project Management and Consultant Team

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1 Introduction

Infill development is defined as new development and redevelopment projects located on vacant or underutilized land within existing developed areas. Infill development is one strategy for revitalizing declining city and suburban cores and town centers. It promotes efficient and cost-effective use of existing infrastructure and services (such as streets, transit, and utilities), and expands opportunities for housing, recreation, and economic growth.

During local land use review and development permitting processes, public agencies commonly require estimates of vehicle travel impacts associated with proposed land use projects, assessments of their potential contribution to traffic congestion, and identification of appropriate mitigation strategies. These strategies often include mitigation fees, private developer contributions, special tax assessment districts, and specific facility improvements.

In preparing traffic and transportation impact analyses, professionals often rely on the Institute of Transportation Engineers' (ITE) published trip-generation rates for various types of land uses. However, ITE data typically reflects isolated suburban development usually lacking availability and proximity of transit service, and the existence of pedestrian and bicycle facilities. As a result, the use of ITE trip-generation rates for proposed urban infill development projects served by transit and having good pedestrian access could significantly over-predict vehicular traffic impacts.

Benefits of Infill Development

- Provides housing opportunities closer to jobs
- Encourages community revitalization
- Reduces suburban sprawl
- Makes better use of existing infrastructure
- Encourages walking and the use of transit
- Reduces need for automobile ownership

The use of trip generation data goes beyond traffic impact analysis. It also has significant economic and environmental consequences. Trip generation rates are used in the development and application of traffic impact fees and are a major determinant in the approval of infill development projects and parking provisions. The use of auto-oriented suburban traffic generation data for assessing urban infill projects can produce an inherent inequity in the approval process resulting in a potential disincentive for developers to take on the increased challenges of infill development.

All of these consequences can result in a slower pace of infill development, higher costs, and delay and/or even rejection of otherwise beneficial infill projects stalling economic development, housing provisions, and job growth within existing urban and suburban areas.

It is clear that further research is needed to help better understand the trip generation characteristics of infill development. Although recently there have been a number of research projects to determine the travel characteristics of infill, transit-oriented, and mixed-use development, the one conclusion that can be drawn from this body of information is that, as a profession that studies the effect of land use on transportation, transportation professionals do not yet fully understand how much traffic is generated by these types of developments in higher-density urban and suburban settings.

1.1 Problem Statement

The Institute of Transportation Engineers (ITE) trip generation rates have been the primary source for travel demand analysis of new development throughout the United States, and they are relied upon for conducting California Environmental Quality Act (CEQA), and local agency development impact analyses. These rates were intentionally based on surveys of isolated suburban development with little or no pedestrian, bicycle, or transit accessibility for ease of data collection. Despite the vast amount of data collected by ITE over the past decades, these trip generation rates may not be sufficient to guide the approval of proposed developments in urban infill areas because the sources of the rates do not reflect variations in density, diversity (land use mix), site design, and the multimodal transportation systems of our larger metropolitan areas, which are critical factors on travel demand.[1] In metropolitan areas, the amount of vehicle trip generation is affected by multiple factors including:

- Proximity to transit
- Density of development
- Development compactness
- The pedestrian environment
- Cost of parking
- Traveler demographics such as income and auto ownership

[1] *Land Use and Site Design - Traveler Response to Transportation System Changes*. (Washington D.C., Transportation Research Board (TRB) Transit Cooperative Research Program (TCRP) Report 95: Chapter 15)

Because the ITE trip generation rates do not account for the variations in these factors, a significant challenge has been created resulting in sometimes speculative adjustments to better estimate urban and multimodal travel demand. The increased interest in land use typologies such as "mixed-use" and "transit-oriented" development in California has led to particular challenges and debate when it comes to travel demand analysis. Transportation and land use planners and engineers are seeking credible empirical trip generation and mode share data to more accurately assess the impacts and benefits of new development in our complex urban land use/transportation systems.

1.2 Purpose of the Study

This research was undertaken by the California Department of Transportation (Caltrans) to address the need for better and more accurate data regarding travel characteristics of infill development in California's metropolitan areas. Specifically, the primary objectives of this study were to:

- Develop a methodology for identifying and describing urban infill locations suitable for collecting infill trip rate data,
- Define and test a methodology for collecting trip generation rate data in urban infill areas of California,
- Develop trip generation rates for common infill land use categories in urban areas of California,
- Establish a California urban infill land use trip generation database, and
- Supplement ITE trip generation data.

1.3 Study Outcomes

This research is intended to provide empirical trip generation data for use in transportation planning and traffic engineering studies for urban infill areas throughout California. This study also provides the foundation for subsequent research to be conducted by Caltrans, local agencies, and/or private organizations to further build a comprehensive urban infill trip generation database.

The most applicable outcome of this study is the production of quantitative information on travel characteristics of urban infill land uses that can be used in traffic impact studies and environmental assessments in this state. This research is intended to establish a standardized data collection and analysis methodology, which will result in consistent information gathering in the future.

One of the goals of this study was to collaborate closely with ITE so that the resulting methodology and data, combined with the addition of national empirical data, eventually can be integrated into a future addition of the Trip Generation Manual or other ITE publication, such as the Trip Generation Handbook.

The methodology and data produced by this study will support transportation planning and assessment for the following types of land uses located in urban infill areas of California (and potentially elsewhere):

- Commercial and office developments,
- High density housing, and
- Mixed-use and transit-oriented developments.

1.4 Report Organization

The subsequent chapters of this report are organized as follows:

Chapter 2 – Defines trip generation, discusses current trip generation usage, and presents sources of trip generation data and relevant trip generation research.

Chapter 3 – Discusses the scope of work including goals, overview of the study, study team, and Technical Advisory Committee. This chapter also discusses coordination with ITE, site selection methodology, site selection criteria, and site selection procedures including challenges and effectiveness of various approaches.

Chapter 4 – Discusses the different data collection methods considered for this study and their challenges. This chapter also describes the chosen data collection methodology and provides an overview of the data analysis process. This chapter provides an overview of the sites surveyed in the "initial pilot" study (used to test the chosen survey methodology), and presents an evaluation of the study sites and their surrounding context.

Chapter 5 – Discusses the findings of the surveyed sites in the "expanded pilot study" (subsequent data collection using the method established in the initial pilot study), compares the derived trip generation rates with ITE trip generation rates, and summarizes the demographic data collected and the statistical analysis

of the data.

Chapter 6 – Presents a summary and the conclusions of this study. This chapter also provides recommendations for future research and the potential implication for transportation and planning policy in California.

Chapter 7 – Bibliography

Chapter 8 – Appendices

2 Current State of Trip Generation Research

2.1 Definitions

Definitions of many of the terms used in this study are as follows:

Context – The nature of the natural or built environment created by the land, topography, natural features, buildings and associated features, land use types, and activities on property adjacent to streets and on sidewalks, and a broader area created by the surrounding neighborhood, district, or community. Context also refers to the diversity of users of the environment.

Context Zone – One of a set of categories used to describe the overall character of the built and natural environment, building from the concept of the "transect" – a geographical cross-section through a sequence ranging from the natural to the highly-urbanized built environment. As defined in ITE's *Context Sensitive Solutions (CSS) in Designing Major Urban Thoroughfares for Walkable Communities*[2], there are six context zones plus special districts describing the range of environments including four urban context zones for the purpose of CSS—suburban, general urban, urban center, and urban core.

Infill development – Like the terms urban and suburban, infill development has many definitions. One definition is "the development or redevelopment of vacant or underutilized sites in economically or physically static or declining areas." The Congress for the New Urbanism describes infill development as "the creative recycling of vacant or underutilized lands within cities and suburbs." California Government Code Section 65088.1 provides a commonly-used definition of Infill development:

> (g) "Infill opportunity zone" means a specific area designated by a city or county, pursuant to subdivision (c) of Section 65088.4, zoned for new compact residential or mixed-use development within one-third mile of a site with an existing or future rail transit station, a ferry terminal served by either a bus or rail transit service, an intersection of at least two major bus routes, or within 300 feet of a bus rapid transit corridor, in counties with a population over 400,000.

Internal capture – The Institute of Transportation Engineers defines internal capture rate as "a percentage reduction that can be applied to the trip generation estimates for individual land uses to account for trips internal to

[2] Daisa, James M., *Proposed Recommended Practice in Designing Major Urban Thoroughfares for Walkable Communities*, (Institute of Transportation Engineers, Washington D.C., 2006).

the site."[3] In transportation analyses, internal trips do not impact facilities external to the site and are often made by walking.

Mixed-use and multi-use development – The Urban Land Institute defines mixed-use as "three or more significant revenue-producing uses, with significant functional and physical integration of the project components, and development in conformance with a coherent plan."[4] Mixed-use development can be a single building or a site with multiple buildings. The mix of uses may be vertical (as in a single building) or horizontal, where each use is within independent buildings but proximate to each other. ITE defines multi-use development as "typically a single real-estate project that consists of two or more ITE land use classifications between which trips can be made without using the off-site road system."[5] For purposes of evaluating "internal capture," the ITE definition is explicit that multi-use development does not include central business districts, suburban activity centers, or shopping centers.

Mode share – The method of travel selected by a person expressed as a percentage of that person's total travel. The common modes of travel include walking, bicycling, using transit, carpooling, and driving alone. Mode share of new development is often measured as the total number of person-trips by each mode of travel as a percentage of the total person trips produced or attracted by the development.

Transit-oriented development – According to the *Statewide Transit-Oriented Development Study: Factors for Success in California*[6], transit-oriented development (TOD) is defined as "moderate to high-density development, located within an easy walk of a major transit stop, generally with a mix of residential, employment, and shopping opportunities designed for pedestrians without excluding the auto. TOD can be new construction or the redevelopment of one or more buildings whose design and orientation facilitate transit use."

Urban and suburban – An urban area is defined by federal-aid highway law (Section 101 of Title 23, U.S. Code) as a place designated by the Bureau of the Census as having a population of 50,000 or more. The traditional definition

[3] Institute of Transportation Engineers, Trip Generation Handbook Second Edition, Washington D.C.: Institute of Transportation Engineers, 2004.
[4] Smith, Mary S. Shared Parking, Second Edition, Washington D.C.: ULI-The Urban Land Institute and the International Council of Shopping Centers, 2005.
[5] Institute of Transportation Engineers, Trip Generation Handbook Second Edition, Washington D.C.: Institute of Transportation Engineers, 2004.
[6] G.B. Arrington, Topaz Faulkner, Janet Smith-Heimer, Ron Golem, Daniel Mayer, Terry Parker, Statewide Transit-Oriented Development Study – Factors for Success in California, Sacramento: California Department of Transportation, 2002.

of suburban is a "residential district located on the outskirts of a city." In more practical terms, there is a continuum of definitions for urban and suburban. People tend to have their own personal "feel" for what constitutes urban and suburban places, so not all definitions mean the same for everyone. ITE defines a gradient of place designations in its *Trip Generation and Parking Generation*[7] handbooks, and has adopted the "transect"[8] in the proposed recommended practice *Context Sensitive Solutions In Designing Major Urban Thoroughfares For Walkable Communities.* (Also see definition of "Context Zone")

Vehicle trip generation – A vehicle "trip" is defined as "a single or one-direction vehicle movement with either the origin or destination inside a study site." Trip generation, as it refers to new development, is the number of automobile trips that the development produces and attracts during a given time period. This data is typically reported for trips made during "peak periods" as well as an entire day.

Walkable – Streets, places, or areas designed or reconstructed to provide safe and comfortable facilities for pedestrians of all ages and abilities. Walkable streets and places provide a comfortable, attractive, and efficient environment for the pedestrian, including: an appropriate separation from passing traffic, adequate width of roadside to accommodate necessary pedestrian-related functions, pedestrian-scaled lighting, well-marked crossings, protection from the elements (e.g., street trees for shade, awnings or arcades to block rain), direct connections to destinations in a relatively compact area, facilities such as benches, attractive places to gather or rest such as plazas, and visually interesting elements (e.g., urban design, streetscapes, or architecture of adjacent buildings).

2.2 Definition of Trip Generation as Used in Transportation Impact Analysis

A Transportation Impact Analysis (TIA) is a study that assesses the demands and impacts of land use development on a community's or region's transportation system. The overall objective of TIAs is to disclose information to public agencies making land use decisions. As it relates to this study, a TIA evaluates the traffic generation of new development and how that traffic affects congestion of the roadway system and the need to invest in capital improvements of the system, whether it is in the form of new roads and highways, traffic signals, turn lanes, or

[7] *Parking Generation* 3rd Edition, Washington D.C.: Institute of Transportation Engineers, 2004.
[8] The transect, developed by Duany Plater-Zyberk and Company, is a continuum of contexts or place designations ranging from natural and agricultural (parks, open space, farmland) to varying intensities of urbanism (from suburban to urban core). The transect identifies six discreet zones.

improved safety. TIAs vary depending on the type, size, and location of the development and are often required by local agencies as part of their development review process. TIAs are also typically required by the California Environmental Quality Act (CEQA).

Trip generation is the first step in the conventional four-step transportation forecasting process commonly used in impact analysis. It predicts the number of trips originating in or destined to a particular development project, or from a "traffic analysis zone" when used in the context of a travel demand forecasting model.

2.3 Current Trip Generation Usage

Some of the key uses of trip generation and TIAs include:

- Identifying impacts and associated capital improvements required to accommodate a development's traffic in combination with other growth.
- Allocating impact fees by land use classification to fund transportation improvements that mitigate the effects of new development.
- Estimating air quality impacts and conformance with regional, state, and federal air quality standards.
- Being instrumental in the local agency entitlement and approval process for new development, which can be one of the leading causes of controversy for development projects.

Accurate trip generation information is important to public agencies because it ensures that adequate transportation facilities are provided to serve new development, and because it generates needed revenue through impact fees. Although public agencies may find that the potential over-estimation of traffic generated by urban infill development based on currently-available ITE data is acceptable—(because it tends to be "conservative")—private developers of infill projects are legitimately concerned about the costs and other impacts that can result from over-estimation. The same can be true when sizing public roadways and associated improvements, especially adjacent to major developments. Further, many agencies promote urban infill development as an important Smart Growth or sustainability principle and therefore need accurate trip generation information to better understand the transportation benefits of infill development.

2.4 Sources of Trip Generation Data

2.4.1 ITE Trip Generation Manual

There are few national sources of trip generation data specific to particular types of land uses. The most widely used and accepted source is ITE's *Trip Generation* manual, which contains the largest database and is periodically updated. The database is populated with contributions from ITE's national membership. ITE provides guidance on the collection of trip generation data and provides forms to contributors. This ensures, theoretically, consistency in data collection. However, since data submittal is voluntary and there is no control to ensure the consistency of data collection procedures and selection of study sites within land use classifications, the trip generation data contain variability within any given land use classification.

For many years, ITE trip generation rates have been the primary source for travel demand analysis of new development throughout California, and they are often used for CEQA and other local agency development impact analyses. Caltrans' *Guide for the Preparation of Traffic Impact Studies*[9] states that "the latest edition of the Institute of Transportation Engineers' Trip Generation report should be used for trip generation forecasts." The Caltrans guidelines also encourage the use of local trip generation rates if appropriate validation is provided to support them.

The *ITE Trip Generation* manual provides trip generation rates and equations for the average weekday, Saturday, and Sunday; the weekday morning and evening peak hours of the generator; the weekday morning and evening peak hours of the generator that coincides with the traditional commuting peak hours for adjacent street traffic (i.e. 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m.); and the Saturday and Sunday peak hours of the generator (if any).

The *ITE Trip Generation* manual states that the trip generation data is an estimate and may not be truly representative of the trip generation characteristics of a particular land use. Moreover, these rates were intentionally developed based on surveys of isolated suburban development with little or no pedestrian, bicycle, or transit accessibility for ease of data collection. Therefore, there has been national concern that ITE rates may not be accurate for use in assessing urban infill development, mixed-use development, and transit-oriented development.

[9] *Guide for the Preparation of Traffic Impact Studies*. Sacramento: California Department of Transportation, 2002.

2.4.2 Other Sources of Trip Generation

Additional sources of trip generation data in California are more localized. The San Diego Association of Governments (SANDAG) publishes *Trip Generators*, trip generation rates collected within the San Diego region and widely used statewide. The California Department of Transportation (Caltrans) published the *Trip End Progress Report* from the 1960s through 1980s, an annual publication of trip generation studies for a collection of land uses in each publication. Although these Caltrans publications provided thorough and comprehensive studies of various land uses, they are considered too outdated for current use.

Unique trip generation studies are published in professional journals such as *ITE Journal*, and a few study results may also be found in TRB's *Transportation Research Records* and annual meeting compendiums. Finally, consultants conduct individual trip generation studies usually as supporting documentation for analysis of specific development projects. Some of these studies are submitted to ITE for inclusion in *Trip Generation,* but many are likely to remain proprietary or unpublished.

2.5 Other Relevant Trip Generation Research

This section summarizes recent and ongoing trip generation research being conducted both nationally and within California.

2.5.1 Transportation Research Board (TRB)

Transportation Research Board projects include projects within the National Cooperative Highway Research Program (NCHRP) and Transit Cooperative Research Program Panel (TCRP). Research projects within these programs are identified below.

Trip Generation Studies for Special Generators (Contract/Grant Number: SP808B4J): This upcoming research project, sponsored by the Maryland Department of Transportation, will provide help when travel forecasting is confronted with projecting traffic in areas with unusual land use proposals that are not adequately covered by the ITE trip generation data. Other details about the project are as follows:

Start Date: 01/01/2008
End Date: 12/31/2008
Status: Active
Source Organization: Maryland Department of Transportation

Vermont Trip Generation Manual (Contract/Grant Number: SPR 700): This research project, sponsored by the Vermont Agency of Transportation, will measure trip generation for the most widely proposed types of development in Vermont and relate it to some measure of the intensity of the particular land uses. The result of the research will be a *Vermont Trip Generation Manual* to be used in conjunction with the preparation and review of Traffic Impact Studies within the state. Other details about the project are as follows:

Start Date: 01/10/2007
End Date: 01/10/2009
Status: Active
Source Organization: Vermont Agency of Transportation

Enhancing Internal Trip Capture Estimation for Mixed-Use Developments (NCHRP Project 08-51): This research project, led by the Texas Transportation Institute at Texas A&M, is nearing completion. It will develop a methodology for enhancing internal trip capture estimates that includes: (1) a classification system of mixed-use developments that identifies the site characteristics, features, and contexts that are likely to influence internally captured trips, and (2) a data collection framework for quantifying the magnitude of internal travel to and around mixed-use developments to determine the appropriate reduction rates. This project is collecting data at about seven mixed-use developments. Other details about the project are as follows:

Start Date: 07/05/2005
End Date: 03/01/2008 (estimated)
Status: Active
Source: NCHRP

Trip Generation Rates for Transportation Impact Analyses of Infill Developments (NCHRP Project 08-66): This national-level research, proposed to NCHRP by Caltrans, will develop an easily applied methodology (for trip generation, modal split, and parking generation) in the preparation of site-specific transportation impact analyses of infill development projects located within higher-density urban and suburban areas. This research project is chaired by the Caltrans Project Manager for this California study. Other details about the project are as follows:

Start Date: 02/01/2008
End Date: 02/01/2010(estimated)
Status: Active
Source: NCHRP

Ensuring Full Potential Ridership from Transit-Oriented Development (TCRP H-27A): This study was a national assessment of TOD issues, barriers, and

successes. This project included case studies from a variety of geographic and development settings with objectives to: (1) determine the behavior and motivation of TOD residents, employees, and employers in their mode choice; (2) identify best practices to promote TOD-related transit ridership; and (3) recommend contextual use of best practices. This study collected empirical trip generation data at 16 TOD sites nationally. Other details about the project are as follows:

Start Date: 12/10/2004
End Date: 12/30/2007
Status: Active
Source: TCRP

2.5.2 United States Environmental Protection Agency (EPA)

EPA has conducted a number of studies comparing urban infill and Greenfield developments. The following studies have been funded through EPA:

The Transportation and Environmental Impacts of Infill Versus Greenfield Development – A Comparative Case Study Analysis (EPA 231-R-99-005): The objective of this study, prepared in 1999, was to determine which type of development site (Infill or Greenfield) provided better or more efficient transportation services, and which site produced fewer transportation-related burdens on the environment.

Comparing Methodologies to Assess Transportation and Air Quality Impacts of Brownfields and Infill Development (EPA 231-R-01-001): The objective of this study, conducted in 2001, was to provide guidance on applicable methodologies to account for the benefits of infill developments in State Air Quality Implementation Plans and transportation conformity determination.

Although the two EPA sponsored studies described above did not estimate trip generation rates for urban infill areas, they presented qualitative and quantitative information about the advantages of infill development, including reductions in travel-time; increases in non-auto mode share; reduced air-pollutant emissions rates; reduced loss of open space; lower commute and infrastructure costs; and improved measures of community quality of life.

2.5.3 California-Specific Trip Generation Research

San Diego Association of Governments Smart Growth Trip Generation and Parking Demand Guidelines: The purpose of this project is to determine

observed trip generation rates for automobile, transit, and non-motorized modes of travel, and to observe parking demand associated with smart growth development. The findings are intended to be published in the form of guidelines for use by local agencies in the San Diego region. This research project is expected to be completed in August 2008.

2.6 Conclusions of Relevant Trip Generation Research

Transportation professionals who evaluate the transportation-related impacts and benefits of proposed land use development projects have various tools at their disposal to estimate trip generation. The most common of these is the database of empirical trip generation studies compiled and published by ITE. However, many transportation and land use professionals (including ITE members) recognize the probable limitations of this data for assessing urban infill developments, and acknowledge the need for new research.

Trip generation plays a critical role in transportation and land use planning, and especially in the assessment of transportation impacts of new development. As many local jurisdictions attempt to implement Smart Growth and more sustainable transportation strategies, it has become clear that, as a profession, traffic engineers may lack appropriate data and tools to accurately assess transportation-related impacts and benefits of proposed urban infill, transit-oriented, and mixed-use development projects.

A review of recent and ongoing research leads to the conclusion that - while there are a number of studies related to trip generation - few of these are specific to urban infill development, and even fewer collect empirical data. Most of the research projects are specific to a unique type or pattern of development (i.e., transit-oriented or multi-use development) that may – or may not – also be located within infill areas. The most relevant research projects include the upcoming NCHRP 08-66 infill trip generation project, the nearly completed TCRP H-27A project, and the upcoming SANDAG Smart Growth trip generation research project (summarized in Section 2.5 above). These efforts all have, or are intended to, collect empirical trip generation data within urban infill areas.

It is not yet known whether and how the products of these related but separate research efforts will be integrated into ITE's future publications so that they can be distributed and applied throughout the nation. ITE is aware of these research projects and, in fact, is represented on some of the research panels. While ITE has not yet determined whether or how these efforts will be brought together in a single published resource, they are considering either a future update of the *Trip Generation Handbook* (an ITE Informational Report) or a separate informational report that compiles the various efforts.

3 Study Design

3.1 Scope of Work

3.1.1 Goals

This research was guided by the following primary goals:

1. To establish a database of empirical trip generation studies for various types of infill development in California's metropolitan areas.
2. To establish a standardized data collection and analysis methodology for urban infill trip generation that will result in consistent information gathering in the future.
3. To coordinate this research effort with the ITE with an objective to integrate the findings into a future ITE publication such as the *Trip Generation* manual*, Trip Generation Handbook*, or other ITE informational report.

Goal 1, in this phase of the research, was only partially met because the number of study sites and land use categories for which data was collected did not meet the objectives established in the scope of work (to collect data for 50 sites). In effect, therefore, this first phase of the research resulted in a pilot study to establish a methodology and to begin to address the challenges associated with data collection. In subsequent sections of this report, the research is divided into an "initial pilot study" used to test the chosen survey methodology, and an "expanded pilot study" which includes subsequent data collection using the method tested in the initial pilot study.

Goal 2 was met by developing and applying a methodology that provides a systematic approach to identifying "urban infill" locations, and specific data-collection sites within these locations. Additionally, this study developed a data collection and intercept survey methodology that has been used at all of the sites surveyed to date, but has yet to be validated. The criteria used to identify urban infill locations is consistent with ITE context classifications used in both *Trip Generation* and *Parking Generation* manuals, as well as in ITE's Proposed Recommended Practice for *Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities.* It uses readily available population and employment data and transit information.

The research team is still developing a method for collecting average daily traffic (ADT) data, in addition to peak-hour data. This report identifies several potential methods for estimating and/or collecting such data. During the

second phase of this effort, one of these methods will be pilot-tested at a site where the selected method can be validated with automatic traffic counts.

All of the methodologies that have been developed in this research (which are described in detail in the appendices to this report) will be presented to a sub-committee of the ITE Trip Generation Committee for peer review and general professional acceptance. However, these methodologies and resulting data cannot be standardized until they are included in a future ITE publication.

The efforts identified in Goal 3 have been initiated with ITE. Interim deliverables and preliminary findings of this research have been shared with ITE staff on a preliminary basis. ITE staff has agreed that this research project, in conjunction with other research efforts underway nationally, will be introduced to a sub-committee of the ITE Trip Generation Committee. Additionally, because the Caltrans Project Manager and one of the principal investigators of this study are the Chair and Principal Investigator, respectively, of a similar new NCHRP study (NCHRP 08-66: Trip Generation Rates for Transportation Impact Analyses of Infill Developments), direct coordination between the California and national efforts will be expedited. Further, ITE is also represented on the review panel for NCHRP 08-66. Finally, ITE has tentatively stated that a synthesis of the various trip generation research efforts underway may be published in an ITE publication, such as a future update of the *Trip Generation Handbook* or an ITE Informational Report.

It is expected that the most applicable short-term outcome of this infill trip rates study will be the production of acceptable quantitative information regarding travel characteristics of ten urban infill land uses that can be used in traffic impact studies and environmental assessments within California. In the longer term, this research will contribute to a nationally established urban infill trip generation database.

3.1.2 Overview of Study

This research project is comprised of six parts:

1. Develop Criteria for Site Selection

This initial task developed a systematic approach to defining "urban" contexts and established criteria for selecting candidate sites. There are several nationally recognized ways to define urban areas and this study draws from several of these methods to derive an approach that is easy to implement with available data. Additionally, this study focuses on land uses within

metropolitan areas where walking, bicycling, and transit are attractive and viable modes of transportation. Therefore, the site selection criterion includes proximity to transit to help ensure that the criterion capture land uses where automobile use is a choice, not a necessity. Finally, because the data is intended to represent a cross section of California land uses, the methodology includes a simple method for allocating study sites among metropolitan areas.

2. Develop Data Collection Methodology

Initially this study attempted to follow ITE's established trip generation data collection methodology,[10] but it quickly became apparent that the standard methodology could not be applied to urban infill development. Because infill land uses often lack parking lots or structures that are specific to a single building (unlike many single-use suburban sites), the use of automated traffic counters at driveways is generally not feasible to capture all of the site's trip generation. Users of urban infill sites who drive may park on-street or in nearby public or private parking facilities. The alternative method selected for this study uses a combination of counts and intercept surveys, and results in a more comprehensive collection of travel information than could be obtained using the standard ITE method of counting automobiles.

3. Select Study Sites

This part of the study consists of identifying candidate sites that meet the study's criteria and obtaining permission from property owners/managers to conduct intercept transportation surveys. The selection of study sites is a relatively straightforward process of comparing site characteristics to the required criteria using GIS mapping. Gaining permission to survey these sites, however, has turned out to be the most challenging aspect of the study. Sites are defined as individual buildings or individual businesses within buildings depending on the land use category being studied. Once a site was identified, persuading property owners and managers to allow the surveys was in itself a challenge that required development of a strategy.

4. Collect Data

Once permission to survey a site is obtained, data collection plans are prepared and implemented on a site-by-site basis. Data collection includes physical counts of all pedestrians entering and exiting buildings, automobile counts (if study site traffic can be distinguished from non-study site traffic),

[10] Trip Generation Handbook Second Edition, Washington D.C.: Institute of Transportation Engineers, 2004. Chapter 4. Conducting a Trip Generation Study (Pgs. 15-28).

and in-person intercept surveys of a sampling of the building users. The surveys collect information on mode of travel, travel time, pass-by traffic, and multi-use trip capture, as well as optional demographic data for future cross-referencing. Finally, working with the building owner/manager, site specific and independent variable information is collected including building/business size, number of units, number of employees, occupied space, number of parking spaces and parking fees, and other data as applicable. Data collection is a joint effort between this research's consultants, traffic data collection firms, and professional surveying firms.

5. Analyze Data

The primary objective of the data analysis is to derive automobile trip generation rates for the selected infill land uses. Because the intercept surveys collect multi-modal information, it is also possible to identify the travel mode share of the site users. Cross-referencing between travel characteristics and demographic data can be performed at a later date. Once the database has grown to an appropriate number of points, a statistical analysis is conducted that includes: tabulation of data, summaries of computations, weighted average trip generation rates by independent variables, calculation of standard deviations, calculation of R^2, and plotting and graphing of trip generation findings.

6. Document Methods and Findings

The final task of the study is to document the study process and findings in a technical report. Documentation is important for several reasons. First, it is important to describe the methodology, analysis, and findings of the research so that others understand how the findings were derived, limitations of the research, and have detailed instructions for repeating the research if so desired. Second, the documentation describes the challenges and lessons learned from this research. This is important for those who continue the data collection methodology and continue to build the trip generation database. Finally, the documentation supports ITE's role in providing peer review of the methods and findings, and eventual integration of this research into national publications.

3.1.3 Study Team and Technical Advisory Committee

General oversight of this study was provided by Caltrans' Office of Community Planning in the HQ Division of Transportation Planning (Terry Parker, Caltrans' Project Manager). The consultant team responsible for conducting the study included:

- The Association of Bay Area Governments (ABAG) – Administration, facilitation of TAC meetings, and overall consultant project management.
- Kimley-Horn and Associates, Inc. (KHA) – Principal investigators, study design, and data collection and analysis.
- Economic Planning Systems (EPS) – Land use and context definitions, Geographic Information Systems, and technical analysis.

Kimley-Horn and Associates' data collection efforts were supported by several subcontractors including:

- Gene Bregman Associates (GBA) – Intercept surveys.
- Luth Research – Intercept surveys.
- Nichols Research, Inc. – Intercept surveys.
- Tony Quiroz – Site identification and selection.

Broad guidance for the research effort was provided through a Technical Advisory Committee (TAC) comprised of representatives of public agencies and consultants who are involved in regional and local planning, development review, and the preparation of traffic impact analyses. TAC members are listed on Page iii of the report.

3.1.4 Coordination with the Institute of Transportation Engineers (ITE)

As stated earlier, an important goal of this research project is eventual "acceptance" of the data and methodology by ITE, and publication of the data and findings in a future update of *Trip Generation* or similar ITE report. ITE has stated they do not "accept" trip generation research, but serve as the liaison between the research investigators and members of the profession. Although part of ITE's mission is to serve as a conduit for the exchange of professional information, they are not a standard-setting organization. As such, ITE will facilitate a process in which a committee of peers provides review and feedback. Beyond this, ITE has a formal process for preparing and publishing a Recommended Practice and an Informational Report. The goal of this study is that ITE publish urban infill trip generation methods and findings in one of the following ways:

- As a new chapter in the ITE *Trip Generation Handbook* specifically dedicated to collecting and applying data for urban infill development. The handbook is a recommended practice and publication of

information in such a document constitutes an ITE supported recommendation. This is the way multi-use internal capture research and methodologies are published and used by practitioners. The California data could be combined with the findings of NCHRP 08-66 (Trip-Generation Rates for Transportation Impact Analyses of Infill Developments) and other similar research efforts to create a national dataset.

- As a separate publication of the research methodology and findings in an ITE informational report (note that the *Trip Generation* manual is an informational report). An informational report contains information that ITE believes is of use to practitioners. As above, the California data could be combined with the findings of NCHRP 08-66 and other research projects to provide a nationally relevant informational report.

The following steps are proposed for gaining ITE "acceptance" of the California Urban Infill Trip Generation Rate Study methods and data:

1. Work with ITE to convene an ITE-nominated subcommittee of the Trip Generation Committee to review the research methodology and initial findings. This step has been initiated with ITE.
2. Prepare and publish articles on the California trip generation method and findings in the "Westernite", ITE's District 6 newsletter, which includes California, as well as in *ITE Journal,* the national professional monthly publication.
3. Present updates on the research and findings at local and national conferences, such as ITE technical and annual meetings, local ITE chapter meetings, and other national organization meetings and conferences, including those of the American Planning Association, Rail~Volution, Congress for the New Urbanism, American Society of Civil Engineers, Transportation Research Board, etc.
4. Coordinate this effort with the research being prepared for NCHRP 08-66, which may result in discussion and presentation of the California methods and data in an NCHRP publication.
5. Work with ITE to determine how this research, in combination with other research efforts, could be synthesized into an ITE publication, following the Recommended Practice or Informational Report guidelines.

3.2 Methodology

3.2.1 Defining Urban Infill Areas

As an initial step in the measurement of trip generation from urban infill development, it is necessary to define what constitutes "urban infill" and where such development presently exists. This section defines the term "urban infill" and proposes a methodology for identifying Urban Infill Areas (UIAs). A more thorough discussion of the definition of urban infill and the site selection criteria used in this study is found in Appendix A (Working Paper #1 Selection of Urban infill Study Sites).

The terms "urban" and "infill" are in common usage throughout the disciplines of land use and transportation planning. Planners have an intuitive grasp of what urban means, and the concept of infill is widely understood to describe the development of new homes, commercial sites, and public facilities on vacant or under-utilized land in existing communities. However, "urban infill" is often defined in qualitative terms narrowly relevant to studies addressing economic redevelopment of blighted areas, or as a nebulous concept relevant to broad-brush policies aimed at preventing "leapfrog" development or sprawl.

It is therefore critical that this current study has a clearer and more applicable definition of "urban infill" that is both relevant to surveys of trip generation in California's urban areas and parametric, that is, based on site and site context characteristics that are measurable.

Components of a good working definition of "urban infill" are provided by ITE "Area" definitions for data collection surveys and by the Smart Growth concepts of Transect/Context Zones, by U.S. Bureau of the Census criteria for the 2000 Census, and in current California and Florida state laws on urban infill and redevelopment.

There is a general consensus in this research that the criteria used in defining UIAs should be applicable to other studies, and should have potential application to future development patterns (i.e., to projected as well as existing urbanized areas). The definition began with an initial set of working criteria for defining UIAs. The initial criteria were reviewed by the TAC, and were refined and finalized in collaboration with the TAC. As agreed upon by the TAC, the following criteria were used to select study sites:

An UIA designation may be applied to any site located either:

- Within a Central Business District (CBD), Central City Not Downtown (CND), or Suburban Center (SBC) Area, as defined by ITE for data collection surveys (see detailed description in next section); or
- Within a General Urban (T/CZ-4), Urban Center (T/CZ-5), or Urban Core (T/CZ-6) Zone, as defined in the Proposed Recommended Practice for *Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities* (see detailed description in next section).

The three area types used in the definition of UIAs, CBD, CND, and SBC, are consistent with the definitions used in ITE's *Parking Generation, 3rd Edition*. These area types provide distinctions that are familiar and intuitive to experienced land use and transportation planners. These area types are described as follows:

- Central Business District (CBD) is the downtown area for a city. CBD characteristics include good transit service, parking garages, shared parking, an extensive pedestrian sidewalk network, multi-storied buildings, priced parking, and a wide range of land uses (including mixed-use sites).
- Central City Not Downtown (CND) is the area outside the downtown area of a larger city. This area has greater land use density than suburban sites, but is substantially less dense than the CBD. The intent of this area designation is for the areas around large central cities (for example, Seattle, San Francisco, Oakland, Atlanta, and Washington, DC) where travel characteristics are likely to be unlike suburban conditions.
- Suburban Center (SBC) areas are those downtown areas of suburbs that have developed CBD characteristics, but are not the central city of a metropolitan region. These activity centers have characteristics that may include good transit service, a mix of surface and structured parking, connected streets, a connected pedestrian network, and a mix of land uses. Examples include the downtown areas of Bellevue, WA; Las Colinas, TX; and Walnut Creek, CA.

The limitations of these area types are two-fold. First, they reflect to some degree the traditional, mono-centric city form, which has employment-generating land uses concentrated primarily in a Central Business District surrounded by concentric rings of decreasing employment densities and proportionally more residential and rural land. However, since the 1980s, many parts of California and across the nation have experienced the decline of CBDs as the major employment center, and the emergence of urban and

suburban employment centers located outside the CBDs. These trends have led to more poly-centric and dispersed urban regions.

In response to these trends, transportation and land use planners have reconceived the traditional "bull's-eye" CBD concept of urban form and concentric area types into the more flexible "Transect Zone" or "Context Zone" concepts. Transect/Context Zones have been introduced into the Proposed Recommended Practice for *Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities,* a joint project of the ITE and the Congress for the New Urbanism.

Transect/Context Zones are a systematic set of development intensity-based codes on a sliding scale ranging from the most rural or undeveloped area to the most urban or developed area. Three of the Transect/Context Zone types, General Urban (T/CZ-4), Urban Center (T/CZ-5), and Urban Core (T/CZ-6), are considered "urban" per ITE's *Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities* and can be included among the components of the desired definition of "urban infill" in parallel with or as alternatives to the more traditional CBD, CND, and SBC Area types. These three Transect/Context Zone types are described below:

- General Urban (T/CZ-4): Denser and primarily residential urban fabric. Mixed-use sites usually confined to corner locations. Characterized by a wide range of building types: single, side yard, and row houses. Setbacks and landscaping are variable. Streets typically define medium-sized blocks. Typical Land Uses - Medium density residential and home occupations; limited commercial and lodging. Typical Buildings - Houses and outbuildings, side yard houses, townhouses, live/work units, corner stores, inns.
- Urban Center (T/CZ-5): "Main Street" land uses, characterized by building types that accommodate retail, offices, row houses, and apartments. Typically has a compact network of streets, with wide sidewalks, uniform street tree planting and buildings set close to the frontages. Typical Land Uses - Medium intensity residential and commercial uses, (i.e., retail, offices, lodging, civic facilities). Typical Buildings - Townhouses, apartment houses, live-work units, shop-front buildings and office buildings, hotels, churches, schools.
- Urban Core (T/CZ-6): "Downtown" land uses, characterized by the tallest buildings, in the greatest variety, and unique civic buildings in particular. It is the least naturalistic zone type; street trees are uniformly planted and sometimes absent. Typical Land Uses - High intensity residential and commercial: retail and offices, lodging, civic buildings. Typical Buildings –

high and medium-rise apartment and office buildings, hotels, townhouses, live-work units, shop fronts, churches, and civic buildings.

- Detailed information regarding urban infill areas is presented in Working Paper #1 in Appendix A.

3.2.2 Selected Land Uses

Concurrent to the identification of the appropriate UIAs is the need to define appropriate land use types for selecting representative infill sites. This research is intended to produce trip generation data for at least ten infill land uses, including residential, office, shopping areas, restaurants, and other commercial land uses typical of urbanized areas. The land use selection criteria discussed and approved by the TAC members includes:

1. Common urban land use types that are consistent with ITE categories (*Trip Generation* [7th ed.]) and generally reflect a range of uses within residential, office, and retail (including entertainment) categories.
2. Land use types where there is a demand for empirical trip generation data based on professional knowledge and frequent applications for development review.
3. Land use types where there is a reasonable propensity for shifting drivers to another mode if the use is located in an urban area. For example, it may be likely that a significant number of patrons would shift significantly from autos to transit or walking if a grocery store was located in an urban area versus a suburban area.
4. Land use types that are considered beneficial to the revitalization of urban areas, and for which current trip generation data may act as a barrier to development approval. These may include types that are considered transit oriented, high-density residential, and urban retail uses.

Because parking availability and costs are often of crucial importance to the types and modes of trips generated by urban infill sites, consideration in choosing candidate uses was also given for those types already represented in ITE's *Parking Generation*. Preferences were given in the initial selection to higher-density residential types, and to nonresidential land uses that are of recurring interest in infill development impact analyses and in application of ITE standards to local transportation demand models. The following 10 land use types, arranged in order, by the ITE land use code in parentheses, were originally selected for this research by the TAC:

- Mid-rise apartment (223)

- Mid-rise residential condominium/townhouse (230)
- High-rise residential condominium/townhouse (232)
- Multiplex movie theater (445)
- Health/fitness club (492)
- Daycare center (565)
- General office building (710)
- Shopping center (820)
- Supermarket (850)
- High-turnover sit-down restaurant (932)

Table 1 starting on the following page lists these land uses and provides their descriptions as published in *ITE Trip Generation* (7th Edition). In addition to the ITE description, Table 1 presents qualifications or recommendations specific to this urban infill trip generation study, if applicable. There are qualifiers/recommendations for four of the categories:

- Residential condominium/townhouse (230) – This is a general category of residential use without a definition of the height of the building. The ITE data included, low - and high-rise buildings. For purposes of the urban infill trip generation study, this category is limited to mid-rise buildings of between three and 10 stories.
- High-rise residential condominium/townhouse (232) – This category represents buildings of three or more stories in height. For purposes of this study, this category is limited to high-rise buildings greater than 10 stories.
- Daycare center (565) – Daycare centers are defined as a free-standing facility. However, this research does not limit potential study sites to free-standing facilities (e.g., the building can be part of a larger building or facility) as long as it is open to the general public.
- Shopping center (820) – The *ITE Trip Generation* manual no longer provides different rates for different size shopping centers. This was discontinued in the 5th Edition of Trip Generation because: 1) there was confusion as to which rate to use when the shopping center was close to the threshold, and 2) it was determined that the regression equations accurately predicted the change in traffic based on the size of the center. For this research, retail sites can be located in a shopping center, along a street, or as part of a mixed-used development.

In addition to the above qualifiers, most of the land uses include qualifiers that allow the site to be part of a mixed-use development, or integrated into a larger complex. This qualifier reflects the change in data collection methodology from traffic counts to intercept surveys. The data collection process will be discussed in detail in Section 4 of this report.

Table 1: Initial List of Land Uses and Descriptions for California Urban Infill Trip Generation Research

Land Use Group	ITE LU Code	ITE Land Use Type	ITE Description	Additional Qualifiers for Trip Generation Study
Residential	223	Mid-Rise Apartment	Mid-rise apartments are apartments (rental dwelling units) in rental buildings that have between three and 10 levels (floors).	No additional qualifiers
Residential	230	Mid-Rise Residential Condominium/Townhouse	Residential condominiums/townhouses are defined as ownership units that have at least one other owned unit within the same building structure. Both condominiums and townhouses are included in this land use. The studies of this land use did not identify whether the condominiums/ townhouses were low-rise or high-rise.	The ITE description does not specify number of floors in this category. This category is limited to mid-rise units of between three and 10 stories.
Residential	232	High-Rise Residential Condominium/Townhouse	High-rise residential condominiums/townhouses are units located in buildings that have three or more levels (floors). Both condominiums and townhouses are included in this land use.	To distinguish from the mid-rise category, the high-rise category is limited to buildings greater than 10 stories.
Recreational	445	Multiplex Movie Theater	A multiplex movie theater consists of audience seating, a minimum of ten screens, a lobby, and a refreshment area. The development generally has one or more of the following amenities: digital sound, tiered stadium seating, and moveable or expandable walls. Theaters included in this category are primarily stand-alone facilities with separate parking and dedicated driveways. All theaters in this category show only first-run movies or movies not previously seen through any other media. They may also have matinee showings.	No additional qualifiers
Recreational	492	Health/Fitness Club	Health/fitness clubs are privately owned facilities that primarily focus on individual fitness or training. Typically they provide exercise classes; weightlifting; fitness and gymnastic equipment; spas; locker rooms; and small restaurants and snack bars. This land use may also include ancillary facilities, such as swimming pools; whirlpools; saunas; tennis, racquetball and handball courts; and limited retail. These facilities are membership clubs that may allow access to the	No additional qualifiers

Land Use Group	ITE LU Code	ITE Land Use Type	ITE Description	Additional Qualifiers for Trip Generation Study
			general public for a fee.	
Institutional	565	Daycare Center	A daycare center is a free-standing facility where care for pre-school aged children is provided normally during the daytime hours. Daycare facilities generally include classrooms, offices, eating areas, and playgrounds. Some centers also provide after-school care for children.	Does not necessarily need to be a free-standing facility and may be integrated into a shopping center, office complex, or mixed-use building.
Office	710	General Office Building	A general office building houses multiple tenants. It is a location where affairs of businesses, commercial or industrial organizations, or professional persons or firms are conducted. An office building or buildings may contain a mixture of tenants including professional services; insurance companies; investment brokers; and tenant services, such as a bank or savings and loan institution, a restaurant or cafeteria, and service retail facilities.	No additional qualifiers
Retail	820	Shopping Center [1]	A shopping center is an integrated group of commercial establishments that is planned, developed, owned, and managed as a unit. A shopping center's composition is related to its market area in terms of size, location, and type of store. A shopping center also provides on-site parking facilities sufficient to serve its own parking demands. [2]	Selection of shopping centers limited to "Neighborhood" and "Community" center classifications as defined by ITE (see definitions below). Additionally, retail land uses can range from small urban shopping centers (less than 190,000 square feet) to individual businesses within buildings.

Land Use Group	ITE LU Code	ITE Land Use Type	ITE Description	Additional Qualifiers for Trip Generation Study
Retail	850	Supermarket	Supermarkets are free-standing retail stores selling a complete assortment of food, food preparation and wrapping materials, and household cleaning items. Supermarkets may also contain the following products and services: ATMs, automobile supplies, bakeries, books and magazines, dry cleaning, floral arrangements, greeting cards, limited-service banks, photo centers, pharmacies, and video rental areas. Some facilities are open 24 hours a day.	No additional qualifiers
Services	932	High-Turnover (Sit-Down) Restaurant	This land use consists of sit-down, full-service eating establishments with turnover rates of approximately one hour or less. This type of restaurant is usually moderately priced and frequently belongs to a restaurant chain. Generally, these restaurants serve lunch and dinner; they may also be open for breakfast and are sometimes open 24 hours per day. These restaurants typically do not take reservations. Some facilities contained within this land use may also contain a bar area for serving food and alcoholic drinks.	No additional qualifiers

[1] In the 6th Edition of Trip Generation, ITE discontinued the distinction in trip generation rate by size of shopping center. A study published in the ITE Journal found that while the trip generation rate did vary by size of center, the regression equations published in the manual did not accurately reflect the variation in trip generation by size of center. See "Trip Generation Characteristics of Shopping Centers", ITE Journal, June 1996.

[2] Additional description in ITE Trip Generation (7th Edition): Shopping Centers, including neighborhood centers, community centers, regional centers and super regional centers, were surveyed for this land use. Some of these centers contained non-merchandising facilities, such as office buildings, movie theaters, restaurants, post offices, banks, health clubs, and recreational facilities (e.g., ice skating rinks). The centers ranged in size from 1,700 to 2.2 million square feet of gross leasable area (GLA).

Definitions:

Neighborhood Shopping Center	Provides for the sale of convenience goods (foods, drugs and sundries) and personal services (such as laundry and dry cleaning, barbering, and shoe repairing) for day-to-day living needs of the immediate neighborhood. It is built around a supermarket as the principal tenant. In theory, the neighborhood center has a typical gross leasable area of 50,000 square feet; in practice it may range in size from 30,000 to 100,000 square feet.

Land Use Group	ITE LU Code	ITE Land Use Type	ITE Description	Additional Qualifiers for Trip Generation Study
Community Center			Provides a wider range of facilities for the sale of soft lines (wearing apparel for men, women, and children) and hard lines (hardware and appliances), in addition to convenience goods and personal services. It is built around a junior department store, variety store, or discount department store as the major tenant, in addition to a supermarket. In theory, its typical size is 150,000 square feet of gross leasable area, but in practice it may range in size from 100,000 to 450,000 square feet.	

During the study process, as it became apparent that gaining permission to survey sites was challenging, the list of land uses was consolidated to the highest priority uses (the top eight) with a shorter list of essential land uses. The essential land uses included:

- Mid-rise apartment (223)
- Residential condominium/townhouse (mid-rise) (230)
- High-rise residential condominium/townhouse (232)
- General office building (710)
- Shopping center (820)

3.2.3 Site Selection Criteria

The overall purpose of the site selection was three-fold: 1) to identify sites distributed within urban areas throughout the state so that data collection is representative of the trip generation of uses within all regions of California, 2) to chose candidate sites that are within areas that meet the criteria for urban infill area, and 3) to chose candidate sites that have the appropriate characteristics for proper data collection. Specific objectives of the site selection were:

- To choose candidate sites that are distributed throughout the state, capturing a cross-section of the state's urban areas. Statewide distribution of sites is intended to capture differences in trip generation that might be reflective of geographic location.
- To select candidate sites in a distribution of urban infill areas at the regional and county level proportional to population.
- Working with the TAC, the following final site selection criteria were adopted for the study:

Urban Infill Area Criteria

1. A candidate site must be located either:
    a. within a Central Business District (CBD), Central City, Not Downtown (CND), or Suburban Center (SBC) Area, as defined by the ITE; or
    b. within a General Urban (T/CZ-4), Urban Center (T/CZ-5), or Urban Core (T/CZ-6) Context Zone, as defined in the *Proposed Recommended Practice for Context Sensitive Solutions in Designing Major Urban Thoroughfares for*

Walkable Communities, and must also meet all of the other criteria defined below.

Transit Proximity Criteria

2. The site must be within 1/3 mile of a site with an existing or future rail transit station, a ferry terminal served by either a bus or rail transit service, an intersection of at least two major bus routes, or within 300 feet of a bus rapid transit corridor. The transit service shall have maximum scheduled headways of 15 minutes for at least five hours per day. It is acceptable to use the collective headways of multiple routes as long as the routes serve the same corridor for a considerable length of the corridor. This criterion pertains to corridors where people can use any route to reach any point within a significant length of the corridor.

The transit proximity criterion is derived from California Government Code Section 65088.4, defining urban infill opportunity zones.

Vacant Developable Land Criteria

3. The site must be within a UIA that contains no more than 10 percent Vacant Developable Land. Vacant Developable Land as defined excludes water bodies, public rights-of-way, land designated for conservation and public recreation, and any other land designated by local governments' policies or comprehensive plans as unavailable for development. However, parking lots on land designated and/or zoned as developable under current policy qualify as Vacant Developable Land.

Population (Residential) and Employment Density Criteria

The site must be located within a UIA that meets one or more of the following density criteria:

4. Where residential land uses comprise at least 60 percent of developed land, average residential density shall be at least 10.0 dwelling units per gross acre[11] of residentially developed land, or
5. Where nonresidential land uses comprise at least 60 percent of developed land, average nonresidential density shall be a floor

[11] Gross acres is the total area including land used for public or private street, alleys, easements, open space, and other such uses. In contrast, net acres is the amount of land remaining after necessary deductions have been made for streets, open space, utility easements, access corridors, or other necessary dedications.

area ratio (FAR) of at least 1.0 and/or an employment density of at least 35.0 jobs per gross acre of nonresidential developed land, or

6. Where neither residential nor nonresidential uses comprise more than 60 percent of developed land, both residential and nonresidential uses must meet the density and intensity criteria prescribed above.

Additional Criteria

Other qualitative criteria to be considered in the selection of sites include:

- The maturity of the site. Newly constructed buildings are poor candidates for data collection, as they may not have developed stable travel characteristics or tenancy.
- Destination retail. Large destination retail shopping centers attract traffic from a larger market area than typical infill development, and often attract tourist traffic. This type of land use is considered a special generator and is not the subject of this study.
- Practicality of collecting data. The ability to cost-effectively collect travel data is critical. Very large and complex sites (such as multiple office towers and large mixed-use centers) with multiple entrances on multiple levels, skywalk connections to adjacent buildings, and large plazas, are difficult to survey and to verify that all trips have been captured.
- Ability to gain permission. The property owner/manager must provide permission to conduct intercept surveys at the site. Not only is this a courtesy to the owner/manager, but is necessary to be able to obtain independent variable data such as building size, number of units, and level of occupancy.
- Located within a walkable district. Although implied by the definition of an UIA and proximity to transit, the site must be located in a district that is walkable (see definition in Section 2.1). No quantitative measurable criteria are applied to walkability, therefore, it is determined through observation.

To assist in the identification of candidate sites, the study team used a map-based or GIS approach using digital map layers and socioeconomic data that are available nationwide from Federal agencies and information centers. Population and employment density was mapped for the entire state identifying, at the 2000 Census Block Group level; those block groups which had residential development densities of at least 10 housing units per land acre, or, employment densities of at least 35 jobs per land acre. Additionally,

digital map layers of California fixed-route bus services and fixed-rail transit routes were integrated into the mapping. Transit route headways are not included in the available map layers and therefore identification of the minimum service criterion was performed manually.

3.2.3.1 Geographic Distribution of Sites

The collection of data is intended to represent infill development in any of California's metropolitan regions. For the purposes of this study, the state was divided into the following four metropolitan areas:

- San Francisco Bay Area (including Santa Cruz/Monterey Bay area)
- Sacramento Area
- Los Angeles Area
- San Diego Area

In general, the data collection effort attempted to survey 50% of the study sites in Northern California and 50% of the study sites in Southern California regions. These metropolitan regions contain concentrations of census block groups that meet the study's minimum density for housing and employment.

Geographic Distribution of Study Sites by Counties/Cities

Within each metropolitan region, site selection was generally intended to be distributed in proportion to the population of each individual county within each region, then by cities within each county that meet the population and employment density criteria and that contain the minimum transit requirements. In practice, given the difficulty encountered in obtaining permission to survey sites, site selection during this phase of the study focused on the larger urbanized cities in the San Francisco Bay Area, greater Los Angeles area, and San Diego.

3.2.4 Site Selection Approach

A number of approaches were used to identify and select the sites. The candidate sites identified by using any of the approaches described below were checked against the site selection criteria described above. This section includes brief descriptions of each approach, its effectiveness, and the challenges of the approach.

3.2.4.1 Study Site Identification Using Aerial Photography or Inspection

Potential sites were identified using aerial photography (e.g., via Google Maps) or identified by direct visual inspection. The following qualitative criteria were applied to the identified sites:

1) From observation, the site was located within a compact, mixed-use, walkable urban area with good pedestrian connections within the district to transit and to adjacent districts; and

2) The site contained the selected ITE land use categories, identified either through a web-based search of businesses, knowledge of the area, or by visual inspection.

Effectiveness of the Approach

This approach was the quickest, but not necessarily the most effective, method of identifying sites that meet the population, employment density, and transit proximity criteria. Once the potential site was identified, the site owner/manager was contacted to obtain permission to conduct the surveys and also to obtain independent variable data such as number of units, gross floor area, occupancy, etc.

Challenges of the Approach

The challenges of this approach included:

- Aerial photography, combined with GIS density mapping, can accurately identify districts that meet the quantitative and qualitative criteria, but cannot identify the types of land uses within individual buildings. Some buildings as viewed from aerials were clearly either residential, office, or commercial retail, but required field observation to confirm.
- Contacting and persuading the site owner/manager to participate in the survey is the most challenging aspect of this approach. Selection by inspection of the site entails "cold calling" the site owner/manager whose first inclination is to decline participation citing tenant privacy and inconvenience, no solicitation policies, or simple rejection. The researchers have found that owners/managers are focused on the day-to-day operations of their properties and addressing the needs of their tenants. Generally, they are less interested in the need or benefits

of this research than those involved in entitling property for development. Therefore, they are not usually aware of the importance of infill-specific trip generation rates data for use in transportation planning.

3.2.4.2 Study Site Identification using TAC Members

The TAC members also provided preliminary identification of sites through local knowledge of their jurisdictions and their personal contacts. The effectiveness of this approach and the challenges involved are described below.

Effectiveness of the Approach

This approach is potentially more effective than site identification by inspection. Since TAC members are involved in the study, the sites identified by them are more likely to be available for the surveys because of the TAC members' relationships with site owners/ managers. This process still involves contacting each site owner/ manager directly to obtain permission to conduct the surveys.

Challenges of the Approach

The challenges of this approach include:

- Requires a moderate to significant level of effort on the part of the TAC member to consult with other TAC agency staff and identify individual building owners/managers who might be willing to participate. TAC members can readily identify appropriate districts containing candidate sites, but because they are voluntarily serving as TAC members (in addition to full-time jobs), they have little time to spend on the effort.
- Most of the TAC members work for public agencies, some of which have development review and approval responsibilities. However, while TAC members may have relationships with the developers of candidate sites, mature sites are typically no longer owned by the developer, resulting in challenges similar to the inspection approach described above.

3.2.4.3 Study Site Identification by Contacting Developers

This method of identifying sites involves contacting developers with whom members of the study team, or others, have a relationship. The

effectiveness of this approach and the challenges involved are described below.

Effectiveness of the Approach

Developers have a comprehensive knowledge of the development review process, including the preparation of environmental documents and traffic impact studies. Therefore, they are aware of the ramifications of accurate trip generation estimates, and understand the objectives of the research study. Convincing developers to participate, or to find time to participate is difficult. This approach is theoretically more effective than the previous approaches because of their inherent understanding that the results of the study directly benefit the developers.

Challenges of the Approach

The challenges of this approach include:

- Most developers are involved with the entitlement process and the construction of the site. Once the building is completed, however, the building typically is either sold or, if retained by the developing company, is usually managed by a different branch of the organization. Even if the developers can direct the study team to a particular owner/manager or management branch of their organization, contact with the owner/manager typically results in challenges similar to the inspection approach described above.
- Developers did not commit the time and effort required to pursue participation through their contacts and management branches. Unless the research provides immediate benefits to their current projects, they are less inclined to make such a commitment.

3.2.4.4 Study Site Identification by Contacting Organizations

This is a "top-down" approach in which key individuals of an organization agree to assist in gaining permission from their members who own/manage candidate sites. This entails initial contact with organizations, associations, corporations, and other institutions that can either provide high level and broad permission to survey sites or put the study team in direct contact with the appropriate persons. This approach establishes and prioritizes a list of entities for initial contact. Contacts can include:

- Property owner/management associations or professional organizations
- Corporations and development companies that develop, own, and manage multiple properties
- Public agencies within metropolitan regions
- Practitioner organizations such as the Urban Land Institute, the American Planning Association, and the Congress for the New Urbanism
- Non-profit or promotional organizations such as downtown business associations or chambers of commerce

The effectiveness of this approach and the challenges involved are described below.

Effectiveness of the Approach

This approach is based on the understanding that because organizations are groups of members working together towards achieving common goals, something that benefits the organization also benefits the individual members. Organizations involved in the planning, construction, management, and operation of land uses or businesses are typically aware of how traffic data can affect the development approval process. They are also usually aware of fiscal ramifications and barriers related to over-estimating traffic impacts, such as development impact fees. This approach is probably the most effective approach since it: 1) involves influential members of the organization, some of whom can make decisions organization-wide, 2) provides a means of communicating the benefits to a broader audience of potential candidates, and 3) helps target the key motivation for owners/managers of candidate sites, such as lower traffic impact fees, sustainable development practices, and/or political and technical support for their industry.

Challenges to the Approach

The challenges of this approach include:

- Some organizations are large and bureaucratic and thus take a long time to make decisions.
- Organizations typically deal with issues associated with their members and thus are not interested in participating in a study unless it directly benefits their members. For example, a property management

organization may not directly benefit from this study, as it does not affect their day-to-day concerns of managing their properties.

- Even if the organization understands the importance of the study, often it can only communicate the benefits and request voluntary member participation.
- Even if the organization agrees to participate, success often still comes down to persuading an individual building owner/manager to participate in the research.
- A moderate to significant effort is required on the part of each organization to communicate the benefits, support the research, and follow up with its members.

3.2.4.5 Solicitation for Participation

The site selection process required that the study team develop a concise summary of the research study to solicit interest and participation. This summary is provided when researchers are making initial contact with individuals and organizations. It also assists organizations in communicating the study objectives, benefits, and procedures to its members. Appendix B contains a list of organizations and individuals contacted as part of this research, and a copy of a letter used to solicit participation.

3.2.4.6 Conclusion of the Site Selection Approaches

Gaining permission to survey sites remains by far the most challenging aspect of this research study. It is a time-consuming task, typically requiring multiple phone conversations, follow-up phone calls, and face-to-face meetings with property owners or managers. Often times, the candidate site is corporate-owned, thus requiring permission from a remote location. Even with a thorough explanation of the purpose of the study, property owners/managers are often reluctant to give permission for on-site surveying, citing tenant and patron privacy and inconvenience or internal policies against soliciting of any type.

Key findings from the experience to date include:

- A general lack of commitment, time, and motivation of most property owners/managers to allow researchers to conduct on-site intercept surveying. This is because the benefits of the research to the building/development industry are not directly apparent or relevant to the individuals or companies who own and manage properties after they are permitted and constructed.
- A prior relationship with the property owner/manager results in a more receptive introduction to the study and its importance. Therefore, approaching owners/managers who may have relationships with the study team or through organizations such as professional/industry organizations, Downtown Business Associations, and/or public agencies appears to be the most effective approach.
- An appropriate amount of time needs to be allocated to the site selection process. Gaining permission and setting up a survey for a single site requires numerous person hours for making initial contact, follow-up phone calls, site inspection, and arranging personnel and survey subcontractors.

4 Data Collection

This chapter discusses the different types of trip generation data collection methods considered for this research. It describes the conventional data collection approach, its challenges, and why the conventional approach is not applicable to urban infill development. It further describes the alternate data collection methods considered and provides an overview of the methodology adopted by the TAC. Finally, this chapter provides an overview of the initial pilot study to test the methodology and an overview of the type of data collected for each site.

4.1 The Conventional Approach to Trip Generation Studies

The conventional approach for collecting vehicular trip generation data is outlined in the ITE *Trip Generation Handbook*. ITE has established a standardized procedure that results in data consistent with the current data presentation in the *Trip Generation* manual. In essence, the conventional approach relies on manual or automatic traffic counts established at the access points of the subject site. When studying a single land use type, the conventional approach requires that the site be a stand-alone facility with its parking dedicated only to that site, and isolated enough so that visitors to the site do not park off-site and walk. Therefore, by definition, sites that meet the ITE requirements are typically isolated locations with ample free parking, and little transit and pedestrian accessibility. Finally, the conventional approach does not provide guidance or procedures for determining the site's non-vehicular mode share.

The limitations described above are the underlying reasons why ITE trip generation rates may not be accurate when used to assess proposed urban infill development. If an urban infill site meets the ITE guidance, it often is an anomaly and may have other characteristics that would cause the site to be unrepresentative of typical urban infill development.

4.2 Limitations of the Conventional Approach

By its very nature, urban infill development cannot be studied using the conventional approach because it would not capture all the vehicle trips likely to be generated by the site. The characteristics of urban infill development users (including residents, employees, customers, and visitors) that lead to this conclusion include:

- Users can park in off-site facilities and walk to a site that may have limited, expensive, or no on-site parking.
- Users can park on-street, sometime many blocks away from the site.

- Users in urban contexts often park nearby and link trips to multiple purposes and uses/destinations.
- Residents of urban residential development may park additional vehicles off-site if their residence cannot accommodate all of their vehicles.

For these reasons, it was determined that surveying site users was the best means of collecting not only vehicular trip generation data, but also mode share data. The survey methods considered for this research are described below.

4.3 Alternative Data Collection Methods

Survey methods include travel journals, mail-in surveys, telephone surveys, combined telephone and mail-in surveys, and in-person intercept surveys. Each method is briefly described below:

4.3.1 Travel Journals

A travel journal is a daily or weekly diary filled in by an individual traveler for the purpose of documenting all of their trips. These surveys can document information about an individual's socio-economic and demographic status, household information, vehicle ownership, and daily travel choices by purpose and mode. This method of survey is one of the most effective means of collecting many types of data, but requires a significant commitment on the part of the journalist and a relatively high response rate. Additionally, this method is reasonable for collecting travel data on the individual, but not for a specific land use or site.

4.3.2 Mail-In Surveys

The most common method of data collection is the mail-in survey. This method involves mailing questionnaires with respondents mailing back the completed surveys. Mail-in survey requires moderate effort to implement and analyze and could provide substantial demographic and travel information, providing that respondents actually participate. Mail-in surveys can be targeted for individual sites or businesses (i.e., residents and employees of a single building or business), but are difficult for surveying visitors and customers. Furthermore, the response rate for mail-in surveys is typically very low, unless made mandatory by an employer or the respondents are provided some form of incentive.

4.3.3 Telephone Surveys

Telephone surveys usually provide a higher response rate when compared to the mail-in surveys, but identifying and contacting the appropriate individual

to survey is challenging. This kind of survey allows for deeper understanding of the respondent's travel behavior through follow-up questions. Telephone surveys are difficult to target to an individual site or business and cannot capture visitors and customers.

Sometimes mail-in surveys and telephone surveys are combined to provide a better response rate. In this approach, the telephone contact is made prior to the mail-in survey, which helps increase the response rate. However, the cost of implementation significantly increases with this approach.

4.3.4 Intercept Surveys

Intercept surveys collect data from a sample of the population being surveyed in-person. Sampling is intended to represent the population of interest. A random sampling procedure assures that each element in the population has an equal chance of being selected. The results of a sample of the population can be applied to the total population. This method is relatively easy to implement, and can specifically target a site, business, and time period. The statistical reliability for this approach is also quite high and, unlike other types of surveys, this method avoids the problem of identifying the appropriate person to contact and the need to follow-up. This approach allows interaction between the survey personnel and respondents to clarify specific questions and misunderstandings. Limitations include the potential to miss a portion of the population, the need to ensure that the total population (i.e., everyone entering and exiting a site) is captured during the survey period, and the response rate (i.e., people willing to take the time to respond).

4.4 Overview of Selected Data Collection Methodology

For this study, intercept surveys were selected as the preferred method of data collection. The intercept surveys collected travel information from users of the selected sites, which was then used to derive automobile trip generation rates for the time periods under study.

As mentioned earlier, intercept surveys collect data from a random sample of the population. The results of surveying a sample of the population can be applied to the total population. For example, if 60% of the random sample drove alone to the site, this proportion is applied to the entire population.

Sampling through intercept surveys requires a precise count of the population. A survey of a portion of a population always has some margin of error in the results, but when the margin of error is reduced to just a few percentage points, it often becomes of little concern. A rule of thumb is to target a 95% confidence with a

5% error level, but surveys may not be able to achieve this high a level. The confidence level is expressed as a percentage, and indicates how often one would expect to get similar results if the survey were repeated.

4.4.1 Data Requirements for Intercept Surveys

In addition to the intercept surveys of individuals, the following information is required for each site:

Population size: The population is the number of people accessing a site during the study period. This information is collected by conducting counts of all people entering and exiting the site during the survey period. Therefore the data collection requires a counter at each individual entrance point in order to capture the entire population.

Independent variable: The computation of a trip generation rate requires establishing an independent variable such as 1,000's of square feet or number of dwelling units. If the selected independent variable is related to the population, then that information needs to be collected at the time of survey. For example, if the independent variable was employees, the number of employees present on the day of the survey is needed. It is desirable to use a fixed independent variable, such as square feet of building area, to avoid variability. This research selected the common independent variables used in the ITE *Trip Generation* manual for each of the selected land use categories, primarily building square footage for commercial uses and dwelling units for residential uses.

4.4.2 Travel Data by Land Use

An objective of the intercept surveys is to collect the necessary information in as short as time as possible so as not to inconvenience the individuals being surveyed. This travel data includes:

- The primary means of travel to the surveyed site on the day of survey
- Information on the primary destination of the site user to identify whether their trip is a primary trip, a pass-by trip, or a linked trip[12]

[12] According to the Institute of Transportation Engineers' Trip Generation Handbook, primary trips are defined as "trips made for the specific purpose of visiting the generator". The stop at the site is the primary reason for making the trip. A pass-by trip is an intermediate stop on the way from an origin to a primary trip destination, such as stopping at a grocery store on the way home from work.

- The number of visits to the site in a typical week, and whether the respondents reside at, work at, or are visiting the site
- The approximate time it took to reach the site
- For mixed-use sites, whether the individual visited multiple uses on the site

These questions can be specifically tailored to the site being surveyed if circumstances warrant different questions.

Sample questionnaires are included in Appendix C.

4.4.3 Demographic Data

In addition to the questions related to travel, the survey asks optional questions to gather demographic data for future cross-referencing with travel characteristics. As with the travel questions, the intent of the optional demographic questions is to keep the survey as short as practical. The demographic information collected during the intercept surveys includes:

- Zip code of residence
- Gender
- Age
- Number of vehicles in the respondent's household
- Purpose of the trip
- Occupation
- Salary range
- Number of people residing in their household
- Household income
- Benefits or incentives offered at their workplace including flexible hours, transit passes, company car, or free parking

Sample questionnaires are included in Appendix C.

A linked trip is where a person makes multiple stops to different land uses as a pedestrian even if they drive to the site, or a nearby site.

4.4.4 Random Sampling Survey Goal

Determining sample size requires a knowledge of the size of the population. For example, a population of 300 persons traveling to/from a site in the peak hour requires that 168 persons be surveyed to achieve a 95% confidence with a 5% error level, or 143 persons to achieve a 90% confidence with a 5% error level. Because the population size cannot be determined in advance, the goal is to collect a simple minimum number of surveys at each site, established at 100 surveys. This is consistent with ITE's recommendation for a minimum of 100 intercept surveys when conducting multi-use development interviews. Low trip-generating land uses may have a lower quota because it may not be practical to collect the minimum number of surveys at each site.

4.4.5 Personnel Requirements

Personnel requirements for the intercept surveys depend primarily on the number of access points that exist at the study site. The methodology requires counting all people entering and exiting the site during the study periods. Trained surveyors are stationed at primary entrance and exit points to conduct the intercept surveys. Because the intercept survey is a random sampling, not all access points need to be surveyed. Additional personnel are stationed at all entries and exits to count all persons entering and exiting the site. This is the site population. Additionally, if the site has its own parking, personnel are required to count vehicle entries and exits, or automatic machine counts can be used to count vehicles.

4.4.6 Time Periods of Data Collection

This research study was initially scoped to collect data representing weekday (Tuesday, Wednesday, or Thursday) morning and evening peak hours of adjacent street traffic, the most commonly used time periods for traffic impact analysis. This is also consistent with the peak hour data presented in ITE's *Trip Generation* manual for most land use categories. The peak hour of adjacent street traffic covers a morning period from 7:00 to 9:00 a.m. and an evening period from 4:00 to 6:00 p.m. For retail and restaurant uses, the midday survey covers a period from 10:00 a.m. to 3:00 p.m. depending on each use's operating hours and peak generating times.

A limitation of the selected methodology for this study is that it is not easily modified for collecting average daily traffic (ADT) information. To date, the surveys have only collected peak period data. While traffic impact studies mostly rely on peak hour data for intersection and roadway analysis, some traffic analyses and travel demand forecasting models use average daily

traffic data (for informational purposes at a minimum). Additionally, air quality analyses rely on average daily traffic data to estimate emissions. True average daily traffic data would require the intercept surveys to extend through a 24-hour period, or at least an 18-hour period for most sites. This has cost implications. However, it is desirable to collect average daily traffic data to the extent it is feasible. Several methods have been considered. In all of the approaches described below, machine counts would be conducted at on-site parking facilities to count site traffic.

The following methods provide empirical daily trip generation data:

1. Conduct 24-hour intercept surveys and pedestrian ingress/ egress counts (or at least from 5:00 a.m. to closing time for most commercial sites, depending on hours of operation), at all survey sites. Permission to survey over extended periods may be more difficult to obtain than just peak period surveys.
2. Conduct a 24-hour trip journal survey of tenants of prototypical sites and land uses, combined with 18-hour or 24-hour counts of pedestrian ingress/egress. Apply journal-derived daily mode share to pedestrian counts to calculate daily trip generation. Challenges include logistics of arranging the journal survey to include multiple tenants of single sites, collecting completed journals, credibility of journal entries, and obtaining a good return rate.
3. Conduct 18-hour or 24-hour pedestrian ingress/egress counts and observe mode of travel for a sampling of users. This avoids the need to intercept people - particularly in late evening or very early morning when it is most inconvenient. This requires careful selection of sites where an observer could view how a person accesses the site (e.g., from the nearest transit stop, nearby parking garage, walking, biking). Also combine with machine counts of sites' parking facility (if one exists) to capture those vehicle trips. Challenges include the selection of sites where observations can be done without alarming the persons being observed.

Alternatively, the following options provide estimates of daily trip generation:

1. Conduct 18-hour or 24-hour pedestrian ingress/egress counts and apply peak period mode shares (from intercept surveys) to the daily population. This assumes the same mode share applies to non-peak period travel as well as peak period travel - which is not likely to be an accurate assumption - but could still provide a

reasonable estimate, particularly since the survey would be collecting pedestrian access data. Challenges include the accuracy of applying peak period mode share to daily travel. Accuracy could be improved with extended intercept surveys covering mid-day and evening periods. The cost of surveys would be significant.

2. Conduct full 18-hour or 24-hour intercept surveys at one typical site per land use category to derive a daily mode share profile, and to determine a peak-to-daily factor. Apply the profile/factor to 18-hour/24-hour pedestrian ingress/egress counts collected at all other sites. This method may be the most cost-effective since it would be restricting 18 to 24-hour intercept surveys to a limited number of sites. However, the accuracy of daily profiles would be dependent on only one or a limited number of sites per land use category. Selection of one typical site may not reflect all possible contexts.

3. Conduct 24-hour machine counts at parking facility driveways of the sites being surveyed to capture on-site vehicle trips. Use this data to develop a peak to daily factor and to validate the peak period estimates of traffic from intercept surveys. Apply the peak to daily factor to the peak period data from the intercept surveys to estimate daily traffic generation.

These alternative methods been reviewed by several TAC members (those involved in traffic analysis) and other transportation professionals. Based on the suggestions that resulted from the review, one or two pilot studies of the 24-hour trip generation methodologies should be conducted to determine each method's viability. Estimate option #3 appears to be the most viable based on the input received in the review, if urban infill sites with individual parking can be located.

Both an "initial" pilot study of three sites and an "expanded" study of ten more sites were conducted. These are described in the following sections.

4.5 Initial Pilot Study

Once the decision was made to use the intercept survey methodology, an initial pilot study was conducted to test the method. The initial pilot study sites focused on urban infill areas in Oakland and San Francisco. Figure 1 shows the pilot study locations.

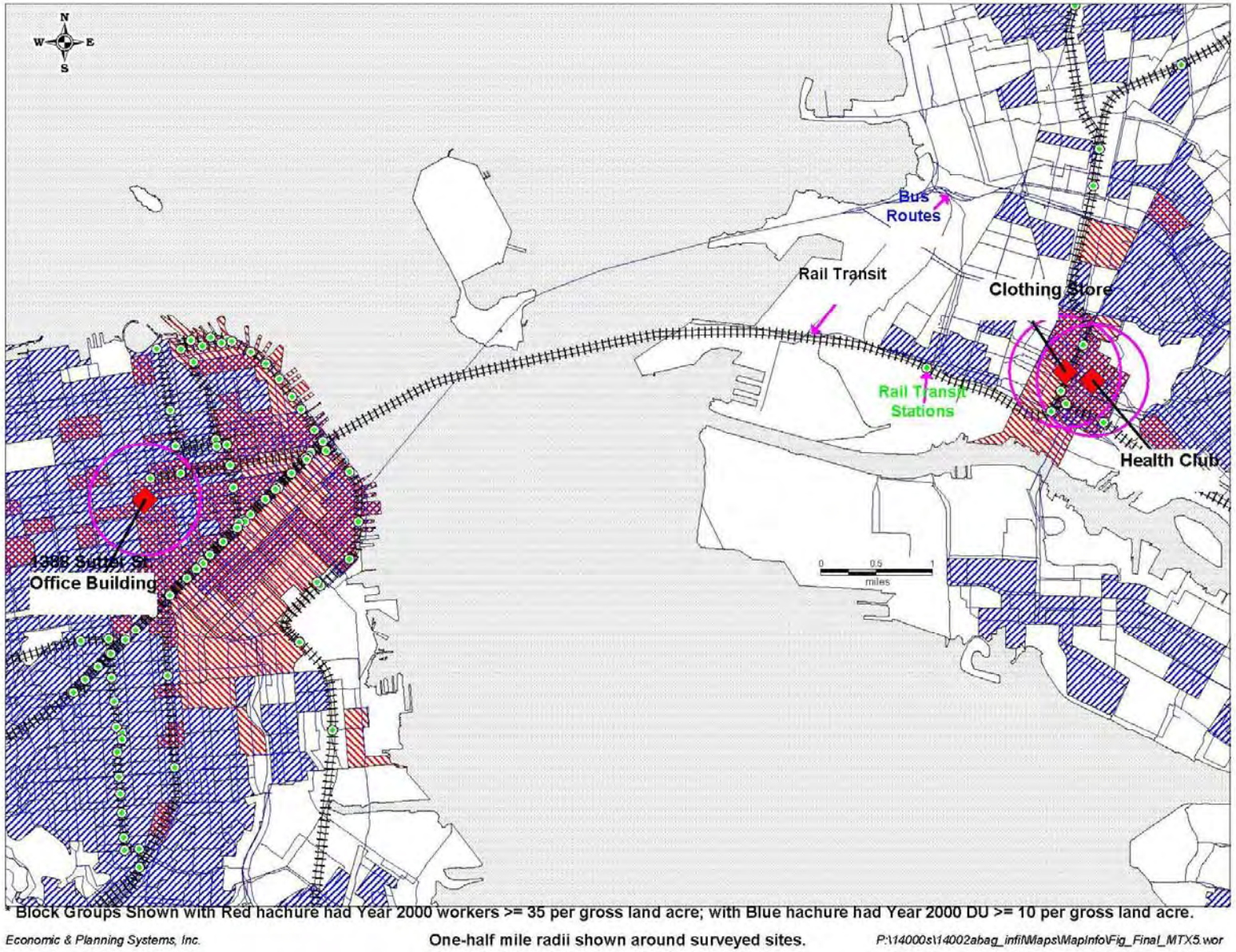
The study sites selected for the pilot study included:

- General Office Building located at 1388 Sutter Street in San Francisco
- Health Club located at 298 14th Street in Oakland
- National chain clothing store located at 1333 Broadway in the Oakland City Center

A brief description of the pilot study sites follows:

General Office Building – This is a privately-owned 120,000 square foot (gross leasable area) office building with a wide variety of tenants comprising primarily professional and service activities. The building was 100% occupied at the time of the survey. The building is located less than one block from Van Ness Avenue, a major transportation and transit corridor. The Civic Center BART Station is located within eight blocks of the office building, too distant to meet the transit proximity criteria. However, MUNI Routes 2 and 3 are within 300 feet of the site each providing a 10-minute headway for four hours a day. The office building has an attached public parking garage, which charges market rates, about $21.00 per day. The location of the office building meets both the nonresidential and residential density requirements. The surrounding land uses include a mix of commercial, retail, and residential. Although the office building does not contain any other uses, the ground floors of adjacent buildings contain cafes and retail. Upper floors of adjacent buildings contain offices and residential uses. There are several high-rise residential towers located within two blocks of the site. The surrounding uses can be classified as Central City (Not Downtown) or Urban Center.

Figure 1 Location of Initial Pilot Study



Health/Fitness Club – This health club is located in Oakland at 298 14th Street. This site is a locally-owned, non-chain, 18,000 square foot health club. The site is located adjacent to AC Bus Transit Route 82, which has a less than 15-minute headway for more than five hours each weekday. The site is also within four blocks (0.29 miles) of the City Center/12th Street BART Station. The surrounding area is mostly high to moderate rise, mixed-use, commercial office, and residential buildings. The ground floors are comprised of restaurants and retail shops. This health club is bordered by an outdoor pay parking lot and is also surrounded by metered on-street parking. A City-owned parking garage is located within two blocks of the site, and charges about $10.00 per day. This location is within a UIA that meets both the nonresidential and residential density requirements. The surrounding area could be classified as Central Business District or Urban Core.

Retail – Shopping Center – Two clothing stores located in the Oakland City Center at 1333 Broadway. The two stores operate as a single retail store occupying 11,000 square feet. The surrounding area primarily consists of high-rise office buildings with ground floor retail and apartment/condominium buildings. This site is situated directly above the City Center/12th Street BART Station, and directly along AC Transit's Routes 14 and 15, both with less than 15-minute headways for more than five hours a day. This location is within a UIA that meets the requirements for both the nonresidential and residential density requirements. The surrounding area could be classified as Central Business District or Urban Core.

4.5.1 Survey Time Periods and Data Collection

General Office Building: Intercept surveys were conducted during the morning (7:30 – 9:30 a.m.) and afternoon (4:00 – 6:00 p.m.) peak periods on Wednesday, May 31, 2006. A total of 107 surveys were collected, and a total of 637 people were counted entering or exiting the site.

Health Club: Intercept surveys were conducted during the morning (7:00 – 9:00 a.m.) and afternoon (4:00 – 6:00 p.m.) peak periods on Wednesday, May 31, 2006. A total of 25 surveys were collected, and a total of 128 people were counted entering or exiting the site (The survey size was very small).

Retail – Shopping Center: Intercept surveys were conducted during the mid-day and afternoon peak periods (11:00 a.m. – 6:00 p.m.) on Thursday June 1, 2006. A total of 83 surveys were collected, and a total of 1,108 people were counted entering or exiting the site.

4.5.2 Observations and Analysis

Table 2 shows the average mode split for pilot study land uses and Table 3 shows the observed trip generation rates and compares them to ITE's average trip generation rate and/or fitted curve equation (from *Trip Generation*, 7th Edition). Key findings include:

- All three of the sites have a relatively low drive-alone mode share (less than 50%), but when all automobile modes are summed, the sites ranged from 36% to 60% auto mode. Total transit (rail and bus) mode shares range from 22% to 52%, with the highest transit mode share occurring at the retail site directly above the BART station. Walking also constituted a relatively high share of travel, ranging from 12% to 16%.
- The observed trip rate for the office building was significantly lower than the ITE average rate and the ITE equation rate in both peak periods, by 50% to 93%.
- The observed rate for the health club was nearly equal (2% difference) to the ITE average for the morning peak hour rate (ITE does not have an equation for this land use category). The observed afternoon peak hour trip rate, however, was significantly lower than the ITE average rate (by 235%). It is important to note that the survey size for this site was very low (25 surveys) and additional health club sites will need to be surveyed to verify the conclusions drawn from this site.

Table 2: Average Mode Split for Initial Pilot Study Land Uses

MODE SPLIT	Office Building	Health/ Fitness Club	Retail – Shopping Center
Drove Alone	46%	47%	24%
Drove with Others	8%	5%	5%
Passenger (car parked nearby)	1%	4%	2%
Passenger (was dropped off)	3%	0%	5%
Taxi	0%	4%	0%
Subtotal all automobile trips	58%	60%	36%
Rail (BART/MUNI/CalTrain/Amtrak)	10%	10%	34%
Bus	17%	12%	18%
Subtotal all transit trips	27%	22%	52%
Bicycle	2%	5%	0%
Walk	12%	16%	12%
Other (scooter)	1%	0%	0%
Note: Percentages do not add to 100% due to rounding.			

- The observed rate for the retail site was significantly lower than the ITE average rate for a shopping center in the PM peak hour, by about 230%. There appears to be a match between the observed rate (12.09) for the midday (PM peak hour of the generator) and the ITE PM peak hour trip rate (13.27). However, the observed PM peak hour rate for clothing store studied was nearly identical to the PM peak hour rate presented in the *Trip Generation* manual for an apparel store. It is clear that more retail sites need to be studied before drawing any conclusions about trip generation or comparisons with ITE. A greater diversity in retail types needs to be surveyed to best estimate urban shopping center trip generation rates.

Table 3: Comparison of Surveyed and ITE Trip Rates for the Initial Pilot Study

Land Use	ITE Code	Observed Trip Rate (trips/ KSF)		ITE Average Trip Rate (trips/KSF)		ITE Trip Rate from Equation (trips/KSF)		Difference between Observed and ITE Trip Rates	
		AM	PM	AM	PM	AM	PM	AM	PM
Office Building	710	1.21	0.92	1.55	1.49	1.81	1.78	50%[1]	93%[1]
Health / Fitness Club	492	1.19	1.21	1.21	4.05	N/A	N/A	2%[2]	235%[2]
Retail Shopping Center	820	12.09[3]	4.01	N/A[4]	3.75	N/A[4]	13.27	N/A	231%

[1] Difference calculated using ITE rate from equation.
[2] Difference calculated using ITE average rate.
[3] This rate is the midday rate representing the PM peak hour of the generator as defined by ITE.
[4] ITE Trip Generation does not provide a weekday rate for "peak hour of the generator" for shopping centers. The trip generation manual provides rates for "apparel store" (Code 870). The average PM peak hour rate for this land use is 3.83 trips per 1,000 SF (rate based on equation is 3.82), and 4.20 trips for the PM peak hour of the generator (rate based on equation is also 4.20).
KSF = 1,000's of square feet.

4.5.3 Lessons Learned from the Initial Pilot Study

There were lessons learned in terms of site selection, conducting the surveys, and the analysis of the data. These lessons from the initial pilot study are discussed below and have been integrated into the approach to the rest of the study.

Site Selection

The selection of individual sites for surveying appears to be one of the most difficult tasks in this research project. The selection of an urban infill area is a straight-forward process, once the residential, non-residential, and transit lines that meet urban infill criteria have been mapped. Even selecting an individual building within an urban infill area is relatively straight-forward. However, gaining permission to conduct surveys is a time-consuming aspect, typically requiring many phone calls, follow-up phone calls, and face-to-face meetings with property owners or managers. Often times, the site is corporate owned requiring permission from a remote location. Even with a thorough explanation of the purpose of the survey, property owners/ managers remain reluctant to give permission citing tenant and patron privacy and inconvenience, or internal policies against soliciting of any type. Key findings from the pilot study include:

- A prior relationship with the property owner/management results in a more receptive introduction to the survey and its importance. Approaching owners/managers of past clients or contacts, or through organizations such as Transportation Management Associations, Downtown Business Associations or public agencies, therefore should be the priority approach to selecting the remaining survey sites.

Conducting the Surveys

- While conducting the surveys, complete knowledge of all access points of the site is critical to ensure that the surveys capture an accurate pedestrian count. It is critical to count all pedestrians entering and exiting the building or the statistical application of the survey results will be invalid. A pre-survey site visit is therefore crucial to plan the survey. The initial pilot study was successful in identifying all site entrances and capturing the total population.

- It is also important to supervise the surveyors to ensure the necessary time periods are manned and that they approach individuals in a polite and professional manner. There is some flexibility in the precise timing of the intercept surveys, but the pedestrian counts must be started and ended on time.

- Use of trained surveyors to conduct the intercept surveys is highly desirable. Surveyors who do not fully understand the purpose of the survey had difficulty explaining it to the people being surveyed. Therefore, it is important to provide adequate information to the surveyors so that they are received as being knowledgeable and trustworthy. Pre-survey meetings should be held to explain the purpose and hear the surveyor's "pitch" to make sure they sound professional, knowledgeable, and friendly.

- It was observed that many people entering/exiting sites, particularly places of employment, are in a hurry and do not want to take time to participate in the survey. Surveyors should be directed to politely ask for participation, indicate the questions will only take about 15 seconds, but not to persist. Tenant complaints to management is cited by property owners/managers as one of the reasons they reject participation in such surveys.

- The initial pilot study found that it worked well when the surveyors filled out the surveys for respondents waiting for an elevator, making it more convenient for the respondents.

- It is important to confirm with the site owner/manager that the appropriate independent variable data and other relevant information is available (e.g., building square footage, number of units, and occupancy) before conducting the survey. It is also important to explain that anecdotal information is unacceptable, that the survey requires more precise information.

- The pilot study found that it was difficult to obtain a minimum of 100 completed surveys. Our return rate was 7%, 17%, and 20% for the three initial pilot sites. If these sites are typical, then it would take multiple days to obtain 100 surveys, which would have a significant effect on the cost of the study.

Analyzing the Data

Since the initial pilot study involved a limited number of surveys, no significant issues related to data analysis were encountered. However, the one key finding regarding the data analysis was potential double counting of automobile trips.

There is the potential to double count automobile trips when a group of visitors fill out multiple surveys. For example, when the driver and a passenger both fill out a survey, the single automobile trip can be counted as two trips. For the pilot study, about 5% to 8% drove others, and 1% to 4% were passengers (car parked nearby). If the driver and passenger of the same

vehicle were surveyed, their one trip has been double counted. One solution for this is to give the surveyors instructions to indicate on the survey if multiple surveys are from groups, if possible. If this is not feasible the trip generation estimates may be somewhat conservative.

4.6 General Overview of Sites for Initial and Expanded Pilot Studies

This section provides a general overview of site characteristics and the data analysis process.

4.6.1 Site Characteristics

The site characteristics data typically collected include:

- For residential sites - total number of dwelling units by bedroom (studios, 1-bedroom, 2-bedroom, etc.).
- For commercial sites – the gross leasable square feet (GLA) of the commercial use. If there are multiple uses within the site, then individual gross leasable square feet by type of use is collected.
- The percent occupancy of the study site at the time of the survey.
- The number of parking spaces provided within the site, and the cost of on-site parking. If off-site parking is provided, then the number of off-site parking spaces provided, their location, and cost.
- The total number of access points (entrance and exits) for the site's buildings. This is typically part of a site floor plan or access diagram.
- Photographs of the site and its surroundings, including an aerial photograph.

4.6.2 Surrounding Context

The surrounding context data collected for the study includes:

- Predominant land-uses within 0.5 mile radius of the site
- A qualitative estimation of connectivity (measure of walking environment)
- Percent of blocks within 0.5 miles with sidewalks
- Distance from Central Business District (CBD)
- Surrounding residential density

- Surrounding employment density
- Area type as defined by ITE
- Transect/Context Zone Type as defined by ITE

Table 4: Connectivity presents the criterion used to measure the level of connectivity for each surveyed site.

Table 4: Connectivity Measure

Connectivity Measure	Description
High	Surrounding areas with small blocks (approx. 200 by 400 feet), compact interconnected street grid, marked crosswalks at every intersection approach, sidewalk on both sides of street, no significant pedestrian barriers, predominantly narrow streets (2-4 lanes), relatively low vehicle speeds.
Medium	Surrounding areas with moderately sized blocks (400 by 600 feet) , crosswalks provided at critical intersections, sidewalks provided on at least one side of the street, predominantly wider streets (4-6 lanes), some pedestrian barriers, and higher vehicle speeds.
Low	Surrounding areas with large blocks (more than 600 feet on a side), crosswalks not provided at intersections, no sidewalk or sidewalk provided on one side of the street with significant gaps, wide streets with multiple travel lanes in each direction (6-8 lanes), higher vehicle speeds, significant pedestrian barriers such as freeways, railroads, drainage channels, etc.
Source: Kimley-Horn and Associates, Inc.	

4.7 General Overview of Data Analysis

The data analysis is comprised of the selection of independent variable(s), determination of a time period for computation of rates, computation of the trip generation rates, and comparison with the ITE trip generation rates. Once enough data has been collected, the process includes a statistical analysis. The steps involved in the data analysis are described below:

1. Selection of Independent Variable(s) for Trip Rate Calculation
   - The independent variable(s) selected for trip rate calculation is consistent with the variable used in the ITE *Trip Generation* manual (7th Edition) for the subject land use category. The minimum independent variable data required for the different land use types are as follows:
     - Gross leasable square footage for the commercial and retail properties
     - Total number of units by bedroom for residential properties

- Total number of staff and number of students at day care centers
- Number of screens at multiplex movie theaters

- Information on independent variable(s) is collected during the preliminary data collection (owner/tenant interview) prior to the collection of traffic data.

2. Determine Time Period for Computation of Rates

   - Trip generation rates are typically computed for the "peak hour of adjacent street traffic" as defined by ITE. This is the most common time period published in the ITE *Trip Generation* manual. These periods include the highest one hour of trip generation between 7:00 a.m. and 9:00 a.m. [AM Peak Hour] and the highest one hour of trip generation between 4:00 p.m. and 6:00 p.m. [PM Peak Hour]. For retail sites, instead of morning surveys, mid-day surveys are conducted covering an extended period between 10:00 a.m. and 3:00 p.m. (depending on the site's operating hours). This is to collect data representing the "peak hour of the generator" as defined by ITE (the highest hour of generation of the site regardless of the adjacent street traffic volume).

3. Compute Urban Infill Trip Generation Rates for Peak Hours of Adjacent Street Traffic

   The intercept surveys result in two primary pieces of data, 1) the total population for the time period (all pedestrians entering and exiting the building), and 2) the travel mode of persons using the site stated as a proportion of all trips as determined through random sampling. The modes of travel are divided into the following categories:

   ### Automobile Trips

   - Drove alone
   - Drove with others
   - Passenger in car (car parked nearby)
   - Passenger (was dropped off)
   - Taxi

   ### Transit Trips

   - Rail (commuter rail, light rail, trolley)
   - Bus

Other

- Bicycle
- Walk
- Other (i.e., scooter)

From this information, the total number of auto trips for the site and time period can be derived. Vehicle trips are the sum of all vehicle related trips (drove alone, passenger, and taxi), and are estimated by applying the applicable mode shares to the highest hour of pedestrian counts in the morning, midday, or afternoon period. Trip generation rates are then derived by dividing the number of auto trips by the gross leasable square footage of the building (or other independent variable). The steps involved in computing the urban infill trip generation rates for peak hours of adjacent street traffic included the following:

- Compute trip generation rate for each site for each time period (AM and PM peak)
- Equation: ∑ Peak Hour Auto Trip Ends / ∑ Independent Variable Units
- The peak hour trip ends were derived from the intercept surveys as described above.
- Determine inbound and outbound percentage for each peak hour
- Equations: Inbound Trip Ends / ∑ (Inbound + Outbound Trip Ends)
- Outbound Trip Ends / ∑ Inbound + Outbound Trip Ends
- Inbound and outbound trip ends were derived from entry counts from the intercept surveys as described above.
- Computing the weighted average trip generation rate. A weighted average trip rate was computed separately for each different land use category.
- Equation: ∑ Trip Ends for All Sites (by land use category) / ∑ Independent Variable Units for All Sites (by land use category)
- Compute standard deviation using standard statistical methods to measure how widely dispersed the data points are around the calculated average. This is performed after sufficient numbers of data points have been obtained.

- Compute the correlation coefficient (R) and coefficient of determination (R^2) using standard statistical methods. This is performed after sufficient numbers of data points have been obtained.
- Develop regression equation (if $R^2 \geq 0.50$)
- Prepare scatter plots of trips versus independent variables.

4. Compare Computed Rates to ITE Rates for Similar Land Use Categories
   - The computed urban infill trip generation rates are compared to the ITE published rates for the same land use categories.
   - Appendix D presents Working Paper #2 - Site Selection and Data Collection/Analysis Methodology.

4.8 Overview of Surveyed Sites for Expanded Pilot Study

To date, the expanded pilot study includes a total of 10 sites (in addition to the three sites surveyed as part of the initial pilot study previously described) that have been surveyed. Six of these study sites are located in the City of Berkeley, three are located in the City of San Diego, and one is located in the City of Los Angeles. This section describes the sites and their surroundings and summarizes the findings of the trip generation data collection in the expanded pilot study.

4.9 Site Evaluation

Each individual site was evaluated to determine whether it met the criteria established in Section 2.

4.10 Site Overview by Land Use

The study sites surveyed are divided into the residential and non-residential (commercial) land use categories.

4.10.1 Residential Land Use Categories

The residential land use category included mid-rise apartments, mid-rise residential condominiums/townhouses, and high-rise residential condominiums/townhouses. A brief description of the sites surveyed in the expanded pilot study under each category is described below.

Mid-Rise Apartments

All study sites surveyed under the mid-rise apartment category are located in the City of Berkeley. All of these sites are rental apartments. Most of the sites are mixed-use buildings containing commercial businesses on the ground

floor. Residential and commercial uses were surveyed separately. It is important to note that a large proportion of the residents surveyed at the six sites are associated with the University of California at Berkeley as either students or employees (about 50%). This does not invalidate the data and, in fact, is representative of university town urban infill development. However, due to the proximity of the sites to the University, the non-auto mode share may be higher than if the sites were not located near the University.

Before and after pictures Bachenheimer Building

1. Bachenheimer Building: The Bachenheimer building is located at 2111 University Avenue, in Berkeley, California. This building has a total of 44 dwelling units—12 1-bedroom and 32 2-bedroom units—and 3,000 square feet of ground floor commercial use. The ground floor commercial is a copy/printing shop. At the time of the survey, the building manager indicated that the residential and the commercial occupancy was 100%. A total of 30 parking spaces are provided within the building. The site location meets both the non-residential and residential density requirements. The Downtown Berkeley BART Station is located within 2.5 blocks (0.17 miles) of the study site, within 1/3 of a mile thereby meeting the transit proximity criteria. Also, AC Transit Routes 51 and 52L are within 300 feet of the site providing 15 minute headways for five hours of the day.

2. Gaia Building: The Gaia building is located at 2116 Allston Way in Berkeley, California. This building has a total of 99 dwelling units—26 1-bedroom and 73 2-bedroom units—and 12,000 square feet of ground floor commercial use. The ground floor commercial is a drinking establishment that provides live entertainment. At the time of the survey, the building manager indicated that the residential occupancy was 99% and the commercial occupancy was 100%. A total of 40 parking spaces are provided within the building. The site location meets the non-residential density requirement. The Downtown Berkeley BART Station is located within 1 block (300 feet) of the study site, meeting the transit proximity criteria. Also, AC Transit Routes 1, 1R, 18, 51, and 52L are within 300 feet of the site providing 15-minute headways for five hours of the day.
3. Acton Courtyard Building: The Acton Courtyard building is located at 1370 University Avenue in Berkeley, California. This building has a total of 71 dwelling units—4 studios, 7 1-bedroom, and 60 2-bedroom units—and 8,000 square feet of ground floor commercial use. The ground

floor commercial is comprised of a sign shop, a piano school, a book store, and a bakery/café. None of these uses, except the café, are among the selected land use categories for this study. The cafe was surveyed. At the time of the survey, the building manager indicated that the residential and the commercial occupancy was 100%. A total of 62 parking spaces are provided within the building. The site location meets the residential density requirement. The Downtown Berkeley BART Station is located about 8 blocks (0.89 miles) away from the study site (more than the 1/3 mile criteria), but AC Transit Routes 51 and 52L are within 300 feet of the site providing 15 minute headways for five hours of the day. These AC Transit Routes 51 and 52L also connect to the BART Station.

4. Touriel Building: The Touriel building is located at 2004 University Avenue, in Berkeley, California. This building has a total of 35 dwelling units (10 1-bedroom and 25 2-bedroom units) with 2,400 square feet of ground floor commercial use. The ground floor commercial is a retail flower shop. At the time of the survey, the building manager indicated that the residential occupancy was 97% and the commercial occupancy was 100%. A total of five parking spaces are provided within the building. The site location meets both the non-residential and residential density requirements. The Downtown Berkeley BART Station is located within 2 blocks (0.17 miles) of the study site, meeting the transit proximity criteria. Also, AC Transit Routes 51 and 52 are within 300 feet of the site providing 15 minute headways for five hours of the day.

Before and after pictures
Touriel Building

5. Berkeleyan Apartments: The Berkeleyan Apartment building is located at 1910 Oxford Street in Berkeley, California. This building has a total of 56 dwelling units—5 1-bedroom and 51 2-bedroom units—with 4,500 square feet of ground floor commercial use. The ground floor commercial use is a non-chain coffee shop. At the time of the survey, the building manager indicated that the residential and the commercial occupancy was 100%. A total of 36 parking spaces are provided within the building. The site location meets both the non-residential and residential density requirements. The Downtown Berkeley BART Station is located within 4 blocks (0.28 miles) of the study site, meeting the transit proximity criteria. Also, AC Transit Route 52L is within 300 feet of the site providing 15 minute headways for five hours of the day.

6. Fine Arts Building: The Fine Arts building is located at 2110 Haste Street, Berkeley, California. This building has a total of 100 dwelling units—4 studios, 32 1-bedroom, and 64 2-bedroom units—with 10,000 square feet of ground floor commercial use. This building has three ground floor commercial units, of which only one commercial unit was occupied. The occupied ground floor commercial use was an architectural design firm and was not surveyed. At the time of the survey, the building manager indicated that the residential occupancy was 100%. A total of 63 parking spaces are provided within the building. The site location meets both the non-residential and residential density requirements. The Downtown Berkeley BART Station is located within six blocks (0.36 miles) of the study site, a little over the 1/3 of a mile transit proximity criteria. However, AC Transit Route 18 is within 300 feet of the site providing 15 minute headways for 5 hours of the day, and connects to the BART Station. AC Transit Routes 1, 1R, and 51 are 600 feet from the study site and these routes also connect to the BART Station.

The following two mid-rise and high-rise condominium/townhouse sites are located in downtown San Diego. They include a mix of rental and owner occupied units.

Mid-Rise Residential Condominiums/Townhouses

7. Atria: The Atria building is located at 101 Market Street in downtown San Diego, California. This building has 4 floors, a total of 149 dwelling units—39 lofts, 21 studios, 58 1-bedroom, and 31 2-bedroom units—with 1,250 square feet of ground floor commercial use. The ground commercial use is a national chain coffee shop, Starbucks. At the time of the survey, the building manager indicated that the residential and commercial occupancy was 100%. A total of 183 parking spaces are provided within the building. The site location meets the non-residential density requirement. The site is within 1/3 of a mile of the San Diego Trolley Gold Route and meets the transit proximity criteria. The site is also within 300 feet of San Diego Metropolitan Transit System (SDMTS) Route 11 which provides 15-minute headways for five hours of the day.

High-Rise Residential Condominiums/Townhouses

8. Horizon: The Horizon building is located at 505 Front Street in downtown San Diego, California. This building has 25 floors, a total of 211 dwelling units—unit count by bedroom is unavailable. There is no ground floor commercial associated with this building. At the time of

the survey, the building manager indicated that the residential occupancy was 100%. A total of 415 parking spaces are provided within the building. The site is within 1/3 of a mile from the San Diego Trolley Gold Route and meets the transit proximity criteria. The site is also within 300 feet of SDMTS Route 11 which provides 15-minute headways for 5 hours of the day.

4.10.2 Non-Residential Categories

The non-residential land use categories surveyed in the expanded pilot study include general office building, supermarket, shopping center (retail), and high-turnover sit-down restaurant. Brief descriptions of the sites surveyed under each of the different non-residential land use categories are described below.

General Office Building

9. Central City Association of Los Angeles (CCALA): The CCALA building is located at 626 Wilshire Boulevard in downtown Los Angeles, California. This building has a total of 138,542 gross leasable square feet of office use and 11,380 square feet of retail uses on the ground floor. The retail use includes a credit union bank, a wine & spirit shop, and a cellular phone store. Surveys were not conducted for the retail uses. At the time of the survey, the building manager indicated that the commercial occupancy was approximately 98%. A total of 136 parking spaces are provided in two parking levels within the building. The site location meets the non-residential density requirement. The site is located within 1/3 mile of the existing Metro Rail Station at 7th Street/Flower Street. It is also within 300 feet of multiple MTA Transit Routes and Metro Rapid Lines which provide 15-minute headways for 5 hours of the day.

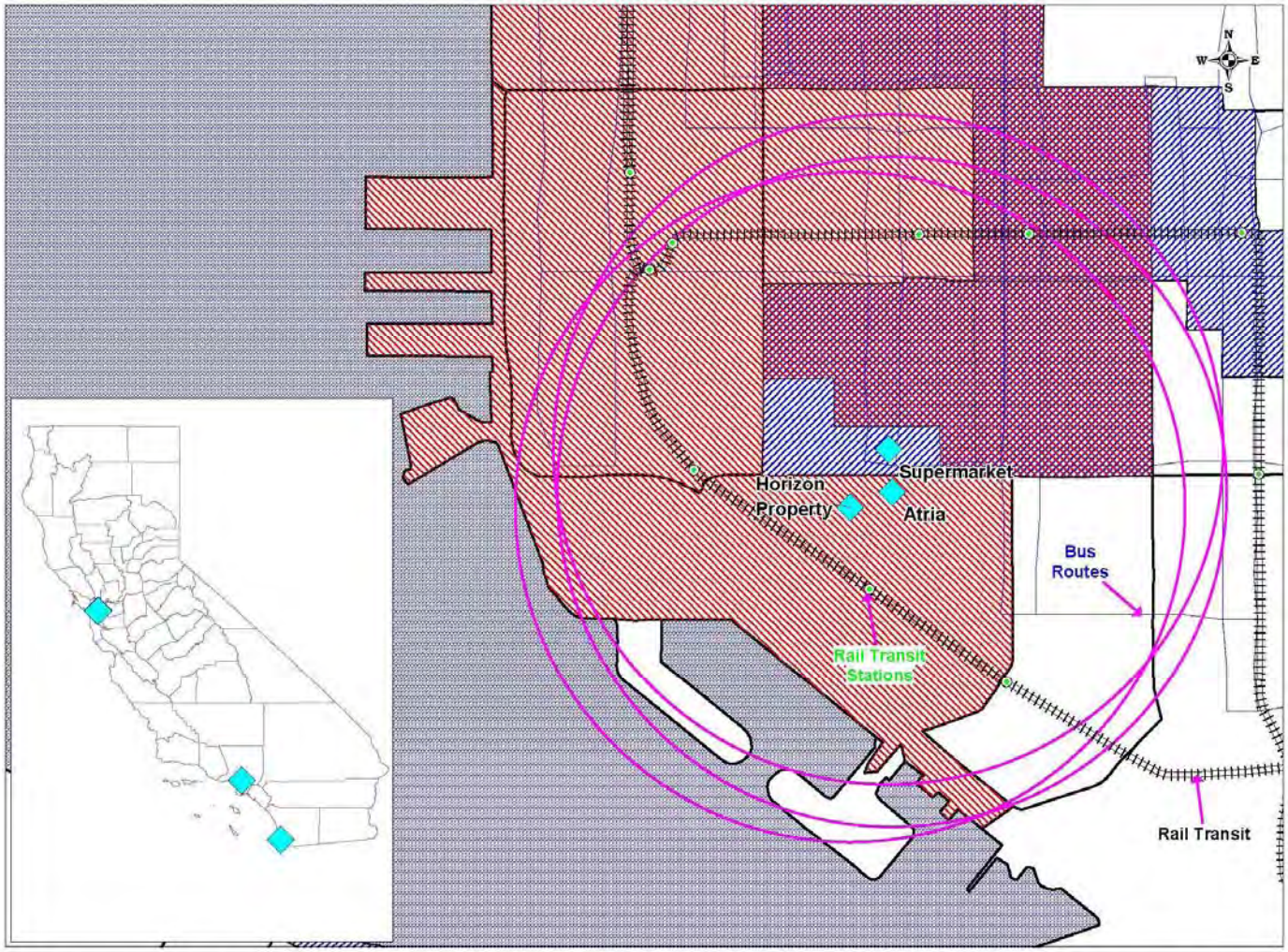
Supermarket

10. Supermarket: The expanded pilot study includes a supermarket located at 101 G Street in downtown San Diego, California. This supermarket has a total of 43,318 gross leasable square feet of commercial space. At the time of the survey, the store manager indicated that the commercial occupancy was 100%. A total of 156 parking spaces are provided on-site. The site location meets the residential density requirement. The site is within 1/3 of a mile from the San Diego Trolley Gold Route meeting the transit proximity criteria. The site is also within 300 feet of SDMTS Route 11 which provides 15-minute headways for 5 hours of the day.

The location of the surveyed sites is shown in Figure 2 (on the following three pages). A one-page summary showing the site characteristics, site description, and comparison of the trip generation rates with published ITE trip rates for each of the studied sites can be found in Appendix E. This appendix contains one-page summaries for each study site which provide an overview of the site's characteristics (floor area, number of units, number of parking spaces), a site description and photograph, an indicator the site's surrounding UIA, how the site surroundings meet the selection criteria, a measure of the pedestrian environment, and a summary of the site's trip generation and mode share data. Appendix F contains additional details for each site.

Figure 2: Location of Surveyed Sites in California

Downtown San Diego Sites

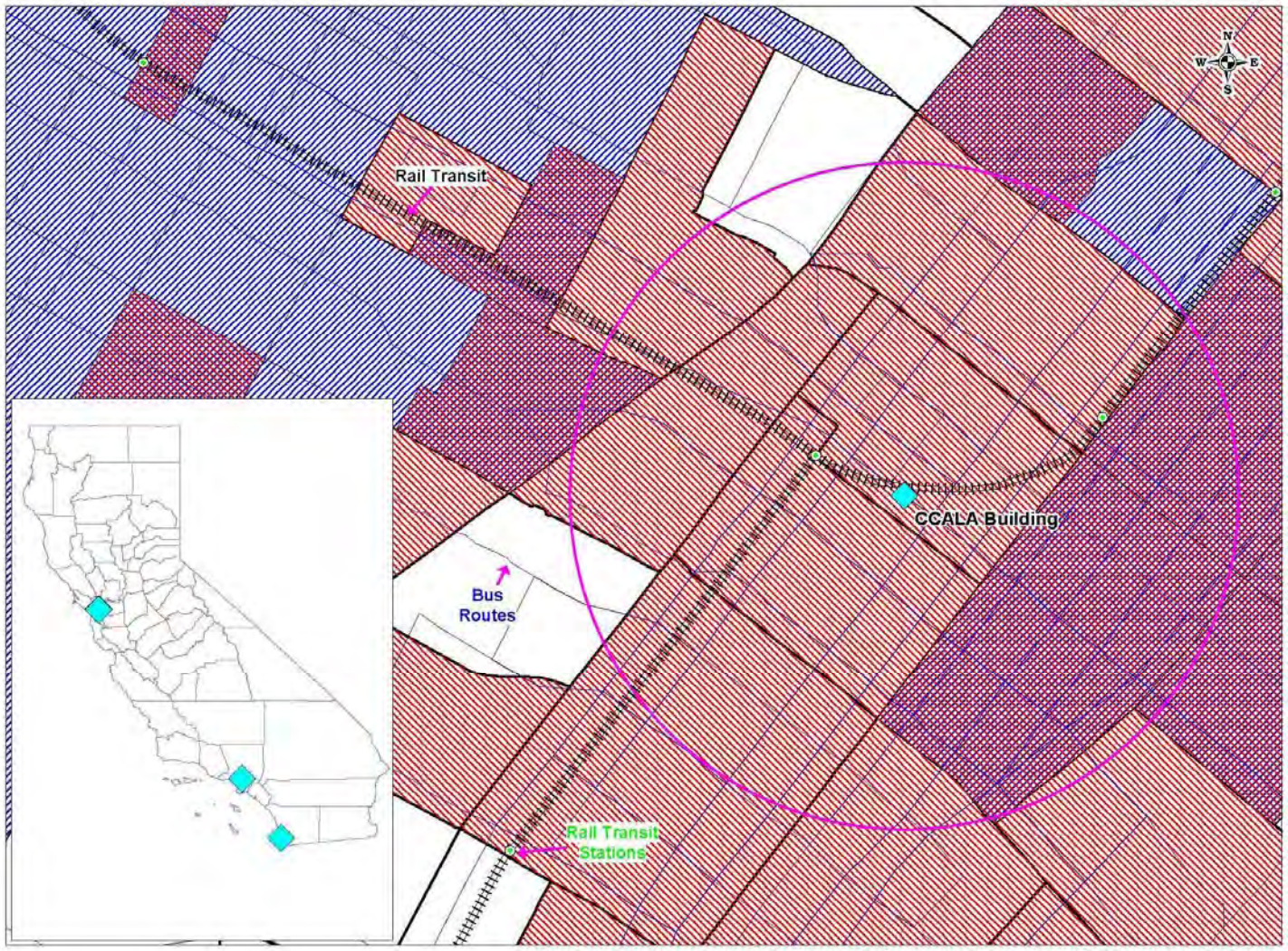


* Block Groups Shown with Red hachure had Year 2000 workers >= 35 per gross land acre; with Blue hachure had Year 2000 DU >= 10 per gross land acre.

Economic & Planning Systems, Inc. One-half mile radii shown around surveyed sites. *P:\14000s\14002abag_infill\Maps\MapInfo\Fig_Final_E5rev.wor*

Figure 2: Location of Surveyed Sites in California (Cont.)

Los Angeles Sites

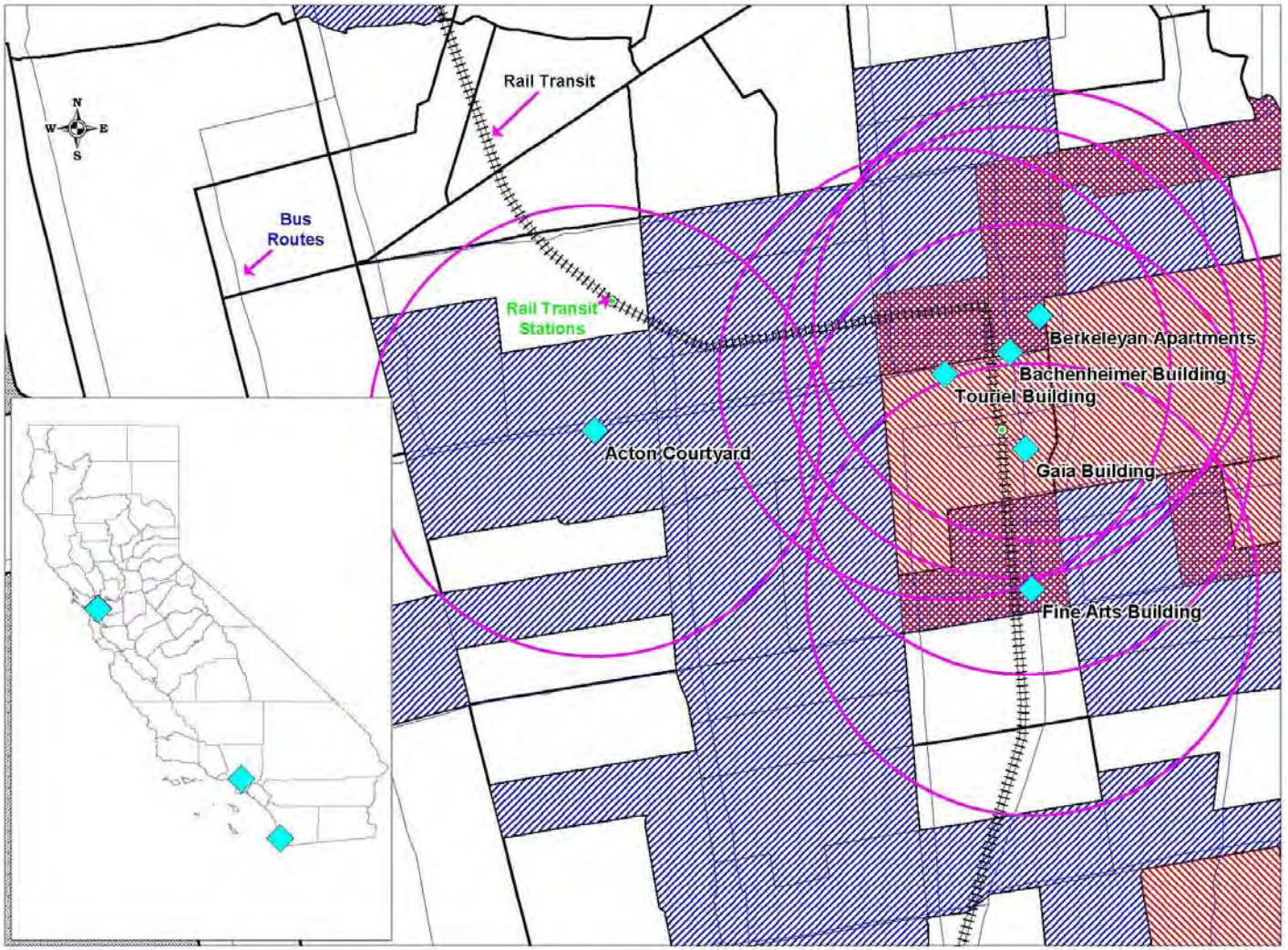


* Block Groups Shown with Red hachure had Year 2000 workers >= 35 per gross land acre; with Blue hachure had Year 2000 DU >= 10 per gross land acre.

Economic & Planning Systems, Inc. One-half mile radii shown around surveyed sites. *P:\14000s\14002abag_infill\Maps\MapInfo\Fig_Final_B5.wor*

Figure 2: Location of Surveyed Sites in California (Cont.)

Berkeley Sites



* Block Groups Shown with Red hachure had Year 2000 workers >= 35 per gross land acre; with Blue hachure had Year 2000 DU >= 10 per gross land acre.

Economic & Planning Systems, Inc. One-half mile radii shown around surveyed sites. *P:\14000s\14002abag_infill\Maps\MapInfo\Fig_Final_A5.wor*

5 Findings

5.1 Overview of Derived Trip Generation Rates by Land Use

The trip generation rates for the sites surveyed to date from both the initial and expanded pilot studies (the observed rates) were derived by estimating the number of vehicle trips (from surveys and pedestrian counts) and dividing these trips by the gross leasable square footage of the building or number of dwelling units. Vehicle trips are the sum of all vehicle related trips (drove alone, passenger, and taxi), and are estimated by applying the applicable mode shares (derived from intercept surveys) to the highest hour of pedestrian counts in either the morning (7:00 – 9:00 a.m.) or afternoon (4:00 – 6:00 p.m.) peak periods.

An overall finding for the limited data collected to date is that the observed trip generation rates for the surveyed sites under different land use categories are generally lower during the morning and afternoon peak hours than comparable ITE trip generation rates. One exception is the supermarket category in which the one site surveyed has observed trip generation rates slightly higher than ITE rates. Also, the observed trip generation rate for residential condominiums/townhouses during the morning peak hour is slightly higher than comparable ITE trip rates.

5.2 Comparison with ITE Trip Generation Rates

Table 5 compares the observed and ITE vehicle trip generation rates for each land use category. It is important to note that this comparison is based on a very small number of sites and surveys (only one site for some categories) and is intended as the beginning of a more comprehensive database.

For residential land use categories, the observed vehicle trip generation rates were lower than ITE trip rates at all locations surveyed during the AM and the PM peak hours, with the exception of the Atria site in San Diego, where the observed AM peak hour trip rate was slightly higher than the standard ITE trip rates. For the surveyed site locations in Berkeley, the observed trip rates were significantly lower than compared to ITE trip rates. As suggested earlier, this may in part be due to the fact that the sites were close to the University of California at Berkeley and the apartment buildings were about 50% occupied by students and employees of the University.

Table 5: Comparison of Derived Trip Rates and ITE Trip Rates

Name	Land Use	Location	AM Peak Hour		PM Peak Hour	
			Observed Trip Rate	ITE Trip Rate (ITE Code)	Observed Trip Rate	ITE Trip Rate (ITE Code)
Residential Land Use						
Bachenheimer Bldg. [1]	Mid-Rise Apartments	Berkeley	0.00	0.30 (ITE 223)	0.04	0.39 (ITE 223)
Gaia Building	Mid-Rise Apartments	Berkeley	0.04		0.28	
Acton Courtyard	Mid-Rise Apartments	Berkeley	0.22		0.17	
Touriel Building	Mid-Rise Apartments	Berkeley	0.05		0.15	
Berkeleyan Apartments	Mid-Rise Apartments	Berkeley	0.07		0.09	
Fine Arts Building	Mid-Rise Apartments	Berkeley	0.13		0.13	
Weighted Average of Berkeley Sites			0.10		0.16	
Horizon Property	High-Rise Apartments	San Diego	0.10	0.34 (ITE 232)	0.17	0.38 (ITE 232)
Atria	Mid-Rise Residential Condominiums/ Townhouses	San Diego	0.46	0.44 (ITE 230)	0.41	0.52 (ITE 230)
Weighted Average of San Diego Sites			0.25		0.27	
Weighted Average of All Sites			0.17		0.21	
Non-Residential Land Use						
Supermarket	Supermarket	San Diego	4.66	3.25 (ITE 850)	10.82	10.45 (ITE 850)
CCALA Building	General Office Building	Los Angeles	0.81	1.55 (ITE 710)	0.62	1.49 (ITE 710)
Bachenheimer Bldg. [2]	Copy/Printing Shop	Berkeley	n/a	1.03 (ITE 820)	4.00	3.75 (ITE 820)
Touriel Building	Flower Shop	Berkeley	0.83	1.03 (ITE 820)	2.92	3.75 (ITE 820)

Notes:

ITE trip rates from *Trip Generation* manual, 7th Edition, 2004.

ITE average trip rate for 'Peak Hour of Adjacent Street Traffic' was used for comparison.

1. Intercept survey indicated no AM peak hour automobile trips.

2. The copy/printing shop is closed during the AM peak hour.

Figure 3 and Figure 4 provide scatter plots comparing the observed trip rates to ITE trip rates for the AM and the PM peak hour. Further details on the mode of travel observed at these survey sites are presented in the following section.

For the non-residential land use categories surveyed, the derived urban infill trip rates were lower than the standard ITE trip rates at all the locations surveyed during the AM and the PM peak hours, except for the Supermarket in San Diego. For the Supermarket, the derived urban infill trip generation rates were slightly higher than the ITE standard rates during both the AM and the PM peak hour.

The weighted average trip rate of the Berkeley sites (representing an urban university town setting) was observed to be 60 to 66% lower than ITE average rates for mid-rise apartments. This is a substantial difference, and an important finding for the study of residential rental apartments near universities.

The weighted average of the San Diego sites may be more representative of typical urban infill residential sites, but also representative of higher-end development with a mix of moderate to high-income owners and renters. The weighted average trip rate of the San Diego sites is not directly comparable to ITE average rates because the 2 sites are within different land use categories. However, the weighted average of all the sites is lower than any of the ITE average rates.

Some of the surveyed sites contained non-residential land use categories that are not included in the list of priority land use categories for this study. Nevertheless, these locations were also surveyed along with the residential component of the site for future reference. The observed trip generation rates for these land use categories were compared to ITE average trip rates for similar land use categories. Table 6 summarizes the comparison of trips rates for non-selected land uses.

For the non-priority land use categories, the observed trip generation rates were found to be lower than the ITE average trip rates for similar land use categories at all the surveyed sites, except for the ground floor commercial land use at Acton Courtyard (bakery and café) in Berkeley, where the AM peak hour rate was slightly higher than the ITE trip rates.

Figure 3: Comparison Between Derived Trip Rates and ITE Standard Trip Estimates - All Residential Land Use Categories - AM Peak Hour

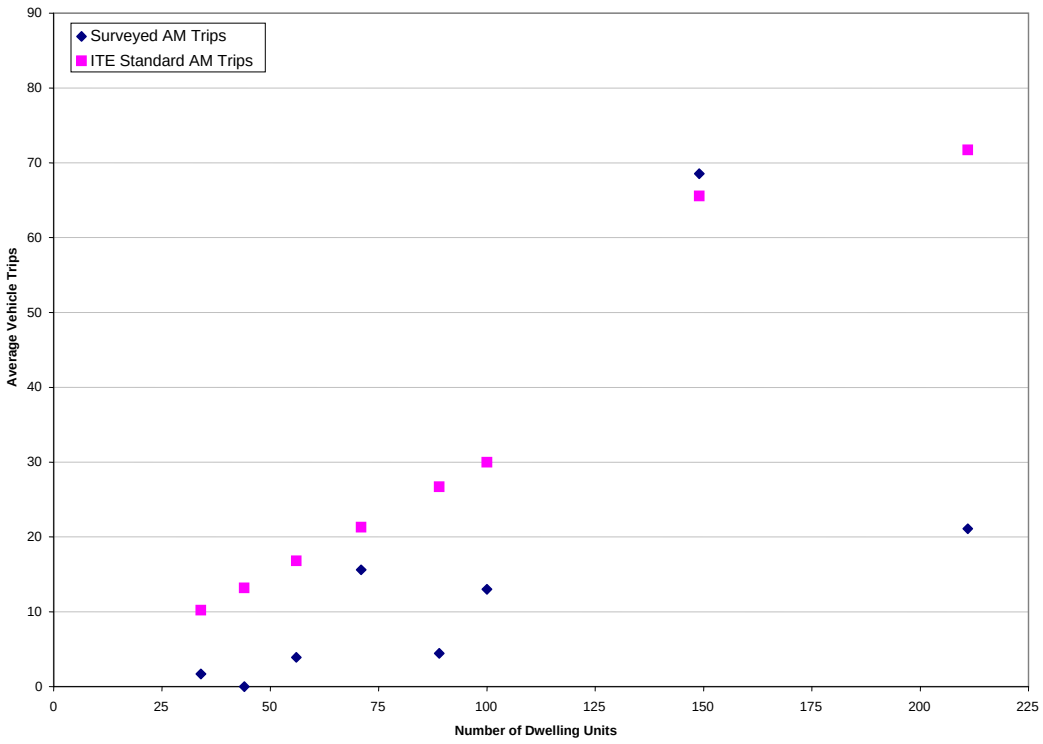


Figure 4: Comparison Between Derived Trip Rates and ITE Standard Trip Estimates All Residential Land Use Categories - PM Peak Hour

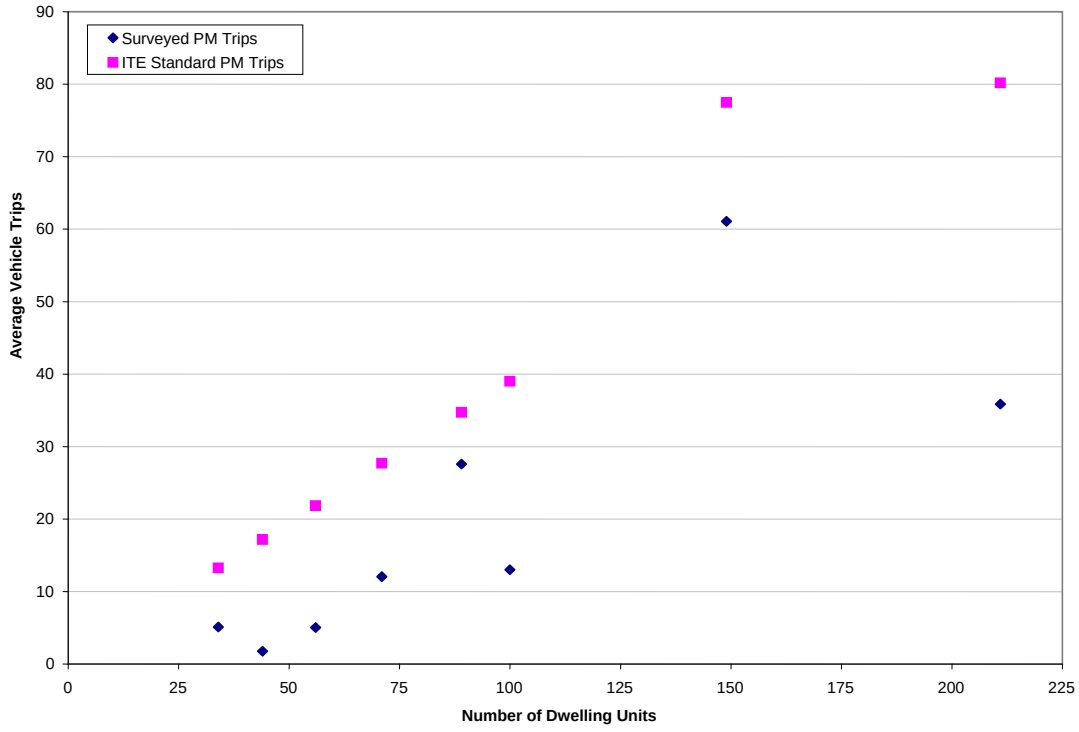


Figure 5 and 6 provide scatter plots comparing the trip generation of the two surveyed office buildings (including the office building surveyed in the pilot study) using the observed and ITE average rates and ITE equations for the AM and PM peak hours.

Table 6: Comparison of Derived Trip Rates and ITE Trip Rates (For Non-Prioritized Land Use Categories)

Name	Commercial Land Use	Location	AM Peak Hour		PM Peak Hour	
			Derived Trip Rate	ITE Trip Rate (ITE Code)	Derived Trip Rate	ITE Trip Rate (ITE Code)
Non-Residential Land Use (not selected for this study)						
Gaia Building [1]	Drinking Place	Berkeley	n/a	0.00 (ITE 936)	0.14	11.34 (ITE 936)
Acton Courtyard	Bakery and Cafe	Berkeley	5.21	4.33 (ITE 933)	8.46	28.00 (ITE 933)
Berkeleyan Apartments [2]	Coffee Shop	Berkeley	17.89	73.03 (ITE 933)	7.85	28.79 (ITE 933)
Atria	Coffee Shop	San Diego	50.80	73.03 (ITE 933)	8.77	28.79 (ITE 933)

Notes:

ITE average trip rates from *Trip Generation* manual, 7th Edition, 2004

ITE average trip rate for 'Peak Hour of Adjacent Street Traffic' was used for comparison.

1. The drinking place was closed in the AM peak hour. Compared to ITE land use code 936 Drinking Place
2. Compared to ITE's coffee shop subcategory under land use code 933 (Fast-Food Restaurant without Drive-Through Window)

Figure 5: Comparison Between Derived Trip Rates and ITE Average and Equation Trip Estimates
ITE 710 – General Office Building – AM Peak Hour

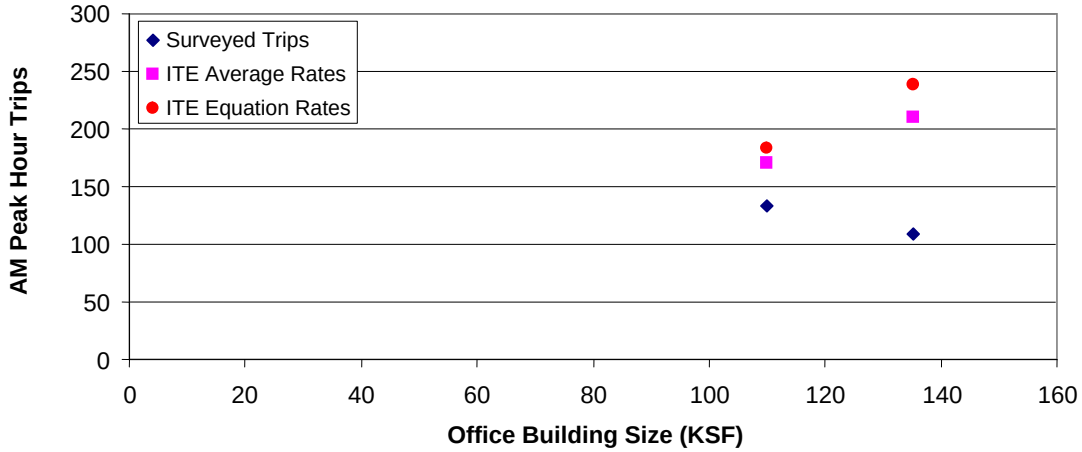
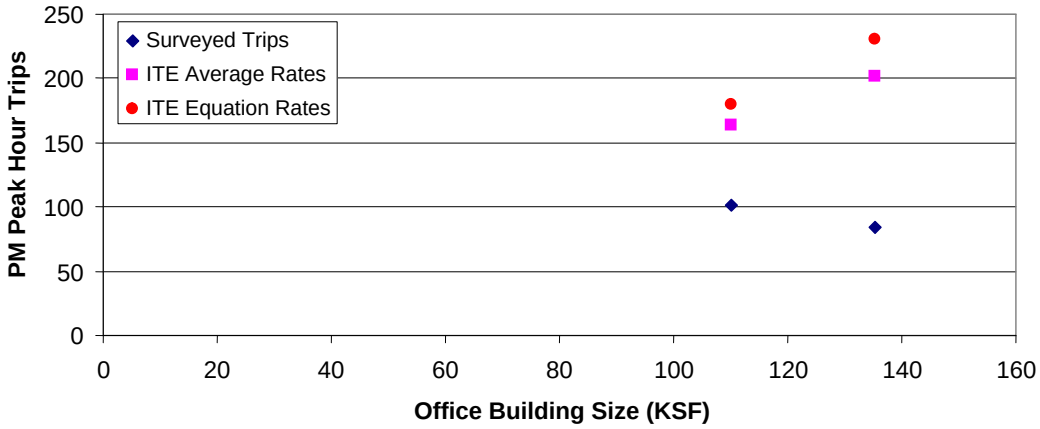


Figure 6: Comparison Between Derived Trip Rates and ITE Average and Equation Trip Estimates
ITE 710 – General Office Building – PM Peak Hour



5.3 Mode of Travel by Land Use

Table 7 summarizes the observed mode of travel by land use and site during the AM and the PM peak hour. For the residential land uses surveyed within the City of Berkeley, the weighted average of percent walk/bicycle trips is approximately 50% in the AM peak hour and 64% in the PM peak hour, indicative of the relationship between these sites and the University. The weighted average of percent transit trips was approximately 23% in the AM peak and 15% in the PM peak hour. Residential land uses in downtown San Diego show higher percentage of auto trips than transit and walk/ bicycle trips, indicating that these residents may commute to areas outside of downtown. However, both San Diego sites have a relatively high walk/bike mode of travel, indicating that the location of these sites is conducive to walking and biking for daily errands.

For the non-residential land uses the following key observations can be made:

- While the CCALA office building in downtown Los Angeles shows that auto trips are the predominant mode of travel (95% in the AM and 77% in the PM peak hour), the observed trip generation rates are nearly half of the ITE average rates. This would indicate that this building generates fewer person trips per 1,000 square feet of built space than a comparably sized building in a suburban environment. This may be due to a lower employee density and an indication that employee density should be identified at future office building sites. However, the transit mode share is very high in the PM peak hour (over 20%). Clearly more data is needed to determine if this finding is a trend among urban office buildings.
- The Supermarket surveyed in downtown San Diego was observed to have a relatively low auto mode of travel (about 50%) and a very high walk/bike mode of travel (about 40%), but the auto trip generation rates are nearly equal to ITE average rates for supermarkets. This would indicate that this supermarket generates many more person trips than a typical suburban supermarket. One would expect that people shopping for groceries would use their vehicle to get groceries home, but the mode share indicates that many people access this supermarket without vehicles, possibly indicating an urban shopping trend of purchasing on a daily basis rather than shopping for an entire week (Also it's the only grocery store available in the downtown San Diego to a large number of residents).

Table 7: Comparison of Mode of Travel by Land Use

Name	Land Use	Location	AM Peak Hour			PM Peak Hour		
			% Auto Trips	% Transit Trips	% Walk / Bicycle Trips	% Auto Trips	% Transit Trips	% Walk / Bicycle Trips
Residential Land Use								
Bachenheimer Bldg.	Mid-Rise Apartments	Berkeley	0%	11%	89%	7%	27%	66%
Gaia Building	Mid-Rise Apartments	Berkeley	20%	7%	73%	24%	5%	71%
Acton Courtyard	Mid-Rise Apartments	Berkeley	57%	29%	14%	35%	30%	35%
Touriel Building	Mid-Rise Apartments	Berkeley	25%	50%	25%	15%	9%	74%
Berkeleyan Apartments	Mid-Rise Apartments	Berkeley	21%	17%	62%	20%	7%	73%
Fine Arts Building	Mid-Rise Apartments	Berkeley	44%	22%	34%	24%	14%	62%
Weighted Average of Berkeley Sites			31%	20%	49%	23%	15%	62%
Horizon Property	High-Rise Apartments	San Diego	77%	3%	20%	73%	7%	20%
Atria	Mid-Rise Residential Condominiums / Townhouses	San Diego	85%	2%	13%	69%	0%	31%
Weighted Average of San Diego Sites			80%	3%	17%	71%	4%	25%
Weighted Average of All Sites			54%	12%	34%	46%	10%	44%
Non-Residential Land Use								
Supermarket	Supermarket	San Diego	50%	10%	40%	49%	12%	38%
CCALA Building	General Office Building	Los Angeles	95%	4%	1%	77%	23%	0%
Bachenheimer Bldg. [1]	Copy/Printing Shop	Berkeley	N/A	N/A	N/A	38%	0%	62%
Touriel Building	Flower Shop	Berkeley	100%	0%	0%	100%	0%	0%

- The Berkeley copy/printing shop may be representative of a neighborhood serving or university serving service, as its automobile mode of travel is relatively low.

5.4 Statistical Analysis of Data

A statistical analysis of the data will be conducted as more data points are collected for each land use category.

6 Summary and Conclusion

This chapter provides preliminary conclusions based on this first phase of the research study which can be considered a pilot study for one of the nation's first comprehensive efforts to collect trip generation data for urban infill land uses. As a pilot study (comprised of an initial and expanded pilot), it has been successful in identifying and testing data collection methods and determining ways to resolve challenges, such as promoting participation in the research. The limited amount of data collected has been disappointing, but the lessons learned in this phase of the study have strengthened the knowledge and techniques for continuing data collection in subsequent second phases of this research.

6.1 Key Conclusions

The preliminary data collected and evaluated to date from 13 sites indicate that certain land use categories have lower trip generation characteristics in urban infill contexts than ITE trip generation rates. Clearly, more data points are required for the full set of selected land uses to substantiate this preliminary conclusion and to establish statistical correlations between urban contexts and trip generation characteristics.

6.2 Recommendations for Further Research

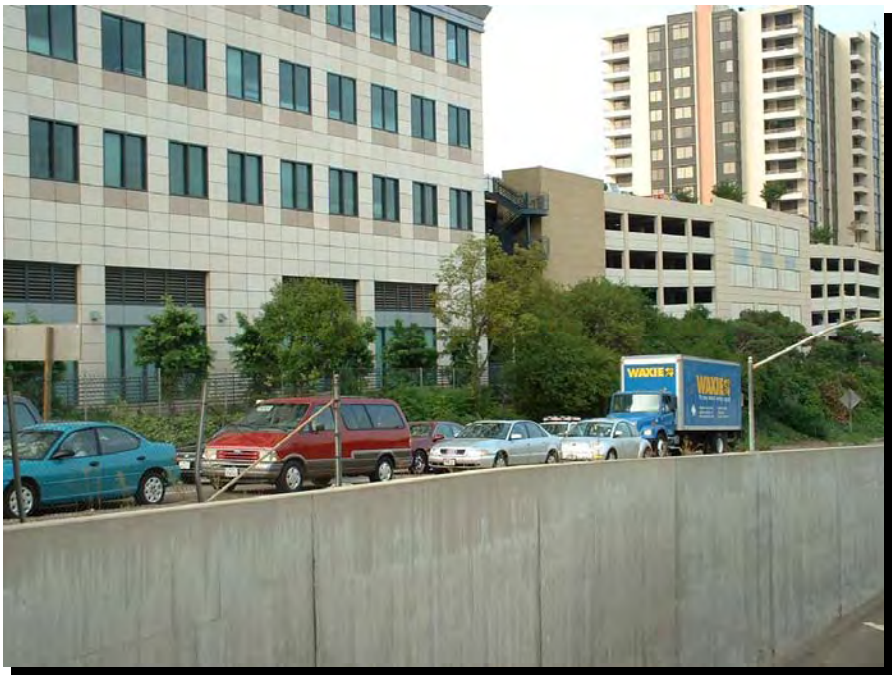
Subsequent research should include the following:

- Continue data collection with the goal of developing a larger database that includes at least five data points for up to ten land use categories. This will provide enough data to perform a reasonable statistical analysis and to correlate the data.
- Conduct a pilot study to test a method of collecting average daily traffic data using intercept surveys. Optimally, the pilot study would locate a site with an isolated parking facility that would allow validation of the method using automatic machine counts. This same pilot study could be used to validate the observed peak hour trip generation rates.
- Use the optional demographic data to cross-reference trip generation to income, auto ownership, and other socio-economic factors.
- Develop additional indicators correlating trip generation rates to urban infill characteristics, such as distance to the Central Business District, walking environment, residential densities, number of on-site parking spaces, and distance to transit.

6.3 Policy Implications for California

The results of this research are crucial to California policies related to transportation and land use planning. Evidence that urban infill development generates less traffic than suburban development (currently felt to be true by many practitioners, but not yet proven) can affect a number of state, regional, and local policies including:

- Development and implementation of Traffic Impact Fees under Government Code 66000
- Guidelines for the preparation of Traffic Impact Analyses
- Support for Smart Growth principles integrated into regional and local agency planning
- Development approval processes
- Air quality and conformity analyses



7 Bibliography

Land Use and Site Design - Traveler Response to Transportation System Changes. Washington D.C.: Transportation Research Board (TRB) Transit Cooperative Research Program (TCRP), Report 95.

Daisa, James M., Proposed Recommended Practice in Designing Major Urban Thoroughfares for Walkable Communities, Washington D.C., Institute of Transportation Engineers, 2006.

Institute of Transportation Engineers, Trip Generation Handbook Second Edition, Washington D.C.: Institute of Transportation Engineers, 2004.

Smith, Mary S. Shared Parking, Second Edition, Washington D.C.: ULI-The Urban Land Institute and the International Council of Shopping Centers, 2005.

Parking Generation 3rd Edition. Washington D.C.: Institute of Transportation Engineers, 2004.

Terry Parker, G.B. Arrington, Topaz Faulkner, Janet Smith-Heimer, Ron Golem, Daniel Mayer, Statewide Transit-Oriented Development Study – Factors for Success in California, Sacramento: California Department of Transportation, 2002.

Guide for the Preparation of Traffic Impact Studies. Sacramento: California Department of Transportation, 2002.

8 Appendices

A. Working Paper #1 – Selection of Urban Infill Sites

B. Organizations and individuals contacted, and copy of participation solicitation letter

C. Sample intercept survey questionnaires

D. Working Paper #2 - Site Selection and Data Collection/Analysis Methodology

E. Site summaries

F. Additional survey site details

G. Institute of Transportation Engineers Summary of Land Use Categories

H. Excerpts from Institute of Transportation Engineers Trip Generation Handbook (Data Collection Methodologies)

APPENDIX A

Economic & Planning Systems
Public Finance
Real Estate Economics
Regional Economics
Land Use Policy

WORKING PAPER #1
SELECTION OF URBAN INFILL STUDY SITES

Prepared for:

The Association of Bay Area Governments, under
State of California Department of Transportation
Division of Research and Innovation
Agreement Number 65A0188:
Trip Generation Rates for Urban Infill in California

Prepared by:

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EXECUTIVE SUMMARY

Institute of Transportation Engineers (ITE) trip generation rates are the primary source for travel demand analysis of new development throughout the United States, and they are relied upon for IGR/CEQA and local agencies' development impact analyses. These rates were intentionally based on surveys of isolated suburban development with little or no pedestrian, bicycle, or transit accessibility, for ease of data collection.

Despite the vast amount of data collected by ITE over the past decades, the existing trip generation rates are not sufficient to guide the approval of proposed developments in urban areas, because the source of the rates do not reflect variations in density, diversity (land use mix), site design and the multimodal transportation systems of our larger metropolitan areas, which are critical factors on travel demand[1]. In addition, the advent of land use typologies such as "urban infill" and "transit-oriented" development in response to Smart Growth policies in California have led to particular challenges and debate when it comes to travel demand analysis.

As an initial step in the measurement of trip generation from urban infill development, it is necessary to arrive at a clear definition of what constitutes "urban infill" and where such development presently exists. It is also necessary to establish criteria to be used in selection of the actual study sites where measurements will be taken. The purposes of this **Working Paper # 1** are, therefore:

1. To recommend a parametric definition for the term 'Urban Infill' and propose a methodology for identifying Urban Infill Areas (UIAs), and

2. To suggest appropriate land use categories, ranges of development densities and other criteria relevant to the selection of study sites.

Working Paper # 1 begins with a general definition of 'Urban Infill' development and the functional attributes of UIAs, followed by a more focused identification of infill land use types. Finally, methods and criteria for the identification and selection of appropriate infill zones and survey sites across the state of California are provided.

The Project Team has a general consensus that the criteria used in defining "Urban Infill Areas" should be applicable to other studies, and should have potential application to future development patterns, i.e., to projected as well as existing urbanized areas. The Project Team suggested an initial set of working criteria for defining UIAs in the Draft version of this Working Paper. The initial criteria were reviewed by the Technical Advisory Committee (TAC) for this study, and refined and finalized in collaboration with the TAC. As agreed upon by the TAC at its December 20th, 2005 teleconference, the following criteria will be used to select study sites:

---

[1] Land Use and Site Design – Traveler Response to Transportation System Changes, TRB's Transit Cooperative Research Program (TCRP) Report 95: Chapter 15

1) An Urban Infill Area (UIA) designation may be applied to any site located either:
   a) within a **Central Business District (CBD)**, **Central City, Not Downtown (CND)** or **Suburban Center (SBC) Area**, as defined by the ITE for data collection surveys; or alternatively,
   b) within a **General Urban (T/CZ-4)**, **Urban Center (T/CZ-5)**, or **Urban Core (T/CZ-6) Zone**, as defined in the Proposed Recommended Practice for Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities estimated to be published in February 2006 (Appendix E provides characteristics of these context zones),

   which **also** meets all of the other criteria defined immediately below.

2) The UIA must be within 1/3 mile of a site with an existing or future rail transit station, a ferry terminal served by either a bus or rail transit service, an intersection of at least two major bus routes, or within 300 feet of a bus rapid transit corridor. The transit service shall have maximum scheduled headways of 15 minutes for at least 5 hours per day.

3) The UIA can contain no more than 10 percent Vacant Developable Land. Vacant Developable Land as defined excludes water bodies, public rights-of-way, land designated for conservation and public recreation, and any other land designated by local governments' policies or comprehensive plans as unavailable for development. Parking lots on land designated and/or zoned as developable under current policy qualify as Vacant Developable Land.

4) Where residential land uses comprise at least 60 percent of developed land, average residential density shall be at least 10.0 dwelling units per gross acre of residentially developed land.

5) Where nonresidential land uses comprise at least 60 percent of developed land, average nonresidential density shall be a floor area ratio (FAR) of at least 1.0 and/or an employment density of at least 35.0 per gross acre of nonresidential developed land.

6) Where neither residential nor nonresidential uses comprise more than 60 percent of developed land, both residential and nonresidential uses must meet the density and intensity criteria prescribed above.

In adopting the above quantitative criteria as a functional definition for "Urban Infill Area", the Study Team and the TAC are mindful of the need for practical measurements that can be applied to or extracted from data that are readily available across the State of California, and at relatively small-area levels, e.g., the census block group level. Economic & Planning Systems prototyped a map-based or GIS approach to identifying candidate UIAs for this **Working Paper #1** using digital map layers and socioeconomic data that are available nationwide from Federal agencies and information centers. These

map layers and data have now been assembled into a functional set covering the State of California, for use with desktop GIS platforms like MapInfo and ArcView, and copies have been made available for use by the Project Team.

Parallel to the identification of the appropriate UIAs, i.e., the 'neighborhoods' or zones within which Urban Infill development conditions pertain, is the need to define appropriate land use types for selecting representative infill sites. The current Study is intended to produce trip generation data for at least ten infill land uses, potentially including apartments, condominiums, office buildings, shopping areas, entertainment sites, restaurants, schools, and other land uses typical of urbanized areas.

The Project Team suggested the land-use selection effort begin with the following criteria:

1) Common urban land use types that are consistent with ITE categories (*Trip Generation* [7th ed.]) and generally reflect a range of uses within residential, office and retail (including entertainment) categories.

2) Land use types for which there is a demand for empirical trip generation data (this would be based on professional knowledge and any information ITE can provide).

3) Land use types for which there is a reasonable propensity for shifting drivers to another mode if the use is located in an urban area. For example, it may be unlikely that patrons would shift from autos to transit or walking if a grocery store is located in an urban area versus a suburban area.

4) Land use types that are considered beneficial to the revitalization of urban areas, but for which current trip generation data may act as a barrier to development approval. These may include types that are considered transit oriented, high density residential, and urban retail uses.

Because parking availability and costs are often of crucial importance to the trips and trip types generated by urban infill sites, consideration in choosing candidate uses was also suggested for those types already represented in ITE's *Parking Generation*.

The Project Team selected a preliminary list of 20 land uses for consideration as appropriate candidates for urban infill trip generation surveys. Preference was given in the initial selection to higher-density residential types, and to nonresidential land uses that are of recurring interest in infill development impact analyses and in application of ITE standards to local transportation demand models. Most, but not all, of the uses in the initial list were among the 91 types represented in the 3rd edition of *Parking Generation*.

In presenting this **Working Paper** for review and comment by the Technical Advisory Committee, the Project Team sought in particular TAC members' discussion and input regarding:

- The suggested definition of UIAs—identifying the requisite attributes of areas from which we will select study sites; and

- The suggested types of land use to study—both in terms of specific site uses and the appropriate priority or weighting of criteria for their selection.

I. INTRODUCTION

As an initial step in the measurement of traffic generation from urban infill development it is necessary to arrive at a clear definition of what constitute "urban infill" development and where such development presently exists. It is also necessary to establish criteria to be used in selection of the actual study sites where measurements will be taken. These are the subjects of this report, **Working Paper #1**.

Working Paper #1 was prepared by Economic & Planning Systems (EPS), in association with Kimley Horn Associates and the Association of Bay Area Governments for review and comment by the Technical Advisory Committee (TAC). Following refinement in response to comments and suggestions, and approval by the TAC, **Working Paper #1** has now been finalized and the Project Team will utilize the agreed-upon definitions and criteria to design and conduct the measurement process.

The purposes of **Working Paper # 1** are:

1) To establish a parametric definition for the term 'Urban Infill' and propose a methodology for identifying UIAs, and

2) To select appropriate land use categories, ranges of development densities and other criteria relevant to the selection of study sites.

The discussion that follows begins with a general definition of 'Urban Infill' development and the functional attributes of UIAs followed by a more focused identification of infill land use types. Finally, methods and criteria for the identification and selection of appropriate infill zones and survey sites across the state of California are provided.

The attached appendices include **Appendix A**, a brief literature review; **Appendix B**, an initial listing of possible locales for urban survey study sites; and **Appendix C**, comprising additional technical background information including a listing of US Census Block Groups in California with high employment and residential densities, a sample parking demand survey form, and a sample of a site characterization checklist. **Appendix D** provides a detailed explanation of the methodology and sources Economic & Planning Systems has applied in a prototype approach to identifying candidate UIAs. Appendix E explains Context Zones, as applied in the Proposed Recommended (ITE) Practice for Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities

URBAN INFILL AREAS: CONCEPTS AND DEFINITIONS

The terms "urban" and "infill" are in common usage throughout the disciplines of land use and transportation planning. Planners have an intuitive grasp of what "urban" means, and the concept of "infill" is widely understood to describe the development of

new homes, commercial sites, and public facilities on vacant or under-utilized land in existing communities. However, "Urban Infill" is often defined in qualitative terms narrowly relevant to studies addressing economic redevelopment of blighted areas, or as a nebulous concept relevant to broad-brush policies aimed at preventing "leapfrog" development or sprawl within urban limit lines.

It is therefore critical that this current study has a clearer and more applicable definition of "Urban Infill" that is both relevant to surveys of trip generation in California's urban areas and parametric, that is, based on site and site context characteristics that are measurable.

Components of a good working definition of "Urban Infill" are provided by ITE 'Area' definitions for data collection surveys and by Smart Growth concepts of Transect/Context Zones, by U.S. Bureau of the Census criteria for the 2000 Census, and in current California and Florida state laws on urban infill and redevelopment. In the selections from these sources cited immediately below, recommended components for further consideration/consolidation are underlined.

The ITE has established five 'Area' types for the purpose of identifying sites' context. As reported in *Parking Generation* (3rd ed.),
http://trafficincident.org/parkgen/datasubmission.asp
The five Area types are:

Central Business District (CBD): This would be the downtown area of a city. Characteristics would include very good transit service, street grid, parking garages, extensive pedestrian sidewalk network, multi-story buildings and a wide range of land uses (including mixed-use sites). Obvious CBDs would be downtown New York, Chicago or San Francisco. CBDs also exist in smaller cities such as downtown areas of Portland, Maine, or Bakersfield, California.

Central City, Not Downtown (CND): This would be the area outside the downtown area of a larger city (typically cities above 250,000 or more in population). These sites typically exhibit greater land use density than suburban sites but are substantially less density than the CBD. The intent of this area designation is for the areas around large central cities such as Seattle, San Francisco, Oakland, Atlanta or Washington, DC—but not large suburban cities which are addressed separately).

Suburban (SUB): Suburban locations are those outside the central city of a metropolitan area. Characteristics would include limited transit services, surface parking, less than complete pedestrian networks, single story buildings and larger groupings of homogeneous land uses. In smaller metropolitan areas (less than 250,000) the area surrounding the CBD could be characterized as suburban.

Suburban Center (SBC): Suburban center areas are those downtown areas of suburbs that have developed CBD characteristics but are not the central city of a metropolitan region. Characteristics can include good transit service, mix of surface and structured parking, connected streets, connected pedestrian network and a mix of land uses. Examples would include the downtown areas of Bellevue, Washington, Las Colinas, Texas or Walnut Creek, California.

Rural (RUR): Areas outside a metropolitan region (any SMSAs) would be considered rural.

Three of the Area types, **CBD, CND,** and **SBC**, are considered "urban" per *Parking Generation* and provide distinctions which are familiar and intuitive to experienced land use and transportation planners. The **CBD**, **CND** and **SBC** Area types can be usefully included among the components of the desired definition of "urban infill" as necessary (but not sufficient) context conditions.

The limitations of the Area types are two-fold. First, they reflect to some degree the traditional, monocentric city form, with employment-generating land uses concentrated primarily in a Central Business District surrounded by concentric rings of decreasing employment densities and proportionally more residential and rural land. Since the 1980's, urban development in many parts of California and across the nation has seen the decline of CBDs, and the emergence of urban and suburban employment centers outside the CBDs, in trends leading to more polycentric and dispersed urban regions.

In response to these trends, transportation and land use planners have reconceived the traditional 'bull's-eye' CBD concept of urban form and concentric Area types into the more flexible Transect Zone or Context Zone concepts. Transect/Context Zones are being introduced into the current development of *Guidelines for Context Sensitive Solutions for the Design of Major Urban Thoroughfares*, a joint project of the Institute of Transportation Engineers and the Congress for the New Urbanism. The final product of this project will be a Recommended Practice published by ITE (See also Appendix E).

Transect/Context Zones are a systematic set of development-intensity-based codes on a sliding scale ranging from the most rural or undeveloped state to the most urban or developed state. The Transect/Context Zone types established by Duany Plater-Zyberk & Company (DBZ) and in common planning usage are:

Natural (T/CZ-1): Approximating or reverting a wilderness condition, including land unsuitable for settlement because of topography, hydrology or vegetation. Typical Land Uses—Natural preserve, recreation and camping. Typical Buildings—Utility infrastructure and camp buildings.

Rural (T/CZ-2): In an open space or cultivated state or sparsely settled. These areas may include woodland, agricultural lands, grasslands and irrigable deserts. Typical Land Uses—Natural reserve, agriculture, recreation and camping.

Typical Buildings: Utility infrastructure, agricultural buildings and farmhouses, migrant worker housing and campgrounds.

Suburban (T/CZ-3): Conventional low-density residential areas, allowing home occupations. Planting is naturalistic with deep setbacks. Blocks may be large and the roads irregular to accommodate natural conditions. Typical Land Uses—Low-density residential and home occupations. Typical Buildings—Houses and outbuildings.

General Urban (T/CZ-4): Denser and primarily residential urban fabric. Mixed-use sites usually confined to corner locations. Characterized by a wide range of building types: single, side yard, and row houses. Setbacks and landscaping are variable. Streets typically define medium-sized blocks. Typical Land Uses—Medium density residential and home occupations; limited commercial and lodging. Typical Buildings—Houses and outbuildings, side yard houses, townhouses, live/work units, corner stores, inns.

Urban Center (T/CZ-5): 'Main Street' land uses, characterized by building types that Accommodate retail, offices, row houses and apartments. Typically has a tight network of streets, with wide sidewalks, steady street tree planting and buildings set close to the frontages. Typical Land Uses—Medium intensity residential and commercial uses, i.e., retail, offices, lodging, civic facilities. Typical Buildings—Townhouses, apartment houses, live-work units, shop front buildings and office buildings, hotels, churches, schools.

Urban Core (T/CZ-6): 'Downtown' land uses, characterized by the tallest buildings, in the greatest variety, and unique civic buildings in particular. It is the least naturalistic zone type; street trees are steadily planted and sometimes absent. Typical Land Uses—High intensity residential and commercial: retail and offices, lodging, civic buildings. Typical Buildings—High- and medium-rise apartment and office buildings, hotels; townhouses, live-work units, shop fronts, churches, civic buildings.

Special Districts (SD): Areas with buildings and building complexes that by their intrinsic function, disposition, or configuration, cannot conform to any of the other six normative Transect Zones types. Single use areas such as heavy industrial, refineries, airports, hospitals and university campuses.

A 'snapshot' of the current application of Transect zones to guide design principles for urban thoroughfares, by the Institute of Transportation Engineers and the Congress for the New Urbanism, is shown in **Table 1**. More detailed explanations and examples of

Table 1
Transect/Context Zone Characteristics
Selection of Urban Infill Study Sites, EPS #14002

Context Zone	Distinguishing Characteristics	General Character	Building Placement	Frontage Types	Typical Building	Type of Public Open Space
T/CZ-1 Natural	Natural landscape	Natural features	Not applicable	Not applicable	Not applicable	Natural open space
T/CZ-2 Rural	Agricultural with scattered development	Agricultural activity and natural features	Very large setbacks	Not applicable	Not applicable	Agricultural and natural
T/CZ-3 Suburban	Single family residential	Detached houses Landscaped yards Low pedestrian activity	Varying front and side yard setbacks	Lawns, porches, fences, landscaping	1 to 2 story Some 3 story	Parks, greenbelts
T/CZ-4 General Urban	Mix of single and moderate density multifamily residential Commercial separated from residential shopping centers, office parks)	Predominantly detached buildings Large landscaped areas Low pedestrian activity	Shallow to medium front and side yard setback Commercial with parking in front	Porches, fences Landscaped buffer areas Parking lots	2 to 3 story Some taller workplace buildings	Parks, greenbelts
T/CZ-5 Urban Center	Mixed-use High-density multifamily residential with retail, workplace, and civic uses at the community or subregional scale	Predominantly attached buildings Landscaping within the public right of way Substantial pedestrian activity	Small or no setbacks Building oriented to street	Stoops, dooryards. Storefronts, Arcaded walkways	3-to-5 story	Parks, plazas and squares
T/CZ-6 Urban Core	Mixed-use Highest-intensity areas in subregion or region, with high-density residential and workplace uses entertainment, civic and cultural uses	Attached buildings forming continuous street wall Landscaping within the public right of way Highest pedestrian and transit activity	Small or no setbacks Building oriented to street, placed at front property line	Stoops, dooryards, forecourts. Storefronts, Arcaded walkways	4+ story Few lower buildings	Parks, plazas and squares
SD Special Districts	Single use areas such as heavy industrial, refineries, airports, hospitals and university campuses, that by their intrinsic function, disposition, or configuration, cannot conform to any of the other six Transect/Context Zone types					

After: 'Table 3.1 Context Zone Characteristics', in *Context Sensitive Solutions in Designing Major Urban Thoroughfares - 3rd Draft,* August 1, 2005 (page 29);
provided by Kimley Horn Associates

the Transect concept in applied land use and thoroughfare planning are provided in *SmartCode v 7.0*, by Duany Plater-Zyberk & Company, June 2005: http://www.dpz.com/pdf/SmartCodeV7.0-6-06-05.pdf.

Three of the Transect/Context Zone types, **General Urban (T/CZ-4)**; **Urban Center (T/CZ-5)**; and **Urban Core (T/CZ-6)**, are considered "urban" per the ITE *Context Sensitive Solutions for the Design of Major Urban Thoroughfares* project described above and can be included among the components of the desired definition of "urban infill" in parallel with or as alternatives to the more traditional **CBD**. **CND** and **SBC** Area types.

A second limitation of the Area types, shared in common with the Transect/Context Zone types, is their primarily qualitative descriptions of urban forms and contexts. Densities and types of development and transit, parking, and pedestrian accessibility and levels or service associated with the Area types and Transect/Context Zones have typically been defined in relative terms, e.g., 'Low-', 'Medium-' and 'High-', rather than with parametric measures such as dwelling units/population/jobs per acre; built space coverage and FARs; or transit service headways. Precedents for more quantitative approaches to defining "urban" areas are available, and will now be discussed.

For the 2000 Census, the Census Bureau classified as "urban" all territory, population, and housing units located within an urbanized area (UA) or an urban cluster (UC). UA and UC boundaries were delineated to encompass densely settled territory, which were defined as aggregates of:

- Core census block groups or blocks that had a Year 2000 population density of at least 1,000 people per square mile, and

- Surrounding census blocks that had a Year 2000 overall density of at least 500 people per square mile. In addition, under certain conditions, less densely settled territory could be included as part of each UA or UC.

http://www.census.gov/geo/www/ua/1ua_2k.html

As further documented in the Federal Register Notice for Urban Area Criteria
http://www.census.gov/geo/www/ua/uafedreg031502.pdf
(Federal Register / Vol. 67, No. 51 / Friday, March 15, 2002 / Notices):

URBAN AREA CRITERIA FOR CENSUS 2000

As a part of the US Census 2000, definitions for UA and UC were developed. The following criteria apply to the 50 states, the District of Columbia, Puerto Rico, American Samoa, Guam, the Northern Mariana Islands, and the Virgin Islands of the United States.

- For Census 2000, a UA consists of contiguous[2], densely settled census block groups[3] (BGs) and census blocks[4] that meet minimum population density requirements, along with adjacent densely settled census blocks that together encompass a population of at least 50,000 people.

- For Census 2000, a UC consists of contiguous, densely settled census BGs and census blocks that meet minimum population density requirements, along with adjacent densely settled census blocks that together encompass a population of at least 2,500 people, but fewer than 50,000 people.

- All criteria based on land area, population, and population density reflect the information contained in the Census Bureau's Topologically Integrated Geographic Encoding and Referencing (TIGER) database (the Census 2000 TIGER/Line file at the time of initial delineation) and the official Census 2000 redistricting data file (the Public Law 94–171 file at the time of initial delineation).

Census 2000 UAs and UCs for the State of California are listed in **Tables 2** and **3**, and shown in **Figure 1.** It can be seen from the tables and in **Figure 1** that some UAs and UCs are located outside of California counties typically as "urban"; however, most of the census-defined urban regions are found in California counties having reached total populations of at least 400,000 in the year 2000.

While UAs and UCs as defined for the Census 2000 counts generally indicate California regions of interest, they are not sufficient definitions of 'Urban Infill' for the intended purposes of this study. First, the use of population density as the sole selective criterion ignores urban nonresidential land uses of equal interest for trip-generation surveys, and does not address the possible impacts of complimentary mixes of adjacent zoning and development on trip generation. Second, there are no considerations of availability or proximity of parking facilities or transit service.

Finally, census UAs and UCs were intentionally defined to be inclusive. Within UA and UC boundaries, the Census Bureau could and did include "green space" and other islands of vacant or only sparsely developed territory, with "jumps" of up to 2.5 miles separating blocks and block groups that met the threshold population densities of 500 to 1,000 persons per square mile. This means that many neighborhoods and sites within

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2 Contiguity requires at least one point of intersection.

3 A census block group is a group of census blocks within a census tract whose numbers begin with the same digit; for example, BG 3 within a census tract includes all census blocks numbered from 3000 to 3999.

4 A census block is an area normally bounded by visible features, such as streets, streams, and railroads, and by nonvisible features, such as the boundary of an incorporated place, minor civil division (MCD), county, or other Census 2000 tabulation entity.

Table 2
Census 2000 Urbanized Areas - California
Selection of Urban Infill Study Sites, EPS #14002

State Code	FIPS Code	Census 2000 Urbanized Area	Population in 2000	Area (sq meters)	Area (sq miles)	Population per sq. mile
06	02683	Antioch	217,591	156,121,048	60.28	3,609.8
06	03574	Atascadero--El Paso de Robles	54,762	79,747,822	30.79	1,778.5
06	04681	Bakersfield	396,125	285,740,955	110.32	3,590.5
06	12754	Camarillo	62,798	55,228,642	21.32	2,945.0
06	16318	Chico	89,221	90,463,755	34.93	2,554.4
06	19504	Concord	552,624	457,017,877	176.45	3,131.8
06	22420	Davis	66,022	35,290,113	13.63	4,845.4
06	26416	El Centro	52,954	42,741,615	16.50	3,208.8
06	28657	Fairfield	112,446	66,862,270	25.82	4,355.7
06	31843	Fresno	554,923	359,030,809	138.62	4,003.1
06	33328	Gilroy--Morgan Hill	84,620	99,185,327	38.30	2,209.6
06	03670	Hanford	69,639	65,966,809	25.47	2,734.2
06	38215	Hemet	117,200	108,290,815	41.81	2,803.1
06	41347	Indio--Cathedral City--Palm Springs	254,856	255,344,357	98.59	2,585.0
06	47611	Lancaster--Palmdale	263,532	234,122,253	90.39	2,915.3
06	50527	Livermore	75,202	54,060,803	20.87	3,602.8
06	50851	Lodi	83,735	60,961,956	23.54	3,557.5
06	51040	Lompoc	55,667	155,667,328	60.10	926.2
06	51445	Los Angeles--Long Beach--Santa Ana	11,789,487	4,319,930,311	1,667.93	7,068.3
06	52984	Madera	58,027	58,572,339	22.61	2,565.9
06	54145	Manteca	51,176	35,247,429	13.61	3,760.4
06	56251	Merced	110,483	93,155,694	35.97	3,071.7
06	57709	Mission Viejo	533,015	354,533,330	136.89	3,893.9
06	58006	Modesto	310,945	222,937,057	86.08	3,612.4
06	61057	Napa	79,867	60,929,170	23.52	3,395.0
06	66673	Oxnard	337,591	196,057,094	75.70	4,459.7
06	68887	Petaluma	59,958	47,840,726	18.47	3,246.0
06	71074	Porterville	60,261	54,639,137	21.10	2,856.5
06	73774	Redding	105,267	182,949,567	70.64	1,490.2
06	75340	Riverside--San Bernardino	1,506,816	1,136,422,783	438.77	3,434.1
06	77068	Sacramento	1,393,498	955,784,543	369.03	3,776.1
06	78310	Salinas	179,173	116,284,529	44.90	3,990.7
06	78661	San Diego	2,674,436	2,026,112,024	782.28	3,418.7
06	78904	San Francisco--Oakland	3,228,605	1,364,031,382	526.65	6,130.4
06	79039	San Jose	1,538,312	673,683,711	260.11	5,914.1
06	79147	San Luis Obispo	53,498	38,415,106	14.83	3,606.9
06	79282	Santa Barbara	196,263	154,823,889	59.78	3,283.2
06	79309	Santa Clarita	170,481	140,721,950	54.33	3,137.7
06	79336	Santa Cruz	157,348	142,196,828	54.90	2,866.0
06	79417	Santa Maria	120,297	92,062,185	35.55	3,384.3
06	79498	Santa Rosa	285,408	264,142,433	101.99	2,798.5
06	80362	Seaside--Monterey--Marina	125,503	105,252,097	40.64	3,088.3
06	82144	Simi Valley	112,345	70,123,206	27.07	4,149.4
06	85087	Stockton	313,392	192,415,050	74.29	4,218.4
06	87004	Temecula--Murrieta	229,810	247,585,114	95.59	2,404.0
06	87490	Thousand Oaks	210,990	223,171,056	86.17	2,448.6
06	88273	Tracy	59,020	33,075,133	12.77	4,621.6
06	89083	Turlock	69,507	48,323,193	18.66	3,725.4
06	89866	Vacaville	90,264	65,598,046	25.33	3,563.9
06	90028	Vallejo	158,967	87,939,538	33.95	4,681.9
06	90541	Victorville--Hesperia--Apple Valley	200,436	321,082,129	123.97	1,616.8
06	90946	Visalia	120,044	103,376,801	39.91	3,007.6
06	92890	Watsonville	66,500	49,512,247	19.12	3,478.6
06	97939	Yuba City	97,645	91,599,143	35.37	2,760.9
06	98020	Yuma, AZ--CA	1,095	3,533,642	1.36	802.6

Sources: U.S. Bureau of the Census, Federal Register Notice November 20, 2002, EPS
http://www.census.gov/geo/www/ua/uaucinfo.html#lists

Table 3
Census 2000 Urban Clusters - California
Selection of Urban Infill Study Sites, EPS #14002

State Code	FIPS Code	Census 2000 Urban Clusters	Population in 2000	Area (sq meters)	Area (sq miles)	Population per sq. mile
06	00523	Adelanto	9,008	9,419,732	3.64	2,476.8
06	01819	Alturas	2,831	5,568,545	2.15	1,316.7
06	02494	Angels City	2,776	5,302,914	2.05	1,355.8
06	02926	Arcata	30,429	49,109,067	18.96	1,604.8
06	03169	Aromas	2,701	11,188,959	4.32	625.2
06	03196	Arroyo Grande--Grover Beach	47,550	47,841,654	18.47	2,574.2
06	03250	Arvin	13,234	10,629,775	4.10	3,224.5
06	04438	Avalon	3,096	3,219,471	1.24	2,490.7
06	04465	Avenal	14,641	6,917,136	2.67	5,482.0
06	05302	Barstow	28,234	39,004,717	15.06	1,874.8
06	05950	Beale AFB	5,112	10,464,053	4.04	1,265.3
06	07435	Bethel Island	2,816	13,765,064	5.31	529.8
06	07516	Big Bear Lake	15,123	31,603,160	12.20	1,239.4
06	07840	Bishop	10,359	19,628,150	7.58	1,366.9
06	08623	Blythe--AZ	11,434	16,860,068	6.51	1,756.5
06	08893	Bonadelle Ranchos-Madera Ranchos	6,249	19,698,898	7.61	821.6
06	09730	Brawley	22,035	14,563,837	5.62	3,918.6
06	11836	Burney	3,239	9,091,092	3.51	922.8
06	12430	Calexico	27,095	15,440,579	5.96	4,544.9
06	12565	California City	7,803	16,801,424	6.49	1,202.9
06	12592	Calipatria	4,095	1,291,602	0.50	8,211.5
06	12646	Calistoga	5,190	6,729,753	2.60	1,997.4
06	12781	Cambria	5,746	8,661,728	3.34	1,718.1
06	13105	Cameron Park	22,066	36,122,122	13.95	1,582.2
06	16696	Chowchilla	7,592	9,893,487	3.82	1,987.5
06	17479	Clearlake	13,873	20,047,341	7.74	1,792.3
06	18181	Cloverdale	7,488	8,087,401	3.12	2,398.0
06	18289	Coalinga	11,724	12,358,842	4.77	2,456.9
06	19342	Colusa	6,066	4,693,428	1.81	3,347.4
06	20044	Corcoran	22,758	14,932,987	5.77	3,947.2
06	20206	Corning	7,671	15,715,378	6.07	1,264.2
06	20584	Cottonwood	4,089	9,737,677	3.76	1,087.6
06	20908	Crescent City	18,812	45,022,944	17.38	1,082.2
06	20989	Crestline	21,531	50,663,833	19.56	1,100.7
06	22987	Delano	39,512	15,360,705	5.93	6,662.2
06	23716	Desert Hot Springs	24,333	30,026,967	11.59	2,098.9
06	24256	Discovery Bay	9,087	8,142,841	3.14	2,890.3
06	24283	Dixon	16,085	11,743,033	4.53	3,547.6
06	24445	Dos Palos	6,327	8,661,531	3.34	1,891.9
06	25579	Earlimart	7,119	5,837,475	2.25	3,158.6
06	26281	Edwards AFB	5,386	20,735,824	8.01	672.7
06	27820	Escalon	6,267	9,842,437	3.80	1,649.1
06	28198	Eureka	43,452	52,637,713	20.32	2,138.0
06	28792	Fairfield Southwest	9,096	10,654,865	4.11	2,211.1
06	29710	Fillmore	13,631	6,035,519	2.33	5,849.4
06	29764	Firebaugh	6,483	7,761,078	3.00	2,163.5
06	30385	Forestville	3,625	8,941,262	3.45	1,050.0
06	30574	Fort Bragg	9,325	13,482,664	5.21	1,791.3
06	30736	Fort Irwin	9,315	220,819,213	85.26	109.3
06	30979	Fortuna	10,483	11,033,854	4.26	2,460.7
06	31492	Frazier Park	3,128	6,757,976	2.61	1,198.8
06	33841	Gonzales	7,695	5,098,755	1.97	3,908.8
06	34597	Grass Valley	34,019	83,899,571	32.39	1,050.2
06	34921	Greenfield	13,220	7,871,005	3.04	4,350.1
06	35677	Gridley	7,512	12,191,498	4.71	1,595.9
06	35839	Guadalupe	5,651	3,709,064	1.43	3,946.0
06	35893	Guerneville	4,990	10,763,923	4.16	1,200.7

Table 3
Census 2000 Urban Clusters - California
Selection of Urban Infill Study Sites, EPS #14002

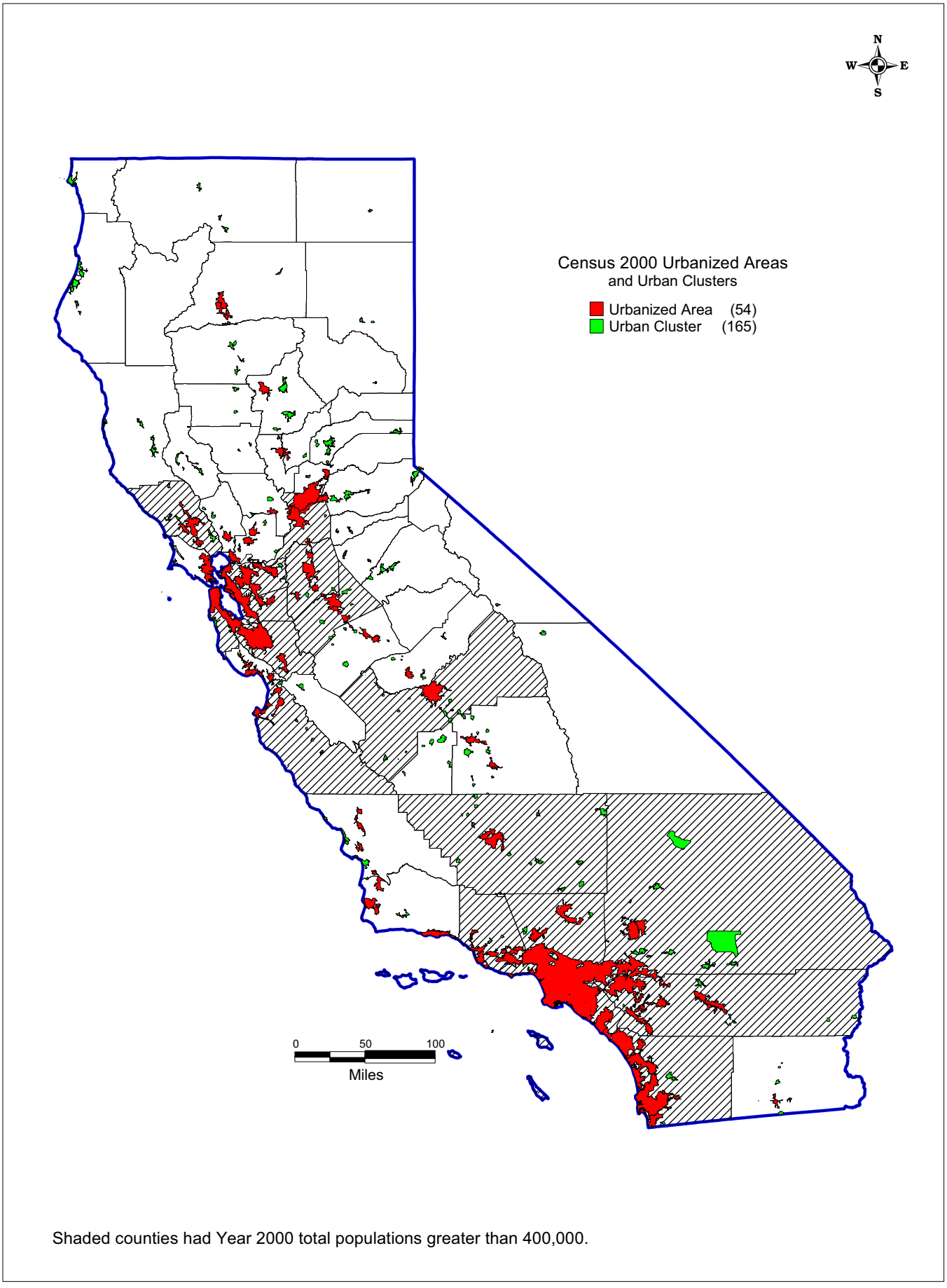
State Code	FIPS Code	Census 2000 Urban Clusters	Population in 2000	Area (sq meters)	Area (sq miles)	Population per sq. mile
06	36055	Gustine	4,681	3,101,647	1.20	3,908.8
06	36271	Half Moon Bay	22,037	28,663,482	11.07	1,991.2
06	38188	Helendale	3,980	5,278,093	2.04	1,953.0
06	39025	Hilmar-Irwin	4,573	6,785,052	2.62	1,745.6
06	39511	Hollister	39,923	24,950,663	9.63	4,144.2
06	39619	Holtville	6,727	8,199,327	3.17	2,124.9
06	40834	Huron	6,306	3,071,540	1.19	5,317.4
06	41104	Incline Village-Crystal Bay, NV--CA	9,056	16,462,996	6.36	1,424.7
06	41509	Ione	7,058	6,742,234	2.60	2,711.3
06	41968	Ivanhoe	4,474	5,199,630	2.01	2,228.5
06	42049	Jackson	6,227	10,263,370	3.96	1,571.4
06	44290	Kelseyville	2,534	2,598,056	1.00	2,526.1
06	44587	Kerman	8,539	3,335,458	1.29	6,630.5
06	45073	King City	12,054	6,774,198	2.62	4,608.6
06	46774	Lake Isabella	3,727	8,925,286	3.45	1,081.5
06	46855	Lake Los Angeles	11,181	17,382,327	6.71	1,666.0
06	46963	Lake of the Pines	6,323	12,955,095	5.00	1,264.1
06	47071	Lakeport	10,883	25,162,589	9.72	1,120.2
06	47233	Lake Wildwood	6,527	16,537,417	6.39	1,022.2
06	49042	Lemoore Station	5,749	5,098,606	1.97	2,920.4
06	49879	Lincoln	10,230	7,471,239	2.88	3,546.3
06	50041	Lindsay	12,644	16,157,966	6.24	2,026.7
06	50473	Live Oak (Sutter County)	6,471	5,598,680	2.16	2,993.5
06	50581	Livingston	11,014	11,300,577	4.36	2,524.3
06	51472	Los Banos	26,036	24,408,913	9.42	2,762.6
06	51931	Lucerne	5,035	7,414,605	2.86	1,758.8
06	52552	McFarland	10,071	10,144,305	3.92	2,571.3
06	53605	Mammoth Lakes	5,800	6,520,662	2.52	2,303.7
06	55927	Mecca	6,589	6,555,740	2.53	2,603.1
06	56170	Mendota	7,870	3,910,671	1.51	5,212.2
06	58276	Mono Vista	10,733	29,636,292	11.44	938.0
06	59437	Morro Bay	26,960	42,342,783	16.35	1,649.1
06	60220	Mount Shasta	5,352	13,927,791	5.38	995.2
06	61435	Needles--AZ	3,987	7,682,871	2.97	1,344.1
06	62569	Newman	7,408	10,983,389	4.24	1,746.9
06	64270	Oakdale	17,946	25,050,664	9.67	1,855.4
06	64432	Oakhurst	2,501	7,646,910	2.95	847.1
06	65377	One Hundred Palms	2,924	6,810,545	2.63	1,112.0
06	65755	Orange Cove	7,720	3,580,913	1.38	5,583.7
06	65836	Orland	7,575	13,948,583	5.39	1,406.5
06	65917	Orosi	12,917	12,447,480	4.81	2,687.7
06	65944	Oroville	34,474	57,433,078	22.17	1,554.6
06	67375	Paradise	35,274	70,389,537	27.18	1,297.9
06	67753	Parlier	11,138	3,676,528	1.42	7,846.3
06	67861	Patterson	12,121	15,315,869	5.91	2,049.7
06	69805	Pixley	2,831	3,901,876	1.51	1,879.2
06	69832	Placerville	27,108	62,483,734	24.13	1,123.6
06	70021	Planada	4,138	2,579,268	1.00	4,155.2
06	71398	Portola	2,626	3,350,372	1.29	2,030.0
06	73288	Ramona	22,954	45,114,125	17.42	1,317.8
06	73315	Rancho Calaveras	4,142	12,507,810	4.83	857.7
06	73342	Rancho Murieta	2,634	4,373,234	1.69	1,560.0
06	73720	Red Bluff	17,633	31,544,651	12.18	1,447.8
06	74044	Reedley--Dinuba	38,662	24,841,550	9.59	4,030.9
06	74449	Richgrove	2,728	3,151,808	1.22	2,241.7
06	74827	Ridgecrest	27,274	43,220,939	16.69	1,634.4
06	75043	Rio Dell	3,763	4,012,704	1.55	2,428.8
06	75097	Rio Vista	4,064	7,160,624	2.76	1,469.9
06	76285	Rosamond	12,077	16,902,241	6.53	1,850.6
06	76717	Running Springs	4,941	7,451,930	2.88	1,717.3
06	77500	St. Helena	6,793	15,077,189	5.82	1,166.9
06	78931	Sanger	20,541	12,035,422	4.65	4,420.4
06	79012	San Joaquin	3,678	4,265,037	1.65	2,233.5
06	79444	Santa Paula	29,070	10,953,006	4.23	6,874.0

Table 3
Census 2000 Urban Clusters - California
Selection of Urban Infill Study Sites, EPS #14002

State Code	FIPS Code	Census 2000 Urban Clusters	Population in 2000	Area (sq meters)	Area (sq miles)	Population per sq. mile
06	80551	Selma	34,716	31,661,981	12.22	2,839.8
06	80929	Shafter	13,668	10,460,473	4.04	3,384.2
06	82846	Soledad	11,524	5,948,150	2.30	5,017.9
06	82873	Solvang--Buellton	14,521	26,878,570	10.38	1,399.2
06	83008	Sonoma	31,487	33,093,624	12.78	2,464.2
06	83035	Sonora	14,300	36,750,505	14.19	1,007.8
06	83305	South Lake Tahoe--NV	31,705	47,681,206	18.41	1,722.2
06	85870	Susanville	9,430	11,131,012	4.30	2,194.2
06	86329	Taft	13,302	14,302,810	5.52	2,408.8
06	86869	Tehachapi	12,990	20,797,744	8.03	1,617.7
06	86923	Tehama	3,261	5,831,195	2.25	1,448.4
06	87031	Temescal Valley	4,897	4,236,302	1.64	2,993.9
06	87112	Terra Bella	3,430	3,649,733	1.41	2,434.1
06	87274	Thermal	3,239	6,596,159	2.55	1,271.8
06	88624	Truckee	8,018	23,700,433	9.15	876.2
06	88840	Tulare	47,294	42,512,151	16.41	2,881.3
06	89191	Twentynine Palms	12,496	24,136,412	9.32	1,340.9
06	89218	Twentynine Palms Base	14,090	707,875,475	273.31	51.6
06	89380	Ukiah	28,871	39,710,238	15.33	1,883.0
06	90109	Val Verde	18,752	25,209,301	9.73	1,926.6
06	92161	Wasco	14,986	6,522,215	2.52	5,951.0
06	92539	Waterford	7,016	3,873,893	1.50	4,690.7
06	93538	Weed	2,865	6,380,158	2.46	1,163.0
06	95374	Williams	3,537	2,436,864	0.94	3,759.3
06	95671	Willits	8,053	18,475,908	7.13	1,128.9
06	95725	Willows	7,410	8,244,106	3.18	2,327.9
06	96724	Winters	6,496	7,465,679	2.88	2,253.6
06	96967	Woodlake	6,895	7,228,367	2.79	2,470.5
06	96994	Woodland	49,168	22,552,879	8.71	5,646.5
06	97372	Wrightwood	3,705	3,399,553	1.31	2,822.7
06	97885	Yountville	2,916	4,217,385	1.63	1,790.8
06	97912	Yreka	7,327	13,157,477	5.08	1,442.3
06	97966	Yucca Valley	18,992	46,018,144	17.77	1,068.9

Sources: U.S. Bureau of the Census, Federal Register Notice November 20, 2002, EPS
http://www.census.gov/geo/www/ua/uaucinfo.html#lists

Figure 1:
Census 2000 Urbanized Areas and Urban Clusters - California



Shaded counties had Year 2000 total populations greater than 400,000.

established UAs and UCs, evaluated in isolation, would not be considered as having "urban" levels of development. By simple extension, such neighborhoods and sites would generally not be good prospects for studies of "Urban Infill" trip generation.

Fortunately, recent legislation passed in the states of California and Florida provides several additional concepts and potential criteria for enhancing the definition of "urban" in ways directly relevant to infill development and transportation impacts.

California Senate Bill (SB) 1636 (Figueroa) was sponsored by the Surface Transportation Policy Project and signed in to law on September 12, 2002. California Government Code Section 65088.1 now reads:

> (g) "Infill opportunity zone" means a specific area designated by a city or county, pursuant to subdivision (c) of Section 65088.4, zoned for new compact residential or mixed use development within one-third mile of a site with an existing or future rail transit station, a ferry terminal served by either a bus or rail transit service, an intersection of at least two major bus routes, or within 300 feet of a bus rapid transit corridor, in counties with a population over 400,000. The mixed use development zoning shall consist of three or more land uses that facilitate significant human interaction in close proximity, with residential use as the primary land use supported by other land uses such as office, hotel, health care, hospital, entertainment, restaurant, retail, and service uses. The transit service shall have maximum scheduled headways of 15 minutes for at least 5 hours per day. A qualifying future rail station shall have broken ground on construction of the station and programmed operational funds to provide maximum scheduled headways of 15 minutes for at least 5 hours per day.

The State of Florida has also adopted policy legislation and government codes providing useful criteria for consideration. While the Florida Growth Policy Act's focus on socio-economic blighted areas is too restrictive to the intent of the proposed California trip generation surveys, the requirements for existing public services and infrastructure and proximity to established transit service are relevant:

> Florida 163.2514 Growth Policy Act; definitions (as used in ss. 163.2511-163.2526):
>
> "Local government" means any county or municipality.
>
> (2) "Urban infill and redevelopment area" means an area or areas designated by a local government where:
>
> (a) Public services such as water and wastewater, transportation, schools, and recreation are already available or are scheduled to be provided in an adopted 5-year schedule of capital improvements;

(b) The area, or one or more neighborhoods within the area, suffers from pervasive poverty, unemployment, and general distress as defined by s. 290.0058;

(c) The area exhibits a proportion of properties that are substandard, overcrowded, dilapidated, vacant or abandoned, or functionally obsolete which is higher than the average for the local government;

(d) More than 50 percent of the area is within 1/4 mile of a transit stop, or a sufficient number of such transit stops will be made available concurrent with the designation; and

(e) The area includes or is adjacent to community redevelopment areas, brown fields, enterprise zones, or Main Street programs, or has been designated by the state or Federal Government as an urban redevelopment, revitalization, or infill area under empowerment zone, enterprise community, or Brownfield showcase community programs or similar programs.

In addition, Florida administrative codes supply clear examples for the specification of threshold limits of 'floor' density levels for both residential and nonresidential development appropriate to Urban Infill designations.

VACANT LAND AND DENSITY AND INTENSITY REQUIREMENTS

Florida Administrative Code 9J-5.0055 Section (6) sets forth the following requirements:

If an area is delineated for urban infill development in the comprehensive plan, it must meet the following vacant land and density and intensity requirements:

- The area cannot contain more than 10 percent vacant developable land. This vacant developable land must exclude water bodies, land designated for conservation, public rights-of-way, public recreation and any other land designated in the local government's comprehensive plan as unavailable for development.

- For areas where residential land uses compose at least 60 percent of the developed land, the average residential density shall be at least five dwelling units per acre.

- For areas where nonresidential land uses compose at least 60 percent of the developed land, the average nonresidential density shall be at least a FAR of 1.0 per gross nonresidentially developed acre of land.

- If neither residential nor nonresidential uses compose more than 60 percent of the developed land, both must meet the density and intensity criteria prescribed above.

II. SUGGESTED (PRELIMINARY) URBAN INFILL AREA CRITERIA

The Project Team has a general consensus that the criteria used in defining "Urban Infill Areas" should be quantitative in nature, be applicable to other studies, and have potential application to future development patterns, i.e., to projected as well as existing urbanized areas. , EPS prepared a set of initial working criteria of "Urban Infill Areas" which combined and revised the components indicated above for further discussion and refinement by the Project Team and the Technical Advisory Committee (TAC). The initial criteria were reviewed by the TAC, and refined and finalized in collaboration with its members. As agreed upon by the TAC at its December 20th, 2005 teleconference, the following criteria will be used to select study sites:

1) An Urban Infill Area (UIA) designation may be applied to any site located either:
   a) within a **CBD**, **CND** or **SBC Area**, as defined by the ITE for data collection surveys; or alternatively,
   b) within a **General Urban (T/CZ-4)**, **Urban Center (T/CZ-5)**, or **Urban Core (T/CZ-6) Zone**, as defined in the Proposed Recommended Practice for Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities estimated to be published in February 2006 (Appendix E provides characteristics of these context zones),

   which **also** meets all of the other criteria defined immediately below.

2) The UIA must be within 1/3 mile of a site with an existing or future rail transit station, a ferry terminal served by either a bus or rail transit service, an intersection of at least two major bus routes, or within 300 feet of a bus rapid transit corridor. The transit service shall have maximum scheduled headways of 15 minutes for at least 5 hours per day.

3) The UIA can contain no more than 10 percent Vacant Developable Land. Vacant Developable Land as defined excludes water bodies, public rights-of-way, land designated for conservation and public recreation, and any other land designated by local governments' policies or comprehensive plans as unavailable for development. Parking lots on land designated and/or zoned as developable under current policy qualify as Vacant Developable Land.

4) Where residential land uses comprise at least 60 percent of developed land, average residential density shall be at least 10.0 dwelling units per gross acre of residentially developed land.

5) Where nonresidential land uses comprise at least 60 percent of developed land, average nonresidential density shall be a FAR of at least 1.0 and/or an employment density of at least [35.0] per gross acre of nonresidential developed land.

6) Where neither residential nor nonresidential uses comprise more than [60] percent of developed land, both residential and nonresidential uses must meet the density and intensity criteria prescribed above.

All six criteria are proposed for practical application by this Study's researchers in identifying and documenting UIAs. However, it is possible and even likely that traffic engineers and other practitioners seeking to apply the urban infill trip rates developed during this and other studies will want and need fewer and simpler criteria. UIA Criteria **1** and **2,** which require compliance with widely recognized thresholds for urban development and transit access and levels of service, may be sufficient for many future users and applications. The practical need for the more restrictive UIA Criteria **4** through **6** in future applications will be evaluated as the Study progresses to site selection, survey and analysis.

The final criteria have been made as simple and as clear as possible, to encourage appropriate and accurate application of resulting survey data and derived trip generation rates. At the same time, the final criteria are intended as definitive and unambiguous, to prevent uncertainty in determining whether specific sites do or do not qualify as "urban infill" development.

In collaboration with the TAC, the Project Team may subsequently include or substitute specific qualitative attributes as complements and/or replacements for one or more of the quantitative criteria. As a practical consideration, the Team and the TAC will understand the crucial equilibrium that must be maintained between flexibility and ease of application on the one hand, and the economic and fiscal pressures that can encourage 'gaming behavior' by urban developers, planners and public works directors on the other.

The choice of trip generation rates can determine the approval or non-approval of proposed urban developments, and frequently determine the nature and scale of required mitigations and traffic impact fees. To the extent specific qualitative attributes are not definitive and unambiguous identifiers of UIAs, and there are potential regulatory and economic benefits to developments proposed as "urban infill", there may be understandable economic pressures on prospective developers to 'push the envelope' and equally understandable fiscal and financial pressures on local jurisdictions to 'constrain the envelope'. It is hoped the end products of this current Study will facilitate the creation of a common basis for analysis and modeling by all parties interested in urban infill developments.

A map-based or GIS approach to identifying candidate UIAs is consistent with current research such as that described in *Using the Internet to Envision Neighborhoods with Transit-Oriented Development Potential* , a June 2002 publication of the Mineta Transportation Institute. EPS prototyped a map-based approach to identifying candidate UIAs for this **Working Paper**, using digital map layers and socioeconomic data that are available nationwide from Federal agencies and information centers. The following section presents this approach in summary overview; a more detailed explanation of the methodology and sources is provided as **Appendix D**.

Census 2000 definitions of urbanized areas depend upon population density only; this is not an oversight but a known area of weakness that generated much comment and discussion in the run-up to the publication of the actual census counts. Census 2000 Journey-to-Work data, as distributed in the Census Transportation Planning Package (CTPP 2000) Part 2 tables, include both employment-by-industry and -by-occupation estimates down to the census Block Group (BG) level for the entire State of California. The CTPP occupational and industrial categories are shown in **Table 4**. The CTPP employment data, in combination with population and housing counts and geographic information available from Census 2000 Summary Files 1 and 3 (SF1 and SF3), can be used to identify Block Groups that meet proposed Urban Infill Area (UIA) development density threshold criteria.

Using threshold filters to limit Block Group selection to those BGs which had (at the beginning of the year 2000) residential development densities of at least 10 housing units per land acre, **OR**, employment densities of at least 35 jobs per land acre, subsets of 2,325 **OR** 298 BGs (of a possible 22,100 California Block Groups) can be identified, as shown in **Figures 2H and 2E.** If we combine the threshold filters, to select those BGs which have both high-density residential and nonresidential development, with circa 2000 residential development densities of at least 10 housing units per land acre and employment densities of at least 35 jobs per land acre, a subset of 135 BGs is identified, as shown in **Figure 2X.**

A complete listing of these 135 mixed-development Block Groups, including County and Census Place of location, land area, Year 2000 population, housing and worker counts and population and employment densities per gross land acre is provided as **Appendix C Table 1**. The furthest column on the right in this table contains hyperlinks to Google Maps. If the reader is viewing this table on a computer with a web browser and an active internet connection, clicking on the hyperlink for any of the BGs in the table will open the browser and show a high-resolution aerial/satellite and road map view of the BG's urban context. Using the Google Maps search tools, the reader can easily 'bring up' many of the land uses being considered for trip-generation analysis.

The adopted density criteria or filter values (Block Groups having 10 or more housing units per land acre or 35 or more jobs per land acre in the year 2000) were chosen in a collaborative effort among Project Team members and the TAC. Many alternative threshold densities are suggested in the planning literature, however.

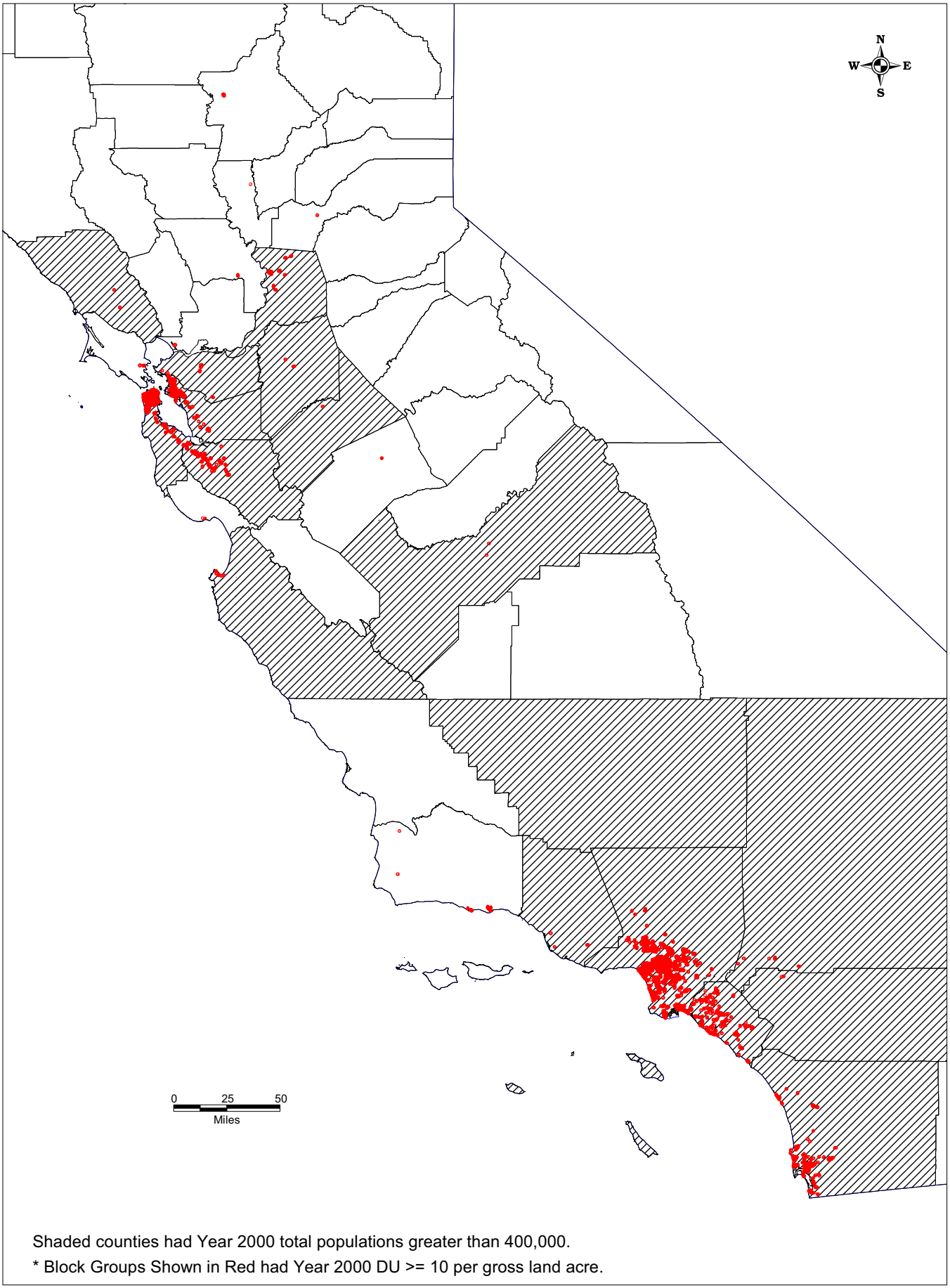
Table 4
Census 2000 Occupation and Industry Categories
Selection of Urban Infill Study Sites, EPS #14002

Occupation Code	Occupation
1	Total Occupation
2	Management
3	Farmers and farm managers
4	Business and financial operations specialists
5	Computer and mathematical
6	Architecture and engineering
7	Life, physical, and social science
8	Community and social service
9	Legal
10	Education, training, and library
11	Arts, design, entertainment, sports, and media
12	Healthcare practitioners and technicians
13	Healthcare support
14	Protective service
15	Food preparation and serving related
16	Building and grounds cleaning and maintenance
17	Personal care and service
18	Sales and related
19	Office and administrative support
20	Farming, fishing, and forestry
21	Construction and excavation
22	Installation, maintenance, and repair
23	Production
24	Transportation and material moving
25	Armed Forces

Industry Code	Industry
1	Total Industry
2	Agriculture, forestry, fishing and hunting, and mining
3	Construction
4	Manufacturing
5	Wholesale trade
6	Retail trade
7	Transportation and warehousing, and utilities
8	Information
9	Finance, insurance, real estate and rental and leasing
10	Professional, scientific, management, administrative, and waste management services
11	Educational, health and social services
12	Arts, entertainment, recreation, accommodation and food services
13	Other services (except public administration)
14	Public administration
15	Armed forces

Source: U.S. Bureau of the Census, CTPP 2000 Documentation

Figure 2H:
Block Groups with High Residential Densities* in 2000

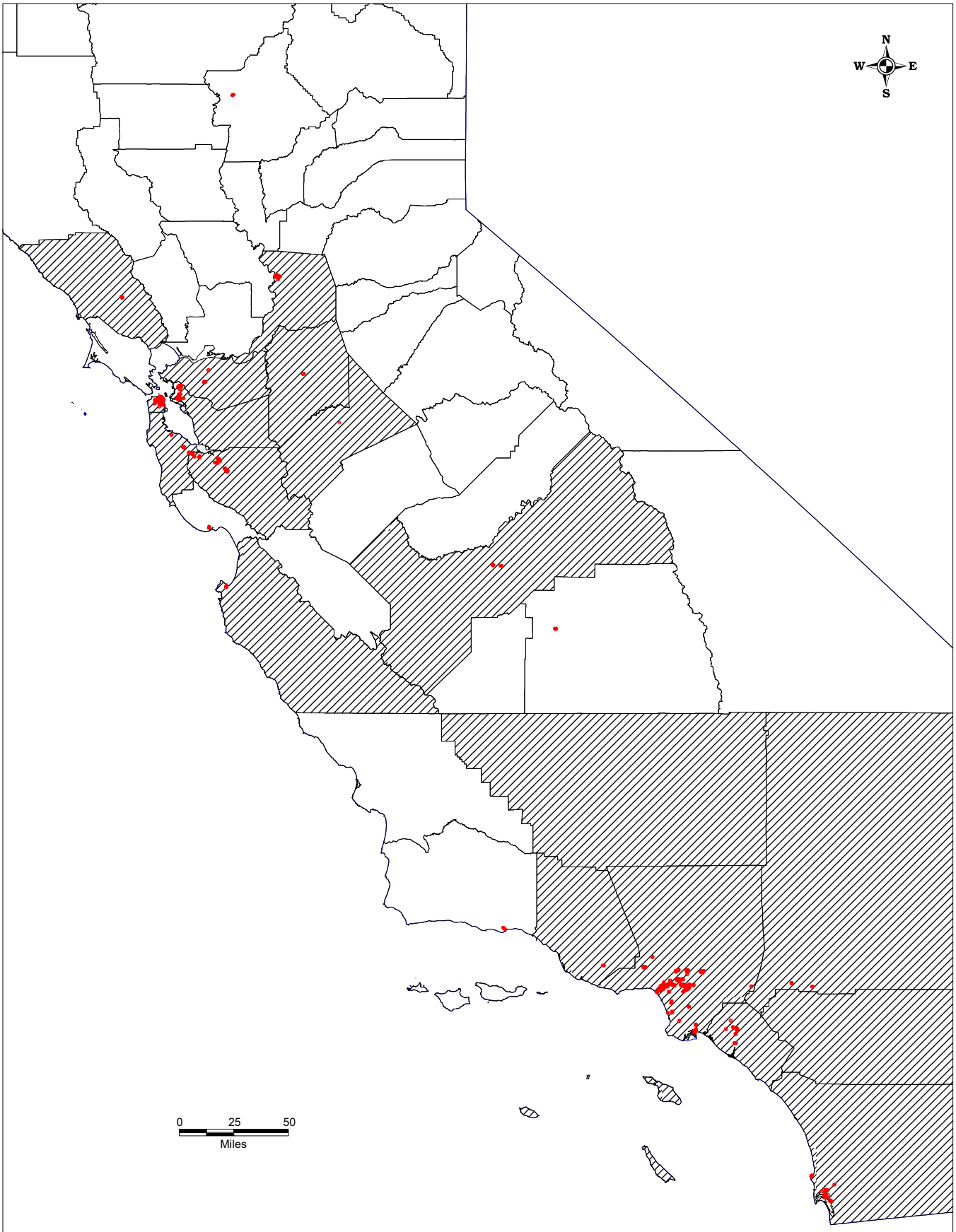


Shaded counties had Year 2000 total populations greater than 400,000.

* Block Groups Shown in Red had Year 2000 DU >= 10 per gross land acre.

Economic & Planning Systems, Inc. *P:\14000s\14002abag_infil\Maps\MapInfo\Fig_WRKP_1_02H.wor*

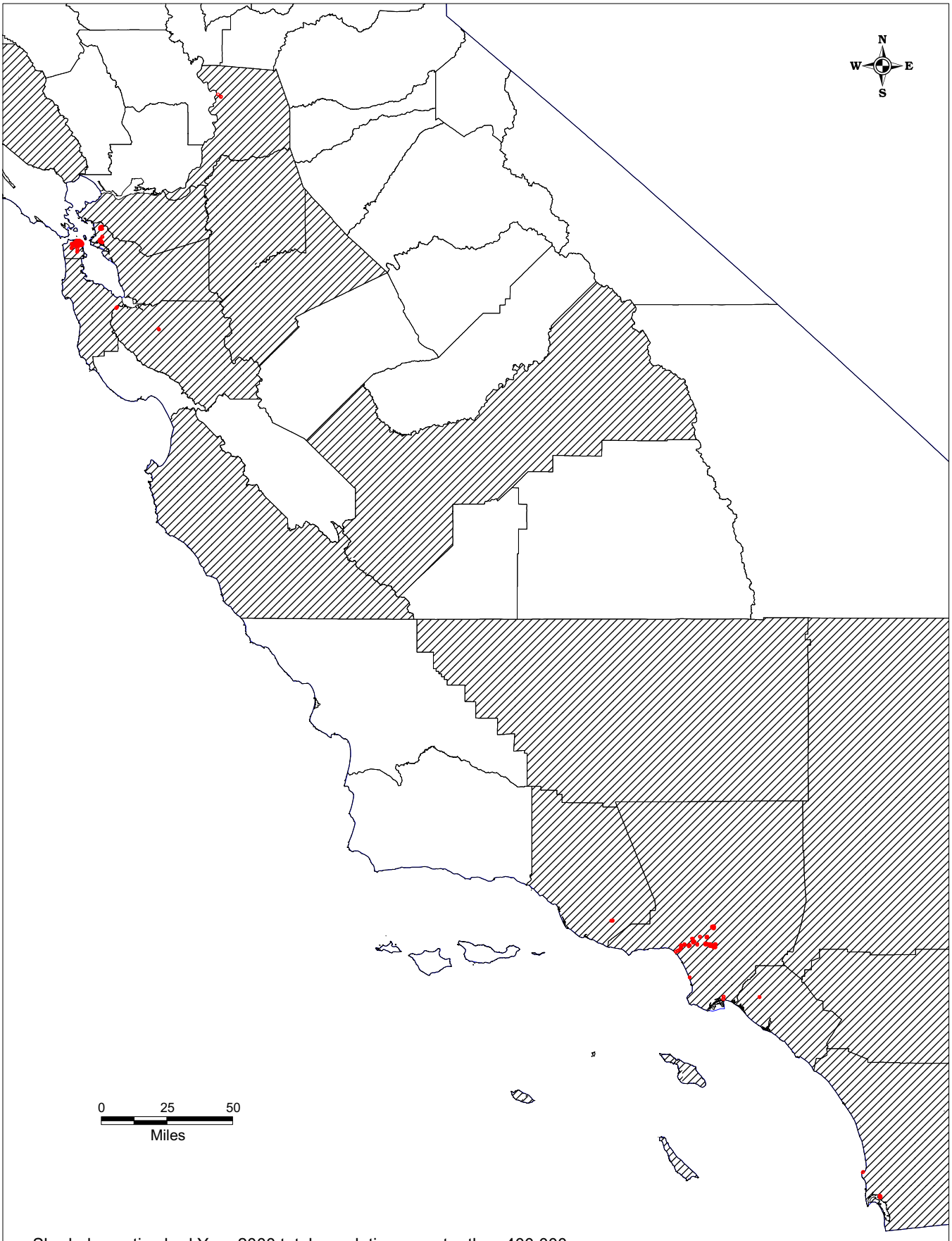
Figure 2E:
Block Groups with High Employment Densities* in 2000



Shaded counties had Year 2000 total populations greater than 400,000.

* Block Groups Shown in Red had Year 2000 Workers >= 35 per gross land acre.

Figure 2X:
Block Groups with both High Residential and Employment Densities* in 2000



Shaded counties had Year 2000 total populations greater than 400,000.

* Block Groups Shown in Red had Year 2000 DU >= 10 per gross land acre & Workers >= 35 per gross land acre.

As a sensitivity test, EPS calculated the number of California BGs meeting the following ranges of combined residential and employment densities:

>=	12	DU	and	>=	50	Jobs	per acre	-	64	Block Groups
>=	9	DU	and	>=	37.5	Jobs	per acre	-	68	Block Groups
>=	6	DU	and	>=	25	Jobs	per acre	-	152	Block Groups
>=	5	DU	and	>=	20	Jobs	per acre	-	125	Block Groups
>=	4	DU	and	>=	15	Jobs	per acre	-	219	Block Groups
>=	3	DU	and	>=	10	Jobs	per acre	-	714	Block Groups

Figure 3 is a thematic map of San Francisco and the nearby North, East, and South Bay areas, displaying by color variation the BGs that meet the six alternatives tabulated above.

The proximity of selected BGs of interest to active transit lines and transit stops/stations can be determined using readily available GIS resources. EPS obtained digital map layers of California fixed-route bus services from an online site hosted by the Moakley Center Geographics Laboratory of Bridgewater State College. Fixed-rail transit route and station spatial data for California were obtained from the National Transportation Atlas Databases 2005.

The California bus and rail transit layers described immediately above were combined with the Block Groups in the vicinity of San Francisco and the East Bay selected by the preliminary threshold filters as shown in **Figure 4. Equivalent selection of Block Groups was performed and working maps were prepared for the** Stockton, Sacramento, Los Angeles, and San Diego areas.

Collectively, the Census and other Federal Agency data and GIS components described above and in **Appendix D** can support alternative quantitative criteria for UIA selection.

Figure 3: Sensitivity Test of Development Densities for Potential Urban Infill Surveys - San Francisco/East Bay Focus

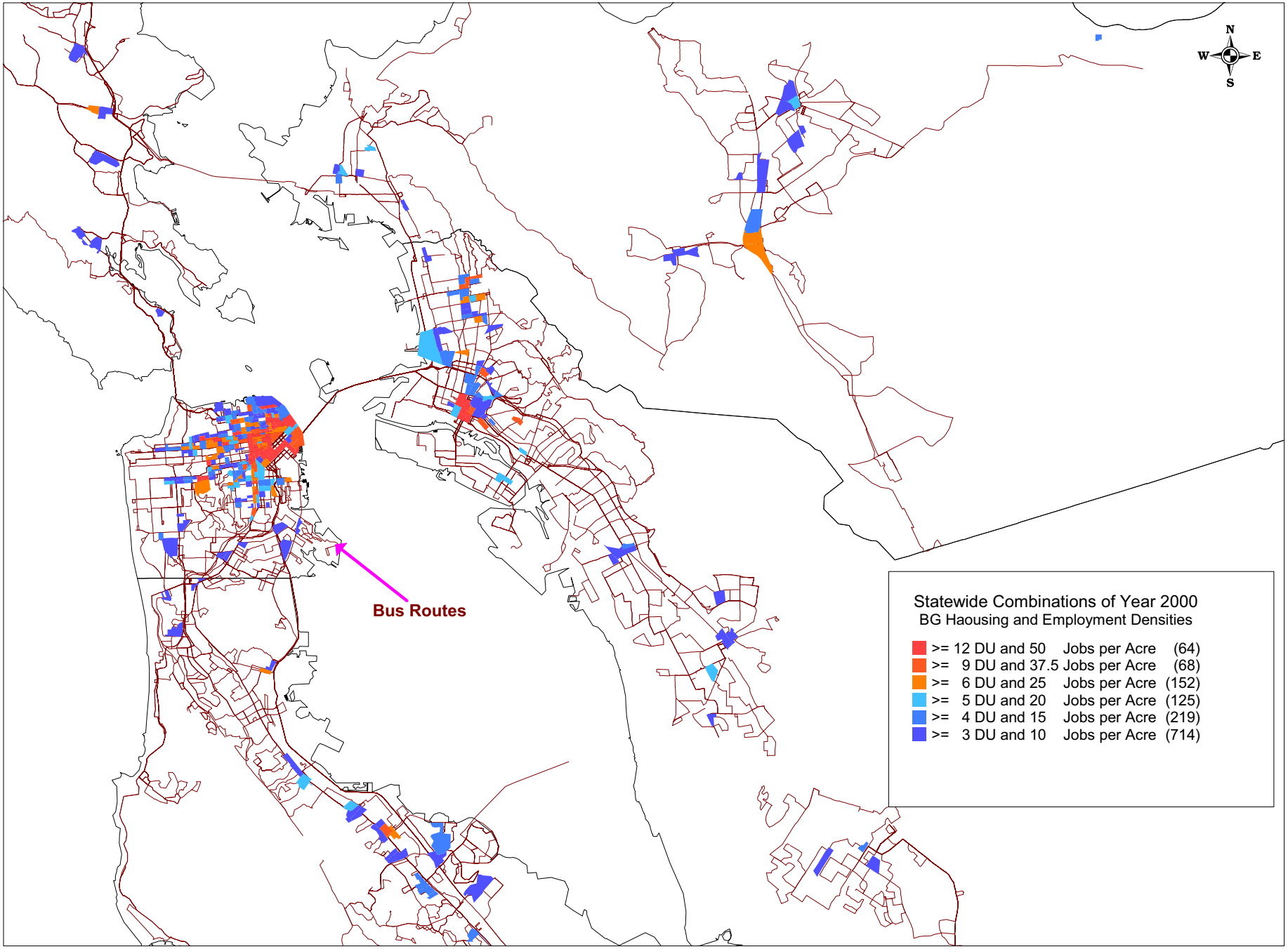
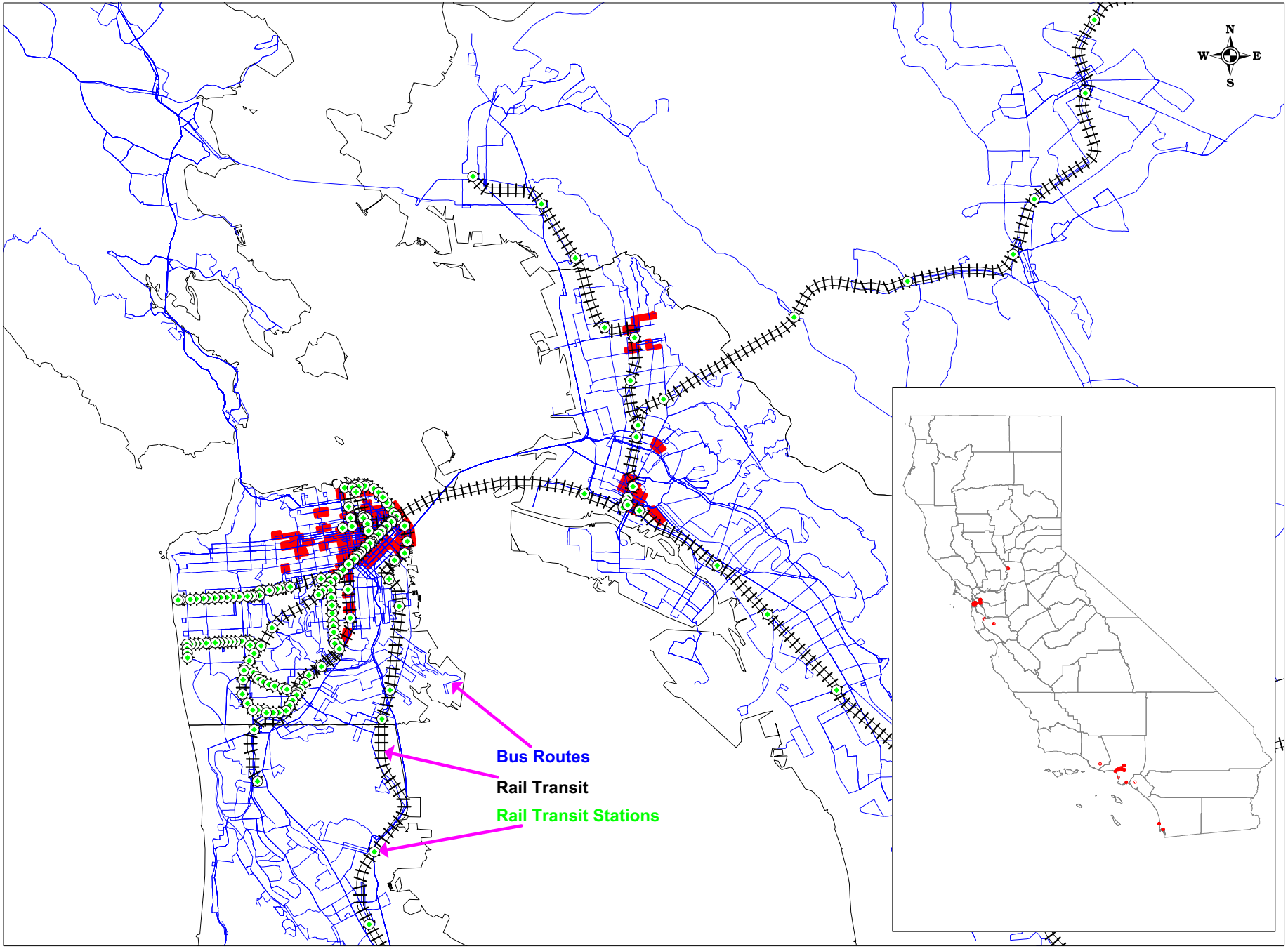


Figure 4: Preliminary Selection* of Block Groups for Potential Urban Infill Surveys - San Francisco/East Bay Focus



*** Block Groups Shown in Red had Year 2000 DU >= 10 per gross land acre & workers >= 35 per gross land acre.**

Economic & Planning Systems, Inc. *P:\14000s\14002abag_infil\Maps\MapInfo\Fig_WRKP_1_04new.wor*

III. RECOMMENDED URBAN INFILL LAND USES

In parallel with the identification of the appropriate small-area 'neighborhoods' or zones within which Urban Infill development conditions pertain, is the need to define appropriate land use types for selecting representative infill sites.

The Project Team began the land-use selection effort with the following criteria::

1) Common urban land use types that are consistent with ITE categories (*Trip Generation* [7th ed.]) and generally reflect a range of uses within residential, office and retail (including entertainment) categories.

2) Land use types for which there is a demand for empirical trip generation data (this would be based on professional knowledge and any information ITE can provide).

3) Land use types for which there is a reasonable propensity for shifting drivers to another mode if the use is located in an urban area. For example, it may be unlikely that patrons would shift from autos to transit or walking if a grocery store is located in an urban area versus a suburban area.

4) Land use types that are considered beneficial to the revitalization of urban areas, but for which current trip generation data may act as a barrier to development approval. These may include types that are considered transit oriented, high-density residential, and urban retail uses.

Because parking availability and costs are often of crucial importance to the trips and trip types generated by urban infill sites, consideration in choosing candidate uses was also suggested for those types already represented in ITE's *Parking Generation* (3rd ed.).

The recent 3rd edition of *Parking Generation* includes data representing 91 of the ITE-defined land uses. These are all indicated in **Table 5**, as line items in bold font.

The Project Team selected a preliminary list of 20 land uses for discussion as appropriate candidates for infill trip generation surveys. Preference was given in the initial selection to higher-density residential types, and to nonresidential land uses that are of recurring interest in infill development impact analyses and in application of ITE standards to local transportation demand models. Most, but not all, of the uses in the initial list were among the 91 types represented in the 3rd edition of *Parking Generation.*

The initial candidates were:

ITE LU Code	ITE Land Use Type
221	Low-Rise Apartment
222	High-Rise Apartment
230	Residential Condominium/Townhouse
310	Hotel
444	Movie Theater with Matinee
445	Multiplex Movie Theater
492	Health/Fitness Club
565	Day Care Center
595	Convention Center
710	General Office Building
720	Medical-Dental Office Building
814	Specialty Retail Center
820	Shopping Center
851	Convenience Market (open 24 hours)
880	Pharmacy/Drugstore without Drive-Through Window
896	Video Rental Store
931	Quality Restaurant.
932	High-Turnover (Sit-Down) Restaurant
934	Fast-Food Restaurant with Drive-Through Window
960	Dry Cleaners

This preliminary list has subsequently been reviewed and discussed with the TAC, and a revised list of ten land uses are now recommended for study. These are, in order by ITE land use code:

ITE LU Code	ITE Land Use Type
223	Mid-Rise Apartment
230	Residential Condominium/Townhouse (midsize)
232	High-Rise Residential Condominium/Townhouse
445	Multiplex Movie Theater
492	Health/Fitness Club
565	Day Care Center
710	General Office Building
820	Shopping Center
850	Supermarket
932	High-Turnover (Sit-Down) Restaurant

Table 5
ITE Land Use Types, with Preliminary Selection of Candidates for Urban Infill Site Surveys
Selection of Urban Infill Study Sites, EPS #14002

ITE Trip Generation (7th ed.) Land Use (LU) Group	ITE LU Code	ITE Land Use Type	Land Use Represented in ITE Parking Generation (3rd ed.)	Preliminary Selection of Candidate LU Types for Urban Infill Site Surveys	Final Candidate Flag
Portand Terminal (Land Uses 000-099)	10	Waterport/Marine Terminal			
Portand Terminal (Land Uses 000-099)	**21**	**Commercial Airport.**	**T**		
Portand Terminal (Land Uses 000-099)	22	General Aviation Airport.			
Portand Terminal (Land Uses 000-099)	30	Truck Terminal.			
Portand Terminal (Land Uses 000-099)	90	Park-and-Ride Lot with Bus Service.			
Portand Terminal (Land Uses 000-099)	**93**	**Light Rail Transit Station with Parking**	**T**		
Industrial/Agricultural (Land Uses 100-199)	**110**	**General Light Industrial.**	**T**		
Industrial/Agricultural (Land Uses 100-199)	120	General Heavy Industrial.			
Industrial/Agricultural (Land Uses 100-199)	**130**	**Industrial Park**	**T**		
Industrial/Agricultural (Land Uses 100-199)	**140**	**Manufacturing**	**T**		
Industrial/Agricultural (Land Uses 100-199)	**150**	**Warehousing**	**T**		
Industrial/Agricultural (Land Uses 100-199)	**151**	**Mini-Warehouse.**	**T**		
Industrial/Agricultural (Land Uses 100-199)	152	High-Cube Warehouse			
Industrial/Agricultural (Land Uses 100-199)	170	Utilities			
Residential (Land Uses 200-299)	**210**	**Single-Family Detached Housing.**	**T**		
Residential (Land Uses 200-299)	220	Apartment			
Residential (Land Uses 200-299)	**221**	**Low-Rise Apartment.**	**T**	**T**	
Residential (Land Uses 200-299)	**222**	**High-Rise Apartment**	**T**	**T**	
Residential (Land Uses 200-299)	223	Mid-Rise Apartment.			T
Residential (Land Uses 200-299)	**224**	**Rental Townhouse.**	**T**		
Residential (Land Uses 200-299)	**230**	**Residential Condominium/Townhouse**	**T**	**T**	**T**
Residential (Land Uses 200-299)	231	Low-Rise Residential Condominium/Townhouse.			
Residential (Land Uses 200-299)	232	High-Rise Residential Condominium/Townhouse			T
Residential (Land Uses 200-299)	233	Luxury Condominium/Townhouse.			
Residential (Land Uses 200-299)	240	Mobile Home Park.			
Residential (Land Uses 200-299)	251	Senior Housing--Detached.			
Residential (Land Uses 200-299)	**252**	**Senior Housing--Attached.**	**T**		
Residential (Land Uses 200-299)	**253**	**Congregate Care Facility.**	**T**		
Residential (Land Uses 200-299)	**254**	**Assisted Living**	**T**		
Residential (Land Uses 200-299)	**255**	**Continuing Care Retirement Community (CCRC)**	**T**		
Residential (Land Uses 200-299)	260	Recreational Homes.			
Residential (Land Uses 200-299)	270	Residential Planned Unit Development (PUD).			
Lodging (Land Uses 300-399)	**310**	**Hotel**	**T**	**T**	
Lodging (Land Uses 300-399)	**311**	**All Suites Hotel.**	**T**		
Lodging (Land Uses 300-399)	**312**	**Business Hotel.**	**T**		
Lodging (Land Uses 300-399)	**320**	**Motel**	**T**		
Lodging (Land Uses 300-399)	**330**	**Resort Hotel.**	**T**		
Recreational (Land Uses 400-499)	**411**	**City Park**	**T**		
Recreational (Land Uses 400-499)	412	County Park			
Recreational (Land Uses 400-499)	413	State Park.			
Recreational (Land Uses 400-499)	**414**	**Water Slide Park.**	**T**		
Recreational (Land Uses 400-499)	415	Beach Park.			
Recreational (Land Uses 400-499)	416	Campground/Recreational Vehicle Park.			
Recreational (Land Uses 400-499)	417	Regional Park			
Recreational (Land Uses 400-499)	418	National Monument			
Recreational (Land Uses 400-499)	**420**	**Marina.**	**T**		
Recreational (Land Uses 400-499)	**430**	**Golf Course**	**T**		
Recreational (Land Uses 400-499)	431	Miniature Golf Course			
Recreational (Land Uses 400-499)	432	Golf Driving Range.			
Recreational (Land Uses 400-499)	433	Batting Cages			
Recreational (Land Uses 400-499)	**435**	**Multipurpose Recreational Facility.**	**T**		
Recreational (Land Uses 400-499)	**437**	**Bowling Alley**	**T**		
Recreational (Land Uses 400-499)	**438**	**Billiard Hall**	**T**		
Recreational (Land Uses 400-499)	**440**	**Adult Cabaret**	**T**		
Recreational (Land Uses 400-499)	**441**	**Live Theater.**	**T**		

Table 5
ITE Land Use Types, with Preliminary Selection of Candidates for Urban Infill Site Surveys
Selection of Urban Infill Study Sites, EPS #14002

ITE Trip Generation (7th ed.) Land Use (LU) Group	ITE LU Code	ITE Land Use Type	Land Use Represented in ITE Parking Generation (3rd ed.)	Preliminary Selection of Candidate LU Types for Urban Infill Site Surveys	Final Candidate Flag
Recreational (Land Uses 400-499)	443	Movie Theater without Matinee			
Recreational (Land Uses 400-499)	**444**	**Movie Theater with Matinee.**	**T**	**T**	
Recreational (Land Uses 400-499)	445	Multiplex Movie Theater		T	T
Recreational (Land Uses 400-499)	452	Horse Racetrack			
Recreational (Land Uses 400-499)	453	Automobile Racetrack.			
Recreational (Land Uses 400-499)	454	Dog Racetrack			
Recreational (Land Uses 400-499)	460	Arena			
Recreational (Land Uses 400-499)	**464**	**Roller Skating Rink**	**T**		
Recreational (Land Uses 400-499)	**465**	**Ice Skating Rink.**	**T**		
Recreational (Land Uses 400-499)	**466**	**Snow Ski Area**	**T**		
Recreational (Land Uses 400-499)	**473**	**Casino/Video Lottery Establishment.**	**T**		
Recreational (Land Uses 400-499)	480	Amusement Park.			
Recreational (Land Uses 400-499)	481	Zoo			
Recreational (Land Uses 400-499)	488	Soccer Complex.			
Recreational (Land Uses 400-499)	**490**	**Tennis Courts**	**T**		
Recreational (Land Uses 400-499)	**491**	**Racquet/Tennis Club**	**T**		
Recreational (Land Uses 400-499)	**492**	**Health/Fitness Club**	**T**	**T**	**T**
Recreational (Land Uses 400-499)	**493**	**Athletic Club**	**T**		
Recreational (Land Uses 400-499)	**495**	**Recreational Community Center**	**T**		
Institutional (Land Uses 500-599)	501	Military Base			
Institutional (Land Uses 500-599)	**520**	**Elementary School**	**T**		
Institutional (Land Uses 500-599)	**522**	**Middle School/Junior High School.**	**T**		
Institutional (Land Uses 500-599)	**525**	**School for the Blind**	**T**		
Institutional (Land Uses 500-599)	**530**	**High School**	**T**		
Institutional (Land Uses 500-599)	534	Private School (K-8).			
Institutional (Land Uses 500-599)	536	Private School (K-12)			
Institutional (Land Uses 500-599)	**540**	**Junior/Community College.**	**T**		
Institutional (Land Uses 500-599)	**550**	**University/College.**	**T**		
Institutional (Land Uses 500-599)	**560**	**Church.**	**T**		
Institutional (Land Uses 500-599)	561	Synagogue			
Institutional (Land Uses 500-599)	**565**	**Day Care Center**	**T**	**T**	**T**
Institutional (Land Uses 500-599)	566	Cemetery.			
Institutional (Land Uses 500-599)	571	Prison.			
Institutional (Land Uses 500-599)	**580**	**Museum**	**T**		
Institutional (Land Uses 500-599)	**590**	**Library**	**T**		
Institutional (Land Uses 500-599)	591	Lodge/Fraternal Organization.			
Institutional (Land Uses 500-599)	**595**	**Convention Center**	**T**	**T**	
Medical (Land Uses 600-699)	**610**	**Hospital.**	**T**		
Medical (Land Uses 600-699)	**612**	**Surgery Center**	**T**		
Medical (Land Uses 600-699)	**620**	**Nursing Home.**	**T**		
Medical (Land Uses 600-699)	**630**	**Clinic.**	**T**		
Medical (Land Uses 600-699)	**640**	**Animal Hospital/Veterinary Clinic**	**T**		
Office (Land Uses 700-799)	**710**	**General Office Building**	**T**	**T**	**T**
Office (Land Uses 700-799)	714	Corporate Headquarters Building			
Office (Land Uses 700-799)	715	Single Tenant Office Building			
Office (Land Uses 700-799)	**720**	**Medical-Dental Office Building.**	**T**	**T**	
Office (Land Uses 700-799)	**730**	**Government Office Building.**	**T**		
Office (Land Uses 700-799)	731	State Motor Vehicles Department			
Office (Land Uses 700-799)	**732**	**United States Post Office**	**T**		
Office (Land Uses 700-799)	**733**	**Government Office Complex**	**T**		
Office (Land Uses 700-799)	735	Judicial Complex			
Office (Land Uses 700-799)	750	Office Park			
Office (Land Uses 700-799)	760	Research and Development Center			
Office (Land Uses 700-799)	770	Business Park			
Retail (Land Uses 800-899)	**812**	**Building Materials and Lumber Store**	**T**		

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ITE Trip Generation (7th ed.) Land Use (LU) Group	ITE LU Code	ITE Land Use Type	Land Use Represented in ITE Parking Generation (3rd ed.)	Preliminary Selection of Candidate LU Types for Urban Infill Site Surveys	Final Candidate Flag
Retail (Land Uses 800-899)	813	Free-Standing Discount Superstore			
Retail (Land Uses 800-899)	814	Specialty Retail Center		T	
Retail (Land Uses 800-899)	**815**	**Free-Standing Discount Store.**	**T**		
Retail (Land Uses 800-899)	**816**	**Hardware/Paint Store.**	**T**		
Retail (Land Uses 800-899)	817	Nursery (Garden Center)			
Retail (Land Uses 800-899)	818	Nursery (Wholesale)			
Retail (Land Uses 800-899)	**820**	**Shopping Center**	**T**	**T**	**T**
Retail (Land Uses 800-899)	823	Factory Outlet Center			
Retail (Land Uses 800-899)	841	New Car Sales			
Retail (Land Uses 800-899)	843	Automobile Parts Sales.			
Retail (Land Uses 800-899)	**848**	**Tire Store.**	**T**		
Retail (Land Uses 800-899)	849	Tire Superstore			
Retail (Land Uses 800-899)	850	Supermarket	T		**T**
Retail (Land Uses 800-899)	**851**	**Convenience Market (Open 24 Hours).**	**T**	**T**	
Retail (Land Uses 800-899)	852	Convenience Market (Open 15-16 Hours)			
Retail (Land Uses 800-899)	853	Convenience Market with Gasoline Pumps.			
Retail (Land Uses 800-899)	**854**	**Discount Supermarket.**	**T**		
Retail (Land Uses 800-899)	**857**	**Discount Club**	**T**		
Retail (Land Uses 800-899)	**859**	**Liquor Store**	**T**		
Retail (Land Uses 800-899)	860	Wholesale Market.			
Retail (Land Uses 800-899)	861	Discount Club			
Retail (Land Uses 800-899)	**861**	**Sporting Goods Superstore**	**T**		
Retail (Land Uses 800-899)	**862**	**Home Improvement Superstore**	**T**		
Retail (Land Uses 800-899)	**863**	**Electronics Superstore.**	**T**		
Retail (Land Uses 800-899)	**864**	**Toy/Children's Superstore**	**T**		
Retail (Land Uses 800-899)	865	Baby Superstore			
Retail (Land Uses 800-899)	**866**	**Pet Supply Store.**	**T**		
Retail (Land Uses 800-899)	**867**	**Office Supply Superstore.**	**T**		
Retail (Land Uses 800-899)	**868**	**Book Superstore**	**T**		
Retail (Land Uses 800-899)	869	Discount Home Furnishing Superstore			
Retail (Land Uses 800-899)	**870**	**Apparel Store**	**T**		
Retail (Land Uses 800-899)	879	Arts and Crafts Store			
Retail (Land Uses 800-899)	**880**	**Pharmacy/Drugstore without Drive-Through Window**	**T**	**T**	
Retail (Land Uses 800-899)	**881**	**Pharmacy/Drugstore with Drive-Through Window.**	**T**		
Retail (Land Uses 800-899)	**890**	**Furniture Store**	**T**		
Retail (Land Uses 800-899)	**892**	**Carpet Store**	**T**		
Retail (Land Uses 800-899)	**896**	**Video Rental Store.**	**T**	**T**	
Services (Land Uses 900-999)	**911**	**Walk-in Bank.**	**T**		
Services (Land Uses 900-999)	**912**	**Drive-in Bank**	**T**		
Services (Land Uses 900-999)	**931**	**Quality Restaurant.**	**T**	**T**	
Services (Land Uses 900-999)	**932**	**High-Turnover (Sit-Down) Restaurant**	**T**	**T**	**T**
Services (Land Uses 900-999)	**933**	**Fast-Food Restaurant without Drive-Through Window**	**T**		
Services (Land Uses 900-999)	**934**	**Fast-Food Restaurant with Drive-Through Window.**	**T**	**T**	
Services (Land Uses 900-999)	935	Fast-Food Restaurant with Drive-Through Window and No Indoor Seating.			
Services (Land Uses 900-999)	936	Drinking Place.			
Services (Land Uses 900-999)	941	Quick Lubrication Vehicle Shop.			
Services (Land Uses 900-999)	942	Automobile Care Center.			
Services (Land Uses 900-999)	943	Automobile Parts and Service Center			
Services (Land Uses 900-999)	944	Gasoline/Service Station.			
Services (Land Uses 900-999)	945	Gasoline/Service Station with Convenience Market.			
Services (Land Uses 900-999)	946	Gasoline/Service Station with Convenience Market and Car Wash			
Services (Land Uses 900-999)	947	Self-Service Car Wash			
Services (Land Uses 900-999)	948	Automated Car Wash.			
Services (Land Uses 900-999)	**960**	**Dry Cleaners**	**T**	**T**	

Table 5
ITE Land Use Types, with Preliminary Selection of Candidates for Urban Infill Site Surveys
Selection of Urban Infill Study Sites, EPS #14002

ITE Trip Generation (7th ed.) Land Use (LU) Group	ITE LU Code	ITE Land Use Type	Land Use Represented in ITE Parking Generation (3rd ed.)	Preliminary Selection of Candidate LU Types for Urban Infill Site Surveys	Final Candidate Flag
Total Count			**91**	**20**	**10**
Initial Selection for Review and Comment			**91**	**20**	

Notes: Land Use Classifications from ITE Trip Generation, 7th Ed. and Parking Generation, 3rd Ed.
91 uses represented in Parking Generation, 3rd. Ed. Initial Selection of Candidate Urban Infill Survey Site candidate land uses by EPS; Final Selections made in collaborative effort with Project Team amd TAC.

Sources: ITE Trip Generation (7th ed.) and Parking Generation (3rd ed.); EPS

SUGGESTED (PRELIMINARY) MINIMUM URBAN INFILL SURVEY SITE CRITERIA

The Project Team will need to evaluate and rate specific candidate sites for suitability as representatives of the final selected uses. Review and refinement of specific site selection criteria will be undertaken as part of **Working Paper #2**; to begin the discussion process, however, the following list of minimum criteria has been suggested for all candidate Urban Infill Survey Sites (UISS):

1) The UISS shall be selected on the basis of the ability to obtain accurate trip generation data for the land use under consideration, and to obtain independent variables per ITE trip generation study guidelines.

2) Survey data must be transferable; it is therefore essential that site development characteristics are representative of the land uses to be analyzed. Considerations of transferability pertain to the application of survey data not only to other existing sites, but to new urban infill development.

3) Land uses appropriate for UISS consideration shall be selected as a subset of the uses defined in ITE's *Trip Generation*, 7th ed.

4) The development within the UISS should be mature (at least two years old) and located in a mature development area. Transit service should have been in place for at least two years.

5) There shall be minimal or no on-site construction or adjacent roadway construction at the time of the survey.

6) The UISS shall be at full occupancy (at least 85 percent) and appear to be economically healthy. The precise percent occupancy at survey time is important, and must be recorded.

7) There shall be no potential for "through" trips or other trips within the trip generation counts (such as significant vehicle, transit, truck, or pedestrian trips generated by adjacent sites).

8) The UISS itself shall not be a mixed-use development. This does not preclude selections of study sites located in mixed zoning contexts.

9) The UISS must be capable of isolation for purposes of counting trips (i.e., no shared parking, consolidated driveways, etc). The survey team must develop effective plans for collecting data on prospective UISS with no private parking facilities.

10) Permission shall be obtainable from the owner/manager of the prospective UISS.

This initial list of site criteria was adapted in part from similar site selection criteria suggested by the ITE for the purpose of parking generation studies (see http://www.ite.org/parkgen/datacollection.asp#Site%20Selection).

We note with interest that the above-referenced ITE web site includes the statements "For sites with complex characteristics (TDM, extensive transit use, shared parking, bicycle parking) a separate web-data entry form is being developed (under construction at this time)" and "The web-based data entry form asks questions with pull-down selections about site characteristics that are important for consideration of parking demand (e.g. parking costs, type of surrounding area, etc…)".

We suggest as a follow-on task for the implementation of concepts discussed in this Working Paper that the Project Team discuss with the designated ITE contact, Lisa Fontana Tierney (mailto:lfontana@ite.org) the possibility of including relevant items from the draft ITE complex site criteria in the selection and rating criteria for Urban Infill Survey Sites. As envisioned by the ITE and as applied in site analyses carried out in the United Kingdom (http://www.trics.org/the_system.htm) to maintain the UK-wide TRICS trip generation database, the complex site criteria include both checklist and parametric data entries designed to capture site contextual information (e.g., parking availability and costs, transit accessibility and frequency of service, etc.).

For comparison purposes, we have included the current ITE Basic Site entry form for Parking Demand as **Appendix C Table 2**, and a summary of the TRICS site survey criteria as **Appendix C Table 3.** A complete list of TRICS site, development and trip data collection criteria can be examined at http://www.trics.org/analysis_of_sites.htm# (requires Internet Explorer 4.1 or later).

In advance of the proposed collaboration with ITE, and suggestions on UISS evaluation criteria from the Project Team and the TAC, EPS prepared a brief summary of the literature regarding several elasticity factors that influence travel demand within urban/infill sites. This technical memorandum is attached as **Appendix A**. EPS also prepared an initial short list of possible locales for potential UISS. This list, attached as **Appendix B,** is intended only as a stimulus to further discussion and to point out the potential for selecting UISS in areas which have considerable data available from previous studies.

The preliminary locale listing has a definite bias toward Pedestrian-Oriented- and Transit-Oriented-Development areas, and the field may well be broadened after the Project Team and TAC settle on the current Study's preferred definition of UIAs and selected Land Uses.

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APPENDIX A FOR WORKING PAPER #1

LITERATURE REVIEW ON SITE SELECTION CRITERIA

LITERATURE REVIEW ON SITE SELECTION CRITERIA

This Appendix offers a brief summary of the literature regarding several factors that may influence travel demand within urban infill sites. This information was offered to the Team as part of our start-up effort to measure trip generation for specific land uses located in such areas and to provide guidelines for evaluating travel demand and related travel demand management measures. This Appendix introduced and described several candidate criteria at a concept level for the consideration of the Team. The Team amended, edited and refined the list of potential criteria as part of the preparation of **Working Paper #1.**

The literature describing recent studies of trip generation/trip reduction factors and VMT/VT elasticity measures appropriate to urban infill land uses frequently emphasize the importance of characterizing and quantifying sites' external settings (contexts) as well as defining their intrinsic (onsite) attributes. There is much discussion of the development diversity and residential and employment densities and thresholds that distinguish 'urban' and 'infill' contexts from suburban development. There are also many references to transit parking proximity (distance), accessibility, and availability factors that appear to significantly impact trip generation rates for urban and infill uses.

Such contextual measures are being applied in current practice as elasticity factors, to provide reproducible and quantifiable methods for adjusting established ITE trip generation rates to urban high-density development sites, mixed-use sites, and transit- and pedestrian-oriented- development sites. For the new Infill/Trip Generation Study now underway, EPS suggests the Team undertake a systematic translation of selected contextual qualifiers and elasticity measures into appropriate urban infill site selection and evaluation criteria. The choice of appropriate contextual criteria will be guided by relevance, clarity of definition, and ease of measurement/evaluation.

This initial list of proposed criteria were gleaned from the studies identified in the References citations distributed to the Team in hard-copy and CD-ROM format by EPS, and from readings in the Online TDM Encyclopedia, a hypertext resource created and actively maintained by the Victoria Transport Policy Institute of British Columbia, Canada: http://www.vtpi.org/tdm/. The Online TDM Encyclopedia draws heavily on U.S. as well as Canadian and international transportation agencies and organizations, assembling and summarizing current and recent research being performed by governmental, private and academic practitioners.

Among the major contextual trip reduction and urban infill elasticity measures that appear repeatedly in the literature are:

- Density
- Clustering of Complimentary Mixed Uses
- Diversity
- Pedestrian-Oriented Design Index
- Parking Accessibility

- Transit Accessibility
- Transit Availability Index

For each of these potential site selection and evaluation criteria, this Appendix provides a concept definition, a formulaic/parametric definition (where available), and quantified ranges and thresholds relevant to the selection and ranking of potential urban infill study site candidates using the proposed criterion.

DENSITY

Definition: Population and/or Jobs within a given area or per unit area.

Formula: [(Population + Employment) per Square Mile]

Relevant Ranges and Thresholds:

URBAN CONTEXT:
- **Urban Area** >= 10 square miles
- **Population** >= 50,000 in contiguous urban area
- **Jobs** >= 50,000 in contiguous urban area
- **Job Density** >= at least 30-50 per gross acre

AUTOMOTIVE TRAVEL CONTEXT:
- **Jobs accessible by car within 30 minutes drive time** >= 100,000

TOD/POD CONTEXT:
- **Jobs** >= 15,000 within 1 to 12 miles of transit center
- **Jobs accessible by transit within 30 minutes commute time** >= 105,000

SITE-SPECIFIC LAND USE DENSITY THRESHOLDS:
- **Residential SF Attached and Detached Density** =15-24 DU per gross acre
- **Residential MF Density** >= 24 DU per gross acre
- **Office FAR** >= .5 FAR
- **Commercial FAR** >= .35 FAR
- **Urban Commercial Job Density** >= 30 jobs per gross acre
- **Regional Commercial Job Density** >= 30 jobs per gross acre

The detailed thresholds and ranges suggested for Density and the other candidate criteria described in this Appendix are open to adjustment and refinement by the Study Team and the TAC. The concept of operationalized, parametric criteria is vital, however, to the Study's purposes in producing new urban infill trip rates acceptable to the ITE while simultaneously establishing a methodology for consistently identifying, characterizing and ranking 'urban' and 'infill' development contexts relevant to trip

generation. Broad definitions of these contexts, such as those typically used in regional planning and listed below, are too subjective and qualitative to capture and quantify crucial factors impacting VMT VT and non-automotive travel options:

Urbanized Area: A U.S. Bureau of Census-designated area of 50,000 or more inhabitants consisting of a central city or two adjacent cities plus surrounding densely settled territory, but excluding the rural portion of cities.

Infill development: In land-use and transit planning, development of vacant parcels in urbanized or suburbanized areas.

CLUSTERING OF COMPLIMENTARY MIXED USES

Definitions: Land use patterns with common destinations located close together, with good pedestrian conditions that create accessible, multi-modal Centers. Alternately, the degree to which two or more complimentary land uses exist within the same Urban Area (typically, within a one-mile radius or one-square-mile grid cell).

Formula: For one operationalized and parametric approach, see *Wrestling Sprawl to the Ground: Defining and Measuring and Elusive Concept*, by George Galster et al. al, Housing Policy Debate Volume 12, Issue 4, pages 681- 717, Fannie Mae Foundation 2001.

http://www.fanniemaefoundation.org/programs/hpd/pdf/HPD_1204_galster.pdf

Relevant Ranges and Thresholds:

TOD/POD CONTEXT:

- **Clustering within 'walkable' neighborhoods 0.5 - 1.0 miles in diameter (typical pedestrian catchment area for commercial centers and transit stations), an area of 125 to 500 acres**

DIVERSITY

Definition: The ratio of jobs to population in proximity to the site.

Formula: {1 - [ABS(b * population - employment) /
(b * population + employment)]}

where: b = regional employment / regional population

Relevant Ranges and Thresholds:

- **The areas within which local Diversity indices are calculated are recommended to be less than two miles in diameter or less than 2,000 acres in coverage.**

Described in *INDEX ® 4D METHOD:A Quick-Response Method of Estimating Travel Impacts from Land-Use Changes*, Prepared for the U.S. Environmental Protection Agency by Criterion Planners/Engineers and Fehr & Peers Associates, Technical Memorandum October 2001.

PEDESTRIAN-ORIENTED DESIGN INDEX

Definition: A measure of the pedestrian environment, including street grid density, sidewalk completeness, and route directness.

Formula: 0.0195 * street network density + 1.18 * sidewalk completeness + 3.63 * route directness.

Where:
0.0195 = coefficient applied to street network density, expressing the relative weighting of this variable relative to the other variables in the Design Index formula,

street network density = length of street in miles/area of neighborhood in square miles

1.18 = coefficient applied to sidewalk completeness, expressing the relative weighting of this variable relative to the other variables in the Design Index formula,

sidewalk completeness = length of sidewalk/length of public street frontage

3.63 = coefficient applied to route directness, expressing the relative weighting of this variable relative to the other variables in the Design Index formula,

route directness = average airline distance to center/average road distance to center

Relevant Ranges and Thresholds:

- **The areas within which local Design indices are calculated are recommended to be less than two miles in diameter or less than 2,000 acres in coverage.**

Described in *INDEX ® 4D METHOD:A Quick-Response Method of Estimating Travel Impacts from Land-Use Changes*, ibid..

PARKING ACCESSIBILITY

Definition: Walking distance in feet between destination/origin site and parking.

Formula: [Walking Distance in Feet to Available Parking]

Relevant Ranges and Thresholds:

- **Adjacent/Excellent Accessibility** <= 100 feet from parking
- **Short Walk/Good Accessibility** > 100 and <= 800 feet from parking
- **Medium Walk/Fair Accessibility** > 800 and <= 1,200 feet from parking
- **Long Walk/Poor Accessibility** > 1,200 and <= 1,600 feet from parking
- **Effectively Non-Accessible** > 1,600 feet from parking

TRANSIT ACCESSIBILITY

Definition: Distance between destination/origin site and nearest transit node(s).

Formula: [Distance to Transit Node(s)]

Relevant Ranges and Thresholds:

- **Short Walk/Good Pedestrian Accessibility** <= .25 miles from transit.
- **Medium Walk/Fair Pedestrian Accessibility** > .25 miles and <= .5 miles from transit.
- **Long Walk/Poor Pedestrian Accessibility** > .5 miles and <= 1.0 miles from transit.
- **Effectively Non-Accessible By Walking**> 1.0 miles from transit node.
- **Automobile and Bicycle Accessibility** 0 to 12 miles from transit node.

TRANSIT AVAILABILITY

Definition: Transit vehicle seats per hour within ¼-mile (½-mile for rail and ferries) of destination/origin site, averaged over 24 hours).

Formula: [Transit vehicle seats per hour within ¼-mile (½-mile), averaged over 24 hours]

Relevant Ranges and Thresholds:

- **One Bus** ~= 50 transit seats.

There are more elaborate measures of transit availability, such as the LITA index summarized below, but their complexity/difficulty/expense of calculation may place them beyond appropriate application for the immediate study of selected urban infill sites.

LOCAL INDEX OF TRANSIT AVAILABILITY

Definition: For a census tract or TAZ, the average of standardized scores of each of three transit components: capacity, frequency, and service coverage.

Formula: [Capacity score] + [Frequency score] + [Service Coverage score]]

Where:
Capacity = Vehicle Capacity * Route Miles / Total Population
Frequency = Total Daily Transit Vehicles, for transit lines having at least one stop in tract
Service Coverage = Number of Stops or Stations In Tract, by transit line / Sq. Mi. of Land Area

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APPENDIX B FOR WORKING PAPER #1

POSSIBLE LOCALES FOR URBAN SURVEY STUDY SITES

POSSIBLE LOCALES FOR URBAN SURVEY STUDY SITES

Berkeley Bart Station Area, Berkeley, Alameda County

"Emery Station", Emeryville, Alameda County

Fruitvale Transit Village, Oakland, Alameda County

North Pleasanton Improvement District, Alameda County

Pleasant Hill Bart Station Area, Pleasant Hill, Contra Costa County

7th Street/Metro Center, Los Angeles

Hollywood/Highland, Los Angeles

'Noho' (North Hollywood) Arts District, Los Angeles

Pacific Court, Long Beach, Los Angeles

American Plaza, San Diego, San Diego County

Rio Vista West, San Diego, San Diego County

Uptown District, San Diego, San Diego County

Mission Street Corridor, San Francisco County

CityPark/Metro Center Project Area, Foster City, San Mateo County

Moffett Park, Sunnyvale, Santa Clara County

Ohlone-Chynoweth, San Jose, Santa Clara County

Cotati CoHousing Development, Cotati, Sonoma County

Aspen Neighborhood, West Davis, Yolo County

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APPENDIX C FOR WORKING PAPER #1

ADDITIONAL TECHNICAL BACKGROUND

Appendix C Table 1
Block Groups with both High Residential and Employment Densities* in 2000
Selection of Urban Infill Study Sites, EPS #14002

STFID	County	Census Designated Place	CDP Type	Tract	Block Group	2000 Total Pop.	2000 Housing Units	2000 Workers (POW)	Land Acres	2000 Pop. / Sq. Mile	2000 Pop. / Acre	2000 HU / Acre	2000 Workers per Acre	Google Maps Link
060014224001	Alameda	Berkeley	city	422400	1	1,457	963	1,870	44.990	20,726.2	32.4	21.4	41.6	060014224001
060014224002	Alameda	Berkeley	city	422400	2	888	514	1,410	30.609	18,566.9	29.0	16.8	46.1	060014224002
060014225001	Alameda	Berkeley	city	422500	1	1,066	619	1,800	40.560	16,820.5	26.3	15.3	44.4	060014225001
060014228002	Alameda	Berkeley	city	422800	2	3,119	373	1,070	30.495	65,458.3	102.3	12.2	35.1	060014228002
060014229002	Alameda	Berkeley	city	422900	2	1,934	1,170	1,815	50.209	24,652.1	38.5	23.3	36.1	060014229002
060014028001	Alameda	Oakland	city	402800	1	1,910	1,356	6,040	93.706	13,045.1	20.4	14.5	64.5	060014028001
060014029002	Alameda	Oakland	city	402900	2	1,286	919	10,460	65.284	12,607.2	19.7	14.1	160.2	060014029002
060014030001	Alameda	Oakland	city	403000	1	1,484	855	6,550	34.756	27,326.1	42.7	24.6	188.5	060014030001
060014030002	Alameda	Oakland	city	403000	2	1,250	696	2,665	48.269	16,573.7	25.9	14.4	55.2	060014030002
060014033002	Alameda	Oakland	city	403300	2	1,536	605	2,860	42.739	23,001.0	35.9	14.2	66.9	060014033002
060014034002	Alameda	Oakland	city	403400	2	1,329	828	1,190	24.491	34,729.1	54.3	33.8	48.6	060014034002
060014034003	Alameda	Oakland	city	403400	3	1,774	1,215	835	18.767	60,496.6	94.5	64.7	44.5	060014034003
060014040002	Alameda	Oakland	city	404000	2	951	564	3,210	53.002	11,483.4	17.9	10.6	60.6	060014040002
060014060003	Alameda	Oakland	city	406000	3	1,866	765	3,160	64.788	18,433.1	28.8	11.8	48.8	060014060003
060377008002	Los Angeles	Beverly Hills	city	700800	2	2,318	1,297	2,700	70.656	20,996.4	32.8	18.4	38.2	060377008002
060373018002	Los Angeles	Glendale	city	301800	2	2,224	951	4,040	83.227	17,102.1	26.7	11.4	48.5	060373018002
060373018004	Los Angeles	Glendale	city	301800	4	2,001	777	3,765	75.384	16,988.2	26.5	10.3	49.9	060373018004
060373019001	Los Angeles	Glendale	city	301900	1	2,165	1,067	2,935	71.460	19,390.0	30.3	14.9	41.1	060373019001
060373019004	Los Angeles	Glendale	city	301900	4	2,132	993	3,320	45.573	29,940.2	46.8	21.8	72.8	060373019004
060373020025	Los Angeles	Glendale	city	302002	5	1,897	995	2,255	39.477	30,753.8	48.1	25.2	57.1	060373020025
060373022013	Los Angeles	Glendale	city	302201	3	1,101	651	2,975	61.745	11,412.1	17.8	10.5	48.2	060373022013
060375761003	Los Angeles	Long Beach	city	576100	3	747	610	4,365	46.945	10,183.9	15.9	13.0	93.0	060375761003
060375763007	Los Angeles	Long Beach	city	576300	7	1,004	459	2,325	44.396	14,473.3	22.6	10.3	52.4	060375763007
060371901003	Los Angeles	Los Angeles	city	190100	3	1,448	803	2,670	55.161	16,800.3	26.3	14.6	48.4	060371901003
060371912011	Los Angeles	Los Angeles	city	191201	1	2,474	920	4,320	79.620	19,886.3	31.1	11.6	54.3	060371912011
060371912012	Los Angeles	Los Angeles	city	191201	2	2,300	906	2,270	60.295	24,413.2	38.1	15.0	37.6	060371912012
060372062002	Los Angeles	Los Angeles	city	206200	2	1,208	738	2,365	64.181	12,045.9	18.8	11.5	36.8	060372062002
060372062003	Los Angeles	Los Angeles	city	206200	3	2,168	473	1,555	43.933	31,582.5	49.3	10.8	35.4	060372062003
060372063003	Los Angeles	Los Angeles	city	206300	3	3,526	1,075	1,790	43.999	51,288.5	80.1	24.4	40.7	060372063003
060372071002	Los Angeles	Los Angeles	city	207100	2	1,404	696	2,475	59.428	15,120.1	23.6	11.7	41.6	060372071002
060372073001	Los Angeles	Los Angeles	city	207300	1	2,860	2,798	17,625	93.325	19,613.1	30.6	30.0	188.9	060372073001
060372073002	Los Angeles	Los Angeles	city	207300	2	879	840	15,225	79.066	7,115.1	11.1	10.6	192.6	060372073002
060372075002	Los Angeles	Los Angeles	city	207500	2	2,018	1,543	1,630	38.998	33,117.6	51.7	39.6	41.8	060372075002
060372087202	Los Angeles	Los Angeles	city	208720	2	757	293	1,490	18.105	26,760.1	41.8	16.2	82.3	060372087202
060372088002	Los Angeles	Los Angeles	city	208800	2	1,072	603	1,170	23.661	28,996.6	45.3	25.5	49.4	060372088002
060372089032	Los Angeles	Los Angeles	city	208903	2	1,547	459	1,090	25.511	38,810.2	60.6	18.0	42.7	060372089032
060372091022	Los Angeles	Los Angeles	city	209102	2	1,516	572	2,640	23.667	40,994.8	64.1	24.2	111.5	060372091022
060372093002	Los Angeles	Los Angeles	city	209300	2	1,248	516	1,655	39.255	20,346.8	31.8	13.1	42.2	060372093002
060372095201	Los Angeles	Los Angeles	city	209520	1	1,731	665	1,240	33.653	32,919.1	51.4	19.8	36.8	060372095201
060372118023	Los Angeles	Los Angeles	city	211802	3	2,710	1,216	1,975	46.750	37,099.5	58.0	26.0	42.2	060372118023
060372121002	Los Angeles	Los Angeles	city	212100	2	1,214	800	5,760	42.013	18,493.4	28.9	19.0	137.1	060372121002
060372123031	Los Angeles	Los Angeles	city	212303	1	3,154	1,101	2,860	37.631	53,641.5	83.8	29.3	76.0	060372123031
060372123041	Los Angeles	Los Angeles	city	212304	1	2,285	861	2,245	50.522	28,945.8	45.2	17.0	44.4	060372123041

Appendix C Table 1
Block Groups with both High Residential and Employment Densities* in 2000
Selection of Urban Infill Study Sites, EPS #14002

STFID	County	Census Designated Place	CDP Type	Tract	Block Group	2000 Total Pop.	2000 Housing Units	2000 Workers (POW)	Land Acres	2000 Pop. / Sq. Mile	2000 Pop. / Acre	2000 HU / Acre	2000 Workers per Acre	Google Maps Link
060372124101	Los Angeles	Los Angeles	city	212410	1	1,355	545	3,695	22.021	39,379.8	61.5	24.7	167.8	060372124101
060372125001	Los Angeles	Los Angeles	city	212500	1	1,439	516	2,925	50.518	18,230.4	28.5	10.2	57.9	060372125001
060372149001	Los Angeles	Los Angeles	city	214900	1	2,154	1,523	3,545	78.548	17,550.5	27.4	19.4	45.1	060372149001
060372163002	Los Angeles	Los Angeles	city	216300	2	1,284	683	2,815	60.388	13,608.1	21.3	11.3	46.6	060372163002
060372641012	Los Angeles	Los Angeles	city	264101	2	2,293	1,566	1,885	53.432	27,465.0	42.9	29.3	35.3	060372641012
060372643013	Los Angeles	Los Angeles	city	264301	3	1,613	1,076	3,585	34.973	29,517.5	46.1	30.8	102.5	060372643013
060372653012	Los Angeles	Los Angeles	city	265301	2	278	279	1,830	24.154	7,366.0	11.5	11.6	75.8	060372653012
060372655101	Los Angeles	Los Angeles	city	265510	1	2,868	1,717	13,955	77.383	23,719.9	37.1	22.2	180.3	060372655101
060372674022	Los Angeles	Los Angeles	city	267402	2	2,832	1,581	3,120	53.895	33,629.6	52.5	29.3	57.9	060372674022
060372679001	Los Angeles	Los Angeles	city	267900	1	3,250	2,217	8,030	182.064	11,424.6	17.9	12.2	44.1	060372679001
060376209025	Los Angeles	Manhattan Beach	city	620902	5	347	239	940	19.392	11,452.4	17.9	12.3	48.5	060376209025
060377014003	Los Angeles	Santa Monica	city	701400	3	1,559	1,057	1,865	38.987	25,592.0	40.0	27.1	47.8	060377014003
060377015022	Los Angeles	Santa Monica	city	701502	2	1,316	729	1,960	49.588	16,984.6	26.5	14.7	39.5	060377015022
060377017012	Los Angeles	Santa Monica	city	701701	2	1,291	681	3,560	63.685	12,973.8	20.3	10.7	55.9	060377017012
060377005003	Los Angeles	West Hollywood	city	700500	3	1,580	1,218	3,340	63.245	15,988.6	25.0	19.3	52.8	060377005003
060590887011	Orange	Garden Grove	city	088701	1	1,370	370	1,715	34.151	25,674.2	40.1	10.8	50.2	060590887011
060670007001	Sacramento	Sacramento	city	000700	1	2,247	232	2,175	18.246	78,817.5	123.2	12.7	119.2	060670007001
060670013003	Sacramento	Sacramento	city	001300	3	1,215	838	2,135	58.869	13,209.0	20.6	14.2	36.3	060670013003
060730053001	San Diego	San Diego	city	005300	1	739	681	4,150	50.196	9,422.3	14.7	13.6	82.7	060730053001
060730053002	San Diego	San Diego	city	005300	2	1,107	649	4,940	49.430	14,333.1	22.4	13.1	99.9	060730053002
060730053003	San Diego	San Diego	city	005300	3	1,933	545	7,380	41.441	29,852.5	46.6	13.2	178.1	060730053003
060730056001	San Diego	San Diego	city	005600	1	1,045	768	2,295	57.329	11,666.1	18.2	13.4	40.0	060730056001
060730082003	San Diego	San Diego	city	008200	3	547	422	2,165	31.990	10,943.5	17.1	13.2	67.7	060730082003
060750101002	San Francisco	San Francisco	city	010100	2	2,227	1,399	2,955	52.784	27,001.9	42.2	26.5	56.0	060750101002
060750102003	San Francisco	San Francisco	city	010200	3	1,043	787	1,460	30.613	21,804.9	34.1	25.7	47.7	060750102003
060750105002	San Francisco	San Francisco	city	010500	2	1,598	1,409	23,135	87.662	11,666.7	18.2	16.1	263.9	060750105002
060750106002	San Francisco	San Francisco	city	010600	2	1,321	745	1,605	17.471	48,392.4	75.6	42.6	91.9	060750106002
060750106003	San Francisco	San Francisco	city	010600	3	1,497	689	1,215	15.180	63,115.2	98.6	45.4	80.0	060750106003
060750107002	San Francisco	San Francisco	city	010700	2	3,008	1,583	1,140	20.181	95,391.5	149.0	78.4	56.5	060750107002
060750107003	San Francisco	San Francisco	city	010700	3	1,653	923	1,225	14.271	74,131.9	115.8	64.7	85.8	060750107003
060750110001	San Francisco	San Francisco	city	011000	1	868	537	570	15.930	34,872.4	54.5	33.7	35.8	060750110001
060750111001	San Francisco	San Francisco	city	011100	1	2,241	1,208	910	21.587	66,439.1	103.8	56.0	42.2	060750111001
060750111002	San Francisco	San Francisco	city	011100	2	2,280	1,297	915	21.636	67,443.2	105.4	59.9	42.3	060750111002
060750111003	San Francisco	San Francisco	city	011100	3	1,038	532	1,635	15.099	43,998.1	68.7	35.2	108.3	060750111003
060750112003	San Francisco	San Francisco	city	011200	3	829	492	1,160	19.387	27,366.3	42.8	25.4	59.8	060750112003
060750113001	San Francisco	San Francisco	city	011300	1	1,781	695	560	12.210	93,351.7	145.9	56.9	45.9	060750113001
060750113002	San Francisco	San Francisco	city	011300	2	1,483	934	490	13.573	69,928.6	109.3	68.8	36.1	060750113002
060750114001	San Francisco	San Francisco	city	011400	1	1,119	581	470	6.778	105,658.4	165.1	85.7	69.3	060750114001
060750114002	San Francisco	San Francisco	city	011400	2	2,056	1,090	1,205	14.465	90,964.1	142.1	75.4	83.3	060750114002
060750115001	San Francisco	San Francisco	city	011500	1	759	582	14,180	39.419	12,322.9	19.3	14.8	359.7	060750115001
060750117002	San Francisco	San Francisco	city	011700	2	984	734	42,280	72.002	8,746.4	13.7	10.2	587.2	060750117002
060750118001	San Francisco	San Francisco	city	011800	1	1,528	789	3,865	13.663	71,576.2	111.8	57.7	282.9	060750118001
060750119001	San Francisco	San Francisco	city	011900	1	1,620	1,230	1,210	18.670	55,531.5	86.8	65.9	64.8	060750119001

Appendix C Table 1
Block Groups with both High Residential and Employment Densities* in 2000
Selection of Urban Infill Study Sites, EPS #14002

STFID	County	Census Designated Place	CDP Type	Tract	Block Group	2000 Total Pop.	2000 Housing Units	2000 Workers (POW)	Land Acres	2000 Pop. / Sq. Mile	2000 Pop. / Acre	2000 HU / Acre	2000 Workers per Acre	Google Maps Link
060750120001	San Francisco	San Francisco	city	012000	1	1,965	1,516	1,170	15.373	81,806.5	127.8	98.6	76.1	060750120001
060750121001	San Francisco	San Francisco	city	012100	1	2,541	1,886	695	14.875	109,327.5	170.8	126.8	46.7	060750121001
060750121002	San Francisco	San Francisco	city	012100	2	921	619	2,810	15.610	37,760.8	59.0	39.7	180.0	060750121002
060750122003	San Francisco	San Francisco	city	012200	3	2,312	1,363	1,025	22.310	66,324.2	103.6	61.1	45.9	060750122003
060750123001	San Francisco	San Francisco	city	012300	1	3,070	2,622	3,365	22.960	85,576.0	133.7	114.2	146.6	060750123001
060750123002	San Francisco	San Francisco	city	012300	2	3,135	1,829	3,290	22.696	88,405.0	138.1	80.6	145.0	060750123002
060750124002	San Francisco	San Francisco	city	012400	2	2,785	1,350	565	11.705	152,272.4	237.9	115.3	48.3	060750124002
060750124003	San Francisco	San Francisco	city	012400	3	1,220	665	2,075	25.949	30,089.9	47.0	25.6	80.0	060750124003
060750124004	San Francisco	San Francisco	city	012400	4	749	598	10,685	47.971	9,992.7	15.6	12.5	222.7	060750124004
060750124005	San Francisco	San Francisco	city	012400	5	1,567	991	1,270	15.467	64,838.9	101.3	64.1	82.1	060750124005
060750125002	San Francisco	San Francisco	city	012500	2	1,110	958	1,790	14.657	48,466.7	75.7	65.4	122.1	060750125002
060750125003	San Francisco	San Francisco	city	012500	3	2,687	1,169	950	20.724	82,979.5	129.7	56.4	45.8	060750125003
060750130003	San Francisco	San Francisco	city	013000	3	1,031	653	875	22.972	28,724.2	44.9	28.4	38.1	060750130003
060750130004	San Francisco	San Francisco	city	013000	4	975	613	1,045	22.875	27,278.7	42.6	26.8	45.7	060750130004
060750133003	San Francisco	San Francisco	city	013300	3	772	500	930	22.649	21,815.0	34.1	22.1	41.1	060750133003
060750133005	San Francisco	San Francisco	city	013300	5	707	364	1,635	26.200	17,270.4	27.0	13.9	62.4	060750133005
060750135002	San Francisco	San Francisco	city	013500	2	1,381	1,016	3,915	30.994	28,516.7	44.6	32.8	126.3	060750135002
060750151001	San Francisco	San Francisco	city	015100	1	1,626	1,104	1,485	22.333	46,595.9	72.8	49.4	66.5	060750151001
060750151002	San Francisco	San Francisco	city	015100	2	794	680	2,330	21.496	23,640.2	36.9	31.6	108.4	060750151002
060750154001	San Francisco	San Francisco	city	015400	1	732	381	1,415	28.024	16,716.9	26.1	13.6	50.5	060750154001
060750154003	San Francisco	San Francisco	city	015400	3	1,481	789	1,960	53.889	17,588.8	27.5	14.6	36.4	060750154003
060750155001	San Francisco	San Francisco	city	015500	1	1,507	1,115	1,245	30.210	31,925.6	49.9	36.9	41.2	060750155001
060750155003	San Francisco	San Francisco	city	015500	3	807	304	1,940	22.826	22,627.3	35.4	13.3	85.0	060750155003
060750157001	San Francisco	San Francisco	city	015700	1	1,124	638	2,075	59.036	12,185.1	19.0	10.8	35.1	060750157001
060750159002	San Francisco	San Francisco	city	015900	2	2,111	1,203	885	23.103	58,478.3	91.4	52.1	38.3	060750159002
060750160001	San Francisco	San Francisco	city	016000	1	2,026	1,609	2,730	41.060	31,578.9	49.3	39.2	66.5	060750160001
060750162001	San Francisco	San Francisco	city	016200	1	676	451	2,670	29.041	14,897.3	23.3	15.5	91.9	060750162001
060750162002	San Francisco	San Francisco	city	016200	2	896	519	1,970	22.570	25,407.7	39.7	23.0	87.3	060750162002
060750165004	San Francisco	San Francisco	city	016500	4	1,114	482	1,575	23.390	30,481.8	47.6	20.6	67.3	060750165004
060750168001	San Francisco	San Francisco	city	016800	1	816	502	1,345	21.363	24,445.8	38.2	23.5	63.0	060750168001
060750168003	San Francisco	San Francisco	city	016800	3	735	460	885	22.170	21,218.1	33.2	20.7	39.9	060750168003
060750176012	San Francisco	San Francisco	city	017601	2	3,248	1,425	4,750	46.737	44,476.7	69.5	30.5	101.6	060750176012
060750176013	San Francisco	San Francisco	city	017601	3	1,946	1,001	4,545	45.000	27,676.2	43.2	22.2	101.0	060750176013
060750178001	San Francisco	San Francisco	city	017800	1	1,010	799	2,900	25.883	24,974.0	39.0	30.9	112.0	060750178001
060750178002	San Francisco	San Francisco	city	017800	2	1,443	1,049	3,010	26.901	34,330.6	53.6	39.0	111.9	060750178002
060750178003	San Francisco	San Francisco	city	017800	3	2,513	1,040	4,115	77.129	20,852.4	32.6	13.5	53.4	060750178003
060750179011	San Francisco	San Francisco	city	017901	1	1,549	1,130	10,215	95.882	10,339.4	16.2	11.8	106.5	060750179011
060750179012	San Francisco	San Francisco	city	017901	2	2,441	1,419	3,490	75.774	20,617.0	32.2	18.7	46.1	060750179012
060750179013	San Francisco	San Francisco	city	017901	3	1,205	906	13,840	65.364	11,798.6	18.4	13.9	211.7	060750179013
060750201001	San Francisco	San Francisco	city	020100	1	871	513	3,390	48.620	11,465.4	17.9	10.6	69.7	060750201001
060750208001	San Francisco	San Francisco	city	020800	1	1,514	441	890	18.268	53,042.3	82.9	24.1	48.7	060750208001
060750208004	San Francisco	San Francisco	city	020800	4	2,053	747	1,370	28.680	45,813.2	71.6	26.0	47.8	060750208004
060750253004	San Francisco	San Francisco	city	025300	4	1,671	603	1,625	35.427	30,187.3	47.2	17.0	45.9	060750253004
060750301011	San Francisco	San Francisco	city	030101	1	1,390	704	1,195	23.438	37,954.9	59.3	30.0	51.0	060750301011
060750301012	San Francisco	San Francisco	city	030101	2	1,312	595	3,615	25.228	33,283.2	52.0	23.6	143.3	060750301012
060750607003	San Francisco	San Francisco	city	060700	3	333	336	1,790	23.727	8,982.3	14.0	14.2	75.4	060750607003
060855113002	Santa Clara	Palo Alto	city	511300	2	1,375	873	3,150	79.259	11,102.8	17.3	11.0	39.7	060855113002
060855009012	Santa Clara	San Jose	city	500901	2	1,625	912	3,065	82.294	12,637.7	19.7	11.1	37.2	060855009012
061110061002	Ventura	Thousand Oaks	city	006100	2	3,847	1,314	4,670	125.060	19,687.1	30.8	10.5	37.3	061110061002
Totals						**218,272**	**120,244**	**468,080**	**5,621.979**	**24,847.8**	**38.8**	**21.4**	**83.3**	
Minima						**278**	**232**	**470**	**6.778**	**7,115.1**	**11.1**	**10.2**	**35.1**	

Appendix C Table 1
Block Groups with both High Residential and Employment Densities* in 2000
Selection of Urban Infill Study Sites, EPS #14002

STFID	County	Census Designated Place	CDP Type	Tract	Block Group	2000 Total Pop.	2000 Housing Units	2000 Workers (POW)	Land Acres	2000 Pop. / Sq. Mile	2000 Pop. / Acre	2000 HU / Acre	2000 Workers per Acre	Google Maps Link

Notes: * This listing of 135 Block Groups includes all those that had Housing Densities of at least 10.0 units per Land Acre, **AND** (in combination with) Employment Densities of at least 35.0 workers per Land Acre in the Census year 2000.

Within this selection, individual Block Groups had Housing Densities as high as 15.2 units per Land Acre, and Employment Densities as high as 59.8 workers per Land Acre. For the approximately 22,100 Block Groups defined for the 2000 Census, estimated Year 2000 Housing Densities were as high as 159.37 units per Land Acre; Employment Densities as high as 794.05 workers per Land Acre.

Sources: U.S. Bureau of the Census, Census 2000 Summary Files 1 and 3; Bureau of Transportation Statistics, CTPP 2000 Part 2; EPS

Appendix C Table 2
Selection of Urban Infill Study Sites, EPS #14002

Parking Demand Survey Form

Institute of Transportation Engineers

*(fill in all highlighted cells - * are required data)*

		Land Use Code*			
		Name of Site			
		Brief Description of Site			
Transit*					
Area*		**City**			
TMP*		**State**		**Country**	
Parking Price*	$	Daily Rate	$	Hourly Rate	

Site Size*		**Units***		**Occupancy***		**Land Use**
Site Size		**Units**		**Occupancy**		
Site Size		**Units**		**Occupancy**		
Site Size		**Units**		**Occupancy**		

Number of Parking Spaces Provided at Site

Highest Observed Parking Demand for the following hours of the day *(hour beginning)**

Date							
Day							
12 Mid							
1:00 AM							
2:00 AM							
3:00 AM							
4:00 AM							
5:00 AM							
6:00 AM							
7:00 AM							
8:00 AM							
9:00 AM							
10:00 AM							
11:00 AM							
12 Noon							
1:00 PM							
2:00 PM							
3:00 PM							
4:00 PM							
5:00 PM							
6:00 PM							
7:00 PM							
8:00 PM							
9:00 PM							
10:00 PM							
11:00 PM							

Person		**Organization**	
Phone			
Fax			
Email			
Notes			

Enter data on the web at www.ite.org — Comments to: ite_staff@ite.org

IF not entered on web site, please mail to:

Institute of Transportation Engineers, 1099 14th Street, NW Suite 300 West; Washington, DC 20005-3438

Form version 1.4

Appendix C Table 3

Each site within the TRICS system contains data within Site, Development and Survey Day sections. Some items of Development data vary according to which land use category sites are located under; most items are shown below.

SITE DETAILS

Bus (or tram) Site Accessibility:	Information regarding site specific bus services, local bus stops, crossing facilities and frequencies of bus services, with a table showing bus destinations, numbers of services per hour and approximate journey times.
Description and address:	Site type identification and full address of the site, including its postcode.
Design Features Encouraging Non-Car Modes:	Comments sections for any relevant information relating to design features at the site which encourage non-car modes, including pedestrians, pedal cycles, public transport and car parking restraint. A set of guidance notes are listed.
Grid Reference:	10-digit Ordnance Survey grid reference of the site.
Location:	Brief description of the type of area that the site is located in (e.g. Edge of Town, Town Centre, Industrial Zone, etc).
Population & Car Ownership:	Ranges for 1 and 5 miles for population, and 5 miles for car ownership (per household).
Public Transport Comments:	Any relevant comments relating to local public transport, its relevance, quality and importance.
Public Transport Provision:	Range based on the number of buses/trains to the site per day, or to within a reasonable walking distance.
Rail Accessibility:	Information regarding local rail stations, pedestrian access to stations, and frequencies of rail services, with a table showing rail destinations, numbers of services per hour and approximate journey times.
Site Comment:	Any relevant comments relating to the site's location, its accesses and the surrounding area.
Use Class:	Alphanumeric 2-digit code representing land use as in the 1998 Use Classes Order.
Walk-in Catchment (500 metres):	The population within 500 metres radius of the site.
Green Travel Plan:	Whether or not the site is associated with a Green Travel Plan.

DEVELOPMENT DETAILS

Bays (civic amenity land use categories):	The total number of recycling/waste bays at the site.
Bedrooms (hotel land use category):	The total number of bedrooms at the site.
Beds (hospital land use categories):	The total number of beds at the site.
Berths (marina land use category):	The total number of boat berths at the site.
Caravans (non-residential caravan park land use category):	Total number of caravans at the site.
Cashcard Facilities (retail land use categories):	A "Yes" or "No" shown to indicate if cashcard facilities are available at the site.
Courts (tennis club land use category):	The total number of tennis courts at the site.
Development Comments:	Any relevant additional information relating to the site's activities and operating hours, employment patterns, the nature of the buildings at the site and its occupants.
Distance to Nearest Similar Site:	The distance (in kilometres) to a site of a similar nature, in size and land use category.
Doctors (GP surgery land use category):	Total number of doctors that work at the site.
Employees (not all land use categories):	The total number of people employed at the site. Within Employment land use categories, this figure is split between Part Time Employees and Full Time Employees.
Filling Bays (petrol filling station land use categories):	The total number of vehicles that can be refuelled at any one time.
Filling Station (retail land use categories):	A "Yes" or "No" shown to indicate if a petrol filling station is located within the site. A "Yes" means that it was included in the survey count.
Gross Floor Area (not all land use categories):	The total floor area of buildings within the site's boundary (including multi-levels), including storage areas. In some land use categories external areas are also included.
Holes (golf course land use categories):	The total number of golf holes at the site.
Households (residential land use categories):	The total number of residential households at the site
Lanes (bowling alley land use category):	The total number of bowling lanes at the site.
Number of Units (not all land use categories):	The number of building units within the site.

Appendix C Table 3

Off-Site Parking Details (not all land use categories):	There are 2 "Yes" or "No" questions within this section. The first question asks if there is off-site parking available close to the site, and the second question asks whether or not this parking was included in the survey counts.
On-Site Parking Details (not all land use categories):	A total number of vehicle parking spaces within the site, with this figure then broken down into Visitor/Customer, Employee, Disabled, OGV Loading Bays, OGV Parking Spaces, Mother & Toddler spaces and Motorcycle spaces. A figure for the number of cycle racks is also given.
Opening Times (not all land use categories):	The operating hours of the site in 24-hour format, shown separately for Monday-Thursday, Friday, Saturday and Sunday.
Open Since:	Year of site opening.
Parking Charges (not all land use categories):	A "Yes" or "No" shown to indicate if there are charges for parking at the site.
Pitches (5-a-side football land use category):	The total number of football pitches at the site.
Pitches (car boot sale land use category):	The total number of pitches for car boot traders at the site.
Pupils/Students (educational land use categories):	The total number of pupils/students registered at the site.
Ranges (driving range land use category):	The total number of driving range bays at the site.
Residential Details (residential land use categories):	Consists of data for bedrooms per household, garages per household, on-street parking per household and unit density.
Residents (nursing home and institutional hostel land use categories):	The total number of residents registered at the site.
Retail Floor Area (retail land use categories):	The total floor area of buildings within the site's boundary that is accessible by the general public. In some land use categories external areas are also included
Rink Size (ice rink land use category):	The area in square metres of the ice at the site.
Seats (multiplex cinema, bingo hall, road-side food and restaurant land use categories):	The total number of seats at the site.
Site Area:	The area of the whole site in hectares, including car parking and other use of space, up to the site's boundary.
Surface Parking (not all land use categories)**:**	A "Yes" represents surface parking, a "No" represents underground or multi-storey parking.
Trade/Site Name:	The official name of the development.
Units (holiday accommodation land use category):	Total number of accommodation units at the site.

SURVEY DAY DETAILS

Car Park Occupancy:	The initial number of vehicles in the site's car park at the time the survey began, and the number remaining as the survey ended.
Cycle, OGV and public service vehicle counts:	Separate hourly count screens throughout the duration of the total vehicles survey for pedal cycles, OGV's (with a percentage split shown between OGV1 and OGV2), and buses. All except pedal cycles are included in the total vehicles count.
Vehicle Occupant, Public Transport User, Pedestrian and Total People Counts	For multi-modal surveys only, separate hourly count screens throughout the duration of the Total Vehicles survey for Vehicle Occupants, Public Transport Users, Pedestrians and Total People.
Survey Date:	Date on which the survey count took place.
Survey Type:	Either "Manual Count" for a manual classified survey or "ATC Survey" for an automatic traffic count (usually 24-hours in duration).
Total Vehicles Count:	Hourly numbers of vehicles arriving at the site, exiting the site, and total vehicle movements, throughout the survey's duration. Also, parking accumulation in the site's car park is shown, the first hourly figure being based on the initial car parking occupancy and the traffic movements for the first hour of the survey.
Vehicle Percentages:	The percentage of the total vehicles count excluding pedal cycles (inbound plus outbound) that consisted of cars (including taxis), motorcycles, light goods vehicles, OGV1 (up to 3 axles), OGV2 (greater than 3 axles), and public service vehicles.
Weather:	Details of weather conditions for the morning and the afternoon on the day of the survey count, taken from a range of possibilities.

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APPENDIX D FOR WORKING PAPER #1

A GIS APPROACH TO IDENTIFYING CANDIDATE URBAN IMPACT AREAS

A GIS APPROACH TO IDENTIFYING CANDIDATE URBAN IMPACT AREAS (UIAS)

In suggesting quantitative criteria as a functional definition for "Urban Infill Area", the Study Team was mindful of the need for practical measurements that can be applied to or extracted from data are readily available across the State of California and the United States, and at relatively small-area levels, e.g., the census block group level. EPS prototyped a map-based or GIS approach to identifying candidate UIAs for **Working Paper #1** using digital map layers and socioeconomic data that are available nationwide from Federal agencies and information centers.

Census 2000 definitions of UAs and UCs focus on population density only; this is not an oversight, but a known area of weakness that generated much comment and discussion in the run-up to the publication of the actual census counts. In the end, "The Census Bureau determined that it could not include industrial or commercial areas on the fringes of UAs or UCs because it could not find a consistent national database that identifies such areas, as it found for major airports. Thus, the Census Bureau does not have the capability to specifically identify commercial and industrial areas on a uniform and comprehensive basis." (Federal Register / Vol. 67, No. 51 / Friday, March 15, 2002 / Notices)

Currently, there is no comprehensive and consistent database of California commercial, industrial, or public service land uses (existing development) available at the parcel or site level. In the absence of such a resource, the employment-by-workplace data collected annually by the Census Bureau for its *County Business Patterns* series and by the California Economic Development Department for its *Labor Market Information* reports could provide workable substitutes, if confidentiality regulations did not restrict those agencies' ability to release small-area and site information. As is, none of the *County Business Patterns* or *Labor Market Information* data on employment-by-industry or -by-occupation is currently available below the ZIP code level, even as special tabulations.

Census 2000 Journey-to-Work data, however, as distributed in the Census Transportation Planning Package (CTPP 2000) Part 2 tables, do include both employment-by-industry and -by-occupation estimates down to the census Block Group (BG) level for the entire State of California. The CTPP occupational and industrial categories are shown in **Table 4 (Working Paper #1 – main text)**. The CTPP employment data, in combination with population and housing counts and geographic information available from Census 2000 Summary Files 1 and 3 (SF1 and SF3), can be used to identify Block Groups that meet several of UIA Criteria proposed above.

As an example, if we use threshold filters to limit Block Group selection to those BGs which have both residential and nonresidential development, and which had (at the beginning of the year 2000) residential development densities of at least 10 housing units per land acre and employment densities of at least 35 jobs per land acre, a subset of 135

(of a possible 22,100 California Block Groups) is selected, as shown in **Figure 2X (Working Paper #1 – main text).**

A complete listing of these 135 Block Groups, including County and Urbanized Area of location, land area, Year 2000 population, housing and worker counts and population and employment densities per gross land acre, is provided as **Appendix C Table 1**. As it happens, all but two of the BGs meeting our initial test criteria for density are located in defined Census 2000 Urbanized Areas, and within California counties having more than 400,000 total populations.Alternative threshold densities are suggested in the planning literature, and it is anticipated these test values may be a focus of further discussion and revision.

As a preliminary sensitivity test, EPS calculated the number of BGs meeting the following ranges of combined residential and employment densities:

>=	12	DU	and	>=	50	Jobs	per acre	-	64	Block Groups
>=	9	DU	and	>=	37.5	Jobs	per acre	-	68	Block Groups
>=	6	DU	and	>=	25	Jobs	per acre	-	152	Block Groups
>=	5	DU	and	>=	20	Jobs	per acre	-	125	Block Groups
>=	4	DU	and	>=	15	Jobs	per acre	-	219	Block Groups
>=	3	DU	and	>=	10	Jobs	per acre	-	714	Block Groups

These counts were made mutually exclusive; the first three ranges subdivide the 284 BG test set into 3 subsets with no double-counts of individual Block Groups. It can be seen that lowering the selection threshold to include BGs having at least 5 dwelling units (DU) per acre and at least 20 jobs per acre would increase the match by 125 BGs or by 44%; lowering the threshold to 4+ DU and 15+ jobs per acre would increase the total match to 628 BGs, more than double the count of the initial test. **Figure 3 (Working Paper #1 – main text)** is a thematic map of San Francisco and the nearby North, East, and South Bay areas, displaying by color variation the BGs that meet the six alternatives tabulated above.

One weakness of this proposed filtering/selection approach is a dependency on the geographic boundaries defined for Census 2000 enumeration. It is possible and likely that some localities could be either erroneously included or excluded from selection as a result of the peculiar size and orientation of their Census Blocks, Block Groups and Tracts. A methodological mitigation for this source of potential error is suggested by the Giuliano and Small method for identifying employment centers. Giuliano and Small defined an employment center as a cluster of contiguous zones, each zone having a minimum employment density of D, and together containing total employment of at least E. D and E cutoffs are typically expressed as 'D-E'; for example '10-10' corresponds to D = 10 jobs/acre and E = 10,000 jobs.

An example of this Giuliano and Small method in application is reported in *Not All Sprawl: Evolution of Employment Concentrations in Los Angeles, 1980 – 2000*, February 2005, by Genevieve Giuliano, et. al., School of Policy, Planning and Development, University

of Southern California: http://www.usc.edu/schools/sppd/lusk/research/pdf/wp_2005-1002.pdf.

On first review, the Giuliano and Small method seems extendable to the task of identifying Urban Infill Areas which occupy adjacent Block Groups, but EPS requests review of this idea and of the entire Working Paper #1 before proceeding along that particular path of investigation.

The proximity of selected BGs of interest to active transit lines and transit stops/stations can be determined using readily available Geographic Information System (GIS) resources. Many of these resources may be available to authorized users through the Caltrans GIS Data Library, which maintains an online catalog at http://www.dot.ca.gov/hq/tsip/TSIPGSC/library/libdatalist.htm. For this study, however, we feel it is important to propose GIS reference data that are available nationwide, so that the core methodologies are 'portable' and can be applied to other studies in other states.

A map-based or GIS approach to identifying candidate UIAs is consistent with current research such as that described in *Using the Internet to Envision Neighborhoods with Transit-Oriented Development Potential* , a June 2002 publication of the Mineta Transportation Institute and the College of Business at San José State University http://transweb.sjsu.edu/publications/01-24.pdf and in the *California Infill Estimation Methodology Project Final Report*, June 30, 2004, describing tools and methods developed by the City of Los Angeles, the County of Los Angeles and the Environment Now Foundation with consultants Terrell Watt and the Solimar Research Group, under Caltrans Contract #07A1466
http://www.solimar.org/pdfs/Infill_Methdology_Final_Report.pdf

EPS obtained digital map layers of California fixed-route bus services from an online site hosted by the Moakley Center Geographics Laboratory of Bridgewater State College, which maintains nationwide bus service databases and route system GIS information in a cooperative project with the Federal Transit Administration (FTA) at http://geolab.bridgew.edu/docs/busroutes/ . Fixed-rail transit route and station spatial data for California have been obtained from the National Transportation Atlas Databases (NTAD) 2005; this set of nationwide geographic databases is available free of charge from the U.S. Department of Transportation, Bureau of Transportation Statistics at https://www.bts.gov/pdc/user/products/src/products.xml?p=1978&c=-1.

The California bus and rail transit layers described immediately above can be combined with the Block Groups selected by the preliminary threshold filters as shown in **Figure 4 (Working Paper #1 – main text).** The proximity of selected BG centroids to bus routes, rail lines and rail transit stations can be determined either interactively, using GIS 'drag and drop' measurement tools, or programmatically, using Co-ordinate Geometry (CoGo) algorithms.

Figure 4 (Working Paper #1 – main text) shows the distribution of preliminarily chosen BGs in the vicinity of San Francisco and the East Bay; similar maps for the larger San Francisco Bay Area, and for the Stockton, Sacramento, Los Angeles, and San Diego Areas, are provided as **Appendix Figures X1 through** X**5**.For up-to-date information on transit schedules and headways, individual service operators will need to be contacted as potential Urban Infill Survey Sites (UISS) are evaluated for actual trip-generation work-ups. Preliminary information on route scheduling is available for nearly all major California transit services from the Federal Transit Authority, either from the Moakley Center Geographics Laboratory resource described above or from the Integrated National Transit Database Analysis System (INTDAS), developed as part of the Florida Transit Information System (FTIS) by the Lehman Center of Transportation Research (LCTR) at the Florida International University, at http://lctr.eng.fiu.edu/Ftis/index.htm. Summary service statistics for individual California transit agencies are also available from the Federal Transit Administration's National Transit Database (NTD) online at http://www.ntdprogram.com/NTD/ntdhome.nsf?OpenDatabase. The NTD summary information is updated annually; reports for 2003 are the most current available.

Collectively, the Census, BTS and FTA data and GIS components described and applied above can support many alternative sets of criteria for Urban Infill Area selection. It is expected that the Project Team will refine the preferred criteria in discussion with members of the Technical Advisory Committee. EPS respectfully recommends that the Team and the TAC give careful consideration to including mixed-use zoning (complimentary proximate development types, but not mixed-use within a single building or on the same site) among the essential components.

This does not mean the acceptance of mixed land uses for any proposed individual study site, but rather the recognition of immediately adjacent residential and nonresidential development as a fundamental aspect of the 'urban' environment, and at the heart of the need for this special study of trip generation in infill areas. This would also be consistent with current California Government Code, as set forth in California Senate Bill (SB) 1636 (Figueroa).

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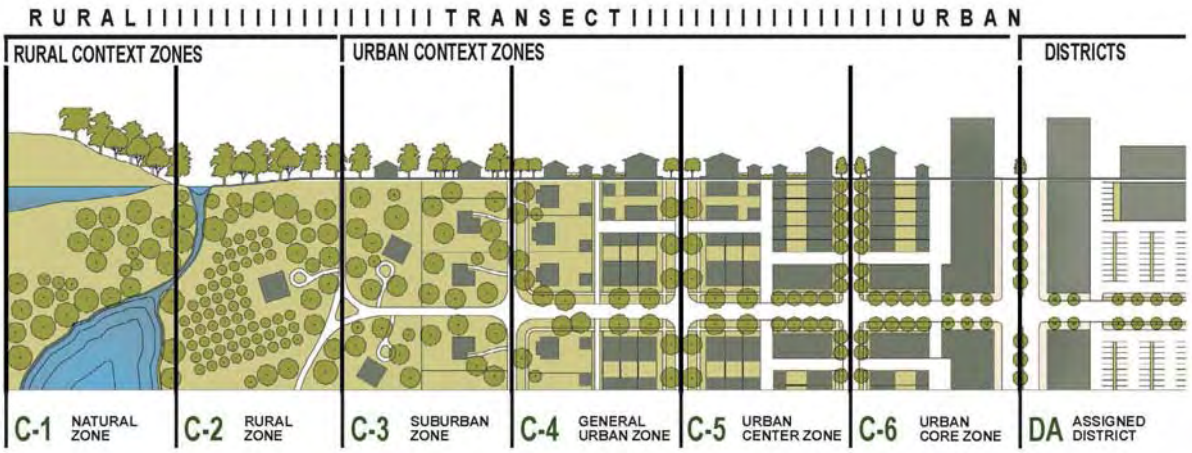
APPENDIX E FOR WORKING PAPER #1

CONTEXT ZONE CHARACTERISTICS

CONTEXT SENSITIVE SOLUTIONS IN DESIGNING MAJOR URBAN THOROUGHFARES FOR WALKABLE COMMUNITIES

ATTACHMENT 3
CONTEXT ZONE CHARACTERISTICS
Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities, Institute of Transportation Engineers Proposed Recommended Practice (est. February 2006)

A wide variety of factors create context in the urban environment. Every thoroughfare has an immediate physical context created by buildings and activities on adjacent properties, and is also part of a broader context created by the surrounding neighborhood or district. While the elements of context relating to buildings, landscape, land uses, and public facilities can combine in almost infinite varieties, a set of four context zones serve to define urban areas. The four context zones are a subset of a more inclusive system of contexts that can be used to describe the full range of environments from natural to highly urbanized. The figure below illustrates this concept through a diagram. Although the diagram graphically represents context zones as a linear continuum from most natural to most urban, in fact the zones are most frequently found arranged in mosaic-like patterns reflecting the complexity of metropolitan regions.



CREDIT: DUANY PLATER-ZYBERK & COMPANY

Many communities have found that context zones are useful in presenting information to the public. Local illustration of context zone examples can offer useful models that aid stakeholders in expressing their desires to create distinctive parts of their communities.

Selecting a Context Zone

Context is defined by multiple parameters, including land use, density, and design features. The following table presents the full range of context zones, but focuses on the suburban through urban core contexts (C-3 through C-6) representing urban conditions. The "distinguishing characteristics" column in the table, for example, describes the overall relationship between buildings and landscape that contribute to context. In addition to the distinguishing characteristics and general character, four attributes assist the practitioner in identifying a context zone:

1) building placement - how buildings are oriented and set back in relation to the thoroughfare,

2) frontage type – what part of the site or building fronts onto the thoroughfare,

3) typical building height, and

4) type of public open space.

Guidelines for identifying and selecting a context zone include:

1. Consider both the existing conditions and the plans for the future, recognizing that thoroughfares often last longer than adjacent buildings.

2. Assess area plans and review general, comprehensive, and specific plans, zoning codes, and community goals and objectives. These often provide detailed guidance on the vision for the area.

3. Compare the area's predominant land use patterns, building types, and land uses to the characteristics presented in the following table.

4. Pay particular attention to residential densities, commercial floor area ratios, and building heights.

5. If an area or corridor has a diversity of characteristics that could fall under multiple context zones, consider dividing the area into two or more context zones.

6. Identify current levels of pedestrian and transit activity, or estimate future levels based on the type, mix, and proximity of land uses. This is a strong indicator of urban context.

7. Consider the area's existing and future characteristics beyond the thoroughfare under design, possibly extending consideration to include entire neighborhoods or districts.

Context Zone Characteristics

	A	B	C	D	E	F	G
	Context Zone	**Summary Character**	**Building Setback/Build To and Frontage**	**Thoroughfare Network Scale**	**Building Height**	**Land Use Mix**	**Public Open Space Type**
1	NATURAL (CZ-1)	Natural	Not Applicable	Regional to State Scale	Not Applicable	Restricted protected natural open space	Natural
2	RURAL (CZ-2)	Agricultural and landscaped, no pedestrians	Large setbacks porch, fence, & work yard	Regional Scale	1 to 2 story with some taller work buildings	Restricted agriculture, limited support residential and commercial	Agricultural
3	SUBURBAN (CZ-3)	Landscaped, few pedestrians, detached buildings widely separated	Deep yard setbacks dominant landscaped character (fence/hedge, yard, & porch)	Predominantly Neighborhood Scale	1 to 2 story with some 3 story	Restricted residential with "at-home" businesses and limited commercial, institutional/civic, and open space	Parks with adjacency to greenbelts
4	GENERAL URBAN (CZ-4)	Urban, pedestrians present, balanced landscape and predominantly detached buildings	Medium yard setbacks balanced landscape and building character (fence/hedge, yard, & porch)	Neighborhood to Regional Scale	2 to 3 story with some 1 story and some above 3 story; and few taller work buildings	Limited medium-density residential with limited mix of other uses typically ground level - institutional/civic, commercial, and open space	Parks
5	URBAN CENTER (CZ-5)	Urban, substantial pedestrian activity, predominantly built with attached buildings with most landscape within the thoroughfare right-of-way	Small or no setback, build to lines common, building character defining street wall (storefront, stoop, & forecourt)	Neighborhood to Regional Scale	3 to 5 story with some lower and few taller buildings	Open higher-density commercial, employment, and residential use with support institutional/civic and open space	Parks, plazas and squares
6	URBAN CORE (CZ-6)	Urban, most pedestrian activity, predominantly built with attached buildings providing a strong sense of enclosure with some landscape within the thoroughfare right-of-way	Small or no setback, build to line at sidewalk/RW, building character defining street wall (storefront, stoop, & forecourt)	Neighborhood to Sector Scale	4+ story with few lower buildings	Open highest-density commercial, employment, and residential use with support institutional/civic and open space	Parks, plazas and squares

APPENDIX B

Appendix B - List of Organizations / Individuals Contacted

Contact Name	Position	Agency/Organization	Telephone Number	City
Barbara Pauly	Administrative Assistant	Albertsons	925-833-6200	Dublin
Ronnetta Lewis	In charge Manager	Albertsons	208-395-6200	Boise
James	Manager	24 Hour Fitness	510-548-4653	Berkeley
Jeff Hudson		Transportation and Land Use Coalition	510-740-3150 x312	California
Adam Smith	Manager	Albertsons	510-538-7120	Hayward
Sonny Astani	Chairman	Astani Enterprises	310-273-2999	Beverly Hills
Patrick Kennedy	Owner	Panoramic Interests	510-883-1000 x300	Berkeley
Christina Jones	V. P Property Management	The Allegro, SNK Development	602-261-7511 x5	
Kate White		Urban Land Institute	415-772-0390	San Francisco
Geeta Rao			415-989-8160 x 22	San Francisco
Kim Havens		Wilson Meany Sullivan	415-905-5300	San Francisco
Jim Ghielmetti	Owner	Signature Properties	925-463-1122	
Paul Peninger	Associate	Non-Profit Housing Association		
Nicki Tyner		Archstone Smith	877-260-3085	
Sharron King	General Manager	South Bay Pavilion	310-366-6636	Carson
Linda Mogadam / Veronica Perez Becker	Vice President of Legislature	CCALA	213-624-1213 x218	Los Angeles
Carol E Schartz	President & CEO	CCALA & Downtown Center Business Improvement District	213-624-1213 x215	Los Angeles
Catherine Leland		CCALA	213-524-1213 x208	Los Angeles
Kim Moore	Manager	The South Group	213-741-2959 x263	Los Angeles
Mike Bates	President	The Mobility Group	949-474-1591 x11	Irvine
Holly	Property Manager	Camden/Tuscany	619-255-4000	San Diego
Allegro	Property Manager		619-595-7801	San Diego
Portico	Property Management	Piescott Property Management	619-702-2354	San Diego
Sabrina	Property Manager	Treo @ Kettner	619-231-4315	San Diego
Barbara Prince	HOA President	Grande Santa Fe Place	619-236-1122	San Diego

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Contact Name	Position	Agency/Organization	Telephone Number	City
Huberts	HOA President	Pinnacle Museum Towers	619-985-7100	San Diego
Horizons		Horizon Marina District	619-338-4096	San Diego
Steven Bodle	Property Manager	Ralph's	619-595-1581	San Diego
Rashid Kassir	Property Manager	Atria	619-230-1891	San Diego
Diana E. Norbury	Property Manager	Equity Residential	510-849-2000	Berkeley
Heather Carter	Property Manager	Baker Pacific Group	213-553-1176	Los Angeles
Michele Dennis	President	BOMA - Greater Los Angeles	213-629-2662	Los Angeles
Martha Cox	Directors of Government and Public Affairs	BOMA - Greater Los Angeles	213-629-2662	Los Angeles
Marc L. Intermaggio	Executive Vice President	BOMA - San Francisco	415-362-2662	San Francisco
Ken Cleveland	Directors of Government and Public Affairs	BOMA - San Francisco	415-362-2662 x11	San Francisco
Robert O. Robledo	Executive Vice President	BOMA - Oakland/East Bay	510-893-8780	Oakland
Yvonne Parker	Executive	BOMA - Inland Empire	909-825-2000	Grand Terrace
Robin Jochims	Executive	BOMA - Orange County	714-258-8330	Tustin
Paul Yoder / Shaw Yoder	Executive	BOMA - Sacramento	916-443-9092	Sacramento
Audrey Benedetto / Craig Benedetto	Executive	BOMA - San Diego	619-243-1817	San Diego
Robert Jacobvitz	Executive Director	BOMA - Silicon Valley	408-453-7222	San Jose
Steve Piperen				Sacramento
George Tsakopolus	Businessman			Beverly Hills
Richard Rich	Developer			
Robert Dunphry		Urban Land Institute		
San Francisco Planning Department		City of San Francisco	415-558-6378	San Francisco
Ellen Dektar	Executive Director	Local Investment in Child Care (LINCC)	510-208-9578	Oakland
Paul Richards	Director of Property Management	Wilson Meany Sullivan	415-905-5300	San Francisco
Kim Martinson	Executive Director	San Francisco TMA	415-392-0210	San Francisco
Zac Wald	Chief of Staff for Oakland Councilwoman Jane Brunner	Oakland		Oakland

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Contact Name	Position	Agency/Organization	Telephone Number	City
Rex Himes		Business Property Managers Association (BPMA)		
Doug Willie		Shopping Center Council		
Mario Torress	Developer	Primestor Development, Inc.	310-652-1177	Los Angeles
Andrew Goodman	Regional Director of Leasing	Equity Office Properties	310-446-2212	Los Angeles
Angela Rinebold	Portfolio Manager	Equity Office Properties	310-446-2208	Los Angeles
Randall Sakamoto	Vice President, Research	Rosen Consulting Group		Los Angeles
Patrick Lacey	Director of Assest Management and Operations	Cabi Developers		Los Angeles
Mary Marx	Managing Director	Cushman & Wakefield	213-955-5187	Los Angeles
Thomas Hilal / Mandana Kohen		Nourmad and Associates		Los Angeles
Criag Peirson	Vice President Dispositions	Arden Realty	310-966-2600	Los Angeles
David Swartz	General Counsel	Arden Realty	310-966-2600	Los Angeles
Greg Husebye	Vice President	Arden Realty	310-966-2664	Los Angeles
Scott Lyle	First Vice President, Operations	Arden Realty	310-966-2600	Los Angeles
Mark Levy	Director of Acquisition	Arden Realty	310-966-2600	Los Angeles
Ann Gary	FAIA, Architect	Murdouch Plaza		Los Angeles
Kambiz Hekmat	Owner	Murdouch Plaza	310-824-3000	Los Angeles
Matthew C. Fragner	Counsel	CIM	310-779-7284	Los Angeles
Gregory R. Hambly	Chief Accounting Officer	Douglas & Emmett	310-255-7831	Los Angeles
Carl Muhlstein	Executive Vice President	Cushman & Wakefield		Los Angeles

APPENDIX C

Association of Bay Area Governments

Caltrans

LOS ANGELES AREA OFFICE TRAVEL SURVEY

This survey is part of a statewide effort to determine how people travel in California's urban areas. Your responses will be used to plan effective transportation improvements. Your responses are completely confidential. Thank you for your time.

Do you work here?

- ❑ Yes
- ❑ No

What primary means of travel did you use to either get here or leave here today?

- ❑ Drove alone
- ❑ Drove others: How many including yourself_____
- ❑ Rode as passenger, car parked nearby
- ❑ Rode as passenger: was dropped off
- ❑ Bus
- ❑ Bicycle
- ❑ Walk
- ❑ Train/Trolley
- ❑ Taxi
- ❑ Other _____

Is this location your primary destination or did you stop here on the way to another destination?

- ❑ Primary destination
- ❑ Stopped here on the way to another destination

How often do you visit this location in a typical week? _____

If you are arriving, approximately how long did it take you to get here today? _____ (minutes)

OPTIONAL QUESTIONS (PLEASE ANSWER AS MANY OR AS FEW AS YOU WANT)

What is the zip code of your home address?

_____

What is your age? (circle one)

19-24 years 25-34 years

35-44 years 45-54 years

55-64 years

65 years or more

Are you:

- ❑ Male
- ❑ Female

How many autos, pickups, vans and motorcycles are available for use by members of your household?

_____ **(enter number)**

What is your occupation?

- ❑ Professional/technical
- ❑ Manager/administrator
- ❑ Sales/account representative
- ❑ Secretarial/clerical
- ❑ Student/intern
- ❑ Service worker
- ❑ Craftsman/mechanic
- ❑ Other _____ (specify)
- ❑ Retired
- ❑ Homemaker
- ❑ Not currently employed

Including yourself, how many people live in your household?

_____ **(enter number)**

What is your approximate household income?

- ❑ 0-$20,000
- ❑ $20,000 - $40,000
- ❑ $40,000 - $60,000
- ❑ $60,000 - $80,000
- ❑ Greater than $80,000

If you are employed, does your employer offer any of the following? (check all that apply)

- ❑ Flexible work hours
- ❑ Free or discounted transit passes or allowance
- ❑ Provide a company car for midday use
- ❑ Free parking

For survey taker use only. Date: Time: Period: Site:

Association of Bay Area Governments

Caltrans

LOS ANGELES AREA RETAIL TRAVEL SURVEY

This survey is part of a statewide effort to determine how people travel in California's urban areas. Your responses will be used to plan effective transportation improvements. Your responses are completely confidential. Thank you for your time.

What primary means of travel did you use to either get here or leave here today?

q Drove alone
q Drove others: How many including yourself_____
q Rode as passenger, car parked nearby
q Rode as passenger: was dropped off
q Bus
q Bicycle
q Walk
q Taxi
q Other _____

Is this location your primary destination or did you stop here on the way to another destination?

q Primary destination
q Stopped here on the way to another destination

If this location was NOT your primary destination, would you have passed by this location if you did not stop here today?

q Yes
q No

Do you work here?

q Yes
q No

How often do you visit this location in a typical week? _____

If you are arriving, approximately how long did it take you to get here today? _____ **(minutes)**

OPTIONAL QUESTIONS (PLEASE ANSWER AS MANY OR AS FEW AS YOU WANT)

What is the zip code of your home address?

_____

What is your age? (circle one)

19-24 years
25-34 years
35-44 years
45-54 years
55-64 years
65 years or more

Are you:

q Male
q Female

How many autos, pickups, vans and motorcycles are available for use by members of your household?

_____ **(enter number)**

What is your occupation?

q Professional/technical
q Manager/administrator
q Sales/account representative
q Secretarial/clerical
q Student/intern
q Service worker
q Craftsman/mechanic
q Other _____ (specify)
q Retired
q Homemaker
q Not currently employed

Including yourself, how many people live in your household?

_____ **(enter number)**

What is your approximate household income?

q 0-$20,000
q $20,000 - $40,000
q $40,000 - $60,000
q $60,000 - $80,000
q Greater than $80,000

If you are employed, does your employer offer any of the following? (check all that apply)

q Flexible work hours
q Free or discounted transit passes or allowance
q Provide a company car for midday use
q Free parking

For survey taker use only. Date: Time: Period: Site:

BERKELEY AREA RESIDENTIAL TRAVEL SURVEY

This survey is part of a statewide effort to determine how people travel in California's urban areas. Your responses will be used to plan effective transportation improvements. Your responses are completely confidential. Thank you for your time.

Do you live here?

- ❑ Yes
- ❑ No

How long is your average commute to and from your final destination?_____(minutes)

What primary means of travel did you use to either get here or leave here today?

- ❑ Drive alone
- ❑ Drive others: How many including yourself_____
- ❑ Ride as passenger/Carpool
- ❑ Bus
- ❑ Bicycle
- ❑ Walk
- ❑ Taxi
- ❑ Train/trolley
- ❑ Other _____

Are you a student /employee/staff of U.C Berkeley?_____

OPTIONAL QUESTIONS (PLEASE ANSWER AS MANY OR AS FEW AS YOU WANT)

What is the zip code of your home address?

_____

What is your age? (circle one)

19-24 years 25-34 years

35-44 years 45-54 years

55-64 years

65 years or more

Are you:

- ❑ Male
- ❑ Female

How many autos, pickups, vans and motorcycles are available for use by members of your household?_____ (enter number)

What is the purpose of your trip? _____

What is your occupation?

- ❑ Professional/technical
- ❑ Manager/administrator
- ❑ Sales/account representative
- ❑ Secretarial/clerical
- ❑ Student/intern
- ❑ Service worker
- ❑ Craftsman/mechanic
- ❑ Other _____ (specify)
- ❑ Retired
- ❑ Homemaker
- ❑ Not currently employed

Including yourself, how many people live in your household?

_____ **(enter number)**

What is your approximate household income?

- ❑ 0-$20,000
- ❑ $20,000 - $40,000
- ❑ $40,000 - $60,000
- ❑ $60,000 - $80,000
- ❑ Greater than $80,000

If you are employed, does your employer offer any of the following? (check all that apply)

- ❑ Flexible work hours
- ❑ Free or discounted transit passes or allowance
- ❑ Provide a company car for midday use
- ❑ Free parking

For survey taker use only. Date: Time: Period: Site:

APPENDIX D

FINAL

WORKING PAPER #2
SITE SELECTION AND DATA COLLECTION/ANALYSIS METHODOLOGY

REVISED MAY 2006

Prepared for:

California Department of Transportation
Technical Advisory Committee

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I. Revisions to the Working Paper

Subsequent to the February 13, 2006 discussion with the TAC and further conversations with the ITE liaison (Gene Arnold), the consultant team has revised the proposed methodology (see Attachment 1 for a summary of the February 13 meeting). It was agreed that the ITE methodology for conducting trip generation surveys was only suitable for isolated suburban locations and even if an urban site could be identified that met ITE's criteria, the resulting data may not be representative of typical urban site characteristics. Therefore it was agreed that the trip generation study would use intercept surveys for the collection of data. Gene Arnold agreed with this approach and indicated that because the ITE Trip Generation Manual is an Information Report, they would accept our methodology into their collection of trip generation studies. We would need to provide a detailed description of our methodology. Section VII below has been revised to reflect the change in methodology.

Additional issues addressed in this revised working paper include:

- Final Land Use Categories:
  - Expand on the qualifier to all land use categories that selected sites can be part of a mixed-use development as long as use is isolated enough to collect necessary data (in this case intercept survey data).
  - It is acceptable to diverge from the strict ITE definition of land use categories to better reflect urban areas.

- Final Urban Infill Area Criteria:
  - Revise criteria to accept the use the collective headways of multiple routes as long as the routes served the same corridor for a considerable length of the corridor.

- Site Selection Methodology:
  - Combine the Monterey Bay/Santa Cruz region with the San Francisco Bay Area region.
  - Combine San Bernadino and Riverside counties with the metropolitan Los Angeles region.
  - Retain the Sacramento area as a separate region.
  - Allocate 50% of study sites to the Northern California regions and 50% to the Southern California regions, then allocate study sites to counties based on the proportion of population and employment in the census block groups that meet UIA criteria, rather than countywide population.

- Data Collection Methodology:
  - Use intercept surveys to collect data (see revised Section VII below).
  - Include retail study sites as small as 10,000 square feet for the Shopping Center land use category.
  - The Data Summary Report will list each study site separately with all the independent variable data and count data collected for that site.
  - The study will report additional information on the characteristics of the areas surrounding the study sites and provided as supplemental data in the appendices.

This additional information would include a combination of quantitative and qualitative characteristics of the site's surrounding district such as land use mix, densities, network attributes, pedestrian system, predominate uses, amenities, etc.

- Use of Pilot Surveys:
    - The use of intercept surveys will be tested through a series of pilot studies in the San Francisco Bay Area region. An initial selection of between 5 and 10 land uses will be selected for the pilot studies. The findings of these surveys will be used to refine the methodology for collection of the full set of sites.

II. Introduction and Objectives

This paper presents a detailed methodology and criteria for selecting candidate sites for data collection, guidelines for data collection at individual sites, and a methodology for analyzing data. The objectives of this working paper are:

1) Establish a technical procedure that moves the study from mapping of Urban Infill Areas to the selection of individual sites for data collection.
2) Develop guidelines for the collection and analysis of trip generation data recognizing that the study of urban areas will not be able to utilize the Institute of Transportation Engineers' (ITE) recommended data collection methods.
3) Establish a process with the ITE liaison to review and approve key steps and procedures.

III. Proposed ITE Review Process

The Institute of Transportation Engineers (ITE) has agreed to review material developed as part of this study. The project team has proposed to ITE participation of a technical liaison comprised of ITE staff and/or member(s) of the ITE Trip Generation Committee. ITE staff participation will be limited to receipt of material developed as part of the study and be available to provide advice on technical matters. ITE will review the trip generation findings at the time we submit them. For participation in the development of the study, we have tentatively agreed to work with Mr. Gene Arnold, a Senior Research Scientist at the Virginia Transportation Research Council. While Mr. Arnold does not represent ITE, he was recommended by ITE and has been involved in the review and development of past trip generation manuals. The process for ITE review is outlined below:

- The project team will provide key information to be reviewed and considered by the liaison. ITE will be copied on all material provided to the liaison. Proposed key information includes:

    - definition of urban infill areas (UIA);
    - UIA selection criteria;
    - proposed ITE land use categories;
    - method and criteria for selecting individual study sites;
    - data collection guidelines and technical methods;
    - identification of independent variables; and

- statistical analysis methods.

- The liaison will be invited to participate in relevant TAC discussions.
- The project team will hold discussions with the liaison specifically on the proposed methodology.
- The project team will work with both ITE staff and the liaison document the methods, data, and analysis for eventual submission to ITE for possible incorporation into a future version of the Trip Generation manual or other trip generation Informational Report.

IV. Final Site Selection Criteria

As agreed upon by the TAC at its December 20th, 2005 teleconference, the following criteria will be used to select study sites:

1) A Urban Infill Area (UIA) designation may be applied to any site located either:

   a) within a **Central Business District (CBD)**, **Central City, Not Downtown (CND)** or **Suburban Center (SBC) Area**, as defined by the ITE for data collection surveys (ITE definitions of these areas is attached as Attachment 2); or alternatively,
   b) within a **General Urban (T/CZ-4)**, **Urban Center (T/CZ-5)**, or **Urban Core (T/CZ-6) Context Zones**, as defined in the Proposed Recommended Practice for Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities estimated to be published in February 2006 (Attachment 3 provides characteristics of these context zones), which **also** meets all of the other criteria defined immediately below.

2) The UIA must be within 1/3 mile of a site with an existing or future rail transit station, a ferry terminal served by either a bus or rail transit service, an intersection of at least two major bus routes, or within 300 feet of a bus rapid transit corridor. The transit service shall have maximum scheduled headways of 15-minutes for at least 5 hours per day. It is acceptable to use the collective headways of multiple routes as long as the routes serve the same corridor for a considerable length of the corridor. This reflect corridors where people can use any route to reach any point within a significant length of the corridor.

3) The UIA can contain no more than 10 percent Vacant Developable Land. Vacant Developable Land as defined excludes water bodies, public rights-of-way, land designated for conservation and public recreation, and any other land designated by local governments' policies or comprehensive plans as unavailable for development. Parking lots on land designated and/or zoned as developable under current policy qualify as Vacant Developable Land.

4) Where residential land uses comprise at least 60 percent of developed land, average residential density shall be at least 10.0 dwelling units per gross acre of residentially developed land, or

5) Where nonresidential land uses comprise at least 60 percent of developed land, average nonresidential density shall be a floor area ratio (FAR) of at least 1.0 and/or an employment density of at least 35.0 per gross acre of nonresidential developed land, or

6) Where neither residential nor nonresidential uses comprise more than 60 percent of developed land, both residential and nonresidential uses must meet the density and intensity criteria prescribed above.

V. Recommended Land Uses (ITE Categories)

Below are the ten land uses agreed upon by the TAC, arranged in order by ITE land use code:

- (223) Mid-rise apartment
- (230) Residential condominium/townhouse (mid-rise)
- (232) High-rise residential condominium/townhouse
- (445) Multiplex movie theater
- (492) Health/fitness club
- (565) Day care center
- (710) General office building
- (820) Shopping center
- (850) Supermarket
- (932) High-turnover sit down restaurant

Table 1 also lists these land uses and provides their descriptions as published in the ITE Trip Generation Manual (7th Edition). In addition to the ITE description, Table 1 presents qualifications or recommendations specific to the urban infill trip generation study, if applicable. There are qualifiers/recommendations for four of the categories:

- (230) Residential condominium/townhouse – In the ITE Trip Generation Manual, this is a general category of residential use without a definition of height of building. The data included low and high-rise buildings. For purposes of the urban infill trip generation study, we recommend that we limit this category to mid-rise buildings of between three and ten stories.

- (232) High-rise residential condominium/townhouse – In the ITE Trip Generation Manual, this category represents buildings of three or more stories in height. For purposes of the urban infill trip generation study, we recommend that we limit this category to high-rise buildings greater than ten stories.

- (565) Day care center – In the ITE Trip Generation Manual, day-care centers are defined as a free-standing facility. For purposes of the urban infill trip generation study, we recommend that we do not limit potential study sites to free-standing facilities (e.g., can be part of a larger building or facility) as long as it is open to the general public and has access/parking isolated enough for the collection of accurate data.

- (820) Shopping center – The ITE Trip Generation Manual no longer provides different rates for different size shopping centers (less than or greater than 600,000 square feet). This was discontinued in the 5th Edition of Trip Generation because 1) there was confusion as to which rate to use when the shopping center was close to the threshold, and 2) it was determined that the regression equations accurately predicted the change in traffic based on the size of the center. These findings were based on a study of 345 shopping centers classified as either neighborhood, community, regional, or super-regional centers (Peyrebrune, Joan C. "Trip Generation Characteristics of Shopping Centers". ITE Journal. June 1996, Pg. 46-50.) For this study retail sites can be part of a mixed-used development.

In addition to the above qualifiers, most of the land uses include qualifiers that allow the site to be part of a mixed-use development, or integrated into a larger complex. This qualifier reflects the change in data collection from traffic counts to intercept surveys.

VI. Proposed Site Selection Methodology

The proposed site selection is based on an approach that relies on both quantitative and qualitative measures and decision-making procedures. It is useful to organize the site selection process in terms of region, county, city, district, and site and to develop criteria for selecting study areas at each geographic level. This organization is summarized below.

Objectives of Site Selection

The overall purpose of the site selection is three-fold, 1) to identify sites distributed within urban areas throughout the state so that data collection is representative of the trip generation of uses within all regions of California, 2) to ensure candidate site are within areas that meet the criteria for UIA, and 3) to ensure that the candidate sites have the appropriate characteristics for proper data collection. Specific objectives of site selection are:

- To ensure a distribution of candidate sites throughout the state, capturing a cross-section of the state's urban areas. Statewide distribution of sites is intended to capture differences in trip generation that might be reflective of geographic location.

- To select candidate sites in a distribution of urban infill areas at the region and county level proportional to population.

A. Determine the Geographic Distribution of Study Sites

- Geographic Distribution of Study Sites by Region

Selection criteria: divide number of study sites (50) to survey 50% of the sites in Northern California and 50% of the sites in Southern California regions. Divide state into four metropolitan regions. These regions contain concentrations of census block groups which meet the minimum density criteria for housing or employment (see Working Paper #1).

Table 1: Final List of Land Uses for the Urban Infill Trip Generation Study

Land Use Group	ITE LU Code	ITE Land Use Type	ITE Description	Additional Qualifiers for Trip Generation Study
Residential	223	Mid-Rise Apartment.	Mid-rise apartments are apartments (rental dwelling units) in rental buildings that have between three and ten levels (floors).	No additional qualifiers.
Residential	230	Residential Condominium/Townhouse (mid-rise)	Residential condominiums/townhouses are defined as ownership units that have at least one other owned unit within the same building structure. Both condominiums and townhouses are included in this land use. The studies of this land use did not identify whether the condominiums/townhouses were low-rise or high-rise.	The ITE description does not specify number of floors in this category. We recommend that we limit this category to mid-rise units of between 3 and 10 stories.
Residential	232	High-Rise Residential Condominium/Townhouse	High-rise residential condominiums/townhouses are units located in buildings that have three or more levels (floors). Both condominiums and townhouses are included in this land use.	To distinguish from the mid-rise category, we recommend that the high-rise category include buildings greater than 10 stories.
Recreational	445	Multiplex Movie Theater	A multiplex movie theater consists of audience seating, a minimum of ten screens, a lobby and a refreshment area. The development generally has one or more of the following amenities: digital sound, tiered stadium seating and moveable or expandable walls. Theaters included in this category are primarily stand-alone facilities with separate parking and dedicated driveways. All theaters in this category show only first-run movies or movies not previously seen through any other media. They may also have matinee showings.	Does not necessarily need to be a free-standing facility (may be integrated into a mixed-use development).
Recreational	492	Health/Fitness Club	Health/fitness clubs are privately owned facilities that primarily focus on individual fitness or training. Typically they provide exercise classes, weightlifting, fitness and gymnastic equipment; spas; locker rooms; and small restaurant and snack bars. This land use may also include ancillary facilities, such as swimming pools, whirlpools, saunas, tennis, racquetball and handball courts and limited retail. These facilities are membership clubs that may allow access to the general public for a fee.	Does not necessarily need to be a free-standing facility (may be integrated into a mixed-use development).
Institutional	565	Day Care Center	A day center is a free-standing facility where care for pre-school aged children is provided normally during the daytime hours. Day care facilities generally include classrooms, offices, eating areas and playgrounds. Some centers also provide after-school care for children.	Does not necessarily need to be a free-standing facility (may be integrated into a mixed-use development).
Office	710	General Office Building	A general office building houses multiple tenants; it is a location where affairs of businesses, commercial or industrial organizations, or professional persons or firms are conducted. An office building or buildings may contain a mixture of tenants including professional services; insurance companies; investment brokers; and tenant services, such as a bank or savings and loan institution, a restaurant or cafeteria and service retail facilities.	Does not necessarily need to be a free-standing facility (may be integrated into a mixed-use development).
Retail	820	Shopping Center [1]	A shopping center is an integrated group of commercial establishments that is planned, developed, owned and managed as a unit. A shopping center's composition is related to its market area in terms of size, location, and type of store. A shopping center also provides on-site parking facilities sufficient to serve its own parking demands. [2]	We recommend that the selection of shopping centers be limited to "Neighborhood" and "Community" center classifications as defined by ITE (see definitions below). Additionally, the trip generation study should attempt to select sites that are near the average size of the neighborhood and community shopping centers identified in the study cited in footnote [1] but also reflect smaller urban retail sites as low as 10,000 square feet.
Retail	850	Supermarket	Supermarkets are free-standing retail stores selling a complete assortment of food, food preparation and wrapping materials and household cleaning items. Supermarkets may also contain the following products and services: ATMs, automobile supplies, bakeries, books and magazines, dry cleaning, floral arrangements, greeting cards, limited-service banks, photo centers, pharmacies and video rental areas. Some facilities are open 24 hours a day.	Does not necessarily need to be a free-standing facility (may be integrated into a mixed-use development).
Services	932	High-Turnover (Sit-Down) Restaurant	This land use consists of sit-down, full-service eating establishments with turnover rates of approximately one hour or less. This type of restaurant is usually moderately priced and frequently belongs to a restaurant chain. Generally, these restaurants serve lunch and dinner; they may also be open for breakfast and are sometimes open 24 hours per day. These restaurants typically do not take reservations. Some facilities contained within this land use may also contain a bar area for serving food and alcoholic drinks.	Does not necessarily need to be a free-standing facility (may be integrated into a mixed-use development).

[1] In the 6th Edition of Trip Generation, ITE discontinued the distinction in trip generation rate by size of shopping center. A study published in the ITE Journal found that while the trip generation rate did vary by size of center, the regression equations published in the manual did accurately reflect the variation in trip generation by size of center. See "Trip Generation Characteristics of Shopping Centers", ITE Journal, June 1996.

[2] Additional description in ITE Trip Generation (7th Edition): Shopping Centers, including neighborhood centers, community centers, regional centers and super regional centers, were surveyed for this land use. Some of these centers contained non-merchandising facilities, such as office buildings, movie theaters, restaurants, post offices, banks, health clubs, and recreational facilities (e.g., ice skating rinks). The centers ranged in size from 1,700 to 2.2 million square feet of gross leasable area (GLA).

Definitions:

Neighborhood Shopping Center	Provides for the sale of convenience goods (foods, drugs and sundries) and personal services (such as laundry and dry cleaning, barbering and show repairing) for day-to-day living needs of the immediate neighborhood. It is built around a supermarket as the principal tenant. In theory, the neighborhood center has a typical gross leasable area of 50,000 square feet; in practice it may range in size from 10,000 to 100,000 square feet.

1. San Francisco Bay Area (including Santa Cruz/Monterey Bay area)
2. Sacramento Area
3. Los Angeles Area
4. San Diego Area

- Geographic Distribution of Study Sites

Selection criteria: The proportion of population and employment within the census block groups that meet the UIA criteria will be used to allocate the regional distribution of study sites to individual counties within each region. The selection of study areas within cities is based on two criteria:

1) Cities with census blocks that meet either housing or employment density criteria and mapped in Working Paper #1, and
2) Cities that have transit systems that meet the minimum service criteria described above (rail stations, BRT systems, and/or maximum headways of 15-minutes for at least 5 hours per day).

This selection criteria requires mapping transit lines (both rail and fixed route) that meet the minimum service criteria.

- Geographic Distribution of Study Sites by District

Selection criteria: the district (an area of contiguous census block groups) must meet the following criteria:

1) District is within 1/3 mile of a an existing or future rail transit station, a ferry terminal served by either a bus or rail transit service, an intersection of at least two major bus routes, or within 300 feet of a bus rapid transit corridor. Transit lines must meet the headway criteria described above. It is acceptable to use the collective headways of multiple routes as long as the routes serve the same corridor for a considerable length of the corridor. This reflects corridors where people can use any route to reach any point within a significant length of the corridor.

This step involves using GIS to map the districts within the distance criteria around transit lines, then identify census block groups within these mapped districts that meet either the housing or employment minimum density criteria. The TAC will be given an opportunity to review identified districts.

B. Preliminary Study Site Identification

Selection criteria: use aerial photography and business search capabilities (e.g., google search) to review identified census block groups and apply the following qualitative criteria:

1) From observation, district or census block groups are located within a compact, mixed-use, walkable urban area with good pedestrian connections within the district, to transit, and to adjacent districts, and
2) District contains the selected ITE land use categories, identified either through web-based search of businesses, knowledge of area, or by visual inspection in field.

Note: The TAC may also provide preliminary identification of sites through local knowledge of their jurisdictions. Sites identified by the TAC will go through the same steps above the consultant uses to identify sites.

C. Site Owner/Tenant Interview

The site owner or tenant interview is necessary to determine the ability to obtain "population" data (needed for statistical analysis of intercept surveys) and independent variable data such as number of units, gross floor area, occupancy, etc. and to gain permission to conduct intercept surveys. The consultant will contact the owner or major tenant of the site and provide an initial interview to 1) gain permission to conduct intercept surveys and gather data about the site, and 2) ensure critical information is available to conduct a study of the site. The initial interview will be followed up with a detailed survey requesting additional data about the site and independent variables. The minimum independent variable data that must be available includes:

- Gross floor area (GFA), and occupied floor area for commercial properties.
- Number of staff and number of students at day care centers.
- Number of screens at multi-plex movie theaters.
- Number of units, and number of occupied units for residential properties.

Based on the owner/tenant interview, the site may be eliminated and review of alternative sites may be required.

E. Finalize Study Site Selection

Final selection of study sites (including TAC review and agreement) occurs when the site meets the criteria described in sections A through D above. A checklist will be developed to ensure criteria is met.

VII. Data Collection Methodology (Intercept Surveys)

A. Develop Schedule and Staffing Plan for Each Site

The purpose of the site data collection plan is to ensure that the appropriate resources are scheduled to collect data within the specified timeframes. The plan will include a schedule and identify the consultant staff person responsible for organizing the data collection, collecting independent variable data and additional site data, and managing the traffic counting subcontractor.

B. Develop Quality Control Plan

The purpose of the quality control plan is to identify staff responsible for reviewing individual site data collection plans, data collection, independent variable information, and additional site information. Quality control is conducted by someone not directly involved in the study. The quality control reviewer is responsible for the checking the data collection methodology and the collected data against the checklist developed above. The quality control reviewer will also check data for reasonableness.

C. Conduct Intercept Surveys

Objective: Use random intercept surveys to collect travel information from users of urban land uses in the derivation of automobile trip generation rates for the peak hours of adjacent street traffic. Initially, a pilot survey of between 5 and 10 sites will be conducted to test the effectiveness of the intercept survey method and to refine subsequent surveys.

Overall methodology: Intercept surveys collect data from a sample of the "population". Sampling is intended to represent the population of interest, in this case the travelers who access a particular land use. The sampling procedure that assures that each element in the population has an equal chance of being selected is referred to as simple random sampling. The results of surveying a sample of the population can be applied to the total population. For example, if 60% of the sample drove alone to the site we could apply this finding to the entire population.

Sampling through intercept surveys requires that we know how many people are in the "population" and how accurate the results should be (see Statistical Confidence below). A survey of a portion of a population always has some margin of error in the results, but when the margin of error is reduced to just a few percentage points, it often becomes of little concern. A rule of thumb is to target a 95% confidence with a 5% error level, but we may not be able to achieve this high a level. The confidence tells us how confident we are about the error level. Expressed as a percentage, it is the same as saying if we were to conduct the survey multiple times, how often would you expect to get similar results.

Determining a sample size to achieve a desired confidence and error level requires that we know the size of our population. For example, if the population is 300 persons travel to/from a land use in the peak hour we would need to survey 168 persons to achieve a 95% confidence with a 5% error level, or 143 persons to achieve a 90% confidence with a 5% error level. Because we may not know the size of population in advance, we would need to collect population information at the time of the survey as discussed below.

Data collection periods and Rate Derivation: The intercept survey is intended to provide data to compute trip generation rates for the peak hour of adjacent street traffic (7:00 to 9:00 AM and 4:00 to 6:00 PM). This is most common rate used by transportation planners and traffic engineers. Intercept surveys can also be used to compute the peak hour of the generator, but is typically only used for special generators such as theaters, theme parks, and other large venues. The use of intercept surveys will not provide enough information to develop average daily trip generations rates because it is not feasible to collect data for a 24-hour period. Average daily trip

generation may be estimated from peak hour data by dividing by a peak to daily factor, but its accuracy would be questionable.

Data requirements: The intercept survey and associated data collection includes the following information for each surveyed site:

Population size: Since our objective to determine how many automobile trips are being generated and using mode share information to determine this number, the population is the number of people accessing a site during the study period. This information would be collected in different ways, but the primary way would be to count the people entering and exiting the site during the survey periods. Therefore the sites selected require that we can survey each individual entrance point to capture the entire population.

Random sampling of population: The intercept surveys will ask specific questions of the random sample of people accessing the site during the study period (see draft questionnaire). The questions will primarily derive the mode of travel used to reach or leave the site, but additional information can be collected as well.

Independent variable: The computation of a trip generation rate requires establishing an independent variable (e.g., trips per 1,000 square feet or trips per employee). If the selected independent variable is related to the population, then that information needs to be collected at the time of survey. For example, if the independent variable was employees, we would need to know how many employees were present on the day of the survey. It is desirable to use a fixed independent variable such as square feet of building area to avoid variability. We will select the most common independent variables used in the ITE Trip Generation Manual.

Conducting the pilot surveys:

1) The methodology is based on the use of a professional surveying firm to conduct the intercept surveys (pilot studies will be conducted by Gene Bregman Associates, San Francisco).
    - The pilot surveys will be conducted on a Tuesday, Wednesday or Thursday of the week of May 29 through June 2. The surveys will be conducted from 7:00 a.m. to 9:00 a.m. and from 4:00 p.m. to 6:00 p.m. Each completed survey will contain the time of arrival or departure.
    - We have established a quota of a minimum of 100 completed surveys per site and will continue the surveys each day until the minimum quota is reached. Low generation land uses such as day care centers may have a lower quota because it may not be possible to collect the minimum. ITE recommends a minimum of 100 surveys when conducting multi-use development intercept interviews.
    - One or two surveyors will ask people entering and exiting the site to fill out a short questionnaire and hand them a clipboard with a one-page series of questions (see draft questionnaire in Attachment 2). The questionnaire incl
    - KHA will arrange to have additional persons count every person entering and exiting the site from all access points.

2) KHA will contact the candidate sites prior to the surveys to gain permission to conduct surveys and ensure that additional independent variable information can be collected.

E. Conducting the Final Surveys

The outcome of the pilot surveys will identify issues, problems, and additional data collection requirements for completing the full set of surveys. The consultant team will use the pilot surveys to refine the methodology. After refining the survey methodology, the remaining sites will be selected and additional surveys will be scheduled and conducted.

F. Quality Review

Essentially, quality review is a second look at the data. In addition to review by the staff responsible for data collection, the quality control reviewer examines the collected data focusing on identifying missing and inconsistent data, and obvious anomalies.

VIII. Data Analysis Methodology

A. Select Independent Variable(s) for Rate Calculation

The selection of independent variables to be used in calculating rates will be consistent with the variables used in the ITE Trip Generation Manual (7^{th} Edition). The minimum independent variable data required is listed in Section VI.C above. This information would be collected in the preliminary data collection (owner/tenant interview) prior to the collection of traffic data. Should the owner/tenant of the site be unwilling to disclose the required minimum information, the site will be discarded.

B. Determine Time Period for Computation of Rates

Trip generation rates will be computed for the "peak hour of adjacent street traffic". This is the most common time period published in the ITE Trip Generation Manual. These periods will be one hour between the time of 7:00 a.m. and 9:00 a.m. and between 4:00 p.m. and 6:00 p.m.

C. Compute Urban Infill Trip Generation Rates for Peak Hours of Adjacent Street Traffic

The steps for computing and evaluating trip generation rates are outlined below.

- Compute trip generation rate for each site for each time period (AM and PM peak)

  Equation: $\sum$ Peak Hour Trip Ends*/ $\sum$ Independent Variable Units

  * Peak hour trip ends will be derived from the intercept surveys as described in Section VII.C above.

- Determine inbound and outbound percentage for each peak hour

Equations: Inbound Trip Ends** / ∑ Inbound + Outbound Trip Ends
Outbound Trip Ends** / ∑ Inbound + Outbound Trip Ends

** Inbound and outbound trip ends will be derived from entry counts as described in Section VII.C above.

- Compute weighted average rate for all sites [This will not be done for the pilot studies]

  Equation: ∑ Trip Ends for All Sites / ∑ Independent Variable Units for All Sites

- Compute standard deviation using standard statistical methods (e.g., $S = \sqrt{\{ [\sum X^2 - (\sum X)^2 / n)] / (n-1) \}}$)

- Compute the correlation coefficient (R) and coefficient of determination (R^2) using standard statistical methods (e.g., least squares method)

- Develop regression equation (if $R^2 \geq 0.50$)

- Prepare scatter plots of trips versus independent variable

C. Quality Review

In addition to review by the staff responsible for data analysis, the quality control reviewer examines the trip generation and statistical computations to ensure correct formulae are used and calculations are correct.

D. Compare Computed Rates to ITE Rates for Similar Land Use Categories

Computed trip generation rates will be compared to ITE published rates for the same land use categories in a comparative matrix.

E. Develop Data Summary Report

The data collection plans, collected data, and analysis described above will be consolidated and summarized in a Draft Data Summary Report and associated technical appendices. Additional data in the report will include a general description of the site and surrounding neighborhood characteristics, as well as a summary of transportation access to the site. The report will be distributed to the TAC for review.

ATTACHMENT 1

Draft Questionnaire

What primary means of travel did you use to either get here or leave here today?

- ❑ Drove alone
- ❑ Drove others: How many including yourself_____
- ❑ Rode as passenger, car parked nearby
- ❑ Rode as passenger: dropped off
- ❑ Bus
- ❑ Rail (BART, Muni, Caltrain)
- ❑ Bicycle
- ❑ Walk
- ❑ Taxi
- ❑ Other _____

Is this location your primary destination or did you stop here on the way to another destination?

- ❑ Primary destination
- ❑ Stopped here on the way to another destination

If this location was NOT your primary destination, would you have passed by this location if you did not stop here today?

- ❑ Yes
- ❑ No

Is this your place of employment or residence?

- ❑ Yes
- ❑ No

How often do you visit this location in a typical week? _____

If you are arriving, approximately how long did it take you to get here today? _____ (minutes)

Optional Respondent Information:

What is the zip code of your home address? _____
What is your age? (circle one)

1. 18 years or under	2. 19-14 years	3. 25-34 years	4. 35-44 years
5. 45-54 years	6. 55-64 years	7. 65 years or more	

- ❑ Male
- ❑ Female

How many autos, pickups, vans and motorcycles are available for use by members of your household?_____ (enter number)

What is your occupation?

- ❑ Professional/technical
- ❑ Manager/administrator
- ❑ Sales/account representative
- ❑ Secretarial/clerical
- ❑ Student/intern
- ❑ Service worker
- ❑ Craftsman/mechanic

Including yourself, how many people live in your household? _____ (enter number)

Are you a full-time employee or part-time employee? (circle one)

What is your approximate household income?

- ❑ 0-$20,000
- ❑ $20,000 - $40,000
- ❑ $40,000 - $60,000
- ❑ $60,000 - $80,000
- ❑ Greater than $80,000

If you are employed, does your employer offer any of the following? (check all that apply)

- ❑ Flexible work hours
- ❑ Transit allowance
- ❑ Provide a company car for midday use
- ❑ Free parking

ATTCHMENT 2
INSTITUTE OF TRANSPORTATION ENGINEERS'
AREA TYPE DEFINITIONS
Parking Generation, 3rd Edition

Urban locations are comprised of one of the three area types:

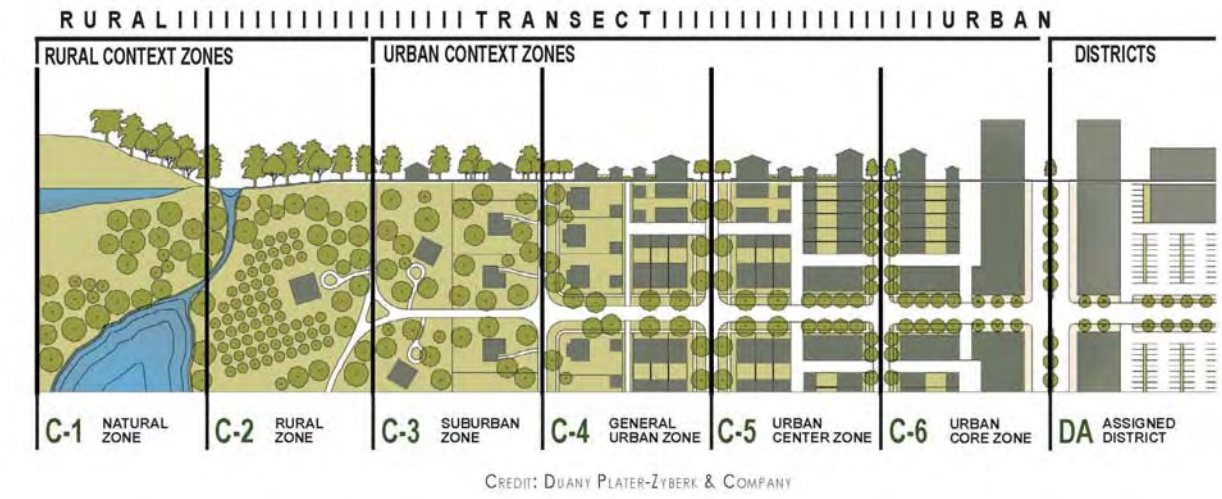
Central Business District (CBD) is the downtown area for a city. CBD characteristics include good transit service, parking garages, shared parking, and extensive pedestrian sidewalk network, multi-storied buildings, priced parking and a wide range of land uses (including mixed-use sites).

Central City, Not Downtown (CND) is the area outside the downtown area of a larger city. This area has greater land use density than suburban sites but is substantially less dense than the CBD. The intent of this area designation is for the areas around large central cities (for example, Seattle, San Francisco, Oakland, Atlanta, or Washington DC) where travel characteristics are likely to be unlike suburban conditions.

Suburban Center (SBC) areas are those downtown areas of suburbs that have developed CBD characteristics but are not the central city of a metropolitan region. These activity centers have characteristics that may include good transit service, a mix of surface and structured parking, connected streets, a connected pedestrian network and a mix of land uses. Examples include the downtown areas of Bellevue, WA; Las Colinas, TX; and Walnut Creek, CA.

ATTACHMENT 3
CONTEXT ZONE CHARACTERISTICS
Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities, Institute of Transportation Engineers Proposed Recommended Practice (est. February 2006)

A wide variety of factors create context in the urban environment. Every thoroughfare has an immediate physical context created by buildings and activities on adjacent properties, and is also part of a broader context created by the surrounding neighborhood or district. While the elements of context relating to buildings, landscape, land uses, and public facilities can combine in almost infinite varieties, a set of four context zones serve to define urban areas. The four context zones are a subset of a more inclusive system of contexts that can be used to describe the full range of environments from natural to highly urbanized. The figure below illustrates this concept through a diagram. Although the diagram graphically represents context zones as a linear continuum from most natural to most urban, in fact the zones are most frequently found arranged in mosaic-like patterns reflecting the complexity of metropolitan regions.



CREDIT: DUANY PLATER-ZYBERK & COMPANY

Many communities have found that context zones are useful in presenting information to the public. Local illustration of context zone examples can offer useful models that aid stakeholders in expressing their desires to create distinctive parts of their communities.

Selecting a Context Zone

Context is defined by multiple parameters, including land use, density, and design features. The following table presents the full range of context zones, but focuses on the suburban through urban core contexts (C-3 through C-6) representing urban conditions. The "distinguishing characteristics" column in the table, for example, describes the overall relationship between buildings and landscape that contribute to context. In addition to the distinguishing characteristics and general character, four attributes assist the practitioner in identifying a context zone:

1) building placement - how buildings are oriented and set back in relation to the thoroughfare,

2) frontage type – what part of the site or building fronts onto the thoroughfare,

3) typical building height, and

4) type of public open space.

Guidelines for identifying and selecting a context zone include:

1. Consider both the existing conditions and the plans for the future, recognizing that thoroughfares often last longer than adjacent buildings.

2. Assess area plans and review general, comprehensive, and specific plans, zoning codes, and community goals and objectives. These often provide detailed guidance on the vision for the area.

3. Compare the area's predominant land use patterns, building types, and land uses to the characteristics presented in the following table.

4. Pay particular attention to residential densities, commercial floor area ratios, and building heights.

5. If an area or corridor has a diversity of characteristics that could fall under multiple context zones, consider dividing the area into two or more context zones.

6. Identify current levels of pedestrian and transit activity, or estimate future levels based on the type, mix, and proximity of land uses. This is a strong indicator of urban context.

7. Consider the area's existing and future characteristics beyond the thoroughfare under design, possibly extending consideration to include entire neighborhoods or districts.

Context Zone Characteristics

	A	B	C	D	E	F	G
	Context Zone	**Summary Character**	**Building Setback/Build To and Frontage**	**Thoroughfare Network Scale**	**Building Height**	**Land Use Mix**	**Public Open Space Type**
1	NATURAL (CZ-1)	Natural	Not Applicable	Regional to State Scale	Not Applicable	Restricted protected natural open space	Natural
2	RURAL (CZ-2)	Agricultural and landscaped, no pedestrians	Large setbacks porch, fence, & work yard	Regional Scale	1 to 2 story with some taller work buildings	Restricted agriculture, limited support residential and commercial	Agricultural
3	SUBURBAN (CZ-3)	Landscaped, few pedestrians, detached buildings widely separated	Deep yard setbacks dominant landscaped character (fence/hedge, yard, & porch)	Predominantly Neighborhood Scale	1 to 2 story with some 3 story	Restricted residential with "at-home" businesses and limited commercial, institutional/civic, and open space	Parks with adjacency to greenbelts
4	GENERAL URBAN (CZ-4)	Urban, pedestrians present, balanced landscape and predominantly detached buildings	Medium yard setbacks balanced landscape and building character (fence/hedge, yard, & porch)	Neighborhood to Regional Scale	2 to 3 story with some 1 story and some above 3 story; and few taller work buildings	Limited medium-density residential with limited mix of other uses typically ground level - institutional/civic, commercial, and open space	Parks
5	URBAN CENTER (CZ-5)	Urban, substantial pedestrian activity, predominantly built with attached buildings with most landscape within the thoroughfare right-of-way	Small or no setback, build to lines common, building character defining street wall (storefront, stoop, & forecourt)	Neighborhood to Regional Scale	3 to 5 story with some lower and few taller buildings	Open higher-density commercial, employment, and residential use with support institutional/civic and open space	Parks, plazas and squares
6	URBAN CORE (CZ-6)	Urban, most pedestrian activity, predominantly built with attached buildings providing a strong sense of enclosure with some landscape within the thoroughfare right-of-way	Small or no setback, build to line at sidewalk/RW, building character defining street wall (storefront, stoop, & forecourt)	Neighborhood to Sector Scale	4+ story with few lower buildings	Open highest-density commercial, employment, and residential use with support institutional/civic and open space	Parks, plazas and squares

APPENDIX E

Site Name: Bachenheimer Building.

Site Location: 2111 University Avenue, Berkeley, CA 94704

Land Use Type: Residential with ground floor commercial

Site Characteristics:	Quantity	
Studios Units:	0	D.U
1 Bedroom Units:	12	D.U
2 Bedrooms Units:	32	D.U
3 + Bedrooms Units:	0	D.U
Total	44	D.U
Ground Floor Commercial:	3,000	Sq. Ft.
Residential Occupancy:	100%	
Commercial Occupancy:	100%	
Number of parking spaces:	30	
Number of spaces per unit:	0.68	
Density of Site:	155	units/acre

Site Description:

Meets Residential Criteria:	Yes	Area Type:	CBD
Meets Employment Criteria:	Yes	Transect / Context Zone Type:	Urban Center (T/CZ-5)
Meets Transit Proximity Criteria:	Yes		
Predominant Land Use within 0.5 miles:	Non-Residential	Distance from CBD:	Within CBD
Connectivity Index (Measure of Walking Environment):	High	Surrounding Residential Density:	11.63 units/gross land acre
% of blocks within 0.5 miles with sidewalks:	100%	Surrounding Employment Density:	36.23 workers/gross land acre

Survey Date: 10th May, 2007

ITE Land Use Codes: ITE 223 Mid-Rise Apartments
ITE 820 Shopping Center

Residential Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate	0.09	0.21	0.30	0.23	0.16	0.39
Directional Distribution	31%	69%	100%	58%	42%	100%
Surveyed Trip Rate	0.00	0.00	0.00	0.03	0.01	0.04
Directional Distribution				70%	30%	100%

Surveyed Mode Split	AM Peak - % Trips		PM Peak - % Trips	
	Auto	0%	Auto	7%
	Transit	11%	Transit	27%
	Walk/Bicycle	89%	Walk/Bicycle	66%

Commercial Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate	0.65	0.38	1.03	1.80	1.95	3.75
Directional Distribution	63%	37%	100%	48%	52%	100%
Surveyed Trip Rate	0.00	0.00	0.00	1.72	2.28	4.00
Directional Distribution				43%	57%	100%

Surveyed Mode Split	AM Peak - % Trips		PM Peak - % Trips	
	Auto	0%	Auto	38%
	Transit	0%	Transit	0%
	Walk/Bicycle	0%	Walk/Bicycle	62%

Note: The commercial shop was closed during the AM peak hour

Site Name: Gaia Building.

Site Location: 2116 Allston Way, Berkeley, CA 94704

Land Use Type: Residential with ground floor Drinking Place

Site Characteristics:	Quantity	
Studios Units:	0	D.U
1 Bedroom Units:	26	D.U
2 Bedrooms Units:	73	D.U
3 + Bedrooms Units:	0	D.U
Total	99	D.U
Ground Floor Commercial:	12,000	Sq. Ft.
Residential Occupancy:	99%	
Commercial Occupancy:	100%	
Number of parking spaces:	40	
Number of spaces per unit:	0.40	
Density of Site:	267	units/acre

Site Description:

Meets Residential Criteria:	Yes	Area Type:	CBD
Meets Employment Criteria:	Yes	Transect / Context Zone Type:	Urban Center (T/CZ-5)
Meets Transit Proximity Criteria:	Yes		
Predominant Land Use within 0.5 miles:	Commercial and Residential	Distance from CBD:	Within CBD
Connectivity Index (Measure of Walking Environment):	High	Surrounding Residential Density:	12.09 units/gross land acre
% of blocks within 0.5 miles with sidewalks:	100%	Surrounding Employment Density:	36.32 workers/gross land acre

Survey Date: 10th May, 2007

ITE Land Use Codes: ITE 223 Mid-Rise Apartments
ITE 936 Drinking Place

Residential Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate	0.09	0.21	0.30	0.23	0.16	0.39
Directional Distribution	31%	69%	100%	58%	42%	100%
Surveyed Trip Rate	0.01	0.03	0.04	0.17	0.11	0.28
Directional Distribution	22%	78%		59%	41%	100%

Surveyed Mode Split	AM Peak - % Trips		PM Peak - % Trips	
	Auto	20%	Auto	24%
	Transit	7%	Transit	5%
	Walk/Bicycle	73%	Walk/Bicycle	71%

Commercial Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate	0.00	0.00	0.00	7.48	3.86	11.34
Directional Distribution				66%	34%	100%
Surveyed Trip Rate	0.00	0.00	0.00	0.14	0.00	0.14
Directional Distribution				100%	0%	100%

Surveyed Mode Split	AM Peak - % Trips		PM Peak - % Trips	
	Auto	0%	Auto	43%
	Transit	0%	Transit	29%
	Walk/Bicycle	0%	Walk/Bicycle	28%

Note: The Drinking Place is closed during the AM peak hour

Site Name: Acton Courtyard

Site Location: 1370 University Ave., Berkeley, CA 94704

Land Use Type: Residential with ground floor commercial

Site Characteristics:	Quantity	
Studios Units:	4	D.U
1 Bedroom Units:	7	D.U
2 Bedrooms Units:	60	D.U
3 + Bedrooms Units:	0	D.U
Total	71	D.U
Ground Floor Commercial:	5,000	Sq. Ft.
Residential Occupancy:	100%	
Commercial Occupancy:	100%	
Number of parking spaces:	62	
Number of spaces per unit:	0.87	
Density of Site:	141	units/acre

Site Description:

Meets Residential Criteria:	Yes	Area Type:	CND
Meets Employment Criteria:	No	Transect / Context Zone Type:	Urban Center (T/CZ-5)
Meets Transit Proximity Criteria:	No		
Predominant Land Use within 0.5 miles:	Residential	Distance from CBD:	< 1 mile
Connectivity Index (Measure of Walking Environment):	High	Surrounding Residential Density:	10.75 units/gross land acre
% of blocks within 0.5 miles with sidewalks:	100%	Surrounding Employment Density:	6.25 workers/gross land acre
Survey Date:	May 8th, 2007		

ITE Land Use Codes: ITE 223 Mid-Rise Apartments
ITE 933 Fast Food Restaurant without Drive-Through Window (Bread Shop)

Residential Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate	0.09	0.21	0.30	0.23	0.16	0.39
Directional Distribution	31%	69%	100%	58%	42%	100%
Surveyed Trip Rate	0.04	0.18	0.22	0.09	0.08	0.17
Directional Distribution	19%	81%	100%	52%	48%	100%

Surveyed Mode Split	AM Peak - % Trips		PM Peak - % Trips	
	Auto	57%	Auto	35%
	Transit	29%	Transit	30%
	Walk/Bicycle	14%	Walk/Bicycle	35%

Commercial Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate	2.21	2.12	4.33	14.00	14.00	28.00
Directional Distribution	51%	49%	100%	50%	50%	100%
Surveyed Trip Rate	2.13	1.67	3.80	4.23	4.23	8.46
Directional Distribution	56%	44%	100%	50%	50%	100%

Surveyed Mode Split	AM Peak - % Trips		PM Peak - % Trips	
	Auto	33%	Auto	57%
	Transit	11%	Transit	10%
	Walk/Bicycle	56%	Walk/Bicycle	33%

Site Name: Touriel Building

Site Location: 2004 University Ave., Berkeley, CA 94704

Land Use Type: Residential with ground floor commercial (Flower Shop)

Site Characteristics:	Quantity
Studios Units:	0 D.U
1 Bedroom Units:	10 D.U
2 Bedrooms Units:	25 D.U
3 + Bedrooms Units:	0 D.U
Total	35 D.U
Ground Floor Commercial:	2,400 Sq. Ft.
Residential Occupancy:	97%
Commercial Occupancy:	100%
Number of parking spaces:	5
Number of spaces per unit:	0.14
Density of Site:	218 units/acre

Site Description:

Meets Residential Criteria:	Yes	Area Type:	CBD
Meets Employment Criteria:	No	Transect / Context Zone Type:	Urban Center (T/CZ-5)
Meets Transit Proximity Criteria:	Yes		
Predominant Land Use within 0.5 miles:	Commercial and Residential	Distance from CBD:	Within CBD
Connectivity Index (Measure of Walking Environment):	High	Surrounding Residential Density:	12.13 units/gross land acre
% of blocks within 0.5 miles with sidewalks:	100%	Surrounding Employment Density:	32.77 workers/gross land acre

Survey Date: May 9th, 2007

ITE Land Use Codes: ITE 223 Mid-Rise Apartments
ITE 820 Shopping Center

Residential Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate	0.09	0.21	0.30	0.23	0.16	0.39
Directional Distribution	31%	69%	100%	58%	42%	100%
Surveyed Trip Rate	0.01	0.04	0.05	0.07	0.08	0.15
Directional Distribution	14%	86%	100%	46%	54%	100%

Surveyed Mode Split	AM Peak - % Trips		PM Peak - % Trips	
	Auto	25%	Auto	15%
	Transit	50%	Transit	9%
	Walk/Bicycle	25%	Walk/Bicycle	74%

Commercial Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate	0.65	0.38	1.03	1.80	1.95	3.75
Directional Distribution	63%	37%	100%	48%	52%	100%
Surveyed Trip Rate	0.44	0.00	0.44	0.85	2.07	2.92
Directional Distribution	100%	0%	100%	29%	71%	100%

Surveyed Mode Split	AM Peak - % Trips		PM Peak - % Trips	
	Auto	100%	Auto	100%
	Transit	0%	Transit	0%
	Walk/Bicycle	0%	Walk/Bicycle	0%

Site Name: Berkeleyan Apartments

Site Location: 1910 Oxford St., Berkeley, CA 94704

Land Use Type: Residential with ground floor commercial (Coffee Shop)

Site Characteristics:	Quantity
Studios Units:	0 D.U
1 Bedroom Units:	5 D.U
2 Bedrooms Units:	51 D.U
3 + Bedrooms Units:	0 D.U
Total	56 D.U
Ground Floor Commercial:	4,500 Sq. Ft.
Residential Occupancy:	100%
Commercial Occupancy:	100%
Number of parking spaces:	36
Number of spaces per unit:	0.64
Density of Site:	227 units/acre

Site Description:

Meets Residential Criteria:	Yes	Area Type:	CBD
Meets Employment Criteria:	Yes	Transect / Context Zone Type:	Urban Center (T/CZ-5)
Meets Transit Proximity Criteria:	Yes		
Predominant Land Use within 0.5 miles:	Non-Residential	Distance from CBD:	Within CBD
Connectivity Index (Measure of Walking Environment):	High	Surrounding Residential Density:	11.07 units/gross land acre
% of blocks within 0.5 miles with sidewalks:	100%	Surrounding Employment Density:	35.72 workers/gross land acre

Survey Date: May 10th, 2007

ITE Land Use Codes: ITE 223 Mid-Rise Apartments
ITE 933 Fast Food Restaurant without Drive-Through Window (Coffee Shop)

Residential Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate	0.09	0.21	0.30	0.23	0.16	0.39
Directional Distribution	31%	69%	100%	58%	42%	100%
Surveyed Trip Rate	0.02	0.05	0.07	0.07	0.02	0.09
Directional Distribution	28%	72%	100%	80%	20%	100%

Surveyed Mode Split	AM Peak - % Trips		PM Peak - % Trips	
	Auto	21%	Auto	20%
	Transit	17%	Transit	7%
	Walk/Bicycle	62%	Walk/Bicycle	73%

Commercial Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate	37.25	35.78	73.03	14.97	13.82	28.79
Directional Distribution	51%	49%	100%	52%	48%	100%
Surveyed Trip Rate	8.23	9.66	17.89	3.22	4.63	7.85
Directional Distribution	46%	54%	100%	41%	59%	100%

Surveyed Mode Split	AM Peak - % Trips		PM Peak - % Trips	
	Auto	64%	Auto	35%
	Transit	0%	Transit	8%
	Walk/Bicycle	36%	Walk/Bicycle	57%

Site Name: Fine Arts Building

Site Location: 2110 Haste St., Berkeley, CA 94704

Land Use Type: Residential

Site Characteristics:	Quantity	
Studios Units:	4	D.U
1 Bedroom Units:	32	D.U
2 Bedrooms Units:	64	D.U
3 + Bedrooms Units:	0	D.U
Total	100	D.U
Ground Floor Commercial:	0	Sq. Ft.
Residential Occupancy:	100%	
Commercial Occupancy:	0%	
Number of parking spaces:	63	
Number of spaces per unit:	0.63	
Density of Site:	168	units/acre

Site Description:

Meets Residential Criteria:	Yes	Area Type:	CBD
Meets Employment Criteria:	No	Transect / Context Zone Type:	Urban Center (T/CZ-5)
Meets Transit Proximity Criteria:	Yes		
Predominant Land Use within 0.5 miles:	Residential	Distance from CBD:	Within CBD
Connectivity Index (Measure of Walking Environment):	High	Surrounding Residential Density:	12.91 units/gross land acre
% of blocks within 0.5 miles with sidewalks:	100%	Surrounding Employment Density:	26.45 workers/gross land acre

Survey Date: May 9th, 2007

ITE Land Use Codes: ITE 223 Mid-Rise Apartments

Residential Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate	0.09	0.21	0.30	0.23	0.16	0.39
Directional Distribution	31%	69%	100%	58%	42%	100%
Surveyed Trip Rate	0.01	0.12	0.13	0.08	0.05	0.13
Directional Distribution	7%	93%	100%	61%	39%	100%

Surveyed Mode Split	AM Peak - % Trips		PM Peak - % Trips	
	Auto	44%	Auto	24%
	Transit	22%	Transit	14%
	Walk/Bicycle	34%	Walk/Bicycle	62%

Commercial Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate						
Directional Distribution						
Surveyed Trip Rate						
Directional Distribution						

Surveyed Mode Split	AM Peak - % Trips	PM Peak - % Trips
	Auto	Auto
	Transit	Transit
	Walk/Bicycle	Walk/Bicycle

Site Name: Central City Association of Los Angeles

Site Location: 626 Wilshire Boulevard, Los Angeles, CA 90017

Land Use Type: Office Building

Site Characteristics:	Quantity
Studios Units:	0 D.U
1 Bedroom Units:	0 D.U
2 Bedrooms Units:	0 D.U
3 + Bedrooms Units:	0 D.U
Total	0 D.U
Ground Floor Commercial:	138,542 Sq. Ft.
Residential Occupancy:	0%
Commercial Occupancy:	97.66%
Number of parking spaces:	136
Number of spaces per 1,000 square feet:	0.98
Density of Site:	N/A units/acre

Site Description:

Meets Residential Criteria:	No	Area Type:	CBD
Meets Employment Criteria:	Yes	Transect / Context Zone Type:	Urban Core (T/CZ-6)
Meets Transit Proximity Criteria:	Yes		
Predominant Land Use within 0.5 miles:	Non-Residential	Distance from CBD:	Within CBD
Connectivity Index (Measure of Walking Environment):	High	Surrounding Residential Density:	9.55 units/gross land acre
% of blocks within 0.5 miles with sidewalks:	100%	Surrounding Employment Density:	197.78 workers/gross land acre

Survey Date: October 10th, 2007

ITE Land Use Codes: ITE 710 General Office Building

Residential Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate						
Directional Distribution						
Surveyed Trip Rate						
Directional Distribution						

Surveyed Mode Split	AM Peak - % Trips	PM Peak - % Trips
Auto		
Transit		
Walk/Bicycle		

Commercial Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate	1.36	0.19	1.55	0.25	1.24	1.49
Directional Distribution	88%	12%	100%	17%	83%	100%
Surveyed Trip Rate	0.67	0.14	0.81	0.12	0.50	0.62
Directional Distribution	83%	17%	100%	19%	81%	100%

Surveyed Mode Split	AM Peak - % Trips		PM Peak - % Trips	
Auto	95%		77%	
Transit	4%		23%	
Walk/Bicycle	1%		0%	

Site Name: Ralphs

Site Location: 101 G Street, San Diego, CA 92101

Land Use Type: Supermarket

Site Characteristics:	Quantity
Studios Units:	0 D.U
1 Bedroom Units:	0 D.U
2 Bedrooms Units:	0 D.U
3 + Bedrooms Units:	0 D.U
Total	0 D.U
Ground Floor Commercial:	43,318 Sq. Ft.
Residential Occupancy:	0%
Commercial Occupancy:	100.00%
Number of parking spaces:	156
Number of spaces per 1,000 square feet:	3.60
Density of Site:	N/A units/acre

Site Description:

Meets Residential Criteria:	No	Area Type:	CBD
Meets Employment Criteria:	Yes	Transect / Context Zone Type:	Urban Core (T/CZ-6)
Meets Transit Proximity Criteria:	Yes		
Predominant Land Use within 0.5 miles:	Non-Residential	Distance from CBD:	Within CBD
Connectivity Index (Measure of Walking Environment):	High	Surrounding Residential Density:	8.79 units/gross land acre
% of blocks within 0.5 miles with sidewalks:	100%	Surrounding Employment Density:	88.26 workers/gross land acre

Survey Date: February 7th, 2007

ITE Land Use Codes: ITE 850 Supermarket

Residential Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate						
Directional Distribution						
Surveyed Trip Rate						
Directional Distribution						

Surveyed Mode Split	AM Peak - % Trips	PM Peak - % Trips
	Auto	Auto
	Transit	Transit
	Walk/Bicycle	Walk/Bicycle

Commercial Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate	1.98	1.27	3.25	5.33	5.12	10.45
Directional Distribution	61%	39%	100%	51%	49%	100%
Surveyed Trip Rate	2.28	2.38	4.66	5.19	5.63	10.82
Directional Distribution	49%	51%	100%	48%	52%	100%

Surveyed Mode Split	AM Peak - % Trips		PM Peak - % Trips	
	Auto	50%	Auto	49%
	Transit	10%	Transit	12%
	Walk/Bicycle	40%	Walk/Bicycle	38%

Site Name: Horizon

Site Location: 505 Front Street, San Diego, CA 92101

Land Use Type: Residential

Site Characteristics:	Quantity
Studios Units:	n/A D.U
1 Bedroom Units:	n/A D.U
2 Bedrooms Units:	n/A D.U
3 + Bedrooms Units:	n/A D.U
Total	211 D.U

n/a - not available

Ground Floor Commercial: 0 Sq. Ft.

Residential Occupancy: 100%
Commercial Occupancy: 0%

Number of parking spaces: 415 (includes 22 motorcycle parking stalls)
Number of spaces per unit: 1.97
Density of Site: 109 units/acre

Site Description:

Meets Residential Criteria: No
Meets Employment Criteria: Yes
Meets Transit Proximity Criteria: Yes

Area Type: CBD
Transect / Context Zone Type: Urban Core (T/CZ-6)

Predominant Land Use within 0.5 miles: Non-Residential
Connectivity Index (Measure of Walking Environment): High
% of blocks within 0.5 miles with sidewalks: 100%

Distance from CBD: Within CBD
Surrounding Residential Density: 8.86 units/gross land acre
Surrounding Employment Density: 83.96 workers/gross land acre

Survey Date: May 31st, 2007

ITE Land Use Codes: ITE 232 High-Rise Residential Condominiums / Townhouses

Residential Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate	0.06	0.28	0.34	0.24	0.14	0.38
Directional Distribution	19%	81%	100%	62%	38%	100%
Surveyed Trip Rate	0.02	0.08	0.10	0.11	0.06	0.17
Directional Distribution	21%	79%	100%	67%	33%	100%

Surveyed Mode Split	AM Peak - % Trips		PM Peak - % Trips	
	Auto	77%	Auto	73%
	Transit	3%	Transit	7%
	Walk/Bicycle	20%	Walk/Bicycle	20%

Commercial Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate						
Directional Distribution						
Surveyed Trip Rate						
Directional Distribution						

Surveyed Mode Split	AM Peak - % Trips		PM Peak - % Trips	
	Auto		Auto	
	Transit		Transit	
	Walk/Bicycle		Walk/Bicycle	

Site Name: Atria

Site Location: 101 Market Street, San Diego, CA 92101

Land Use Type: Residential with ground floor commercial (Coffee Shop)

Site Characteristics:	Quantity
Studios / lofts Units:	60 D.U
1 Bedroom Units:	58 D.U
2 Bedrooms Units:	31 D.U
3 + Bedrooms Units:	0 D.U
Total	149 D.U
Ground Floor Commercial:	1,250 Sq. Ft.
Residential Occupancy:	100%
Commercial Occupancy:	100%
Number of parking spaces:	183
Number of spaces per unit:	1.23
Density of Site:	83 units/acre

Site Description:

Meets Residential Criteria:	No	Area Type:	CBD
Meets Employment Criteria:	Yes	Transect / Context Zone Type:	Urban Center (T/CZ-5)
Meets Transit Proximity Criteria:	Yes		
Predominant Land Use within 0.5 miles:	Non-Residential	Distance from CBD:	Within CBD
Connectivity Index (Measure of Walking Environment):	High	Surrounding Residential Density:	8.64 units/gross land acre
% of blocks within 0.5 miles with sidewalks:	100%	Surrounding Employment Density:	81.20 workers/gross land acre

Survey Date: March 20th, 2007

ITE Land Use Codes: ITE 230 Residential Condominiums / Townhouses
ITE 933 Fast Food Restaurant without Drive-Through Window (Coffee Shop)

Residential Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate	0.07	0.37	0.44	0.35	0.17	0.52
Directional Distribution	17%	83%	100%	67%	33%	100%
Surveyed Trip Rate	0.14	0.32	0.46	0.21	0.20	0.41
Directional Distribution	30%	70%	100%	51%	49%	100%

Surveyed Mode Split	AM Peak - % Trips		PM Peak - % Trips	
	Auto	85%	Auto	69%
	Transit	2%	Transit	0%
	Walk/Bicycle	13%	Walk/Bicycle	31%

Commercial Trip Rate Comparison

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
ITE Trip Rate	37.25	35.78	73.03	14.97	13.82	28.79
Directional Distribution	51%	49%	100%	52%	48%	100%
Surveyed Trip Rate	23.88	26.92	50.80	4.47	4.30	8.77
Directional Distribution	47%	53%	100%	51%	49%	100%

Surveyed Mode Split	AM Peak - % Trips		PM Peak - % Trips	
	Auto	50%	Auto	17%
	Transit	13%	Transit	0%
	Walk/Bicycle	37%	Walk/Bicycle	83%

APPENDIX F

Projects

< Rental Properties

BACHENHEIMER BUILDING (2004)

Location
2119 University Avenue
Berkeley, California

Lot Size
12,400 sf

Units
44 Apartments
(7 low-income)

Density
155 units / acre

Parking
30 spaces

Commercial Space
3,000 sf
Offices/Retail

Amenities
High-speed internet access
Rooftop gardens
Stacked hydraulic parking lifts

August 2004

October 2002

Source: *http://www.panoramicinterests.com/projects/bachenheimer.html*

PANORAMIC INTERESTS

Berkeley Apartments

Phone: 510.883.1000
Fax: 510.883.9000
info@panoramicinterests.com

2116 Allston Way, Suite One • Berkeley, CA 94704

contact us

Projects

< **Rental Properties**

GAIA BUILDING (2001)

Location
2116 Allston Way
Berkeley, California

Lot Size
14,850 sf

Units
91 Apartments
(19 low-income)

Density
267 units / acre

Parking
42 spaces

Commercial Space
12,000 sf
No leases signed yet

Amenities
High-speed internet access
Interior courtyard
Rooftop gardens
Stacked hydraulic parking lifts

August 2001

June 2000

Phone: 510.883.1000
Fax: 510.883.9000
info@panoramicinterests.com
contact us

Projects

< **Rental Properties**

ACTON COURTYARD (2003)

Location
1392 University Avenue
Berkeley, California

Lot Size
22,000 sf

Units
71 Apartments
(20 low-income)

Density
141 units / acre

Parking
56 spaces

Commercial Space
8,000 sf
Jubilee Restoration
Restaurant
Offices/Retail

Amenities
High-speed internet access
Interior courtyard
Stacked hydraulic parking lifts

Completed 2004

May 2003

PANORAMIC INTERESTS

Berkeley Apartments

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contact us

Projects

< **Rental Properties**

TOURIEL BUILDING (2004)

Location
2004 University Avenue
Berkeley, California

Lot Size
7,000 sf

Units
35 Apartments

Density
218 units / acre

Parking
8 spaces

Commercial Space
2,400 sf
Darling Florists

Amenities
High-speed internet access
Rooftop gardens
Stacked hydraulic parking lifts

August 2004

January 2003

Phone: 510.883.1000
Fax: 510.883.9000
info@panoramicinterests.com

2116 Allston Way, Suite One • Berkeley, CA 94704

Projects

< Rental Properties

BERKELEYAN APARTMENTS (1998)

Location
1910 Oxford Street
Berkeley, California

Lot Size
10,700 sf

Units
56 Apartments

Density
227 units / acre

Parking
39 spaces

Commercial Space
4,500 sf
Yali's Cafe
Computer Training Program

Amenities
Interior courtyard
Rooftop gardens
Stacked hydraulic parking lifts

Awards
Excellence in Design,
Downtown Berkeley Association

1998

1996

Phone: 510.883.1000
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info@panoramicinterests.com

2116 Allston Way, Suite One • Berkeley, CA 94704

Projects

< Rental Properties

FINE ARTS BUILDING (2004)

Location
2110 Haste Street
Berkeley, California

Lot Size
26,000 sf

Units
100 Apartments
(20 low-income)

Density
168 units / acre

Parking
55 spaces

Commercial Space
12,000 sf
Fine Arts Theater
Retail
Cafe

Amenities
High-speed internet access
Interior courtyard
Rooftop gardens
Stacked hydraulic parking lifts

August 2004

January 1972

REALTOR® Lew Breeze
Dream Homes California
Little Italy Branch in
Downtown San Diego
Tel. (619) 846-5889
Email downtown@sdcondo.com

• Currently For Sale •

• Summary of Downtown Condos •

Choose another Downtown Community:

Choose a development:

Name: Horizons
by Bosa Development

Location: 510 First Ave. and 555 Front St.
in the Marina District

More Details:
Completed in 2001
211 condos and town homes
1036 sq.ft. to 2200 sq.ft.
Full Amenities
Designed by ARC Design International

Rating:

Click Here For Available Properties

Click Here For A Slideshow of Images

Atria On Market San Diego in Downtown's Marina District

For more information on Atria on Market in San Diego, currently available condo and townhome listings call George Alexiou toll-free at **800-334-1650** or direct **619-921-0284**

Atria On Market is located in the heart of the Marina District, downtown San Diego's premier residential neighborhood. Direct across from the new Ralph's and within steps to Horton Plaza and upscale boutiques, live music and fine restaurants of the Gaslamp. Walk to the ballpark to catch a game of the San Diego Padres, to the San Diego Convention Center and to the Seaport Village.

Community amenities include - Grand lobby entrance with drop-off area, Computer/business center with conference room, State-of-the-art exercise/fitness facility, Media room, Street-level retail services, including Starbucks Coffee, Elevators, Rooftop deck with barbeque, fireplace and downtown views, Gated underground parking.

Downtown Ralphs Thriving In Urban Market

Store director says he's seen it all, shared a popsicle with Jerry Lewis

In few places do the wealthy and homeless, executives and tourists, all stand in line every day for the same service. Then again, few places are like the 24-hour Ralphs grocery store on G Street Downtown.

Chip Walsh runs Ralphs and a snappy deli.

Overseeing the urban market and its eclectic clientele is Chip Walsh, the store director and a Ralphs employee for 20 years.

"It's certainly an exciting environment," says Walsh, who has managed the 6-year-old market for the last two and a half years. "With such a diverse group of customers, there's never a dull moment."

The store has its own particular rules, like not selling alcohol after midnight. Shoppers get two hours of free parking in the underground lot, where a private management service uses handheld computers to monitor and tow unauthorized cars.

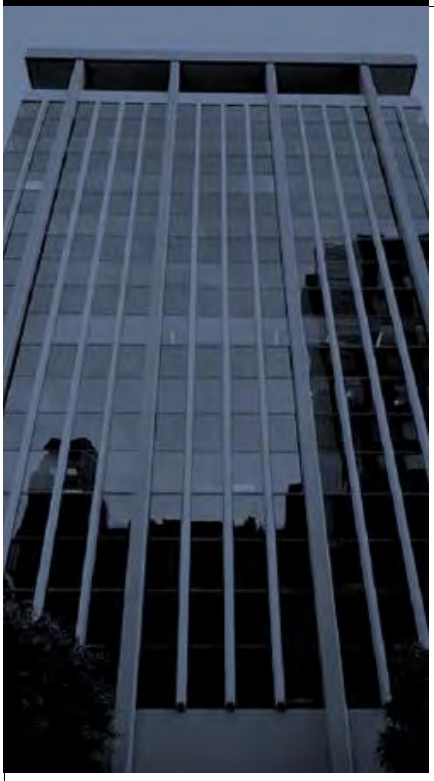
While some Downtown boosters brag the market is No. 1 in the region, corporate Ralphs says this isn't so. The store does rank among the top five in San Diego, somewhere among those in Hillcrest, La Jolla, Del Mar and Mission Valley.

Among its star attractions is the service deli and salad bar, which boasts one of the highest lunch sales in the Ralphs corporation. Those who have shopped the store during the lunch-hour rush, from 11:30 a.m to 1:30 p.m., can attest to its popularity. It takes 35 employees to run the deli, about a third of the 107 that Walsh supervises.

With its unique location blocks from the San Diego Convention Center, Gaslamp Quarter, and adjacent to Horton Plaza and Downtown's priciest homes, this Ralphs gets more than its fair share of famous clientele and unusual shoppers. Walsh recalls one evening when actor Jerry Lewis, who lives on his boat in the harbor, came in looking for his favorite popsicle. Walsh did not stock this brand but Lewis said he'd pay whatever it took to get them. Within 24 hours, the frozen treats arrived. Soon after, Walsh found himself seated on a stack of beer cases eating one with Lewis. Now the novelties are a regular.

"Down here, you have to prepare yourself for the unexpected," Walsh says.

— Maria L. Kirkpatrick



Oscar de la Hoya Hops in the Downtown LA Ring with Office Buy

RENTV News Headline
10.11.04

In a deal that closed on the first of October, Oscar de la Hoya's Golden Boy Enterprises LLP has just acquired a majority interest in a 148.7k sf Class B office building at 626 Wilshire Blvd in downtown Los Angeles. De la Hoya purchased the stake from Barker Pacific Group (BPG) and together, along with Christopher Rising of Rising Real Estate Group, formed a new real estate partnership called Golden Boy Wilshire LLP. Rising also acquired a minority interest in the building, which was valued at $16 mil, or about $108/sf, in this deal.

BPG acquired the building from AEW for about $8.5 mil last October when it was less than 40% leased, but since then they have been on a leasing tear, as Michael Barker, managing director of the Los Angeles-based development company said, "For the last twelve months we have been quickly leasing the available space in the building and we saw an opportunity to capitalize on the value our team created by increasing the tenancy to over 80 percent,"

The 12-story building is located on the corner of Hope St and Wilshire Blvd, about three blocks from the Harbor Freeway/Interstate 110 in the heart of the financial district of downtown Los Angeles.

Barker is retaining a reduced ownership position in the property, and will continue to manage it as well as retain its offices in the building. Handling the leasing will be Rising's firm, called The Rising Real Estate Group. Adding to the ownership party at the building is the fact that the de la Hoya's firm, Golden Boy Enterprises, will relocate to into 5.5k sf at the property next month from Library Tower, at 533 West 5th St. Other tenants in the building include Telehouse, Gianelli & Morris, Wescom Credit Union, Consensus Planning Group, and Nextel of California. The rest of the tenant roster includes a number of law firms and other professional service companies.

The building, originally designed by Langdon Wilson and built in 1967, was renovated in 2002 under the direction of architect Scott Johnson of Johnson Fain Partners. Johnson is renowned for his architectural design work at Fox Tower, 1999 Avenue of the Stars and MGM Tower in Los Angeles, and Rincon Plaza in San Francisco. The modern renovations included a sleek new main entrance and lobby with translucent glass walls, rich wood framed portals and redesigned security console with stainless steel and marble finishes.

Barker Pacific Group Inc is a 20-year-old firm that has completed or has under development or redevelopment in excess of $1 billion in commercial projects, including the award winning Hamilton Landing, a 550k sf Class-A office conversion project on Hamilton Air Force Base in Marin County. Several of Barker Pacific Group's other notable projects include: 100 First Plaza and 500 Sansome Street in San Francisco, The Fine Arts Building and 5055 Wilshire Boulevard in Los Angeles, the Xerox Centre in El Segundo, and The Miami Arena and Columbus Center in South Florida.

This deal could be an appetizer for a few larger courses to follow. As Andy Fixmer of the LABJ noted a few editions ago, several sizable properties are now on the market in downtown LA. Sumitimo Life Realty hired Cushman & Wakefield's David Hasbrouck, Richard Plummer and Anthony Gatti to market 1000 Wilshire Blvd, the stylish 471k sf office building hovering over the 110 Fwy with the Wedbush Morgan sign at its peak. Sumitomo picked up this asset in 1999 for $73 mil and Fixmer suggests it might command as much as $100 mil, or $212/sf. Wedbush occupies 113k sf pursuant to a lease with seven years left. Another large tenant is the law firm of Buchalter Nemer Fields & Younger, which this year committed to 70k sf here for 10 years at an average effective rent of roughly $2.38/sf/mo FSG.

Other properties being shopped include: Figueroa Plaza, the asset the City of LA almost bought and then decided not too… again, which is owned by Northridge Capital who has it listed with Secured Capital; Transamerica Tower, the 32-story high-rise, which is owned by Canyon-Johnson Urban Fund LP and is being marketed by CB Richard Ellis; and the Hyatt hotel on Hope, which is being shopped by Cargill, who bought it as part of the mixed use complex at 7th and Flower that contains the hotel, the Macy's Plaza mall and the 700 S. Flower St office building. Secured Capital and Kennedy-Wilson are both handling the hotel listing.

APPENDIX G

Volume 2, Trip Generation Rates, Plots and Equations

Port and Terminal (Land Uses 000-099)

Industrial (Land Uses 100-199)

Residential (Land Uses 200-299)

Lodging (Land Uses 300-399)

Recreational (Land Uses 400-499)

Volume 3, Trip Generation Rates, Plots and Equations

Institutional (Land Uses 500-599)

Medical (Land Uses 600-699)

Office (Land Uses 700-799)

Retail (Land Uses 800-899)

Services (Land Uses 900-999)

APPENDIX H

CHAPTER 4

Conducting a Trip Generation Study

4.1 Background

A local jurisdiction may wish to conduct its own trip generation study to validate use of ITE *Trip Generation* rates or equations in its community, establish its own rates reflecting unique conditions found in that community, or establish rates for land use types not included in *Trip Generation*. A state or province may wish to investigate trip generation rates in detail for land use types of particular concern in its jurisdiction. Consultants, ITE districts, sections, or individual ITE members may want to supplement the ITE national database on trip generation.

To maintain consistency with ITE's nationally recognized database and procedures, local studies should follow procedures consistent with those described below. However, it is recognized that local jurisdictions may need to tailor the process to meet the specific needs of the community and the characteristics of the sites being studied.

To enhance the national database, ITE encourages the submittal of all new trip generation data. Sample data collection forms for reporting the information are included at the end of this chapter. These forms should be used whenever possible.

4.2 Reasons to Conduct a Trip Generation Study

The general purpose of a trip generation study is to collect and analyze data on the relationships between trip ends and site characteristics for a particular land use.

Before initiating the study, its specific purpose should be identified. The specific purpose will help the analyst target the characteristics of the sites, the data to be collected, the number of sites to survey and the analysis to be conducted.

◆ If the description of a site is **not covered by the land use classifications** presented in *Trip Generation*, the analyst should collect local data and establish a local rate.

When to Conduct a Trip Generation Study

- **New land use not covered by *Trip Generation***
- **Inadequate number of studies in *Trip Generation***
- **Size of site outside of range of *Trip Generation* data points**
- **Establish a local trip generation rate**
- **Validate *Trip Generation* for local application**
- **Supplement national database**

◆ If the site is located in a downtown setting, served by significant public transportation, or is the site of an extensive transportation demand management program, the site is **not consistent with the ITE data** and the analyst should collect local data and establish a local rate.

◆ If the size of a site **is not within the range of data points** presented in *Trip Generation* for the land use, the analyst should collect local data and establish a local rate.

◆ If the *Trip Generation* database has an **insufficient number of data points,** the analyst should collect local data and establish a local rate.

◆ If the *Trip Generation* database produces curves with **unsatisfactory standard deviation or regression coefficients**, the analyst should collect local data and establish a local rate.

◆ If local circumstances (e.g., age of residents, worker shifts, other differences in independent variables) make a site **noticeably different from the sites for which data were collected and reported** in *Trip Generation*, the analyst should collect local data and establish a local rate.

◆ If the site is a **multi-use development,** the analyst should refer to Chapter 7 in this handbook for guidance on special data collection and analysis efforts required for multi-use developments.

◆ If the applicability or validity of ITE *Trip Generation* data for local use is **questioned by traffic professionals or local officials,** the analyst may need to collect local data and either validate the national data or establish a local rate.

◆ If it is desirable to establish trip generation characteristics for a **land use not included in the current edition of *Trip Generation,*** the analyst should collect and analyze the data for local use and submit the data to ITE.

4.3 Trip Generation Study Design

Trip generation study design should include the land use to be surveyed, number of survey sites, selection of appropriate sites, survey period, independent variable data to be compiled and traffic counting methodology.

Information is often available from analyses undertaken in either the same jurisdiction or other jurisdictions. In planning the local study, reviewing existing data is helpful in determining issues that may be encountered and identifying expected results. Also, because existing data may be integrated into the local study to reduce the amount of new data that need to be collected, it is important to have prior knowledge of the availability and procedures used to collect the data.

Selection of Land Use to Study

Trip generation studies should be considered to supplement the *Trip Generation* database when the following conditions apply:

◆ Land uses of local interest for which ITE *Trip Generation* presents little or no data;

◆ Local land uses that do not fit into existing ITE land use classifications;

◆ Land uses that are more specific than the generalized land use categories in *Trip Generation;*

◆ Land uses for which the range in development size in the *Trip Generation* data plots does not cover the local range in development sizes; or

◆ Land uses for which local trip generation rates are theorized to be substantially different from those in *Trip Generation.*

Sample Size Determination

Sufficient sample size is necessary to enable the analyst to draw valid conclusions from the trip generation study. However, no simple statistical methodology has been established for determining the number of sites that should be studied to obtain statistically significant trip generation results. In reality, trip generation is influenced by far more than one or two independent variables. As a result, significant variation of individual sites from the weighted average rate or regression curve is frequent. Common practice in the traffic planning industry has been to collect trip generation data at three to five sites that truly meet the recommended site selection criteria with the assumption that these data will yield a relatively stable sample.

To establish a local trip generation rate
◆ Survey at least three sites (preferably five)

To validate the ITE* Trip Generation *rate
◆ Survey at least three sites

To combine local trip generation data with ITE* Trip Generation *data
◆ Survey at least two sites

To submit data to ITE
◆ Survey at least one site

If the analyst intends to establish a local trip generation rate, it is recommended that at least three sites (and preferably at least five) be surveyed. The higher number is suggested because it will enable the analyst to more readily identify—and potentially discard—outlier values and to produce a more reliable estimate of local trip generation characteristics. It is recognized, however, that budgetary constraints and perhaps even the lack of suitable survey sites may limit the trip generation study to three sites.

If the analyst intends to validate *Trip Generation* data for local use, it is recommended that no fewer than three sites be surveyed. If the analyst intends to supplement the *Trip Generation* data with local data and produce a consolidated trip generation rate, it is recommended that at least two sites be counted. ITE will accept data from one site.

Site Selection

Site selection is critical in achieving representative and consistent trip generation rates. Failure to select sites appropriately may lead to inaccurate trip generation rates and equations. Use of unrepresentative sites as a basis for trip generation estimates can result in over- or underestimating trips to be generated by a proposed development.

Suggested criteria for identifying sites for collection of trip generation data are as follows:

◆ Data should be transferrable; therefore, it is critical that both trip data and development characteristics be representative of the land uses to be analyzed. This includes development size, mix of development components and geographic location with respect to the area roadway network and area development patterns.

◆ The development should have reasonably full occupancy (i.e., at least 85 percent) and appear to be economically healthy (note: percent occupancy at the time of the survey, if applicable, should be recorded).

◆ The development should be mature (i.e., at least two years old) and located in a mature area so it represents the ultimate characteristics of a "successful" development.

◆ The data needed to describe the independent variables should be available.

◆ The site should be selected on the ability to obtain accurate trip generation and development characteristics.

◆ It should be possible to isolate the site for counting purposes:

- No shared parking (unless the parking areas for the site are easily distinguishable);
- No shared driveways (unless the driveways for the site are easily distinguishable);
- Limited ability for pedestrians to walk into the site from nearby parcels;
- Limited transit availability or use (unless transit usage can be counted—e.g., elementary students who ride a school bus); and
- No through-traffic.

◆ The site should have a limited number of driveways (as a data collection cost consideration).

Key Site Selection Criteria

- **Satisfies definition of ITE Land Use Code**
- **Reasonably full occupancy**
- **Mature**
- **Necessary data can be obtained readily and accurately**
- **Typical of sites in area with no unusual activities underway**

◆ The driveways (or the method of counting traffic) should ensure against double-counting vehicles.

◆ It should be possible for counts to be made safely. The need for any special security measures should be identified.

◆ The site should consist of a single land use activity (unless a multi-use study is being conducted as described in Chapter 7).

◆ There should be minimal to no on-site construction or adjacent roadway construction.

◆ Permission should be obtained from the owner or the building manager (note: owners/managers are sometimes more willing to be surveyed if the confidentiality of their site is guaranteed or if the results are provided to them).

Independent Variable Selection

For a new land use being surveyed, one or more appropriate independent variables need to be identified, measured and analyzed. When identifying a potential independent variable, the following points should be considered.

◆ The data for the independent variable should be readily available, for the survey site and any potential proposed development of this land use type for which trip generation estimates may be desired.

◆ The number of trips generated at the site should be influenced in a logical way by the independent variable. **Correlation does not equal causation.**

◆ Available site data should be accurate, for sites being counted and proposed future development (i.e., if it cannot be projected for new development, it is not an appropriate independent variable).

◆ Variables for similar sites should be provided directly and not merely estimated from a different variable. For example, the number of employees at a site may appear to be a valid independent variable, but it should not be used if the value is typically derived by factoring in another independent variable, such as gross square footage of the development site.

Key Characteristics of Independent Variables to Include in a Local Trip Generation Study

- **Logical relationship to site trip generation**
- **Value measured directly for the survey site, not derived**
- **At least those used in similar *Trip generation* land uses**
- **Confidence that the available site data are accurate**

When in doubt about which independent variables may be most appropriate, refer to *Trip Generation* under the same or similar land use to see which ones have produced the most stable relationships and reliable rates or equations. Typical independent variables include number of employees, gross floor area, gross leasable area and number of occupied rooms or dwelling units. It is critical that the definitions of independent variables be the same as those defined in *Trip Generation* (Chapter 3 in the *User's Guide*, Seventh Edition) or Appendix D of this handbook.

For a trip generation study involving a land use for which trip end and independent variable information is already provided in *Trip Generation*, the choice of independent variables should (at the minimum) include those presented in *Trip Generation*. If other independent variables appear to be logical and satisfy the criteria cited above, data for them should be collected and analyzed as well.

In general, it is recommended that data be collected and compiled for as many potential, appropriate independent variables as practical. As the *Trip Generation* database grows, it is quite likely that future analyses of the available data will identify additional relationships involving more than the currently used independent variables.

The sample data collection forms presented at the end of this chapter contain a list of suggested data to obtain.

Development Data Requirements

Trip generation estimates are based on development characteristics that are used as independent variables. This normally requires a check with the owners or managers of the development to ensure the availability of accurate data on physical characteristics. For example, it is insufficient to merely count dwelling units or square feet. A count of *occupied* square feet or units is needed. The occupied space represents the portion of the development that is actually generating trips.

Occupied square footage should also be carefully evaluated to make sure that it is actually being occupied *and used* rather than merely leased or purchased. For example, in some land use classifications (particularly warehousing, industrial and office), it is common practice for tenants to lease or purchase future expansion space, but not to occupy it for some time. Use of "leased or

purchased" square footage instead of "occupied and used" square footage can be misleading and may be one reason for the scatter in the historical data points within certain classifications in *Trip Generation*.

Typical Development Data

- **Description of site**
  - **Square footage and/or units**
  - **Percent occupancy**
  - **Site acreage**
  - **Location within area (CBD, suburban, rural)**
  - **Name and description of principal uses**
- **Site plan**
- **Adjacent street traffic volumes**

At this stage in the study design process, it is necessary to decide whether to include consideration of transit use, parking accumulation and automobile occupancy. If these issues are to be considered as factors in the analysis of the local trip generation data, then appropriate data should be collected.

Survey Periods

Site-generated traffic should be counted, if feasible, for a full 7-day period to determine when total site-generated traffic volumes peak during weekdays and the weekend. At the minimum, automatic traffic recorder counts should be taken through a full 24-hour period, although a preferred length of time would consist of 48 consecutive hours.

Some sites require manual counting techniques because automatic traffic recorder devices will not capture all trips (or may not be accurate due to the configuration of the site driveways). Manual traffic counts should last for a minimum of 2 hours for each peak period, depending on whether the adjacent street traffic peak or the generator's peak is being surveyed. If the desired traffic analysis requires other periods, counts for those periods should also be obtained.

The day of the week and time of day are also important considerations in obtaining meaningful results. The purpose of the study will dictate the critical time period for analysis.

In many cases, the season of the year is also important. In general, traffic generation for land uses with little or no seasonal variation should be counted on average days. For land uses with significant seasonal variation, time periods representing the 30th to 50th highest hours of the year may be used. Retail centers and recreational uses are typical examples of land uses with significant seasonal variation.

Care should be taken to avoid making counts during special events, holidays, construction periods, bad weather, or other times when conditions at the study site or in its vicinity may affect site trip generation. The time period being surveyed should represent typical activity for the site (e.g., no data collection should be conducted during a super sale at a retail site) unless the study is specifically designed for collecting data during a peak time (e.g., holiday shopping season for retail sites).

4.4 Conducting the Study

The following guidelines should be reviewed and followed to the extent possible when collecting traffic volume and site characteristics data.

- Count directional traffic volumes (entering and exiting) by 15-minute period.

- Where directional counts cannot be made automatically, manual counts should be made during the street peak periods, plus the peak period of the generator to record the peak-hour entering and exiting volumes. Two or more days of peak period traffic counts are desirable.

- If possible, collect hourly traffic volume data (or obtain from the governing jurisdiction) on all streets adjacent to and with access to or from the site so that adjacent street peak hours can be determined. The traffic counts of multiple driveway volumes must be done concurrently.

- Surveys or traffic counts conducted on public streets may require a courtesy call to the proper governing authority. Providing a copy of the traffic volume data or the final study to either the public or private agency involved is another good policy.

Use of ITE's data collection forms (found at the end of this chapter) is recommended. These forms identify the information needed for a successful study, and their use will increase standardization of data collection and facilitate the inclusion of the data into ITE's existing database.

◆ Data concerning the site should be obtained through interviews with the site owner or manager and, if necessary, by means of measurements.

◆ Verify automatic counts with manual counts for short period(s). If pneumatic road tube counters are used, exercise extra caution and verification because the accuracy of this equipment may degrade at low-speed traffic conditions.

◆ If the site could be considered a multi-use development, refer to Chapter 7 (Multi-Use Developments) for guidance on additional data collection needs.

◆ If pass-by data are being collected, specific intercept surveys will be needed (as described in Chapter 5, Pass-By, Primary and Diverted Linked Trips).

◆ If needed, record hourly entering and exiting traffic by vehicle classification and vehicle occupancy and compare with corresponding automatic counts to determine a factor for adjusting the raw automatic counts. This may require classifying vehicles by number of axles if automatic counters have been used. Refer to the latest edition of the ITE *Manual of Transportation Engineering Studies* for guidance.

4.5 Establishment of a Local Trip Generation Rate or Equation

This section provides guidance if the **purpose of the trip generation study is to establish a new local trip generation rate or equation.** If the purpose of the study is to validate the use of *Trip Generation* for a local application, Section 4.6 provides appropriate guidance.

It is recommended that the first analysis step in the establishment of a local trip generation rate or equation be the development of a hypothesis for why the *Trip Generation* data might not be appropriate for local application. For example, the rationale could involve the age of residents, metropolitan area characteristics and/or the availability of transit. It is important that the local community have **a common-sense rationale for believing that the local rate is or should be significantly different from that presented in *Trip Generation*.**

(Note: the absence of any data covering a particular land use is also a valid reason for conducting a local trip generation study.)

The second analysis step in the establishment of a local trip generation rate or equation should be confirmation that a local trip generation rate/equation is indeed justified. This confirmation should be predicated on satisfying the following three criteria:

◆ At least three local sites are counted **(five sites are preferable)**;

◆ The weighted average rate for the counted sites is at least 15 percent higher or lower than the comparative *Trip Generation* rate **or** if *Trip Generation* provides only two or fewer data points; and

◆ The local counts provide consistent results.

If establishment of a local trip generation rate or equation is justified based on these three criteria, the next step should involve the selection of either the computed trip generation rates or equations (if applicable) as the local trip generation estimator. The development of the local rate or equation should likewise **satisfy the standards assigned to *Trip Generation* data for its use.** In other words, the local data should be used with the same caution and desire for statistical integrity as the ITE database.

As described in Chapter 3 (Guidelines for Estimating Trip

HOW TO ESTABLISH A LOCAL RATE

- **Formulate hypothesis for why local trip generation is unique**
- **Confirm that local data justify a local trip generation rate/equation**
  - **At least three sites counted (five preferred)**
  - **Local rate at least 15 percent different from *Trip Generation* rate**
  - **Locally consistent data**
- **Satisfy statistical validity standards applied to *Trip Generation* data**

Generation), an acceptable use of the weighted average trip generation rate requires at least three data points with a computed **standard deviation that is no more than 110 percent of the weighted average rate.** The acceptable use of a regression equation requires at least four data points with a computed R^2 **of at least 0.75.**

The local trip generation documentation should clearly state the local rates and/or equations, the situations in which they are applicable and what to do in situations where they are not applicable. The documentation should also present the site-specific information.

Consideration should be given to submitting the data to ITE for use in subsequent editions of *Trip Generation*. Sources will be cited, but the identity of specific sites will be kept confidential. Data should be transmitted to:

Institute of Transportation Engineers
1099 14th St., NW, Suite 300W
Washington, D.C. 20005-3438
Tel: +1 202-289-0222
Fax: +1 202-289-7722

4.6 Validation of *Trip Generation* Rates/Equations for Local Use

This section provides guidance if the **purpose of the trip generation study is to validate the use of *Trip Generation* data for a local application.** If the purpose of the study is to establish a new local rate, Section 4.5 provides appropriate guidance.

Validation of *Trip Generation* data for local use does not preclude the development of local rates with the local data.

Validation of *Trip Generation* rates or equations for use in a particular locale should be accomplished using a two-step process. The first step is to collect local trip generation data at no fewer than three local sites (or supplemental data obtained from other sources to create a database of three or more local data sites).

The second step involves analysis of the local data and comparison of it to the ITE *Trip Generation* data. A *Trip Generation* rate/equation should be considered valid for local use if it meets the following criteria:

- The trip generation rate for each of the locally surveyed sites falls within one standard deviation of the *Trip Generation* rate;
- Of the sites surveyed locally, at least one has a rate higher than the *Trip Generation* weighted average rate or equation and one has a lower rate; **or** all of the survey sites generated trips with totals within 15 percent of the *Trip Generation* average rate or equation (calculated as follows: the difference between the survey site rate and the *Trip Generation* rate, divided by the *Trip Generation* rate);
- The locally collected data generally fall within the scatter of points shown in the current *Trip Generation* data plot; and
- Common sense derived from the local trip generation study indicates that the *Trip Generation* data are valid for local application.

If the local data do not meet all of the above criteria, development of a local rate or equation should be considered (refer to Section 4.5 for guidance).

Consideration should be given to submitting the data to ITE for use in subsequent editions of *Trip*

Generation. Sources will be cited, but the identity of specific sites will be kept confidential.

4.7 Combining *Trip Generation* and Local Data

If the *Trip Generation* database for a particular land use is relatively small (e.g., nine or fewer sites), the local community should **consider merging the national and local databases to create a consolidated trip generation rate.** It is recommended that this merging of the data sets take place **if the local and national average rates are reasonably close (e.g., within 15 percent of each other).** The merging of the two databases under those circumstances should improve the statistical strength of the overall database for the particular land use.

If the local and national rates are substantially different, refer to Section 4.5 for guidance on the establishment of a local rate.

The following procedure demonstrates the proper steps for merging the local and national databases.

This procedure can be used for any land use, time period and independent variable for which weighted average trip rates, average size of the independent variables and number of studies are provided in *Trip Generation*.

Note: This method of combining data sets does not allow precise calculation of the standard deviation or of a revised regression equation because of the unavailability of the exact data points in the ITE national database.

The basic equation for calculating a combined weighted average trip generation rate is:

$$\text{(1) combined weighted average trip rate} = \frac{\sum \text{trip ends (ITE)} + \sum \text{trip ends (local)}}{\sum \text{independent variable units (ITE)} + \sum \text{independent variable units (local)}}$$

The parameters "$\sum$ trip ends (ITE)" and "$\sum$ independent variable units (ITE)" can be calculated from statistics provided in *Trip Generation*.

(2) $\sum$ trip ends (ITE) = (weighted average trip rate) x (average value of independent variable unit) x (number of studies)

(3) $\sum$ independent variable units (ITE) = (average value of independent variable unit) x (number of studies)

The parameters "$\sum$ independent variable units (local)" and "$\sum$ trip ends (local)" should be available from the local data base.

The following is a sample application of this process. Assume the following information is known about three local Free-Standing Discount Superstore (Land Use 813):

	Average Weekday Trip Ends	GFA (1,000 sq. ft.)
Site 1	10,000	160
Site 2	7,000	190
Site 3	9,000	135
Total	26,000	485

From page 1,328 of Volume 3, *Trip Generation*, Seventh Edition:

weighted average trip rate = 49.21
average value for the independent variable unit = 160
number of studies = 10

The weighted average trip rate for the three new sites is 53.61, which is 9 percent higher than the *Trip Generation* rate. Because the new data are within 15 percent, the following calculations can be used.

From equation (2):	$\sum$ trip ends (ITE) = 46.21 x 160 x 10 = 78,736
From equation (3):	$\sum$ independent variable units (ITE) = 160 x 10 = 1,600
From local data:	$\sum$ independent variable units (local) = 485
From local data:	$\sum$ trip ends (local) = 26,000
Applying equation (1):	combined weighted average trip rate = (78,736 + 26,000)/(1,600 + 485) ≈ 50.2

The updated weighted average rate is 50.2 weekday trips per 1,000 sq. ft. of gross floor area.

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Trip Generation Data Form (Part 1)

Land Use/Building Type:[1]	ITE Land Use Code:
Source:	Source No. (*ITE use only*):
Name of Development:	Day of the Week:
City: State/Province: Zip/Postal Code:	Day: Month: Year:
Country:	Metropolitan Area:

1. For fast-food land use, please specify if hamburger- or nonhamburger-based.

Location Within Area:

☐ (1) CBD ☐ (3) Suburban (Non-CBD) ☐ (5) Rural
☐ (2) Urban (Non-CBD) ☐ (4) Suburban CBD ☐ (6) Freeway Interchange Area (Rural)
☐ (7) Not Given

Detailed Description of Development:

Independent Variable: (include data for as many as possible)[2]	Actual	Estimated		Actual	Estimated
_____ (1) Employees (#)	☐	☐	_____ (9) Parking Spaces (% occupied: _____)	☐	☐
_____ (2) Persons (#)	☐	☐	_____ (10) Beds (% occupied: _____)	☐	☐
_____ (3) Total Units (#) (indicate unit:_____)	☐	☐	_____ (11) Seats (#)	☐	☐
_____ (4) Occupied Units (#) (indicate unit:_____)	☐	☐	_____ (12) Servicing Positions/Vehicle Fueling Positions	☐	☐
_____ (5) Gross Floor Area (sq. ft.) (% of development occupied :_____)	☐	☐	_____ (13) Shopping Center % Out-parcels/pads	☐	☐
_____ (6) Net Rentable Area (sq. ft.)	☐	☐	_____ (14) A.M. Peak Hour Volume of Adjacent Street Traffic	☐	☐
_____ (7) Gross Leasable Area (sq. ft.) (% of development occupied:_____)	☐	☐	_____ (15) P.M. Peak Hour Volume of Adjacent Street Traffic	☐	☐
			_____ (16) Other _____	☐	☐
_____ (8) Total Acres (% developed: _____)	☐	☐	_____ (17) Other _____	☐	☐

2. Definitions for several independent variables can be found in the *Trip Generation User's Guide* Glossary.

3. Please provide all pertinent information that helps to describe the subject project. If necessary, attach a detailed report.

Other Data:

Vehicle Occupancy (#):
_____ A.M. _____ P.M. _____ 24-hour %

Percent by Transit:
_____ A.M. % _____ P.M. % _____ 24-hour %

Percent by Carpool/Vanpool:
_____ A.M. % _____ P.M. % _____ 24-hour %

Employees by Shift:

	Start Time	End Time	Employees (#)
First Shift:	_____	_____	_____
Second Shift:	_____	_____	_____
Third Shift:	_____	_____	_____

Parking Cost on Site: Hourly _____ Daily _____

Transportation Demand Management (TDM) Information:

At the time of this study, was there a TDM program (that may have impacted the trip generation characteristics of this site) underway?

☐ No

☐ Yes (If yes, please check appropriate box/boxes, describe the nature of the TDM program(s) and provide a source for any studies that may help quantify this impact. Attach additional sheets if necessary)

☐ (1) Transit Service
☐ (2) Carpool Programs
☐ (3) Vanpool Programs
☐ (4) Bicycle/Pedestrian Facilities and Site Improvements
☐ (5) Employer Support Measures
☐ (6) Preferential HOV Treatments
☐ (7) Transit and Ridesharing Incentives
☐ (8) Parking Supply and Pricing Management
☐ (9) Tolls and Congestion Pricing
☐ (10) Variable Work Hours/Compressed Work Weeks
☐ (11) Telecommuting
☐ (12) Other _____

Please Complete Form on Other Side

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Trip Generation Data Form (Part 2)

Summary of Driveway Volumes *(All = All Vehicles Counted, Including Trucks; Trucks = Heavy Duty Trucks and Buses)*

	Average Weekday (M-F)						*Saturday*						*Sunday*					
	Enter		*Exit*		*Total*		*Enter*		*Exit*		*Total*		*Enter*		*Exit*		*Total*	
	All	*Trucks*	*All*	*Trucks*	*All*	*Trucks*	*All*	*Trucks*	*All*	*Trucks*	*All*	*Trucks*	*All*	*Trucks*	*All*	*Trucks*	*All*	*Trucks*
24-Hour Volume																		
A.M. Peak Hour of Adjacent[1] Street Traffic (7 – 9) Time (ex : 7:15 - 8:15):																		
P.M. Peak Hour of Adjacent[1] Street Traffic (4 – 6) Time:																		
A.M. Peak Hour Generator[2] Time:																		
P.M. Peak Hour Generator[2] Time:																		
Peak Hour Generator[3] Time (Weekend):																		

[1] **Highest hourly volume between 7 a.m. and 9 a.m. (4 p.m. and 6 p.m.).**
[2] **Highest hourly volume during the a.m. or p.m. period.**
[3] **Highest hourly volume during the entire day.**
Please refer to the *Trip Generation User's Guide* for full definition of terms.

Hourly Driveway Volumes- Average Weekday (M-F)

A.M. Period	*Enter*		*Exit*		*Total*		*Mid-Day Period*	*Enter*		*Exit*		*Total*		*P.M. Period*	*Enter*		*Exit*		*Total*	
	All	*Trucks*	*All*	*Trucks*	*All*	*Trucks*		*All*	*Trucks*	*All*	*Trucks*	*All*	*Trucks*		*All*	*Trucks*	*All*	*Trucks*	*All*	*Trucks*
6:00-7:00							11:00-12:00							3:00-4:00						
6:15-7:15							11:15-12:15							3:15-4:15						
6:30-7:30							11:30-12:30							3:30-4:30						
6:45-7:45							11:45-12:45							3:45-4:45						
7:00-8:00							12:00-1:00							4:00-5:00						
7:15-8:15							12:15-1:15							4:15-5:15						
7:30-8:30							12:30-1:30							4:30-5:30						
7:45-8:45							12:45-1:45							4:45-5:45						
8:00-9:00							1:00-2:00							5:00-6:00						

☐ **Check if Part 3 and/or additional information is attached.**

Survey conducted by: Name: _____

Organization: _____

Address: _____

City/State/Zip: _____

Telephone #: _____ Fax #: _____ E-mail: _____

Please return to:

Institute of Transportation Engineers
Technical Projects Division
1099 14th Street, NW, Suite 300 West
Washington, DC 20005-3438 USA
Telephone: +1 202-289-0222
FAX: +1 202-289-7722
ITE on the Web: www.ite.org

Institute of Transportation Engineers

Trip Generation Data Form (Part 3)

Name/Organization: _____ *City/State:* _____

Telephone Number: _____

Detailed Driveway Volumes: Attach this sheet to Parts 1 and 2 if you are providing additional information.

Day of the week: _____

(All = All Vehicles Counted, Including Trucks; Trucks = Heavy Duty Trucks and Buses)

A.M. Period	*Enter*		*Exit*		*Total*		*P.M. Period*	*Enter*		*Exit*		*Total*	
	All	*Trucks*	*All*	*Trucks*	*All*	*Trucks*		*All*	*Trucks*	*All*	*Trucks*	*All*	*Trucks*
12:00-12:15							12:00-12:15						
12:15-12:30							12:15-12:30						
12:30-12:45							12:30-12:45						
12:45-1:00							12:45-1:00						
1:00-1:15							1:00-1:15						
1:15-1:30							1:15-1:30						
1:30-1:45							1:30-1:45						
1:45-2:00							1:45-2:00						
2:00-2:15							2:00-2:15						
2:15-2:30							2:15-2:30						
2:30-2:45							2:30-2:45						
2:45-3:00							2:45-3:00						
3:00-3:15							3:00-3:15						
3:15-3:30							3:15-3:30						
3:30-3:45							3:30-3:45						
3:45-4:00							3:45-4:00						
4:00-4:15							4:00-4:15						
4:15-4:30							4:15-4:30						
4:30-4:45							4:30-4:45						
4:45-5:00							4:45-5:00						
5:00-5:15							5:00-5:15						
5:15-5:30							5:15-5:30						
5:30-5:45							5:30-5:45						
5:45-6:00							5:45-6:00						
6:00-6:15							6:00-6:15						
6:15-6:30							6:15-6:30						
6:30-6:45							6:30-6:45						
6:45-7:00							6:45-7:00						
7:00-7:15							7:00-7:15						
7:15-7:30							7:15-7:30						
7:30-7:45							7:30-7:45						
7:45-8:00							7:45-8:00						
8:00-8:15							8:00-8:15						
8:15-8:30							8:15-8:30						
8:30-8:45							8:30-8:45						
8:45-9:00							8:45-9:00						
9:00-9:15							9:00-9:15						
9:15-9:30							9:15-9:30						
9:30-9:45							9:30-9:45						
9:45-10:00							9:45-10:00						
10:00-10:15							10:00-10:15						
10:15-10:30							10:15-10:30						
10:30-10:45							10:30-10:45						
10:45-11:00							10:45-11:00						
11:00-11:15							11:00-11:15						
11:15-11:30							11:15-11:30						
11:30-11:45							11:30-11:45						
11:45-12:00							11:45-12:00						