

VMT Estimation Tool – Set Up Instructions

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In order to set up the “Sketch 7” VMT Estimation Tool for first time use, regionally-specific data must be loaded into the Microsoft Excel spreadsheet and the Silverlight web GIS application. The following instructions are provided to guide users in selecting and setting up both the spreadsheet and web GIS tools.

Background: Sketch7 is a land use scenario comparison tool that conducts a “sketch level” estimation of land use and transportation relationship using “7 Ds” elasticities: density, diversity, distance, design, destination, demographics, and development scale. It examines how a land use scenario differs from an established or modeled land use scenario by comparing them on land metrics such as the number and types of jobs and households, densities, mixture of uses, etc. The tool also compares the scenarios on travel behavior, and - depending on the scale of the project - can provide estimates of vehicle miles traveled (VMT).

**** Important note:**** The Sketch 7 tool estimates VMT using elasticities derived from the research conducted for the “Improved Data & Tools for Integrated Land Use-Transportation Planning in California” study. However, there are some important considerations for applying Ds elasticities in this tool instead of using two- and/or three-step Ds equation modules:

- The most reliable means of applying the D equations resulting from this study is as several-step multi-variable equations - the two-step and/or three-step “Ds Analysis modules” - rather than a series of elasticity applications. Elasticities derived from these D equations were used to show that they are consistent with the results other research tailored for California regions. They can also be used to show how elasticities computed from testing MPO models compare with the research-based elasticities for the region. (*Please refer to [Appendix D](#) for more information.*)
- However, application of elasticities requires setting “boundary controls” to prevent large changes in “independent” variables from producing exorbitant changes in “dependent” variables. The ranges in independent variables over which the elasticity values were derived do not allow for stable application over increases in a variable by a substantial percentage (say a 400% increase in density). Therefore, testing is needed to determine reasonable maximum and minimum elasticity effects and reasonable floor and ceiling constraints on net changes in independent variables and/or floor and ceiling values on dependent variables (such as the minimum and maximum VMT per household presently found in a region, for example).
- Applying a series of elasticities requires controlling for compounding effects. Using the elasticities in isolation creates the potential for sequential factoring of the dependent

variable by relatively large effects, even though the individual D variables naturally work in concert with one another rather than as independent levers. Floor and ceiling effects need to be used to control the lower and upper bounds of adjusted VMT generation once all elasticities have been applied to be sure that they are within the range expected of the new built environment “area type” based on evidence from the lowest and highest VMT generating examples of each area type presently found in the region.

Sketch 7 Spreadsheet

In order for all calculations to take place, a few sets of data are needed in Sketch 7 including:

- set of land uses, or “place types”, entered into the tool
- base set of regional data from a travel demand model using the same land uses as above
- Ds elasticities appropriate to the region

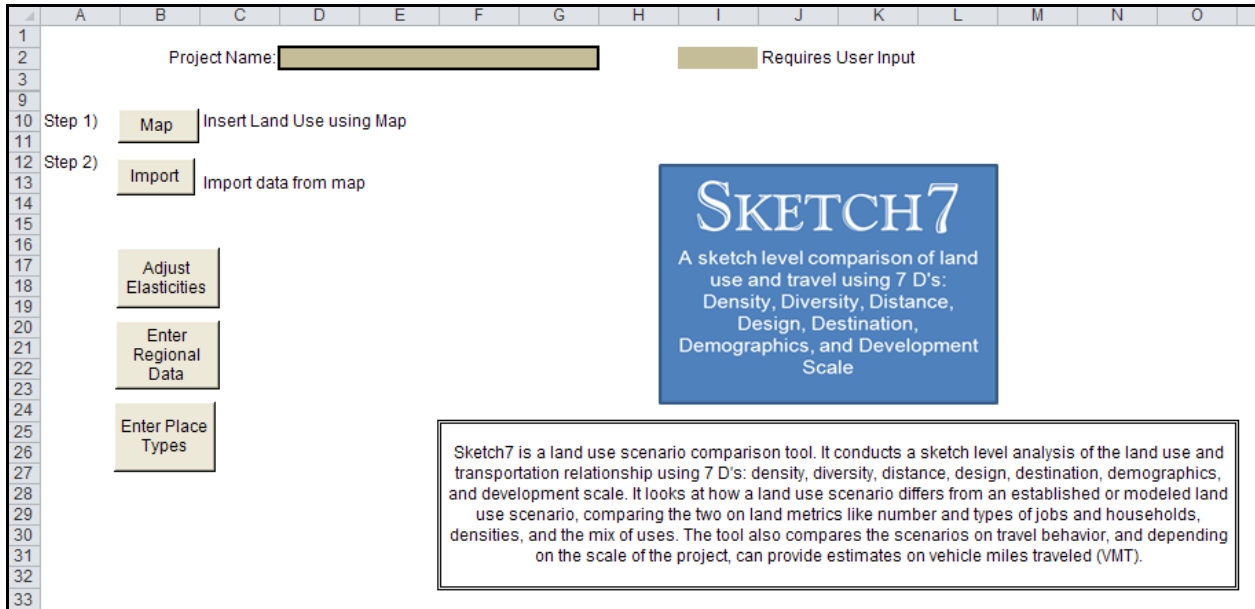


Figure 1 - Sketch7 Start Screen

place types

The land uses, or place types within Sketch7, are defaulted to a generic set of land uses used in this study. The information that is needed within the place types tab includes:

- Name
- Order (sorting order)
- Residential Density (dwellings per acre)
- Employment Density (employees per acre)
- % Retail (% of land for retail uses)

The place types used in Sketch7 must be consistent with those used in the Silverlight GIS mapping application as well as the travel model used to supply base metrics. To update the place types, the user clicks on the “Update Place Types” button from the *start* tab and enters the appropriate information as outlined above.

	A	B	C	D	F
1	Place Type	Order	Residential Density	Employment Density	% Retail
2	Single-family	1	4.0	0.0	0.0%
3	Multi-Family	2	20.0	0.0	0.0%
4	Retail	3	0.0	20.0	100.0%
5	Regional Retail	4	0.0	43.0	100.0%
6	Service	5	0.0	53.0	50.0%
7	Office	6	0.0	140.0	10.0%
8	Mixed Use	7	32.0	290.0	20.0%
9	Industrial	8	0.0	6.0	5.0%
10	Utility	9	0.0	6.0	0.0%
11	Airport	10	0.0	6.0	10.0%
12	Institutional	11	0.0	6.0	0.0%
13	Schools	12	0.0	20.0	0.0%
14	Military	13	0.0	1.0	0.0%
15	Prison	14	0.0	6.0	0.0%
16	Agriculture	15	0.0	0.0	0.0%
17	Open Space	16	0.0	0.0	0.0%
18	Vacant	17	0.0	0.0	0.0%
19	Road	18	0.0	0.0	0.0%
20					
21					

Figure 2 - Sketch7 Place Types

regional data

Regional data from a TAZ based travel model must be entered into the tool for each of the place types found in the place type tab (see above). These data should be sorted by TAZ and place type, and include:

Table 1 - Sketch7 Regional Data Requirements with Field Names Indicated in Parentheses

Household Population (POP_TOT)	Dwelling Units (DU) (HH_TOT_P)	Employees (EMPTOT_I)	Retail Employees (EMP_RET)
Non-Retail Employees (EMP_NRET)	Acres with DUs (NETAC_DU)	Acres with Employees (NETAC_EMP)	Total Trips (PT_TOT_RES)
Vehicle Trips (VT_TOT_RES)	Walk Trips (WK_TOT_RES)	Bike Trips (BK_TOT_RES)	Transit Trips (TRN_TOT_RES)
VMT per Household (VMT_TOT_RES)	VMT per Capita (....)	Jobs within 20 minute Drive (JOBS20D)	Jobs within 45 minute transit trip (JOBS45T)

To update these data, the user selects the “Update Regional Data” button from the *start* tab, and enters the data as outlined above. Note that each TAZ will have one row for each place type found within it, as shown in Figure 3. For example, TAZ 658 has seven place types found within it, and each gets a separate row.

	B	C	D	E	F	G	H	I	J	K	
1		Done	702								
2	taz	optype	POP	TOT HH	TOT P	EMPTOT I	EMP RET	EMP NRET	NETAC DU	NETAC EMP	PT TOT RES
3	658	Single-family	117	34	0	0	0	0	218	0	469
4	658	Multi-Family	0	0	10	0	10	0	1	0	0
5	658	Retail	0	0	12	7	5	0	1	0	0
6	658	Regional Retail	117	39	0	0	0	232	0	462	0
7	658	Service	156	52	0	0	0	29	0	487	0
8	658	Office	49	18	0	0	0	3	0	218	0
9	658	Mixed Use	20	7	0	0	0	1	0	69	0
10	658	Industrial	0	0	11	3	8	0	10	0	0
11	663	Utility	360	121	0	0	0	794	0	1435	0
12	663	Airport	0	0	1	1	0	0	0	0	0
13	663	Institutional	0	0	23	0	23	0	4	0	0
14	663	Schools	0	0	17	0	17	0	41	0	0
15	663	Military	267	90	0	0	0	580	0	1064	0
16	663	Prison	103	41	0	0	0	31	0	358	0
17	663	Agriculture	2	1	0	0	0	1	0	3	0
18	663	Open Space	22	8	0	0	0	1	0	83	0
19	663	Vacant	0	0	24	0	24	0	8	0	0
20	663	Road	0	0	21	6	16	0	22	0	0
21	664	Single-family	148	54	0	0	0	438	0	506	0
22	664	Multi-Family	49	17	0	0	0	73	0	205	0
23	664	Retail	78	20	0	0	0	14	0	317	0
24	664	Regional Retail	4	1	0	0	0	0	0	14	0
25	664	Service	7	3	0	0	0	0	0	35	0
26	664	Office	0	0	203	0	203	0	50	0	0
27	665	Mixed Use	236	74	0	0	0	1024	0	956	0
28	665	Industrial	0	0	54	2	51	0	24	0	0
29	665	Utility	0	0	10	1	9	0	7	0	0

Figure 3 - Example of Regional Data Input

elasticities

The elasticities in Sketch 7 adjust the base travel metrics up or down, depending on the relationship of the measure to travel behavior. The base “default” Ds values used in the tool (as described in [Appendix G](#)) are based on results for the Sacramento region of the “Improved Data and Tools for Integrated Land Use-Transportation in California” study. These are listed in Figure 4 below.

The user has the ability to adjust these base default elasticities to reflect the results of this study for other regions (or other studies) -- and needs to do so for accurate use. To update the Ds elasticities, the user selects the “Update Elasticities” button from the *start* tab.

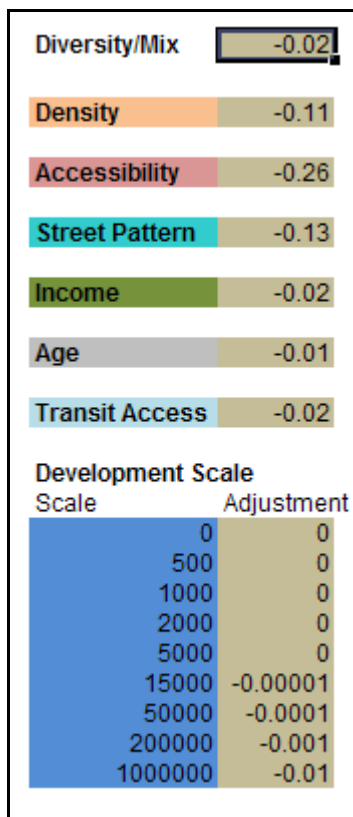


Figure 4 - Sketch7 Base Elasticities (for the SACOG region)

Using the Sketch 7 Spreadsheet Tool

Once all three sets of data are updated, the user can begin using the Sketch 7 spreadsheet, which can be downloaded at: <http://ultrans.its.ucdavis.edu/projects/improved-data-and-tools-integrated-land-use-transportation-planning-california> (under “VMT Spreadsheet Tool”).

Silverlight GIS Application

The purpose of this website application is to enable a user to select one or more parcel locations within the area on the map and produce a buffer from those points to retrieve all parcels within that buffer. A table then appears showing data for each parcel along with a highlighted selection of each parcels location. At this point, the user can adjust the original data to fit the needs of a particular scenario. The **Employment**, **Dwelling Units**, and **Landuse Type** fields are all editable and can be changed to any value the user desires. Lastly, when all field value changes are completed, the user can export the table into an “xml” spreadsheet onto their local computer to export into an Excel spreadsheet for further analysis.

Web server administrators have a few requirements to fulfill to host this application. The website utilizes ESRI’s ArcServer GIS web mapping technology with data stored in an ArcSDE database for use over the internet. Data storage can also include shapefiles and file based geodatabases. A

copy of Microsoft Visual Studio will be needed to change URL parameters and publishing of the website onto an IIS based web server.

Users of the website also have the requirement of installing the Microsoft Silverlight browser plugin before they can view the web site. Upon navigating the site, a script checks to see if the browser contains the plugin, and if not provides a link to install.

The shapefile or geodatabase must include the following fields:

- Landuse Type (must be consistent with the place types in Sketch7)
- Dwelling Units
- Employees
- TAZ

An example of the website for the Sacramento region can be seen at:

[http://mapping.sacog.org/landusebuffer.](http://mapping.sacog.org/landusebuffer)

Silverlight Code

A zip file containing all Silverlight code can be downloaded at the following URL:

<http://ultrans.its.ucdavis.edu/projects/improved-data-and-tools-integrated-land-use-transportation-planning-california> “To download the silverlight code, [click here.](#)”

The contents of the file should be unzipped into a new folder. Visual Studio 2010 is required to open the project by selecting the *.sln file.

Once the project is opened, the solution explorer will reveal a web section and a Silverlight section. All changes in the code should be performed in the Silverlight portion of the site.

Finally, the site will need to be published to a web server using Visual Studio.