Climate and transportation expert panel summary

On June 22, 2022 Metro hosted a panel to learn from national experts about the best practices and tools being used nationally to assess and monitor climate impacts of transportation.

The attached materials capture the panel discussion and provide an easy guide for those interested in learning what was discussed. A full video recording of the panel discussion is available: https://vimeo.com/manage/videos/723107656/16bc305fea

1. Agenda
2. A discussion guide with timestamps from the video recording indicating when specific questions were asked of the panelists.
3. A summary of the panel discussion
4. Background materials:
    - Background on Climate Action in Oregon and the Greater Portland Region's Climate Smart Strategy
    - Background on Use of Vision Eval and Key Transportation Assumptions for Climate Smart Strategy Proxy
    - Metro Modeling Overview

Agenda

Metro
600 NE Grand Ave.
Portland, OR 97232-2736

Meeting:	Climate and transportation expert panel
Date:	June 22, 2022
Time:	7:30 am – 10:00 a.m.
Place:	Zoom webinar. Register: https://us02web.zoom.us/webinar/register/WN_BYx9mF6gTWymXUr1Q-vqdA

Objectives:

- Learn from national experts about the best practices and tools they are using to assess and monitor climate impacts at the system, corridor and project levels, including the known strengths and limitations of the tools being used to inform VMT and GHG reduction strategies and monitor progress toward adopted VMT and GHG reduction targets.
- Ask for feedback and gain insight on modeling and monitoring practices currently being used and considered by Metro, including the opportunities to improve Metro's current approach.
- Build a shared understanding of what the 2023 RTP is expected to demonstrate in terms of VMT and GHG performance in response to Executive Order 20-04 and the statewide Climate-Friendly and Equitable Communities rulemaking.
- Set the foundation for a collaborative regional approach to reducing transportation's impact on climate change by convening agency and community partners to inform how Metro works with state, regional and local partners to meet adopted VMT and GHG reduction targets.

Panelists

- Kyung-Hwa Kim, Performance Analysis and Monitoring Manager at the Atlanta Regional Commission
- Eric Sundquist, Sustainability Advisor; SB 743 Program Manager, California Department of Transportation
- Shoshana M. Lew, Executive Director, Colorado Department of Transportation
- Rebecca White, Director, Division of Transportation Development, Colorado Department of Transportation
- Susan Handy, Professor of Environmental Science and Policy and Director of the National Center for Sustainable Transportation at the University of California, Davis
- Dan F.B. Flynn, Data Scientist, U.S. Department of Transportation Volpe Center

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AGENDA

7:30 – 8:10 a.m. **Welcome and introductions**

- Welcome (Margi Bradway, Moderator)
- Opening remarks (Metro Councilor Gonzalez)
- Presentation: Overview of state and regional climate policies and strategies and Metro's modeling and monitoring toolbox (Metro staff)
- Panelist introductions (Panelists)

8:10 – 9:05 a.m. **Expert panel discussion**

The moderator will facilitate a discussion with the expert Panel focused on using climate analysis tools for strategy development, evaluation and monitoring and assumptions for the future of electric vehicle technology.

9:05 – 9:10 a.m. **Break**

9:10 – 9:40 a.m. **Facilitated Q&A with Metro Council and JPACT members**

Metro Council and JPACT members will be promoted to "panelists" to ask the panelists questions.

9:40 – 10 a.m. **Expert Panel Final Thoughts & Closing**

Climate and transportation expert panel discussion guide

Date: June 22, 2022
Time: 7:30 – 10:00 a.m. PT
Place: Zoom webinar

Webinar link:
https://vimeo.com/manage/videos/723107656/16bc305fea
Numbers below indicate the time stamp from the webinar.

Panelists and presenters:
Director Shoshana Lew, Executive Director, Colorado Department of Transportation
Director Rebecca White, Division of Transportation Development Director, Colorado Department of Transportation
Erik Sabina, Colorado Department of Transportation
Eric Sundquist, Sustainability Advisor; SB 743 Program Manager, California Department of Transportation
Susan Handy, Professor of Environmental Science and Policy and Director of the National Center for Sustainable Transportation at the University of California Davis
Kyung-Hwa Kim, Performance Analysis and Monitoring Manager at the Atlanta Regional Commission
Dan F.B. Flynn, Data Scientist, U.S. Department of Transportation Volpe Center

Metro Council and JPACT members:
Councilor Juan Garcia Gonzalez
Councilor Christine Lewis
Councilor Shirley Craddick
Councilor Gerritt Rosenthal
Mayor Steve Calloway, City of Hillsboro
Councilor Kathy Hyzy, City of Milwaukie

Presenters and moderator:
Thaya Patton, Senior Researcher and Lead Climate Modeler
Kim Ellis, Principal Transportation Planner, Metro
Margi Bradway, Deputy Director, Planning, Research & Development, Metro; moderator

Expert panel discussion

Margi Bradway, Metro, facilitated a discussion with the panelists. The questions that were asked of panelists answered are noted below.

Timestamp 43.00 What are your processes for conducting the EMTR analysis? What are the tools you are using, and how are they accounting for different factors?
Timestamp 49.00 How does California measure GHG or VMT?
Timestamp 55.20 How does what California is doing contrast with the Colorado approach?
Timestamp 58.28 How does each model help with decision-making?

Timestamp 1.02.23 What are Atlanta's processes and tools and how do they help with decision-making?
Timestamp 1.12.21 How do fleet assumptions fit into analysis at region, state or project level? Where do fuels fit, or don't fit into induced demand analysis? In the study of induced demand, are fleet assumptions held solid or is focus solely on the VMT?
Timestamp 1:18:25 Do MPOs use different approaches and assumptions in modeling related to GHG emissions?
Timestamp 1.23.26 How do you monitor progress?

Metro Council/JPACT discussion

Timestamp 1.36.22 Councilor Hyzy said there is tension around induced demand – what is the best response? What does modelling show that induced demand will do in terms of addressing climate issues and reducing GHGs? How do we, as a region, most effectively think about it?
Timestamp 1.46.24 Margi asked Colorado panelists if they are taking into account induced demand.
Timestamp 1.49.00 Councilor Lewis asked about the effectiveness of modeling GHG at the project level. Are we diverting GHG emissions from a highway to a neighborhood street?
Timestamp 1.54.02 Councilor Lewis asked about getting a level of granularity in a project, or is it only possible once it has gone through NEPA?
Timestamp 1.57.10 Councilor Rosenthal asked if models have been used to identify the impacts of the increase of gas prices. How much GHG reduction could we get if gas prices continue to rise to European rates? Will the increase in gas prices be a significant factor in decreasing GHG?
Timestamp 2.04.57 Mayor Steve Calloway asked at what point is there benefit to adding an auxiliary lane or widening, to increase efficiency and decrease GHG?
Timestamp 2.11.00 Councilor Gonzalez asked if climate modeling is at point as a performance tool where it has done enough to change/alter projects across the country, or is it too new to really model for, so projects that were going to happen, happen anyway? As climate modeling is advancing across the country, how is it impacting, improving or stopping projects?

Summary Notes: Climate and transportation expert panel

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Presenters and moderator:
Thaya Patton, Senior Researcher and Lead Climate Modeler
Kim Ellis, Principal Transportation Planner, Metro
Margi Bradway, Deputy Director, Planning, Research & Development, Metro; moderator

Welcome and Introductions
00.00: Metro Planning, Development and Research Deputy Director Margi Bradway welcomed panelists, guests and Councilor Juan Garcia Gonzalez. She said Metro is working on modeling and policy development for the 2023 Regional Transportation Plan. She began the event by referencing Oregon's state goals on climate and Governor Kate Brown's executive order directing agencies to reduce climate pollution even further. She reviewed the agenda and ground rules.

02.20: Councilor Gonzalez gave opening remarks, noting that over 110 people (this later increased to 156) are in the audience and expressing gratitude to the panelists. He noted that in Oregon, transportation is one of the largest contributors to greenhouse gas emissions. The Regional

Transportation Plan (RTP) outlines all transportation planning over the next 25 years. Metro's climate modeling work is a cornerstone, and the Metro region has a history of collaboration.

Margi invited the panelists to introduce themselves and give a short overview of their work.

05.24: Director Shoshana Lew, Executive Director, Colorado Department of Transportation, began with a history of their policy rulemaking as a requirement. Senate Bill 260 focused on combining traditional investment in roads and bridges while broadening the way they think about it. The bill specifically directs them to think about greenhouse gas emissions and vehicle miles travelled. She stressed the importance of having a big tent to include everyone in the conversation. They held 10 public meetings plus many small meetings, including technical meetings that included modelers. She recommended having regulators be very aware of policy making. They tried to create a rule - conformity policy framework for greenhouse gases related to infrastructure. There have a couple of opportunities to hit the target, and if that doesn't work, there are opportunities for mitigation. It includes all Colorado MPOs and the state. She talked about mitigations. All projects have built into them some form of VRT. Director Rebecca White and Erik Sabina are also in attendance.

14.24: Eric Sundquist, Sustainability Advisor; SB 743 Program Manager, California Department of Transportation said he focuses on implementing legislation as a result of Senate Bill 743,which forces them to look at induced demand in their projects. He showed a slide on induced demand, saying it is unintuitive. He listed three motivations. 1. It is bad for congestion. Studies that review road widenings show they become just as congested as before widening. 2. The impacts - environmental/emissions, safety, noise, equity 3. Widening roads puts a huge burden on maintaining and operating the system. Like other impacts, traffic congestion is measured under California Environmental Quality Act (CEQA). They have to assess project impact, then make changes to the project scope or provide mitigation. They try to avoid the latter as it is costly. Consider a benefit cost ratio.

18.47: Susan Handy, Professor of Environmental Science and Policy and Director of the National Center for Sustainable Transportation at the University of California, Davis works with the state and CalTran to implement its AB 32 policy which puts in place reduction of GHG and also a Senate Bill to reduce Vehicle Miles Traveled (VMT) in urban areas. Strategies include investments in transit, land use policies and bike/pedestrian policies. She mentioned their induced travel calculator and the benefits of active travel projects. She said key themes are to look at empirical evidence and extract from that. Most of work is project level.

21.44: Kyung-Hwa Kim, Performance Analysis and Monitoring Manager at the Atlanta Regional Commission talked about the role of planner and modeler. She uses facts and performance measures. Modelers can provide date to planners explaining if a project is achievable. Modeling describes how to get there but one model will not answer all questions and multiple scales are needed.

25.30: Dan F.B. Flynn, Data Scientist, U.S. Department of Transportation Volpe Center, said he supports the VisionEval tool which evaluates the impacts of potential policies and looks at performance metrics such as GHG from transportation. It can be used at a higher strategic level.

27.00: Margi introduced Metro's Kim Ellis, Principal Transportation Planner and Thaya Patton, Senior Researcher and Lead Climate Modeler. Kim presented on Metro's Climate Smart Strategy.

34.50: Thaya Patton presented on Metro's Climate Analysis Toolbox.

Expert Panel Discussion

43.00: Margi opened the discussion with two questions:
What are your processes for conducting the EMTR analysis?
What are the tools you are using, and how are they accounting for different factors?

Daniel Flynn said he develops and promotes the modeling tools at the Volpe Center, which is part of the US Department of Transportation. Volpe Center is a fee for service in-house consultancy that works with the Federal Highway Administration Office of Planning that developed the GreenSet model, which then was developed into VisionEval. He supports users of the model. It is in between more detailed models and has components that interact with land use at regional levels and has the features of a sketch model, for example determining the range of uncertainty given policy choices. It is good at estimating VMT at the regional level and at a more granular level, including within census tracks. It is not a project level analysis tool. He showed a slide illustrating VisionEval.

49.00: Margi turned to Eric Sundquist, asking how they measure GHG or VMT. He explained the GHG measurement comes out of the conformity setting. With VMT, they use other tools such as …He talked about VMT and where it departs from GHG. If demand models were great, it is laborious, project by project and for some, impossible. There are no transportation land use models. If area was big enough, he said you would still have to create a new no-build land use area. Doing project by project is very laborious. They have opted for a more targeted assessment that uses models to a lesser extent.

NCSD calculations take a big step up. More lane miles equals more VMT. It is straightforward, but does not cover everything, for example, a new interchange. Assessment of VMT is moving forward. The NCSD calculator allows interpolation of results with the demand model. It does not work with looking at transit or VMT reduction and mitigations. GHG goes through a conformity type process, though MOVES. They are looking at the fleet mix and emissions per mile from different vehicles. An example of a conflict: a road diet can look bad in GHG or conformity because the cars are going slower, while it looks great in VMT because cars are going slower or idling. Also, the BC model does not have feedback loop in terms of induced demand.

Margi commented that California has found a way to do both; use a VMT calculator and travel demand model.

55.20: Margi asked Colorado panelists to contrast what California is doing with the Colorado approach.

Erik Sabina said he heads the travel demand forecasting group at Colorado DOT and led the development of the activity based model project. He said that a couple of years ago they had the only fully desegregate activity based models at the state level in the U.S. After that, his focus switched to GHG. He agreed with Eric Sundquist, saying the activity based machines took a lot of crank turning to get an answer out and that small projects cannot be seen in that type of model. They worked with the FTA and now make use of two models: a large desegregate model, and EERPAT. They also mine studies around the country for elasticity and reasonable relationships around input and output.

58.28: Margi said Colorado has done great work on GHG goals. She asked the Colorado panelists how each model helps with decision-making.

Erik Sabina said when GHG rules were created, they developed a set of three scenarios, using the terms aggressive but feasible, using a combination of EERPAT and the statewide model. They came up with low, medium and high estimates with groups of measures that were attached to each. This way people could see what they did and how it related to each outcome.

Rebecca added that they used the model tools to develop the GHG standard. Colorado is now implementing the standard and using the tools to determine if they are meeting it. They use the travel model to look at their ten year long range plan. If they cannot meet the goals with the mix of projects, they will look at mitigation tools. They will use EERPAT. They have a spreadsheet of expected GHG reductions when looking at different options. This is based on a lot of literature review. To reiterate, it is an art and a science. We are dealing with the limitation of MOVES and complete streets. When you run a complete street through MOVES, it shows a worse outcome, yet complete streets meet our goals. Should we move away from MOVES and adopt more of a spreadsheet model? Colorado is right in the middle of this process now.

Margi said this is timely given the federal infrastructure bill and the focus on complete streets.

1.02.23: Margi invited Kyung-Hwa Kim to talk about their processes and tools and how they help with decision-making in the Atlanta region. Kyung-Hwa shared slides describing models and modelling. She made several points including that there are many factors that impact travel demand including economic, but what is measured are accessibility and mobility. Travel modelling cannot reflect the full reality. She reviewed MPO modeling history. She said we need separate models to understand. She said they use the activity based model and also the three-based model for the purpose of analyzing. She concluded saying TIP project evaluation and prioritization are important.

1.12.21: Margi noted that no one has talked about how fleet assumptions fit into their analysis, at region, state or project level. She asked Professor Handy to weigh in on where fuels fit, or don't fit into the induced demand analysis.

Susan Handy said the California Air Resources Board (CARB), in its efforts to meet targets to reduce GHG, concluded that even a very aggressive effort to convert to electric vehicles is not enough; it is also necessary to reduce vehicle miles traveled. They are coming out with a new scoping plan. Regardless of what happens to the fleet, we need to reduce how much people are driving. There is a life cycle of emissions attributed to driving. It is not just about what comes out of the tailpipe; it is also about manufacturing the car and tires, building the roads. [2022 Scoping Plan Documents | California Air Resources Board]

Margi asked, in their study of induced demand, do they hold fleet assumptions solid or do they focus solely on the VMT aspect?

Susan responded that she uses the term induced travel. Aside from inducing changes in land use or promoting growth in a region, shifts in travel will occur when there is change in the capacity of the highway system. They created the estimator for change in VMT and for change in highway capacity and it doesn't look at fleet mix.

1.16.18: Margi asked Erik Sabina about Colorado's inputs on fleet. He said that Colorado's energy office developed a target of 940,000 light duty EVs on the road by the year 2030, compared to about 5 million total vehicles on the road. It has been challenging with stakeholders to communicate that this number is more impactful now than it will be in the future. For example by 2050, they hope that 100% of light duty vehicles will be EV. They use these numbers in the background for other analysis.

1:18.25: Margi asked Daniel if MPOs use different approaches and assumptions in modeling related to GHG emissions. He replied that at Metro, they asked if they could isolate the assumptions about EV growth in households versus all other vehicles on the road. New York State has used the VisionEval model to look at impacts on the EV market and growth of GHG emissions.

1.20.35: Eric Sundquist said they are in VMT and less in fleet mix. We will not know the exact answer. Various uptakes of EVs usually leave us behind, rather than ahead of whatever the scenario is. He suggested estimating conservatively and go from there. On SB 375, they are not meeting their goals and Portland is not meeting their goals.

1.22.01: Kyung-Hwa said it is complicated. It is related to economics, the demand and consumption. A crucial question is, what is our uncertainty? Narrow the uncertainty through assumptions.

1.23.26: Margi asked if anyone was monitoring progress. How do you monitor progress? Rebecca replied that it is not as simple as putting up an air quality monitor. They have committed to doing annual reports and every three years, a comprehensive look. It is challenging to detect how much change is occurring when looking at issues like land use. Margi asked, is progress based on specific strategies to reduce GHG or is it actual numbers compared to planning goals? Rebecca replied they would generate a CO2 equivalent number for the light duty fleet and compare that to the goal. The rule for 2030 would reduce 1.5 million metric tons.

1.25.38: Eric Sundquist said they monitor at a gross level and that they are going in the wrong direction. They've legislatively required analysis. The SB 150 report, AB 285 talk about why they are getting bad results. There is the GHG, VMT, what are is being built and why, where is the money going, what are the financial/policy/legal/institutional/educational constraints that are pushing in the wrong direction? He mentioned there are two recent reports that could be helpful. Margi said Molly Cooney Mesker will send out these reports. Reports:

- California Transportation Assessment Report - Pursuant to AB 285
- DRAFT 2022 PROGRESS REPORT (ca.gov)

1.28.18 – 1.36.21: **Break**

Facilitated Q&A between panelist experts and Metro Council and JPACT members

1.36.22: Margi invited Metro Council and JPACT members to ask questions of the panel.
Councilor Hyzy thanked the panelists and noted how useful this context and modeling information is for her as an elected official. She said she wants to do the climate work right and well and not in a way that feels imposed, but that invites everyone in. There is tension around induced demand – what is the best response? What does modelling show that induced demand will do in terms of addressing climate issues and reducing GHGs? How do we, as a region, most effectively think about it? There are multiple mega projects coming up. She said she advocates for true solutions for problems, not the usual, not necessarily comprehensive solutions.

Susan said there are great resources that explain how induced travel works, including her lecture through the National Center for Transportation and videos on YouTube. She said it is a basic economic principle. If you expand highways, you reduce the price of driving. If you reduce the price, people will do or consume more of it. With driving, decisions revolve around destinations, mode and over the longer term, live/work locations and what kind of land development happens where. All impact VMT. Travel demand models do not do a good job of measuring these factors, hence the need for the induced travel calculator. If the goal is to reduce VMT, we should not expand the capacity of the highway or roadway system. All of the evidence shows this. We are overselling to the public that highway expansion is a solution to congestion. It may reduce congestion in the short run, but the highway capacity will fill up again.

1.43.50: Eric Sundquist added that there is a vicious cycle effect - as there is more auto-centric development, it undercuts work on other modes: transit, walking, biking. There is not enough money for transit to serve low density development and employment sites that occur alongside highways. Auto-centric development causes a mode shift away from transit, walking and biking.

1.45.11: Kyung-Hwa noted uncertainties include not knowing the future location of housing and types of land use. Autonomous vehicles are coming and people are teleworking. Despite people moving to the suburbs in Atlanta, there is still congestion. There are no good predictions, but scenario testing provides a glimpse of what might or might not happen.

1.46.24: Margi asked Colorado panelists if they are taking into account induced demand.
Erik Sabina said the virtue of their large activity-based model list is that it covers 6 elements of induced demand. The activity-based models covers 5 of them; they illuminate inter-relationships and effects. If driving is so dominant, it pushes other modes to the sidelines. A difficulty remains with the land use effect, which is very complex. Land use is one of the six elements. They do scenarios that include land use to illustrate a range of possibilities to policy makers.

1.49.00: Councilor Lewis asked about the effectiveness of modeling GHG at the project level. She mentioned diversionary impact – shifts of modality but also shifts of corridor. Are we diverting GHG emissions from a highway to a neighborhood street?

Kyung-Hwa said the Atlanta Regional Commission has a very detailed way of understanding and modeling the pollutants at a link level, using a tool consistent with the travel demand model to understand the impact the diversion will create. They also have a project level model, a simple spreadsheet to demonstrate air quality impact. She said sometimes they need to do a comprehensive model to get a result on the network fatalities but some can be dealt with at a smaller, project scale.

Eric Sundquist said with GHG it doesn't where it's emitted, but particulate emissions do matter. For example, a highway widening diverts traffic from a neighborhood, reducing safety and other impacts but raising GHG. Under the statute, they need to weigh impacts and mitigate. Models are really about distributing traffic on the network. To the extent that the model is granular enough to show neighborhood effects, they would look at that as well as countervailing effects. They can look at different project alternatives, scope the project, and decide if it can go forward or how to mitigate.

1.54.02: Councilor Lewis asked about getting a level of granularity in a project, or is it only possible once it has gone through NEPA? Eric Sundquist replied that it is possible to do it sooner but because NEPA kicks in after the alternatives have been selected, it is kind of backwards. They are trying to switch the order by redoing purpose and need statements to encompass the environmental outcomes.

Margi noted that in California, the California Environmental Quality Act (CEQA) is the state equivalent of NEPA.

Erik Sabina added that the tools are available to do project level analysis. It takes a multi set of tools including the larger models we've been discussing. Larger level models will measure the effects of diversion. Simulation models can look at things like road design elements.

1.57.10: Councilor Rosenthal said the price of gas is key factor in the choice to drive, yet there is also pent up demand due to the pandemic. Have models been used to identify the impacts of the increase of gas prices? How much GHG reduction could we get going forward if gas prices continue to rise to European rates? Will the increase in gas prices be a significant factor in decreasing GHG?

Kyung-Hwa replied that we can estimate people's propensity of how they will react to gas price increases before the prices go up. We observe their behaviors through household surveys or transit board surveys; they provide historical information and help us estimate their propensity for choice of travel mode and time of travel. The model will not predict correctly on this question, but if we change sensitivity to high prices, the result will change. No one knows if gas prices will stay up and if this will be a significant factor in decreasing GHGs.

Eric Sundquist added that this question is more along the lines what Susan shared on induced travel and short and long term elasticities. There has been research on travel outcomes based on gas prices. This can be added to the model, but it is a lot of work leading to a false outcomes. You might look at doing something literature or broad based.

Susan added that there is a lot of research that indicates that elasticity is smaller than you would think; people don't change their behaviors and often, because many don't have a choice. They have to drive so they adapt to the higher price. Research has been done on the range of price changes that have occurred in the American reality. We don't know what the impact of extreme changes will be.

2.04.00: Margi mentioned that Metro completed a congestion pricing study using scenarios which compared tolling to VMT tax to other tools.

2.04.57: Mayor Steve Calloway said we have hours of congestion that creates GHG. At what point is there benefit to adding an auxiliary lane or widening, to increase efficiency and decrease GHG?

Kyung-Hwa asked if this would be more an engineering level analysis, a micro-simulation.

Margi said that you could run into a conflict looking at the travel demand model versus NEPA analysis, which uses a more granular model. How do you reconcile these?

Susan said there is a tradeoff between traffic flow and the induced travel. Travel speed will increase immediately after construction, but do we account for the extra congestion and emissions caused by construction? Traffic flow will speed up but this will induce additional driving. There is a need to take into account both, but there is not a good net assessment of benefits.

Rebecca said she appreciated the question. Colorado is a rapidly growing state with a lot of people sitting in traffic. She said it depends on the corridor. They are working on lane balancing, where two lanes increase to three then drop back to two lanes. In other corridors, they widen the highway and the traffic levels initially improve, then come back to congested levels five years later. For this reason, in the metro areas they look at managed lanes or improving transit.

Margi recalled that Director Shoshana Lew, in her introduction, talked about bus rapid transit as a mitigation that is used by Colorado DOT.

2.11.00: Councilor Gonzalez said projects and mega projects take a life of their own because of legislative mandate or the DOT. Are we at a point where climate modeling as a performance tool has done enough to change/alter projects across the country, or is it too new to really model for, so projects that were going to happen, happen anyway? As climate modeling is advancing across the country, how is it impacting, improving or stopping projects?

Kyung-Hwa said that at the Regional Commission they adopted a regional evaluation performance measure that includes GHG. For every project, they look for a quantified GHG benefit. It is hard to move the needle but they try to account for or understand the impact of large and small projects.

Eric Sundquist added that the tools are there but that this group is the outlier. Most of country is not doing this, so there are no outcomes but where it is being done, there are some good outcomes. There is increasing counterweight to institutional pressure to widen highways. There are project examples. It is not for lack of technical tools; it is lack of political will.

2.15.54: Margi asked panelists for lessons learned, advice for Metro or takeaways.

Dan said that given the interest in induced demand, project level analysis and work at the regional level, there is a need more than one tool.

Erik Sabina said using better modeling tools will pay dividends. For policy, aim for clear discussions to help know what the limitations are. Do not be paralyzed by lack of perfect analysis. You can make a lot of progress with less than 100% perfect numbers. Rebecca added that they took the leap and are seeing results. Keep the tent broad and the stakeholder group diverse. They had a lot of people who were upset, they took a lot of time talking to them, and they have made progress as a state.

Eric Sundquist reiterated that a lack of precision exists in all older tools. Given the uncertainties and lack of precision, assume that any highway widening will be eaten up by new demand in 5-10 years with a net increase in VMT and GHG, plus bring back all congestion and include impacts on adjacent neighborhoods. Have people who advocate for capacity improvements tell you why it is not true. Have them prove; be more skeptical.

Susan said we do modeling for statutory requirements and to make decisions but the modeling tools are imperfect and have limitations. There has been much false precision historically. They don't tell us what to do. We should be deciding what kind of future we want and work towards that future.

Kyung-Hwa wrapped up, saying we are all facing the same challenges. There is a need to work together and not re-invent the wheel. Go forward to the future we want, knowing modeling cannot solve all issues. When we work together we make a better region and society.

Margi thanked the panel for their time and sharing of resources, and thanked the audience.

JUNE 2022

CLIMATE SMART STRATEGY

Metro

2023 Regional Transportation Plan Update

Background on Climate Action in Oregon and the Greater Portland Region's Climate Smart Strategy

Prepared for members of the Transportation and Climate Expert Panel

Introduction

Climate change is the defining global challenge of the 21st century. And as the recent increase in climate-induced wildfires and extreme weather events has demonstrated, it is likely to have significant impacts on the Portland region.

The transportation sector is the largest contributor to greenhouse gas emissions in Oregon.[1] It is therefore a key focus of the greenhouse gas reduction efforts statewide and in the greater Portland region. Metro and the Oregon Department of Transportation (ODOT) each have a history of climate planning and an established "carbon reduction strategy" to reduce greenhouse gas (GHG) emissions from the transportation sector.

In 2007, the Oregon Legislature first set statewide climate change goals to reduce emissions by at least 10 percent below 1990 levels by 2020 and at least 75 percent below 1990 levels by 2050.[2] The goals apply to all emissions sectors – energy production, buildings, solid waste and transportation. More recently, Executive Order 20-04 set new greenhouse gas emissions reduction goals that call for the State of Oregon to reduce its GHG emissions at least 45 percent below 1990 emissions levels by 2035 and at least 80 percent below 1990 levels by 2050.[3] These updated goals are consistent with the reductions that climate scientists now believe are necessary to avoid catastrophic climate change impacts.

In 2009, the Oregon Legislature enacted HB 2001 directing Metro to develop and adopt a climate plan to reduce GHG emissions from light duty vehicles. The Legislature further directed the Land Conservation and Development Commission (LCDC) to adopt GHG emissions reduction targets for light duty vehicles for all of Oregon's metropolitan areas, although the Portland region was the only region with a mandated GHG reduction target. In 2010, the Oregon Legislature directed the ODOT to work with Metro and other metropolitan planning organizations, other state agencies and local governments to adopt a statewide transportation strategy on GHG emissions aimed at achieving the goals adopted by the Legislature in 2007.

In 2014, the Joint Policy Advisory Committee on Transportation (JPACT) and the Metro Council adopted the Climate Smart Strategy[4] with broad regional support from community, business and elected leaders. Approved by LCDC in 2015, the strategy was based on extensive stakeholder and public input, scenario planning and analysis. As part of the process, Metro conducted detailed modeling and analysis of various greenhouse gas scenarios and identified the types of transportation-related mitigation strategies that would have the greatest potential for reducing greenhouse gas emissions in the long term. This informed the Climate Smart Strategy that was ultimately adopted and continues to guide the region's response to the climate crisis today.

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[1] https://www.oregon.gov/deq/aq/programs/Pages/GHG-Oregon-Emissions.aspx

[2] House Bill 3543, enacted on August 7, 2007. https://www.oregonlegislature.gov/bills_laws/lawsstatutes/2007orLaw0907.html

[3] https://www.oregon.gov/gov/Documents/executive_orders/eo_20-04.pdf

[4] https://www.oregonmetro.gov/climate-smart-strategy

Adopted in 2014, Metro's Climate Smart Strategy is grounded in Metro's land use goals and adopted 2040 Growth Plan. The Regional Transportation Plan is a key tool for the greater Portland region to implement the adopted Climate Smart Strategy and achieve the GHG reduction targets adopted for the region by the Land Conservation and Development Commission.

The strategy outlined how the Portland metropolitan region will reach targets to reduce transportation-related greenhouse gas emissions from light duty vehicles. The regional Climate Smart Strategy includes a set of policies, strategies and near-term actions to guide how the region moves forward to integrate reducing greenhouse gas emissions with ongoing efforts to create the future we want for our region. It is grounded in Metro's land use goals and adopted 2040 Growth Plan and implemented through the Regional Transportation Plan.

The Climate Smart Strategy includes a wide-range of strategies for reducing GHG emissions from light duty vehicles, many of which are not funded or are underfunded. The Climate Smart Strategy was updated in 2018 as part of the Regional Transportation Plan update and will be updated again in 2023 to ensure ongoing compliance with Oregon's GHG emissions reduction targets.

Targets for the year 2035 were first set by the LCDC for each of Oregon's metropolitan areas in 2011. LCDC set additional targets for each metropolitan area through the year 2050 in 2017, and recently adopted temporary rules to support achievement of these targets through the statewide Climate Friendly and Equitable Communities (CFEC) rulemaking. The targets adopted for the Portland region are to reduce greenhouse gas emissions from light vehicle travel (from 2005 levels) as follows:

- A 20 percent reduction for the year 2035
- A 25 percent reduction for the year 2040
- A 35 percent reduction for the year 2050
- Targets for the years 2041-2049 steadily increase from 26 to 34 percent in order to maintain progress toward the 2050 target.[5]

These targets reflect additional greenhouse gas emissions reductions needed beyond what was expected to be achieved through State-level policies and actions identified in the Statewide Transportation Strategy (STS) that aim to advance Oregon's transition to cleaner, low-carbon fuels and zero and low-carbon emissions vehicles. At the state level, the Oregon Transportation Commission formally adopted the STS into the Oregon Transportation Plan in 2018. The STS resulted from a state-level scenario planning effort that examined all aspects of the transportation system, including the movement of people and goods, and identified a combination of strategies to GHG emissions. The STS identified a variety of effective emissions reduction strategies at the statewide level in transportation systems, changes in vehicle and fuel technologies, and compact urban land use patterns served by transit, walking and biking connections in the state's eight metropolitan areas.

[5] Oregon Department of Land Conservation and Development, Climate-Friendly and Equitable Communities Proposed Amendments to OAR 660-044 (Division 44), May 5, 2022, p. 6. https://www.oregon.gov/lcd/Commission/Documents/2022-05_Item_3_CFEC_Attachment_E_Draft-Rules-for-Division-44.pdf

GHG Forecasting and Monitoring

Since 2010, ODOT and Metro have been developing, testing, and refining tools to measure and forecast transportation-related GHG emissions. Formally called GreenSTEP and Metropolitan GreenSTEP, the VisionEval Framework includes both a statewide (VE-State) and a metropolitan (VE-RSPM) version that is used in Oregon.[6] These are essentially the same suite of tools that the State of Oregon used to set the region's greenhouse gas reduction targets in 2012 and continues to be used to help monitor progress towards Oregon's legislatively mandated GHG reduction goals and implementation of the Statewide Transportation Strategy.

In 2018, ODOT reviewed and prepared a monitoring report on progress to date in implementing Oregon's STS, which sets a vision for meeting the State's transportation-related GHG reduction targets.[7] According to the report, "Oregon is on track to reduce GHG emissions by 15-20 percent below 1990 levels by 2050, which falls far short of the STS vision."[8] The report also evaluated the state's progress on different types of GHG reduction strategies and found that:

- implementation of all transportation options and land use strategies was on track or moving in the right direction.
- progress on intelligent transportation systems, pricing, and clean fuels strategies was mixed, with some strategies moving in the right direction and others making no progress or trending in a negative direction.
- vehicle technology strategies are "not making a lot of progress in the direction of the STS vision;"[9] the STS found that there has been slightly more negative change than progress in this category.

Metro conducted a similar review of the Climate Smart Strategy in 2018 as part of the update to the Regional Transportation Plan (RTP). Appendix J to the 2018 RTP showed that Metro is implementing the actions called for in the Climate Smart Strategy, as required by OAR 660 Division 44, and found that our region was making satisfactory progress implementing the Climate Smart Strategy and was on track to meet its targets for 2035 and 2040.[10] Greenhouse gas emissions analysis conducted for the 2018 RTP relied on use of the regional travel demand model (RTDM) and MOVES – the Environmental Protection Agency (EPA) approved model for forecasting on-road mobile source greenhouse gas emissions in the region. Significant methodological differences in how VisionEval and MOVES estimate on-road vehicle emissions do not allow for direct comparison of forecasted on-road vehicle emissions results. As a result, while the RTDM and MOVES analysis forecasted GHG emissions, the analysis could not be used to demonstrate progress toward the GHG reduction targets defined in OAR 660-044-0060. Finally, Metro's review found that more investment, actions and resources are needed to ensure the region achieves the mandated greenhouse gas emissions reductions. In particular, additional funding and prioritization of Climate Smart Strategy investments and policies that substantially reduce greenhouse gas emissions will be needed.

While ODOT analysis tools are focused at the state level, Metro is working with ODOT to build upon ODOT's VisionEval suite of tools to allow analysis at the regional level in support of the 2023 RTP update. The focus of this work is to allow a more detailed evaluation at the regional scale using transportation

[6] https://www.oregon.gov/odot/Planning/Pages/Technical-Tools.aspx#GreenSTEP
[7] ODOT, Oregon Statewide Transportation Strategy, 2018 Monitoring Report, April 19, 2018. https://www.oregon.gov/odot/Planning/Documents/STS-2018-Monitoring-Report.pdf
[8] ODOT 2018, p. 26.
[9] ODOT 2018, p. 22.
[10] Metro, Climate Smart Strategy implementation and monitoring, 2018 Regional Transportation Plan Appendix J, December 6, 2018. https://www.oregonmetro.gov/sites/default/files/2019/04/02/RTP-Appendix_J_Climate_Smart_Strategy_Monitoring181206.pdf

networks and behavioral models to better understand and manage the impacts of transportation policies and investments on GHG emissions and determine if the 2023 RTP is meeting GHG reduction targets. This work is intended to complement the state-level analysis tools currently available, and advance ongoing efforts to integrate GHG outcomes into the regional transportation planning process.

Looking Ahead

Much has changed since 2018. Metro is now beginning the 2023 RTP update amid increasing evidence of our changing climate and its impacts. Major climate studies have found that changes are stronger and are happening more rapidly than expected, and that emissions need to fall dramatically by 2030 to prevent irreversible global damage.[11] Oregon did not meet its 2020 goal to reduce emissions to 10 percent below 1990 levels; at last count emissions were roughly 10 percent above 1990 levels.[12] And though our region demonstrated it was on track to meet our greenhouse gas reduction targets in 2018, the global pandemic and other urgent challenges suggest we may now be falling behind implementing some of the policies and investments called for in the Climate Smart Strategy. In addition, the region is contemplating new and updated policies that should be considered for inclusion in an updated Climate Smart Strategy.

Since 2018, the State has adopted new policies and programs to support clean vehicles and fuels in response to Executive Order 20-04.[13] The Every Mile Counts Program and its coordinated STS Multi-Agency Implementation Work Plan are focused on reducing greenhouse gas emissions and implementing the STS. Recent actions include the formation of climate offices within ODOT and ODEQ and the statewide CFEC rulemaking by the LCDC and the Department of Land Conservation and Development (DLCD). In addition, several Oregon vehicles and fuels legislative actions and Environmental Quality Commission (EQC) rules are expected to be in place by the end of 2022 that will help greatly advance the STS goals to "clean up every mile" and associated air quality impacts:

1. Clean Car Standards Program (ZEV1) (EQC adopted in 2005)
2. Clean Fuels Program (CFP1) (HB2186, 2009)
3. Clean Electricity Standard (HB2021, 2021)
4. Advanced Clean Truck Rules (ACT) (EQC adopted in November 2021)
5. Climate Protection Program (CPP) (EQC adopted in December 2021)
6. Clean Fuels Program Expansion (CFP2) (EQC expected adoption in 2022)
7. Clean Car Standards Program Expansion (ZEV2) (EQC expected to initiate rulemaking mid-2022)

The first three are expected to achieve by 2026 a roughly 10 percent reduction in state GHG emissions. The Climate Protection Program is an overarching policy that will restrict sales of fossil fuel sales in the state across multiple sectors increasingly each year starting in 2022. The latter programs are critical to implementing that policy to ease the transition to a low carbon future for all vehicle groups. Some credit trading is allowed prior to 2030, which makes it hard to predict exact forecasts in the near term. The ZEV programs when fully implemented should roughly conform to the goals set out in SB1044.

Metro continues to explore opportunities to evolve and enhance its capabilities and approach to forecasting GHG emissions and monitoring progress implementing the Climate Smart Strategy. To further advance that work in support of the 2023 RTP update, Metro is hosting an Expert Review Panel on Transportation and Climate Planning and Modeling on June 22, 2022.

[11] Intergovernmental Panel on Climate Change (IPCC), Climate Change 2021: The Physical Science Basis, Summary for Policymakers, October 2021. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf

[12] Oregon Department of Environmental Quality, Oregon Greenhouse Gas Sector-Based Inventory Data. https://www.oregon.gov/deq/aq/programs/Pages/GHG-Inventory.aspx

[13] https://www.oregon.gov/gov/Documents/executive_orders/eo_20-04.pdf

JUNE 2022

CLIMATE SMART STRATEGY

Metro

2023 Regional Transportation Plan Update

Background on Use of VisionEval and Key Transportation Assumptions for Climate Smart Strategy Proxy

Prepared for members of the Transportation and Climate Expert Panel

Background on VisionEval

In order to ensure that the 2023 Regional Transportation Plan makes meaningful and measurable progress in reducing greenhouse gas emissions, Metro and the Oregon Department of Transportation (ODOT) Climate Office collaborated to adapt the state-level VisionEval to operate at a regional-level. Formally called GreenSTEP and Regional Strategic Planning Model (RSPM), VisionEval is the essentially the same suite of tools that the State of Oregon has used to set the region's greenhouse gas reduction targets in 2012 and 2017, and monitor progress implementing the Statewide Transportation Strategy since 2013.

Since 2013, ODOT has used a state-level version of VisionEval that uses county-level data as inputs. To support the 2023 RTP Update, the ODOT and Metro team developed a regional-scale version of VisionEval that uses regional, sub-regional, and census tract level data as inputs. The goals of this effort are to:

- Adapt the state-level version of VisionEval to create a regional-scale VisionEval to inform local and regional GHG planning efforts in the Portland region.
- Evaluate the potential effectiveness of new and emerging strategies to reduce GHG emissions that were not adopted in the 2014 Climate Smart Strategy or 2018 RTP – especially congestion pricing, a proven emissions reduction strategy that is moving forward in our region.
- Examine what reductions in vehicle miles traveled (VMT) per capita are necessary to meet our greenhouse gas emissions reduction targets, assuming different rates of transition to cleaner, low and zero carbon fuels and more fuel-efficient vehicles.
- Provide an updated reality check on the assumptions underlying in the Climate Smart Strategy by comparing them to ongoing developments in clean fuels, clean vehicles, and RTP implementation during the 8 years since the strategy was adopted, and particularly during the 4 years since ODOT and Metro last assessed the implementation of their respective climate strategies.
- Better understand how the tools used to analyze GHG emissions account for different policies and strategies to help ensure that emissions reductions that are forecast in the RTP actually occur.
- Inform how best to forecast GHG emissions in the 2023 RTP update, recognizing limitations in the various tools available.
- Frame a regional discussion on what changes to the Climate Smart Strategy may be needed to stay on track, and even accelerate achieving the region's greenhouse gas emissions reduction targets.

Climate Smart Strategy: review of key transportation assumptions

The first phase of this work focused on examining whether the region and state are making progress toward the many milestones that must be met for Climate Smart Strategy to be a success. Staff developed two scenarios in VisionEval – a proxy of the adopted Climate Smart Strategy, slightly updated to be consistent with the more detailed inputs in the new regional-scale version of VisionEval, and a scenario that extrapolates current trends, and compared these two scenarios order to analyze progress in implementing the Climate Smart Strategy as reflected in the 2018 Regional Transportation Plan.

Through the 2023 Regional Transportation Plan update, future tasks will assess whether the assumptions underlying the Climate Smart Strategy need to be updated based on more recent information, estimate the change in GHG reductions due to changing assumptions, and if needed, to explore additional actions that can help the region stay on track to meet its GHG reduction targets.

The two scenarios developed for the first task of the analysis are:

Reference Case Scenario which assumes that current trends in Oregon's transition to cleaner fuels, more fuel-efficient vehicles (as assumed in the 2013 Statewide Transportation Strategy), and transportation demand management continue into the future, and does not account for future actions to reduce GHG emissions. The Climate Smart Proxy Scenario (described below) will be compared to this scenario in order to assess whether the Climate Smart Strategy as adopted in the 2018 RTP is on track to meeting the region's GHG reduction targets.

A **Climate Smart Strategy Proxy Scenario** representing the 2014 Climate Smart Strategy as currently adopted in the 2018 RTP.[1] This scenario is based on adopted policies and plans, including:

- assumptions about Oregon's transition to cleaner, low carbon fuels and more fuel-efficient vehicles from the 2013 Statewide Transportation Strategy[2] and
- assumptions about implementation of VMT-reducing strategies in the 2018 RTP.

This scenario produces greater GHG reductions than the Reference Case because it assumes that policies and plans that have yet to be fully implemented will drive emissions downward in the future. We also analyzed each component of this strategy, estimating the potential GHG emissions reduction from each individual change in assumptions between the Climate Smart Strategy proxy scenario and the Reference Case. This analysis will allow an evaluation of whether the key assumptions underlying the Climate Smart Strategy (as reflected in the 2018 RTP) are still reasonable, and to better understand the impact

[1] The Climate Smart Strategy scenario is a "proxy" because the analysis used a different tool that draws on different assumptions and data to estimate GHG assumptions than were used when analyzing GHG emissions during development of the 2014 Climate Smart Strategy and subsequent analysis conducted during the 2018 RTP update. During development of the Climate Smart Strategy, Metro worked in partnership with ODOT to develop and use the Metropolitan GreenStep tool to forecast GHG emissions reductions from light duty vehicles. During the 2018 RTP update, Metro used a separate, more detailed set of network-based tools, including the regional travel demand model in conjunction with the federally-approved Environmental Protection Agency (EPA) tool, MOVES, to forecast greenhouse gas emissions reductions. Due to significant methodological differences in how GreenStep/VisionEval and MOVES estimate on-road vehicle emissions, the results of the 2018 RTP GHG analysis could not be compared directly with GHG analysis conducted during development of the Climate Smart Strategy. Though the assumptions used in creating this scenario mirror those used for the 2018 RTP (Climate Smart Proxy) as closely as possible, neither the assumptions nor the results are identical because of significant underlying differences between GreenStep, VisionEval and our travel model which do not allow for direct comparison of forecasted on-road vehicle emissions results from each GHG modeling tool.

[2] https://www.oregon.gov/odot/Planning/Pages/STS.aspx. In 2018, the Oregon Transportation Commission adopted an amendment to incorporate the STS as part of the Oregon Transportation Plan (https://www.oregon.gov/odot/Planning/Pages/Plans.aspx)

that changing individual policy assumptions would have on achieving the region's GHG reduction targets. **Table 1** describes how the key assumptions underlying state and regional climate plans vary between the reference case and the climate smart strategy proxy scenarios.

Table 1: Key transportation assumptions, by scenario

VisionEval Input	Reference case – 2035 assumptions	Climate Smart Strategy Proxy – 2035 assumptions	Notes on current assumptions
Gas Prices	Gas prices are $2.47 per gallon[3]	Gas prices are $6.75 per gallon	
Electricity Prices	Electricity prices are $0.14/kWh	Electricity prices are $0.23/kWh	
Commercial Fleet Age	The average lifetime of commercial vehicles is 9 years	The average lifetime of commercial vehicles is 7.6 years	Commercial vehicle lifetimes currently average 14.2 years and are increasing.[4]
Fleet Electrification	7% of commercial trucks are hybrid or electric	50% of commercial trucks are hybrid or electric	
Commercial Fleet Share	80% of light-duty commercial vehicles are trucks/SUVs and 20% are cars	20% of light-duty commercial vehicles are trucks/SUVs and 80% are cars	58% of light-duty commercial vehicles are trucks, and that percentage has been increasing.[5]
Household Fleet Share	42% of light-duty passenger vehicles are trucks/SUVs and 58% are cars	20% of light-duty passengers vehicles are trucks/SUVs and 80% are cars	80% of new U.S. vehicle sales are trucks, and that percentage has been increasing.[6]
Household Vehicle Fleet Age	The average lifetime of passenger cars is 10.7 years / 11.54 years for trucks/SUVs	The average lifetime of passenger cars is 7 years / 7.7 years for trucks/SUVs	Passenger vehicle lifetimes currently average 11.9 years and are increasing.[7]
Transit Service	Transit service hours continue to grow at current rates.	Transit service hours grow at the rate envisioned in the RTP, leading to ~20% more	Between 2010 and 2019, transit service hours grew at roughly half the rate of the

[3] Vision Eval uses 2010 dollars for price inputs.
[4] Brusseau, D., Aging Trucks Create More Service Opportunities, NTEA News, https://www.ntea.com/NTEA/Member_benefits/Industry_leading_news/NTEANewsarticles/Aging_trucks_create_more_service_opportunities.aspx?fbclid=IwAR3mkimdcKilEbdqwvYYSwODX5Hop5g6odQWuQdIt9cJ37I30kwxgv209PU
[5] Bureau of Transportation Statistics, U.S. Automobile and Truck Fleets by Use, https://www.bts.gov/content/us-automobile-and-truck-fleets-use-thousands
[6] FRED Blog, Long-term trends in car and light truck sales, March 15, 2021. https://fredblog.stlouisfed.org/2021/03/long-term-trends-in-car-and-light-truck-sales/
[7] Bureau of Transportation Statistics, Average Age of Automobiles and Trucks in Operation in the United States, https://www.bts.gov/content/average-age-automobiles-and-trucks-operation-united-states

VisionEval Input	Reference case – 2035 assumptions	Climate Smart Strategy Proxy – 2035 assumptions	Notes on current assumptions
		service than under the Reference case	population.[8] The region plans to increase transit service significantly,[9] but agencies have cut service during the COVID pandemic.
Pay-As-You-Drive Insurance	18% of the region uses pay-as-you-drive (PAYD) insurance	40% of the region uses PAYD insurance	Both scenarios assume that 6% of drivers use PAYD in 2020.
Employer-based Travel Options Programs	5.5% of workers receive regular travel options programming	40% of workers receive regular travel options programming	
Household-based Travel Options Programs	<1% of households receive regular travel options programming	45% of households receive regular travel options programming	

[8] TriMet, TriMet Service and Ridership Statistics, November 30, 2021. https://trimet.org/about/pdf/trimetridership.pdf.

[9] Metro, Regional Transit Strategy, 2018 Regional Transportation Plan, December 6, 2018.

TRANSPORTATION RESEARCH AND MODELING SERVICES

Metro transportation modeling

Transportation modeling is an essential component of planning for regional infrastructure improvements, such as highway and transit projects. The process of travel demand forecasting uses what we know about the existing world to predict what conditions will be like in the future. It is not a guess or an estimate, but a projection based on empirical data and foreseeable circumstances. The transportation modeling used in the Portland metro region is peer-reviewed and validated against observed data. Past model performance on project forecasts is another relevant indicator for model validation.

To understand how people will make trips, modelers look at the reasons why people travel. The model takes into consideration the real choices made by residents in our region. This information is collected from rigorous surveys. Metro's last survey--the Household Travel Behavior Study--tracked 6,000 households to understand how factors such as age, income, children, car ownership, and transportation infrastructure characteristics affect travel choices.

Data input into the transportation model includes population and employment, both existing conditions and forecast, in a way that is consistent with local comprehensive plans as well as roadway and transit routes.

In the model, our region is divided into over 2,000 discrete geographic areas called transportation analysis zones. Census data, land characteristics, economic factors and accessibility measurements feed into land use models that project the number of households and jobs located in each zone.

Metro uses a standard four-step modeling process for travel demand forecasting. This four-step process consists of the following parts:

1. Trip generation
2. Trip distribution
3. Mode choice
4. Trip assignment

Trip generation: Do I want or need to take a trip?

The first step in the modeling process forecasts the number and types of trips generated from each transportation analysis zone. The projection is based on the number and demographic profiles of households and employment in each zone.

Households are separated into 64 profiles stratified by size, income and age. Employment is categorized into nine types, ranging from service sector and retail, to finance and agriculture. Using behaviors identified in the Household Travel Behavior Study, the model forecasts the likelihood of households to make certain types of trips based on household type and employment mixes in each zone. Trip types are classified as work, shopping, recreation, college, school, and other.

Trip distribution: Where do I want to go?

Next, the model predicts where the trips produced in the first step are destined. Each zone's availability of attractions—work, shopping, recreation and other opportunities—and the accessibility (access to auto networks and transit) from the zones where trips are produced determines where trips are likely to go.

continued

For more information on transportation modeling in the Portland Metro region, contact the Metro Research Center at 503-797-1915.

Metro

Clean air and clean water do not stop at city limits or county lines. Neither does the need for jobs, a thriving economy and good transportation choices for people and businesses in our region. Voters have asked Metro to help with the challenges that cross those lines and affect the 25 cities and three counties in the Portland metropolitan area.

A regional approach simply makes sense when it comes to protecting open space, caring for parks, planning for the best use of land, managing garbage disposal and increasing recycling. Metro oversees world-class facilities such as the Oregon Zoo, which contributes to conservation and education, and the Oregon Convention Center, which benefits the region's economy

Mode choice: How will I get there?

As in the real world, travelers in the model have many transportation choices, including walking, biking, driving alone or with others, and walking or driving to transit. For the model to forecast travel demand with a reasonable degree of confidence, it must account for why people make those decisions.

The model considers the following factors when determining mode choice:

- Cost - What are the expenses of operating and maintaining a car? Are there parking expenses? How much does transit cost? Are there tolls?
- Travel time - Is it faster to drive, take transit, walk or bike?
- Auto availability - Do I have access to a car?
- Transit access - Can I get to transit easily?
- Urban design - Am I in a high-density, mixed-use area where I'm more likely to walk or bike?
- Socio-economic relationships - What is my household income? Are there as many cars as employed people in my household?

Trip assignment: What route should I take?

The model uses data from the previous three steps to simulate the way people will travel. For auto trips, the model assigns traffic to streets in specified time periods. The model assumes the availability of multiple routes between origins and destinations, accounting for congestion.

The base year assignment of vehicle trips is validated against actual traffic counts to ensure that the model is performing well. To forecast the transit trips route, the model considers the time segments of the journey, including walk time, wait time and time in vehicle. Again, the results of a model run are validated to actual transit boarding counts.

Model review

Transportation modeling plays a crucial role in funding and implementing transit projects. Therefore, the Federal Highway Administration and Federal Transit Administration require regular reviews of the travel demand model to ensure that it meets federal guidelines. Metro's transportation model and its outputs are regularly peer-reviewed by modeling professionals from academia, consulting firms, and metropolitan planning organizations, as well as the Federal Transit Administration.

For more information on transportation modeling, visit Metro's Transportation Research and Modeling Services program:

www.oregonmetro.gov/transportationmodeling

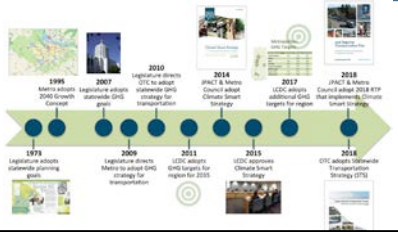
Metro, 600 NE Grand Ave., Portland, OR 97232-2736

2023 Regional Transportation Plan Update

Climate and Transportation Expert Panel

June 22, 2022

History of reducing climate pollution from transportation in Oregon



2

Regional Greenhouse Gas Targets

per capita light vehicle greenhouse gas emissions reduction below 2005 levels (in addition to reductions anticipated from changes to fleet and technology)

OAR 660-044 adopted by the Oregon Land Conservation and Development Commission in 2011 and amended in 2017

Metropolitan area	2035 Target	2040 Target	2050 Target
Portland Metro[1]	20%	25%	35%
Albany	--	20%	30%
Bend	18%	20%	30%
Corvallis	21%	20%	30%
Eugene-Springfield[2]	20%	20%	30%
Middle Rogue	--	20%	30%
Rogue Valley	19%	20%	30%
Salem-Keizer	17%	20%	30%

[1] Required scenario planning, adoption and implementation
[2] Required scenario planning

3

2040 Growth Concept is our platform for local and regional climate action

Adopted in 1995

Implemented through adopted community and regional plans

Building toward six desired outcomes

4

Climate Smart Strategy

Regional policies and strategies for reducing emissions

Adopted in 2014 and approved by LCDC in 2015

5

Extensive, inclusive engagement built the Climate Smart Strategy

6

How were we doing in 2018?

We were making satisfactory progress if we fully implement the 2018 RTP, but recognized more work and funding needed

We exceeded Climate Smart targets for:

- land use and growth in 2040 mixed-use centers
- transit service hours
- households served by frequent transit service

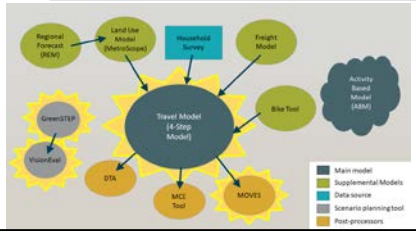
We fell short of RTP targets for:

- sidewalk and biking system completion
- tripling walking, biking and transit mode share
- reduced per capita vehicle miles traveled by 10 percent by 2040

oregonmetro.gov/rtp

7

Metro's Climate Analysis Toolbox



8

2040 Growth Concept (1995)

Region's first scenario planning effort

Travel Demand Model (early version)

MOBILE6 (air quality)

9

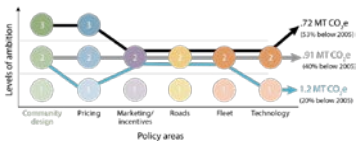
What is GreenSTEP?

A strategic planning tool that **estimates VMT and GHG emissions** based on demographic, roadway, fuel, and vehicle characteristics

10

Climate Smart Strategy Approach (2014)

Tested 144 combinations



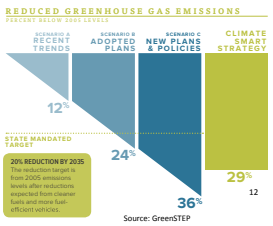
11

oregonmetro.gov/climatestrategy

Climate Smart Strategy Scenarios

144 scenarios narrowed to 3

3 scenarios narrowed to our preferred scenario



What is the travel model?

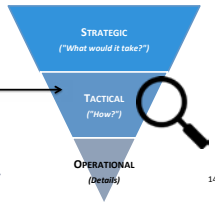
aka "the regional travel demand model"
aka "the 4-Step model"
aka "the trip based model"
aka "the federally mandated model"

- A network-based simulation of the ground transportation system
- A tool for testing future transportation alternatives
- A behavioral model based on observed choices
- The tool we must use for all regional transportation plans and NEPA activities

13

Emissions Modeling with MOVES

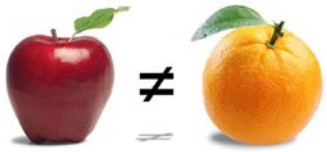
MOVES
+
Regional Travel Demand Model
=
Estimates emissions
(GHGs, criteria pollutants and air toxics)



14

Comparing apples and oranges

Results vary greatly depending on how you define the target and what you measure (e.g., year, household, on-road, per capita, vehicles, etc.)



15

What we learned from the 2018 Regional Transportation Plan

We can expect to meet our climate goals if:

- we fund and implement our plan
- funding of projects and programs in the plan are prioritized based on their potential carbon reduction

We should continue to improve our tools to measure and track carbon emissions

- 46 percent

expected reduction in per capita greenhouse gas emissions from passenger vehicles by 2040 (compared to 2015 levels)

Source: Metro regional travel demand model and Metro regional emissions model (MOVES)

16

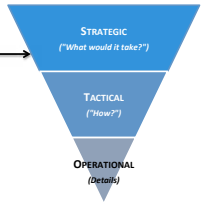
Evolution of VisionEval Suite of Tools

GreenSTEP->EERPAT->RSPM

VisionEval

VE-State

VE-RSPM
(Regional Strategic Planning Model)



17

What we've done since 2018

Developed regional VE-RSPM in partnership with ODOT and the City of Portland

Used by the City of Portland to support GHG planning

Can be used in 2023 RTP

Consistent with State level target setting tools

18

Where do we go from here?

19

oregonmetro.gov/rtp

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June 22, 2022 Climate Smart Expert Panel Registrant List

Adams	Steve	City of Milwaukie
Albrecht	Gary	Clark County Public Works
Alfred	Roger	Metro
Amiton	David	Oregon Department of Transportation
Andersen	Michael	Sightline Institute
Anderson	Jovi	Bend Metropolitan Planning Organization
Appanaitis	Garth	DKS Associates
Appenbrink	Nadine	
Armstrong	Tom	City of Portland
Ayers	Connor	Metro
Barker	Ken	volunteer
Barrett	Andrew	Wilsonville
Bassok	Alon	Washington State Department of Transportation
Bates	Jordan	Representative Maxine Dexter
Bayer	Maureen	Jordan Ramis
Bell	Katherine	Oregon DOT
Benoit	Emily	City of Vancouver
Berry	Jessica	Multnomah County
Bettinardi	Alex	Oregon DOT
Bezner	Mike	Clackamas County
Blackhorse	Summer	Metro
Bolen	Glen	ODOT
Bosa	Peter	Oregon Metro
Boyd	Allison	Multnomah County
Boylan	Kevin	City of Beaverton
Bradway	Margi	Oregon Metro
Breakstone	Aaron	Metro
Brey	Hailey	
Bruun	Scott	Oregon Business & Industry
Buchanan	Paul	
Buehrig	Karen	Clackamas County
Callaway	Steve	City of Hillsboro
Campos	Jennifer	RTC
Carlson	Suzanne	ODOT
Celentano	Andrea	Metro
Cheek	Maddie	City of Tualatin
Cho	Grace	Metro Planning and Development
Christopher	Basil	
Clarke	Kelly	Lane Council of Governments
Collins	Tim	Metro
Cooney-Mesker	Molly	Metro
Cooper	Colin	City of Hillsboro
Craddick	Shirley	Metro Council/JPACT Chair
Cunningham	William	City of Portland Bureau of Planning and Sustainability
Daleo	Sharon	City of Portland
Dartnell	Camilla	
David	Lynda	RTC

Dea	John	City of Gresham
Deffebach	Christina	Washington County
Degner	Andrew	Portland Metro Regional Water Consortium
Deke	Tyler	Bend MPO
DeMarco	Lyndsey	Air Sciences Inc
DePriest	Patrick	ODOT
DePriest	Patrick	ODOT
Dill	Jennifer	Portland State University
DiLoreto	Greg	
Dirks	Greg	City of Wood Village
Dobson	Cassandra	Parametrix
Dolata	Mat	WSP
Dorfman	Rachel	Lane Council of Governments
Drake	Markley	Happy Valley
Dyar	Ryan	City of Milwaukie
Edgar	Paul O.	Transportation Systems and Consulting Analyst
Elbel	Elizabeth	Oregon DEQ
Elias	Evan	Oregon Dept. of Energy
Ellis	Kim	Metro
Engelmann	Jessica	City of Beaverton
Farwell	Tracy	Better Energy LLC
Fenton	Kellie	
Flynn	Dan	U.S. Department of Transportation Volpe Center
Francis	Carley	WSDOT
Freels	Michael	Oregon Department of Energy
Frohning	Rebecca	
Fryer	Barbara	City of Cornelius
Garber	Sorin	Sorin Garber & Associates
Gonzalez	Juan Carlos	Metro Regional Government
Gregor	Brian	Oregon Systems Analytics LLC
Gudman	Jeff	
Hackett	Sarah	Oregon Department of Transportation
Hampton	Matthew	Metro
Handy	Susan	UC Davis
Hardesty	Jo Ann	Portland City Commissioner
Hesse	Eric	PBOT
Higgins	Jay	City of Gresham
Hogg	Mel	Portland Bureau of Transportation (PBOT)
Holmqvist	Ally	Metro
Holmstrom	Bill	State of Oregon
Holthoff	Michael	Oregon Department of Transportation
Hoover	Sylvan	Oregon Department of Transportation
Hunrichs	Lisa	Oregon Metro
Hurley	Peter	Portland Bureau of Transportation
Hyzy	Kathy	JPACT Clackamas Cities Rep
Hyzy	Kathy	JPACT
Iannarone	Sarah	The Street Trust

Ibrahim	Idris	
Isbell	Grayson	ODOT
Jackson	Raymond	MWVCOG
Jefferson	Dwight	City of Portland Oregon
John	Jennifer	Interstate Bridge Replacement Program - Parametrix
Johnson	Chris	Metro
Kaempff	Daniel	Metro
Kelley	Steve	Washington County
Kelly	Katherine	CITY OF VANCOUVER
Kennedy	Rebecca	City of Vancouver WA
Kim	Kyung-Hwa	Atlanta Regional Commission
Kloster	Tom	Metro
Knudson	Becky	Oregon DOT
Knudson	Anthony	Oregon DOT
Koper	Steve	City of Tualatin
Kransky	Gerik	Oregon Department of Environmental Quality
KRINKE	MARA	Parametrix
Krueger	Monica	Metro
KUBEJA	LUKAS	CJTN
Labbe	Ted	Urban Greenspaces Institute
Lacy	Cassie	City of Bend
Lalonde	Ginette	WSP USA
Lee	Tammy	PSU
Lem	Lewis	Port of Portland
LEPROWSE	RYAN	
Lew	Shoshana	Colorado Department of Transportation
Lewis	Christine	Metro
Lightsey-Walker	André	The Street Trust
Liljenwall	Sharon	Oregon DOT
Lorenzini	Jaimie	City of Happy Valley
Lyman	Kate	TriMet
Mai	Chi	Oregon Department of Transportation
Main	Eric	Oregon Health Authority
Mangle	Katie	Alta Planning + Design
Marchant	Bret	Greater Portland Inc
Martin	Shannon	City of Gresham
McTighe	Lake	Oregon Metro
Melson	Christopher	Louisiana Transportation Research Center
Mermin	John	Metro
Meyer	Cody	DLCD
Milam	Ronald	Fehr & Peers
Millar	Stephanie	ODOT
Moland	Abe	
Mooring	Jessica	Portland Bureau of Planning and Sustainability
Morgan	Brett	1000 Friends of Oregon
Morrison	Hannah	Portland Bureau of Transportation
Mros-O'Hara	Elizabeth	Metro

Murshed	Delwar	WSDOT
Nameny	Phil	City of Portland Bureau of Planning & Sustainability
Napoli	Andrea	Bend MPO
Neild	Pam	City of Portland
O'Brien	Tara	TriMet
Ocken	Julie	
Odermott	Don	City of Hillsboro
Olds	Jonathan	Washington State Department of Transportation
Orman	Michael	Oregon Department of Environmental Quality
Pagenstecher	Gary	City of Tigard
Patton	Thaya	Metro
Paykar	Victoria	Climate Solutions
Pederson	Cindy	Metro
Pepper	Amy	City of Wilsonville
Pepple	Karl	US EPA R10
Perrault	Ramona	Metro
Peters	Sarah	Fehr & Peers
Peters	Bill	Oregon DEQ
Prior	Garet	ODOT
Ramirez	Lucia	Oregon DOT
Ramos	Eduardo	Metro
Ransom	Matt	Southwest Washington Regional Transportation Cou
Rice	Carly	City of Gresham
Richardson	Carole	Plangineering LLC
Roberts	Stephen	Washington County
Roll	Josh	Oregon DOT
Rosenthal	Gerritt	Metro
Roth	Dave	City of Tigard
Routh	Steph	Sightline Institute
Royce	Francie	npGreenway
Ruen	Cameron	Clackamas County
Ruenjinda	Piyawee	
Sapunar	Kim	MWVCOG SKATS
Schlosshauer	Kari	City of Portland
Schuytema	Peter	Oregon DOT
Sherman	Brett	City of Happy Valley
Shoaf	Syd	Lane Council of Governments
Skiles	Michaela	Metro
Small	Rebecca	City of Vancouver
Smith	Chris	Portland Transport
Sosnovske	Julie	Washington County, OR
Stasny	Jamie	
Steckler	Becky	Urbanism Next Center at the University of Oregon
Stowers	Robyn	Metro
Sundquist	Eric	California Department of Transportation
Takushi	Theresa	State of Colorado - Department of Transportation
Thomasson	Catherine	Dpo

Todd	Kendra	
Tracy	Morgan	City of Portland-BPS
Tritsch	Emily	City of Tigard
Tsongas	Theodora	
TU	THUY	Thuy Tu Consulting, LLC
Turnoy	Scott	Oregon Department of Transportation
Valle	Shane	Portland Bureau of Transportation
Vissar	Vanessa	ODOT
Wardell	Erin	Washington County
Webb	Dayna	City of Oregon City
Weidner	Tara	Oregon DOT
White	Rebecca	Colorado Department of Transportation
Wilcox	Robin	ODOT, Public and Active Transportation Division
Wilhelmsen	Zoë	Colorado Department of Transportation
Williamson	Tonia	North Clackamas Parks & Recreation District
Wills	Heather	WSP
Wilson	Kate	LCOG
Winans	Kiara	DEQ
Wind	Cory-Ann	Oregon DEQ
Windsheimer	Rian	Oregon Dept. of Transportation
Winter	Caleb	Metro
Wolff	Emily	WSP
Wright	Sara	