

The Role of Land Use in Reducing VMT and GHG Emissions: A Critique of TRB Special Report 298

The 2009 release by the National Research Council of *Driving and the Built Environment: The Effect of Compact Development on Motorized Travel, Energy Use and CO2 Emissions*¹ has fueled the ongoing debate about the role of land use in vehicle miles traveled (VMT) and greenhouse gas (GHG) emissions. Calthorpe Associates takes issue with the report's conclusion that land use plays a small role in reducing VMT and GHG emissions. Our work with the Rapid Fire model and the Vision California project (www.visioncalifornia.org) shows how significant land use is in meeting VMT and GHG reduction goals and targets.

TRB Special Report 298 provides a thorough review of the literature on VMT and land use. However, counter to the conclusions drawn by Rapid Fire and Calthorpe Associates through the Vision California project, the authors of Special Report 298 assert that compact development will have very low market penetration over the coming decades and that land use can play a fairly minor role in transportation GHG reduction. The specific assumptions that lead to these conclusions are counter to those indicated by research and utilized by Calthorpe Associates' Rapid Fire model in deriving its results. Market penetration over the coming decades will be a function of both supply and demand, and indicators associated with both are continuing to show a move towards more compact growth patterns² and more demand for compact unit types.

To prove their case and apply their assumptions, the Special Report 298 authors posit three scenarios, ranging from a Base Case with no compact development at all between 2000 and 2050, to a 'moderate' scenario with 25% compact development, to an 'upper bound' scenario with 75% compact development. They make the assumption that compact development can have a maximum impact of a 25% reduction in VMT, which contradicts extensive research by Ewing, Cervero, and others³; this impact is below the low end of the reduction spectrum laid out in *Growing Cooler*⁴.

¹ [Driving and the Built Environment: The Effects of Compact Development on Motorized Travel, Energy Use, and CO2 Emissions – Special Report 298](#). Otherwise known as TRB or NAS Special Report 298 (National Research Council, 2009).

² The EPA has measured a continued national shift towards growth within central cities ([U.S. Environmental Protection Agency, 2010](#)), and national market demand studies are showing that the existing supply of large-lot single family homes on the ground will meet projected demand for that product through at least year year 2025, while there is significantly more demand than supply for more compact development types ([Nelson, 2006](#)). Additionally, market research indicates that most households prefer improved accessibility, land use mix and a diversity of transportation options, and will choose small-lot and attached homes with these features if they are available. ([Litman T. A., 2010](#))

³ While 25% is within the range of possible reduction in VMT per capita due to compact growth, it does not represent the maximum end of that range, which is certainly above 50%. ([Ewing & Cervero, Travel and the Built Environment, 2001](#)), ([Ewing & Nelson, CO2 Reductions Attributable to Smart Growth in California, 2008](#)), ([Litman, 2010](#)), ([United States Environmental Protection Agency, 2001](#)), ([Yang, McCollum, McCarthy, & Leighty, 2008](#))

⁴ ([Ewing, Bartholomew, Winkelman, Walters, & Chen, 2008](#))

Again counter to Rapid Fire assumptions, Special Report 298 posits that in the scenarios *with* compact development, the per-household VMT of non-compact development goes UP by 8.4% or 17.5%, with the higher increase for the scenario with 75% compact development. There is *no* increase in household VMT for the Base Case scenario, which has no compact development at all. (A reproduction of the Special Report 298 scenario characteristics and results is included in Table 1 for reference). This is the opposite assumption of what one would expect based on the research, and the opposite of what is included in the Rapid Fire default assumptions. Then, Special Report 298 takes its maximum 25% reduction in VMT for compact development and applies it to this new *higher* VMT instead of to base VMT. The combined effects of these two assumptions impact final scenario results, which illustrate a very minor reduction in VMT and GHG due to land pattern differences. The ‘moderate’ scenario considered most tenable by Special Report 298 sees a 1.3-1.7% reduction in GHGs, while their ‘upper bound’ 75% compact scenario (which they consider highly unlikely) sees a maximum reduction in GHGs of 11% by 2050.

	Year	Base Case		Scenario 1		Scenario 2	
		Low	High	Low	High	Low	High
New Development Assumptions							
% growth in housing units		42.5%	82.5%	42.5%	82.5%	42.5%	82.5%
% new and replacement units in 2050	2050	40.8%	54.9%	40.8%	54.9%	40.8%	54.9%
% of new and replacement units in Compact development	2050	0%	0%	25%	25%	75%	75%
VMT Change Assumptions							
Baseline VMT per HH	2000	21,187	21,187	21,187	21,187	21,187	21,187
% change in VMT per HH							
Existing development		0%	0%	0%	0%	0%	0%
New non-compact development		0%	0%	8.4%	8.4%	17.5%	17.5%
New compact development		0%	0%	-12.0%	-12.0%	-25.0%	-25.0%
VMT Results							
2050 VMT per HH							
Existing development	2050	21,187	21,187	21,187	21,187	21,187	21,187
New non-compact development	2050			22,967	22,967	24,895	24,895
New compact development	2050			20,211	20,211	18,671	18,671
% change in total VMT between 2000 and 2050 (for Scenario 1)		50.2%	90.9%	48.3%	87.7%		
% change in total VMT between 2000 and 2050 (for Scenario 2)		55.6%	100%			42.6%	78.0%
% change in VMT/GHG in 2050 from Base Case scenario ⁵				-1.3%	-1.7%	-8.4%	-11.0%

Table 1: Summarized Version of Table 5-2 from "TRB Special Report 298: Driving and the Built Environment"⁶

⁵ Assumptions for fleet MPG and carbon content of fuel are consistent for all scenarios, thus the percent changes in GHG emissions are identical to those for VMT.

⁶ (National Research Council, 2009)

Also of note, Special Report 298 assumes no change in the behavior of the existing base environment due to the form of incremental growth. Our research has shown that the benefits of more compact land use patterns, coupled with a shift towards a more balanced transportation investment profile that expands pedestrian, bicycle and transit infrastructure, will have beneficial effects not just for the incremental growth that is added, but also for the existing environment and those in it. Other research⁷ and results from the Rapid Fire model clearly illustrate that the behavior of residents of the existing environment changes due to the addition of adjacent new development and transportation infrastructure, resulting in significant impacts on VMT and GHG emissions⁸.

When compared to the Rapid Fire model and its assumptions, the combined assumptions of TRB Special Report 298 lead to far different conclusions about the role of land use in VMT and GHG reductions. It is our opinion that the specific VMT assumptions applied by the Special Report 298 authors are not only highly conservative, but also that they do not follow a logical sequence in their application. Moreover, additional overly conservative assumptions made by Special Report 298 about the market potential of compact development further downplay the role of land use in GHG reduction in the report. As stated by *Growing Cooler* coauthor Reid Ewing, “The [TRB] committee’s projections are a product of very conservative and even questionable assumptions. They assume that only residential development can be redirected into compact patterns, and they ignore commercial buildings, which are replaced at five times the rate of residential structures.”⁹ Ewing, Nelson and Bartholomew have released a fairly thorough analysis of Special Report 298¹⁰, finding that Special Report 298 was an overly conservative assessment of the effects of land use on travel behavior, based at least in part on some erroneous or misplaced assumptions.

To summarize, while Special Report 298 includes a good summary of existing research, its conclusions as to the likely effects of more efficient land use patterns on achieving GHG emissions targets are based on assumptions and methods that we find questionable:

- Demographics and market demand are already changing in ways not assumed by Special Report 298, with increased supply and demand for the compact growth product
- Special Report 298 does not include a full analysis of the impact of both commercial and residential redevelopment and turnover, which are important factors that need to be accurately measured
- Recent research shows that the reduction in VMT per capita due to compact development is deeper than the Report assumes to be the case

⁷ When back-casts are run on the Rapid Fire model, and their assumptions and results are compared with other research (Yang, McCollum, McCarthy, & Leighty, 2008), (Polzin, 2006), it becomes clear that the behavior of the increment alone does not explain all changes in VMT over time; the behavior of the base also changes in response to the character of the urban form of the incremental growth.

⁸ Vision California findings are summarized in [“Vision California: Charting our Future, Statewide Scenarios Report.”](#) (Calthorpe Associates, 2010)

⁹ (Ewing, Planning Magazine, 2009)

¹⁰ (Ewing, Nelson, & Bartholomew, Response to Special Report 298 Driving and the Built Environment: The Effects of Compact Development on Motorized Travel, Energy Use, and CO2 Emissions, 2009)

- The character of new growth patterns and their associated transportation infrastructure investments will have a corresponding influence on the behavior of the base environment; Special Report 298 assumes base environment travel behavior remains static
- Special Report 298 does not apply its VMT assumptions in a logical order, as described earlier in this document, leading to a significant underrepresentation of the impact of land use on VMT and GHG emissions.

For these reasons, as well as others highlighted by other experts in the field, we do not believe Special Report 298 should be relied upon as an accurate assessment of the likely future effects of differing land use patterns on travel behavior and GHG emissions.

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