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MEMORANDUM

Date: January 31, 2014 Project #: 12383

To: SMF PA2 Project Team

From: Alice Chen, Darryl DePencier, Bruce Appleyard, Caleb Schroeder, and Alex Steinberger

Project: Smart Mobility Framework Pilot Area 2: SBCCOG Long Range Transportation Plan

Subject: Comparison of Performance Measures and Results – REVISED DRAFT

INTRODUCTION

This memorandum presents the results of our analysis applying the Smart Mobility Framework (SMF) principles and performance measures to assess four long range land use and transportation scenarios for the South Bay Cities. The analysis was conducting using the Envision Tomorrow Plus (ET+) scenario planning tool. The analysis focuses on two different land use scenarios and two different transportation assumptions in a corridor stretching between Inglewood and Hawthorne; "Hawthorne Corridor" as defined below.

BACKGROUND

This effort is part of a larger study being conducted for Caltrans Headquarters Office of Planning to test implementation of the SMF into current transportation planning processes. Specifically, the Pilot Area 1 (PA1) involved integrating SMF principles and performance measures into a second generation Corridor System Management Plan (CSMP) for I-680 corridor within Contra Costa County in Caltrans District 4. The PA1 study is intended to be supplementary and complementary to the CSMP process.

For Pilot Area 2, the goal was to develop a suite of easy-to-use processes and tools to apply the SMF toward best practices for sub-regional planning products, project analysis, and ultimately, infrastructure decision making. The product allows local planners to dynamically understand the trade-offs, costs and benefits of various components of the land use and transportation project portfolios to optimize a comprehensive set of beneficial economic, environmental, and social equity outcomes based on Metro's Countywide Sustainability Planning Policy (CSPP) principles and priorities as well as the SBCCOG sub-regional priorities.

APPROACH

For Pilot Area 2 (South Bay Cities), our approach has been:

1. Define the land use and transportation scenarios.
2. Identify which SMF performance measures to apply.
3. Review the tools and data available for the analysis and select the tools.
4. Refine the tools and collect the data for selected performance measures.
5. Conduct the preliminary analysis.
6. Compare results of SMF performance measures to traditional performance measures.

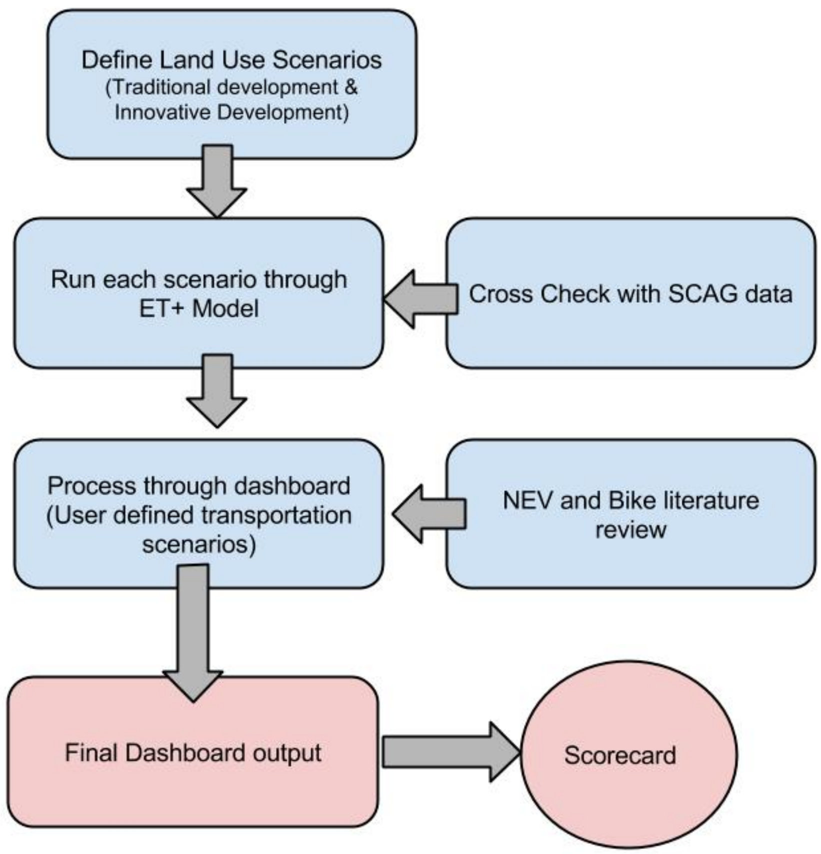


Exhibit 1. Approach Diagram

Specifically, for the analysis using the ET+ Model, as shown in Exhibit 2, the process involved several steps and allows for an iterative step during the evaluation to modify the scenarios before finalizing and documenting the results.

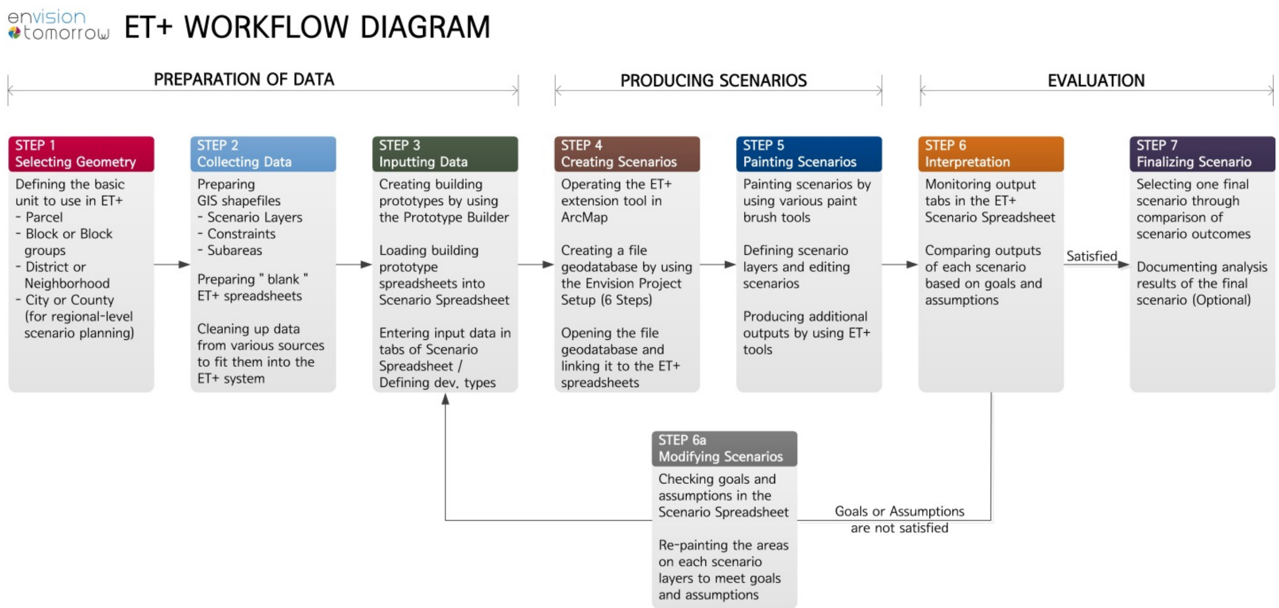


Exhibit 2. ET+ Workflow Diagram

Portfolio Scenarios

Four portfolio scenarios that combine transportation improvements with land use strategies were developed in consultation with the South Bay Cities Council of Governments (SBCCOG) and Metro to illustrate the benefits of the applying SMF performance measures to attain the sustainable community objectives. Given the size of the South Bay Cities subregion and the neighborhood level of the Sustainable South Bay strategy, two representative areas within the subregion were initially identified for the portfolio scenarios. However, as described below, this memo presents the analysis results for the Hawthorne Corridor study area.

The purpose of the portfolio scenarios is to illustrate the benefits of using the SMF at a subregional level to identify transportation improvement projects in combination with land use strategies to attain sustainable community objectives as presented in Metro's Countywide Sustainability Planning Policy (CSPP). The intent is to assess the effectiveness of the SMF on the analysis of a portfolio of projects in a sub-regional long range plan rather than the assessment of a single project or multiple alternatives for a single corridor.

After discussions with the Project Team during meetings in April and May 2013 and for the purposes of the our analysis, the following five scenarios were developed that compares existing conditions to various levels of innovation in future land use and transportation improvements:

- **Scenario One** shows the existing conditions in the corridor. This scenario serves as a base case to compare other scenarios to.

- **Scenario Two** assumes only traditional infrastructure and transportation improvements that have already been identified in SBCCOG's Measure R as well as the Congestion Management Fee (CMF) program that are not fully funded with current "traditional" land use patterns.
- **Scenario Three** focuses only on hypothetical innovative sustainable land use changes, but with traditional transportation improvements.
- **Scenario Four** includes innovative transportation projects (e.g., NEV subsidy, mobility hubs, charging stations, shared lane; multi-lane boulevards), but assumes traditional land use patterns.
- **Scenario Five** evaluates the SBBCOG's innovative project proposals and land use changes in the Sustainable South Bay plan. This is the most progressive of all four future scenarios, providing the groundwork to consider an array of innovative transportation projects (e.g., NEV subsidy, mobility hubs, charging stations, shared bicycle lanes; multi-lane boulevards) in combination with the "neighborhood nodes" concept for the land use configuration.

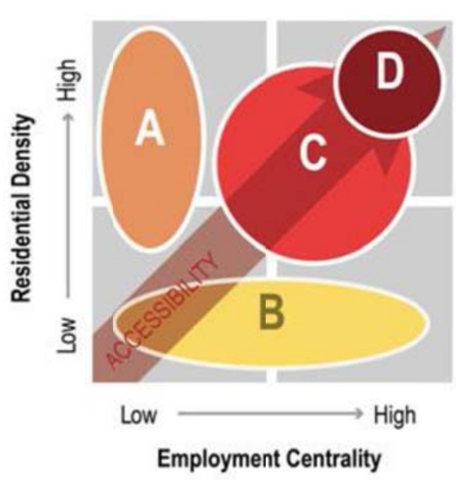
Study Area

Given the geographic coverage of the South Bay cities and the need to identify a subset of transportation projects and land use changes within the subregion, the SMF place types and Metro's Accessibility Clusters were used to focus our efforts. Hawthorne Corridor study area was selected because it presents a high potential to transition to more sustainable transportation planning area.

The Pilot Area Study focuses on the "Hawthorne Corridor":

- Hawthorne Boulevard corridor stretches between West Manchester Avenue to the north and Artesia Boulevard at the south. To the west, the study area is bounded by Aviation Boulevard and Crenshaw Boulevard to the east. The Hawthorne Corridor passes through the cities of Lawndale, Hawthorne, and Inglewood as well as unincorporated Los Angeles County.

This study area has been identified by SBCCOG in *Sustainable South Bay: An Integrated Land Use and Transportation Strategy* as representative of higher density locations that have high potential for redevelopment and land use redistribution. Image X shows the Accessibility Clusters concept, as presented in LA MTA's *Metro Countywide Sustainability Planning Policy.*



The map in Exhibit 3 of the south bay region captures a combination of two factors, residential density and job access or centrality, showing the high degrees of both centrality and population density for the Hawthorne corridor area. These were identified to be key factors in that step the stage for future smart growth development. This study examines how different land use intensities of both residential and commercial influence this focused, yet powerful set of performance measures. This corridor also matches SCAG's 2035 growth projections, specifically in terms of future population density.

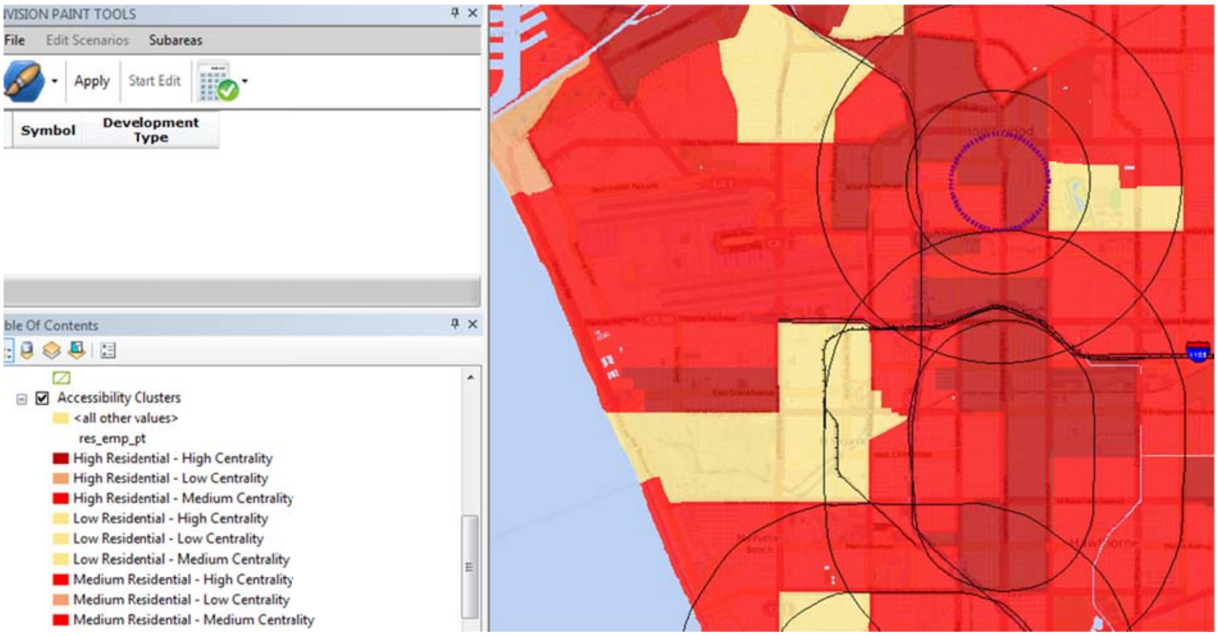


Exhibit 3. Hawthorne Boulevard – Accessibility Clusters

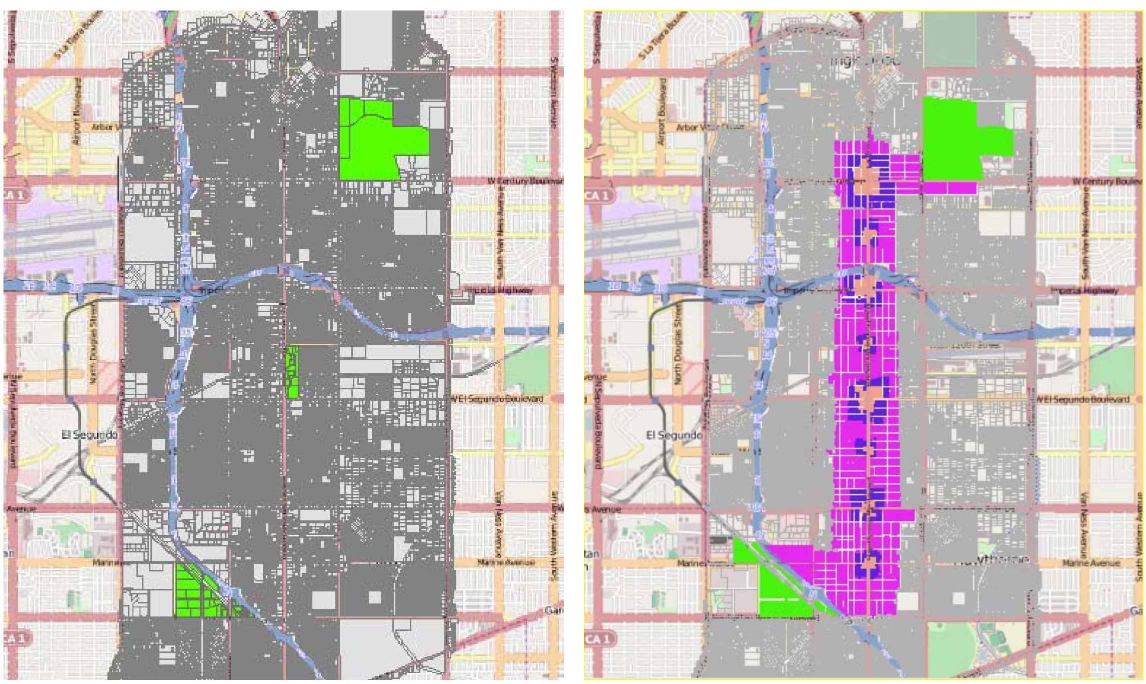


Image A Image B

Exhibit 4. Hawthorne Corridor Study Area

Exhibit 4 Image A shows the Traditional Land Use assumptions. The areas that were "developed" in this scenario are shaded green. These are three sites that have been identified for redevelopment by members of the project team from the SBCCOG. The development profiles for these sites (mixture of uses, density and street patterns) are consistent with plans approved for the Hollywood Park site. The mixture is comprised of retail, parking, single family homes, town homes and office space.

Exhibit 5. Examples of Traditional Land Use Types

Exhibit 4 Image B shows the Innovative Land Use development assumption. The green color is consistent with the development type in Image A, the orange color represents dense commercial and retail nodes, the purple color represents dense residential; multistory apartment complexes and mixed use residential buildings, and the pink represents medium residential: small plot single family houses and townhomes.

Exhibit 6. Examples of Innovative Land Use Types

Table 1 illustrates the types of transportation projects represented under the “Traditional” and “Innovative” transportation scenarios.

Table 1. Transportation Project Types – Traditional vs. Innovative

<table>
<tr><th>Traditional Transportation</th><th>Innovative Transportation</th></tr>
<tr><td rowspan="4">Existing infrastructure and policy</td><td>NEV subsidy</td></tr>
<tr><td>Street network conducive to NEV use, ex: shared lanes, street punch through</td></tr>
<tr><td>Charging stations,</td></tr>
<tr><td>Mobility hubs</td></tr>
</table>

	Increase in Bike infrastructure

Performance Measures

The scenarios were evaluated based on a set of recommended performance metrics that were based on the SMF performance measures and compared to the performance measures used by Metro in the LRTP as well as by SCAG for the RTP/SCS. In selecting the performance metrics, the intent was to identify a subset of the SMF measures that would be most meaningful in demonstrating the sustainability policies at the subregional scale. The recommended metrics are listed in Table 2.

Table 2. Recommended Performance Metrics

Performance Metric	Tool/Data
Average Proximity to Employment (30 min by Transit)	Travel Demand Model
Average Proximity to Employment (20 min Drive)	Travel Demand Model
Average Vehicle Occupancy (AVO)	2001 Regional Household Travel Survey
Modal Travel Time and Cost	Travel Demand Model
NEV, Bicycle, Walking Facilities	GIS
Percentage of Trips by Transit	Travel Demand Model
Percentage of Trips by NEV	SBCCOG Research
Percentage of Trips by Bicycling	Census/ACS/LA Bike Model
Percentage of Trips by Walking	Census/ACS
Quantities of Criteria Pollutants and GhGs	Travel Demand Model, EMFAC
Vehicle Hours of Delay (VHD) or Person Hours of Delay	CMF Tool, Travel Demand Model
Vehicle Miles Traveled (VMT) or Person Miles Traveled	ET+, Travel Demand Model
Vehicle Hours Traveled (VHT)	ET+, Travel Demand Model
VMT per Capita by Speed Range	Travel Demand Model
Number of Crashes	SWITRS, Travel Demand Model, ET +
Number of Vulnerable User Crashes	SWITRS, Travel Demand Model, ET +

Tools and Data

Envision Tomorrow Plus (ET+) is a unique scenario planning tool. This tool interfaces between ArcGIS and Excel to evaluate how changes at the parcel level affect a number of different regional measures. ET+ provides a real-time evaluation of relevant indicators to measure a scenario's performance. Indicators include both VMT and carbon emissions analysis.

ET+ is an open-access scenario planning tool, which allows users to download the software for use within the ArcMap/Excel interface. Both the ArcMap files and Excel spreadsheets can be modified. In this way, ET+ is versatile and expandable, which is a key reason for choosing this particular software package for this project. ET+ requires an initial batch of data to be input that tunes the sensitivity of the model to the particular region that is being studied. The unique inputs for ET+ are customizable allowing exact development type and mixtures to be defined. This allowed for the creation of the two unique land use scenarios that were evaluated in this study. Once the model processed initial results based on land use changes, further modifications were made possible through the supplemental dashboard tool. The dashboard tool allows for user defined modification to the overall results incorporating different transportation assumptions.

ET+ provides a real-time evaluation of relevant indicators to measure a scenario's performance. ET+ includes a total of 61 indicators relating to land use, transportation, housing, economy, and environment.

ANALYSIS

ET+ consists of two primary tools: the Prototype Builder and the Scenario Builder. The Prototype Builder is used to create individual buildings – the smallest unit of analysis in an ET+ scenario. This template spreadsheet is a simplified planning-level pro forma, not unlike one used by a developer to evalulate the financial feasibility of a development project. For the purposes of our analysis, the Prototype Builder was used to model a library of building types and the Scenario Builder was used to create the land use scenarios and evaluate each scenario using a set of user-defined benchmarks or indicators.

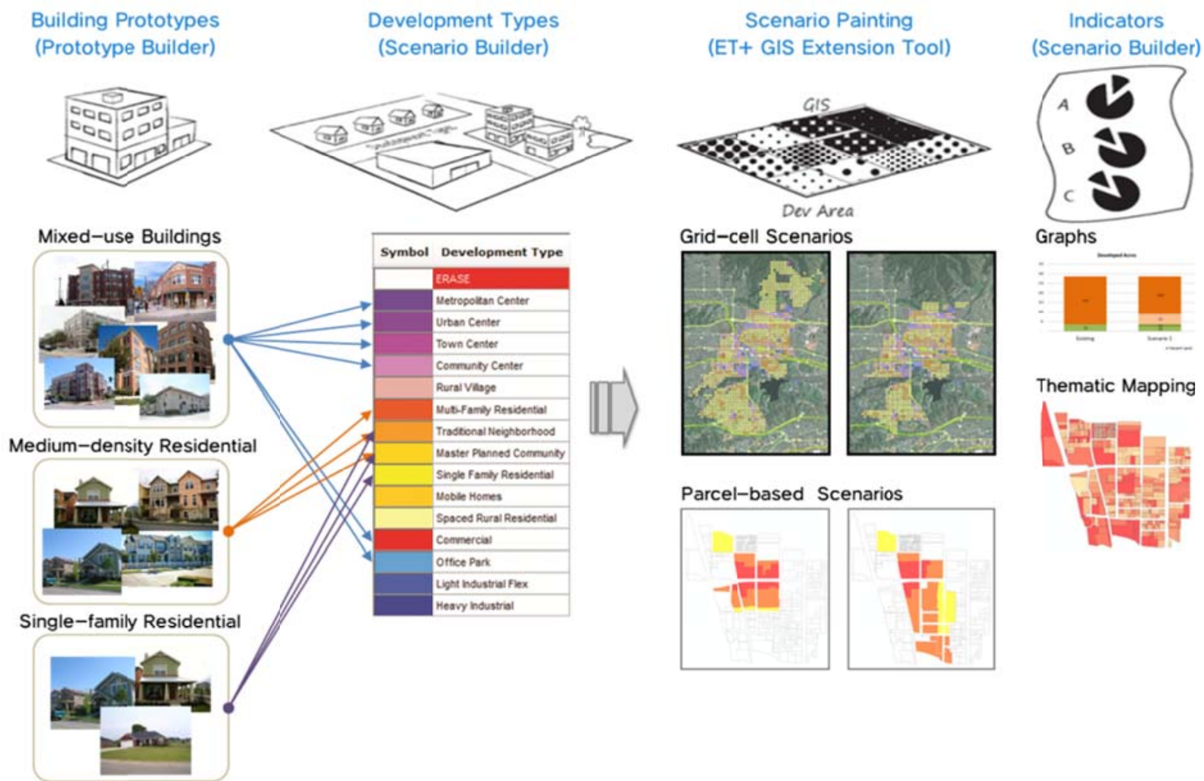


Exhibit 7. ET+ Model Tools

To create the land use scenarios, data is entered into the ET+ spreadsheets, examples of which are shown in Exhibit 8 and Exhibit 9. Figure X shows how different indicators are calculated. The basic premise consists of quantifying and capturing various qualities of the existing land use, then replacing chosen parcels with a new set of information that reflects the specified type of development in that scenario. The model examines a total of 61 different indicators grouped into 7 categories: Baseline Information, Growth, Transportation, Land Use, Economy, Housing and Environment. The models utilize these indicator to then calculate the net effects from the existing scenario to the proposed development scenario. This is a two part process; the first step of the model run quantifies changes in land use, housing and demographics, while the second set focuses on the net effects on transportation. This same process is repeated in the second half of the model run in order to examine the net effect that land use changes have on transportation.

Indicators		Summary_New	Summary_Total
Baseline Info. (7)	Population	●	●
	Net New Population		●
	Displaced Population		●
	School Aged Children		●
	Average Household Size	●	●
	People per Net Acre	●	●
	Housing Units per Net Acre	●	●
Growth (2)	Developed Acres (with %)	●	●
	Infill Development	●	
Land Use (5)	Land Area Mix	●	●

	Land Mix Score(Entropy)	●	●
	Building sqft Mix	●	
	Building sqft Score (Entropy)	●	
	Average Floor Area Ratio (FAR)	●	
Transportation (15)	Walk and Transit Friendliness (0-1 scale)	●	●
	Parking Spaces	●	
	Parking Spaces per 1,000 sq. ft. of Development	●	
	Parking Lot Coverage	●	
	Parking Cost as Percent of Building Value	●	
	New Road Land Miles	●	
	New Road Cost	●	
	Walk Trips		●
	Transit Trips		●
	Vehicle Trips		●

Indicators		Summary_New	Summary_Total
Transportation (15)	Internal Trips		●
	External Trips		●
	Vehicle Miles Traveled (VMT)		●
	Mixed Use District Travel – VMT per Capita		●
	ULI Shared Parking Savings		●
Economy (14)	Employment Mix	●	●
	Employment by Type	●	●
	Net New Jobs		●
	Displaced Jobs		●
	Job-Housing Balance	●	●
	Jobs per Net Acre	●	●
	Household Income Needed to Afford the Average Home Cost in Each Scenario	●	
	Average Wage in Each Scenario	●	
	Subsidy	●	
	Financial	●	
	Subsidy per Unit	●	
	Property Tax Revenue per Acre	●	●
	Sale Tax Revenue per Acre	●	●
	Monthly Household Costs (H+T+E)		●
Housing (11)	Housing by Type	●	●
	Housing Mix	●	●
	Net New Housing Units		●
	Redeveloped Housing Units		●
	Owner/Renter Mix	●	
	Average Rent	●	
	Average Rental Unit Size	●	
	Average Home Price	●	
	Average Owner Unit Size	●	
	Housing Distribution by Income	●	
	Housing by Building Type	●	
Environ. (7)	Impervious Cover of New Development (%)	●	
	Energy Use per Household	●	●
	Carbon Dioxide (CO2) Emission per Household	●	●

	Landscaping Water Use per Household	●	●
	Internal Water Use per Household	●	●
	Waste Water per Household	●	●
	Solid Waste per Household	●	●
TOTAL (61 Indicators)		**45 Indicators**	**38 Indicators**

(*) Note: Indicators colored in blue are ones that are used in both the 'Summary_New' and the 'Summary_Total' tabs.

Figure X

The following provide various snap shots of the input and output sheets of the model. Exhibit 8 and 9 function as the foundation of the different development types. These sheets represent proposed land use change scenarios and translate those into a set of number to feed into the model. Exhibit 9 captures the overall characteristic of the region. This information is built into the model from the R&D phase.

2. Enter Development Type Names Clear Streets	Block Size					Street Characteristics							
	Block Width 1 (ft)	Block Width 2 (ft)	Buildable Block Area (Sq Ft)	Total block Area (to center line) (Sq Ft)	Total Block Area (Acres)	Number of Drive Lanes	Drive Lane Width	On-street Parking Width	Bike Lane Width	Sidewalk Width	Total Landscaping Width	Total Street Width	Cul-de-sac as percent of all intersections
Hotel 5	350	350	122,500	188,356	4.3	4	10	5	4	12	2	84	0%
Lifestyle Retail Suburban Main Street	350	350	122,500	188,356	4.3	4	10	5	4	12	2	84	0%
Office 5	350	350	122,500	188,356	4.3	4	10	5	4	12	2	84	0%
Mixed-Use Office 5	350	350	122,500	188,356	4.3	4	10	5	4	12	2	84	0%
Mixed-Use Office 15	350	350	122,500	188,356	4.3	4	10	5	4	12	2	84	0%
Conventional Lot Single Family - 6,00	350	350	122,500	188,356	4.3	4	10	5	4	12	2	84	0%
Small Lot Single Family - 4,000 sq ft	350	350	122,500	188,356	4.3	4	10	5	4	12	2	84	0%
Townhomes Medium	350	350	122,500	188,356	4.3	4	10	5	4	12	2	84	0%
Garden Apartment	350	350	122,500	188,356	4.3	4	10	5	4	12	2	84	0%
Apartment 3	350	350	122,500	188,356	4.3	4	10	5	4	12	2	84	0%
Apartment 5 - Wrapped Parking	350	350	122,500	188,356	4.3	4	10	5	4	12	2	84	0%
Apartment 5	350	350	122,500	188,356	4.3	4	10	5	4	12	2	84	0%
Condo 5	350	350	122,500	188,356	4.3	4	10	5	4	12	2	84	0%
Mixed-Use Residential Renter 5	350	350	122,500	188,356	4.3	4	10	5	4	12	2	84	0%
Hollywood Park	350	350	122,500	188,356	4.3	4	10	5	4	12	2	84	0%
Commercial and Retail	350	350	122,500	188,356	4.3	4	10	5	4	12	2	84	0%

Exhibit 8. ET+ Spreadsheet: Define Development Types

Load Buildings Clear Buildings	1. Load your Prototype buildings		Housing Type			Residential Rent		Residential Sales Price		
#	Building Name	Dwelling Units / Acre	Type of Housing	Percent Renter	Percent Owner	Rent ($/SqFt)	Avg Rent ($/Mo.)	Sales Price ($/SqFt)	Avg Sales Price ($)	Avg Monthly Mortgage Payment ($)
6	Mixed-Use Office 15	-		0%	0%	$ -	$ -	$ -	$ -	$ -
7	Conventional Lot Single Family - 6,00	5	SF	0%	100%	$ -	$ -	$ 270	$ 567,000	$ 3,399
8	Small Lot Single Family - 4,000 sq ft	12	SF	0%	100%	$ -	$ -	$ 275	$ 495,000	$ 2,968
9	Townhomes Medium	13	TH	0%	100%	$ -	$ -	$ 260	$ 390,000	$ 2,338
10	Garden Apartment	22	MF	100%	0%	$ 1.80	$ 1,980	$ -	$ -	$ -
11	Apartment 3	36	MF	100%	0%	$ 1.65	$ 1,403	$ -	$ -	$ -
12	Apartment 5 - Wrapped Parking	66	MF	100%	0%	$ 1.90	$ 1,900	$ -	$ -	$ -
13	Apartment 5	46	MF	100%	0%	$ 1.90	$ 1,520	$ -	$ -	$ -
14	Condo 5	62	MF	0%	100%		$ -	$ 300	$ 300,000	$ 1,799
15	Mixed-Use Residential Renter 5	57	MF	100%	0%	$ 1.75	$ 1,750	$ -	$ -	$ -
16	Hollywood Park	-			0%		$ -		$ -	$ -

Exhibit 9. ET+ Spreadsheet: Building Prototypes

Exhibits 11 and 12 show examples of the outputs on the scenario spreadsheet. These portray the type of information that the model is capable of summarizing for different scenarios.

HH Travel App Inputs	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Select Project County (or nearest location)	Los Angeles County, California			
Land Use Characteristics				
Employees in Region	650,000	650,000	650,000	650,000
Employees in Study Area	92,864	97,080	92,864	97,080
LN Employees in Study Area	11.44	11.48	11.44	11.48
Employment Density	6,146	6,425	6,146	6,425
% Change in Employment Density	0%	5%	0%	5%
New Employees in Study Area	625	7,552	625	7,552
Population in Study Area	126,497	133,126	126,497	133,126
JobPop	0.43	0.43	0.43	0.43
LN JobPop	-0.85	-0.84	-0.85	-0.84
Area (acres)	9,670	9,670	9,670	9,670
Area (square miles)	15.11	15.11	15.11	15.11
LN Area (square miles)	2.72	2.72	2.72	2.72
Activity Density	14,519	15,237	14,519	15,237
LN Activity Density	9.58	9.63	9.58	9.63
Developed Land Area Mix (Sq Ft)				
Residential Land Area Amount (sq ft)	649,013	7,195,702	649,013	7,195,702
Commercial Land Area (sq ft)	115,217	1,221,783	115,217	1,221,783
Public/Institutional Land Area (sq ft)	156,571	1,985,398	156,571	1,985,398
Total Land Area (sq ft)	920,801	10,402,883	920,801	10,402,883
Land Use Mix (Entropy)	0.50	0.51	0.50	0.51
LN Land Use Mix (Entropy)	-0.69	-0.67	-0.69	-0.67
Residential Unit Mix				
Single Family Residential (du)	22,081	22,236	22,081	22,236
Townhouse Residential (du)	214	938	214	938
Multi-Family Residential (du)	11,138	14,784	11,138	14,784
Mobile Home Residential (du)	0	0	0	0
Total Residential Amount (du)	33,434	37,958	33,434	37,958

Exhibit 10. ET+ Land Use Inputs Scenario Spreadsheet

			Traditional Transportation				Innovative Transportation			
	Business As Usual		Traditional Land Use		Innovative Land Use		Traditional LU/ Innov. Trans		Innov. LU/Innov. Trans	
Commercial Parking	-	0%	-	0%	-	0%	-	0%	-	0%
Total	361,911,569		343,880,652		372,314,452		362,832,370		372,314,452	
Land Mix Score (Entropy)		0.80		0.80		0.79		0.80		0.79

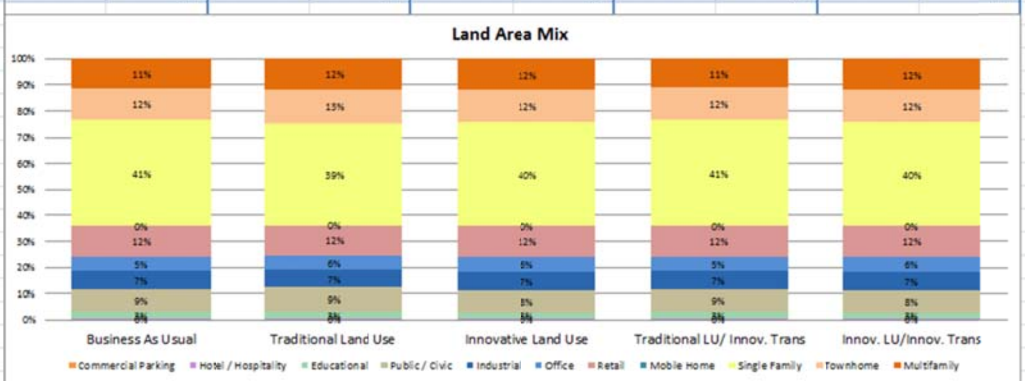


Exhibit 11. Comparison of Land Use Mix by Scenario

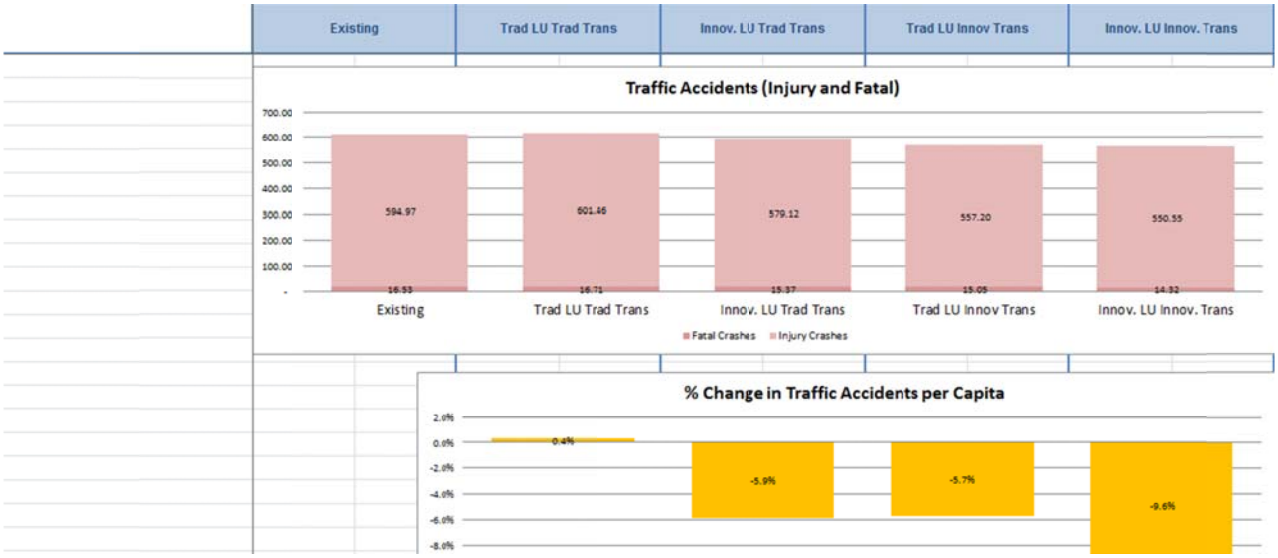


Exhibit 12. ET+ Indicator: Comparison of Traffic Accidents by Scenario

RESULTS

Dashboard

The dashboard serves a dual purpose, first it provides a snapshot of key metrics measured in the model, second it allows for further interactive analysis to be completed. The dashboard calculator was constructed on top of the ET+ platform to facilitate our comparison of the performance of both traditional and innovative land use and transportation components.[1] An extensive survey of the available research on the influence of NEV and bicycle projects was used in the construction of the dashboard calculator which captures and operationalize the sensitivities between user defined inputs regarding "innovative" transportation projects (NEV, bicycle, bus and walking projects) with outcomes (VMT, GHG emissions).

In scenario planning there are some impacts that can be readily quantified but there are also many hypothetical changes based on behavioral changes. Behavior is influenced by a variety of different factors not just physical infrastructure. Surrounding land use, transportation policy, integration of different networks and cost of transportation are all influencing factors and are fluid and change over time but have a real impact on behavior and travel patterns. This tool serves as a user defined medium to reflect how potential changes in NEV, Bike, Bus and pedestrian activity use will affect other measures such as CO2 and daily VMT per capita. These adjustments serve as a way to capture and quantify hypothetical innovative transportation policy and projects. Examples of potential influencing factors include; NEV subsidy, street network conducive to NEV use and an increase in bike facility per capita, transit hubs, dedicated bus lanes, safe routes to school and sidewalk repairs.

Assumptions:

This project deals in a developing area of planning research. While theoretically we can assume the direction a policy might have on an outcome variable (NEVs will help lower GHG), there is a degree of uncertainty about the magnitude, which leads us to rely on both qualitative and quantitative measures.

The dashboard reflects quantitative data with the ability for user defined modifications. These modifications are poised to capture potential impacts of four modes of transportation: NEV, Bicycle, Transit and Pedestrian. While the model provides a base line measure for mode share that includes these four modes, there are many potential influencing variables that are, at this time, hard to fully capture. In order to better capture the ambiguity in future travel patterns the dashboard has this added post-processing tool.

1

NEV:

The following displays the assumptions for the NEV post processing calculation:

	Existing	Traditional LU Traditional Transportation	Traditional LU Innovative Transportation	Innovative LU Traditional Transportation	Innovative LU Innovative Transportation
NEV Ownership	1%	1%	User Defined 1-25%	5%	User Defined 1-25%
NEV Use (as percent of VMT)	19%	19%	19%	User Defined 19%-45%	User Defined 19%-45%

Baseline mode share is assumed to be 1%, baseline percent of vehicle miles travels (VMT) replaced by NEV is 19%*. (SBCCOG *Zero Emission Local Use Vehicles: The Neglected Sustainable Transportation Mode,* 2013) Based on research we hypothesized that land use has a greater effect on the NEV use while innovative transportation measures and policies has a greater effect on ownership. For traditional land use and transportation we assumed baseline numbers except for the innovative land use/traditional transportation column we assumes a 5% ownership rate as opposed to the baseline of 1%.

Bicycle:

There was less conclusive research available for bicycle use so we provided a broad range for the user to select. The user is identifying the percent of the population that would switch from a car to a bicycle for 1/3 of their VMT. The user selects from a range of 1-25%. This number would reflect an average of both ends of the spectrum: those switching to bicycle for their daily commute and those switching to a bicycle solely for errands or other minor trips. The calculations for the different combinations of innovative/traditional land use and transportation are shown below. We added an additional 50% increase as a scaling factor when there are both innovative land use and innovative transportation factors at play.

	Existing	Traditional LU Traditional Transportation	Traditional LU Innovative Transportation	Innovative LU Traditional Transportation	Innovative LU Innovative Transportation
Bicycle use increase (Percent of population	Model Output	Model Output	User defined (1/3 of 1-25%)	User defined (1/3 of 1-25%)	User defined (1/3 of 1-25% + 50% increase)

Transit:

The ET+ model captures change in transit mode share specifically due to land use, but there are factors beyond what is captured in the model that could influence people to switch from vehicular travel to transit. These factors captured under the umbrella term "innovative transportation" could include transit hubs, dedicated bus lanes, and operational efficiencies (signal prioritization). This portion of the dashboard allows the user to capture these speculative changes. The user selects the percent increase in transit mode share from a range of 1-25%.

	Existing	Traditional LU Traditional Transportation	Traditional LU Innovative Transportation	Innovative LU Traditional Transportation	Innovative LU Innovative Transportation
Transit use increase (Percent of population	Model Output	Model Output	User defined, additional (1-25% of population)	Model Output	User defined, additional (1-25% of population)

Pedestrian:

The model captures change in pedestrian mode share due to land use, but there are other contributing factors outside of the model that could influence behavioral change. Safe routes to school projects and programs, road diets, and sidewalk improvements are all factors beyond the model that could influence people to switch from vehicular travel to walking. This portion of the dashboard allows the user to capture these speculative changes. The user selects the percent increase in walking from a range of 1-25%. We added an additional 50% increase as a scaling factor when there are both innovative land use and innovative transportation factors at play.

	Existing	Traditional LU Traditional Transportation	Traditional LU Innovative Transportation	Innovative LU Traditional Transportation	Innovative LU Innovative Transportation
Pedestrian increase (Percent of population	Model Output	Model Output	User defined, additional (1-25% of population)	User defined, additional (1-25% of population)	User defined, additional (1-25% of population + 50%)

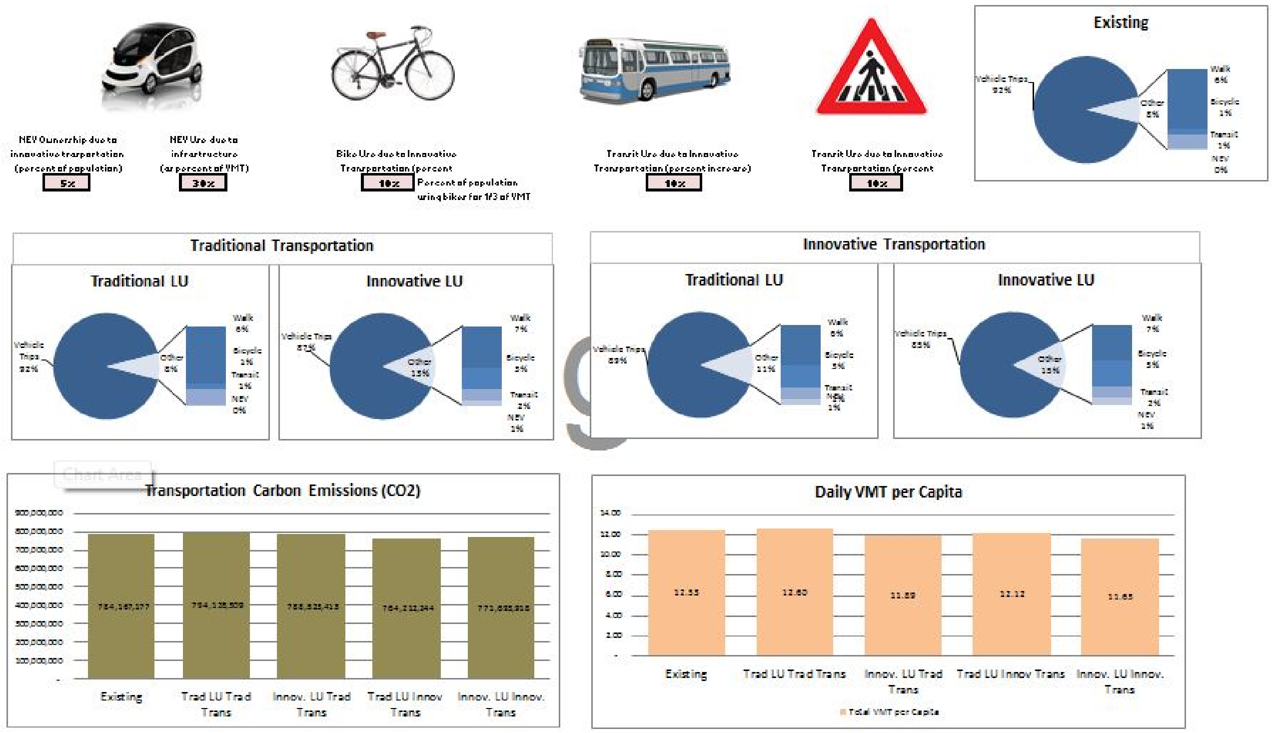


Exhibit 13. Hawthorne Corridor Dashboard: Comparison of Performance Metrics

Exhibit 14 shows the how vehicular CO2 emissions vary depending on the speed of the vehicle. This information is essential to this study, specifically in the consideration of future neighborhood electric vehicle (NEV) use. NEVs typically are operated at slower speeds and for shorter trips than the average automobile trip. (SBCCOG Zero Emission Local Use Vehicles The Neglected Sustainable Transportation Mode, 2013) This is significant because, on average, vehicles traveling at speeds under 25mph emit twice the emissions that a vehicle traveling at speeds over 25mph would emit (Exhibit 14). This indicates that NEV use will provide an additional reduction to emissions as would other modes that replace low speed trips. It is important to note that this additional reduction in CO2 emissions is not currently reflected in the model. It is postulated that NEV, bike, pedestrian and zero emission bus trips would net twice the CO2 reduction. The model is structure to measure primary mode choice only, so without further modification it is difficult to quantify the added reduction for zero emission modes. Specifically, more research is needed to differentiate the effect of replacing a car trip with another zero emission mode.

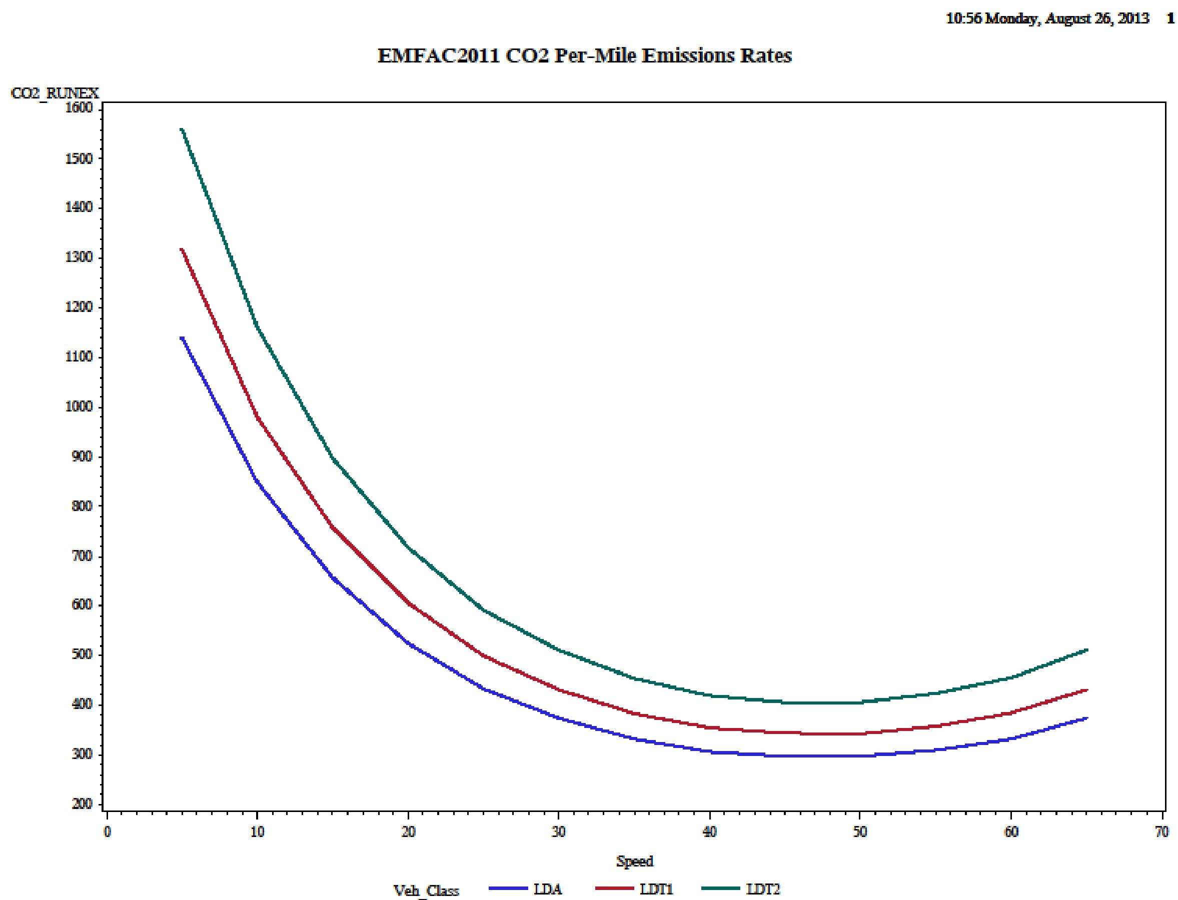


Exhibit 14. CO2 Per Mile Emission for three vehicle classes at different speeds (Leonard Seitz)

Report Card

The report card serves to holistically illustrate how varying land use and transportation characteristics perform in regards to each measure. As our planning scenarios represent innovative and relatively untested land use and transportation projects (e.g., NEV) and profiles, we need to allow theoretical assertions to reside alongside empirical and quantitative measures. Therefore, a report card framework is used to reflect both quantitative and qualitative aspects of the performance of the various scenarios. the report card indicates how various measures may perform under different transportation and land use conditions, as reflected in the SMF/ET+ Model and Calculator outputs. In addition, the Report Card gauges performance in comparison to ideal conditions for each measure:

Existing	Traditional Land Use			Innovative Land Use		
Quantitative	Quantitative	*Traditional Transportation*	*Innovative Transportation*	Quantitative	*Traditional Transportation*	*Innovative Transportation*
		Qualitative	Qualitative		Qualitative	Qualitative

In sum, the Report Card reflects metrics from the model, while also capturing in a qualitative manner, improvement due to innovative transportation and land use characteristics. The report card provides a framework to measure performance as it relates to ideal conditions as well as giving an indication of the effectiveness of each scenario on various performance measures.

	Existing	Traditional LU			Innovative LU		
	Landuse: B- Transportation: C	Quantitative Measures from Land Use Model	Qualitative Assesment		Quantitative Measures from Land Use Model	Qualitative Assesment	
Measure	Metric	Metric	Traditional Transportation	Innovative Transportation	Metric	Traditional Transportation	Innovative Transportation
Average Proximity to Employment (within 30 min drive)	24.1%	37.0%	C-	C+	45.0%	B-	A-
Average Proximity to Employment (within 30 min transit)	2.0%	1.0%	C-	B-	2.0%	B	A-
Average Vehicle Occupancy			D+	B-		C+	B+
Modal Travel Time and Cost*	$651	$506	D+	C+	$455	C+	B+
NEV, Bicycle, Walking Facilities	Low	Low	D-	B-	Low	D-	B-
Percentage of Trips by Transit			C+	B		B-	A-
Percentage of Trips by NEV			F	D		C-	B-
Percentage of Trips by Bicycling			D+	C+		B	A
Percentage of Trips by Walking			C-	B-		A-	A+
Quantity of Criteria Pollutants	4.40	3.90	C	B-	3.80	C+	B
Vehicle Hours of Delay			C	B-		C+	B-
Vehicle Miles Traveled (VMT)	35.12	11.84	C	B	8.77	B+	A-
Vehicle Hours Traveled			C	B-		A-	A
VMT per Capita by Speed Range			C	B		B+	A-
Number of Crashes	1052	-66%	C	B	-75%	B	A-
Number of Vulnerable User Crashes	250	85	C	B+	62.5	B+	A
		Average Grade:	C	B-		B-	B+

Exhibit 15. Report Card for Hawthorne Corridor

COMPARISON OF SMF PERFORMANCE MEASURES TO TRADITIONAL MEASURES

(Without the SCAG model data we won't be able to do this comparison until the next draft)