

National Capital Region Transportation Planning Board

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MEMORANDUM

ITEM #8

TO: Transportation Planning Board

FROM: Monica Bansal
Department of Transportation Planning

SUBJECT: Background and Analytical Framework for the “What Would it Take?” Scenario

DATE: January 14, 2010

The following memo provides detailed background on the development and analytical framework for the “What Would it Take?” (WWIT) Scenario, which is one of two scenarios in the current TPB Scenario Study and focuses on achieving aggressive regional climate change goals in the transportation sector. The memo is divided into the following sections:

- A. **Scenario purpose:** Overview of why the scenario was developed and expected outcomes
- B. **Climate change goals:** Background on goals adopted in COG Climate Change Report and use in this scenario
- C. **Overview of study methodology:** Overview of analysis steps including baseline development, examination of current and forecast conditions, strategy identification, analysis of individual analysis, and grouping strategies.

A. Scenario Purpose

The WWIT scenario was developed by the TPB Scenario Study Task Force to begin addressing climate change in our transportation planning. The Task Force, currently chaired by TPB Member Harriet Tregoning, was created in December 2007 to provide policy-level stewardship for the continuation of the Regional Mobility and Accessibility Study (RMAS) and related TPB activities, and to specifically respond to emerging issues, such as climate change, and to integrate scenario work into other TPB plans and initiatives. The WWIT scenario was developed to build off of other regional climate-related work and has become an important part of a comprehensive COG climate change effort, including the approval of the COG Climate Change Report in November 2008. The Climate Change Report contains regional carbon dioxide (CO₂) reduction targets and a comprehensive list of potential strategies for each sector, including transportation. These targets serve as the primary goal of this scenario, and the recommended strategies provide a portion of the analytical framework.

The WWIT scenario specifically examines what it would take in the transportation sector to meet the aforementioned CO₂ targets. The outcome of this analysis is the identification of effective and cost-effective transportation strategies for climate change mitigation that can be adopted by state and local jurisdictions in the region. The results will not only provide the region with an indication

of what may be necessary to achieve climate change goals, but also with a menu of strategies that can be adopted in the short-term and in the long-term.

B. CO₂ Reduction Goals

The scenario begins with the COG regional goals of reducing annual regional CO₂ emissions to 2005 levels by 2012, 20% below 2005 levels by 2020, and 80% below 2005 levels by 2050. For the purposes of this scenario, these same reduction targets are being assumed for the transportation sector. Mobile-source emissions are roughly 30% of overall regional CO₂ emissions, making the transportation sector an integral factor in the region's ability to meet CO₂ reduction goals.

C. Overview of Study Methodology

The WWIT scenario was analyzed according to a simple set of steps:

1. Creating a baseline inventory of mobile source CO₂ emissions
2. Determining sources of reduction potential
3. Identifying potential reduction strategies
4. Analyzing individual strategies for effectiveness, cost-effectiveness, and timeframe for implementation
5. Combining additive strategies to determine different pathways toward approaching or meeting goals

1. Baseline

In order to determine the emissions reductions that will be necessary in the future, the first step in the scenario analysis was to determine the baseline forecast of mobile CO₂ emissions in the region. This analysis began in 2008 using the regional travel demand model outputs for the 2008 CLRP as the starting point. However, external factors over time required some re-benchmarking throughout 2008 and 2009. First, new CAFE standards were passed by Congress at the end of 2007 requiring 35 mpg by 2020. These CAFE standards were further strengthened in 2009 to 35.5 mpg by 2015. Lastly, new analysis of regional fleet characteristics in 2009 showed that with a troubled economy, fleet turnover was not happening as rapidly as we had come to expect in this region. This translated into higher than expected (though still declining) emissions rates over time.

In order to account for all of these important factors, the baseline for the WWIT scenario now consists of the 2009 CLRP, projections for CAFÉ 35.5 mpg by 2015, and transportation emission reduction measures (TERMs) already being implemented throughout the region for the purpose of reducing criteria air pollutants, such as the Commuter Connections Program.

The table below shows the steps toward getting to the final baseline projections described above. The analysis begins with emissions projections for the 2009 CLRP under pre-2007 CAFE standards (25 mpg). Adding the new CAFE standard of 35.5 mpg by 2015 reduces emissions significantly to 3% below 2005 levels. The last layer of the final baseline is the committed TERMS, which include a long list of measures already being implemented throughout the region, but that are not reflected in our travel demand model. After accounting for reduction commitments already made, both at the federal and local level, we are left with a slightly lower reduction goal than we began with: 19% below 2005 levels in 2020 and 37% below 2005 levels in 2030.

**TABLE: CO₂ Emissions from Cars, Trucks, and Buses
(Annual MT of CO₂, 8-hour Ozone Non-Attainment Area)**

	2005	2020	2030
CAFE 25 mpg (prior to new CAFE standards)	24.1	29.9	32.3
% Change from 2005 levels	---	24.2%	34.0%
+ 2009 CAFE (35.5 mpg by 2016)	24.1	24.1	23.4
% Change from 2005 levels	---	0%	-3%
+ Committed Transportation Emission Reduction Measures (final baseline)	24.1	23.9	23.3
% Change from 2005 levels	---	-1%	-3%
CCSC Proposed Regional Goal	24.1	19.3	14.5
% Change from 2005 levels	---	-20.0%	-40%
What's Left to Meet the Goal?	---	4.6	8.8
% Change from 2005 levels	---	-19%	-37%

2. Sources of Reduction Potential

After identifying the CO₂ reduction necessary to meet regional climate goals, a thorough understanding of where emissions are being generated is essential to developing a comprehensive list of potential reduction strategies for analysis. Mobile CO₂ emissions are generally affected by fleet composition, fuel choice, and how the fleet is used. The regional fleet is generally comprised of light duty vehicles, such as passenger cars and SUVs, and heavy duty vehicles, such as buses and trucks. As seen in the previous table, a great deal of progress toward our climate goals can be achieved by making the light duty vehicles purchased and driven in this region more fuel efficient. However the new CAFE standards only apply to light duty vehicles, which currently account for 90% of VMT, but only 80% of emissions. In 2030, absent fuel economy standards for heavy duty vehicles, trucks and buses are projected to remain at 10% of VMT, but will account for a growing share of CO₂ emissions at almost 30%. This signals a major opportunity for future CO₂ reductions.

In addition to the fleet composition, the type of fuel used in the region can offer areas for potential reduction. According to national data from the U.S. Department of Energy, in 2009 gasoline is the source of 99% of energy consumed in the light duty transportation sector. Even with significant alternative fuel mandates from the Energy Independence and Security Act of 2007, fuel use in 2030 is still projected to be dominated by gasoline at 81% of energy consumed in the light duty transportation sector. Although there is significant penetration of ethanol and diesel in 2030, there is still a great deal of room for increased alternative fuel use in this region.

Lastly, *how* we travel can also have a significant impact on emissions, both from reducing travel and making vehicle operations more efficient. This includes many aspects of travel, such as trip purposes, trip lengths, trip mode, vehicle occupancy, congestion, and driver behavior. For example, in examining the nature of trips made in the region it became clear that a large percentage of auto trips are less than three miles in length. Specifically, 45% of non-work trips and 18% of work trips are projected to be less than three miles in 2030. This signals a high reduction potential from

converting these short trips to non-polluting modes, including bicycling, walking, and low- or non-polluting vehicles.

Improving vehicle operations can also have a significant impact on emissions because CO₂ emissions are related to vehicle operating speeds. Research from the University of California at Riverside shows that CO₂ emissions follow a U-curve, where, for a typical vehicle fleet, very slow vehicle speeds (less than 15 mph) can have up to twice the CO₂ emissions per mile of higher speeds (20-70 mph). The 2009 CLRP includes forecast congestion for 2030, which shows congested conditions to be prevalent throughout the region. Reducing congestion, as well as other operational improvements and driver education, can thus provide a major source of CO₂ emissions reductions.

3. Potential Reduction Strategies

Based on the above analysis and previous sources of transportation strategies, a list of strategies to be individually analyzed was developed. These strategies fall within three possible categories:

- (1) *Fuel Efficiency*, such as stricter CAFE standards, state/local incentives to purchase highly fuel-efficient vehicles, and heavy duty vehicle CAFE standards
- (2) *Alternative Fuels*, such as higher oil prices leading to the increased use of alternative fuels (biofuel, electricity, CNG, hydrogen, etc), regional green fleet policies, and increased provision of alternative fueling infrastructure
- (3) *Travel Efficiency*, such as increased telecommuting, bicycle/pedestrian facilities, infrastructure and services, improved transit access, service and information, eco-driving campaigns, parking and congestion pricing, increased incident management, signal optimization, bike and car-sharing, and increased commuter bus services.

The specific measures analyzed in the WWIT scenario were derived from several sources. They include a subset of the potential transportation emissions reduction measures (TERMs), which had been previously analyzed for potential criteria pollutant emissions reductions. Also included are transportation strategies listed in the COG Climate Change Report, strategies from other TPB initiatives such as the CLRP Aspirations Scenario, and broader strategies derived from federal, state and local sources, such as fuel efficiency and alternative fuel use.

A full list of strategies (and their groupings, described later) is attached to this memo.

4. Analysis of Individual Strategies

Each strategy was analyzed along three lines: (1) effectiveness at reducing CO₂ emissions, (2) cost-effectiveness per ton of CO₂ abated, and (3) the timeframe on which the measure can be implemented. First, each measure was analyzed for its CO₂ reduction potential using sketch planning methods and using existing programs as a model whenever possible. Measures were also assessed for their cost-effectiveness as a method of prioritizing the variety of possible interventions. Some strategies can serve as “low-hanging fruit” and provide relatively inexpensive benefits in the short term, such as telecommuting programs, as opposed to more complex, expensive, and longer-term measures, such as major changes to current land use patterns.

Lastly, measures were analyzed over a twenty year time period to determine not only the timeframe for implementation, but also to determine their cumulative reduction impacts. Experts have stated that GHG emissions remain in the atmosphere for many decades, making them unlike criteria pollutants, such as PM and NO_x, where only annual emissions are examined. Therefore, GHG

emissions cannot be looked at on an annual basis, but rather should be considered cumulatively across several decades. If emissions are examined in a cumulative manner, early emissions reductions will have a compounding effect upon future emissions levels, demonstrating that early GHG emissions reductions will be increasingly necessary to effectively stabilize GHG emissions and avoid the most severe impacts of climate change. For instance, actions that can have an effective and immediate response, such as increased fuel prices, can be looked at as an early strategy, while those that require a long planning horizon, such as a new facility, will need to be planned early in order to realize cumulative benefits by target years.

5. Grouping Strategies

Following individual analysis of strategies, combinations of strategies were constructed in order to determine whether any combinations meet or come close to the regional CO₂ reduction targets. Strategies were grouped along two different lines: level of government in charge of implementation and timeframe for implementation. There are two sets of two different groupings, one examining the impacts of short and long term federal actions and one examining short and long term regional/state/local actions. The four groups are as follows:

- a. No further federal/local action: legislation already adopted, including 2015 CAFE standards, remain unchanged until 2030
- b. High federal role: current legislation is augmented with longer term policies, such as enhanced CAFE by 2030, heavy duty vehicle CAFE standards and national gas price increases
- c. Short-term regional actions: all strategies that are implementable by state and local governments before 2020
- d. Long-term regional actions: all strategies that are implementable by state and local governments between 2020 and 2030

A full list of the measures included in each grouping is attached to this memo. It is important to note that the groupings combine additive strategies to the extent possible at this time. It is possible that further combinations can be made to move closer to achieving regional goals, though careful analysis will be needed in order to avoid double-counting or overstating benefits.

Results of this analysis will be presented to the TPB at its meeting on January 20, 2010.

Appendix A:
List of WWIT Groupings and Individual Strategies

1. Federal Actions:
 - a. No Further Federal or Local Action

Strategies:	Description	CO₂ Reduction (2010-2030) (million tons)
<i>Fuel Efficiency:</i> CAFE 35.5 mpg by 2016	CAFE standards adopted in 2007 and later strengthened in 2009 moving from 25 mpg corporate average fuel economy to 35.5 mpg by 2016	-107.24
<i>Alternative Fuels:</i> DOE Annual Energy Outlook, based on current energy legislation	Uses national forecasts of energy usage in the transportation sector completed annually by the U.S. Department of Energy. Forecasts are conducted according to current legislation and market assumptions.	-13.21
<i>Travel Efficiency:</i> Committed TERMS	Committed TERMS include strategies already adopted by state and local jurisdictions in the region to address criteria air pollutants.	-3.46

Note: 208 MT CO₂ reduction between 2010 and 2030 needed to meet COG goals

- b. High Federal Role

Strategies:	Description	CO₂ Reduction (2010-2030) (million tons)
<i>Fuel Efficiency:</i> CAFE 55 mpg by 2030	Assumes that after CAFE 35.5 mpg is achieved in 2016, CAFE standards are further strengthened to 55 mpg by 2030.	-24.85
<i>Fuel Efficiency:</i> Doubling heavy duty vehicle CAFE by 2020	Assumes institution of heavy duty CAFE standards, which would double current heavy duty vehicle fuel economy by 2020	-26.29
<i>Alternative Fuels and Travel Efficiency:</i> High energy prices (\$7/gallon gas)	Uses DOE forecasts for a national high energy price scenario, which assumes \$7/gallon gasoline. This causes higher alternative fuel usage and a 6% reduction in VMT.	-27.13

2. Regional Actions
 a. Shorter term Strategies

Strategies:	Description	CO ₂ Reduction (2010-2030) (million tons)
(1) Increase Non-Auto Mode Share		-2.07
10 transit stores in MD	Arlington stores used as the example	-0.14
6 kiosks in MD	Transportation information kiosks similar to ones in VA and DC	0.00
Metrorail feeder bus service	At 2 underutilized park and ride lots and \$.50 am fare buy-down program	-0.01
Implement neighborhood circulator buses	Expanded circulator bus service to/from Metrorail in 10 neighborhoods	-0.10
Real-time bus schedule information	Internet and bus shelter display units, with satellite technology tracking 596 buses.	-0.04
Purchase 185 WMATA buses	CNG buses on 36 crowded routes in DC	-0.63
WMATA bus information displays with maps (2000 cases)	Increased and improved bus service information at 2000 stops.	-0.07
Enhanced commuter services	Bus service from Metrorail to Potomac Mills and Arundel Mills shopping centers; bus service from Reston/Herndon, Centreville, and Springfield to Pentagon and downtown DC.; and bus service on HOV facilities such as US 50, I-270, and US 29.	-0.33
Free bus-rail transfers	Free bus to rail transfers similar to the reduced fare rail to bus transfers.	-0.17
Free off-peak bus service	Free bus service mid-day and on weekends.	-0.14
K Street Transitway	Implementation of the K Street Transitway project on K Street in NW DC between 10 th St and 23 rd St.	-0.16
TIGER smart hubs	Implementation of the technology component of the TPB TIGER grant submission: regional website of comprehensive transportation information and digital displays at 20 intermodal hubs.	-0.04
TIGER bus priority	Implementation of the bus priority component of the TPB TIGER grant submission: transit signal priority, queue jump lanes, etc on 10 bus corridors.	-0.10
Improve pedestrian facilities near rail stations	Improved sidewalks, curb ramps, crosswalks, and lighting at 11 MARC	-0.05

	stations and 12 Metrorail stations in Montgomery County.	
Bike stations at rail stations	Assumes construction of 9 bike stations similar to the Union Station BikeStation.	-0.01
TIGER bike-sharing	Implementation of the bike-sharing component of the TPB TIGER grant submission: regional expansion of DC's bike-sharing program from 500 bikes to 3000.	-0.06
(2) Pricing		-8.99
Volunteer employer parking cash-out subsidy	Equal compensation for free parking to those not driving to work	-0.56
Parking impact fees	Administered by local governments to recoup costs associated with maintaining roadways and mitigating negative impacts of auto use. Fees are charged per parking space to land owners.	-4.08
Pay-as-you-drive insurance	Assumes 30% of light duty drivers will switch to PAYD insurance within 6 years (insurance premiums are on a per-mile driven basis).	-4.35
(3) Improve Operational Efficiency		-22.82
Eco-driving incentives and promotion	Based on study done in Denver, assuming 50% of drivers adopt eco-driving practices.	-20.56
Idling reduction	Enforcement of existing idling regulations. Many states have state-wide anti-idling laws and several counties and cities have their own anti-idling rules.	-0.11
MATOC	Regional coordination of incident management. Assumes current MATOC commitments.	-0.13
Traffic signal optimization	Optimization of almost 2000 signals throughout the region.	-2.02
(4) Reduce Travel		-1.78
Expanded Telecommuting (conversion of all potential telecommuters)	Based on State of the Commute Report, all commuters stating that they are able and willing to begin telecommuting do so within 5 years.	-0.82
Carpool incentive program	Based on Commuter Connections Carpool Incentive Demonstration Project Study where participants received \$1 per carpool trip taken.	-0.06
Vanpool incentive program	Incentive program designed to increase	-0.48

(\$25/van/day)	number of vanpools in the region.	
Expand car-sharing program	Funds incentives for 1000 new car-sharing customers.	-0.01
Employer outreach, public and private (Metrochecks and carpooling)	Marketing and implementing employer-based TDM programs	-0.41

b. Longer term Strategies

Strategies:	Description	CO₂ Reduction (2010-2030) (million tons)
(1) Increase Transit use		-2.65
Construction of 1000 parking spaces at Metrorail stations	WMATA adding 1000 parking spaces at different Metrorail stations.	-0.04
Incremental increase in transit (heavy rail)	Example used is the Dulles rail project to indicate the order of magnitude of CO ₂ reduction for a major Metrorail expansion.	-0.76
Completion of 2030 Bike/Ped plan by 2020	Accelerated completion of the TPB Bicycle and Pedestrian Plan by 2020 instead of 2030.	1.85
(2) Pricing		-0.42
TPB Value Pricing Study, with transit	2008 TPB Value Pricing Study, including new priced lanes on major freeways, pricing of existing arterials in DC and pricing of national parkways. Also includes enhances bus transit operating on priced lanes.	-0.42
(3) Reduce Travel		TBD
CLRP Aspirations Scenario	TPB land use and transportation scenario examining concentrated land use around a network of BRT and pricing.	TBD