Webinar Transcript

U.S. DOT Report to Congress:
"Transportation's Role in Reducing U.S. Greenhouse Gas Emissions"

Wednesday, June 16, 2010

Hello, this is JoAnna Smith from the U.S. Department of Transportation. Welcome to the webinar for the report to congress entitled "Transportation's Role in Reducing U.S. Greenhouse Gas Emissions." A couple of housekeeping things: if you have questions, you can type them into the chat box you see on your screen. We will hold the questions until the end and announce them over the phone and the speaker will answer them at that time. Feel free to ask questions at any time throughout the presentation. First, we have Beth Osborne. She will be kicking things off.

Hi, thank you for everyone who is participating today. I am Deputy Assistant Secretary for Transportation Policy and I am here to give some background to read this report came from and what is meant to do. Everyone on this call I am sure is aware that confronting climate change is a top priority for the Obama administration and the Department of Transportation.

The U.S. Department of Transportation is committed to action that will reduce greenhouse gas emissions, diminish our dependence on foreign oil, create clean energy jobs, build livable communities, and protect us all from dangerous climate change.

The DOT is already taking action through the Department's livability initiative and the Sustainable Communities Partnership with EPA and HUD. The initiative supports low carbon transportation options such as public transportation, walking, and biking; promotes development of housing in close proximity to transit; and promotes mixed-use development that enables residents to easily access goods and services. These actions improve quality of life, lower household transportation budgets, and as shown by this study, reduce greenhouse gas emissions. The Department's high speed rail initiative will also provide a low carbon travel alternative.

Further, in April 2010, the Department and EPA announced a national greenhouse gas and fuel economy program for cars and light-duty trucks. Analysis indicates cumulative industry greenhouse gas reductions of approximately 900 million metric tons CO2e and fuel savings of approximately 1.8 billion barrels of oil. The DOT is also implementing new statutory authority to issue fuel economy standards for medium- and heavy-duty trucks.

In aviation, DOT has put energy and environmental concerns at the heart of the effort to modernize the U.S. air traffic system, called NextGen. Likewise, the Maritime Administration is focused on the potential of new technologies to reduce the harmful emissions from marine diesel engines through cooperative efforts with the EPA and the maritime industry.

Yet there is more to be done. As indicated in this report, a full range of strategies can be brought to bear to reduce transportation's greenhouse gas emissions: improving fuel efficiency; expanding the use of low-carbon fuels; improving the efficiency of the transportation system;

and reducing the volume of travel that relies on carbon-based fuels. These strategies can be implemented through a range of policy options—an economy-wide carbon price, efficiency standards, market-based incentives, transportation planning and investment, and research and development.

USDOT looks forward to working with Congress on transportation policy that reduces greenhouse gas emissions, provides for economic vitality, and enhances our quality of life. Linda Lawson will now give some more background on the report and the DOT Center for Climate Change.

Thank you. I'm just going to make a few comments today.

I wanted to point out that this report is a product of U.S. DOT Climate Change and Environmental Forecasting, which is the focal point for technical expertise on multi modal transportation and climate change at the Department.

The Center has also established a clearinghouse which is a one-stop source of information and you will be able to find the electronic version of this report at the clearing house. The clearinghouse is at http://climate.dot.gov.

The lead contractor on our report was Cambridge Systematics and Joanne Potter from Cambridge is with us today.

While this report focuses on climate mitigation strategies, we need to keep in mind that the transportation sector is also affected by the impacts of climate change. We have experience on climate adaptation and are working to expand our initiatives to ensure our transportation system is prepared for future impacts.

Adaptation activities include our participation on the CEQ-led Interagency Climate Change Adaptation Task Force and our Gulf Coast Study. We are currently in Phase 2 of the study, which will further examine impacts on the multimodal transportation system of Mobile, AL to develop tools for decision makers to respond to impacts across the country.

This presentation today will proceed by going over the background of climate change and looking at emission levels and trends. This discussion will be led by John Davies of FHWA. We will then go over a number of strategies in specific areas to reduce transportation's impact on climate change. Joanne Potter of Cambridge Systematics will discuss low carbon fuels and vehicle efficiency, and Tina Hodges of FTA will go over system efficiency and travel activity. A.J. Singletary of the Office of the Secretary will discuss transportation planning and investment and key interactions, as well as impacts on DOT goals, research gaps, and policy options.

The presentation will be followed up by a question-and-answer period. We have assembled a team of experts here at USDOT Headquarters to field questions.

And with that, we'll move to John Davies.

Thank you. To address the question, why this report, the answer is to say that we are talking about climate change, one of the most significant and challenging environmental issues that humans have ever faced. The Intergovernmental Panel on Climate Change (IPCC) in its fourth assessment report states that climate change is unequivocal, that warming of the climate system is occurring, and that it is likely that most of the warming since the mid 20th century is due to human activities. The amount of greenhouse gases we produce will significantly determine the environmental outcomes, including significant increases in temperature along with sea level. Ultimately they have the potential to affect Earth systems including ecosystems and water resources and ultimately human systems, such as agriculture. With the transportation sector being one of the largest slices of the global inventory of human produced emissions, ultimately we have to reduce emissions to limit the rise in global temperatures and limit these changes.

In terms of what accounts for the majority of greenhouse gases from human activities, here we see that CO2 is predominant. These estimates reflect the global warming potential of human produced greenhouse gases over a hundred year timeframe. CO2 results from the combustion of fossil fuel, upon which the U.S. economy, and transportation to an even greater degree, is currently reliant.

Tailpipe emissions from the transportation sector account for about 29 percent of overall US greenhouse gas emissions. Within the transportation sector, light duty vehicles account for a majority and on-road sources collectively account for about 80 percent. The third largest source, after freight trucks, is aviation. Naturally, there are a lot of caveats associated with these numbers. These are tailpipe numbers. They don't include life cycle emissions from the refining of fuel, manufacturing of vehicles, or construction of infrastructure. Some of those show up in other sectors. The second caveat is that CO2 emissions from ethanol combustion are not included in these totals. The assumption is that the feedstock, corn, essentially sequesters carbon as it is growing. And that emissions from agriculture and ethanol production are included in other sectors. Finally, there are a couple of greenhouse gases that are not included in official inventories but are closely associated with the transportation sector – tropospheric ozone and black carbon.

Looking back at historical trends in GHGs, let's go back to 1990. The trends are striking. GHGs from all U.S. sources increased about 15 percent. The transportation sector, however, during this timeframe had twice that growth rate and accounted for half of the net increase in total U.S. GHG emissions. What is more surprising are the trends associated with individual modes. You can see that light duty emissions, since they account for a majority of transportation emissions, are in the same ball park as the overall transportations sector's increase. Freight truck emissions grew substantially, at over three times the rate of light duty vehicle emissions. If you look at the EPA inventory of greenhouse gases, it accounts for one of the single largest items for growth. Even more surprising is that commercial aircraft emissions didn't increase much at all.

The question is, what factors caused these particular growth rates? Again, GHG emissions are closely tied to fuel consumption, CO2 in particular. Looking at the factors that drive fuel consumption, you can see it as a foot race between the effects of the amount of travel and the fuel economy of the vehicles. In the case of light duty vehicles, VMT grew. People were travelling more on a per capita basis. The fuel economy of the entire vehicle fleet improved

marginally and that is because of the retirement of older vehicles. We also saw an increase in ethanol. As a result of all of those factors, we saw a 24 percent increase in tailpipe emissions.

For aircraft, there was something a little surprising. The amount of activity in passenger miles increased more than light duty vehicles, about 69 percent versus 40 percent. The increase in the amount of aircraft miles was quite a bit less and that was largely because of significant increases of loading of those planes. It went from an average of 60 percent of seats full to up to 80 percent full. In the meantime, the average plane became a little more efficient. Taking into all of those factors, airline GHGs increased about 4 percent.

The story for trucks is also interesting. The ton mile increase was about 58 percent. More than light duty vehicles. The truck VMT was up about the same amount, but the GHGs increased by about 77 percent. The average ton mile was carried a bit less efficiently. It is something of a mystery in understanding what is underlying that. There was some influence of increased speed limits, there was a spread of congestion outside of urban areas. Trucks did a little bit more operating in urban areas. Collectively, this variable might explain the net increase in CO2 per ton mile.

As I mentioned earlier, life cycle emissions are a pretty big deal with the transportation sector. We've got this entire collection of processes to consider. We've got fuel cycle, not only the combustion of fuel but also the extraction of petroleum and the shipment of those materials and the refining process and distribution. In terms of vehicles, we have GHGs associated with the manufacture of components, the manufacture of vehicles and the shipment of all of that. For vehicle infrastructure, we have GHGs associated with the clearing of land, building materials, the energy input and creating and laying asphalt. The point is, all these items at up significantly. While we don't have super accurate estimates about their impact, they represent a considerable increment relative to tailpipe GHGs. A lot of these occur outside the United States, complicating the accounting.

To try to put this into perspective, U.S. transportation tailpipe GHGs accounted for 5 percent of all global GHGs. If we count the additional life cycle emissions, U.S. transportation sources accounted for about 8 percent of the global total, which is a large amount. This graph shows the life cycle emissions of individual modes, and shows a couple of surprising things. Gasoline fuel cycle emissions are proportionately larger than those of other fuels. The other surprising thing is the infrastructure cycle emissions are particularly high for rail transit modes. Again, this is an area that we recognize as being fruitful for additional research.

Where are we headed with respect to greenhouse gas trends? The Department of Energy develops a projection of U.S. GHGs, including projections for the transportation sector and individual modes. These were their forecasts and included historical data. After a period of growth, GHGs are expected to be more or less flat through 2030. Underlying this trend, we have a lot of stuff going on. Fuel economy will improve a fairly significant amount. These assumptions are the earlier 35-mile per gallon by 2020 fuel economy standard. We see a significant amount of renewable fuels entering as a result of the renewable fuels standard. Again, these were only tailpipe numbers. There needs to be life cycle accounting to those effects and, of course, there is more travel. The combined effect of all of those things is going to have emissions

stay flat. The challenge is ultimately to meet significant emissions reductions. The current administration target is to reduce GHGs somewhere around 42 percent by 2030. To tell us how we are going to get there, I would turn it over to Joanne Potter.

The first part of the analysis looked at the range of the challenge we are facing in terms of reducing greenhouse gases from transportation and then we moved to an analysis of the strategies that might help us get there. The strategies available to reduce greenhouse gases from transportation cover a broad gamut of strategies. We typically talk about them under four categories that are sometimes referred to as the four legs of the stool. They are: to reduce the carbon content of fuels, to increase the fuel efficiency of our vehicles, to increase the efficiency of our transportation system so that mobility is provided and maintained in an adaptable and most efficient fashion, and finally, to reduce carbon intensive travel activity. We look to each of these groups of strategies in turn. In addition, there are two strategies that cut across each of these four areas. Putting a price on carbon at a national level will effect each of these four categories of strategies. Secondly, transportation planning and investment -- which is the purview of transportation agencies at state, regional and local levels -- primarily affects the system efficiency and travel activities strategies. A key observation about the four basic strategy groups is that different entities hold the levers in terms of how these strategies can be implemented. It is important and a challenging opportunity to design portfolios and strategies that most effectively interact and support each other in reducing carbon emissions from transportation.

I would like to briefly explain the methodology we use for analyzing all of these strategies. This is primarily a synthesis where we took existing literature to understand what analysis is out there and what it says in terms of reduction capabilities. We did do some original analysis to develop estimates that would provide a common baseline drawing on available data. All of the strategies are compared to a common baseline. We did a snapshot of one analysis year at 2030 and for some of the strategies we also projected to 2050 if it was needed to show long-term effects. All of this analysis was done first on a per unit basis, for instance efficiency per vehicle or per trip. That doesn't automatically mean that on a national level you would achieve that. There are several considerations about how broadly the strategy is implemented, how quickly it is implemented and the geographic scope over which it is implemented that affects national aggregate effect of any of these strategies. Those considerations were then taken into account to develop national level estimates. There are a number of uncertainties in the analysis that are listed here and overall this approach should be seen as an order of magnitude estimate of the effectiveness of different strategies. Let me turn now first to the strategy group of reducing the carbon intensity of fuels. You can look at fuels in terms of fuels that are currently available including corn ethanol, biodiesel and others, as well as next generation fuels that are currently under research and development. The effectiveness in reducing greenhouse gases of these fuels varies considerably. The Energy Independence and Security Act of 2007 develops a threshold of roughly a 20 percent reduction from currently available fuels on a life cycle basis, but the next generation of fuels has the potential to be much more efficient, with that threshold between 50 and 80 percent reduction.

Looking more closely at biofuel, the effectiveness varies broadly depending on the source of the biofuel, the feedstock that is used, the production method, the carbon content of the energy used

in the production process, the changes in land use that are required to produce that fuel. There are also considerations as to impacts on agricultural markets and to over what time frame you're doing the analysis. The cellulosic and advanced biofuels offer steeper greenhouse gas reductions than first generation biofuels, but there is a good deal more research and scaling of production that will be necessary before those fuels are broadly available.

Turning to aviation fuels, aviation has some unique challenges to face. There are additional safety considerations, the fuels that are deployed need to be available internationally. There are constraints on the weight and storage of fuels that aviation has to address and give special consideration compared to surface transportation. In fact, some synthetic fuels can sometimes increase CO2 compared to conventional fuels that are available today. In time, fuels from fats, plants, sugar and cellulose have the potential to reduce greenhouse gases from aviation, but the cost of producing those fuels are significant in order to meet the stringent aviation standards required for safety. The Federal Aviation Administration is working through the Commercial Aviation Alternative Fuels Initiative to develop alternative jet fuels and to make those feasible in the future.

Electricity has a great deal of potential to reduce greenhouse gases, but it brings with it advantages and challenges. On the plus side, the infrastructure to deliver electricity to vehicles is much easier to set up than other alternative fuels since we already have an electricity grid that covers the nation. The source of that electricity has a big impact on life cycle greenhouse gas emissions levels so that some sources of electricity have a much lower carbon footprint than other sources. Right now at the current grid national average, it is projected that electric vehicles can reduce greenhouse gases about 33 percent below conventional vehicles, but a nationwide low emissions grid could increase the reduction potential to as much as 80 percent. Finally, continuing research on batteries is necessary to reduce their cost and weight.

This graph illustrates the findings of the Electric Power Institute on the range of carbon emissions intensity possible in the future. The emissions intensity of our current electrical grid is shown on the left and you can see that on the high end we have areas of the Midwest that are heavily dependent on coal and the carbon footprint and electricity production in that area is higher than other parts of the country. Over time, you can see the estimates for 2030 and 2050. Overtime, the increased use of wind, solar, nuclear and hydro sources of electricity could sharply improve the greenhouse gas emissions profile of electricity production by 2050.

Turning to hydrogen, hydrogen fuel cell vehicles have on road efficiencies of up to 40 to 70 percent as compared to 25 to 30 percent for internal combustion engines. However the emissions benefits depend heavily on the method of hydrogen production. For instance, using today's grid to produce hydrogen generates more CO2 than gasoline, but if we move to biomass or nuclear sources to produce hydrogen, we can almost eliminate greenhouse gas emissions. However, there are significant challenges for distribution, production and reducing costs before hydrogen fuel cell vehicles are available for widespread use. Right now the cost-effective estimates for hydrogen range very broadly. By 2050, we could be reducing transportation greenhouse gases by 22 percent, if there is a market penetration in light duty vehicles of as much as 60 percent, and that assumes a 79 to 84 percent emission reduction on a per vehicle basis.

The following slide shows the range of greenhouse gas emission reductions estimated for various fuel and vehicle technologies.

In considering vehicle efficiency, it is important to look at both the potential for improvements with our current conventional vehicles through a number of strategies that can increase the efficiency of those vehicles and reduce greenhouse gases using the fleet we have, and to look ahead to more advanced vehicles that will make greater progress. Advanced conventional vehicles that use advanced engine controls, component electrification, and other currently available technologies, could reduce GHGs 8 to 30 percent on a per vehicle basis. Hybrid electric vehicles can achieve greenhouse gas reduction on a per vehicle basis. They represent less than 2 percent of the current fleet and will need to address the cost of more broad introduction and implementation of those vehicles over time in order to achieve broader savings on a national basis.

Plug-in hybrids are available in the midterm and could achieve an up to 70 percent greenhouse gas reduction per vehicle.

For all of these, the key will be to take these per vehicle greenhouse gas reductions and translate them into broad market penetration in order to see national level reductions.

A couple of points on heavy duty truck and rail improvements. As John mentioned, the freight sector is the fastest-growing source of increase in greenhouse gas emissions. There are near term strategies that can be implemented for heavy-duty vehicles that would achieve reductions with the current fleet, but incentives would be needed to make that feasible for truckers and fleets. The rail sector has potential for 20 percent or more improvements from power system and train efficiency.

Aviation and marine also have potential for improvements. The net effect of these improvements on a national level are constrained due to the fact that the turnover rate for airplanes and the vessels is long, between 20 and 40 years. The contribution of these sectors to total emissions is relatively small, so even though these contributions are important, they will have a small impact on transportation reductions as a whole. That is a brief overview of technology and fuels. Now I will turn to Tina Hodges.

Thanks, Joanne. My name is Tina Hodges and I work for the Federal Transit Administration. With system efficiency strategies we are talking about using the existing system better. For these strategies, there are benefits in terms of reduced congestion, travel time, travel costs and economic benefits, that are often more important than their greenhouse gas reduction benefits. A challenge is that to the extent you are improving travel conditions, and this also goes for travel activity strategies, you would have typically additional travel so that would counteract some of the reduction benefits.

On this slide we see a summary of the greenhouse gas reduction findings for the strategies we looked at. First, the reduction for the sub sector in 2030 and the reduction below the all transportation U.S. greenhouse gas emission baseline. The combined impact of all of these strategies is estimated to be around 3 percent to 6 percent. Reduced speed limits is the exception

to the co-benefits discussed earlier as it would increase travel time. We had previously the 55-mile per hour speed limit so we have a pretty good experience of what that could do, but, of course, that would involve additional enforcement. The freight, rail and marine operations strategy includes reducing vehicle miles traveled in the intermodal terminal, reducing real chokepoints and limited modal diversions. I'm going to drill down a little bit on these strategies. On the highway management side we have strategies such as signal improvements and synchronization, ramp metering, travel information such as message boards and radio, etc. and bottleneck improvements. These strategies seek to reduce greenhouse gas emissions by reducing acceleration and deceleration. We primarily cited the results of existing studies in the literature, FHWA is conducting further research in this area. Truck idle reduction is an interesting strategy. The two basic types are truck stop electrification so that truckers could plug into and have the heating and air-conditioning systems run off that while they're on their rest period. Power units have the advantage of being onboard the truck so they can stop basically anywhere. This is interesting because even though it affects one sub sector and the overall magnitude is small, it is very cost effective.

In the aviation sector, the system efficiency opportunities include things such as more direct routing and takeoff and landing profiles. Many of these improvements are being implemented through FAA's NextGen program. Operational improvements such as single engine taxi and electric gate power show modest potential although they may have significant co-benefits in the form of reductions in airline cost savings. Aviation improvements could create induced demand.

As for travel activity strategies, these strategies seek to reduce carbon intensive travel activity and encompass things such as encouraging shifts to low carbon modes. The pricing strategies under this category seek to put a price on the externalities to achieve a more efficient outcome. Integrated transportation and land use planning can reduce trip frequency and trip length. Public information campaigns such as eco driving are also part of this strategy.

The summary of the greenhouse gas reductions in 2030 are provided on this slide. Altogether, the estimate we developed is about a 5 percent to a 17 percent greenhouse gas reduction depending on implementation level. You can see some of them have higher or lower reductions than others. Pay as you drive insurance shifts a fixed cost to a variable cost to influence travel so you would pay based on how much you drive rather than a flat fee.

I wanted to go into detail on a few of these strategies. One that gets a lot of interest is land use. This is a multi faceted strategy which includes density, mixed uses, distance to activity centers, etc. What we did for the report, we looked at a broad range of literature, but particularly at three national level reports. The Transportation Research Board Special Report Driving and the Built Environment, Moving Cooler, and Growing Cooler. These reports were conducted independently and had independent methods and functions, but it is reassuring that they all came up with the same general magnitude of order of benefits. The bland approach we took was to take the center of this range of estimates for a 1 percent to a 4 percent reduction in 2030. This shows some of the assumptions and compares the studies. All relied on estimating the impact of a certain percent of new urban development taking place in so-called compact areas. They had different definitions of that.

On this next slide, this is a visual on different density levels. For the moving cooler study, 43 percent up to 90 percent of new urban development is estimated to take place in “compact” development. That definition of compact was approximately greater than or equal to five dwelling units per residential acre. That is the density level of your quintessential suburb of Levittown, New York. What we are talking about then is not the low the density level of the type of development we saw in the 1990's. But we are also are not talking a massive shift to a very urban environment like downtown San Francisco.

Public transportation is an interesting strategy because it varies a lot by region. At the national level, the estimate we developed based on the literature was up to a one and half percent reduction. The key assumption was a transit ridership growth rate of two 1/2 percent up to four 1/2 percent. The reason the results are not higher is that we are starting from a low national mode share of only around 2 percent and only about 5 percent of Americans live near rail transit. Transit shares in particular cities are much higher. For commutes to the central business district of Chicago, that is a 55 percent mode share. Transit strategies could be key in some areas and another thing to note is expanding transit can reduce household costs, but entails a public investment.

In terms of pricing strategies we looked at in order to influence travel activity patterns, VMT fees, if you had a fee of $0.2 up to $0.5 per mile that is estimated to reduce greenhouse gas emissions by 1 to 3.5%. The important thing to note is the key assumption with the pricing strategies is the elasticity of vehicle travel with respect to travel cost. The elasticity we used was consistent with what FHWA uses in the HERS model. Changing the elasticity assumptions would have a large effect on the outcome. Another thing to note is that to the extent that there are travel alternatives available, the elasticity would shift.

Moving on to the strategy of pricing carbon. Putting a price on carbon through a cap and trade system encourages cost effective GHG reductions across economic sectors. (A carbon tax operates similarly, and is discussed in the report.)
The type of cap and trade system under consideration in Congress would require electric power generators, petroleum importers and refiners, and other large emitters to hold allowances for each ton of their emissions. Those that can reduce their emissions relatively cheaply will need to acquire and submit fewer allowances. Entities can buy and sell allowances, establishing a market price.

In the transportation sector, the impact would be about a 20 cent increase in the price of gas, according to EPA’s estimated allowance prices. This would not, alone, be enough to drive large decreases in transportation GHGs through 2030, according to DOE and EPA modeling. As shown in the graph, most reductions in this timeframe come from the electric power sector.

Some argue that a cap and trade system should be allowed to function on its own to encourage the most cost-effective strategies economy-wide. Environmentally speaking, it makes no difference if the carbon reduction comes from transportation or from power generation.
If it is more costly to reduce emissions from transportation than from other sectors, then it is economically efficient for most emission reductions to come initially from the other sectors.

However, if there are market failures that reduce the reaction to higher prices, then pursuing additional measures can lower implementation costs by compensating for these market failures. For instance, there is significant evidence that drivers tend to undervalue fuel savings in vehicle purchase decisions. In addition, the price signal does not directly effect those who make decisions on transportation options available to consumers, such as local and state governments making land use, highway, and transit decisions.

Complementary measures, such as fuel economy standards, vehicle technology research, system efficiency, and travel alternatives can increase transportation's response to a carbon price. When allowance prices are higher in the future, transportation would be prepared to make cuts as technologies and travel alternatives would be available.

It's important to note though that complementary measures in transportation or any other sector would not reduce overall emissions, since the level of overall emissions is controlled by the cap. But they can lower implementation costs by correcting market failures. Policies to work in conjunction with a cap and trade system should be carefully designed to make sure they do not force reductions that are costly.

A gas tax would have a similar impact, but would only apply to the transportation sector. With a gas tax, there is strong precedent for the revenue to be used for transportation, while there is no such precedent for carbon pricing revenue. With that, I will pass it on to AJ Singletary.

The efficiency of the transportation system and the level of travel activity can be directly influenced through decisions regarding planning, funding, design, construction, and operations of the transportation system. The Federal government is an important partner with state and local governments in shaping the nation's transportation infrastructure. The Federal government provides billions of dollars in infrastructure funding and requires a transportation planning process to receive these funds. Options for incorporating climate change considerations into the transportation planning and investment process span a broad range of stringency and impact.

Technical assistance: Most technical assistance can be done without legislation. Assistance may include scenario planning, integrated transport as well as land use planning. Guidance can be given on best planning practices, and integrated planning can reduce travel distances. Another technical assistance parameter involves removing codes that require low density/single use development. Ordinances and encouragement can help support mixed use and mixed income development supported by multi-modal transportation choices. Data collection modeling and inventories are also ways to provide technical assistance.

Regulations: Potential approaches include making climate change a planning factor in the regulations or requiring transportation plans to include emission reduction targets and strategies for reducing transportation emissions. The Waxman-Markey bill passed by the House would require strategies as part of transportation planning.

Investment: Using performance based investment could reward activities that reduce GHG emissions, and gives a fair amount of flexibility. Investment in transit, bicycle, pedestrian

facilities, system efficiency improvements offers a choice of ways to get around, improves efficiency, and also reduces emissions.

Utah provides a good example of an integrated transportation and land use planning process. Through "Envision Utah", Salt Lake City residents examined the implications of a range of development scenarios, from dispersed development to significant increases in densities, and ended up selecting a vision of focusing new growth in walkable, transit-oriented communities. The region is now building the public transportation and roadway infrastructure to support that vision.

As mentioned previously, this report did not analyze strategies in bundles but did look at numerous interactions between strategies. Interactions can be thought about in terms of overlaps and synergies.

For instance, under CAFE, the most cost effective reductions will have already been made, so a cap and trade system would result in little additional fuel economy improvement.

The benefits of system efficiency strategies aimed at reducing stop and go congestion will diminish with the introduction of hybrids.

Increased vehicle efficiency will also reduce the absolute impact of VMT reduction strategies, while VMT reduction strategies will reduce the absolute impact of vehicle efficiency strategies.

Transit, bicycle/pedestrian, land use, and pricing strategies have synergistic effects that enhance the effectiveness of each strategy when implemented together.

Research combined with pricing signals or technical forcing regulations can reinforce one another.

The legislative mandate for the report specifically asked us to look at petroleum savings and air quality impacts as well as climate change.

In evaluating strategies, it's also important to look at how policies meet other transportation goals, such as economic growth, overall sustainability, mobility, and cost-effectiveness.

All of the strategies analyzed will reduce oil dependence and most will improve air quality.

Land use, transit, and bike/ped strategies result in livability benefits, including reduced household transport expenditure, improved accessibility (especially for low income individuals and those too young or too old to drive), quality of life, and economic development.
Most strategies reduce gas consumption and therefore reduce Highway Trust Fund receipts, while pricing strategies raise revenue that could be used to improve the sustainability of our transportation system.

There are definitely research gaps in the climate change and transportation arena. We knew of some needed research prior to our report and also came across areas of undecided knowledge while writing the report. Areas suggested for further research include elasticities, and how they

shift under different conditions; key Interactions among strategies; induced demand; cost effectiveness; life cycle emissions, which John touched on earlier; data, tools, and decision support for MPOs and states; and information technologies to support efficiency.

As mentioned earlier, this report doesn't contain specific policy recommendations, but we did analyze policy options that can be used to implement strategies to reduce emissions from the transportation sector.

Policy review should consider factors together to maximize effectiveness. Many strategies have co-benefits. Planners need to look at policies, costs, and equity.

Efficiency: Regarding efficiency improvements, fuel economy and GHG emissions standards are a potentially high strategy over the long term considering our fleet turnover rate.

Low carbon fuel standards such as renewable fuel standards can have long term benefits, as well. The new U.S. Renewable Fuel Standard signed into law in 2008 calls for the production of 36 billion gallons of biofuels, mainly ethanol and biodiesel, annually by 2022, with 21 billion gallons coming from advanced biofuels.

Transportation planning and investment: Technical assistance in integrated transportation and land use planning can be provided. Other policy strategies include requiring GHG analysis and reduction strategies in plans, as well as performance based investment. And, as mentioned previously, investment in transit, bicycle, pedestrian facilities, system efficiency improvements can call bring some emissions reductions ranging in the short to mid term.

Market-based incentives such as tax credits, feebates, VMT fees, and pay as you drive insurance, as well as higher gas taxes, offer moderate reductions in the mid-term and high reductions in the in the long term. It is important to note that market based incentives should be technology neutral.

Research and development also has an important role to play in policy options. R&D on advanced vehicles and fuels, and on data, tools, decision support, and costs and benefits are important in reaching policy conclusions that support a sustainable transportation system. R&D strategies have potential for high reductions in the long term.

Tina mentioned earlier that a price signal such as cap and trade or carbon tax can be used economy-wide to reduce emissions. This is an example where it's important to consider the impacts of policy on specific sectors and subsectors, as economy-wide carbon pricing would impact sectors at varying levels and would reduce transportation emissions most significantly in the long term.

This brings us to the end of our formal presentation.

The Secretary and President Obama are committed to more livable communities and sustainable transportation, and we hope this seminal report helps inform the discussion in Congress and

elsewhere so we can all achieve the sustainable transportation system we know is possible. We're happy to take questions, and I believe JoAnna will help direct this process.

I want to remind the group that we will be posting a transcript and recording and this presentation on the website. We will try to address as many of the questions as we can right now. If we don't get to your question we will make an attempt to answer that question on the transcript online. It you have additional questions, feel free to ask them online. I want to let you know we have people representing all of the modes here. We can have people introduce themselves. All of our presenters are available to answer questions. The URL for finding this information is climate.dot.gov.

We had a couple of questions regarding the fact that freight emissions have increased significantly over the period of time analyzed. Which of the measures addressed in your report address freight truck GHG emissions? Can you address that a little more?

The freight issue, this is Mike Johnson of FMCSA, the issue about freight is one that is going to be challenging. It is a type of situation where some of the modes play a lot of roles. U.S. multi-modal interfaces can produce bottlenecks and create emissions. Some of the situations with trucks in particular have to do a lot with congestion and just-in-time delivery and different types of services and delivery times that trucks provide for us. This is going to be an area that the Department will have to look at more closely as far as reducing emissions from freight transportation. We will always continue to need goods and services moved around and we have to find ways of doing that more efficiently. One of the ways we can try is to get trucks off the road and switch them to other modes that produce less emissions and I think there are some ideas and initiatives that are going on.

One of the things we do have is the marine highway program that has started and seeks to provide a low emission marine alternative to truck travel in certain corridors.

We should also mention that NHTSA is working on heavy duty truck fuel economy standards with EPA as the president mentioned in his recent announcement. We were charged by the Energy Independence and Security Act with this, and it will be a first time looking to add fuel economy standards for heavy trucks. The National Academy has completed a report and the two agencies have started their work together.

Is FTA looking to fund zero emissions?

The FTA research office has a number of research programs ongoing. There is also what we call the TIGGER program (Transit Investment Generating Greenhouse Gas and Energy Reduction). That program is to provide competitive grants to transit agencies to reduce emissions. The first round of grants went out under that program and then there will be a second round shortly.

What tools are being developed to reduce short haul airline trips in favor of rail? Trips under 500 miles?

We really don't employ any tools at FAA to favor one mode or another. [Speaker Unclear].

There was a question about clarification on whether a van pool was included in public transit or under carpooling?

This is Chris Porter, we included it under carpooling and ridesharing.

Is DOT doing anything to reduce black carbon from heavy duty trucks?

That is certainly an issue on the fuel side that is being addressed by the new low sulphur fuel regulations set forth by EPA. There are capture devices on trucks as well.

How much do the assumptions and the GHG reduction estimates in this report match those in the Moving Cooler study?

The U.S. DOT report to Congress relied on the Moving Cooler study as one of the studies that was cited from the literature. The estimates are very consistent with those in the system efficiency and travel activity sections of the Moving Cooler study.

Moving Cooler only addressed the travel activity and behavior not the vehicle technology and strategies, and, of course, different sources were used for those.

The baselines for the two reports are a little different. The baseline used for the report to Congress is the AEO 2009 baseline while the Moving Cooler report used a baseline with more aggressive fuel efficiency assumptions.

What impacts will increases in fuel efficiency or less expensive fuels have on VMT?

That begs the question of the rebound effect. That can be conceptualized as part of the general cost of transport. We could use the elasticities that are part of the HERS model on how much additional travel you have in response to reductions in travel costs.

[Inserted: Chris Porter: Re: Fuel economy standards and rebound effect - see p. 3-10 of the report. NHTSA estimates that 5-15% of the fuel savings from more efficient vehicles would be lost through greater travel due to lower vehicle operating costs.]

One source for looking at the rebound effect would be the CAFE rulemaking Environmental Impact Statement. It is available in the docket.

There has been a request for speakers to identify themselves when answering questions so those on the phone can know who is speaking. How does DOT expect an 18% market penetration of hydrogen fuel cells by 2030?

The clarification is, that was the high range of estimates found in the literature. The most optimistic thing in the literature was 18 percent. That would be difficult. We were looking at the upper end.

In addition to strategies of technical assistance, regulation, and investment, what role does the Department envision for education regarding reducing GHG emissions? Could programs such as Safe Routes to School be expanded to educate youth about transportation choices?

NHTSA will include education materials and information regarding vehicle fuel economy for consumers.

This is Mike Johnson, this is a good topic. One program we are looking at that is implemented in the U.K. is one that teaches truck drivers to drive more fuel efficiently. They found they can achieve up to 20 percent fuel reduction. It also gives you a safety benefit as well because of the way they are driving.

In terms of education, when we had 30 university transportation centers, we had one focused on environmental issues, today we have 60 and you would be hard-pressed to find one that doesn't include environmental sustainability as part of the research portfolio.

We have a question about what assumptions were used regarding the penetration of electric vehicles into the passenger car market.

We will get back to you on that one.

[Inserted: The report does not predict what the fleet mix would be in the future per se. It does calculate what transportation sector wide greenhouse gas emissions reduction might result if battery electric vehicles had a very high level of market penetration found in the literature, 56%. Based on per vehicle reductions of 78-87% with an electricity grid at 240 to 421 grams CO2e per kilowatt hour, and an aggressive market penetration of 56% in 2050, the report estimates a transportation sector-wide reduction of 26-30%. Please see Volume 2, page 2-65 to 2-76 for more details.]

Can anyone discuss the use phase impact on life cycle analysis?

This is John Davies, maybe a little clarification on that if that refers to combustion emissions themselves. Combustion is at the center of the life cycle process and is what is reported in the official inventories. The other life cycle processes add an additional increment beyond that. I can try to fully respond to that offline. [See bottom of transcript for further discussion.]

There was a question about how many of these approaches seem to refer to urban approaches, but there is a lot of concern that if agricultural areas increase their productivity that VMT will increase. Is DOT doing anything to look at agricultural areas?

This is John Davies again, I am wondering if that is referring partly to additional transport emissions that might be associated with the harvesting of corn and other ethanol production purposes. Those additional emissions would be part of the life cycle emissions for those deals. It is potentially a consequential issue. EPA's regulatory impact analysis for the renewable fuel standard has tried to quantify these transport emissions and this could be built into a fuel cycle

estimate of the additional emissions associated with biofuels. In terms of additional passenger miles traveled in rural areas, some of the strategies here indirectly, for instance inner-city mileage charge, would affect travel activity more broadly.

In addition to that, this is Tina Hodges, the Department, particularly the livability initiative is looking at context sensitive solutions for transportation to take into account the community structure and the differences between particular communities.

Several people asked about what DOT is doing to provide tools and resources for state and local governments, that was identified as a gap, and so what can we provide to state and local agencies to help fill those needs?

This is John Davies from Federal Highway Administration. We are trying to provide a number of resources that we will be rolling out over time. One of which will be a mitigation guidebook that will help MPOs and state departments of transportation estimate the impact of a variety of mitigation strategies. This is a real challenge as far as these results are context specific and we are trying to think about ways that this resource will ultimately deliver meaningful estimates for the users. We are also undertaking modeling work to help quantify the GHG reduction from highway operations strategies. We have to recognize the fact that this is a real modeling challenge, especially with estimating the variety of behavioral changes that occur because of the strategies.

This is Joanne Potter, I might also flag a forthcoming SHRP study. The SHRP C09 is providing tools for incorporating greenhouse gases in transportation decision-making. That should be out this fall.

This is Richard Corley of MARAD. I also want to mention that there is study on different emissions impacts from shipping routes around the Interstate 95 corridor. That is available on our website.

This is AJ Singletary, a lot of the modes have individual plans and tools that they can provide to local decision makers. We have made an effort to bring these together and provide a one-stop source on our transportation and climate change clearinghouse at www.climate.dot.gov.

This is Linda Lawson and we want to thank you all for joining us today. We are out of time. This has been a good conversation and we will follow-up with the answers to the questions we didn't get to. We want to say thank you to everyone and as we said earlier, be sure to check out the website, climate.dot.gov. Thank you. [Event Concluded]

Questions answered in writing after the event because there was insufficient time to address them during the event:

Q: Bill Roettker: what are your assumptions regarding penetration of electric vehicles into the passenger car market?

A: The report does not predict what the fleet mix would be in the future per se. It does calculate what transportation sector wide greenhouse gas emissions reduction might result if battery electric vehicles had a very high level of market penetration found in the literature, 56%. Based on per vehicle reductions of 78-87% with an electricity grid at 240 to 421 grams CO2e per kilowatt hour, and an aggressive market penetration of 56% in 2050, the report estimates a transportation sector-wide reduction of 26-30%. Please see Volume 2, page 2-65 to 2-76 for more details.

Q: Brian Shaw: Did the study look at how improving congestion would impact GHG production?

A: Yes. The system efficiency section analyzed several congestion reducing strategies and their impact on greenhouse gas emissions, including bottleneck relief strategies; traffic management strategies such as signal timing, ramp metering, and faster clearance of incidents; and traveler information.

Q: Mingming lu: May I ask a question now, as I have to leave around 2pm. Are there any plans to reduce black carbon from heavy duty trucks, e.g. through alternative fuels? Thank you.

A: There will be some reductions in black carbon through the fuel economy rulemaking by improving efficiency. Please keep an eye out for the draft EIS for the truck CAFE rule from NHTSA.

Q: Dave Perlman: The Interagency Transportation, Land Use, and Climate Change Working Group's pilot project on Cape Cod, which began a few months ago, is a good example of scenario planning being done to reduce GHG emissions, integrating land use and transportation, adapting to climate change impacts (mainly SLR), and multi-agency coordination.

A: Thank you for your comment. This is a good example.

Q: Peter Hurley: There is currently negative incentives to reduce VMT. What's the likelihood of changing the incentive to reward communities that reduce per capita VMT with greater points for our projects?

A: The Administration is in the process of developing recommendations for the next surface transportation authorization. Funding and programs will be central to that discussion. Further livability and sustainability are among our key goal areas under the Department’s strategic plan.

Q: Jim Larsen: Transportation Management Associations represent the "front line" of a lot of demand management solutions, yet they are not considered a core component of the Partnership for Sustainable Communities, nor are they eligible as non-profit entities for funding under most of these Federal funding programs. In most cases eligibility requirements are limited to state and local governments and MPO's.

A: Transportation Management Associations (TMAs) are groups of citizens, firms, or employers that organize to address the transportation issues in their immediate locale by promoting rideshare programs, transit, shuttles, or other measures. TMAs can play a useful role in brokering

transportation services to private employers. TMA's are not eligible for Federal State Planning and Research Funds (SPR) or Metropolitan Planning Funds (PL). A private agency or a non-profit agency such as a TMA can submit a Congestion Mitigation and Air Quality (CMAQ) project if it establishes a partnership with a public agency. A written agreement must be in place between the public agency and the private agency. It remains the responsibility of the public agency to apply for CMAQ funds and to oversee and protect the investment of CMAQ funds in the public-private partnership. See 23 U.S.C. Section 149(e).

Q: Nathan Sandwick: First, thanks to the presenters. (Along the same lines as first part of question posted by DOT E46124...). What types of assistance do planning practitioners expect from FHWA, towards their goals of reducing GHG emissions?

A: FHWA could provide assistance by:

- Providing information on how to integrate climate change considerations into the transportation planning process;
- Providing technical assistance on analyzing greenhouse gas reduction strategies including the development of tools such as the "Carbon Calculator", currently under development by FHWA to assist State DOTs and MPOs with estimating the potential greenhouse gas reductions from various transportation-related strategies; and,
- Providing consistent public education and outreach materials on transportation and climate change issues.

FHWA has a number of tools and resources available for planning practitioners at http://www.fhwa.dot.gov/hep/climate/resources.htm. Publications available on that site include Integrating Climate Change into the Transportation Planning Process, Summary Report: MPO Peer Workshop on Planning for Climate Change, and Guidance: Planning Program Funds to Support Integration of Transportation, Land Use, and Climate Change. Please also see www.climate.dot.gov.

Q: Oregon DOT MGH: It seems like a large elephant in the room has to do with national and global increases in population. Obviously, this issue is only tangentially related to transportation, but what is U.S. DOT's role in addressing unchecked gains in population as a way to reduce GHG emissions?

A: World population is not our scope.

Q: Chris Simmons: While this is a synthesis report, is any consideration being given to the signals being given through the 132(f) qualified transportation (tax) benefit, and the scheduled return of that benefit for transit to pre-2009 levels?

A: FTA has done work in the area of transit commute benefits. Please call the FTA Office of Budget and Policy and ask for Tom Yedinak if you would like to discuss further.

Q: Petra Mollet: As the energy intensity of extracting petroleum increases as we move toward more difficult to obtain sources (like oil sands), do you anticipate that the life cycle element of the transportation sector will increase in significance? Is this likely to change the relative

strength of various strategies? The current analysis appears to rely primarily on tailpipe emissions in estimating impacts.

A: Oil and tar sands have considerably greater fuel cycle impact than traditional petroleum feedstocks, and their widespread use would increase the transportation sector's life cycle emissions. It's worth noting that a cap-and-trade approach could account for fuel cycle in addition to combustion emissions, which would discourage the widespread utilization of these fuels. I would strongly agree with the point that life cycle considerations are critical in understanding the sector's overall GHG impact, especially given the targeted increase in renewable fuels.

Q: AJ Steffen: Regarding transportation planning, is there any consideration for ending the construction of red light-green light intersections and instead construct roundabouts (traffic circles) in an effort to reduce idle time when commuting?

A: While communities are unlikely to eliminate the construction of red-light intersections, roundabouts do represent a viable strategy for reducing GHGs from stop-and-go events. Although this study did not specifically analyze their reduction benefits, it's worth noting that roundabouts have operational effects that are similar to traffic signal synchronization, a technique included on the traffic management strategy. FHWA's forthcoming Mitigation Guidebook will attempt to provide further evidence regarding roundabouts' GHG benefits.

Q: Chris Simmons: You mentioned that consideration was given to the current climate bills circulating through Congress. Was any review given to current bills with ancillary effects to climate bills, such as HR 3517 (Commute LESS), HR 3271 (Green Routes to Work), or S 1795 (Private Investment in Commuter Vanpooling)?

A: The report was intended as an analysis of the broad range of strategies for reducing transportation emissions rather than an analysis of specific legislation. The report included analysis of commuter measures, teleworking, ride matching, carpooling, vanpooling, flexible work schedules, marketing campaigns, employer outreach, and parking management.

Q: Leif Wathne (presenters): I think it is important to recognize that fuel economy can be addressed on two levels - 1) the vehicle itself, and 2) the driving surface. Research suggests that there are approximately 3-6% fuel efficiency improvements available for trucks alone via this second strategy. This is analogous to airplanes flying at higher altitudes because the air density is reduced an fuel efficiency improves. It seems the report is focused only on the vehicle side (and fuel side) of this issue.
Leif Wathne (presenters): Yes. The eco-footprint of a highway is not only comprised of the upstream impacts (material extraction, processing, etc.) as well as the construction impact and the maintenance and end-of life impacts, but also the use-impacts (i.e. the footprint of the vehicles operating on the highway). As it turns out, recent Life Cycle Assessments (LCA) illustrate that the use-phase eco-profile dwarfs impacts from all other phases of a highway's life cycle. Therefore, any kind of improvement in energy use, emissions, waste, etc. in that phase will have a pronounced impact. Specifically, pavement rigidity and smoothness impact the fuel efficiency of vehicles traveling over the roadway. Because roadways are in service every hour of

every day for decades, incremental improvements in this fuel efficiency will have an enormous cumulative impact. Any life cycle assessment that ignores this is not truly capturing all the impacts. I have some references that expand on this point, if you are interested.
Leif Wathne (presenters): Another use-phase impact that should be captured and considered in transportation decision-making is SRI (or surface reflectivity). According to research conducted at Lawrence Berkeley National Laboratories, use of cool pavement (light colored, reflective pavements) can enhance global cooling, or offset dozens of gigatons of CO2. There are also safety implications (improved visibility) as well as energy saving associated with reduced roadway lighting needs (due to the lighter colored and reflective road surface).

A: FHWA is currently developing a web-based "Carbon Calculator" tool to assist State DOTs and MPOs in analyzing various transportation-related strategies to measure their greenhouse gas reduction potential. One of the strategies the tool will include is resurfacing highways to improve smoothness and decrease friction.

FHWA's Office of Pavement Technology is a is working on an ongoing initiative to improve pavement smoothness across the country. FHWA is working with individual States to hold workshops addressing such areas as pavement smoothness specifications, design/construction techniques, and the use of road profilers to measure smoothness when paving, and has sponsored a road profiler comparison and verification study to improve analysis methods and testing procedures used for profiler verification.

More information can be found at: http://www.fhwa.dot.gov/pavement/

FHWA is currently developing a web-based Carbon Calculator tool to assist State DOTs and MPOs in analyzing various transportation-related strategies to measure their greenhouse gas reduction potential. One of the strategies the tool will include is the use of "green" construction materials such as "cool pavements." Benefits of cool pavements include:

- *Reduced stormwater runoff and improved water quality:* Permeable pavements can allow stormwater to soak into the pavement and soil, reducing runoff and filtering pollutants. Both permeable and non-permeable cool pavements can also help lower the temperature of runoff, resulting in less thermal shock to aquatic life in the waterways into which stormwater drains.
- *Lower tire noise:* The open pores of permeable pavements can reduce tire noise by two to eight decibels and keep noise levels below 75 decibels, although noise reduction may decline over time.
- *Enhanced safety:* Permeable roadway pavements can improve safety by reducing water spray from moving vehicles and increasing traction through better water drainage.
- *Better nighttime visibility:* Reflective pavements can enhance visibility at night, potentially reducing lighting requirements and saving both money and energy.
- *Improved local comfort*: Cool pavements in parking lots or other areas where people congregate or children play can provide a more comfortable environment.