California Smart-Growth Trip Generation Rates Study

Final Report

Appendix C

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Summary & Comparison of existing tools for estimating
Trip Generation Rates for Smart Growth Land Uses

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Introduction

This document summarizes various tools, as discovered by the research team, that aid traffic engineers (as well as project planners and developers) in estimating trip generation rates. In its search for tools, the team focused particularly on uncovering those that provide trip generation estimates for projects located within urban environments where transit and non-motorized transportation is more common. The ability of a tool to respond to location, density, mixed use, and design and other "D" factors (described in the Definitions document) that facilitate non-motorized travel was also a key consideration. In general, the search emphasized tools that are more context-sensitive than the traditional Institute of Transportation Engineers' (ITE) *Trip Generation* methodology, which, by virtue of its emphasis on surveys of land uses in suburban settings, tends to overestimate rates for developments incorporating one or more smart growth principles.

The majority of the tools summarized here are models designed to adjust the trip generation rates provided by ITE (or a similar set of rates compiled by the San Diego Association of Governments, SANDAG) in order to better reflect the effects of different land use mixes, density, design, location, and transportation attributes on trip generation. In addition to these types of tools, a few alternative tools will be described which do not rely as heavily (or at all) on the ITE/SANDAG rates. All of these tools provide transportation professionals with potential improvement over the traditional method of estimating trip generation rates for smart-growth projects. However, none of these tools are without flaws. This summary will serve as an guide to both what exists currently within the realm of trip generation rates tools, and what further improvements need to be made in order to more accurately estimate trip generation rates for smart growth type developments.

Tool Type 1: Adjustments to ITE/SANDAG Rates

ITE/SANDAG Rate Adjustments

	Pros	Cons
ITE *Trip Generation Handbook*	✓ Court tested ✓ Easy to use ✓ Provides peak-hour rates ✓ Accepted for use in traffic impact analyses (TIAs)	✗ Reductions based on a small sample size ✗ No consideration of D's ✗ No multi-modal output ✗ Tends to over-estimate
EPA MXD/SANDAG Mixed Use Model	✓ Easy to use ✓ Calculations are transparent ✓ Estimates have been validated ✓ Sensitive to D's ✓ Provides multi-modal output	✗ Only applicable to sites between 5 and 2000 acres ✗ Somewhat data intensive
Peter Eakland's Model	✓ Easy to use ✓ Calculations are transparent ✓ Provides distinct city center rates for some land use types	✗ No distinction between passby trips and non-motorized trips

Summary & Comparison of existing tools for estimating
Trip Generation Rates for Smart Growth Land Uses

URBEMIS	✓ Easy to use ✓ Sensitive to D's ✓ Court tested ✓ Calculations are unable to be manipulated	✗ No peak-hour estimates ✗ Calculations are not immediately transparent ("Black box" type interface)
NCHRP 8-51 Tool (Texas DOT)	✓ Calculations are transparent ✓ Provides multi-modal output ✓ Sensitive to Diversity/Mixed-use	✗ Very data intensive ✗ Based on 6 surveyed sites

ITE Trip Generation

The ITE *Handbook* provides practitioners with guidance on the proper use of the data provided in *Trip Generation,* in addition to supplemental material regarding the trip generation estimation process. Chapter Seven of the *Handbook* provides a methodology for estimating trip generation rates at mixed-use sites, using a worksheet provided in the document. However, the analyst is instructed to "exercise caution" when using this methodology to estimate reductions, as the data represent a very small sample size, and all sites are located in a single state. Further, this methodology is only applicable to mixed use developments (MXDs) and does not account for other factors known to affect trip rates, such as density, transit availability, street design, etc. In fact, the *Trip Generation Handbook* specifically cautions against using ITE trip rates data in downtowns or locations served by transit[1]. Also, as trip generation rates calculated using this worksheet are expressed as reductions from the vehicle trip generation rates provided in *Trip Generation*, no modal split information is provided using this methodology. Though *Trip Generation* is widely used and accepted since it was developed by ITE, and is the most cited authority on trip generation estimates in the United States, it exhibits the aforementioned drawbacks.

EPA MXD Model/SANDAG Mixed Use Model

These two tools can be analyzed together as they adjust trip estimates using the same elasticities for a set of land use and transportation variables known to affect trip generation. These models provide reductions to vehicle trip estimates in ITE's *Trip Generation* or San Diego's *Traffic Generators* (a tool similar to *Trip Generation*, but specific to the San Diego area). These reductions to vehicle trips are categorized as internally captured trips within MXDs, walking/biking external trips, or transit external trips ("external" refers to trips outside of a MXD site or neighborhood). The EPA tool is in spreadsheet format, with some basic data input required by the analyst. These tools take into account the "D-factors" in land use known to affect travel, and their vehicle trip estimates have been validated at more than 40 sites mostly in California. The most significant drawback to these models is that they have been formally validated only for sites ranging from 5 to 2000 acres in size. A method of accounting for smaller and single-use developments within mixed use developments or other "smart growth" neighborhoods is currently has been developed and tested by SANDAG and its consultants

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1 ITE *Trip Generation Handbook, Second Edition*. June 2004. Page 15: "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."

Summary & Comparison of existing tools for estimating
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Peter Eakland's Model

Peter Eakland, an independent transportation planner, developed a tool that provides an input module for analysts to estimate trip generation using the numbers in the City of San Diego's *Traffic Generators* (a somewhat more detailed version of SANDAG's *Traffic Generators*). This tool puts rates and equations into a spreadsheet format, which makes the trip generation estimation process more user-friendly and transparent. Other attractive features of this tool include its ability to estimate city center vehicle trip rates, and to take into account vehicle trips generated by existing developments. One drawback is that it provides no distinction between non-motorized and passby trips (these are all grouped under "passby"). Further, it does not account for the "D-factors" known to affect trip generation rates as it is based purely on the information provided in *Traffic Generators*.

URBEMIS

This tool, which stands for "urban emissions", was originally created by the California Air Resources Board (ARB) in order to facilitate the assessment of criteria pollutant emissions from light-duty vehicle travel related to land use projects in California. During the late 1990s, it was upgraded and a "mobile source mitigation component" added under the direction of a consortium of air quality management districts in California, who continue to update and disseminate URBEMIS via the Internet. Among other things, it is capable of estimating trip generation for MXDs using one or two of the aforementioned "D-factors". It is a very user-friendly tool and has withstood several legal challenges for use in air quality impacts analyses of land use projects in California. However, because it was developed as an air quality analysis tool, it does not provide peak-hour trip generation rates which are of significant importance in traffic impact studies. Further, the interface of this software provides the user with no insight into the calculations being performed so its transparency is somewhat limited; however, the analyst can find descriptions of most of the module's calculations in the user's guide. This "drawback" could potentially be viewed as an advantage as the calculations cannot be inappropriately manipulated by the user.

NCHRP 8-51 Method and Spreadsheet Tool

The National Cooperative Highway Research Program (NCHRP) is in the midst of finalizing a project (*Enhancing Internal Trip Capture Estimation for Mixed-Use Developments*) aimed at outlining a methodology for analysts to collect appropriate data in order to estimate internal capture rates for MXDs, and apply these rates as reductions to trip generation rates. This tool is in spreadsheet format, which enhances its user transparency. In addition to internal capture rates, it provides mode split estimates, which is ideal for a tool of this kind. However, since this tool is meant to assist analysts in collecting their own trip generation rates data, it is extremely data intensive and thus unlikely to be used as a primary trip generation estimation tool.

Tool Type 2: Organized Empirical Database Tools

Organized Empirical Database Tools

	Pros	Cons
UK's TRICS	✓ Easy to use ✓ Based on a large amount of up-to-date survey data ✓ Provides multi-modal output ✓ Context-sensitive (urban v. suburban)	✗ Only applicable to developments in the UK
New Zealand Trips and Parking Database	✓ Based on up-to-date survey data ✓ Provides multi-modal output ✓ Context-sensitive (D's)	✗ Only applicable to developments in New Zealand

UK's TRICS

The Trip Rate Information Computer System (TRICS) is a trip generation rates tool that has been used in the United Kingdom since 1989. It is a comprehensive and dynamic database consisting of trip generation estimates based on actual vehicle counts as well as multi-modal survey data for a variety of different land use types (located in England, Scotland, Wales, and Ireland). Trip generation estimates for proposed land use projects are multi-modal (based on multi-modal data), and sensitive to urban versus suburban locational factors. Users have access to all of the survey data from existing land uses to estimate trip generation, as well as detailed information regarding the survey sites. The database is updated with new survey data every three months. The TRICS system is an exemplary tool for calculating multi-modal trip generation rates, though it is clearly not applicable to developments in the United States as it is based solely on UK data.

New Zealand Trips and Parking Database

This tool is similar to TRICS in the sense that it is a comprehensive database of trip generation rates data. It provides users with information on trip generation rates based on land use groups and activity subgroups. The Trips and Parking Database, like TRICS, provides multi-modal estimates, and seems to be context-sensitive to an even higher degree than the TRICS database, utilizing more of the "D-factors" that affect trip generation. However, this database is only directly applicable to developments in New Zealand.

Tool Type 3: Person-trip Based Tools

Person-trip Based Tools

	Pros	Cons
San Francisco method	✓ Easy to use ✓ Based (at least somewhat) on up-to-date survey data	✗ Based on supplemental data solely from San Francisco ✗ Data are not specific to Ds ✗ Calculations are not transparent

San Francisco Method

The *Transportation Impact Analysis Guidelines for Environmental Review,* as published by the Planning Department of the City and County of San Francisco in 2002, provides a trip generation methodology used in analyzing developments in the City and County of San Francisco. This tool is in the form of a look-up table with trip rates (per square feet) for various land use types. Unique to this tool is its ability to estimate person-trips in place of vehicle-trips, and to estimate modal split based on local travel survey data. The tool itself is based on a combination of ITE's *Trip Generation*, data from the San Francisco Citywide Travel Behavior Survey, and various environmental impact report traffic analyses. Although most of San Francisco consists of dense urban typically mixed-use development, the data used to create this tool are not specifically analyzed in terms of the "D-factors". There's also uncertainty regarding the accuracy of using travel survey data to estimate trip generation rates for individual sites. Further, as this tool is based on San Francisco survey data, its applicability outside the City and County of San Francisco is questionable.