Validating VMT Reductions From Transportation Measures

Extended Abstract #52

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INTRODUCTION

Air quality agencies in California and elsewhere are working to reduce greenhouse gas (GHG) emissions to protect the climate and to avoid negative impacts on air quality related to climate change. In California, the transportation sector is the largest source of GHG emissions.[1] In the San Francisco Bay Area, the transportation sector accounts for almost 37% of total GHG emissions.[2] Although cleaner fuels and advanced technologies are expected to result in more fuel-efficient vehicles, these gains may be offset or eroded by increased motor vehicle use. For example, in the Bay Area vehicle miles of travel (VMT) are projected to increase by 33% by 2035, outstripping the projected population growth of 23%.[3] Thus, curbing VMT growth will be essential to achieve the State's GHG reduction targets embodied in AB 32 and the Governor's Executive Order S-3-05, as well as achieving policy objectives related to air quality and public health. Current practice to gauge the effectiveness of transportation demand management (TDM) measures, however, may be inaccurate due to data availability, lack of technical expertise, limited resources, or other contributing factors.

Having recognized the importance of reducing VMT and GHG emissions from mobile sources, local air districts in California collaborated and developed a report under the auspices of the California Air Pollution Officers Association (CAPCOA) to identify a range of GHG reduction strategies.[4] The report provides a list of 27 project-level TDM measures, organized into 5 broad common categories. These measures are based on a comprehensive literature search and draws upon the most recent and relevant in transportation research.[5, 6, 7] The measures were also selected based on the feasibility of quantifying the VMT reductions, the availability of robust data upon which to base the quantification, and whether the measures would result in appreciable reductions. As a result, the report enables a better assessment of reduction measures when estimating project-level GHG (and other pollutant) emissions.

Seeing the value of the work presented in the CAPCOA report, the Bay Area Air Quality Management District (BAAQMD) sought to make this information more widely available and accessible to local governments. Soon after the release of the CAPCOA report, BAAQMD contracted with Fehr & Peers Transportation Consultants to develop a userfriendly Excel-based modeling tool. This collaboration produced a TDM tool (the Tool) which is intended to assist with designing and evaluating infill, transit-oriented development projects in order to better assess methods and strategies that can decrease emissions of GHGs and air pollutants by reducing project-level VMT.

In addition to providing the findings and formulas of the CAPCOA report in a convenient interactive program, the Tool builds upon the report's earlier work by (1) validating the VMT and trip reduction findings in the CAPCOA report in comparison with data from a variety of existing sites within the Bay Area, and (2) recalibrating the Tool based upon the results of the validation process. The validation and recalibration processes described below are intended to verify the reliability of the CAPCOA report methodologies and Tool's performance, advance the understanding of TDM quantification, and provide a means for recalibrating the Tool to improve the precision of calculation results.

VALIDATION PROCESS

The validation process included the selection of Bay Area projects that have documented VMT or trip reduction data as well as information about TDM strategies in place with the project, estimating project VMT using the Tool and comparing the Tool's predicted results to the project's documented data. The validation process would reveal how well the Tool performs in predicting VMT reduction when compared to documented count or survey data for each site.

Step #1 in the validation process was to find existing Bay Area projects that (1) already are implementing a variety of TDM measures listed in the CAPCOA report, and (2) have documented VMT reduction, vehicle trip reduction, or mode share shift data. It was critical that a good mix of projects that represented different types of settings (urban vs. suburban), varying locations relative to transit, and different uses (residential vs. commercial) were identified.

Step #2 was to categorize each validation site by place type (infill, suburban center, etc.). This is an important step because the VMT reduction estimates for a given TDM strategy vary by place type. Also, the Tool imposes a cap on the total VMT reduction that can be achieved by means of combined strategies; this cap also varies by place type. **Table 1**, below, shows the projects and place types selected for validation. Nine candidates were ultimately selected.

TABLE 1 – VALIDATION SITES

Place Type[1]	Near Heavy Rail	Away from Heavy Rail
Infill	1. Great Western Building, Berkeley (office)	6. Alta Bates Summit Campus, Oakland (medical)
Suburban Center	2. Hacienda Business Park, Pleasanton (office) 3. Alameda County[2] BART TOD (residential) 4. Pleasant Hill BART TOD (residential)	7. Lawrence Berkeley National Laboratory, Berkeley (research park)
Suburban	5. Caltrain TOD (residential)	8. Town of Moraga (mixed-use) 9. Genentech Campus, S. San Francisco (office)

[1] No projects located in an "urban" setting were selected due to a lack in readily available data
[2] Projects located in Hayward, Fremont, and Union City

Step #3 in the validation process was to prepare and review a site report based on the available data for each validation site. If the site report did not directly provide VMT reduction, calculations steps were used to convert from the reported metrics to percent reduction in VMT. **Figure 1** provides an example screenshot of the calculation step for the Great Western Building site. An estimated VMT reduction was calculated because only mode share information was provided for this particular project site.

GREAT WESTERN BUILDING

(Berkeley, at Berkeley BART station)

Validation Calculations

	Commute[1]
Drive Alone	45.2%
Carpool	4.8%
Rail	25.0%
Bus	13.5%
Walk & Bicycle	11.5%

1. Table 6-6, BART-Berkeley, Travel Characteristics of TOD

Summarized Total Trips	Calculated	typical ITE development[1]	Difference
Drive Alone	45%	82%	
Carpool	5%	11%	-43.0%
Transit	39%	2%	36.5%
Other	12%	5%	
Total	100%	100%	

1. CA Statewide HH Travel survey, 2000-2001, Table 8.12, Commuters by Mode of Travel to Work

Validation	
VMT Reduction	
25.2%	transit method

Figure 1 - Validation Calculation Example

Step #4 was to input the specific TDM measures currently being implemented for each validation site into the Tool; an estimated percent VMT reduction was then generated for each site relative to a VMT baseline of a typical ITE suburban development. **Figure 2**, below, provides an example screenshot of the strategies that were tested with the Tool and its resulting calculations.

Tool Calculations

Strategy from Report	Tool Strategy Name	Input into tool	Results	Questions/ Insight	source
	location	infill			
parking = 1.6 / employee		--			Travel Characteristics
23.65 residents per acre 20.64 jobs per acre	density	20.64 jobs	0%		Travel Characteristics
"excellent" walking routes					
137 ft to bart station= 0.03 miles	transit accessibility	0.03 miles	24%		Travel Characteristics
>$100/month parking	Workplace Parking pricing	$3/day	5%		Travel Characteristics (p.102)
32.3% allows work from home	alternative work schedules	32.3% for 1.5 days telecommute	6%		Travel Characteristics Table 6-5
38.7% helps pay for transit	transit subsidy	38.7% for subsidy of $1.50	5%		

Calculated	
24.6%	Land Use Strategies
14.7%	CTR Strategies
35.7%	Total

Figure 2 - Tool Calculation Example for Sample Validation Site

Table 2 summarizes the results of the validation process. The shadings in the table indicate where there are relatively large (> 5%) differences between the project site report's result and the result from the Tool.

The validation process showed that, on the whole, the Tool predicted VMT well compared to the site report data. The delta was < 5% for five out of the nine sites. The delta was > 5% for four sites, of which two sites had deltas > 10%. The sites for which the Tool over-predicted the VMT reduction by more than 5% were all office sites. These office sites all had transit accessibility reduction credits combined with some commute trip reduction (CTR) credits. The consistent over-estimation suggests double counting may be occurring.

TABLE 2 – VALIDATION SITES COMPARISON					
Validation Site	**Location**	**Measure Descriptions**	**VMT Reduction (compared to typical ITE development)**		**Delta**
			Site Report Result	**Tool Result**	
Alameda County BART TOD	Suburban Center	Density, transit access, parking limits	14.7%	12.5%	**-2.2%**
Alta Bates	Compact Infill	Transit access and subsidy, shuttle, parking pricing, commute marketing	6.0%	23.8%	**17.8%**
Caltrain TOD	Suburban	Density, diversity, transit access, parking limits	5.8%	8.3%	**2.5%**
Genentech	Suburban	Transit access and subsidy, shuttle	11.2%	15.0%	**3.8%**
Great Western	Compact Infill	Density, transit access and subsidy, alternative work schedules	25.2%	35.7%	**10.5%**
Hacienda Business Park	Suburban Center	CTR program voluntary, transit subsidy, alternative work schedules	8.3%	14.3%	**6.1%**
Lawrence Berkeley National Lab	Suburban Center	Transit access and subsidy, destination access, shuttle, alternative work schedules, rideshare	17.3%	18.5%	1.2%
Moraga	Suburban	Design, transit access, diversity	12.1%	5.0%	**-7.1%**
Pleasant Hill BART TOD	Suburban Center	Transit access, density, parking limits	16.8%	12.5%-	4.3%

RECALIBRATION PROCESS

The purpose of the recalibration process was to enhance the Tool based on the validation results. This process focused on further analyzing the validation results which showed the largest discrepancies. Several questions were posed to determine *why* there were large discrepancies in certain cases and *what* can be done to refine the Tool:

1. Were there any common patterns among the large discrepancy sites?
2. Could the discrepancies be linked to certain specific TDM strategies?
3. Were there any strategies that posed a high risk of double counting?
4. Could unique characteristics of the validation sites explain the discrepancies?
5. To what extent were the Tool results impacted by the trip reduction caps?

ENHANCED RULES TESTING

Based on the validation results, Fehr & Peers tested various measures to reduce the potential for double counting transit accessibility and commute trip reduction (CTR) credits. The final iteration of testing resulted in implementation of the following rules, see **Figure 3**.

- For projects ≤ ¼ mile from transit: apply transit accessibility strategy but do not apply CTR strategies (reductions due to 5 minute walk of transit)
- For projects > ¼ mile and ≤ ½ mile from transit: apply both transit accessibility and CTR strategies (transit proximity and CTR play a role if office is near transit)

- For projects > ½ mile from transit: do not apply transit accessibility strategy but do apply CTR strategies (when offices are not near transit, reductions from CTR)

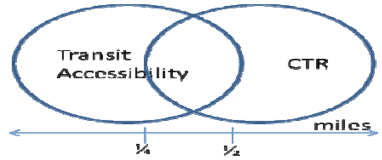

Figure 3 - Additional Rules

The rationale behind these rules is that projects closest to transit have a higher risk of double-counting with CTR strategies based on the transit accessibility literature[7] (where all trip reduction credit was attributed to transit proximity). Being less than ¼ mile from transit likely yields the greatest motivation to use transit, whereas any additional CTR strategies would likely not provide much incremental benefit. On the other hand, with projects greater than ½ mile from transit, proximity alone likely will not motivate significant transit use. CTR strategies in these cases will likely have a much larger impact in increasing alternative means of commuting.

Two sites still have deltas > 5%: Alta Bates and Moraga. Unique site-specific factors may impact the results at these sites, but they may also illustrate potential limitations of the Tool. Although Alta Bates Medical Campus is relatively close to BART (0.7 miles from MacArthur BART), the impact of transit accessibility may be over-predicted in this case. The walking environment and perceived personal safety in the vicinity of Alta Bates are both ranked low compared to other projects with similar distances to transit; this may account for the fact that observed transit use is lower than predicted by the Tool. For Moraga, the project site actually spans an entire town. The large delta may be due to the fact that the CAPCOA report and the Tool were developed to apply at a project level, rather than a city-wide scale.

CONCLUDING THOUGHTS

Validating the TDM Tool's predicted results by comparing them with documented count and survey data for each site proved to be a valuable exercise. Although the Tool performed well overall, thus confirming its underlying assumptions, the validation process provided for a greater understanding of its limitations. In particular, the exercise highlighted (1) the fact that unique characteristics at a given project site may lead to different real-world results than what the Tool may predict, (2) the need to be aware of the potential for double counting when estimating the combined effectiveness of multiple TDM measures, and (3) that the Tool is best suited to estimate the effectiveness of project-level mitigation, reflecting that a larger plan-level analysis requires a different approach to an analysis. The revised Tool, recalibrated based on key findings of the validation process, provides a more precise estimate of VMT reduction for the implementation of the TDM measures provided in the CAPCOA report. Although this validation and recalibration exercise was focused on project sites within the Bay Area, the enhanced understanding of TDM quantification may prove to be valuable beyond the boundaries of the region.

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