



Metro | Agenda

Meeting: Metro Technical Advisory Committee
Date: Wednesday, April 2, 2014
Time: 10 a.m. to noon
Place: Council Chamber

Time	Agenda Item	Action Requested	Presenter(s)	Materials
10:00 a.m.	CALL TO ORDER Chair Updates <ul style="list-style-type: none"> Diversity Action Plan Survey 	Information	John Williams, Chair	In packet
	Citizen Comments to MTAC Agenda Items	Information	All	
10:10	Amendment to Metro Functional Plan Title 4 Regarding Establishment of Trails in Regionally Significant Industrial Areas <i>Objective: Inform MTAC of proposed amendments to Title 4 allowing trails in RSIA's</i>	Recommendation to MPAC	Roger Alfred, Metro	In packet
10:30	Climate Smart Communities Scenarios Project: Health Impact Assessment Findings <i>Objective: MTAC receives findings and recommendations from the Climate Choices Health Impact Assessment of the CSC scenarios</i>	Information	Andrea Hamberg & Nicole Iroz-Elardo; Oregon Health Authority	In packet
11:00	Climate Smart Communities Scenarios Project: MPAC & JPACT discussions to shape the draft preferred approach <i>Objective: MTAC receives an update on engagement activities and upcoming JPACT and MPAC discussions to shape the draft preferred approach</i>	Information	Kim Ellis, Metro	In packet
11:30	2015 Growth Management Decision: Draft population and employment forecast <i>Objective: Inform MTAC about the draft forecast and its peer review process</i>	Information	Ted Reid, Metro	At meeting
Noon	Adjourn			

(Continued)

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2014 MTAC Tentative Agendas As of 3/26/14

April 16 MTAC meeting <ul style="list-style-type: none"> • 2015 Growth Management Decision: Draft buildable land inventory • Findings from the 2014 RTP and 2015-2018 MTIP – Environmental Justice and Title VI analysis 	May 7 MTAC meeting <ul style="list-style-type: none"> • Staff recommendation on potential refinements to the draft public review ATP from public comments • CSC: Preview of draft public engagement report and emerging ideas for draft preferred approach • RTP recommendations to MPAC on potential refinements from public comments
May 21 MTAC meeting <ul style="list-style-type: none"> • Comments from the Chair: 2014 RTP Process Update/Share air quality conformity results • Climate Smart Communities: Discuss draft preferred approach 	June 4 MTAC meeting
June 18 MTAC meeting <ul style="list-style-type: none"> • Recommendation to MPAC on ATP adoption resolution • Recommendation to MPAC on 2014 RTP ordinance 	July 2 MTAC meeting
July 16 MTAC meeting <ul style="list-style-type: none"> • Climate Smart Communities: discuss proposed RFP amendments and near-term implementation recommendations 	August 6 MTAC meeting <ul style="list-style-type: none"> • Climate Smart Communities: discuss proposed RFP amendments and near-term implementation recommendations
August 20 MTAC meeting <ul style="list-style-type: none"> • 2015 Growth Management Decision: draft 2014 Urban Growth Report 	September 3 MTAC meeting <ul style="list-style-type: none"> • 2015 Growth Management Decision: Residential Preference Survey • Climate Smart Communities: discuss evaluation results and public review of draft preferred approach
September 17 MTAC meeting	October 1 MTAC meeting
October 15 MTAC meeting <ul style="list-style-type: none"> • 2015 Growth Management Decision: 2014 Urban Growth Report (recommendations to MPAC) • Climate Smart Communities: discuss public comments & begin discussion of recommendations to MPAC 	November 5 MTAC meeting <ul style="list-style-type: none"> • 2015 Growth Management Decision: 2014 Urban Growth Report (recommendations to MPAC) • Climate Smart Communities: discuss public comments & begin discussion of recommendation to MPAC

November 19 MTAC meeting	December 3 MTAC meeting
December 17 MTAC meeting	***

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BEFORE THE METRO COUNCIL

FOR THE PURPOSE OF AMENDING)	ORDINANCE NO. 14-XXXX
TITLE 4 OF THE URBAN GROWTH)	
MANAGEMENT FUNCTIONAL PLAN)	Introduced by Martha J. Bennett, Chief
REGARDING THE ESTABLISHMENT OF)	Operating Officer, with the concurrence of
TRAILS IN REGIONALLY SIGNIFICANT)	Tom Hughes, Council President
INDUSTRIAL AREAS)	
)	

WHEREAS, on December 16, 2010 the Metro Council adopted Ordinance No. 10-1244B, which included amendments to Title 4 (Industrial and Other Employment Areas) of the Urban Growth Management Functional Plan (UGMFP); and

WHEREAS, those amendments included the addition of new protections for Regionally Significant Industrial Areas (RSIAs) under Metro Code Section 3.07.420.D that require cities and counties within the Metro region to adopt land use regulations for RSIAs that “prohibit the siting of parks intended to serve people other than those working or residing in the RSIA”; and

WHEREAS, on February 28, 2013 the Metro Council adopted Resolution No. 13-4415 approving Metro’s Ice Age Tonquin Trail Master Plan, which describes a proposed 22-mile regional trail facility connecting the Tualatin River to the Willamette River and includes a preferred trail alignment that crosses through an area southwest of the City of Tualatin that is mapped with an RSIA designation; and

WHEREAS, on November 1, 2013 the Land Use Board of Appeals (LUBA) issued an opinion in Terra Hydr v. City of Tualatin, LUBA No. 2013-016, holding that the proposed regional trail described by Metro’s Ice Age Tonquin Trail Master Plan fell within the meaning of a “park” as that word is used in Metro Code 3.07.420.D and therefore would not be allowed within the RSIA; and

WHEREAS, the Metro Council has determined that the protections created in Metro Code 3.07.420.D should not be construed to prohibit trails that provide active transportation options and pedestrian and bicycle connectivity from crossing through an RSIA; now therefore,

THE METRO COUNCIL ORDAINS AS FOLLOWS:

1. Section 3.07.420.D of the Metro Code is hereby amended as follows:

“D. Cities and counties shall review their land use regulations and revise them, if necessary, to prohibit the siting of schools, places of assembly larger than 20,000 square feet or parks intended to serve people other than those working or residing in the RSIA. Nothing in this subsection is intended to prohibit trails from being located within an area designated RSIA on Metro’s Title 4 Map.”

ADOPTED by the Metro Council this _____ day of _____ 2014.

Tom Hughes, Council President

Attest:

Approved as to Form:

Kelsey Newell, Recording Secretary

Alison R. Kean, Metro Attorney

Executive Summary

Community Climate Choices Health Impact Assessment

Climate change may pose serious risks to public health. Significant shifts in the climate are already happening. The Third National Climate Assessment found that as the climate continues to change, Oregon will likely experience more frequent heat waves and wildfires, an increase in asthma and other respiratory diseases, changes in disease patterns, and diminishing water quality and quantity [1]. Curbing climate change is a critical public health issue and national public health officials support efforts across the nation to reduce greenhouse gas (GHG) emissions.

The recommendations offered in this Community Climate Choices Health Impact Assessment (CCC HIA) will be considered during Phase 3 of Metro's Climate Smart Communities Scenarios (CSCS) Project, underway in the Portland, Oregon metropolitan region. The focus of the project is to understand and choose the best way to reduce GHG emissions through transportation and land use strategies. The CSCS Project seeks to reduce GHG emissions by reducing per capita vehicle miles traveled (VMT) for light duty-vehicles and by investing in technologies that reduce emissions.

Community Climate Choices Health Impact Assessment Scope

Geography: Portland, Oregon metropolitan region within the Urban Growth Boundary

Timeline: 2010 (base year) to 2035 (horizon year)

Scenarios - adopted local and regional plans with:

A: existing revenues

B: increased revenues from existing sources

C: new plans, policies and revenue sources

Exposure pathways: physical activity, traffic safety, air quality, land use

Quantitative tool: Integrated Transportation Health Impact Model (ITHIM)

Other considerations: magnitude of health costs associated with health pathways, vulnerable populations.

Health Impact Assessment (HIA) is a way to consider how a policy or plan affects community health before the final decision is made. By providing objective, evidence-based information, HIA can increase positive health effects and mitigate unintended health impacts. The Public Health Division of Oregon Health Authority (PHD) conducted this assessment at Metro's request, with funds provided by the Center for Disease Control and Prevention's Healthy Community Design Initiative.

Investments in land use and transportation systems that reduce GHG emissions positively impact health by increasing physical activity, reducing traffic collisions and improving air quality. PHD and Metro agreed that the CCC HIA is necessary to better inform Metro and its partners in the selection of a final scenario by December 2014.

Key findings

This analysis found that the strategies under consideration to reduce GHG emissions also result in important health benefits in all exposure pathways, including increased physical activity, fewer traffic injuries and less exposure to air pollutants. These changes are likely to reduce illness and death in the region.

Through a literature review including 348 peer-reviewed articles and government reports linking the built environment to health, PHD found most of the land use strategies under consideration for the CSCS Project promote health. Evidence shows that elements such as level of residential density, land use mix, the number of nearby community destinations and ease of street connectivity are effective at promoting active transportation. Scenario B and C subsections labeled ‘Complete Streets and Active Transportations Investments’ support healthy behaviors the most. These strategies include better street connections, safer street crossings, wider sidewalks, safer street crossings, improved bus stops, more bikeways, trails and on-street bicycle facilities, and more efficient operation of transit signals.

The literature also aligns with advisory members’ equity concerns. Low-income households in search of affordable housing options may locate in neighborhoods that are not well-served by affordable transportation options and have fewer health-supportive amenities. This underscores the need to create and preserve affordable housing options in areas that are well-served by transit.

Integrated Transport and Health Impact Model (ITHIM)

In addition to literature reviews for all pathways, PHD also used a quantitative model, ITHIM, to help understand the relative impact of each of three exposure pathways — physical activity, traffic safety and air pollution as measured by particulate matter (PM2.5) [2]. ITHIM uses relative risks and burden of disease to estimate avoided illnesses (as measured by disability adjusted life years) and deaths for nine conditions associated with physical activity, three conditions linked to PM2.5 exposure, and current traffic fatality rates. A clear limitation of ITHIM is it underestimates all health benefits by restricting calculations to certain pathways and diseases.

Results from ITHIM predict that strategies for reducing GHG emissions will promote health; health benefits occur in all exposure pathways for all scenarios. Scenario A levels of investment are expected to contribute to 64 avoided premature deaths annually. Scenarios B and C would result in 98 and 133 avoided premature deaths respectively. Every 12% decrease in GHG — the difference between each successive scenario — results in an approximate 0.65% decrease in illness among diseases studied.

Physical activity

The most significant and attainable health benefit of active transportation is increased physical activity. Increased physical activity from active transportation could account for as much as 86–91% of avoided deaths and 69–84% of avoided illness resulting from implementing the CSCS project.

We can improve our region’s health and reduce premature deaths by increasing the number of people who regularly walk or bike to the library, school, work, church or store. A safe and convenient transportation system provides individuals with the flexible and healthy options they need to routinely

choose more active modes of transportation. Prioritizing non-automobile users in the design and maintenance of streets increases the safety of all users and will facilitate walking, bicycling and use of public transit.

Traffic safety

Reduced GHG emissions through lower per capita vehicle miles traveled (VMT) results in fewer overall traffic fatalities and injuries. Scenario A results in one avoided traffic fatality per year and decreases disabilities from serious injuries (measured by disability adjusted life years or DALYs) by 2.0%. Scenario C would help avoid 12 traffic fatalities and 12.5% of DALYs from serious injuries a year.

Due to the increase in miles covered in active transportation modes, ITHIM shows the absolute numbers of pedestrian and bicycle fatalities will rise even as the rate decreases due to population growth. While physical activity benefits outweigh the risks of active transportation, effort should be made to mitigate traffic hazards for pedestrians and cyclists through traffic calming, street design and mode separation. Efforts should also be made to capture the 53% of ‘interested but concerned’ individuals in the region who would like to bike, but are worried about safety issues.

Air quality

Improved air quality is an important benefit of addressing GHG. Metro is targeting aggressive GHG emission reductions of 12, 24 and 36% for Scenarios A, B and C respectively. However, Metro’s scenarios result in only modest PM2.5 reductions of 2.8, 3.2 and 3.6% due to population growth and reliance on fleet change and fuel technologies. ITHIM results predict a modest decrease in respiratory illness, heart disease cases associated with air pollution, and premature death of lung cancer patients from long-term PM2.5 exposure.

ITHIM only incorporates long-term exposure to PM2.5 and may underestimate health benefits associated with improved air quality. As suggested by the Portland Air Toxics Solutions Project, additional benefits may accrue from lower ambient ozone and air toxic concentrations.

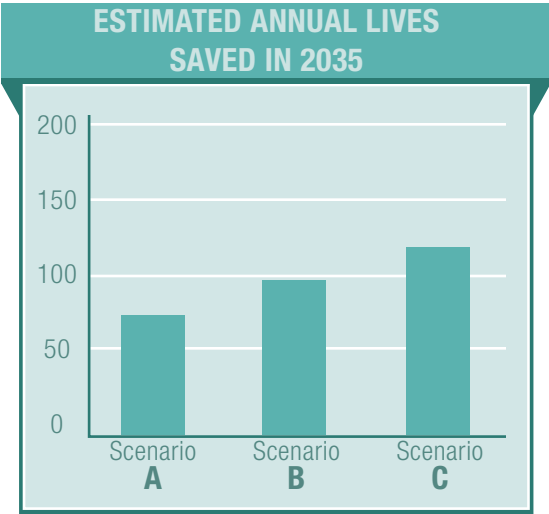
There is no safe level of PM2.5 exposure and current average concentrations of ozone are above safe levels. Episodic PM2.5 (winter) and ozone (summer) events require regional solutions such as leading public efforts to change travel behavior in order to minimize health risk. Poor air quality can be localized and many vulnerable populations live near transportation corridors. Care should be taken to influence increased physical activity while minimizing exposure when designing active transportation facilities and adjoining transportation corridors.

Recommendations

Climate change poses a risk to the future health of Oregonians. Proposed strategies to mitigate climate change will also increase health benefits associated with physical activity, traffic safety and improved air quality. Based upon the findings of this report and with the support of the CCC HIA Advisory Committee, PHD has developed a series of recommendations to preserve and promote healthy communities throughout the region.

By developing and implementing a preferred scenario that meets or surpasses the GHG emissions reduction target set by the Department of Land Conservation and Development, PHD anticipates an improvement in public health.

The majority of health benefits from the CSCS Project can be attributed to active transportation such as walking and biking to work, transit, school and community destinations. Based on this evidence, this HIA recommends that Metro maximize opportunities for active transportation for all communities by:



- Adopting and identifying stable funding for the design elements listed in the subsection ‘Complete Streets and Active Transportation Investments’ of Scenarios B and C: street connections, wider sidewalks, safer street crossings, improved bus stops, bikeways, transit signal priority, and on-street bicycle facilities and trails.
- Improving transit service miles to meet levels recommended in Scenario C.
- Using an equity analysis to plan and develop equal access to active transportation throughout the region.
- While the benefits of physical activity far outweigh the risks, active modes of transportation can lead to increased exposure to traffic injury and air pollution. In order to reduce the risk of increased exposure to traffic injury and air pollution for all road users, this HIA recommends that Metro prioritize the design and maintenance of non-automobile facilities by:
 - Including safety features for pedestrians and bicyclists, such as separation from motorized traffic, when possible. Prioritize non-automobile users in design and maintenance of streets.
 - Providing a parallel bicycle route one block removed from high-volume roads where feasible to reduce exposure to localized pollution while still maintaining access to community destinations.

Per capita VMT reduction is expected to modestly improve air quality as measured by many pollutants including air toxics, but temporal and localized air quality concerns remain. Due to temporal and spatial air quality concerns, this HIA recommends that Metro maximize overall improvements in air quality through actions such as:

- Aligning the CSCS preferred alternative to PATS goals. In collaboration with DEQ, determine how the preferred alternative helps meet Oregon’s adopted ambient benchmark concentrations.
- Reducing exposure by using zoning and incentives to improve indoor filtration systems in new buildings along transportation corridors.
- Convening a regional committee to further address episodic air quality events. Solutions should be season specific and could promote incentives for short-term, alternative commute arrangements.
- Finally, to improve health equity, this HIA recommends Metro ensure social and health goals are considered when prioritizing investments by:
 - Explicitly and transparently addressing how investment links low-income and other vulnerable households to health-promoting resources.



PUBLIC HEALTH DIVISION
Environmental Public Health
Center for Prevention and Health Promotion

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The full report is available at: www.healthoregon.org/hia

COMMUNITY CLIMATE CHOICES

Health Impact Assessment (HIA)



Flexible, safe, reliable transportation systems
PROVIDE HEALTHY CHOICES.

Community Climate Choices

Health Impact Assessment

Health Impact Assessment Program
Environmental Public Health Tracking Program
Environmental Public Health
Center for Prevention and Health Promotion
Public Health Division
Oregon Health Authority



Prepared by:

Nicole Iroz-Elardo, Ph.D. (c)
Policy Analyst
HIA Program

Andrea Hamberg, B.A.
Program Coordinator
HIA Program

Eric Main, A.I.C.P.
GIS Analyst
EPHT

Julie Early-Alberts, M.S.
Manager, Healthy Communities Unit
Environmental Public Health

Acknowledgments:

We would like to thank the members of this project's Advisory Group for their time, expertise and participation in this HIA. See appendix B for a complete list of the Advisory Group.

We would like to thank Metro, especially Kim Ellis and Thaya Patton for their assistance, and the Oregon Department of Transportation, in particular Brian Gregor, for providing data and support for the assessment. We would also like to thank Kim Ellis, Elizabeth Clapp, Lainie Smith, Sarah Armitage, Aida Biberic, John McArthur, Barbara Pizacani, and Brendan Haggerty for their thorough review of an early draft of this report. We are grateful to Dr. James Woodcock at the Centre for Diet and Activity Research, Cambridge Institute of Public Health, for allowing us to use ITHIM and for his expert consultation throughout the project, and to Dr. Neil Maizlish at the State of California Department of Public Health for sharing his ITHIM results with us.

Finally, we thank this project's funders, the Centers for Disease Control and Prevention's Healthy Community Design Initiative, for their continued support to build state and local capacity to conduct Health Impact Assessment in Oregon. The contents of this document are solely the responsibility of the authors, and do not represent the views of the Centers for Disease Control and prevention.

Suggested citation: Iroz-Elardo N, Hamberg A, Main E, Early-Alberts J, Douglas, J.P. *Community Climate Choices Health Impact Assessment*. Oregon Health Authority. March 2014: Portland, OR

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ACRONYMS

BRFSS	Behavioral Risk Factor Surveillance System
CCC	Community Climate Choices
CSCS	Climate Smart Communities Scenarios
DALY	disability adjusted life years (sum of YLL and YLD)
DEQ	Oregon Department of Environmental Quality
GHG	greenhouse gas
GreenSTEP	Greenhouse Gas Strategic Transportation Energy Planning Model
HIA	Health Impact Assessment
ITHIM	Integrated Transport and Health Impact Model
LDV	light-duty vehicle (gasoline powered)
ODOT	Oregon Department of Transportation
PHD	Public Health Division of the Oregon Health Authority
PATS	Portland Air Toxics Solutions
VMT	vehicle miles traveled
WHO	World Health Organization
YLD	years of life with a disability
YLL	years of life lost

EXECUTIVE SUMMARY

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Key findings

This analysis found that the strategies under consideration to reduce GHG emissions also result in important health benefits in all exposure pathways, including increased physical activity, fewer traffic

CCC HIA Scope

Geography: Portland, Oregon metropolitan region as defined by the Urban Growth Boundary

Timeline: 2010 (base year) to 2035 (horizon year)

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A: existing revenues

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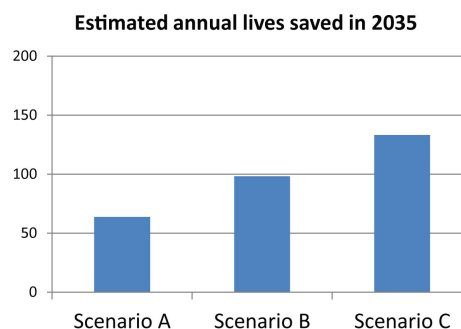
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We can improve our region's health and reduce premature deaths by increasing the number of people who regularly walk or bike to the library, school, work, church or store. A safe and convenient transportation system provides individuals with the flexible and healthy options they need to routinely choose more active modes of transportation. Prioritizing non-automobile users in the design and maintenance of streets increases the safety of all users and will facilitate walking, bicycling and use of public transit.

The CDC recommends 150 minutes per week of moderate physical activity for adults. Meeting this goal can increase life expectancy and reduce expensive and debilitating diseases. Nearly half of all Oregonians do not meet this recommendation.

Traffic safety

Reduced GHG emissions through lower per capita vehicle miles traveled (VMT) results in fewer overall traffic fatalities and injuries. Scenario A results in one avoided traffic fatality per year and decreases disabilities from serious injuries (measured by disability adjusted life years or DALYs) by 2.0%. Scenario C would help avoid 12 traffic fatalities and 12.5% of DALYs from serious injuries a year.

Due to the increase in miles covered in active transportation modes, ITHIM shows the absolute numbers of pedestrian and bicycle fatalities will rise even as the rate decreases due to population growth. While physical activity benefits outweigh the risks of active transportation, effort should be made to mitigate traffic hazards for pedestrians and cyclists through traffic calming, street design and mode separation. Efforts should also be made to capture the 53% of 'interested but concerned' individuals in the region who would like to bike, but are worried about safety issues.

Air quality

Improved air quality is an important benefit of addressing GHG. Metro is targeting aggressive GHG emission reductions of 12, 24 and 36% for Scenarios A, B and C respectively. However, Metro's scenarios result in only modest PM_{2.5} reductions of 2.8, 3.2 and 3.6% due to population growth and reliance on fleet change and fuel technologies. ITHIM results predict a modest decrease in respiratory illness, heart disease cases associated with air pollution, and premature death of lung cancer patients from long-term PM_{2.5} exposure.

Portland Air Toxics Solutions Project

DEQ created the Portland Air Toxics Solutions (PATS) project to develop air toxics reduction strategies for the Portland region.

In the Portland area success has been achieved in reducing lead, carbon dioxide and ozone (smog) to meet federal clean air standards.

Despite this progress, DEQ is concerned about air toxics, which are known or suspected to cause serious health problems including cancer, nerve damage and respiratory irritation.

www.deq.state.or.us/aq/toxics/pats.htm

ITHIM only incorporates long-term exposure to PM_{2.5} and may underestimate health benefits associated with improved air quality. As suggested by the Portland Air Toxics Solutions Project, additional benefits may accrue from lower ambient ozone and air toxic concentrations.

There is no safe level of PM_{2.5} exposure and current average concentrations of ozone are above safe levels. Episodic PM_{2.5} (winter) and ozone (summer) events require regional solutions such as leading public efforts to change travel behavior in order to minimize health risk. Poor air quality can be localized and many vulnerable populations live near transportation corridors. Care should be taken to influence increased physical activity while minimizing exposure when designing active transportation facilities and adjoining transportation corridors.

Recommendations

Climate change poses a risk to the future health of Oregonians. Proposed strategies to mitigate climate change will also increase health benefits associated with physical activity, traffic safety and improved air quality. Based upon the findings of this report and with the support of the CCC HIA Advisory Committee, PHD has developed a series of recommendations to preserve and promote healthy communities throughout the region.

By developing and implementing a preferred scenario that meets or surpasses the GHG emissions reduction target set by the Department of Land Conservation and Development, PHD anticipates an improvement in public health.

The majority of health benefits from the CSCS Project can be attributed to active transportation such as walking and biking to work, transit, school and community destinations. **Based on this evidence, this HIA recommends that Metro maximize opportunities for active transportation for all communities by:**

- Adopting and identifying stable funding for the design elements listed in the subsection ‘Complete Streets and Active Transportation Investments’ of Scenarios B and C: street connections, wider sidewalks, safer street crossings, improved bus stops, bikeways, transit signal priority, and on-street bicycle facilities and trails.
- Improving transit service miles to meet levels recommended in Scenario C.
- Using an equity analysis to plan and develop equal access to active transportation throughout the region.

While the benefits of physical activity far outweigh the risks, active modes of transportation can lead to increased exposure to traffic injury and air pollution. **In order to reduce the risk of increased exposure to traffic injury and air pollution for all road users, this HIA recommends that Metro prioritize the design and maintenance of non-automobile facilities by:**

- Including safety features for pedestrians and bicyclists, such as separation from motorized traffic, when possible. Prioritize non-automobile users in design and maintenance of streets.

- Providing a parallel bicycle route one block removed from high-volume roads where feasible to reduce exposure to localized pollution while still maintaining access to community destinations.

Per capita VMT reduction is expected to modestly improve air quality as measured by many pollutants including air toxics, but temporal and localized air quality concerns remain. **Due to temporal and spatial air quality concerns, this HIA recommends that Metro maximize overall improvements in air quality through actions such as:**

- Aligning the CSCS preferred alternative to PATS goals. In collaboration with DEQ, determine how the preferred alternative helps meet Oregon's adopted ambient benchmark concentrations.
- Reducing exposure by using zoning and incentives to improve indoor filtration systems in new buildings along transportation corridors.
- Convening a regional committee to further address episodic air quality events. Solutions should be season specific and could promote incentives for short-term, alternative commute arrangements.

Finally, to improve health equity, this HIA recommends Metro ensure social and health goals are considered when prioritizing investments by:

- Explicitly and transparently addressing how investment links low-income and other vulnerable households to health-promoting resources.

INTRODUCTION

Health can be defined as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”[3]. A health impact assessment (HIA) is a way to explicitly consider how a policy or plan facilitates a healthy community before a final decision is made. The objective, evidence-based information provided by the HIA can be used to inform public decisions to increase positive health effects and mitigate unintended health impacts. In this case, the HIA looks at how Metro’s Climate Smart Communities Scenarios (CSCS) Project may affect the health of people in the Portland metropolitan region.

The 2009 Oregon Legislature required the Portland metropolitan region to develop a plan to reduce per capita greenhouse gas emissions (GHG) from cars and small trucks by 20 percent below 2005 levels by 2035. The Public Health Division of the Oregon Health Authority (PHD) supports statewide efforts to reduce GHG because curbing climate change is a critical public health issue. There are many ways to reduce emissions while creating healthy, more equitable communities with a vibrant regional economy. The goal of this HIA is to help provide information on which strategies are most health protective and what potential solutions may be when strategies have unintended health consequences.

To meet reduced GHG benchmarks, Metro is targeting fewer per capita single-occupancy vehicle (SOV) trips and vehicle miles traveled (VMT) by increasing land use and transportation investments. The CSCS Project is focused on meeting the emission target by investing in communities and providing services and shopping near where people live, improving transit service, using technology to manage traffic flow, building a well-connected network of complete streets and providing safer routes for walking and biking.

Metro is also considering impacts on public health, the economy, the environment and equity as part of the planning effort. Transportation investments and land use affect health in important ways. Many of the planned investments and actions have been shown to increase walking, biking and use of transit and reduce how often and how far people drive to meet their everyday needs. This will likely add 20–30 minutes of additional daily physical activity for individuals who shift to more active modes, greatly reducing the physical inactivity disease burden.

The primary health benefit associated with reducing GHG through the CSCS Project is increased physical activity and associated positive health outcomes. The reliance on active transportation to decrease GHG provides the bulk of the health benefits; the final plan could maximize health returns by

The final plan could maximize health returns by increasing access and reducing barriers to biking, walking, and transit.

increasing access and reducing barriers to biking, walking, and transit. This HIA also found the proposed investments and action to reduce GHG could result in decreased cancer, cardiovascular and respiratory burden from cleaner air and decreased traffic injuries from managing congestion.

PROJECT OVERVIEW

Metro's Climate Smart Communities Scenario Project

This HIA informs Phase 3 of Metro's Climate Smart Communities Scenario (CSCS) project which will help choose the best investments and policies to reduce GHG emissions in the Portland metropolitan region. The plan includes strategies that will result in fewer per capita vehicle miles traveled (VMT) by gasoline-powered, light-duty vehicles (LDV). The HIA analyzed expected health benefits associated with reductions in per capita VMT and accompanying improvements in air quality and traffic conditions.

Metro's planning efforts are directed by a series of Oregon legislative mandates and administrative rules. The 2007 Oregon Legislature passed HB 3543 establishing statewide goals to reduce GHG emissions, calling for a reduction of 10% under 1990 levels by 2020 and 75% by 2050. These goals apply to all sectors, including energy production, buildings, solid waste and transportation. In 2009, the Oregon Legislature enacted HB 2001, a broad-based transportation bill that directed Metro to develop a preferred scenario to reduce GHG emissions from LDV while accommodating planned population and job growth. HB2001 also requires Metro to adopt the preferred scenario following public review and for local governments to implement the preferred scenario through local transportation and land-use plans. As a result of these legislative mandates, the Oregon Land Conservation and Development Commission (LCDC) set LDV GHG emissions reduction targets for each of Oregon's six largest metropolitan planning areas in June 2011. The Portland metropolitan area target calls for a 20% reduction below 2005 levels. This reduction is in addition to those expected from cleaner fuels and more fuel-efficient vehicles. A second LCDC rule-making effort in November 2012 required Metro to adopt a preferred scenario by December 31, 2014.

To meet the legislative mandates and administrative deadlines, Metro has developed a three-phase process to analyze transportation and land use strategies while engaging the broader community including both citizens and policy makers of local governments, state agencies, port commissions and transit providers. During 2011, Phase 1 tested 144 different scenarios with the help of stakeholder organizations. The results of PHD engagement in Phase 1 are found in the CSCS HIA, released in April 2013[4]. The CSCS HIA quantitatively analyzed six 'representative' scenarios for three health pathways: physical activity, air quality and traffic safety. This analysis showed proposed investments, policies and actions that reduce GHG emissions also reduce VMT, providing important health benefits in all three areas studied. Physical activity accounts for the majority of health benefits in all six scenarios due to the shift to more active modes of transportation.

In Phase 2, which began in 2012, Metro narrowed and refined the 144 different scenarios through extensive modeling, down to three alternative approaches. Scenario A assumes implementing adopted plans with existing revenues and essentially represents a low-investment scenario. Scenario B relies on increased revenues to fund priority investments, reflecting full implementation of the adopted Regional Transportation Plan. Scenario C assumes additional policy and infrastructure investment beyond current adopted plans and would require even more revenue and new funding sources. Scenario C includes

significant improvements to transit service across the region. All three scenarios assume there will be advancements towards cleaner fuels and more fuel-efficient vehicles.

In 2013 Metro released the results of Phase 2 of the CSCS project and has transitioned into Phase 3 – Community Choices. In Phase 3, Metro is seeking input from community and business leaders, local governments, state agencies and the public to determine which investments and actions should be included in a preferred scenario. Metro anticipates defining the draft preferred scenario in late spring 2014, with opportunities for public input in the fall of 2014. The Metro Council is scheduled to consider adoption of the preferred scenario in December 2014.

PHD and Metro agreed that a follow-up HIA, the Community Climate Choices HIA (CCC HIA), was necessary to better inform Metro and its partners in the selection of a final scenario. The CCC HIA provides additional information for Phase 3 decisions through a health-based analysis of the three scenarios developed in Phase 2. The HIA integrates an extended literature search with an update of the quantitative modeling as recommended by the previous HIA.

Climate, transportation, and public health

Climate impacts our health in many ways. Climate change-related events that may adversely affect public health include drought and reduced water supply; extreme heat; wildfires; extreme precipitation and flooding; severe winter storms; worsening air quality due to ozone pollution; decreased frost that leads to changes in vegetation patterns and longer growing seasons; and increases in vector- or insect-borne diseases. To mitigate the effects of climate change, many communities are implementing plans and policies that will reduce GHG emissions [1].

Addressing changing climate through land use and transportation investments, policies and actions has long-term health implications. This approach includes designing communities and streets to make walking, biking, and expanded transit service more safe and convenient. Creating communities that reduce barriers to walking and biking will increase the proportion of Portland metropolitan residents who are able to meet physical activity will increase heart health, reduce body mass index (BMI) and decrease risk for many chronic diseases.

Cancer and heart disease are currently the top two “underlying causes of death,” accounting for 48% of all deaths in Oregon[6]. This reflects a larger trends of chronic disease such as heart disease, Type II diabetes and cancer surpassing communicable and infectious disease as the primary cause of mortality (death) and morbidity (illness) in high-income countries such as the U.S.

Table 1. Top 10 risk factors ranked by attributable burden of disease, U.S. and Canada in 2010	
Rank (out of 43)	Risk factor
1	Tobacco smoking (including second-hand)
2	High BMI
3	High blood pressure
4	High fasting glucose
5	Physical inactivity and low physical activity
6	Diets low in fruits
7	Alcohol use
8	Diet low in nuts & seeds
9	High cholesterol
10	Drug use
Source: Global Burden of Disease Study, 2010[5]	

Behaviors linked to these chronic diseases, such as tobacco use, physical inactivity, poor diet, and alcohol and drug use have been identified as top risk factors for illness and death in Canada and the United States[5] (Table 1).

Screening and scoping with the advisory committee

In 2011, PHD was awarded a three-year grant through the CDC's Healthy Community Design Initiative. As part of this grant, PHD agreed to perform three HIAs to explore how to best integrate health considerations into transportation and community planning decisions. The PHD program prioritizes performing HIAs on regional or state-wide transportation and community planning decisions and relies heavily on consultation from a diverse set of multi-disciplinary stakeholders in the form of an advisory committee.

Health Impact Assessment (HIA) begins with a process of scoping with the advisory committee; through scoping, the specific pathways and health conditions of concern are identified and prioritized. The scope of this HIA was influenced a great deal by the previous CSCS HIA addressing Phase 1, which identified increased physical activity, traffic safety and cleaner air as potential ways that the final plan could affect health. It was clear that GHG emission reductions achieved by walking and biking to work and transit would result in significant health benefits through increased physical activity. As people drive less, they are less likely to be involved in traffic collisions. Driving less will also result in cleaner ambient air. These three pathways were addressed in the CSCS HIA released in April 2013.

In the CSCS HIA, PHD used the ITHIM model to help understand the relative impact of the three exposure pathways: physical activity, traffic safety, and air pollution as measured by $PM_{2.5}$ [2]. The ITHIM modeling assumed six scenarios representative of the 144 scenarios under consideration in Phase 1. ITHIM used information about the relative risk of 13 diseases given exposure to two types of inputs provided by ODOT's GreenSTEP model: measures of miles traveled by mode and particulate matter ($PM_{2.5}$) as an indicator of air quality¹. Results indicated that physical activity is the dominant pathway to health benefits. One of the recommendations of the CSCS HIA was to "carry out additional quantitative health impact assessment of the three scenarios that are identified for further evaluation in spring 2013 to further inform development and adoption of a final preferred scenario."

In early summer 2013, PHD and Metro followed that recommendation and began a second HIA – the Community Climate Choices HIA (CCC HIA) – to better inform Metro and its partners in the selection of a final scenario by December of 2014. To guide the CCC HIA, PHD reconvened 38 regional experts in land use and transportation planning, local governments and public health to help develop the CCC HIA in September 2013. See Appendix B for complete list. PHD held a series of small group and agency-specific

¹ ITHIM is limited to modeling pathways with known risk ratios: nine diseases linked to physical activity, traffic injuries and fatalities, and three diseases linked to $PM_{2.5}$ exposure. Please see Appendix E for more information about ITHIM methodology and limitations.

conversations in addition to full advisory committee meetings in order to maximize participation opportunities in the CCC HIA:

- June 19, 2013: Metro project review and HIA screening with Community Choices program staff.
- August 29, 2013: Meeting with DEQ Air Toxics program staff to discuss air quality questions and concerns raised during the CSCS HIA.
- September 19, 2013: First advisory committee small group conversation to discuss monetization options and finalize the HIA scope (12 participants).
- October 17, 2013: Second advisory committee small group conversation to review initial air quality findings and discuss equity implications (8 participants).
- October 31, 2013: Third advisory committee small group conversation to review initial land use findings and discuss equity implications (11 participants).
- November 12, 2013: Meeting with full advisory committee to review assessment findings, discuss framing considerations and develop draft recommendations (25 participants).

The advisory committee provided feedback on the areas and methodologies of the assessment, initial findings and draft recommendations. Advisory committee members who were unable to attend meetings were encouraged to provide input electronically throughout the process.

Parameters were determined by the scenarios defined by Metro: the analysis uses 2010 as the base year and 2035 as the horizon; geography² considered is the Portland metropolitan region within the Urban Growth Boundary, and the three scenarios match those of Phase 2 of Metro's project. Baseline for quantifying health effects applies 2010 prevalence of illness or death to projected 2035 population figures.

The scope of the CCC HIA also incorporates three additional areas of concern that surfaced during the CSCS HIA and CCC HIA processes. First, several advisory group members expressed an interest in expanding the air quality analysis beyond ITHIM's treatment of PM_{2.5}. In response, PHD undertook an additional literature review of transportation-

CCC HIA Scope

Geography: Portland, Oregon metropolitan region within the Urban Growth Boundary

Timeline: 2010 (base year) to 2035 (horizon year)

Metro Scenarios - adopted local and regional plans with:

- A: existing revenues
- B: increased revenues from existing sources
- C: new plans, policies and revenue sources

Exposure pathways: physical activity, traffic safety, air quality, land use

Quantitative tool: Integrated Transportation Health Impact Model (ITHIM)

Other considerations: magnitude of health costs associated with health pathways, vulnerable populations

² Metro used ODOT's GreenSTEP model for air quality; this regional model does not account for changes in Vancouver, WA emissions. In some instances in the report, health data is reported in a different geography such as 3-county or MSA (7-county); when an alternative to the UGB is used, it is clearly indicated in the tables and text.

related air quality health science. This included exploring other criteria pollutants and air toxics for inclusion in ITHIM as well as understanding both long and short-term exposures to transportation-related air pollution. While data and methodological limitations did not allow for complete integration of these other air pollution concerns, the air quality literature in this HIA has been expanded to discuss these pathways.

Second, many advisory group members expressed an interest in directly analyzing land use strategies within the plan. After an extensive literature review, this HIA includes a section devoted to understanding how the specific land use and transportation strategies may affect health.

Finally, advisory group members and decision makers expressed an interest in understanding the magnitude of saved costs associated with health benefits. Methodological limitations make a global number impossible to compute, but this HIA contains information about the costs of diseases of interest throughout the report.

Methods

HIA is guided by practice standards established by the Society of Practitioners of Health Impact Assessment (SOPHIA). This HIA adheres to the HIA Minimum Elements established by the North American HIA Practice Standards Working Group (Appendix A).

HIA begins by assessing the state of the science for pathways of interest with in-depth literature reviews. PHD maintains a robust database of 348 journal articles, scientific reports, and government guidance linking the built environment to health. In order to address the specific nature of this planning exercise, this database was updated by performing GoogleScholar, Pubmed, and ScienceDirect searches for literature specific to the pathways since 2008: [health] AND [physical activity, safety, and air pollution, land use]. Particular weight was given to systematic reviews, government guidance, and/or articles addressing sub-populations with vulnerabilities such as children, elders, and racial-ethnic minorities.

An important objective of HIA is documenting current health conditions. PHD used state and federal databases to characterize current prevalence and incidence rates. Information about costs associated with health impacts come from a combination of reports from partner state agencies and CDC's Chronic Disease Calculator, v2.0. <http://www.cdc.gov/chronicdisease/resources/calculator/>

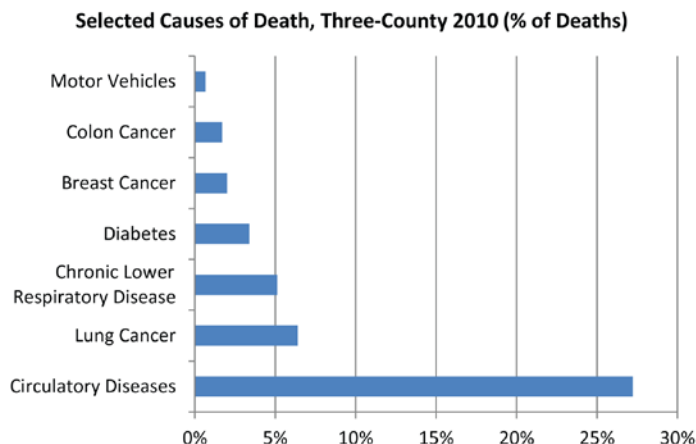
This HIA also quantitatively modeled health impacts using ITHIM for physical activity, traffic safety, and air quality as measured by PM_{2.5}. ITHIM uses current and local burden of disease estimates and applies relative risks or measures of expected changes in exposure to estimate changes in mortality (deaths) and illness (as measured by disability adjusted life years or DALYs). ITHIM calculates mortality and illness for both baseline and each scenario (A, B, and C as defined by Metro in Phase 2); outputs are generally reported in the difference between baseline and scenario. Conceptually, baseline in ITHIM is the expected number of deaths and illness given the current rate of exposure for the expected population in

2035. Estimated impact is thus the difference between the expected outcome at baseline and the scenario. More information is available about ITHIM methodology in Appendix E.

CURRENT HEALTH CONDITIONS, RISK FACTORS, AND COSTS

Approximately 11,050 people died in the three-county area (Clackamas, Multnomah and Washington counties) in 2010. Of those deaths, at least 42% were from causes that may be impacted by this plan. For example, primary cause of death statistics for the area indicate nearly one- quarter of deaths are from circulatory disease (heart and strokes), another 11% are from chronic respiratory diseases or lung cancer, and at least 3% of death certificates list

diabetes as a primary cause[5]. All other causes, or 58% of deaths, are caused by conditions not directly tracked in the HIA but are likely to improve with implementation of the plan. Approximately one third of the ‘other’ category (and approximately 20% of the overall total) are cancers with less direct links to physical activity or air-pollution.



Underlying conditions erode quality of life for many individuals. Table 2 on the following page provides Oregon and Portland MSA³ prevalence rates for chronic conditions and associated risk factors as estimated from the CDC’s *Behavioral Risk Factor Surveillance System Survey* (BRFSS) in 2011[8]. According to BRFSS, approximately 3% of adults in the region have survived a heart attack, a similar number suffer from chest pain or heart disease and 2.7% report having survived a stroke. These three cardiovascular conditions are highly associated with risk factors such as physical inactivity, high blood pressure, high cholesterol, and high BMI (weight). Recent BRFSS data also shows that approximately 28% of adults report high blood pressure and 36% have had a high cholesterol reading in the past 5 years. Nearly 40% of adults report not meeting the recommended 150 minutes of aerobic physical activity per week. Over 35% are overweight and nearly 24% are obese[8].

Respiratory illness significantly degrades quality of life. Poor air quality contributes to conditions such as asthma and chronic obstructive pulmonary disease (COPD). A little more than 5% of adults report having COPD. Over 9% of Portland region adults report a current asthma condition; the Oregon adult rate is the sixth highest rate in the country [8, 9]. At least 7–8% of children in Oregon have asthma according to parental response and when teens are directly surveyed, the prevalence increases to 10% [9].

³ The Portland-Vancouver-Hillsboro OR-WA MSA is defined as the seven county region including Clackamas, Columbia, Multnomah, Washington, and Yamhill Counties in Oregon, and Clark and Skamania Counties in Washington

Table 2. Adult prevalence rates for chronic disease and associated risk factors [8]

BRFSS 2011 category	U.S. state median	Percent of adults [95% Confidence Interval]	
		Oregon	Portland MSA ⁴
Heart attack	4.4	3.6 [3.1-4.2]	3.2 [2.5-4.0]
Chest pain or coronary heart disease	4.1	3.6 [3.1-4.0]	3.1 [2.4-3.7]
Stroke	2.9	2.9 [2.5-3.4]	2.7 [2.1-3.3]
Any physical activity last month?	73.8	80.3 [78.7-81.3]	81.5 [79.5-83.6]
150 minutes of aerobic per week	57.7	61.1 [59.3-62.9]	60.3 [57.8-62.8]
High blood pressure	30.8	29.9 [28.5-31.3]	27.9 [26.0-29.9]
Cholesterol checked and high in past 5 years	38.4	38.5 [36.8-40.2]	36.1 [33.8-38.5]
Overweight	35.7	34.8 [33.31-36.4]	35.8 [33.4-38.1]
Obese	27.8	26.7 [25.2-28.3]	23.7 [21.7-25.7]
Diabetic	9.5	9.3 [8.4-10.2]	8.5 [7.3-9.8]
Depression (ever treated)	17.5	23.9 [27.5-25.3]	22.8 [20.8-24.7]
COPD (Chronic obstructive pulmonary disease)	6.1	5.9 [5.2-6.7]	5.2 [4.2-6.3]
Ever had asthma	13.6	16.7 [15.4-18.0]	16.2 [14.3-18.0]
Current asthma	9.1	10.5 [9.4-11.5]	9.6 [8.2-11.0]

Chronic conditions are a significant financial burden to households and taxpayers. While Oregon-specific cost data are sometimes difficult to calculate, the CDC provides a Chronic Disease Cost Calculator to estimate state-specific Medicaid (Oregon Health Plan), Medicare, and private insurance expenditures for the treated population in any given year. The tool estimates annual direct medical costs in 2010 dollars and does not include lost wages, reduced productivity or years lost to premature death. It does minimize double counting across categories by statistically controlling for deaths with more than one cause, also called comorbidity [10]. Additional information about assumptions, data sources and modeling techniques can be found in Appendix D.

⁴ Data at this level of geography is age-adjusted and can be compared to other MSAs and the State.

Table 3 displays the estimated expenditures on chronic disease in Oregon, adjusting the costs for proportion of population living in the three-county area. More than \$1.5 billion dollars is spent each year on cardiovascular disease in the region. Fifteen percent of Oregon's population are Medicaid recipients and 14%, including some that also qualify for Medicaid, are Medicare recipients [11]. Of the \$1.5 billion spent each year on cardiovascular disease, \$623 million of that cost is borne by the taxpayer in Medicaid and Medicare payments and at least \$481 million is paid by private insurance. The cost incurred in 2010 by all payers for maintenance and complications from diabetes is estimated at \$710 million, asthma cost \$176 million and depression, which is helped by physical activity, cost \$382 million [10].⁵

Table 3. Estimates of 2010 three-county annual expenditures (in 2010 \$mil) for select chronic diseases

	Medicaid	Medicare	Private insurers	All payers ¹
Total cardiovascular disease²	\$120	\$503	\$481	\$1,551
Chronic heart failure	\$12	\$31	\$10	\$78
Coronary heart disease	\$12	\$167	\$189	\$470
Hypertension	\$47	\$149	\$197	\$592
Stroke	\$48	\$120	\$63	\$356
Other heart disease	\$30	\$106	\$68	\$258
Diabetes	\$59	\$199	\$226	\$710
Asthma	\$34	\$39	\$66	\$176
Depression	\$22	\$80	\$157	\$382

Source: CDC Chronic Disease Calculator, v2.0[10]

(1) All payers is estimated separately and may not equal the sum of Medicaid, Medicare, and private insurers.

(2) Total cardiovascular disease is a summation of the listed conditions, but only includes a portion of hypertension to avoid double counting. Similarly, diabetes complications can lead to cardiovascular disease; summing cardiovascular disease and diabetes would result in double counting. All other categories statistically control for listed conditions as well as common diseases not listed.

According to the CDC, more than \$1.5 billion dollars is spent each year on cardiovascular disease in the region. Almost half of that cost is borne by taxpayers.

⁵ The Chronic Disease Cost tool also provides projected costs; it estimates that expenditures for cardiovascular disease will increase by 79%, asthma by 66%, and diabetes by 77% by 2020 after accounting for inflation.

FINDINGS: ITHIM – Overview and results

ITHIM was identified in the CSCS HIA as a way to quantify morbidity (illness and injuries) and mortality (death) related to transportation changes. ITHIM was developed by public health researchers in the UK to assess potential health impacts of GHG reductions at a regional level by using population-based disease burden information for 13 different conditions in three potential pathways: physical activity, traffic safety (injuries and fatalities), and air quality [2].

Health outcomes in ITHIM include premature mortality (death) and morbidity (illness). Mortality data is based on burden of disease — specifically the relative risk of a disease given a change in exposure — associated with physical activity, traffic crashes, and air quality. The last time ITHIM results were released for the CSCS HIA, mortality data was based on U.S. risks. To improve accuracy of the model, mortality data for this HIA was based on Oregon-specific risks using 2010 vital statistics [12].

For morbidity, ITHIM calculates disability adjusted life years (DALYs) from the World Health Organization's (WHO) burden of disease database. DALYs are the sum of years of life lost (YLLs) and years living with a disability (YLDs). The YLL component of DALYs in ITHIM was revised using mortality rates from the Oregon Public Health Assessment Tool (OPHAT). Average mortality counts for 2008–2010 were extracted from OPHAT for the transportation related illnesses addressed in ITHIM and entered into the DALY Calculation Template from WHO (http://www.who.int/healthinfo/global_burden_disease/tools_national/en/) to revise YLL. YLD values were imputed from the United States burden of disease for the population of Oregon and entered into the ITHIM.

Table 4. ITHIM data inputs

Data Input	Baseline (2010)	Scenario A Adopted plans with existing revenue	Scenario B Adopted plans with increased revenue	Scenario C Scenario B plus additional policy/ infrastructure and new funding sources	Data source and notes
Reduction in GHG		↓12%	↓24%	↓36%	Modeled using ODOT's GreenSTEP. GreenSTEP inputs include Metro's Household Activity Survey, monitored PM2.5 emissions rates from DEQ.
Vehicle miles traveled (VMT) per person per week	134	125	117	102	
Distance by mode ¹	Walk=1.0% Bike=1.6% Bus=0.21% Car=97.2%	Walk=1.3% Bike=1.7% Bus=0.16% Car=96.7%	Walk=1.5% Bike=2.6% Bus=0.21% Car=95.6%	Walk=1.8% Bike=3.5% Bus=0.39% Car=94.2%	
PM _{2.5} (µg/m3)	6.6317	↓2.8%	↓3.2%	↓3.6%	
UGB population	1,481,118	1,954,716 (2035 Estimate)			U.S. Census

(1) GreenSTEP breaks out VMT per person per week for the modes listed. The inputs reported here have been changed to percent.

ITHIM requires a number of inputs beyond health disease burden information. Metro provided vehicle miles traveled by mode and road type and PM_{2.5} levels for each scenario. (Details are provided in Table 4.) PHD used 2010 census data for age distributions in the three-county area and outputs were increased by approximately 42% to adjust for the additional expected population by 2035.

ITHIM results are summarized in Table 5. (More detailed methodology descriptions, limitations and results are provided in Appendix E; pathway-specific results are discussed in later sections.) ITHIM shows that the current investment trajectory (Scenario A) will result in 64 avoided annual deaths in 2035 or a 0.9% drop in premature mortality given current death rates for conditions considered. ITHIM measures avoided illness through DALYs with current investment trajectories resulting in a 0.7% decrease in illness.

More aggressive investments clearly show greater reductions in disease and death. Scenario C would more than double the number of avoided annual deaths when compared to Scenario A. The 133 avoided annual deaths represent an approximate 2% reduction in current premature mortality rates with these pathways. Similarly, each additional 12% reduction in GHG from light-duty vehicles would garner the co-benefit of a 0.65% reduction in DALYs.

Table 5. Summary of ITHIM results

	Avoided	Scenario A		Scenario B		Scenario C	
		Count ¹	Percent reduction	Count ¹	Percent reduction	Count ¹	Percent reduction
Physical activity	Mortality	-58	1.4%	-89	2.1%	-116	2.9%
	DALY ²	-793	1.3%	-1333	1.9%	-1786	2.8%
Traffic safety	Mortality	-1	1.2%	-4	3.5%	-12	10.5%
	DALY ²	-72	2.0%	-173	4.9%	-443	12.5%
Air quality (PM_{2.5})	Mortality	-4	0.2%	-5	0.2%	-5	0.3%
	DALY ²	-37	0.2%	-42	0.2%	-47	0.2%
Total	Mortality	-64	0.9%	-98	1.4%	-133	2.0%
	DALY ²	-903	0.7%	-1548	1.3%	-2276	1.9%

(1) This count has been adjusted for expected population of the UGB in 2035.

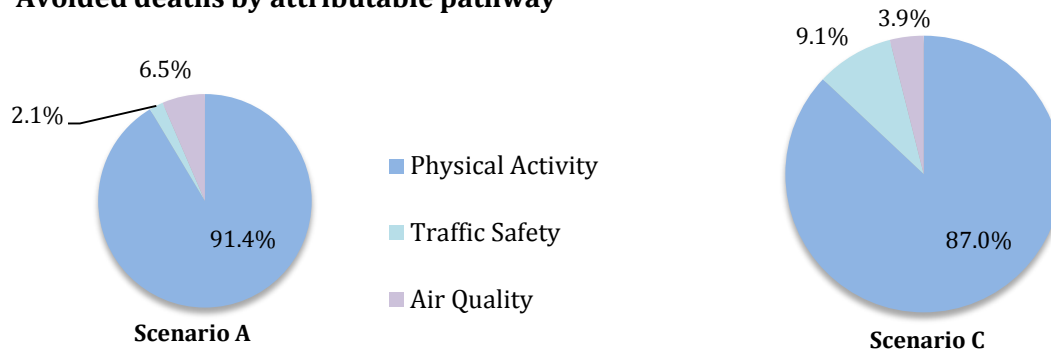
(2) Disability adjusted life years (DALY) is the summation of years of life lost (YLL) and years living with a disability (YLD) due to injury or disease. Note that YLD assumptions were not available some sub-categories and therefore significantly underestimate DALYs for physical activity and air quality.

ITHIM results also show that the majority of health benefits associated with GHG emission reductions are from increased physical activity: between 87.0–91.4% of prevented deaths and between 78.5–87.9% of prevented illness as measured by DALYs. ITHIM underestimates health benefits of all pathways; the model is limited to nine disease associated with physical activity, reported rates of collisions, and three diseases associated with PM_{2.5} as an indicator of air quality. (Please see Appendix E for expanded discussion of limitations.) Despite these

ITHIM results show that the majority of health benefits associated with GHG emission reductions are from increased physical activity.

limitations, these patterns are largely congruent with current patterns of disease burden and knowledge about active transportation addressing the large burden associated with physical inactivity.

Avoided deaths by attributable pathway



Highlights of ITHIM

- Lowering GHG emissions results in health benefits in each scenario.
- Using the strategies proposed, current levels of investment (Scenario A) would result in 64 avoided deaths annually. Scenarios B and C would result in 98 and 133 avoided deaths, respectively.
- Every 12% decrease in GHG emissions (the difference between each scenario) results in approximately a 0.65% decrease in DALYS among diseases studied.
- The vast majority of avoided deaths and illness are attributable to increased physical activity. ITHIM underestimates all health benefits by restricting to certain pathways and diseases. For example, it does not account for health benefits of decreased air toxics. However, the large contribution of physical activity is consistent with current public health knowledge of the burden of disease from inactivity.

FINDINGS: Land use

Local land use regulations and community design shape the physical environment of our region. Land use impacts how we live, work and play, and can moderate or influence healthy environments and behaviors. Zoning has historically been used to protect human health by separating noxious, polluting uses from residential areas. Contemporary trends in land use research have shown a more nuanced if complex understanding of the intersection between land use and health. For example, land use mix and density may dictate the distance and ease in traveling to health-supportive resources such as employment, school, food, and recreation. Many of the CSCS Project strategies and actions focus on the interaction between land use and transportation; for the remainder of this section, “land use” refers to this interaction.

Another way to conceptualize the impact of land use and community design is to consider how physical activity, traffic safety, and air quality may change in different land use contexts and design decisions. The design of transportation facilities within mixed-use areas can impact health in multiple ways. The width, placement and striping of bicycle lanes and sidewalks can induce or prohibit active transportation modes due to perceived safety and desirability, serve as protection from auto collisions, and impact localized concentrations of air pollutants. When schools, shopping, services, residential and employment opportunities are in close proximity, people do not have to travel as far, making walking, bicycling and transit more convenient and viable travel options.

PHD performed a literature⁶ review in order to understand the links between health and the specific land use strategies being considered. A summary of the literature for each land use strategy is provided in Table 6. The Magnitude of Health Impacts and Weight of Evidence columns provide a 1-5 scale (5 as the highest) to describe scientific knowledge for each pathway related to the strategy. The Magnitude of Health Impacts column reflect trends in overall burden of disease; strategies that are anticipated to have large effects on disease due to environmental and/or behavior changes were rated higher than those that will have more modest effects. The Weight of Evidence column addresses the quality and quantity of the research; ‘1’s or ‘2’s reflect conflicting or emerging research while a 5 rating reflect a robust literature drawn from meta-analyses, large epidemiological studies, and/or systematic reviews.

Although there is little literature directly linking health to the strategy, there is robust documentation of the health impacts of increased physical activity levels caused by more walking, bicycling and use of transit [13-16]. (See the Physical Activity section for more information.) Consequently, investments, policies and actions that make it more safe and convenient to walk and bike will benefit health. This is

⁶ PHD maintains a robust database of 348 journal articles, scientific reports, and government guidance linking the built environment to health. In order to address the specific nature of this planning exercise, this database was updated by performing GoogleScholar, Pubmed, and ScienceDirect searches for the following since 2008: [health, physical activity, safety, and air pollution] AND [density or sprawl, mixed-use, transportation modes, parking, and transit service]. Particular weight was given to systematic reviews and/or articles addressing sub-populations with vulnerabilities such as children, elders, and racial-ethnic minorities.

reflected in the Weight of Evidence column of Table 6 (page 22), which addresses the mode shift and health evidence separately for some strategies.

Many of the land use strategies under consideration are spatially interconnected and work synergistically. Residential density at or above levels associated with traditional single-family home urban neighborhoods is health supportive. However, the benefits of residential density require good connectivity to many diverse community destinations within walking and biking distance to encourage active transportation [17-21].

Complete streets may be the most health-promoting aspect of the investments and actions being considered.

Advisory group members repeatedly commented that land use strategies mattered a great deal. This is congruent with literature that stresses the cumulative effect of pedestrian and bicycle facilities, design, and nearby destinations in supporting active transportation options that result in increased physical activity [21-23]. These elements are addressed in the CSCS Project subsections ‘Complete Streets and Active

Transportation’ in Scenarios B and C. Complete streets may be the most health-promoting aspect of the investments and actions being considered.

Low-income households are particularly reliant on the public transportation network to access job opportunities, shopping, services and other everyday needs [24]. Due to budget constraints, low-income households often live in neighborhoods with more affordable housing that lack supportive resources such

as healthy food, parks, community centers and high quality medical care. Housing location has been found to amplify negative health associated with low socio-economic status [25, 26]. These neighborhoods often lack transit services and other amenities such as safe and convenient sidewalks, bike lanes and parks. These locations may have traffic safety risks such as high volume roads or poorly designed intersections that are difficult for vulnerable populations such as children and elders to navigate [26-30]. Community design and land use strategies listed in Table 6 place health supportive resources near affordable housing options. Transportation systems, and particularly public transit, play an important role in linking low-income households to health promoting resources such as fresh food, health providers and living wage jobs [24, 26].

Transportation systems, and particularly public transit, play an important role in linking low-income households to health promoting resources such as fresh food, health providers and living wage jobs.

Highlights of land use

- Elements of residential density, land-use mix, number of nearby community destinations and street connectivity are particularly effective at encouraging active transportation. These elements also work synergistically to influence walking, biking and use of transit.
- Most of the land use strategies listed in Table 6 and included in the scenarios promote health across multiple pathways.
- Investments and actions in Scenario B and C's subsections 'Complete Streets and Active Transportation' are the most important elements in encouraging healthy behavior. These elements include street connections, wider sidewalks, safer street crossings, improved bus stops, bikeways, transit signal priority, on-street bicycle facilities and trails.
- Low-income households, in search of affordable housing, may locate in neighborhoods that lack suitable transportation options. These neighborhoods also have fewer health supportive amenities. Low-income households may need access to health supportive resources more than any other group. It is important to create and preserve affordable housing options in areas that are well served by transit.

Table 6. Summary of literature review for land use strategies in Climate Smart Community Choices, Phase 2.

Land use policy	Current levels	Scenario A/B/C	Health pathway	Magnitude of health impact (5 '+' =largest)	Weight of evidence (5 '+' =most)	Additional considerations
Households in mixed use areas	26%	36% 37% 37%	Mixed use in the presence of reasonably high residential density and a short distance from many diverse community destinations is most likely to shift transportation mode and increase physical activity [17, 19].	+++	+++++	Mixed land use should be designed for all incomes including low-income families. Design matters. For example, multi-unit apartment complexes are often a land use buffer and qualify as mixed-use. These apartment complexes need to be fully integrated for connectivity to benefit from mixed-use. Housing/workplaces along major arterials are exposed to higher concentrations of air and noise pollution.
Urban Growth Boundary Expansion	2010 UGB	+28,000 +12,000 +12,000 (acres)	UGB literature is limited; however, limiting UGB expansion increases the likelihood of community destinations near residences by encouraging a compact, urban form. There is robust support for controlling sprawl. Urban development intensity is generally health supportive because nearby available resources increase. (See mixed-use above.) Residential density leads to increased physical activity as individuals shift to active transportation modes for daily activities [31, 32].	+++	++++	Development intensity without connectivity may not result in increased physical activity. Minimizing the expansion of the UGB may put upward pressure on housing prices, potentially exacerbating patterns of low-income households located in areas with limited resources. Controlling the UGB without addressing congestion (see delay reduced by traffic management policy below) can increase commute times which negatively impacts an individual's time for health-promoting activities.

Land use policy	Current levels	Scenario A/B/C	Health pathway	Magnitude of health impact (5 '+' =largest)	Weight of evidence (5 '+' =most)	Additional considerations
Bike travel	9%	10% 15% 20%	Aggressive mode shifts to bicycles will increase physical activity and health.	++++	+++ (mode shift evidence) ++++ (health evidence)	The access, placement, and design of bike facilities must maintain perceived and real safety [33]. Placement should also be designed to minimize air pollution exposure when possible [34].
Transit service (Daily revenue miles)	73,000	80,000 87,000 159,000	Increased transit service increases physical activity [35-38] (walking to/from stops), decreases air pollution, and increases traffic safety.	+++	+++++ (mode shift evidence) +++ (health evidence)	Low-income households are more likely to depend on transit and may have less access to transit. Transportation costs may be inelastic for this group but are a larger share of the household budget, so increases in transit costs may have inequitable impacts. Similarly, these households may choose a longer commute time to find affordable housing, which erodes time available for other health promoting activities. Expansions of service should consider and prioritize reaching low-income neighborhoods.
Work/non-work trips in areas with parking management	13%/8%	No change 30%/30% 50%/50%	Parking management influences active transportation and associated physical activity [39, 40].	+++	+++++ (mode shift evidence) + (health evidence)	The potential burden of parking costs and access to alternative transportation modes for low-income households should be considered.

Land use policy	Current levels	Scenario A/B/C	Health pathway	Magnitude of health impact (5 '+' =largest)	Weight of evidence (5 '+' =most)	Additional considerations
Miles of freeway/arterials added	N/A	+9 miles +81 miles +105 miles	<p>Addressing congestion leads to decreased traffic injuries and fatalities, increased time for healthy activities and decreased air pollution [41, 42].</p> <p>Adding road/lane miles could potentially increase connectivity by completing the system.</p> <p>Major roads are a significant barrier to active transportation, physical activity and social cohesion [26].</p>	<p>+</p> <p>++</p> <p>--</p>	<p>++</p> <p>++</p> <p>++++</p>	<p>Induced demand may erode the congestion related pathways over time.</p> <p>Health impacts of additional lanes are extremely localized and vary by project. Each project should carefully assess the impact on nearby residents and mitigate air quality, noise and physical barriers during both construction and end-use.</p> <p>Care should be taken in designing multi-mode improvements to maximize health when adding arterial lane miles.</p> <p>The literature describes mixed results from reducing congestion with additional lane-miles. Reducing congestion should reduce the number of crashes, but the crashes may be more severe due to higher speeds associated with good traffic flow.</p>
Delay reduced by traffic management strategies	10%	No change 20% 35%	Addressing congestion leads to decreased traffic injuries and fatalities, increased time for healthy activities and decreased air pollution [41, 42].	++	+++	Addressing congestion through traffic management is a more direct route to controlling commute times versus adding arterials or freeways.) PHD recommends this strategy over additional lane miles.

FINDINGS: Physical activity

ITHIM results for physical activity clearly indicate that reductions in GHG through increased walking and biking to transit and destinations produce significant health benefits. Physical activity prompted by investments in Scenario A can be expected to help avoid 58 deaths annually by 2035. Scenario C could help avoid 116 deaths and help reduce disease burden by up to 2.8%.

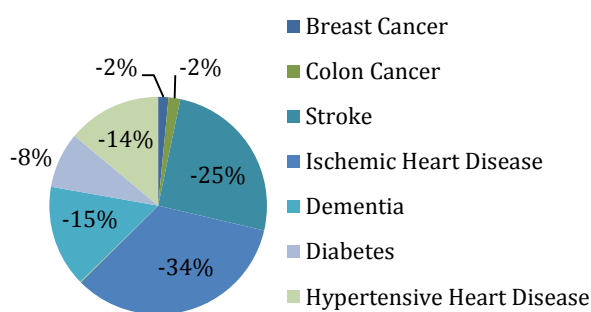
Table 7. ITHIM results attributable to physical activity

Avoided	Scenario A		Scenario B		Scenario C	
	Count ¹	Percent	Count ¹	Percent	Count ¹	Percent
Mortality	-58	1.4%	-89	2.1%	-116	2.9%
YLL	-468	1.5%	-747	2.3%	-988	3.1%
YLD	-325	1.0%	-586	1.6%	-799	2.3%
DALY ²	-793	1.3%	-1333	1.9%	-1786	2.8%

(1) This count has been adjusted for expected population in 2035.

(2) Disability adjusted life years (DALY) is the summation of years of life lost (YLL) and years living with a disability (YLD) due to injury or disease. Note that YLD assumptions were not available for some sub-categories and therefore significantly underestimate DALYs for physical activity and air quality.

Physical activity avoided deaths by disease (Scenario B)



Physical inactivity is the fifth largest contributor to the current disease burden in the U.S.[5]. A large portion of expected health benefits from the CSCS Project are attributable to physical activity: over 87% of avoided premature deaths and 78.5% of avoided years living with a disability (DALYs) in Scenario C. Activity alleviates disease and death through preventative mechanisms such as reaching and maintaining a healthy weight or body mass index, decreasing blood pressure and cholesterol, and lowering blood glucose levels to prevent diabetes [43-45]. Increasingly,

studies are showing that moderate physical activity regimens address cardiovascular disease (heart attack, chest pain, and stroke) and diabetes in a more prescriptive fashion, often performing as well as common pharmaceuticals [46].

Further analysis shows that avoided deaths and illness are largely from cardiovascular disease. In Scenario B, 73 percent of avoided deaths and 55 percent of avoided DALYs in the physical activity category are from heart disease or stroke.

Walking or biking to work, school, transit and other community destinations helps people reach the Surgeon General's physical activity recommendation of 150 minutes per week for adults and 300 minutes per week for children.

Well-functioning Transportation Systems Facilitate Choice and Physical Activity

Consider the transportation choices of an individual who lives in Troutdale and works in downtown Gresham.

Monday: Rides an 8-mile round-trip to workplace along safe and marked bike lanes.

Tuesday: Telecommutes but walks 1.5 miles by walking children to and from school and taking a break at a nearby coffee shop.

Wednesday: A child's extracurricular activity requires taking the family car. However he walks 0.75 miles to get lunch from a great sandwich shop.

Thursday: An important business meeting in downtown Portland is facilitated by taking the MAX into downtown and back to the office. After taking the bus home, he walks 1.25 miles over the course of the day to and from transit.

On Friday: Bike day! Repeat of the 8-mile round-trip bike ride.

Saturday: 3-mile round-trip family bike ride to a park for a soccer game.

Sunday: 3-mile round-trip family bike ride to church.

Assuming the commuter travels at 3-miles per hour when walking and 12 miles per hour when biking, this person has accumulated 150 minutes of physical activity for the week from travel alone.

Active forms of transportation such as walking or biking to work, school, transit and other community destinations are remarkably effective at helping individuals reach the Surgeon General's physical activity recommendation of 150 minutes per week for adults and 300 minutes per week for children [47]. New mass transit options may change daily physical activity levels, and could add 10 minutes of physical activity each day for one group of new transit users [48]. Only 60% of adults in the region currently meet the recommendation[8], suggesting active transportation investments could help a large proportion of the population begin to meet physical activity goals. Failure to meet the recommended 150 minutes of physical activity a week is estimated to reduce life expectancy by 3.4 years [16].

Transportation choices allow individuals to routinely and flexibly integrate physical activity into everyday lives. These choices are dependent upon a well-functioning and safe transportation system for all types of users. It also requires the support of a built environment that encourages active transportation through relatively high residential density featuring mixed use with many diverse, nearby community destinations anchored by high connectivity throughout the system.

An aggressive mode split change clearly drives the ITHIM physical activity results. Increasing the bike-mode split from 9% of 10-mile single-occupancy vehicle (SOV) trips in 2010 to 10, 15 and 20% in Scenarios A, B and C accounts for the majority of anticipated physical activity gains. The significant increase in transit service miles between Scenarios B and C amplifies the walking mode shift through walk trips to transit. Both strategies are critical in creating the health benefits.

Adults and children are more likely to choose active forms of transportation when they perceive they will be able to do so safely [49]. Design details and investments to make streets more complete and comfortable for potential pedestrians and cyclists are not accounted for explicitly in the ITHIM model. Complete streets and active transportation investments will be critical in implementing

aggressive mode shifts needed to reach GHG reduction targets. (See Traffic Safety section for more information about perceived safety.)

Complete streets are needed in all communities. Low-income households are more likely to live in neighborhoods with fewer amenities including pedestrian and bicycling facilities [25, 27]. Suburban communities generally have lower levels of connectivity and less dense transit service. Both low-income and suburban communities will require significant pedestrian, bicycle, and transit investments to accrue health benefits at rates similar to wealthier and more urban parts of the region.

Highlights of physical activity

- The majority of health benefits (87–91% of avoided deaths, 79–88% of avoided illness depending on scenario) are attributable to increased physical activity such as walking and biking to work, transit, school and other destinations.
- A transportation system with many safe and convenient options provides individuals with flexible and healthy choices needed to routinely shift modes from single occupancy vehicles to more active modes of transportation. Prioritizing non-automobile users in design and maintenance of streets increases the safety of all users and will facilitate transportation mode shift to walking, bicycling and using transit.

FINDINGS: Traffic safety

Reduced reliance on single-occupancy vehicles will help control congestion as the metro population continues to grow. ITHIM estimates that current levels of investment will help avoid one traffic fatality (1.2% reduction) and a 2.0% reduction in DALYs due to fewer serious traffic accidents. Scenario C results in far more aggressive traffic safety benefits with 12 lives saved and 12.5% fewer years of disability due to injuries.

Table 8. ITHIM results attributable to traffic safety

Avoided	Scenario A		Scenario B		Scenario C	
	Count ¹	Percent reduction	Count ¹	Percent reduction	Count ¹	Percent reduction
Mortality	-1	-1.2%	-4	-3.5%	-12	-10.5%
YLL	-28	-1.2%	-84	-3.5%	-251	-10.5%
YLD	-44	-3.8%	-89	-7.6%	-192	-16.4%
DALY	-72	-2.0%	-173	-4.9%	-443	-12.5%

(1) This count has been adjusted for expected population in 2035.

(2) Disability adjusted life years (DALY) is the summation of years of life lost (YLL) and years living with a disability (YLD) due to injury.

The U.S. Department of Transportation (DOT) provides guidance in valuing prevented traffic fatalities. The current default value of statistical life (VSL) – a measure that aggregates many individuals' willingness-to-pay for a small reduction in mortality risk – is \$9.1 million (in 2012 dollars) with a range of \$5.2–\$12.9 million provided for sensitivity analyses [50]. DOT also provides guidance about valuing injuries through an Abbreviated Injury Scale (AIS). Developed in the 1970s, AIS uses a QALY-based system to divide all possible injuries from crashes into a six-category scale of severity with the top severity being death. Current levels range (in 2012 dollars) from \$27K for a minor laceration injury to \$5.4 million for a critical injury such as ruptured liver [50]. There are no clearly established methods to convert DALYs to QALYs in order to apply AIS to ITHIM results.

The modeling indicates a reduction of LDV VMT per person on all types of roads with an increase in bicycle and pedestrian miles on minor streets and arterials. Even though overall traffic safety will improve, the increase of bicyclists and pedestrians on minor streets and arterials results in an increase in the absolute number of accidents for these two modes. The model predicts 2.5 more pedestrian deaths and 1.3 more bicyclist deaths in Scenario B in 2035. Since Scenario B also predicts 7.9 fewer automobile and motorcycle deaths, the overall fatality outcome is a net benefit of 4.0 avoided deaths. Patterns are similar for serious injuries and other Scenarios.

Table 9. ITHIM traffic safety results by mode for Scenario B

Mode	Annual fatalities			DALYs ¹		
	Baseline	Scenario B	Difference	Baseline	Scenario B	Difference
Walk	34.3	36.7	2.5	889.2	952.8	63.6
Cycle	10.4	11.7	1.3	316.7	356.7	40.0
Bus	0.0	0.0	0.0	0.0	0.0	0.0
Car	53.4	45.9	-7.5	1905.8	1639.5	-266.2
HGV	0.8	0.8	0.0	19.1	19.1	0.0
Motorbike	15.9	15.6	-0.4	424.5	413.9	-10.6
Total	114.8	110.7	-4.0	3555.4	3382.0	-173.3

(1) Disability Adjusted Life Years (DALYs)

This uneven distribution of benefits by mode may seem counterintuitive to studies that suggest a ‘safety in numbers’ effect. The safety in numbers effect is that as the proportion of pedestrians or bicyclists increases to a critical mass, motorized vehicle drivers become trained to ‘look’ and account for the non-motorist users, resulting in fewer collisions. The effect has been documented internationally and evidence is starting to appear in popular bicycling regions in the U.S. [33, 51-53]. While ITHIM allows for a safety in numbers adjustment, PHD did not exercise the safety in numbers option because it is unclear how to quantify the effect. The model also does not take into account infrastructure investments that may increase future bicyclist safety through increased visibility and separation from motorized traffic.

The physical activity benefits far outweigh the traffic risks associated with active modes of transportation [54-56]. One European study found that cycling instead of driving resulted in life-expectancy gain of 3–14 months over the course of a lifetime, far outweighing the potential risk of inhaled air pollution (0.8–40 days lost) and the risk of traffic accidents (5–9 days lost) [55].

The traffic safety results still indicate a need for safe strategies for pedestrians and bicyclists. The most effective way to increase safety for pedestrians and cyclists is through traffic calming measures and greater physical separation from motorized traffic [57-60]. Pedestrians, especially older adults, seem particularly sensitive to the location of sidewalks [61-63]. Bicyclists fare better on minor side roads than in unseparated bike lanes on major roads and benefit greatly from bicycle-specific facilities [53, 64].

The physical activity benefits of biking and walking far outweigh the traffic risks.

Perceived safety is a leading reason for individuals to avoid more active forms of transportation. Parental perceptions about perceived safety are predictive of children walking and biking to school [65, 66]. Bicyclists also respond to

perceived safety. A recent study in the Portland region indicates 60% of Portlanders and 53% of the rest of the region are ‘interested but concerned’ about cycling. This potential ‘market’ of cyclists is far more worried about traffic safety than current cyclists; 84% are concerned about being hit by a car compared with 39–52% of ‘enthused and confident’ or ‘strong and fearless’ cyclists [67].

The cumulative effect of design strategies, investments and policies to address safety may serve as an indicator that streets are safe for all modes and thus help increase the number of pedestrians and bicyclists [40].

Highlights of traffic safety

- Traffic safety is an important co-benefit of reducing GHG emissions. Scenario A would result in one avoided traffic fatality per year and decrease serious injuries by 2.0%. Scenario C would help avoid 12 traffic fatalities and decrease serious injuries by 12.5% a year.
- The shift in transportation modes results in an increase in the absolute numbers of pedestrian and bicycle fatalities, even as the rate decreases. Even though the physical activity benefits far outweigh the risks of active transportation, this suggests extra effort should be made to mitigate traffic hazards for pedestrians and cyclists through traffic calming, street design and mode separation when possible.
- Fifty-three percent of individuals in the region are 'interested but concerned' about cycling. Addressing perceived safety for pedestrians and cyclists will help implement large mode shifts.

FINDINGS: Cleaner Air

Improving overall air quality is an important health benefit of GHG reduction. Reducing per capita VMT combined with clean fuel technologies are expected to decrease air pollutants attributable to light-duty vehicles. These pollutants include: PM_{2.5}, ozone precursors and air toxics such as benzene, 1, 3-butadiene, arsenic and chromium VI. Reductions of these pollutants would likely result in increased respiratory health, decreased cardiovascular events such as heart attacks, and decreased cases of cancers such as lung cancer and leukemia. Additionally, some populations are at greater risk from exposure to air pollution. For example, people with lung cancer have an increased risk of death when exposed to increased levels of PM_{2.5}.

To quantify the health impacts of cleaner air, ITHIM developers chose PM_{2.5} as the pollutant indicator for mobile, onroad sources. PHD accepted this choice of pollutant based on the scientific consensus about the strength of and causal nature of the relationships between PM_{2.5} and health. The periodic reviews of pollutants commissioned by the EPA [68-70] and a recent World Health Organization [71] scientific review all suggest that PM_{2.5} is the best air pollution indicator for health-impact analyses. Using PM_{2.5} as the exposure pollutant in ITHIM does underestimate some health effects including some cancer risks^{7,8}.

The PM_{2.5} inputs for ITHIM were modeled by Metro in ODOT's GreenSTEP. Metro's scenario analyses showed a decrease in annual concentration of particulate matter as measured by PM_{2.5} of 2.8% (Scenario A) to 3.6% (Scenario C). This is expected to result in modest decreases in deaths and illness (Table 10), primarily from fewer respiratory illnesses, reduced heart disease related to air pollution and reduced lung cancer mortality related to long-term PM_{2.5} exposure.

Table 10. ITHIM results attributable to air quality (PM_{2.5})

	Scenario A		Scenario B		Scenario C	
	Count	Percent reduction	Count	Percent reduction	Count	Percent reduction
Mortality	-4	0.2%	-5	0.2%	-5	0.3%
YLL	-37	0.2%	-42	0.2%	-47	0.3%
YLD	0	0.0%	0	0.0%	0	0.0%
DALY	-37	0.2%	-42	0.2%	-47	0.2%

(1) This count has been adjusted for expected population in 2035.

(2) Disability adjusted life years (DALY) is the summation of years of life lost (YLL) and years living with a disability (YLD) due to illness. YLD are unavailable for respiratory and air pollution-related cardiovascular disease as well as lung cancer at this time.

⁷ For more information on cancer risks associated with light-duty vehicles in the Portland region please see Portland Air Toxics efforts [74].

⁸ Limitations are discussed in greater detail below and found in the discussion of ITHIM methodology in Appendix E. A more detailed discussion of potential air pollutants of interest and the current scientific understanding of health linkages is available in Appendix F.

The modest effect of the CSCS Project on air quality health benefits can be explained by the small reduction in PM_{2.5} in the GreenSTEP model. One reason GreenSTEP is not showing a particularly large reduction in PM_{2.5} is because heavy-duty diesel vehicles are a larger driver of PM_{2.5} but are not under the purview of this project, which focuses on light-duty vehicles (LDV) only. A second reason for the modest decrease in PM_{2.5} is that GHG emissions reduction is a function of both decreased VMT per capita *and* technological and fuel changes. Reductions in PM_{2.5} from per capita VMT reduction are largely displaced with increasing population. Per capita VMT is decreasing, but VMT for the entire region will increase by 22.7% for Scenario A and 13.3% for Scenario B. Only Scenario C shows an overall reduction (2.2%) in regional VMT. The end result is that PM_{2.5} hardly changes at all.

There are additional limitations with using PM_{2.5} as the primary air quality pollutant in ITHIM. The model only accounts for long-term exposure to PM_{2.5} even though there is good evidence that short-term, episodic exposure to PM_{2.5} and other air pollutants results in health effects. ITHIM includes the effects of long-term exposure from PM_{2.5} such as heart disease related to air pollution, lung cancer mortality and respiratory diseases. ITHIM does not address short-term PM_{2.5} exposure including a one-day lag in hospitalizations and emergency department visits for ischemic heart disease and congestive heart failure (heart attacks) following a spike in PM_{2.5} concentrations. A region of 5 million people can expect one premature cardiovascular death from a heart attack for every 10 µg/m³ increase in PM_{2.5} during the preceding day [72]. Causal respiratory outcomes are less certain for short-term PM_{2.5} exposure but include emergency room visits and hospitalizations for COPD and respiratory infections [69].

Another limitation of ITHIM is that other important air pollutants highly attributable to LDV are not accounted for in the health model. The advisory group questioned the extent to which ITHIM was underestimating air quality benefits by limiting to PM_{2.5} and suggested expanding the pollutant profile to include other criteria pollutants such as ozone and air toxics such as benzene. Ground-source ozone (smog) is another air-pollutant highly associated with transportation-related air pollution and is strongly correlated with significant long-term and short-term respiratory health effects. Exposure to ozone can result in decreased resistance to respiratory and lung infections. Over time, this exposure may restrict lung growth in children, alter the airway and put significant stress on the cardiovascular system [70]. Analysis of longitudinal cohorts documents a likely causal effect on mortality and morbidity from long-term exposure to ozone. Mortality is estimated at about a 4% increase in risk for every 10 ppb exposure [73]. Ozone and other criteria pollutants could not be quantified in ITHIM due to high multicollinearity between transportation-related pollutants and high correlation of health outcomes.

Also excluded from ITHIM but with significant carcinogenic effects are air toxics. A recent analysis of these pollutants and resulting recommendations are available in the Portland Air Toxics Solutions (PATS) report [74, 75]. Air toxics related to carbon emissions standards may show larger decreases in ambient concentrations than PM_{2.5} in the scenarios. Although not included in ITHIM, decreased concentrations of air-toxics would also result in cancer and non-cancer health benefits. Recommendations from PATS include: use the ongoing regional transportation planning process to reduce vehicle use, target a 20% per person reduction in vehicle emissions by 2035, improve traffic signals to reduce congestion, support

strong national standards for clean vehicles, adopt the latest California clean car standards, and promote electric vehicle charging stations [74, 75].

PHD continues to use PM_{2.5} within ITHIM for several reasons. First, scientific understanding is well developed for PM_{2.5}, and it has the largest health impact at current ambient concentrations. (See appendix F

There is no level at which exposure to PM_{2.5} is safe.

for a broader discussion of PM_{2.5} science.) Second, the correlation between variables is high. Pollutants associated with LDV emissions show a great deal of multicollinearity. Health outcomes such as respiratory and cardiovascular disease resulting from exposure are also highly correlated. One recent and highly cited dual-pollutant model of ozone and PM_{2.5} showed ozone is primarily associated with respiratory outcomes and PM_{2.5} with cardiovascular outcomes [73]. This suggests current relative risks for PM_{2.5} may already account for some, but not all, of ozone respiratory effects and lung cancers from arsenic and chromium. Reductions in PM_{2.5} would be expected to have similar rates of reduction in death and disease [71, 72].

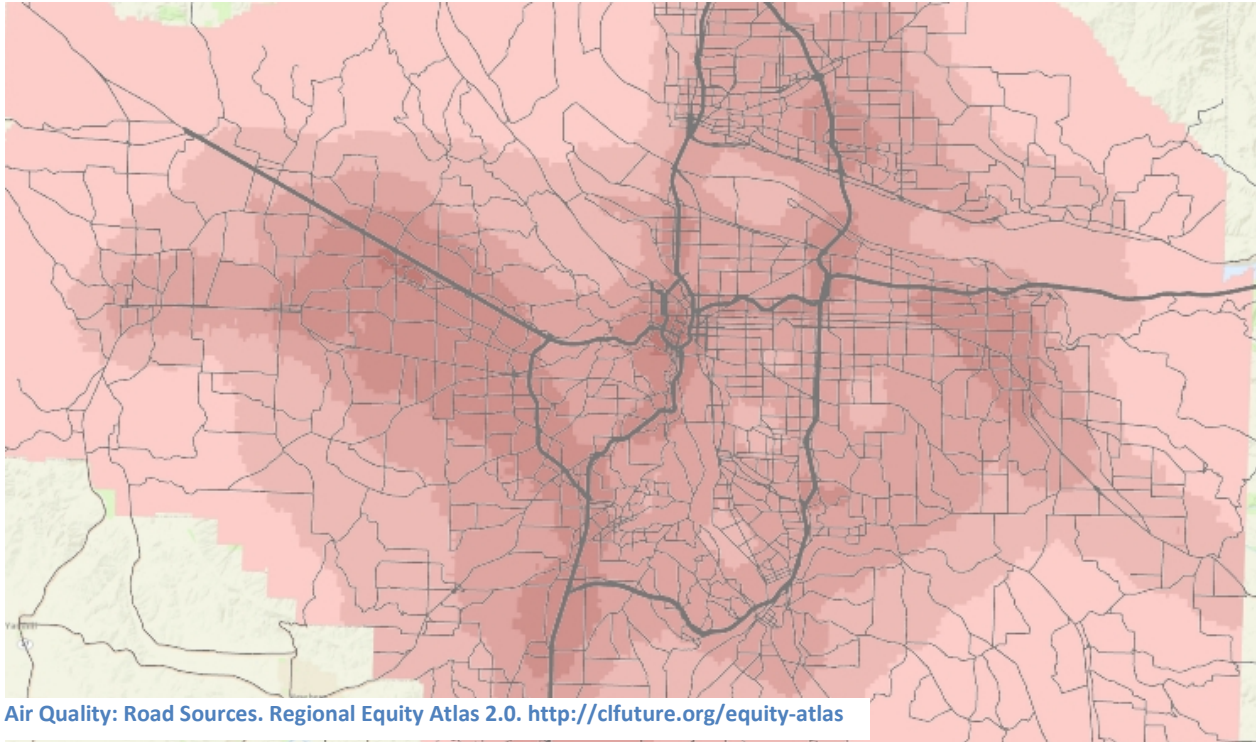
The strategies and investments under consideration could protect health by reducing exposure to both PM_{2.5} and ozone.

It is important to note the temporal and localized effects of air pollution. ITHIM is based on long-term exposure, but short-term exposure to PM_{2.5}, ozone and other air pollutants is also associated with negative health effects. There is no level at which exposure to PM_{2.5} is safe [71, 72]. Any threshold for which ozone does not degrade health “is likely to lie below 0.045ppm”

and may be lower than even 0.035ppm [71]. Climate change is also likely to result in warmer summers with even higher ground-source ozone levels.

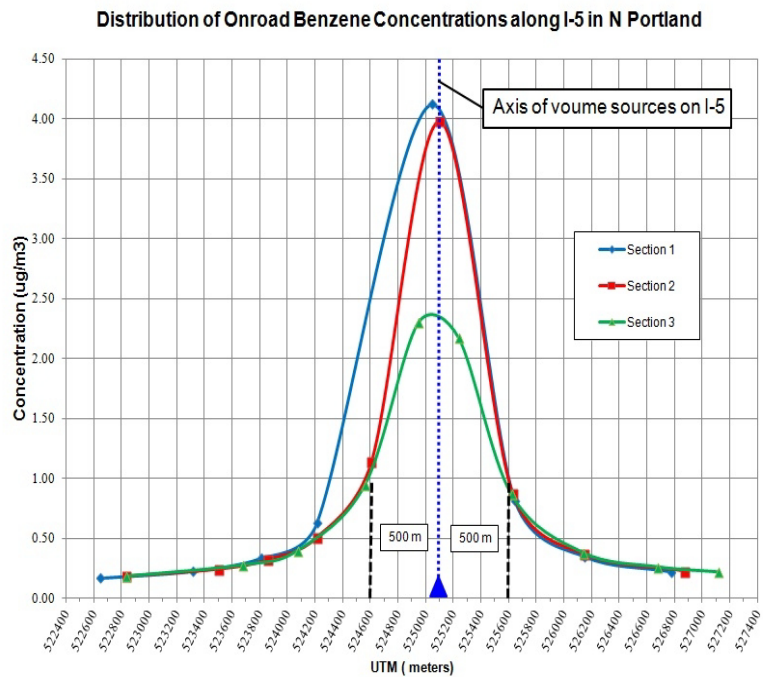
Additional analysis of temporal patterns (see Appendix F) shows that there were five episodes of elevated PM_{2.5} and one episode of elevated ozone in 2012. These spikes in short-term exposure are highly correlated and predictable from forecasted weather. Spikes in PM_{2.5} during winter inversion layers and ozone on hot, summer days call for short-term interventions. Regional transportation strategies could help address episodic, short-term exposure to both PM_{2.5} and ozone.

Air pollution is also highly localized[76]. Modest improvements in overall air quality should prompt modest gains in health benefits. These gains could be more significant in communities located near industry and transportation facilities due to the cumulative burden of exposure to air pollution from many sources [77, 78]. Models of air quality along road sources show higher concentrations of pollutants near interstates and on the windward side of the hills west of downtown Portland as seen in the map below.



A recent DEQ analysis of ambient benzene concentrations along Interstate 5 near Killingsworth Street in North Portland shows that in-road concentration levels are up to ten times higher than urban background levels. While the concentrations drop quickly, concentrations are still 3–4 times higher than urban background levels 500 meters (or 5 blocks) removed from the freeway.

Given the localized nature of air pollution, elevated exposure during transport, particularly in active modes, is a growing concern. The benefits of physical activity outweigh the risks of exposure to air pollutants [54-56, 79]. The literature shows mixed results when measuring concentrations by mode (car, bike, or walking) [80-84]. On major streets, everyone is exposed to much higher levels of air pollution no matter the activity. However, because pedestrians and cyclists have elevated respiratory rates and may be in the roadway



longer, individuals taking these modes have higher personal exposures and uptakes of pollutants [84, 85]. Similarly, individuals working or living along major roads and freeways will also be at risk for higher personal exposure [86].

Highlights of air quality

- Improved air quality is an important benefit of addressing GHG. Metro's scenarios result in modest PM_{2.5} reductions of 2.8, 3.2, and 3.6%. This translates into a relatively modest decrease in lung-cancer deaths, respiratory illness and heart disease related to long-term PM_{2.5} exposure.
- ITHIM underestimates health benefits associated with improved air quality by only incorporating long-term exposure to PM_{2.5}. Although likely that additional benefits would accrue from lower ambient ground-source ozone and air toxic concentrations, understanding the extent of such benefits is beyond the scope of this HIA.
- PHD recommends that Metro aligns the CSCS project investments and actions to PATS goals. Metro's scenarios address many of the PATS recommendations such as using technology to manage congestion, more efficient fuel standards and expanded use of electric vehicles. This should lead to a reduction in ambient air toxic concentrations and increased health. It is beyond this analysis to determine if the scenarios meet State of Oregon adopted ambient benchmark concentrations for the suite of pollutants monitored under PATS.
- There is no safe level of PM_{2.5} exposure and safe levels of exposure to ozone are much lower than current ground-source ozone averages. Short-term episodes of elevated PM_{2.5} (winter inversion layers) and ozone (hot, summer days) are not accounted for in ITHIM, but can result in elevated rates of cardiovascular and respiratory death and illness.
- Air quality is localized and many vulnerable populations live near transportation corridors. Transportation corridors are documented to have much higher ambient concentrations of pollutants than other areas. Care should be taken in designing active transportation facilities and buildings adjoining transportation corridors to balance supporting increased physical activity while minimizing exposure.

SUMMARY OF KEY FINDINGS

GHG emission reductions using the proposed strategies will improve health through reducing the risk of climate change and through important health benefits associated physical activity, traffic safety, and improved air quality. Current levels of investment (Scenario A) are expected to contribute to 64 avoided deaths annually; Scenarios B and C would result in 98 and 133 avoided deaths respectively. Every 12 percent decrease in GHG emission – the difference between Metro scenarios – would result in approximately a 0.65 percent decrease in DALYS (illness) among diseases studied.

The majority of health benefits (87-91 percent of avoided deaths, 79-88 percent of avoided illness) from proposed strategies, regardless of scenario, are attributable to increased physical activity from active transportation such as walking and biking to work, transit, school, and other destinations. A transportation system with a broad range of safe and convenient options provides individuals with flexible and healthy choices needed to routinely shift from single occupancy vehicles to more active modes of transportation.

RECOMMENDATIONS

Climate change poses a risk to the future health of Oregonians. Proposed strategies to mitigate climate change will also increase health benefits associated with physical activity, traffic safety and improved air quality. Based upon the findings of this report and with the support of the CCC HIA Advisory Committee, PHD has developed a series of recommendations to preserve and promote healthy communities throughout the region.

By developing and implementing a preferred scenario that meets or surpasses the GHG emissions reduction target set by the Department of Land Conservation and Development, PHD anticipates an improvement in public health.

The majority of health benefits from the CSCS Project can be attributed to active transportation such as walking and biking to work, transit, school and community destinations. **Based on this evidence, PHD recommends that Metro maximize opportunities for active transportation for all communities by:**

- Adopting and identifying stable funding for the design elements listed in the subsection ‘Complete Streets and Active Transportation’ of Scenarios B and C: street connections, wider sidewalks, safer street crossings, improved bus stops, bikeways, transit signal priority, and on-street bicycle facilities and trails.
- Improving transit service miles to meet levels recommended in Scenario C.
- Using an equity analysis to plan and develop equal access to active transportation throughout the region.

While the benefits of physical activity far outweigh the risks, active modes of transportation can lead to increased exposure to traffic injury and air pollution. **In order to reduce the risk of increased exposure**

to traffic injury and air pollution for all road users, PHD recommends that Metro prioritize the design and maintenance of non-automobile facilities by:

- Including safety features for pedestrians and bicyclists such as separation from motorized traffic when possible. Prioritize non-automobile users in design and maintenance of streets.
- Providing a parallel bicycle route one block removed from high-volume roads when feasible to reduce exposure to localized pollution while still maintaining access to community destinations.

Per capita VMT reduction is expected to modestly improve air quality as measured by many pollutants including air toxics, but temporal and localized air quality concerns remain. **Due to temporal and spatial air quality concerns, PHD recommends that Metro maximize overall improvements in air quality through actions such as:**

- Aligning the CSCS preferred alternative to PATS goals. In collaboration with DEQ, determine how the preferred alternative helps meet State of Oregon adopted ambient benchmark concentrations.
- Reducing exposure by using zoning and incentives to improve indoor filtration systems in new buildings along transportation corridors.
- Convening a regional committee to further address episodic air quality events. Solutions should be season specific and could promote incentives for short-term, alternative commute arrangements.

Finally, to improve health equity, PHD recommends Metro ensure social and health goals are considered when prioritizing investments by:

- Explicitly and transparently addressing how investment links low-income and other vulnerable households to health-promoting resources.

APPENDICES

- A. HIA Minimum Elements and Practice Standards
- B. Advisory committee
- C. Health conditions and prevalence rates by county (BRFSS)
- D. CDC Chronic Disease Cost Calculator
- E. ITHIM results
- F. Air quality white paper

Appendix A. HIA Minimum Elements and Practice Standards

November 2010, Version 2

North American HIA Practice Standards Working Group, Society for the Practitioners of HIA

A health impact assessment (HIA) must include the following minimum elements, which together distinguish HIA from other processes. An HIA:

1. Is initiated to inform a decision-making process, and conducted in advance of a policy, plan, program, or project decision;
2. Utilizes a systematic analytic process with the following characteristics:
 - a. Includes a scoping phase that comprehensively considers potential impacts on health outcomes as well as on social, environmental, and economic health determinants, and selects potentially significant issues for impact analysis;
 - b. Solicits and utilizes input from stakeholders;
 - c. Establishes baseline conditions for health, describing health outcomes, health determinants, affected populations, and vulnerable sub-populations;
 - d. Uses the best available evidence to judge the magnitude, likelihood, distribution, and permanence of potential impacts on human health or health determinants;
 - e. Rests conclusions and recommendations on a transparent and context-specific synthesis of evidence, acknowledging sources of data, methodological assumptions, strengths and limitations of evidence and uncertainties;
3. Identifies appropriate recommendations, mitigations and/or design alternatives to protect and promote health;
4. Proposes a monitoring plan for tracking the decision's implementation on health impacts/determinants of concern;
5. Includes transparent, publicly accessible documentation of the process, methods, findings, sponsors, funding sources, participants and their respective roles.

Appendix B. List of CCC HIA Advisory Committee members

Tom Armstrong
City of Portland

Sarah Armitage
DEQ

Adam Barber
Multnomah County Planning

Aida Biberic
DEQ

Janne Boone-Heinonen
OHSU

Margi Bradway
ODOT

Peter Brandom
City of Hillsboro

Ben Bryant
City of Tualatin

Karen Buehrig
Clackamas County

Steve Butler
City of Milwaukie

Betsy Clapp
Multnomah County Health Dept.

Lynda David
Regional Transportation Council

Chris Deffebach
Washington County

Jennifer Donnelly
Dept. of Land Conservation & Development

Denny Egner
Dept. of Land Conservation & Development

Kim Ellis
Metro, Principal Transportation Planner

Leah Fisher
Health Promotion & Chronic Disease Prevention

Barbara Fryer
City of Beaverton

Jana Gastellum
Oregon Environmental council

Andy Ginsburg
DEQ

Heather Gramp
PHD

Mara Gross
Coalition for Livable Future

Tia Henderson
Upstream Public Health

Eric Hesse
TriMet

Jon Holan
City of Forest Grove

Stacy Humphrey
City of Gresham, Urban Design & Planning
Dept.

Katherine Kelley
City of Gresham

Mary Kyle McCurdy
1000 Friends of Oregon

Nancy Kraushaar
City of Wilsonville

Michelle Kunec
City of Portland

John MacArthur
Oregon Transportation Research and
Education Consortium-PSU

Margaret Middleton
City of Beaverton

Thaya Patton
Metro

Barbara Pizacani
PDES

Mel Rader
Upstream Public Health

Dan Rutzick
City of Hillsboro

Vivek Shandas
PSU

Lainie Smith
ODOT

Steve White
Oregon Public Health Institute

Appendix C. County-level BRFSS

BRFSS 2011 category	U.S. state median	Percent of adults [95% confidence interval]				
		Oregon	Portland MSA ²	Clackamas ¹	Multnomah ¹	Washington ¹
Heart attack	4.4	3.6 [3.1–4.2]	3.2 [2.5–4.0]	3.3 [1.7–5.0]	3.0 [1.5–4.5]	2.6 [1.5–3.8]
Chest pain or coronary heart disease	4.1	3.6 [3.1–4.0]	3.1 [2.4–3.7]	2.8 [1.4–4.2]	2.9 [1.7–4.2]	2.9 [1.6–4.2]
Stroke	2.9	2.9 [2.5–3.4]	2.7 [2.1–3.3]	2.8 [1.2–4.4]	2.7 [1.4–3.9]	3.0 [1.5–4.5]
Any physical activity last month?	73.8	80.3 [78.7–81.3]	81.5 [79.5–83.6]			
150 minutes of Aerobic per week	57.7	61.1 [59.3–62.9]	60.3 [57.8–62.8]	62.5 [56.7–68.2]	65.0 [60.9–69.2]	58.4 [53.0–63.8]
High blood pressure	30.8	29.9 [28.5–31.3]	27.9 [26.0–29.9]	30.6 [25.8–35.4]	26.8 [23.5–30.2]	27.1 [23.0–31.2]
Cholesterol checked and high in past 5 years	38.4	38.5 [36.8–40.2]	36.1 [33.8–38.5]	39.3 [33.5–45.1]	37.0 [32.8–41.2]	33.5 [28.7–38.3]
Overweight	35.7	34.8 [33.31–36.4]	35.8 [33.4–38.1]	35.6 [30.0–41.1]	35.9 [32.0–39.8]	34.3 [29.4–39.2]
Obese	27.8	26.7 [25.2–28.3]	23.7 [21.7–25.7]	25.4 [20.3–30.6]	19.5 [16.3–22.6]	25.5 [21.0–30.0]
Diabetic	9.5	9.3 [8.4–10.2]	8.5 [7.3–9.8]	8.6 [5.7–11.5]	8.8 [6.7–10.9]	6.0 [4.2–7.8]
Depression (ever treated)	17.5	23.9 [27.5–25.3]	22.8 [20.8–24.7]	21.7 [17.2–26.1]	25.5 [21.9–29.1]	22.3 [18.2–26.3]
COPD (Chronic obstructive pulmonary disease)	6.1	5.9 [5.2–6.7]	5.2 [4.2–6.3]	5.2 [3.1–7.3]	5.1 [2.9–7.4]	5.2 [3.2–7.2]
Ever had asthma	13.6	16.7 [15.4–18.0]	16.2 [14.3–18.0]	13.9 [10.2–17.5]	15.4 [12.3–18.5]	20.8 [16.1–25.6]
Current asthma	9.1	10.5 [9.4–11.5]	9.6 [8.2–11.0]	8.3 [5.5–11.0]	9.0 [6.5–11.4]	10.9 [7.7–14.2]

- (1) These are not age-adjusted prevalence rates; caution should be used when comparing counties.
- (2) The Portland-Vancouver-Hillsboro OR-WA MSA is defined as the seven-county region including Clackamas, Columbia, Multnomah, Washington and Yamhill Counties in Oregon, and Clark and Skamania Counties in Washington

Appendix D. CDC Chronic Disease Cost Calculator

The costs of chronic disease reported are from a recent version (November 2013) of the CDC's Chronic Disease Cost Calculator that can be found at www.cdc.gov/chronicdisease/resources/calculator/index.htm. The Cost Calculator uses a regression-based approach to estimate costs for chronic disease by state and payer type for the treated population. Below is a table of the Oregon (not three-county) results with accompanying notes as provided by the calculator, descriptions of datasets from the technical guide found at www.cdc.gov/chronicdisease/pdf/cdcc_tech_appendix.pdf, and the FAQs found at www.cdc.gov/chronicdisease/resources/calculator/faq.htm.

Overall summary for all diseases for Oregon

	All payers	Medicaid	Medicare	Private insurers	Absenteeism	All payers+ absenteeism
Arthritis	\$1,553	\$69	\$445	\$610		
Asthma	\$411	\$79	\$92	\$153		
Cancer	\$1,888	\$43	\$620	\$878	\$202	\$1,754
Congestive heart failure	\$182	\$27	\$72	\$23	\$40	\$451
Coronary heart disease	\$1,098	\$29	\$390	\$442	\$106	\$1,994
Hypertension	\$1,382	\$109	\$349	\$460	\$3	\$185
Stroke	\$832	\$112	\$281	\$147	\$45	\$1,143
Other heart disease	\$603	\$69	\$248	\$158	\$63	\$1,445
Depression	\$892	\$51	\$187	\$367	\$53	\$885
Diabetes	\$1,658	\$137	\$464	\$528	\$9	\$612
Diseases of the Heart	\$1,883	\$125	\$710	\$624	\$94	\$986
Total cardiovascular disease	\$3,620	\$281	\$1,174	\$1,123	\$62	\$1,721

*Costs reported in millions.

*Includes costs only for diseases that are selected and have cost values available.

Notes:

Annual expenditures inflated to 2010 \$ following recommendations from the Agency for Healthcare Research and Quality. Costs include expenditures for office based visits, hospital outpatient visits, emergency room visits, inpatient hospital stays, dental visits, home health care, vision aids, other medical supplies and equipment, prescription medicines, and nursing homes. Payer populations are not mutually exclusive. Costs for all payers are calculated independently of costs for Medicaid, Medicare, and private insurers. Sums of the total costs across subpopulations may not equal the overall total costs due to rounding. Treated population is defined as the number of people receiving care for the disease in the previous year. The treated population in the Medical Expenditure Panel Survey and the National Nursing Home Survey was likely more resource-intensive than those included in alternative prevalence definitions based on a history of the disease who have not sought treatment recently. All results generated from the tool are estimates. Actual costs may be larger or smaller than those reported. [Continued below.]

The estimates for hypertension and diabetes include a portion of the costs of complications including congestive heart failure (CHF), coronary heart disease (CHD), stroke and other heart diseases. The sum of costs over selected diseases that include hypertension and diabetes could overestimate the costs associated with all the selected diseases. The costs for diseases of the heart include CHD, CHF, and other heart disease. The costs for total cardiovascular disease include diseases of the heart, stroke, and an estimate of hypertension costs that avoids double-counting of costs with other diseases. Excluding the costs of complications lowers the estimates for hypertension and diabetes by approximately 34% and 39%, respectively.

CDC Cost Calculator, default source data sets,

- (See: http://www.cdc.gov/chronicdisease/pdf/cdcc_tech_appendix.pdf for more information) *U.S. Census Bureau*: Total state population and breakdowns by sex and age for 2008 and state population projections by sex and age for 2010 through 2020 came from the U.S. Census Bureau.
- *Kaiser Family Foundation*: Medicare beneficiary data came from the Kaiser Family Foundation 2008 Medicare Health and Prescription Drug Plan Tracker.
- *Medicaid Statistical Information System (MSIS)*: Medicaid enrollment data came from the Medicaid Statistical Information System (MSIS) State Summary Fiscal Year 2008. MSIS data are used by CMS to produce Medicaid program characteristics and utilization information for the states. The purpose of MSIS is to collect, manage, analyze and disseminate information on eligibles, beneficiaries, utilization and payment for services covered by State Medicaid programs.
- *Current Population Survey (CPS)*: Private insurance enrollment data and breakdowns of enrollment by sex and age by payer (private insurance, Medicaid, and Medicare) came from the Current Population Survey (CPS). Private insurance data came from the 2008 CPS and Medicaid and Medicare data came from the 2007 through 2009 CPS. The Current Population Survey (CPS) is a monthly survey of about 50,000 households conducted by the Bureau of the Census for the Bureau of Labor Statistics. The sample is scientifically selected to represent the civilian noninstitutional population. The sample provides estimates for the nation as a whole and serves as part of model-based estimates for individual states and other geographic areas.

Treated Population, per-person costs, and absenteeism (Treated population is defined as the number of people receiving care for the disease in the previous year.)

- *Medical Expenditure Panel Survey (MEPS)* Data were pooled from the 2004 through 2008 Medical Expenditure Panel Survey (MEPS) Consolidated Data Files, a nationally representative survey of the civilian non-institutionalized population that provides data on annual medical expenditures, sources of payment, insurance coverage, and days missed from work due to illness or injury for each participant. The combined five-year MEPS sample included 153,012 persons of all ages living in the U.S. Estimates for both the treated population and costs have been adjusted to be nationally representative using MEPS sampling weights for years 2004 through 2008. The default data include years prior to the implementation of Medicare Part D, which took effect in 2006. All expenditure data were inflated to 2010 dollars using the gross domestic product general price index as recommended by Agency for Healthcare Research and Quality to reflect more current dollar values.

- *National Nursing Home Survey (NNHS)* Estimates for the institutionalized population, which are not available in other data sources, were derived from the 2004 National Nursing Home Survey (NNHS). The NNHS is a nationally representative sample of United States nursing homes, their services, their staff, and their residents. The NNHS provides information on nursing homes from two perspectives-that of the provider of services and that of the recipient of care. For recipients, data were obtained on demographic characteristics, health status, and sources of payment. Diseases were defined using International Classification of Disease (ICD-9) codes based on any diagnosis of the condition, either at admission or time of the survey and primary or secondary diagnosis.

Appendix E. ITHIM methodology and detailed results

The Integrated Transport and Health Impact Model (ITHIM) was developed by public health researchers in the United Kingdom to assess the potential health impacts of GHG emission reduction scenarios for London, U.K. and Delhi, India [4]. The model was later adapted for use in the San Francisco Bay area and applied to transportation scenarios created to comply with California's GHG emissions reduction goals. PHD further adapted the tool for use in the Portland metropolitan region for the CSCS HIA by using census data for the geography that makes up the Portland metropolitan region. In the CSCS HIA, PHD used ITHIM to assess six sample scenarios representative of a range of options associated with the 144 Phase 1 scenarios Metro was currently investigating. One of the recommendations of the CSCS HIA was to rerun ITHIM when the alternative scenarios had been narrowed by Metro to a manageable number. The CCC HIA contains the ITHIM analysis of the three scenarios (A, B, and C) defined in Metro's Phase 2 of the CSCS Project.

METHODOLOGY

For each disease considered, ITHIM applies measures of changes in exposure to estimate changes in mortality (deaths) and illness (as measured by disability adjusted life years or DALYs). ITHIM calculates mortality and illness for both baseline and each scenario and outputs are generally reported in the difference between baseline and scenario. Conceptually, baseline in ITHIM is the expected number of deaths and illness given the current rate of exposure for the expected population in 2035. Estimated impact is the difference between the expected outcome at baseline and the scenario.

ITHIM's methodology is grounded in applying relative risks to appropriate demographics. Relative risk is a statistical construct used by epidemiologists to understand the ratio of the probability of an event (developing a disease or dying) for those exposed compared to the probability of developing the disease without the exposure. In practice, relative risks are developed from large, longitudinal studies. For example, the probability of developing diabetes between two different groups — those who met the Surgeon General's exercise recommendations and those who did not — can be calculated from national, longitudinal survey data. Applying relative risks calculated from large cohort studies or in some cases, meta-analyses of multiple studies, allows ITHIM to estimate the number of new deaths or incidence of disease given current prevalence (or burden of disease) rates and the expected change in exposure from each scenario. By doing so, ITHIM is able to quantify the difference between baseline and scenario and allows for comparisons across scenarios.

One advantage of ITHIM is the ability to compare across various pathways. This is especially true when the tool can be refined to include local data. ITHIM was initially developed using global burden of disease data. This was updated with U.S. prevalence data for the San Francisco and CSCS HIA work. For the CCC HIA, PHD further refined ITHIM by using Oregon-specific prevalence

data for mortalities; local demographic data was used to extrapolate WHO models to local populations for DALYs.

This burden of disease approach allows for a comparison in impacts from each disease included and, by summing diseases by exposure type, from exposure pathways. For instance, it allows PHD to state that Scenario B will prevent six times as many stroke deaths (through increased exercise) as traffic fatalities.

ITHIM uses the relative risks for 13 separate diseases assigned to three exposure pathways: physical activity, traffic safety, and particulate air pollution as indicated by PM_{2.5}. The burden of disease approach is helpful in understanding which exposure pathway and/or disease is driving health benefits (or burdens). In turn, this allows specific recommendations and mitigation measures to maximize health given the constraints of the scenarios.

ITHIM depends on modeled and survey data such as burden of disease estimates, relative risk ratios, air pollution estimates and outputs from ODOT's GreenSTEP model. ITHIM does not account for statistical uncertainty of modeled and survey data, which likely increases the uncertainty of ITHIM estimates.

The primary limitation of ITHIM is that it underestimates health benefits due to data availability and the specific exposures and diseases represented in each pathway. Although such an assessment is outside of the scope of this HIA, additional analyses on the reduction of toxic air pollutants and ozone from transportation and transportation-specific policies (such as fleet turnover and advances in fuel technology) would likely show additional health benefits.

Table E-1 Exposure pathway, variable, and included illness for ITHIM

	Exposure pathway		
	Physical activity	Traffic safety	Air quality
Exposure variable	Per capita miles traveled by mode as modeled by GreenSTEP	Miles traveled by person by mode by type of street (non-arterial, arterial, freeway) as modeled by GreenSTEP	PM _{2.5} as modeled by GreenSTEP
Included illness	<ul style="list-style-type: none"> Breast cancer Colon cancer Stroke² Ischemic heart disease² Depression³ Dementia Diabetes Hypertensive heart disease² 	Serious traffic injuries	<ul style="list-style-type: none"> Lung cancer¹ Inflammatory heart disease^{1,3} Respiratory disease¹

(1) Illness is measured by disability adjusted life years (DALYs) which is the summation of Years of Life Lost (YLL) and Years of Life with Disability (YLD). These illnesses do not have YLD rates available.

(2) While primarily affected by changes in exposure to physical activity, ITHIM also applies an air quality factor to these illnesses.

(3) Relative risks of death were not available for these illnesses.

ITHIM is limited in its ability to quantify and compare health pathways by the specific diseases included in each pathway. Inclusion of disease is based upon the availability of data for the relative risk, the relative importance of the disease for that particular exposure, and the ability to control the relative risk for other diseases of interest. Table E-1 lists the specific diseases by exposure category in this version of ITHIM. Because ITHIM is limited to the 13 diseases, it likely underestimates the health benefits from reducing GHG emissions in all of the major exposure routes. Contemporary trends in medical science are increasingly linking physical activity to many other diseases, conditions, and cancers. Similarly, traffic safety in ITHIM is limited to prevalence rates of *reported* collisions; ITHIM thus underestimates the number of prevented collisions to the extent that collisions are under-reported – particularly for bicyclists. Air quality is limited in ITHIM to PM_{2.5} exposure only and thus underestimates health benefits from lower concentrations of a variety of ambient pollutants including ozone and air toxics.

Air quality affects a broad range of health outcomes and can be described through dozens of exposure variables. Advisory committee members suggested that ITHIM's treatment of the air pollution pathway was particularly weak due to its reliance on PM_{2.5} as the *only* exposure variable for light-duty vehicle (LDV) emissions. PHD feels confident in PM_{2.5} as the indicator due to the state of the science surrounding PM_{2.5} as transportation-related air pollutant. However, PHD acknowledges that PM_{2.5} does not capture the entire LDV emission profile including those of ozone precursors and air toxics. (Please see Appendix F for further discussion.) It is also important to note that PM_{2.5} is considered a good transportation indicator because of the vast amount attributable to heavy-duty diesel emissions; however diesel emissions are beyond the scope of Metro's planning project.

PHD investigated adding additional pollutant profiles into ITHIM but ran into several issues. First, there is a high occurrence of multicollinearity between transportation-related emission pollutants and correlation between health outcomes. For example, in most of the country, long-term ozone and PM_{2.5} measurements are highly correlated. Relative risks constructed with multi-pollutant models are relatively rare. Thus, even though PM_{2.5} appears biologically linked to cardiovascular disease and ozone to respiratory disease, either pollutant can be used to predict both diseases. Summing PM_{2.5} and ozone impacts would certainly double-count to some degree. This also suggests that some of the PM_{2.5} health effects captured in the relative risks for lung cancer, respiratory disease, and cardiovascular disease may be picking up effects from other transportation related pollutants that are highly correlated with PM_{2.5} emissions. For example, reduced time to death for lung cancer patients from PM_{2.5} exposure may also include some lung cancers deaths from benzene exposure given the current science supporting the relative risk estimates. Complicating matters further, the cardiovascular and respiratory systems are biologically linked, making any separation of health outcomes difficult, particularly across a suite of pollutants.

Second, knowledge about the health risks of many air pollutants is based on toxicology studies for cancer. For example, most air toxics tracked by Oregon DEQ are known carcinogens.

However, the risk of air toxics is generally stated in the *lifetime* risk of disease based on at least a multi-year exposure, such as working for many years at an industrial plant with high levels of toxic exposure. *Relative* risk ratios have an interpretation of yearly incidence or prevalence of disease based upon a shorter-term exposure such as a year; and is difficult to convert *lifetime* risk.

DETAILED RESULTS

Table E-2 provides detailed ITHIM results by exposure pathway for all three scenarios. Results include avoided mortality (deaths) and illness. Illness is measured by disability adjusted life years (DALY) which is the summation of years of life lost (YLL) and years living with a disability (YLD) due to illness. Results are presented in counts (or cases) avoided as well as percent reduction from current disease prevalence levels. Also note that ITHIM's raw count output assumes a stable (in this case 2010) population. All results in the report have been adjusted approximately 32% upward to account for population growth within the UGB. For example, there should be 58 fewer deaths from increased physical activity in 2035 if Scenario A is implemented. This is 1.4% decrease in current deaths attributable to physical inactivity.

Table E-2 Avoided mortality and illness (DALY) by exposure pathway and scenario

	Avoided	Scenario A			Scenario B			Scenario C		
		Count	Percent	Count w/ population factor ¹	Count	Percent	Count w/ population factor ¹	Count	Percent	Count w/ population factor ¹
Physical activity	Mortality	-44	-1.4%	-58	-68	-2.1%	-89	-88	-2.9%	-116
	YLL	-355	-1.5%	-468	-566	-2.3%	-747	-748	-3.1%	-988
	YLD	-247	-1.0%	-325	-444	-1.6%	-586	-605	-2.3%	-799
	DALY	-601	-1.3%	-793	-1,010	-1.9%	-1333	-1,354	-2.8%	-1786
Traffic safety	Mortality	-1	-1.2%	-1	-3	-3.5%	-4	-9	-10.5%	-12
	YLL	-21	-1.2%	-28	-64	-3.5%	-84	-190	-10.5%	-251
	YLD	-33	-3.8%	-44	-68	-7.6%	-89	-145	-16.4%	-192
	DALY	-55	-2.0%	-72	-131	-4.9%	-173	-336	-12.5%	-443
Air quality (PM_{2.5})	Mortality	-3	-0.2%	-4	-4	0.2%	-5	-4	-0.3%	-5
	YLL	-28	-0.2%	-37	-32	0.2%	-42	-36	-0.3%	-47
	YLD	-0	-0.0%	0	-0	0.0%	0	-0	-0.0%	0
	DALY	-28	-0.2%	-37	-32	0.2%	-42	-36	-0.2%	-47
Total	Mortality	-48	-0.9%	-64	-74	1.4%	-98	-101	-2.0%	-133
	YLL	-404	-0.9%	-533	-662	1.4%	-874	-974	-2.1%	-1286
	YLD	-280	-0.6%	-370	-511	1.1%	-675	-750	-1.6%	-990
	DALY	-684	-0.7%	-903	-1,173	1.3%	-1548	-1,725	-1.9%	-2276

- (1) ITHIM estimates disease reduction based on stable (2010) population figures. Assuming disease burden rates remain the same in 2035, counts are adjusted upward by addressing the 32.0% increase in population expected within the Urban Growth Boundary from 2010 to 2035.
- (2) Disability adjusted life years (DALY) is the summation of years of life lost (YLL) and years living with a disability (YLD) due to illness. YLD are unavailable for respiratory and inflammatory cardiovascular disease (all cardiovascular disease associated with air pollution exposure) as well as lung cancer at this time.

To compare exposure pathways, the percent reduction attributable to each was calculated for deaths and illnesses. Table E-3 provides detailed results and shows that the majority of health benefits are from reducing physical inactivity burden.

Table E-3 Percent of health benefits attributable to exposure pathway by scenario

		Percent reduction attributable to exposure pathway		
		A	B	C
Physical activity	Mortality	91.4%	91.1%	87.0%
	YLL	87.8%	85.6%	76.8%
	YLD	88.0%	86.8%	80.6%
	DALY	87.9%	86.1%	78.5%
Traffic safety	Mortality	2.1%	4.1%	9.1%
	YLL	5.3%	9.6%	19.5%
	YLD	11.9%	13.2%	19.4%
	DALY	8.0%	11.2%	19.5%
Air quality	Mortality	6.5%	4.8%	3.9%
	YLL	7.0%	4.8%	3.7%
	YLD	0.0%	0.0%	0.0%
	DALY	4.1%	2.7%	2.1%

THIM provides outputs by disease for exposure pathways in which more than one disease is included. Tables E-4 present the population adjusted avoided illness (DALY) and mortality results for individual diseases in the physical activity and air quality (PM_{2.5}) exposure pathways.

Table E-4 Avoided mortality and illness (DALY) by illness and scenario for physical activity and air quality exposure pathways¹

	Scenario A		Scenario B		Scenario C	
	DALY	Mortality	DALY	Mortality	DALY	Mortality
Breast cancer	-13	-1	-29	-1	-32	-1
Colon cancer	-11	-1	-21	-2	-24	-2
Stroke	-181	-15	-290	-23	-400	-29
Ischemic heart disease	-205	-20	-319	-30	-442	-42
Depression	-57		-125		-162	
Dementia	-117	-8	-220	-14	-241	-15
Diabetes	-129	-5	-209	-7	-324	-10
Hypertensive heart disease	-79	-9	-119	-12	-161	-16
Physical activity total	-793	-58	-1,333	-89	-1,786	-116
Lung cancer	-21	-2	-24	-2	-26	-3
Inflammatory heart disease (associated with PM2.5 exposure)	-2		-3		-3	
Respiratory disease	-14	-2	-16	-2	-17	-2
Air quality (PM_{2.5}) Total	-37	-4	-42	-5	-47	-5

(1) ITHIM estimates disease reduction based on stable (2010) population figures. Assuming disease burden rates remain the same in 2035, counts are adjusted upward by addressing the 32.0% increase in population expected within the Urban Growth Boundary from 2010 to 2035.

ITHIM addresses traffic safety by estimating the number of severe crashes and fatalities by mode and by type of road. The tool is able to account for increased crashes for active transportation users even as overall traffic crashes decrease as miles travel shift from car to other modes. Table E-5 and E-6 present estimates for traffic fatalities and injuries respectively in 2035. Note that all counts have been adjusted for 2035 population. Also note that injuries are serious injurious only. Injury information is further analyzed to develop DALY results presented above.

Table E-5 ITHIM estimates of expected DALYs from traffic injuries by mode in 2035

Mode	Baseline	Scenario A	Scenario B	Scenario C
Walk	889.2	958.3	952.8	898.1
Cycle	316.7	312.3	356.7	372.7
Bus	0.0	0.0	0.0	0.0
Car	1905.8	1773.9	1639.5	1418.1
Motorbike	424.5	419.4	413.9	404.4
Total ¹	3555.4	3483.0	3382.0	3112.5
Sum of difference between baseline and scenario		-72.4	-173.3	-442.9

(1) Note that the total is not the sum of the modes presented as it also adds in a small but fixed number of HGV crashes.

Table E-6 ITHIM Estimates of Expected Traffic Fatalities by Mode in 2035

Mode	Baseline	Scenario A	Scenario B	Scenario C
Walk	34.3	37.0	36.7	34.6
Cycle	10.4	10.2	11.7	12.4
Bus	0.0	0.0	0.0	0.0
Car	53.4	49.7	45.9	39.7
Motorbike	15.9	15.8	15.6	15.3
Total ¹	114.8	113.4	110.7	102.7
Sum of Difference between Baseline and Scenario		-1.4	-4.0	-12.1

(1) Note that the total is not the sum of the modes presented as it also adds in a small but fixed number of HGV crashes

Appendix F. Air Quality White Paper

ITHIM estimates air pollution mortality and morbidity using particulate matter (PM_{2.5}) as an indicator. The advisory group suggested exploring the expansion of the pollutant profile and expected health impacts beyond PM_{2.5}. Other commonly considered air pollutants include ground-level ozone (O₃) and NO₂ exposure. Ambient air is also monitored for known carcinogens or air toxics. All of these pollutants were investigated for potential inclusion in this HIA.

Air pollution is primarily regulated through the U.S. EPA and monitored by Oregon. The most prominent EPA regulations are for six ‘criteria’ pollutants. Three of these are particularly relevant to transportation: PM_{2.5}, ozone and NO₂. The regulator context informs both the current conditions and the body of scientific evidence. Table 1 provides a summary of the most recent EPA science reviews for PM_{2.5}, ozone and NO₂ and includes known health outcomes and the relative weight of evidence. The health outcomes are cardiovascular (PM_{2.5}), respiratory (ozone) and central nervous system illness, and death. Because PM and ozone are further developed, the remainder of this section concentrates on these two pollutants when discussing criteria pollutants.

TABLE 1 Summary of U.S. EPA integrated science assessment weight of evidence for health effects associated with PM, ozone, and NO₂

Health outcome	PM (PM _{2.5}) 2009 ISA[69]	O ₃ 2013 ISA[70]	NO _x (NO ₂) 2008 ISA[68]
Short term exposure			
Respiratory morbidity	●●●●	●●●●●	●●●●
Cardiovascular morbidity	●●●●●	●●●●	●●
Central nervous system morbidity	Not reviewed	●●●	Not reviewed
Mortality	●●●●●	●●●●	●●●
Long term exposure			
Respiratory morbidity	●●●●	●●●●	●●●
Cardiovascular morbidity	●●●●●	●●●	●●
Reproductive/birth outcomes	●●●	●●●	●●
Central nervous system morbidity	Not reviewed	●●●	Not reviewed
Cancer	●●●	●●	●●
Mortality	●●●●●	●●●	●●

- **Causal** - Evidence is sufficient to conclude there is a causal relationship and has been shown to result in health effects in studies in which chance, bias, and confounding could be ruled out with reasonable confidence.
- **Causal likely** - Evidence is sufficient to conclude that a causal relationship is likely to exist, but important uncertainties remain.
- **Suggestive of causal** - Evidence is suggestive of a causal relationship but is limited. (i.e. - relies only on toxicology, or high quality epidemiological study is inconsistent with past evidence)
- **Inadequate to Infer** - Evidence is inadequate to determine that a causal relationship exists; available studies are of insufficient quantity, quality, consistency, or statistical power.
- **Not likely to be causal**

Scientific consensus about the strength of and causal nature of the relationships between PM_{2.5} and health is clear from the EPA reviews [68-70]. A recent World Health Organization scientific review also concludes that PM_{2.5} is the best air pollution indicator for health impact analyses [71]. Because the

health pathways and risk ratios are most developed for PM_{2.5}, PHD feels confident in using PM_{2.5} as the primary air pollution indicator within ITHIM.

Still, health evidence is mounting for ambient exposure from ozone and certain air toxics. Further, some pollutants affect certain health outcomes more than others. The following sub-sections provide analyses of criteria pollutants (PM_{2.5} and ozone) and carcinogenic air toxics. Each section provides a brief literature review to understand the breadth and severity of health effects followed by presentation of local incidence of disease and pollution conditions. After the discussion of specific pollutants is a section that addresses the spatial distribution of air pollution and the health burden it places on specific vulnerable populations.

Criteria pollutants (PM_{2.5} and ozone)

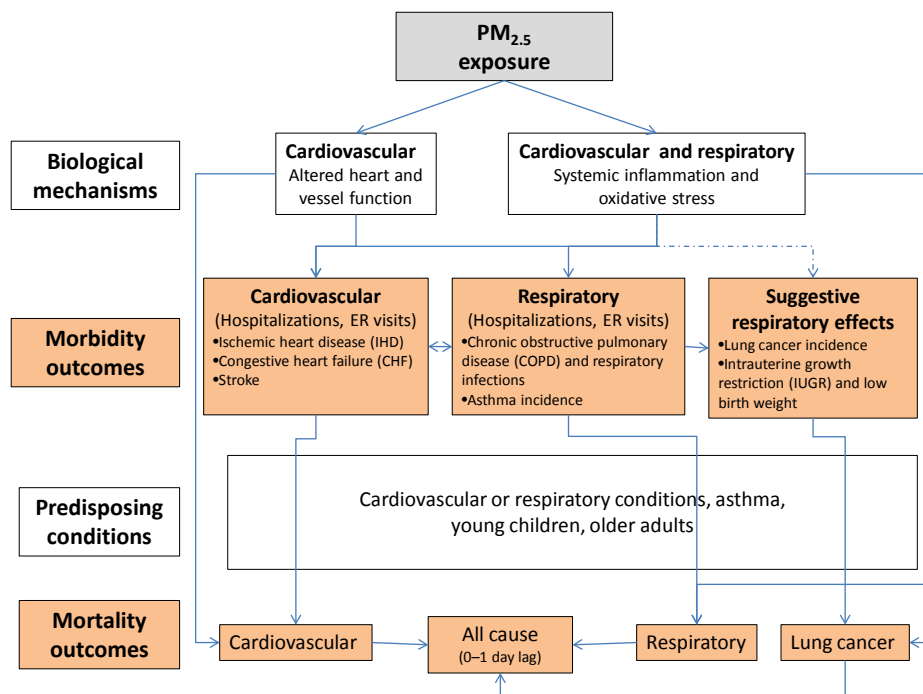
EPA regulates six criteria pollutants including PM_{2.5} and ozone. PM_{2.5} is ambient ultra-fine particles created during the combustion process and is primarily an issue during winter inversion layers. Ozone is created from reactions of precursor pollutants — largely emitted through combustion processes — in the presence of solar radiation. Elevated ground-source ozone concentrations typically occur in the afternoon and during summer months. The primary route of exposure for PM_{2.5} and ozone is through inhalation.

Transportation emissions are a significant source of both pollutants. Nationally, road transportation accounts for 6.9% of PM_{2.5} emission totals. Ozone is routinely reported in terms of precursor pollutants with 38.5% of NO_x and 1.2% of SO_x emission totals attributable to road transportation. Populations clustered near roads are much more likely to be exposed to road transportation sources. A recent study estimated that weighting concentrations by population would result in road transportation as the top contributor of human exposure. In this model, road transportation accounted for 26.3% of PM_{2.5} and 54.3% of ozone exposure [87].

Health pathways for PM_{2.5}

Inhaling PM_{2.5} harms the heart and lungs as the particles embed deep within the respiratory tract. Particulate matter degrades health through systemic inflammation, oxidative stress, and altered heart and blood vessel function. Short and long-term health outcomes of concern are primarily cardiovascular with secondary respiratory effects (see Figure E.1).

FIGURE E.1 Pathway diagram- Particulate matter exposure and health outcomes



The EPA states with the highest levels of confidence that short and long-term exposure to PM_{2.5} causes cardiovascular morbidity (illness) and mortality (death), likely causes respiratory disease and death, is increasingly associated with poor birth outcomes such as low birth weight, and is increasingly believed to exacerbate lung cancer resulting in death.

Evidence of **short-term** exposure to PM_{2.5} is best developed for cardiovascular mortality and non-fatal cardiovascular events [72]. Documented short-term morbidity outcomes associated with PM_{2.5} include a one day lag in hospitalizations and emergency department visits for ischemic heart disease and congestive heart failure following a spike in PM_{2.5} concentrations. A region of 5 million people can expect one premature cardiovascular death for every 10 µg/m³ increase in PM_{2.5} during the preceding day [72]. Causal respiratory outcomes are less certain but include emergency room visits and hospitalizations for COPD and respiratory infections [69].

Long-term exposure to PM_{2.5} also increases the risk of cardiovascular and cardiopulmonary mortality [72]. A recent review suggests chronic exposure to PM_{2.5} increases the nonaccidental risk of death by 6%, cardiovascular death by 12–14%, and lung cancer death by 15–21% for every increase in 10 µg/m³ [88].

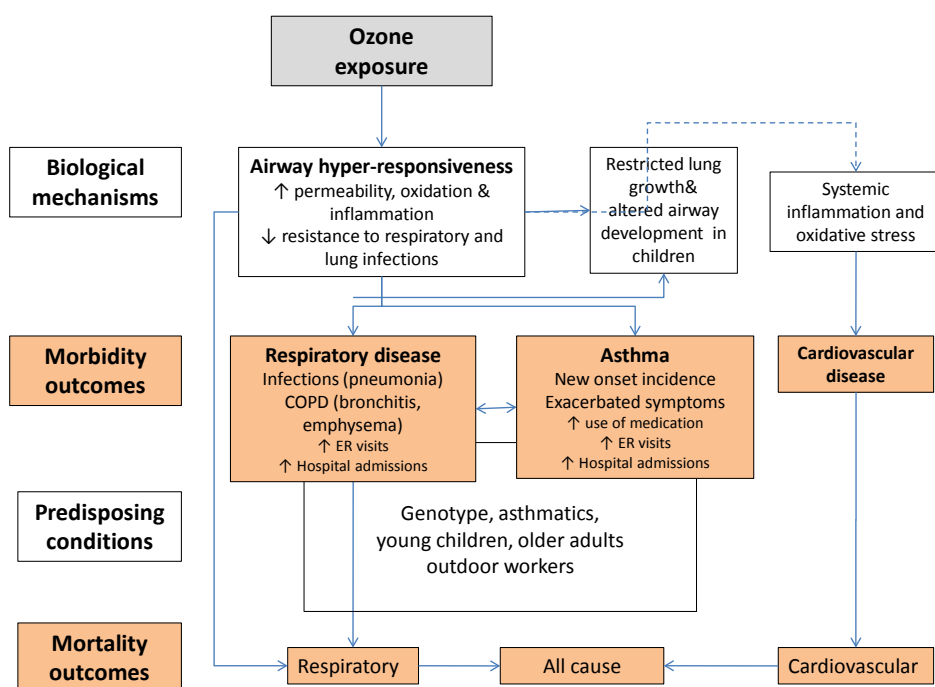
Morbidity outcomes associated with long-term exposure include: bronchitis in children, chronic bronchitis in adults over 30 years, asthma attacks, cardiovascular and respiratory hospital admissions, urgent care or emergency department visits due to asthma and cardiovascular disease, and restricted activity days for adults [71].

Emerging multi-pollutant models suggest pulmonary and respiratory responses associated with PM_{2.5} may be due to highly correlated exposure to co-pollutants such as ozone [73]. Yet the linear relationship between PM_{2.5} exposure and cardiovascular mortality hold at all levels for both short and long-term relationships [71, 72]. This implies **there is no level at which exposure to PM_{2.5} is safe** and that **all reductions in PM_{2.5} would be expected to have similar rates of reduction in death and disease**.

Health pathways for ozone

Ground-source ozone is documented to cause short-term airway hyper-responsiveness including increased permeability, oxidation and inflammation. (See Figure E.2.) Exposure to ozone can result in decreased resistance to respiratory and lung infections. Over time, this may restrict lung growth in children (an asthma risk), alter the airway, and stress the cardiovascular system [70].

FIGURE E.2 Pathway diagram- Ozone exposure and health outcomes



The relationship linking respiratory effects to **short term** exposure of ozone is well documented. Short-term health outcomes include respiratory mortality and morbidity as measured by respiratory and cardiovascular hospital admissions. Exposure to ozone has also been shown to increase new onset asthma, asthma symptoms, medication use, emergency room visits, and hospitalizations [70, 71].

Analysis of longitudinal cohorts also documents a likely causal effect on mortality and morbidity from **long-term** exposure to ozone. Research shows the strongest associations between long-term exposure and respiratory morbidity and mortality, with a 4% increase in risk for every 10 ppb exposure. Any secondary cardiovascular effects may be due to the correlation between ozone and PM_{2.5} [73]. Other

research suggests that mortality risk increases with ozone exposure in populations with predisposing conditions such as COPD, diabetes and congestive heart failure. Research also supports the conclusion that long-term ozone exposure exacerbates asthma incidence, severity and hospitalization [70, 71].

Analysis of local cardiovascular and respiratory conditions

Ozone and PM_{2.5} have a significant effect on cardiovascular and respiratory conditions. While PM_{2.5} may be more directly linked to cardiovascular outcomes and ozone to respiratory outcomes, the presence of either pollutant can cause and exacerbate both types of health effects.

Many people suffer from heart disease in the Portland region. According to BRFSS, approximately 3% of adults in the region have had a heart attack; a similar number suffer from chest pain or heart disease and 2.7% report having suffered a stroke. These three cardiovascular conditions are highly associated with risk factors such as physical inactivity, high blood pressure, high cholesterol and high BMI (weight). Recent BRFSS data also shows that approximately 28% of adults report high blood pressure and 36% have had a high cholesterol reading in the past five years. Nearly 40% of adults report not meeting the recommended 150 minutes of aerobic physical activity per week. More than 35% are overweight and nearly 24% are obese [8].

Prevalence⁽¹⁾ of adults who have suffered from heart attack, angina and stroke in Oregon and the three-county Portland region

	Heart attack	Angina (chest pain from heart disease)	Stroke
Oregon	3.6%	3.6%	2.9%
Clackamas	3.3%	2.8%	2.8%
Multnomah	3.0%	2.9%	2.7%
Washington	2.6%	2.9%	3.0%

(1) 2011 BRFSS

Cardiovascular disease is costly to treat. Oregon Hospital Discharge Index data in 2008 showed hospitalization charges for heart attacks averaged about \$40,000 [89]. The CDC estimates from the Chronic Disease Cost Calculator put the annual direct medical costs at over \$1.5 billion for the Portland metropolitan area. Approximately \$620 million of the region's cardiovascular costs are associated with Medicare and Medicaid patients which make up 14 and 15% of the Oregon population [10, 11].

Respiratory illness also significantly degrades quality of life. Conditions such as asthma and COPD are caused and/or exacerbated by poor air quality. A little more than 5% of adults report having COPD. More than 9% of Portland region adults report a current asthma condition making the Oregon adult rate the sixth highest in the country [8, 9]. At least 7–8% of children in Oregon have asthma according to parental response and when teens are directly surveyed, the prevalence increases to 10% [9].

Controlling asthma can be difficult and costly. Most asthma patients fill multiple prescriptions regularly. When medications are not adequately controlling symptoms, patients use the emergency department

and hospital system. For every four asthma visits to the emergency department, at least one results in a hospitalization. The average cost of an asthma hospitalization is approximately \$14,300. In 2011, this resulted in over \$15 million in charges and taxpayers were asked to pay nearly \$10 million for Medicaid and Medicare patients [9].

Costs (charges) of asthma hospitalization, 2011

		Clackamas	Multnomah	Washington	Three-county	Oregon(1)
Average cost of hospitalization						\$14,300
Total costs	Medicaid/OHP	\$677,661	\$2,681,673	\$999,123	\$4,358,457	\$8,000,000
	Medicare	\$872,489	\$3,452,655	\$1,286,371	\$5,611,514	\$10,300,000
	All payment sources	\$2,371,813	\$9,385,857	\$3,496,931	\$15,254,601	\$28,000,000

(1) Source: All-Payers, All Claims Database[9]

Analysis of local PM_{2.5} and ozone conditions

The EPA sets National Ambient Air Quality Standards (NAAQS) Rules to regulate PM_{2.5} and ozone.⁹ These are provided below. Routinely exceeding the NAAQS will result in regulatory action including mandated completion of attainment plans.

Current U.S. EPA NAAQS for NO_x, ozone and PM

Pollutant [final rule cite]	Primary/ secondary	Averaging time	Level	Form
Ozone [73 FR 16436, Mar 27, 2008]	Primary and secondary	8-hour	0.075 ppm (3)	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particle Pollution PM _{2.5} Dec 14, 2012	Primary	Annual	12 µg/m ³	annual mean, averaged over 3 years
	Secondary	Annual	15 µg/m ³	annual mean, averaged over 3 years
	Primary and secondary	24-hour	35 µg/m ³	98th percentile, averaged over 3 years

Source: www.epa.gov/air/criteria.html 8/23/13

⁹ It is important to consider that NAAQS are routinely revised and almost always become more stringent as scientific evidence builds. For instance, the Federal Clean Air Science Advisory Committee reviewing evidence before the 2008 EPA NAAQS rule of 0.075 ppm recommended a standard in the 0.060-0.070 ppm range. The court has upheld the 0.075 ppm rule, but most health experts would lower the standard to 0.060 ppm or below. The EU has a non-binding rule of no more than 25 days at or above 0.060 ppm; UK rules suggest levels below 0.050 ppm all but 10 days of the year.

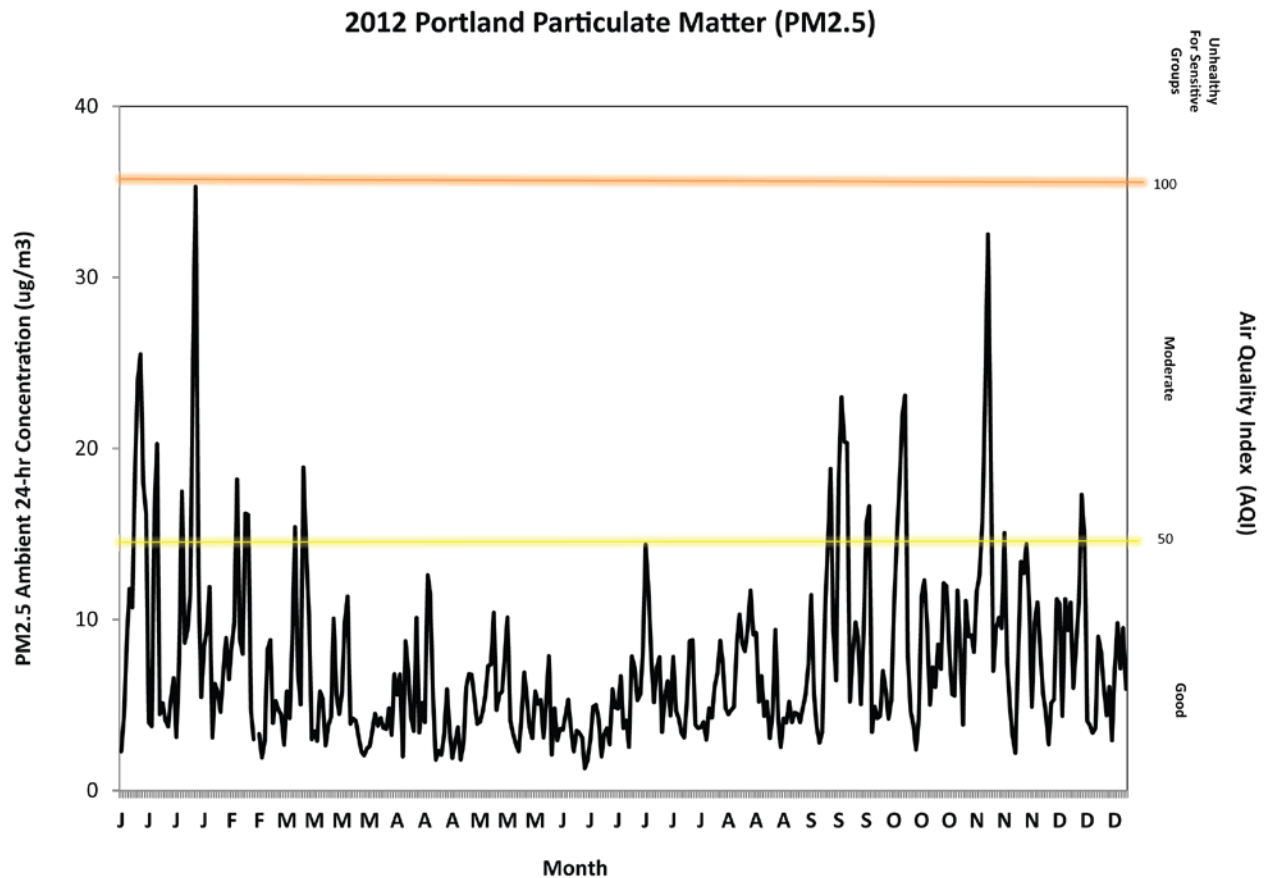
In general, the Portland metropolitan area is well within attainment. The yearly average of PM_{2.5} has ranged between 6.3 and 9.8 µg/m³ over the past decade. A yearly average of 2012 day-time ozone levels is approximately 0.033 ppm. While these levels are within attainment, this chronic exposure results in long-term illness and death.

The CDC's National Environmental Health Tracking [90] program provides county-specific estimates of mortality reduction in all-cause and coronary heart disease death associated with chronic exposure to PM_{2.5}. This tool estimates that a 10% reduction in PM_{2.5} from 2009 levels (yearly mean = 7.8 µg/m³) would result in a 0.5% decrease in all-cause mortality and a 2.2% decrease in cardiovascular mortality. This is the equivalent of 57 annual deaths, 31 of them from coronary heart disease, in the three-county Portland region [90]. Another highly influential and cited study found that every 10 ppb increase in ozone results in a 1.040 (1.013–1.067) relative risk of respiratory death even after controlling for PM_{2.5} effects [73].

Another recent study used the epidemiological evidence to estimate sector-specific deaths attributed to long-term exposure to PM_{2.5} and ozone. Oregon-specific mortality rates were estimated. According to this study, road transportation-related PM_{2.5} — including both heavy duty diesel and light duty vehicles — causes more than 108 cardiovascular and lung cancer deaths and ozone causes more than 15 premature respiratory deaths within the UGB each year [87].

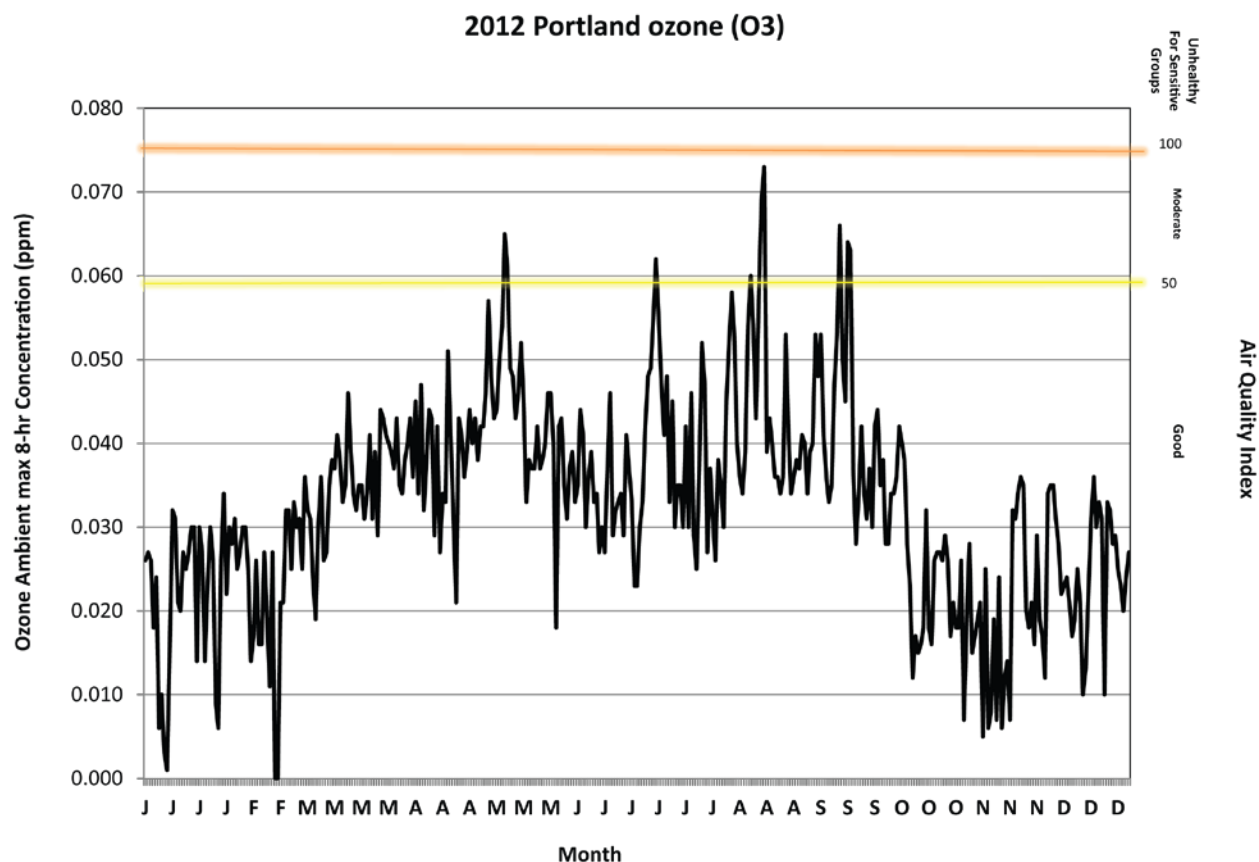
The NAAQS for PM_{2.5} and ozone also help protect against acute health effects associated with high short-term exposure. The EPA has also developed an Air Quality Index (AQI) as a public communication tool to advise when air quality is poor enough to warrant behavior modification. AQIs are forecasted using meteorological data to predict when weather patterns will result in short term spikes in PM_{2.5} (winter inversion layers) and ozone (hot summer days).

The graphs below provide daily maximum 24-hour PM_{2.5} and 8-hour ozone averages and the associated AQI as recorded in the southeast Portland metropolitan region in 2012. The region is NAAQS compliant because there are few, if any, short-term spikes of PM_{2.5} above 35 µg/m³ or ozone above 0.075 ppm.



Source: Oregon DEQ, 2012

The AQI categories suggest that any value below 50 is ‘good’ for public health and values between 50 and 100 are only of ‘moderate’ concern. However, the public health literature increasingly suggests that all levels of $\text{PM}_{2.5}$ and ozone are of concern. There is no level at which $\text{PM}_{2.5}$ does not affect health. It is also widely recognized that any threshold for which ozone does not degrade health “is likely to lie below 0.045 ppm” and may be lower than even 0.035 ppm [71]. Warmer summers from weather events and climate change may result in even higher ozone levels.



Source: Oregon DEQ, 2012

Short-term AQI levels between 50 and 100 produce measurable impacts in cardiovascular and respiratory illness and death. These short-term air-quality ‘episodes’ may be weather-driven, but are still of great public health concern, particularly for vulnerable populations including those with high cardiovascular or respiratory risks and populations exposed to higher localized concentrations near busy roads and highways.

To understand the impact of short-term, acute exposure in the moderate AQI range, we considered the impact of $PM_{2.5}$ episodes¹⁰ on one high-severity endpoint: death from a heart attack. A day or even hours of elevated $PM_{2.5}$ exposure can trigger a heart attack in populations with underlying heart disease risk factors. In 2012, the region recorded five $PM_{2.5}$ episodes where concentrations were well above $20 \mu\text{g}/\text{m}^3$ for multiple days. For an area of 1.5 million people, every three-day $PM_{2.5}$ episode results in approximately one premature cardiovascular death triggered by a heart attack.¹¹ In the U.S., 15.2% of

¹⁰ Defined as multiple days with $PM_{2.5} > 15 \mu\text{g}/\text{m}^3$ with at least one of the days $> 20 \mu\text{g}/\text{m}^3$.

¹¹ The American Heart Association (Brook et al, 2010) states that every day with a $10 \mu\text{g}/\text{m}^3$ increase in $PM_{2.5}$ results in a one day lag of one premature cardiovascular death per 5 million people.

heart attacks result in death within 30 days [91]. In 2012, the Portland region likely experienced approximately 30 preventable heart attacks, five resulting in death, due to elevated exposure during PM_{2.5} episodes.

A comparable exercise could be carried out for other cardiovascular endpoints for PM_{2.5} episodes. Additional analysis would also tell a similar story for respiratory conditions such as asthma during ozone episodes. For example, a recent study of 1.2 million children under age six in New York State found the risk of respiratory and asthma hospitalization increased by 22% for every 0.001 ppm increase in mean ozone during the warm season and 68% on days with ozone was greater than 0.070 ppm even after controlling for 13 socio-economic, familial and weather variables [92].

Air toxics

Air toxics refer to the suite of pollutants in the air from a variety of sources, including industrial processes, transportation and wood burning stoves. This section briefly summarizes the 2012 Oregon Department of Environmental Quality (DEQ) Portland Air Toxics Solutions (PATs) report and effort and focuses on air toxics most associated with light-duty cars and trucks [75]. The table below lists the pollutants associated with light duty vehicles. It also lists possible health effects including EPA's cancer risk classification and the toxicological evidence.

Onroad mobile air toxic pollutants and health effects

Pollutant	Health effects	Toxicological evidence - animal (A) or human (H)
Acrolein	General respiratory congestion; eye, nose, and throat irritation	A, H
Arsenic	Known (Class A) human carcinogen (lung); irritation of skin and mucous membranes	A, H
Benzene	Known (Class A) human carcinogen (leukemia); anemia, blood disorders, immune system damage	A, H
1,3-Butadiene	Probable human carcinogen (leukemia); cardiovascular disease	H
Chromium VI	Known (Class A) human carcinogen (lung); respiratory tract damage and disease	H
Ethyl benzene	Respiratory irritation, central nervous system	A
Formaldehyde	Probable (Class B1) human carcinogen (lung & nasal); respiratory irritation	H
Naphthalene	Possible (Class C) human carcinogen; eye and retina damage	A, H
Polycyclic aromatic hydrocarbons (PAH)	Varies depending on compound; 7 are probable (Class B2) carcinogens	

Inorganic arsenic, benzene, and chromium IV are all listed as Class A, known carcinogens. 1,3-Butadiene, a probable human carcinogen, is highly attributable to light-duty vehicle exposure. Epidemiological studies have shown arsenic and chromium increase the risk of lung cancer. Similar studies have shown that benzene increases the risk of blood disorders including leukemia. 1,3-Butadiene also increases the risk of leukemia and may increase cardiovascular effects. The EPA lifetime carcinogenic unit risks for each pollutant are shown below.

Lifetime carcinogenic risk for inhaled exposure

Pollutant	Primary cancer type	Unit risk
1, 3-Butadiene	Leukemia	3E-3 per $\mu\text{g}/\text{m}^3$ (0.08 per ppm)
Arsenic	Lung	4.3E-3 per 1 $\mu\text{g}/\text{m}^3$ (1)
Benzene	Leukemia, primarily acute myeloid	2.2E-6 to 7.8E-6 per 1 $\mu\text{g}/\text{m}^3$
Chromium VI	Lung	1.2E-2 per 1 $\mu\text{g}/\text{m}^3$

Source: www.epa.gov/iris/

(1) may increase in $>2 \mu\text{g}/\text{m}^3$ exposure settings

Current conditions

Oregon has adopted ambient benchmarks significantly lower than the lifetime carcinogenic risk in an effort to reduce health risks. (See www.deq.state.or.us/aq/toxics/docs/abcRuleFinal.pdf.) These

benchmarks are meant to protect the public — including more sensitive groups such as the elderly and children — from health outcomes beyond cancer.

Oregon’s Department of Environmental Quality (DEQ) monitors air toxics within the Metro region. DEQ recently modeled expected pollutant levels in 2017 for 19 pollutants and compared the results to benchmarks. Select results of this modeling exercise are provided in the table below.

Air toxics in the Portland metropolitan region

Pollutant	Current levels	Oregon benchmark		Modeled 2017 (1)	
	µg/m ³	µg/m ³	% Reduction	% Attributable to onroad mobile	% Attributable to light duty
Acrolein	0.131	0.02	84.7%	3	1.9
Arsenic	0.000558	0.0002	64.2%	28	10.1
Benzene	0.956	0.13	86.4%	13	12.4
1,3-Butadiene	0.249	0.03	88.0%	64	56.3
Chromium VI	0.000107	0.00008	25.2%	59	54.9
Diesel pm	1.117	0.1	91.0%	16	0
Ethyl benzene	0.631	0.4	36.6%	32	30.4
Formaldehyde	0.667	0.077	88.5%	8	5.0
Naphthalene	0.159	0.03	81.1%	10	6.2
Polycyclic aromatic hydrocarbons (PAH)	0.018	0.0009	95.0%	10	2.8-6.2

(1) Oregon DEQ (2011) Air Toxics Pollutant Summaries. 6/2/11.

Metro’s Climate Smart Communities Scenarios Project is focused on light-duty vehicles. Significant reductions in vehicle miles traveled and gasoline fuel consumption are expected to help reduce air toxic pollutants with large portions attributed to light-duty, gasoline vehicles. These pollutants include a suite of 15 PAHs (2.8–6.2%), arsenic (10.1%), benzene (12.4%), ethyl benzene (30.4%), chromium VI (54.9%), and 1,3 butadiene (56.3%).

The scenarios under consideration are projected to reduce GHG emissions by 12, 24 and 36% respectively. The corresponding estimated decrease in PM_{2.5} is 2.8, 3.2 and 3.5%. It is beyond the scope of this analysis to determine how individual air toxic pollutants will change under the scenarios given the limitations of ODOT’s GreenSTEP model and the ITHIM methodology. Air toxics should decrease by at least the amount projected for PM_{2.5} and may follow a trajectory closer to the GHG reduction targets depending on the pollutant. Further analysis would be needed to determine how the preferred alternative aligns with Oregon adopted ambient benchmark concentrations for the pollutants monitored under PATS.

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OHA 8613 (03/14)

Metro's Climate Smart Communities Scenarios Project

The goal of the legislative mandate is to reduce per capita greenhouse gas emissions from cars and small trucks by 20% in the Portland metropolitan area by 2035. Metro, the Portland metropolitan regional government, is leading a community process to plan to meet this requirement in the Climate Smart Communities Scenarios Project.

www.oregonmetro.gov/index.cfm/go/by.web/id/36945

Health Impact Assessment

HIA can increase positive health effects and mitigate unintended health impacts by providing objective, evidence-based information. OHA conducted this assessment at Metro's request, with funds provided by the Center for Disease Control and Prevention's Healthy Community Design Initiative. The HIA looked at the potential health benefits that may result from implementing each of three scenarios.

More than 30 people representing local governments, state and regional agencies, community groups and public health nonprofits provided guidance and data for this HIA. Seven members of the advisory committee provided a full technical review of the draft report.

Climate change and health

Significant shifts in the climate are already happening. The Third National Climate Assessment reported that as the climate continues to change, Oregon will likely experience more frequent heat waves and wildfires, an increase in asthma and other respiratory diseases, changes in disease patterns, and diminishing quality and quantity of water.

www.globalchange.gov/what-we-do/assessment

To view the entire report visit:

<https://public.health.oregon.gov/HealthyEnvironments/TrackingAssessment/HealthImpactAssessment/Pages/Community-Climate-Choices-HIA.aspx>

Community Climate Choices Health Impact Assessment Scope

Geography: Portland, Oregon metropolitan region within the Urban Growth Boundary

Timeline: 2010 (base year) to 2035 (horizon year)

Scenarios - adopted local and regional plans with:

A: existing revenues

B: increased revenues from existing sources

C: new plans, policies and revenue sources

Exposure pathways: physical activity, traffic safety, air quality, land use

Quantitative tool: Integrated Transportation Health Impact Model (ITHIM)

Other considerations: magnitude of health costs associated with health pathways, vulnerable populations.



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COMMUNITY CLIMATE CHOICES Health Impact Assessment (HIA)



Flexible, safe, reliable transportation systems PROVIDE HEALTHY CHOICES.

As mandated by the 2009 Oregon Legislature, the Metro regional government is assessing options for reducing greenhouse gas emissions in the Portland metropolitan area. This HIA found that the investments in land use and transportation systems under consideration impact health by increasing physical activity, reducing traffic collisions, and improving air quality.

The vast majority of the health benefits depend on the use of active transportation to decrease emissions. This suggests the final plan could maximize health returns by increasing access and reducing barriers to biking, walking and transit.



PHYSICAL ACTIVITY

Physical inactivity is a leading risk factor for deadly health burdens in our region. Exercising at least 150 minutes a week prevents chronic diseases and can add up to four years in life expectancy, but only half of all Oregonians meet that goal. Chronic diseases are costly. More than \$1.5 billion is spent each year on cardiovascular disease in the region and of that cost, \$623 million is borne by taxpayers in Medicaid and Medicare payments.

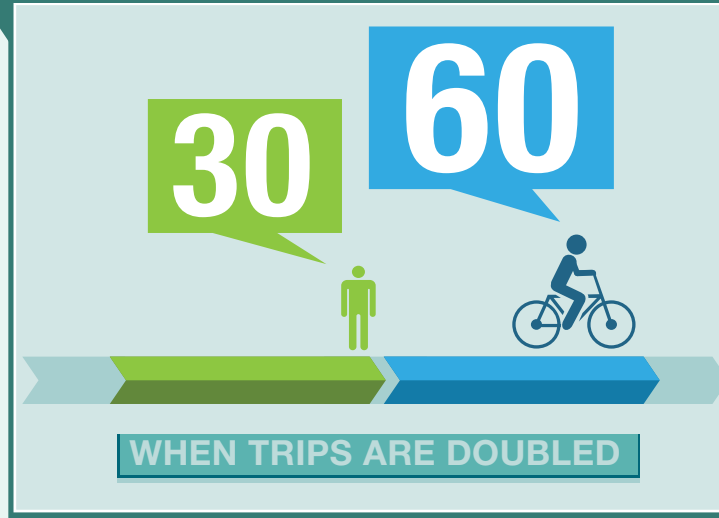
Increasing the number of people who regularly exercise by choosing to walk or bike to the library, school, work, church or the store can improve our region's health, reduce premature deaths and lower health care costs.



Scenario C would support the largest increases in walking and biking. Adding one more half-mile walking trip per person per week would save about 30 lives each year. Doubling the number of two-mile bike trips per person per week would save about 60 lives each year.

SCENARIO C

NUMBER OF ANNUAL LIVES SAVED



Transportation choices allow people to routinely and flexibly integrate physical activity into their lives. These choices depend on a well-functioning and safe transportation system for all types of users throughout the region.

Evidence shows that land-use elements of residential density, land-use mix, number of nearby community destinations and street connectivity are particularly effective at removing barriers to walking, biking, and use of transit. Complete streets may be the most health-promoting aspect of the investments and actions being considered.

TRAFFIC SAFETY

Reducing greenhouse gas emissions depends on reductions in per capita vehicle miles traveled (VMT) and expanded use of walking, biking and transit. **Reductions in per capita VMT improve traffic safety for car users in all scenarios.**

Scenario A results in one avoided traffic fatality per year and a decrease in disabilities from serious injuries by 2%. Scenario C results in reductions in disabilities from serious injuries by 12.5% and helps avoid 12 traffic fatalities a year. In cost-benefit analyses, the U.S. Department of Transportation and ODOT (Oregon Department of Transportation) routinely value a life lost in a traffic collision at more than \$9 million.

Although biking and walking can lead to an increased exposure to injury and air pollution, the overwhelming health benefits of physical activity far outweigh the risks. In Scenario B and C of Metro's Overview of Phase 2 Scenario Assumptions, the subsections labeled 'Complete Streets and Active Transportation Investments' are most important in supporting healthy behavior and reduce risks associated with biking and walking.

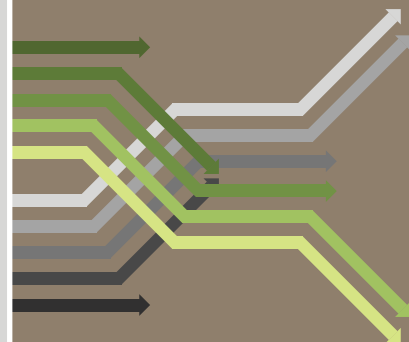


AIR QUALITY

Improving overall air quality is an important health benefit of greenhouse gas emissions reduction. The combined effect of reduced per capita vehicle miles traveled and cleaner fuel technologies is expected to modestly improve air quality under all scenarios, with the greatest improvements in Scenario C.

Air pollution can be highly localized with high concentrations near transportation corridors such as freeways and roads. Many vulnerable populations live in locations with high concentrations of air pollution. Active transportation facilities and buildings along transportation corridors should be designed to support increased physical activity while minimizing exposure to air toxics.

COMPLETE STREETS
SUPPORT HEALTHY CHOICES
FOR ALL USERS WITH



- Wider sidewalks
- Safe street crossings
- Improved bus shelters
- Bike lanes and cycle tracks
- Connections to regional bicycle network and regional trails





DATE: March 17, 2014

TO: TPAC, MTAC and Interested Parties

FROM: Kim Ellis, Principal Transportation Planner
Peggy Morell, Senior Communications Specialist

SUBJECT: Climate Smart Communities Scenarios Project – Update on 2014 Engagement Activities

PURPOSE

This memo provides an update on public engagement efforts being conducted for the Climate Smart Communities Scenarios Project to inform upcoming JPACT and MPAC discussions to shape the draft preferred approach. The memo also transmits a report summarizing recently completed stakeholder interviews for TPAC and MTAC consideration.

ACTION REQUESTED

No action is requested at this time.

BACKGROUND

The Climate Smart Communities Scenarios Project was initiated in response to a mandate from the 2009 Oregon Legislature to reduce per capita greenhouse gas emissions from cars and small trucks by 20 percent below 2005 levels by 2035. The goal of the project is to engage community, business, public health and elected leaders in a discussion to shape a preferred approach that accommodates expected growth, meets the state mandate and supports local and regional plans for downtowns, main streets and employment areas.

MOVING FORWARD TO SHAPE AND ADOPT THE REGION'S PREFERRED APPROACH IN 2014

Nearly two decades ago, the region agreed on a course for how to manage growth with the adoption of the 2040 Growth Concept – a blueprint for how the region grows over the next 50 years. For the last 20 years, the region has focused development and investment where it makes sense – in downtowns, main streets and employment areas.

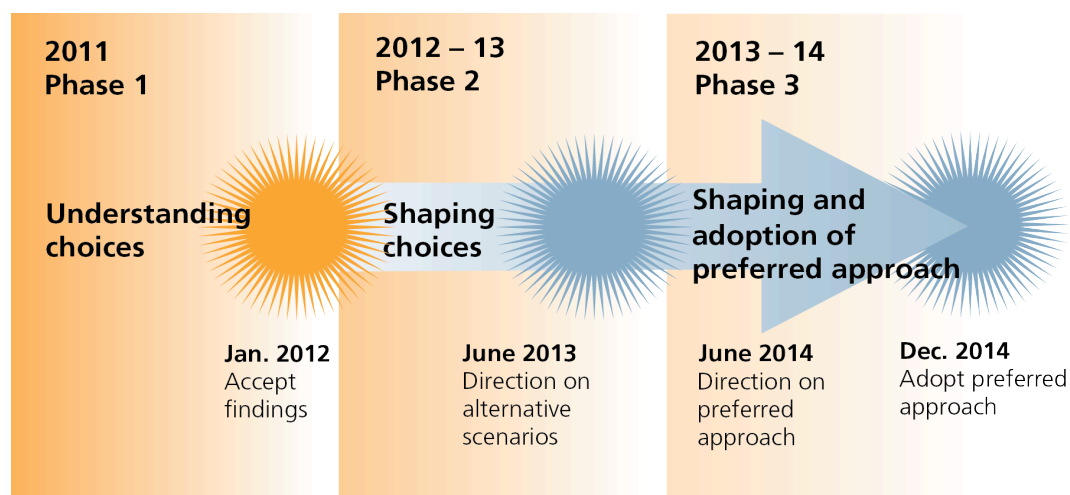
The results of the 2013 evaluation demonstrate that implementation of the 2040 Growth Concept and locally adopted zoning, land use and transportation plans and policies make the state-mandated greenhouse gas emissions reduction target achievable – if we make the investments and take the actions needed to implement those plans and make them a reality.

Similar to the analysis conducted for the Statewide Transportation Strategy accepted by the Oregon Transportation Commission in 2013, the CSC analysis demonstrated there are potentially significant benefits that can be realized by implementing adopted plans (Scenario B) and new policies and plans (Scenario C), including cleaner air, improved public health and safety, reduced congestion and delay and travel cost savings that come from driving shorter distances and more

fuel efficient vehicles. The analysis also showed that if we continue investing at our current levels (Scenario A) we will fall short of what has been asked of our region as well as other outcomes we are working to achieve – healthy communities, clean air and water, transportation choices, and a strong regional economy.

These findings can help the region make the case for increased investment and other actions that will be needed to implement the preferred approach the Metro Council considers for adoption in 2014. The project is in its third and final phase, and remains on track to meet its legislative and administrative mandates. **Figure 1** shows the project timeline.

Figure 1. Climate Smart Communities Project Timeline



In February, MPAC and JPACT approved moving forward with the eight-step process to shape and adopt a preferred approach in 2014 [**Attachment 1**]. As recommended by MPAC and JPACT, the preferred approach that is developed will start with the plans cities, counties and the region have adopted - from local zoning, capital improvement plans, comprehensive and transportation system plans to the 2040 Growth Concept and regional transportation plan - to create great communities and build a vibrant economy.

Toward that end, from January to May 2014, Metro is facilitating a Community Choices discussion to explore policy choices and trade-offs. The engagement activities will build upon earlier public engagement to solicit feedback from public officials, business and community leaders, interested members of the public and other identified audiences. Online comment opportunities, interviews, discussion groups, and statistically valid public opinion research will be used to gather input on:

- perceptions of the region's transportation system
- perceptions of access to jobs, and affordable housing and transportation options
- perceptions of the feasibility of implementing key strategies under consideration
- perceptions of investment priorities and infrastructure finance
- general willingness to support key strategies under consideration
- general willingness to pay more for key strategies under consideration
- general willingness to take personal actions to reduce greenhouse gas emissions.

During this period, community and business leaders, local governments and the public will also be asked to weigh in on which investments and actions should be included in the region’s preferred approach, with a focus on the policy questions proposed for discussion and input:

Table 1. Key policy questions for the Community Choices discussion

<ul style="list-style-type: none"> • <i>What mix of investments and actions best support your community’s vision for healthy and equitable communities and a strong economy while reducing greenhouse gas emissions?</i> <ol style="list-style-type: none"> 1. Make streets and highways more safe, reliable and connected 2. Make biking and walking more safe and convenient 3. Make transit more convenient, frequent, accessible and affordable 4. Use technology and “smarter” roads to actively manage traffic flow and boost system efficiency 5. Provide information (marketing and education) to expand walking, biking, carpooling, and use of transit and fuel-efficient driving techniques 6. Manage parking with a market-responsive approach to use parking resources efficiently • <i>Given the current uncertainty around transportation funding, how should we pay for investments needed to realize our shared vision for walkable communities, job creation, and affordable housing and transportation choices?</i>

To the extent possible, these engagement activities are being coordinated with the 2014 RTP update comment period that is planned for March 21 to May 5. A public engagement summary report and recommendations for the draft preferred approach will be provided to the Metro Council and Metro’s policy advisory committees at the first joint MPAC/JPACT meeting.

TPAC and MTAC will review the engagement summary, results of the April 11 MPAC/JPACT meeting and begin developing recommendations to JPACT and MPAC at their April 25 and May 7, respectively. TPAC and MTAC will be asked to finalize their recommendation to JPACT and MPAC at their regular meetings on May 21 and May 23, respectively.

On May 30, JPACT and MPAC will consider MTAC and TPAC’s recommendations and be requested to make a recommendation to the Metro Council on the draft preferred approach. The recommendation on the draft preferred approach will be subject to final evaluation and public review.

Figure 1 provides a summary of Phase 3 engagement activities and Council milestones for reference.

FIGURE 1. PHASE 3 PROJECT MILESTONES AND PUBLIC PARTICIPATION OPPORTUNITIES



PUBLIC ENGAGEMENT ACTIVITIES

Metro has contracted with two public opinion research and engagement firms, JLA Public Involvement and DHM Research, to develop and conduct five engagement activities during the Community Choices discussion period. In addition, Metro staff will be independently conducting three community forums in coordination with the integrated comment periods being held for the 2014 Regional Transportation Plan update (which includes consideration of the Regional Active Transportation Plan), and the Metropolitan Transportation Improvement Plan for 2014-2018. During this period, Metro Councilors and staff will also be engaging state commissions and county-level policy coordinating committees.

Table 2 provides a summary of Phase 3 engagement activities.

TABLE 2. PHASE 3 ENGAGEMENT ACTIVITIES

Who	Engagement activity	Timeframe	Number of participants
Metro Councilors and staff	State Commission Briefings		LCDC and OTC members and department directors
	1 - Land Conservation and Development Commission	Feb. 14 (completed)	
	2 – Oregon Transportation Commission	March 20	
JLA Public Involvement	Stakeholder interviews	Jan. – Feb. (completed)	33 elected officials and public health, environmental, business, environmental justice & equity leaders
DHM Research	Focus groups by 3 counties with representative sample of participants	Feb. 22 (completed)	22 community members
DHM Research	Public opinion survey with statistically representative sample of participants	March 17-21	600 community members (200 from each county)

Who	Engagement activity	Timeframe	Number of participants
JLA Public Involvement	Discussion groups 1 - Investments and actions discussion 2 - Implementation and monitoring of preferred approach	1 – March 28 2 – April 2	40-50 public health, environmental, business, environmental justice & equity stakeholders
JLA Public Involvement	Online public comment tool*	Mar. 21-May 5	Estimated 2,000+ visitors
Oregon Policy Consensus Center	Facilitate joint JPACT and MPAC meetings	April 11 May 30	JPACT and MPAC members and alternates
Metro staff	Three community forums* (one in each county)	Early April	Estimated 75+ residents
Metro Councilors and staff	County-level policy coordinating committee briefings	May 1 – C-4 subcommittee May 5 – EMCTC May 5 - WCCC	City and county officials, JPACT and MPAC members

*Coordinated engagement effort with RTP, ATP and MTIP

HIGHLIGHTS OF COMPLETED ENGAGEMENT EFFORTS

To date, the stakeholder interviews and focus groups have been completed. A report summarizing the stakeholder interviews is provided in **Attachment 2**. Key themes and trends from engagement efforts include:

Stakeholder interviews

Prioritizing investments and actions

- Half thought that all strategies should be carried forward.
- Missing strategies: more efficient residential/commercial buildings, freight and construction vehicles, funding mechanisms, inclusionary zoning, climate adaptation/preparation.
- Need for flexibility, “menu of options.”
- This cannot be a mandate. Need local control and creativity.
- Do not penalize outlying communities who cannot be as dense as urban Portland.
- Focus on the low hanging fruit first. Then try the more rigorous strategies. Perhaps do a phased approach, and reassess every 5 years.
- Concern about economic impacts to businesses and low-income families.

Focus groups

Prioritizing investments and actions

- Maintain and make transit more convenient, frequent, accessible and affordable was the top strategy overall.

- Use technology and “smarter” roads to manage traffic flow and boost efficiency was the top strategy in Washington County.
- Overall, these two represent the top strategies with the goal of making the Portland metropolitan region a great place for participants and families to live as well as meeting the tailpipe emissions targets.
- Short term, there was shared desire that local and regional officials address the economy and jobs, education, and road maintenance.
- Greenhouse gas emissions and the environment were not top of mind short-term issues.
- Long term, participants demonstrated a shared desired to see officials address the economy and jobs, education, and traffic congestion/infrastructure.
- Greenhouse gas emissions and the environment were not top of mind long-term issues.

In addition, Metro Councilors Collette and Dirksen and staff provided a project update to the Land Conservation and Development Commission on February 14. The commission gave strong support and praise for the significant technical, engagement and policy work completed to date. Members underscored the project’s ongoing theme that planning for climate change and achieving broader community goals are not opposing objectives. The director of the Department of Land Conservation and Development (DLCD) strongly recommended that Metro engage now with the Governor’s advisors to discuss how the project could inform priorities for the 2015 legislative session, particularly given the project’s emphasis on investing in communities in combination with state actions related to cleaner fuels and more fuel-efficient vehicles as the way to meet state climate goals and broader goals for clean air and water, healthy communities and a vibrant regional economy. The commission agreed that Metro is on schedule and making reasonable progress toward the development of a preferred scenario that will meet targets and scenario planning rule requirements. The next LCDC briefing will be at the September 25-26 commission meeting. Commissioner Lidz (the LCDC liaison to the project) was also invited to attend the April 11 and May 30 joint MPAC/JPACT meetings.

HOW ENGAGEMENT ACTIVITIES WILL INFORM JOINT MPAC AND JPACT MEETINGS

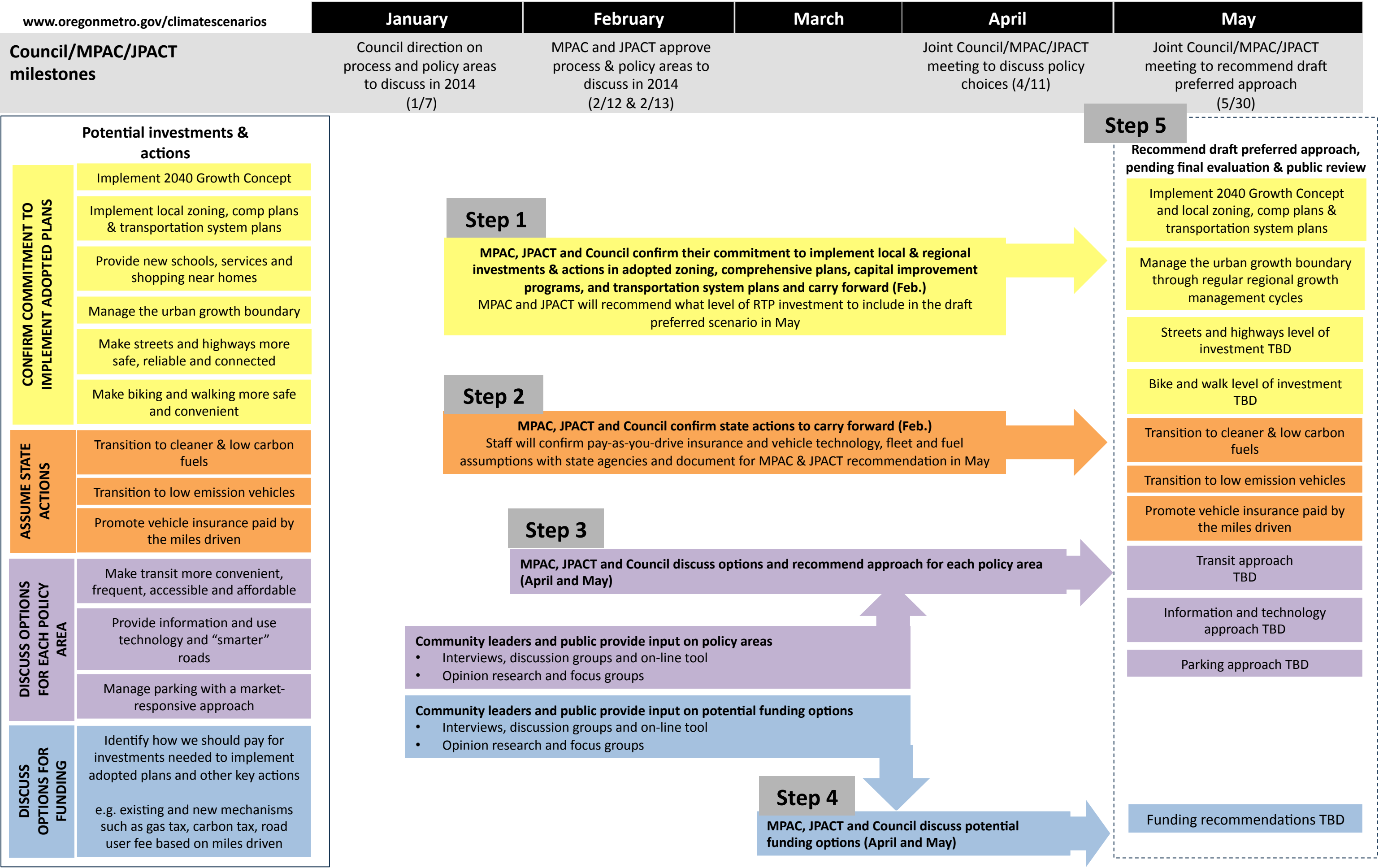
The April 11 joint MPAC/JPACT meeting will use interactive discussions facilitated by the Oregon Policy Consensus Center to begin building consensus on what investments and actions should be included in the draft preferred approach. A summary report of the results of completed engagement activities will be provided at the meeting to help inform those discussions along with a presentation by Adam Davis of DHM Research on findings from the focus groups and public opinion research. JLA will moderate a panel of community and business leaders who participated in interviews and discussion groups to share their feedback on investments and actions under consideration for inclusion in draft preferred approach.

In between the first and second joint meeting, Metro Councilors and staff will support JPACT and MPAC members with reporting the results of the April 11 meeting to the county-level policy coordinating committees - the C-4 subcommittee in Clackamas County on May 1, the East Multnomah County Transportation Coordinating Committee on May 5, and the Washington County Policy Coordinating Committee on May 5. The purpose of the briefings is to share information from the April 11 meeting and seek input on the draft preferred approach in advance of the second joint meeting.

The May 30 joint meeting will conclude with a formal recommendation to the Metro Council from each committee. MPAC and JPACT will be requested to make a recommendation on a draft preferred approach, subject to final analysis and public comment. In June, the Metro Council will then consider MPAC and JPACT's recommendation.

Attachments:

1. Process for Shaping the Preferred Approach in 2014 (*March 10, 2014*)
2. Climate Smart Communities Scenarios Project Stakeholder Interviews Report (*February 2014*)



Process for Adopting the Preferred Approach in 2014

	June	July	August	September	October	November	December
Council/MPAC/JPACT milestones	Council action on draft preferred approach, pending final evaluation and public review (6/19)	Council action on 2014 RTP investment priorities (7/17)	Council/MPAC/JPACT discuss proposed RFP amendments and near-term implementation recommendations (8/5, 8/13 & 8/14)	Council/MPAC/JPACT discuss evaluation results and public review draft preferred approach (9/2, 9/10 & 9/11)	Council/MPAC/JPACT review public comments and discuss recommendation to Council (10/7, 10/8 & 10/9)	MPAC & JPACT recommendation to Council on preferred approach (11/12 & 11/13)	Council action on preferred approach (12/11)
						Step 8	

Step 6

Complete final evaluation & prepare public comment materials and adoption legislation

Staff evaluates draft preferred approach
Staff documents planning assumptions and conducts performance evaluation with regional travel model and metropolitan GreenSTEP

Staff and technical advisory committees prepare draft Regional Framework Plan (RFP) amendments and adoption legislation
Staff and technical advisory committees draft Regional Framework Plan amendments and adoption legislation

Staff and technical advisory committees prepare Draft near-term implementation recommendations
Staff and technical advisory committees draft near-term implementation recommendations, which may include funding and other recommendations to state agencies and commissions, the 2015 Legislature and the 2018 RTP update

Step 7

Convene public comment period

- A 45-day public comment period will be held from Sept. 5 to Oct. 20
- Hearings and on-line comment opportunities

Step 8

Recommended preferred approach

Implement 2040 Growth Concept and local zoning, comp plans & transportation system plans

Manage the urban growth boundary through regular regional growth management cycles

Streets and highways level of investment TBD

Bike and walk level of investment TBD

Transition to cleaner & low carbon fuels

Transition to low emission vehicles

Promote vehicle insurance paid by the miles driven

Transit approach TBD

Information and technology approach TBD

Parking approach TBD

Funding recommendations TBD

Near-term implementation recommendations TBD

**CLIMATE
SMART**
COMMUNITIES
SCENARIOS PROJECT

Stakeholder Interviews Report

February 2014

*Prepared for Metro by
JLA Public Involvement, Inc.*

**MAKING A
GREAT
PLACE**



About 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 sustainable transportation and living choices for people and businesses in the region. Voters have asked Metro to help with the challenges and opportunities that affect the 25 cities and three counties in the Portland metropolitan area.

A regional approach simply makes sense when it comes to providing services, operating venues and making decisions about how the region grows. Metro works with communities to support a resilient economy, keep nature close by and respond to a changing climate. Together we're making a great place, now and for generations to come.

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Carlotta Collette, District 2

Craig Dirksen, District 3

Kathryn Harrington, District 4

Sam Chase, District 5

Bob Stacey, District 6

Auditor

Suzanne Flynn

Visit the project website for more information about the climate Smart Communities Scenarios Project at www.oregonmetro.gov/climatescenarios

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Metro Climate Smart Communities Scenarios Project

Stakeholder Interviews Report – February 2014

INTRODUCTION

Project Overview

The Climate Smart Communities (CSC) Scenarios Project was initiated in response to a mandate from the 2009 Oregon Legislature to reduce per capita greenhouse gas emissions by 20 percent from cars and small trucks by 2035. The goal of the Climate Smart Communities Scenarios Project is to engage community, business, public health and elected leaders in a discussion with their communities to shape a preferred approach that meets the state mandate and supports local and regional plans for downtowns, main streets and employment areas.

Metro evaluated many different investments and actions that could reduce greenhouse gas emissions – such as increasing transit service, shifting to low emissions vehicles, improving walking and biking, etc. In 2012-2013, Metro analyzed these investments and actions to determine their climate benefit and how well they support other social, environmental and economic goals. The research resulted in good news – we can reach the state target with existing adopted local and regional plans if we make the investments needed to make those plans a reality. In late 2013, Metro shared the results of the analysis with elected officials and staff at the local and county levels.

Stakeholder Interviews Background

In January 2014, Metro launched a public engagement process to get public input on the investments and actions to help begin to shape the preferred approach. As part of this public input process, Metro contracted with JLA Public Involvement to interview 33 key individuals that represent diverse interests including city and county government, environment, public health, environmental justice and equity, business, and transportation. The purpose of the interviews was to further build Metro's understanding of different communities' and organizations' priorities and how they are reflected in their plans and visions. The interviews focused mostly on the 14 investments and actions analyzed by Metro, and covered potential funding mechanisms to pay for investments and incentives to encourage use of transit, and more carpooling, walking and biking. Individuals were also asked about ways to improve Metro's public process and promote collaboration among all jurisdictions and communities in the region.

KEY THEMES AND TRENDS

Prioritization of investments and actions

Improving transit is a priority among stakeholders across all interest groups; people recognized transit investments as a key to improving community health, providing access to jobs, and better connecting communities. Improving the safety and convenience of biking and walking is another main priority—

although several stakeholders stressed that bicycle/pedestrian projects should not receive funding at the expense of road projects. There is general agreement that all of the actions and investments be carried forward into the preferred scenario. Elected officials from suburban jurisdictions said that expanded access to car-sharing and managed or paid parking strategies would not work well in their less-dense communities, though most did not oppose these actions in other communities.

Key priorities of specific interest groups include:

- Elected officials and business leaders support investments to improve local and regional street connectivity in suburban and outer communities and to make commuting by transit faster and more convenient.
- Equity, social justice and public health leaders support more investments in bus lines or Bus Rapid Transit to serve low-income communities living in outer parts of the region.
- Business and suburban community representatives prioritize maintaining streets and making roadways more safe, reliable and connected.

Many stakeholders support the “Where We Live and Work” actions, and stress the need to provide a variety of housing and development options within the Portland metropolitan region. Key input from specific interest groups includes:

- Elected officials stress that local jurisdictions must maintain control over how to implement local plans and how to site new services and businesses within their boundaries.
- Environmental, equity and public health leaders have a preference for maintaining a tight urban growth boundary, while business leaders and some elected officials prioritize the need for adequate industrial and employment land and new residential developments where people want to live.
- Environmental, equity and public health leaders suggest reevaluating local transportation and comprehensive plans to determine their potential negative impacts to vulnerable communities, including economic, health, and housing impacts. Avoiding gentrification and ensuring affordable housing options close to services and jobs are important considerations.

Stakeholders acknowledge that the “Our Health and Environment” actions are important to reduce greenhouse gas emissions, but assume that they will happen outside of the CSC Scenarios project, through federal or state legislative action. Therefore, the CSC Scenarios project should focus on actions and investments that create livable and desirable communities.

Need for flexibility and local control

Elected officials, particularly in suburban communities, said it is important that the project provide a “menu of options” so that leaders can select the best options to meet their communities’ unique needs. Without flexibility and local control over which actions to implement, it is unlikely that many communities will support the preferred scenario. They said that the preferred scenario needs to benefit the entire region and respect the needs of all types of communities—urban, rural and suburban; and that projects should not have to fit within a narrow set of criteria to be fundable (i.e., criteria that only a dense urban community could meet).

Need to advance social equity and reduce disparities in the region

Equity and environmental justice leaders want more information about how the actions will be implemented in specific communities. They suggest that all actions be studied to determine their economic and health impact on low-income communities, and to see how benefits and burdens are distributed to different communities in the region.

Need to support economic development in the region

Some elected officials and business representatives expressed concern about the CSC Scenario project's economic impact and effect on competitiveness. They want to maintain sufficient industrial and employment land and freight access. They advised that the preferred scenario should not impede economic development priorities, nor should it penalize businesses and industries that by their nature have limitations in what they can do to reduce GHG emissions.

Need for more information on potential funding sources

Stakeholders rated their level of support for four potential funding sources.

- *Number of miles driven*: Most highly supported funding source because it acts as a user fee.
- *Raising the gas tax*: Stakeholders somewhat support this, recognizing that the gas tax by itself is no longer a sufficient funding source as vehicles become more fuel-efficient.
- *Charging for parking*: Stakeholders somewhat support this in urban centers served by good transit, although there are concerns about the impacts on retail businesses.
- *Carbon tax*: This received the most opposition, mostly because there are many unknowns about its implementation.

Stakeholders want to know how revenues from all four funding sources will be used, and may condition their support depending on the intended use. Equity and environmental leaders warn that any regressive fees or taxes will disproportionately impact low-income individuals, and suggest that fees or taxes be charged in proportion to income.

Support for Incentive Programs

Stakeholders rated their level of support for several incentive programs to reduce drive alone work trips. They somewhat support the proposed tax incentives, although there was disagreement over the level of incentives needed to get people to change their driving habits. Some stakeholders expressed concern that not all industries or business types are able to make transportation changes, so would not be able to take equal advantage of the incentives.

Outreach and Engagement

Many elected officials want increased collaboration between Metro and local jurisdictions to create plans and policies that incorporate local needs, not mandates from the regional government. Equity and environmental justice leaders suggest early, meaningful, continued and culturally-specific engagement with low-income communities and communities of color, as well as capacity-building for populations that do not have the expertise to otherwise participate. Stakeholders across different interest groups said that the messaging of the CSC Scenarios project must be relevant to all audiences and clearly

illustrate how the actions and investments will impact people’s daily lives. Many also suggest focusing less on greenhouse gas reduction goals and more on how the project can create livable, attractive communities.

LIST OF STAKEHOLDERS INTERVIEWED

	Name	Organization or Community Affiliation	Interest Represented
1	Jay Bloom	Elder Representative	Equity/EJ
2	Jody Carson	West Linn City Councilor	Elected official
3	Timothy Clark	City of Wood Village Councilor	Elected official
4	Corky Collier	Columbia Corridor Association	Business
5	Denny Doyle	City of Beaverton Mayor	Elected official
6	Andy Duyck	Washington County Commission Chair	Elected official
7	Ben Duncan	Multnomah County Health Department	Public health
8	Mara Gross	Coalition for a Livable Future	Equity/EJ
9	Chris Hagerbaumer	Oregon Environmental Council	Environment
10	Mike Houck	Urban Greenspaces Institute	Environment
11	Duncan Hwang	Asian Pacific American Network of Oregon	Equity/EJ
12	Donna Jordan	Lake Oswego City Councilor	Elected official
13	Tim Knapp	City of Wilsonville Mayor	Elected official
14	Gerik Kransky	Bicycle Transportation Alliance	Transportation
15	Susie Lahsene	Port of Portland	Business
16	Mary Kyle McCurdy	1000 Friends of Oregon	Environment
17	Sandra McDonough	Portland Business Alliance	Business
18	Neil McFarlane	TriMet	Transportation
19	Diane McKeel	Multnomah County Commissioner	Elected official
20	Julia Meier	Coalition of Communities of Color	Equity/EJ
21	Dave Nielsen	Home Builders Association	Business
22	Steve Novick	City of Portland Commissioner	Elected official
23	Jon Ostar	OPAL Environmental Justice	Equity/EJ
24	Paul Savas	Clackamas County Commissioner	Elected official
25	Travis Stovall	East Metro Economic Alliance	Business
26	Pam Treece	Westside Economic Alliance	Business
27	Peter Watts	Clackamas County Business Alliance	Business
28	Ramsay Weit	Community Housing Fund	Equity/EJ
29	Steve White and Noelle Dobson	Oregon Public Health Institute	Public health
30	Jerry Willey	City of Hillsboro Mayor	Elected official
31	Desiree Williams-Rajee	City of Portland Bureau of Planning and Sustainability, Equity Specialist	Equity/EJ
32	Philip Wu	Kaiser Permanente	Public health

SUMMARY BY QUESTION AND TOPIC

Investments and Actions

Question: Which three to five investments and actions are most important to supporting your business or organization, or in realizing your community's vision?

Overall, making improvements to transit facilities is most important to stakeholders, as is making bicycle and pedestrian movement safer and more efficient. Many also think it is important to implement local zoning, comprehensive and transportation plans. While many support managing the urban growth boundary, there are conflicting ideas for how management should occur. There is support for providing services and shopping close to neighborhoods, but there are concerns about implementation. The chart below shows how many stakeholders rated each action or investment among their top three to five priorities. Some individuals discussed concerns or aspirations for each of the investments and actions rather than listing their priorities.

Prioritization of investments and actions

WHERE WE LIVE AND WORK	Top Priority
Implement 2040 Growth Concept	8
Implement local zoning, comprehensive plans and transportation plans	13
Provide new schools, services, and shopping close to neighborhoods	11
Manage the urban growth boundary	9
HOW WE GET AROUND	
Maintain and make transit more convenient, frequent, accessible and affordable	22
Manage parking with a market-responsive approach	5
Use technology and “smarter” roads to manage traffic flow and boost efficiency	7
Provide information to expand use of low carbon travel options and fuel-efficient driving techniques	2
Make walking and biking more safe and convenient with complete streets and trails	18
Maintain and make streets and highways more safe, reliable and connected	10
Expand access to car-sharing	0
OUR HEALTH AND ENVIRONMENT	
Transition to low emission vehicles and engines, including electric vehicles	6
Transition to cleaner and low carbon fuels	2
Achieve federal fuel economy standards	2

Implement 2040 Growth Concept

Eight stakeholders from across all interest groups rated this as a top priority. Several others are unsure of what exactly the 2040 Growth Concept contains and are concerned that this is too large an undertaking to be counted among the investments and actions. In general, supporters of this action said that land use patterns should support walking, biking, transit and access to services, and integrate a range of affordable housing options. They said the CSC Scenarios project should support development in centers and corridors where transit is good. This will encourage short bike/walk trips and more transit

usage. The region is on the right path here. The challenge is to continue that path. A transportation representative suggested strengthening development in the Gateway District and reinvigorating the Beaverton Regional Center, and an environmental leader suggested that climate adaptation elements of the 2040 Growth Concept should be called out specifically.

Implement local zoning, comprehensive plans and transportation plans

Thirteen people rated this as a top priority. There is support across all interest groups, and particularly by environmental, public health and equity leaders. Some noted that it only makes sense to include local plans that are likely to help meet the GHG reduction goal. It was pointed out that some communities' comprehensive plans are very aspirational and expensive, and may be too unrealistic to fully implement.

Specific concerns about this action include:

- Local plans, and particularly transportation system plans, often do not consider how the specific community vision fits within the regional context. Communities should look at their plans across jurisdictional lines. For example, local TSPs should consider how to efficiently connect with neighboring communities to improve regional transportation. Rules for developing TSPs should require communities to consult with neighboring jurisdictions when creating their TSPs.
- There is too much willingness to grant industrial land conversions to developers.
- There is growing community pushback against increased density. It may not be feasible to implement the density requirements in local plans once neighbors begin fighting against the impacts of density, particularly the impact of new developments that do not provide off-street parking. People desire a variety of housing options, including homes in less dense areas, and local adopted plans may not offer sufficient variety.

Some equity and environmental justice stakeholders stressed that local plans must include meaningful community engagement opportunities, equity considerations, and transit improvements. Many plans are created without looking at health impacts so may need to be reassessed from a public health perspective. In order to avoid the displacement of low-income residents to less-served parts of the region, all local plans should include rental and ownership housing choices for all income levels. It was also suggested that local regulations should make it easier for people to live in home share communities and provide Additional Dwelling Units (ADUs); these kinds of shared living situations are desirable to both the Millennial and Baby Boomer generations.

Provide new schools, services, and shopping close to neighborhoods

Eleven stakeholders rated this as a priority, particularly elected officials and public health representatives. They agree that community design can have a major impact on reducing vehicle emissions. A couple of elected officials from outer communities noted that good community design is needed in new suburban developments to avoid sprawl. Some participants stressed the importance of locating jobs near neighborhoods. One business leader stressed that industrial development must be decentralized to allow more industrial lands near neighborhoods. Industrial lands provide foundation jobs and communities grow around these areas to include other services and retail centers.

A couple of people added that Safe Routes to Schools should be a focus of the CSC Scenarios project. Schools located at the edges of communities create a barrier to biking and walking; a particular problem in suburban areas. It was also noted that walkable communities are particularly attractive and desired by new retirees, who prefer to live in intergenerational areas close to services, culture and shopping.

Some elected officials who do not find this action to be a priority advised that businesses and the market, rather than government, should dictate where services and businesses locate. It was pointed out that that locating jobs near homes may not make sense for the younger generation which tends to change careers and jobs frequently; and most households have two wage earners who may need to travel to opposite ends of the region for their respective jobs.

Manage the urban growth boundary

Nine people rated urban growth boundary (UGB) management as a top priority, although many people have concerns. Most frequently, people said that UGB expansion must be managed *effectively*, which means different things to different people. This action has the most divergent points of view, with a clear split between those that believe the UGB should be kept tight and those that want more lands brought in. A couple of people expressed surprise that managing the UGB does not rate very highly for its climate benefit, and thought it should be rated more highly.

Environmental leaders favored a tighter UGB and stressed the benefits of limiting expansion: it makes it more likely for mixed use development to occur and promotes reinvestment in places where people want to live. It also protects agriculture and local food sources. There was a suggestion to halt expansion of the UGB in the next 5-year cycle and instead focus attention inside the UGB to make the best use of current urban areas, particularly underutilized areas like surface parking lots, strip malls, and brownfields. Another environmental leader stressed the importance of protecting green areas and natural resources within the UGB to deal with future impacts of climate change.

Some business representatives and elected officials support more UGB expansion to provide more land for employment and industrial uses, particularly large lots. A couple of jurisdictional and business representatives are concerned that constraining UGB expansion too much could lead to negative climate change impacts; if people do not have sufficient housing options within the UGB, they will choose to live outside of it and commute even further for work.

A few elected officials said that the current UGB process is flawed and leads to many appeals. One example is that areas like Damascus have been brought in but not resulted in the envisioned community; while areas where people do want to live have not been brought into the UGB, such as parts of the South Cooper Mountain area. The key is to look at how new areas are connected to existing communities. Business and jurisdictional leaders advised that proximity to urban services, including transit, roads, sewer and water, is key to deciding whether an area should be brought into the UGB. They pointed out that construction of new infrastructure creates more emissions. Some officials expressed concern about expansion into the Stafford area. Specifically, they expressed not wanting to see a lot of growth that would require an expansion of an urban services boundary to serve the area.

Maintain and make transit more convenient, frequent, accessible and affordable

Nearly everyone who responded to the prioritization question agreed that improving transit service should be of highest priority for the CSC Scenarios project, and that this action has the greatest potential for reducing GHG emissions. Leaders across all interests said there is a great need throughout the Portland metropolitan region for more reliable and frequent transit service that meets the needs of commuters. Stakeholders noted that improving transit and other active transportation modes has benefits beyond reducing GHG emissions including less pollution, cleaner air, and better health through increased walking and easier access to health resources and hospitals. Active transportation creates greater social cohesion, which itself is a great health benefit, and provides low income communities with a low-cost travel option. Transit can benefit freight and auto travel because more transit usage means less congestion on roads.

Jurisdictional and business representatives said there is a need to make transit more effective for commuters and to expand service to employment areas. The number of people who use transit in the Portland metropolitan region is high for the size of the region, but the number who use transit for commuting is relatively low. They suggested improving the transit commute by creating more rapid bus service options by making efficiency improvements like bus-only lanes, express buses, or Bus Rapid Transit that could compete with driving time. Expanding the amount of service that does *not* connect with the light rail system will serve commuters that don't work downtown or live in areas not served by light rail.

Transit in suburban communities

Many representatives of suburban communities said that they need more transit service, and more frequent and reliable service. Generally, there is sufficient service from most communities to downtown Portland with TriMet's "hub and spoke" model. Lacking, however, are local transit options to help residents reach nearby destinations, as well as regional service connecting suburbs to one another. With the hub and spoke system, residents cannot efficiently take transit to their destination without going out of direction into downtown Portland. While there is a need for more local service in suburbs, there is also acknowledgment that the greatest transit market is in urban Portland.

Leaders in suburban communities would like to see more creative transit options for employees to reach manufacturing areas or employment centers outside of downtown Portland. They stressed that even though there is not enough density in these employment centers to meet TriMet's service criteria, and people would only use the transit service during commute times, this is still a need that must be met, whether by TriMet or a different type of provider altogether.

Several elected officials suggested local shuttle programs to provide short-distance service within suburban communities, such as in Lake Oswego and West Linn. These could be operated by TriMet or by the cities; however, some stakeholders believe that current regulations inhibit cities from providing transit. Small transit systems may be more responsive and efficient in providing creative transit services that fit the needs of non-urban communities. For example, a local shuttle bus system may be more useful for cities with lower density, large populations of older adults or difficult topography.

Suburban community representatives added that providing the “last mile” transit connection is critical for suburban communities. This is lacking on the Westside in areas like Tigard and Tualatin. Many small communities do not have funding to be able to provide this connection themselves.

Funding

There is concern about how to fund transit improvements. Some environmental leaders support greater taxation or other revenue streams paid for by drivers. A couple of business leaders oppose raising taxes to fund transit projects, and said investments should only be made where ridership potential is high.

Environmental Justice and Equity Concerns

Leaders in public health, equity and environmental justice said that the cost of transit must be kept affordable and must serve low-income communities with an equitable fare structure. They suggest that the region invest more in new bus lines that serve low-income populations and in Bus Rapid Transit (BRT), not just in street car and light rail; there is a need for greater focus on operational investments and providing more frequent service as opposed to funding major capital investments. The support for more BRT is shared by leaders across interest areas because it is seen as an option that can provide great service at a fraction of the cost of light rail. Stakeholders advise that Metro challenge the assumption that developers will not build to high densities along BRT lines, and look for models where BRT does spur economic development.

Some equity leaders suggested changes in housing development requirements to help increase transit service. For example, new housing developments might be required to locate near bus service. Employers might also provide subsidies for commuters.

Support for specific projects

Several elected officials expressed support for the Southwest Corridor Plan and/or for the Powell-Division High Capacity Transit project. There are some concerns about gentrification following the Powell-Division project.

Manage parking with a market-responsive approach

Five stakeholders rated managed parking as a top priority, and many more expressed strong concern about this action. No elected officials said this should be a top priority. Environmental, transit, bicycle/pedestrian, and equity representatives mostly support this action; they pointed out that “free parking” is never free – it is just a question of who bears the cost. They said managed parking can make a big impact on one’s choice to use alternative transportation. Equity leaders agreed that paid parking generally impacts the wealthy more than the poor, who are less likely to own a vehicle. On the other hand, they are concerned about any regressive fee that can disproportionately impact low-income individuals that must drive.

A couple of business leaders would support this action if it is managed according to a market response. However, there is already a shortage of parking in downtown Portland. If parking cost increases are planned, impacted businesses must be part of that conversation. Downtown businesses pay for a lot of parking costs by validating parking stubs of retail shoppers.

One perceived barrier to managed and paid parking according to a transit representative is the lack of institutional structure and enforcement of parking regulations. It was pointed out that the City of Portland is the only jurisdiction with an active parking program, and they struggle with managing it.

Use technology and “smarter” roads to manage traffic flow and boost efficiency

Seven stakeholders, mostly elected officials, rated this action as a top priority. Several jurisdictional representatives noted that their agencies already invest in traffic technology and smarter roads. This action appealed to them because it is low cost and has a moderate climate benefit. Some public health representatives wondered if this action might make drive alone travel more attractive, since more efficient roads means less congestion. Business leaders and elected officials support increased Intelligent Transportation Systems (ITS) and smart facilities; extending technology to freight, commerce and fleet vehicles; and developing GPS technology to aid freight trucks in choosing routes with minimal bicycle traffic. Another suggestion is to create dedicated freight corridors as has been done in Vancouver, WA, to help reduce freight and bicycle/pedestrian conflicts.

Provide information to expand use of low carbon travel options and fuel-efficient driving techniques

Two jurisdictional representatives said this action should be a top priority. Stakeholders support providing information that goes beyond printing pamphlets and running ads. They suggested that the focus should be on door-to-door and personal campaigns that can be more individualized. Studies have shown this type of campaign can truly change behavior. For example, a door-to-door campaign was launched when the MAX yellow line began, and it increased ridership dramatically. One suggestion is to run a “try it once” campaign that shows people how easy it is to walk, bike or take transit. A couple of elected officials in suburban communities said providing information and education probably won’t make much of an impact in how people choose to travel because most people know about their options.

Make walking and biking more safe and convenient with complete streets and trails

Nearly all stakeholders across all interest groups rated this action as a top priority, although it is less supported by business representatives. As with improved transit, stakeholders support this action because it would provide multiple other benefits, such as improved health, better integration with neighbors and services, and is less expensive for both government agencies and users. Some people said that this action should get more than just two stars for its climate benefit. It is a major priority from a public health perspective, particularly with regards to safety.

Several jurisdictional representatives said that their cities already invest substantial funds into bicycle/pedestrian projects, and plan to continue to do so. Several people said that bicycle/pedestrian projects should focus on safety and improving the perception of safety of biking and walking. For example, there should be more dedicated, separate trails for biking and walking because some people will never feel safe biking in vehicle traffic. There should be greater bicycle/pedestrian connectivity from neighborhoods to commercial areas in suburban communities. The focus needs to be on projects that are convenient and provide safe access to places where bikers and walkers actually want to go; not just striping a bike lane on a road.

Funding concerns

One of the most frequent comments by bicycle/pedestrian, transit, and environmental representatives is that there needs to be a dedicated funding source for bicycle/pedestrian projects. A suggestion is to dedicate 100 percent of Regional Flexible Funds to active transportation projects instead of the current 75 percent. A few people, particularly from the business community and some suburban representatives, are concerned about the potential for *overfunding* bicycle/pedestrian projects and taking funding away from needed road projects. They said that, since the majority of people and freight move by vehicles, investments in auto travel must take priority. Some stakeholders are also concerned that taking funding away from road projects could also mean a backlash from drivers.

Messaging about bicycle/pedestrian projects

Several people suggested changing the messaging around bicycle/pedestrian projects to make them more appealing to drivers. For example, messaging should highlight the economic development aspect of increased bicycle/pedestrian travel. Bicyclists and walkers spend less on travel and healthcare costs and can put that saved money back into the local economy. It was also suggested that Metro help promote the message that bicycle/pedestrian projects are needed in order to meet the legislative GHG reduction target. This could help make such projects more acceptable to the freight community or drivers who otherwise see bicycle/pedestrian projects as being in direct competition with vehicular movement or funding for road projects.

Climate adaptation strategy

An environmental advocate stressed that “complete streets” should include bioswales, urban forestry canopy, and planting street trees as part of street design in order to create a better climate adaptation strategy. It is important to have better onsite stormwater management and to implement methods to combat urban heat island impacts.

Maintain and make streets and highways more safe, reliable and connected

Ten people, particularly business leaders and representatives of suburban communities, rated this action as a top priority. They said street and highway improvements are needed to help move freight more efficiently to make the Portland metropolitan region more competitive in terms of business. Some people thought this action should have more than one star of climate benefit since road improvements lead to less congestion and idling, creating cleaner air. They advised that reduced congestion also has positive health and livability benefits. Public health leaders suggested that the CSC Scenarios project study the impacts of highway corridors and freeways to the health of people living nearby. A few people said that the focus needs to be on streets that complement walking and biking. They feel making streets safer would improve health outcomes in the region.

Elected officials in suburban communities said they want a greater focus on regional road connectivity, particularly connectivity between suburbs. They named specific areas needing improvements including infrastructure in East Multnomah County, connectivity between the Clackamas Town Center and I-5, and traffic reduction on I-205 and OR 43 around West Linn. Several people expressed support for the Southwest Corridor Plan and Westside Transportation Study.

Expand access to car-sharing

No individuals rated expanding car-sharing as a top priority, although there is not much opposition to it moving forward. A few business and jurisdictional representatives said that the private sector should take care of car-sharing.

Some representatives of suburban communities said that car-sharing would not work in their less dense areas, particularly where the “last mile” transit connection is missing. Equity leaders said that car-sharing must be more accessible and affordable to low income communities for their use; for example, there could be car-share parking integrated into affordable housing developments.

“Our Health and Environment” investments and actions

Six people identified transitioning to low emission vehicles and engines as a priority; and two people identified the other “Our Health and Environment” actions as priorities (transition to cleaner and low carbon fuels and achieve federal fuel economy standards). While people acknowledged that the three “Our Health and Environment” actions are important, some said these strategies should not be a high priority for Metro because they will happen with or without the CSC Scenarios project and do not improve communities or livability. These interviewees stated that the CSC Scenarios project is an opportunity to achieve the types of community visions that cities and the region have said they want. Those who support the actions as a top priority noted that they have a low cost and high climate benefit.

There is concern by some elected officials and business representatives that certain industries will not be able to switch fuels or vehicle type by nature of their business, such as the construction and deliveries industries. Some also wondered how the transition to low emission vehicles would be made. For example, if there is an incentive to purchase low emission vehicles, who pays for that incentive? The project should not penalize those who cannot afford fuel-efficient vehicles or who must use certain vehicle types for business.

Question: What actions need to be included in a preferred approach to gain your support?

Stakeholders indicated which actions and investments must be included in the CSC Scenarios project’s preferred approach in order to gain their support. Some added different actions or considerations that go beyond the investments and actions suggested by Metro. (Note: Elected officials were not asked this question. Eleven people discussed the question, including business, equity, environmental justice, transportation, public health, and environmental representatives.)

Investments that must be included to gain support

WHERE WE LIVE AND WORK	Must Include
Implement 2040 Growth Concept	3
Implement local zoning, comprehensive plans and transportation plans	3
Provide new schools, services, and shopping close to neighborhoods	2
Manage the urban growth boundary	4

HOW WE GET AROUND	
Maintain and make transit more convenient, frequent, accessible and affordable	7
Manage parking with a market-responsive approach	0
Use technology and “smarter” roads to manage traffic flow and boost efficiency	0
Provide information to expand use of low carbon travel options and fuel-efficient driving techniques	0
Make walking and biking more safe and convenient with complete streets and trails	6
Maintain and make streets and highways more safe, reliable and connected	1
Expand access to car-sharing	0
OUR HEALTH AND ENVIRONMENT	
Transition to low emission vehicles and engines, including electric vehicles	0
Transition to cleaner and low carbon fuels	0
Achieve federal fuel economy standards	0

Equity and environmental justice leaders said that inclusionary zoning and improved community engagement and collaboration must be included in the preferred approach. This means early, meaningful, continued and culturally-specific engagement with communities, as well as capacity-building for populations that do not have the expertise to otherwise participate. An environmental leader said that climate adaptation or preparation strategies must be specifically called out.

Question: Which investments and actions may not work for your community but you could support in another part of the region?

This question was directed to elected officials. Responses included:

- *Locate schools, services and shopping close to neighborhoods* – This would not work in Lake Oswego or West Linn because of the nature of the communities, or because commercial areas are already built out. One representative said that mixed-used development is planned to occur in existing town centers and commercial centers, but the local code will not allow moving this activity into neighborhoods.
- *Manage parking* – Five representatives of suburban and outlying communities said this would not work in their communities. The representatives focused primarily on paid parking, and said that this action is not needed due to plentiful parking in the suburbs. Some are concerned that paid parking would hurt businesses and the economy. There is some support for managed parking like parking structures, which encourage people to park for free in one location downtown and then walk to nearby local destinations, reducing the number of vehicles driving around looking for parking in that district.
- *Expand access to car sharing* – Five representatives of suburban and outlying communities said their communities would not support car-sharing because of a lack of density. Car ownership is high in these areas and many people prefer to drive their own vehicles. Some people said that private industry should manage car sharing programs; they know where the demand is and can do a better job at responding to the market than a government program can.

- “Our Health and Environment” actions – Two people expressed concern that imposing certain vehicle and fuel types on individuals limits personal choice. Federal fuel economy standards could have a negative impact on farmers, who would see increased fuel prices in agriculture.

Question: Are there any investments and actions that shouldn't be carried forward into a preferred scenario?

In general, there is agreement that all of the actions and investments should be carried forward. Sixteen people thought that all of the actions should be carried forward and eight thought at least one action should not be carried forward.

One business leader thought that managing UGB expansion should not be included if it means not expanding the UGB at all. Two business and jurisdictional representatives said that managing parking and expanding access to car-sharing are not critical to move forward, as there are likely more effective ways to combat climate change.

Three elected officials took issue with the “Our Health and Environment” actions. They would rather see the federal government and/or private market take care of the transition to cleaner vehicle and fuel types; they also stated alternative fuels may not be the most efficient for all vehicle types, such as for large or freight vehicles. One person thought that the Columbia River Crossing project should not demand the bulk of our transportation dollars without understanding the tradeoffs.

Equity interests expressed a need for more details about implementation before deciding which actions should or should not go forward. They would support managed and paid parking only if there is corresponding strong transit investment to provide a real alternative to driving. Similarly, they would support street and highway improvements only if coupled with greater connectivity to biking and walking and more transit connectivity from outer parts of the city. They advised that attention be paid to the potential disproportionate impact of some actions. For example, creating denser communities may lead to higher housing costs and gentrification, displacing low-income communities.

Other comments on investments and actions

Need for more information

Some business and equity leaders want more information, particularly cost information, before deciding which investments and actions should be a top priority. More information is specifically needed by equity and environmental justice representatives to understand how the actions would impact vulnerable populations and public health, and by business participants to understand how the actions might impact the economy and market competition.

Need for flexibility and local control

A major theme from elected officials, particularly in suburban communities, is that the actions should not be “one size fits all,” and that cities need to have flexibility to choose from a menu of options that fit their unique needs. They said that local jurisdictions know best how they could meet the state mandate

for their constituents; they should be offered suggestions on how to meet the state mandate, but not be told that they must implement one action or another.

Fairness to non-urban communities

Elected officials from suburban communities want to ensure the actions do not penalize non-urban communities, where driving is often the only transportation option due to distance and poor transit options. Suburbs should not be penalized for not being able to implement impractical actions in their communities. Similarly, funding for projects should not be tied to whether or not a jurisdiction can implement all of the identified actions.

Missing actions and project limitations

Six people thought that the project is too limited because it looks only at emissions from personal vehicles, while ignoring other major sources of carbon emissions. Ideas for additional actions include:

- Changes to building code or otherwise updating homes to be more energy efficient.
- Higher cost road projects that would reduce congestion.
- Standards for commercial vehicles, including construction vehicles, throughout Oregon. Companies use older equipment that causes a lot of pollution. Oregon could look to California and Washington as a model for construction vehicle emissions standards.
- Funding mechanisms such as the gas tax, carbon fee, and VMT fee that have the potential to change behavior. These should be considered as actions, not just as funding mechanisms.
- Inclusionary zoning.
- Climate adaptation and preparation strategies. A climate adaptation strategy may require revisiting all regulations to see if they are adequate to address climate adaptation.

Economic impact considerations

Some elected officials and business representatives are concerned about the CSC Scenario project's economic impact and effect on competitiveness. They said that, as the economy is slowly recovering, there is a need for more industrial land in the region, good freight access, as well as broader access to national and international markets and transportation to support it. The CSC Scenario project should not impede economic development priorities, nor should it penalize industries that by their nature have limitations in what they can do to reduce GHG emissions. Stakeholders said that a strong economy is better able to support and encourage risk-taking and innovative solutions to curb the impacts of climate change.

Focus on low-hanging fruit first

A couple of jurisdictional representatives strongly supported a tiered approach, and said that Metro should focus first on the low-cost, high-climate benefit actions and then assess progress every five or so years. Only if these aren't sufficient, should Metro focus on the more rigorous strategies. This tiered approach might also have more public support. The actions should not be so aggressive as to lose community support.

Questions for Equity and Public Health Leaders

Leaders in equity, environmental justice, and public health were asked additional questions to address some of the specific considerations of the populations they serve. They discussed potential unintended consequences of the actions for vulnerable communities. They also provided ideas for better ways to engage low-income communities and communities of color in the CSC Scenarios project.

Question: Of the 14 investments and actions, where is the greatest need for further discussion about implementation and tradeoffs?

This question was asked as a follow up to the Equity and Environmental Justice Scorecards Workshop held in 2012. Stakeholders said there is a need to discuss implementation and tradeoffs for *all* of the investments and actions. In particular, they want to know how the investments and actions will be implemented in East Portland and areas that currently lack sidewalks, good transit, and walkable communities. Most importantly, the project must measure the economic impact that actions would have on low-income residents.

Some of the important considerations for the investments and actions include:

- *Implement 2040 Growth Concept* – The region should providing more affordable housing options and better access to essential resources.
- *Improve transit* – Must be affordable and accessible to low-income communities.
- *Manage parking* – Appears to be applicable only for urban Portland. If paid parking is intended to be implemented elsewhere, then more detail is needed about the cost.
- *Provide new schools, services, and shopping close to neighborhoods* – There is a need to avoid food and health deserts.
- *Transition to cleaner fuels* – Need to know the specific transition steps.
- *Transition to low emissions vehicles* – This will likely require incentives if it costs more. Efficient vehicles are expensive and low-income individuals usually cannot afford them. Putting in place an incentive to help these populations buy an electric vehicle or fuel efficient vehicle would have both a positive climate benefit and help reduce driving costs.
- *Expand access to car-sharing* – Need more models to consider. For example, the Car-To-Go model works in urban Portland but not in other areas.
- *Manage the UGB* – Accessible neighborhood services are very important. UGB expansion may deemphasize development in existing communities where people with less mobility currently live.
- *Maintain and make streets more safe, reliable and connected* – Safer roads are a key equity concern.

There was also a suggestion to add “social cost and benefit” as a third variable in considering tradeoffs. Monetary cost and relative climate benefit should not necessarily be the primary drivers of the project. It makes sense to implement those investments and actions that are low cost and have a high climate benefit; but they also need to be evaluated for their social cost and benefit. Some investments and actions with a low climate benefit may have a high social benefit, and should be implemented to promote community and equity goals.

Question: Which investments and actions could have unintended outcomes for underrepresented communities?

Environmental justice, equity and public health leaders said that all of the investments and actions could have unintended negative outcomes. The economic impact of all actions should be looked at through a strong equity analysis. In particular, the project should avoid regressive taxes or fees or find ways to mitigate impacts from any the increased economic burden on low-income communities.

Stakeholders said that the CSC Scenarios project should pay particular attention to the following:

- *Implement local plans* – Implementation must avoid displacing vulnerable populations. Allowing for adequate affordable housing in all areas, and creating Community Benefit Agreements or community self-sufficiency strategies could help avoid displacement.
- *Improve transit* – The region must prioritize improved bus service and shift away from the heavy emphasis on light rail that currently exists. Otherwise, transit improvements will disproportionately benefit the wealthier population at the expense of lower income populations that rely on the bus.
- *Transition to low emissions vehicles* – Moving to more fuel-efficient vehicles can have a negative impact on people who can only afford older vehicles. If incentives only help the wealthier population buy more expensive vehicles, this exacerbates inequality.
- *“Where we live and work” actions* – All of these have the potential to negatively impact housing affordability. There are not a lot of good tools to ensure affordable housing in the region, particularly because state law does not allow inclusionary zoning. Urban renewal districts provide the opportunity to increase the amount of affordable housing by requiring a certain percentage set-aside for affordable housing. Other potential tools include tax abatements for developers that build affordable housing units into Transit Oriented Development communities; or, a requirement within the region that each jurisdiction contain a certain percentage of all housing types, including condos, apartments, single family homes, etc.
- *Manage parking* – Paid parking can negatively impact low-income populations because it is a regressive fee.
- *Use technology and “smarter” roads* – This could negatively impact low-income populations if individuals have to pay to access this technology.
- *Implement local plans* – Zoning and comprehensive plans must have tools or incentive to mitigate displacement. Equity must be woven into these plans.
- *Tax incentives* – Tax incentives may reduce funding for direct services that the government would otherwise provide.
- *Provide information to expand use of low carbon travel options* – This information should be presented with sensitivity to different languages and cultures. The right messenger should provide the information. This will require a greater investment in time and resources by government staff than providing information in the usual way.

Question: Is there a study or lens that should be included in the preferred scenario?

Equity and environmental leaders said that Metro and the various jurisdictions should consider the potential positive and negative economic impacts of the actions on people with limited incomes.

Particularly, they said, there needs to be sensitivity to the effect that certain transportation actions may have on the combined transportation/housing cost burden of low income individuals. It is also important to ensure that low-income communities have good access to jobs.

Additionally, jurisdictions could conduct a Health Impact Assessment of the actions, and put into place Community Benefits Agreements connected with specific projects. Organizations of color have spent time identifying the needs of their communities and strategies that would benefit specific communities. The CSC project should consult those lists.

More generally, local comprehensive plans and transportation projects should have more stakeholders engaged than typical. This will ensure that equity is considered at the project level. For example, advisory committees for transit projects should include more community representation.

Stakeholders cited particular sources for more detail, including:

- Literature on Bus Rapid Transit <http://www.nbrti.org/research.html>
- Research on Bus Signal Prioritization and Bus Jump Lanes
- Elasticity Studies from Victoria Transit Institute for example <http://www.vtpi.org/tranelas.pdf>. Their long term studies on elasticity are important.
- Urban Habitat's study on Ensuring Lifeline Service in all of the Bay Area's Low-Income Communities http://urbanhabitat.org/files/Urban_habitat_lifeline_2008.pdf

Funding Sources

Currently, sufficient funding does not exist to implement all potential investments and actions of the CSC Scenarios project or to implement local zoning, comprehensive plans and transportation plans. Stakeholders were asked to discuss potential mechanisms that could provide more sustainable funding sources. They rated their level of support for four potential mechanisms. The highest support is for a fee on number of miles driven. People somewhat support raising the gas tax and charging for parking in urban center locations served by good transit. The carbon tax received the most opposition.

Funding Source #1: Raise the gas tax

Stakeholders across all interests somewhat support raising the gas tax (rating average: 1.9). However, even those that support it generally agree that it is no longer effective as a user fee and is an insufficient funding source as vehicles become more fuel efficient. A couple of people support the gas tax as a short-term measure to be replaced or supplemented by a VMT fee, or used as one part of a hybrid funding scheme.

Many people commented on how revenues would be used. A couple of equity and public health leaders said they support raising the gas tax if revenues are used for transit projects; otherwise, they oppose it. People understand that the use of the gas tax is constitutionally constrained to road projects and projects in the right-of-way. A few elected officials said they only support raising the gas tax if funding is used exclusively for road and highway maintenance. A couple of environmental and bicycle/pedestrian representatives support using a greater percentage of gas tax revenue for building complete streets and

striping more bike lanes on roads, and perhaps raising the state level set-aside from 1 percent to 5-10 percent.

Several people said that drivers may be more willing to support an increase in the gas tax if they understand where the funding is going. One suggestion is to follow the Washington County approach, which lays out the exact projects (and their costs) that gas tax revenues would fund. There is some concern by elected officials about the allocation of gas tax revenue among jurisdictions. How an increase in the gas tax might affect manufacturers and haulers and the competitiveness of the market in Oregon are also concerns.

Funding Source #2: Charge for parking in commercial districts, downtowns or locations served by good transit

Overall, stakeholders somewhat support paid parking (1.9 average rating). Most environmental, equity and public health leaders strongly support this funding mechanism, particularly if revenues are used to fund transit. A few elected officials from suburban areas oppose it in their particular communities because it might negatively impact businesses. Other community representatives strongly support charging for parking, as do some members of the business community. Some business representatives do not support charging for parking because it penalizes businesses that must drive by nature of their industry (for example, delivery businesses and service providers).

Several people stressed that paid parking should be implemented only in areas that are well served by transit, which is not the case in most areas outside of urban Portland. Otherwise, paid parking is a penalty on those who have no choice but to drive. Some suburban jurisdictional representatives are concerned that paid parking may hurt businesses in dense areas that are already struggling to attract customers without parking measures in place.

A few environmental, bicycle/pedestrian, and transit representatives stressed that paid parking should be part of a larger, creative and comprehensive parking management plan. For example, revenues from parking meters could be given to businesses in parking districts to help them provide their employees and customers with alternative transportation options; this could make paid parking more palatable to businesses that would otherwise bear the cost. Different prices for parking at different times of day, and using private lots for public parking at times when the lots are usually vacant or unused are also options. Paid parking revenues could be used to fund Transportation Demand Management strategies, like the Lloyd District Transportation Management Association. Jurisdictions could also implement parking strategies associated with fee areas, like carpool parking spots.

Funding Source #3: Moving from a gas tax to a fee on number of miles driven

A fee on number of miles driven (or VMT fee) is the most highly supported funding mechanism (average rating: 1.6). People support this mechanism because it acts as a true user fee, whereas the gas tax no longer does. Stakeholders are split on whether the VMT fee should replace or be in addition to a gas tax or carbon tax. A couple of business leaders oppose the VMT fee because the population may need a financial incentive to purchase more expensive electric or fuel efficient vehicles, and the VMT fee removes that incentive.

Some thought that the VMT fee will eventually be put in place by the federal government so should not be dealt with by local or regional government now. A few people want more information about the impacts of the VMT fee before offering their support, particularly the economic impact on travel-heavy businesses. The state of Oregon has conducted a pilot study on the VMT fee; the results of this study will be useful to help understand the fee's impacts.

Some elected officials suggest expanding the VMT fee to charge different rates at peak driving times, and to charge more for use of bridges and highways that require vast amounts of funding to build and maintain.

There are concerns about how the VMT fee will be implemented, specifically privacy concerns if a tracking device is installed on vehicles. One suggested solution is to have inspectors check vehicle odometers at annual emissions inspections. Some people conditioned their support of the VMT fee on its ability to be implemented efficiently and cost-effectively, using acceptable technology. There were suggestions to implement the VMT fee in conjunction with a higher weight-mile tax on freight vehicles since heavy vehicles put more strain on roads; and to index the VMT fee with inflation to ensure it continues to be a viable funding source in the long-term

Stakeholders want to know whether the revenue from the fee will be constitutionally constrained, or whether it can be used to fund a broad range of alternative transportation projects. Members of the environmental and equity communities support using VMT fee revenue for transit and bicycle/pedestrian projects. There may be some equity concerns with the VMT fee, since it impacts people who live in outer communities more than it impacts those who can afford to live closer to downtown or to their jobs. A link to an article on the VMT was provided for reference:

<http://www.blueoregon.com/2013/09/mileage-tax-good-idea-if-properly-implemented/>

Funding Source #4: Moving from a gas tax to a carbon emissions tax

The carbon emissions tax has the lowest support of any of the funding mechanisms (average rating: 2.6). Just under half of participants support it, mostly environment, equity and public health leaders. About a third of the participants, mostly elected officials, oppose the carbon emissions tax and several other people feel neutral about it. Several people said they are unsure because there is not enough information about how the tax would be implemented.

Those who oppose the tax believe it will be difficult to implement, and that it may negatively impact several groups of people. If the tax is assessed on the manufacturing industry or source of carbon, this could negatively impact the economy, particularly domestic vehicle manufacturers and the domestic fuel industry. They may have to compete with foreign vehicle manufacturers and fuel importers that do not pay the tax. If the tax is assessed on the car purchaser, it could negatively impact low-income individuals who cannot afford to purchase newer fuel-efficient or electric vehicles. There is concern that climate change skeptics may actively oppose the carbon emissions tax, whereas they might support a gas or VMT tax since these taxes are aimed at more than just dealing with climate change.

Those who support the tax indicate it more accurately reflects the true cost of carbon usage. Just like the tobacco tax, it could be used to both curb people's use of carbon and provide funding for needed projects. Supporters suggested the tax could fund a variety of alternative transportation projects, not just road projects; or it could be used for social benefits, similar to the tax on cigarettes. Alternatively, revenues could fund climate adaptation strategies. The carbon tax revenues could create additional clean sector jobs, helping improve the economy.

People have different ideas on how the tax should be implemented. There is more support for charging the tax upstream in the energy industry; for example, by levying the tax at Oregon's borders with the importers of coal, gas, etc. to account for the overall carbon consumption that occurs in Oregon. A couple of people added that manufacturers who pay the tax will find ways to reduce carbon; if the cost is downstream, then manufacturers have less incentive to be innovative with clean technology. There is less support for a direct fee on consumers. It was suggested that the rate be managed by the Citizens' Utility Board. Someone also suggested extending the carbon fee to cover building structures based on their carbon footprint, as well as levying the tax on both freight and passenger vehicles.

Question: What would these funding mechanisms look like in your community? How would they impact community members?

Some public health, environmental justice, and equity leaders were asked about the potential unintended consequences or disparate impacts of the proposed funding mechanisms. In general, they responded that it is difficult to assess potential impacts without more details on implementation and cost impacts per person or driver. They said the most important consideration is that the funding mechanisms not be regressive; a flat tax will always disproportionately impact low-income communities. There needs to be exemptions for low-income families. Some suggested that funding mechanisms be levied on freight trucks in addition to passenger vehicles.

From a public health perspective, there may not be much difference in the way each of the mechanisms impact health, but it depends on the details of how the mechanisms are implemented. In general, economic status and education are the two biggest predictors of health; so any funding mechanism that creates an undue economic burden could have negative health consequences.

Equity and environmental justice leaders said that revenues from new funding mechanisms should be used for more transit, particularly to serve outer, low-income communities. All communities that pay taxes or fees should receive a fair share of the benefits and investments in transit. There is support to lift restrictions in order to expand the use of revenues from existing funding sources for bicycle/pedestrian, transit and transit-oriented development projects.

There is some concern that both an increased gas tax and VMT fee could disproportionately impact low-income residents who cannot afford to live near downtown or their jobs, so are forced to drive longer distances. Leaders said there is a need to increase the variety of housing options throughout the Metro area, and to provide affordable and low-cost housing options in and near urban Portland.

Other Funding Comments

Other sources of funding

Some stakeholders suggested other funding sources. Several elected officials support a local vehicle registration fee, and some jurisdictions are already considering this. One elected official suggested increasing or altering the structure of the state vehicle registration fee; for example, the fee could be higher for gas guzzling vehicles and RVs which cause more damage to roads.

Other ideas for funding sources include:

- More use-based fees such as tolling, particularly on bridges and highways. This may require some changes to the federal restrictions on tolling.
- Reevaluate use of current resources and see where we can gain operational efficiencies.
- Implement a state sales tax.
- A “vehicle value tax” or “luxury vehicle tax” which assigns a higher value to more expensive vehicles. This would be more equitable to low-income drivers.
- Congestion pricing, with a rate based on income level. Using technology, a system installed on vehicles could tally up the vehicle’s road use at certain times of day, and calculate a fee tied to the driver’s income. However, there may be privacy concerns with this strategy.
- Fee for use of park and rides. The average person who parks and rides makes over \$70,000 a year; right now they are parking for free.
- The streetcar should cost the same as bus and rail fares.
- WES should be a premium cost because it is artificially subsidized.
- Implement cordon pricing.
- Restructure tax breaks given to corporations. If these tax breaks are removed, there may be more funding available for needed projects.
- Increase the payroll tax to fund transit, but only if the general public supports this.
- Look into federal funding sources to subsidize transit, bicycle and pedestrian projects.
- Implement a pilot project for free bus service to see if this would increase transit use.

Use of revenues

A couple of people noted that drivers will be more willing to pay fees and taxes if they know that revenues are going towards projects that benefit their communities; jurisdictions and Metro should focus on marketing to help people understand funding pressures and where revenues are being spent. On the other hand, there is some concern particularly from elected officials about using revenues from the proposed sources for anything besides road maintenance projects.

Economic impact concerns

A business leader cautioned that the new fee amounts should not be so high that they penalize drivers and businesses that rely on driving. Jurisdictions need to implement taxes slowly and incrementally over time, so that businesses can plan their transportation expenses in advance. There is also concern about the economic impact of fees on the freight industry. If fees or taxes are increased on freight vehicles, then revenues need to be used for projects that directly or peripherally improve freight movement.

Other comments

Environmental and bicycle/pedestrian leaders generally said that these funding strategies are the correct ones to pursue, and that the region should aggressively pursue increased revenues from driving in order to fund elements of the CSC project. A couple of people expressed concern that climate change skeptics will oppose any fee marketed as a fee to fund GHG reduction projects.

One elected official questioned the imposition of any funding mechanism at this point because advances in fuel technology and fuel-efficient vehicles can get the region close to the legislative GHG reduction target without any need for increased taxes. It was suggested that Metro focus on those low-cost actions, and then re-measure in 2020. If by then it seems like the region is not making enough progress towards the 20 percent legislative mandate, then at that point the region should have a discussion about implementing a new funding source.

Incentive Programs

The CSC Scenarios project is considering a variety of incentive programs to encourage people to choose to drive less. Stakeholders were asked to discuss these incentives and rate their level of support for each.

Incentive #1: Tax incentives to businesses that offer free transit passes, telecommuting, and flexible work hours to their workers

Overall, stakeholders somewhat support this incentive (average rating: 2.0). Public health, environmental and equity leaders gave it the highest support. Many jurisdictional leaders said that the problem in many communities is a lack of good transit, not a lack of an incentive; so it makes more sense for government to provide better transit options and for employers to decide for themselves how to provide incentives.

Stakeholders are split on whether this incentive is necessary. Some business representatives said that businesses intrinsically benefit from offering free transit passes, etc. and so do not need an additional incentive. Bus passes are fully tax-deductible and this may be incentive enough for many businesses. On the other hand, some business and public health representatives said that people need an incentive to change their behavior, and once they experience the options, they may permanently change behavior. It is important to ensure that incentives phase out over time rather than being permanent. It was also suggested that regional leaders lobby Congress to equalize the federal tax breaks given to businesses that offer free parking and free transit passes to encourage more transit usage.

Some people expressed concern that not everyone will be able to take advantage of this incentive equally, which might feel like a penalty to some businesses. Some companies cannot offer flexible work hours or telecommuting options by nature of the business, or they may depend on deliveries or other travel that make transit usage impracticable.

Incentive #2: Tax incentives to businesses that offer programs that encourage their workers to carpool or enroll in car sharing

Stakeholders are generally neutral to somewhat supportive of this incentive (average rating: 2.4). They said this incentive is less practical and feasible than the incentive for free transit passes and flexible work arrangements; and that commuters who carpool likely already do so because it helps save them money, and don't need an additional incentive or information to carpool more. There is concern about how this will be monitored and implemented; for example, a company should not receive an incentive for simply posting flyers that encourage carpooling.

It was noted that the Portland metro region may not have the right scale or size to make carpooling attractive, since commutes in Portland are relatively short. There is also concern that small businesses and those located outside of the urban core will not be able to take advantage of this incentive, so may feel penalized. A few people suggest creating more TMA style programs, which leverage multiple employees in a district to work together to come up with creative carpooling programs.

Incentive #3: Local government using money from taxpayers for marketing and information to help people use public transit, biking, and walking

Stakeholders are generally neutral to somewhat supportive of this incentive (average rating: 2.6). Some jurisdictional representatives said they already use taxpayer money either formally or informally to promote active transportation. Elected officials stressed that it should be up to local governments to decide whether to use scarce local funds for this purpose, based on local needs and taxpayer sentiment.

Some jurisdictional and business leaders oppose or are neutral towards this incentive because they think marketing won't do much to change behavior, since most people already know about their transportation options. They want to see evidence of the effectiveness of marketing campaigns. Some don't think it is the government's place to try to change people's behavior.

A few environmental, bicycle/pedestrian and jurisdictional representatives said this incentive will provide more results than other proposed incentives, particularly if funding goes towards one-on-one and creative marketing campaigns. For biking, organizing rides and talking about route finding and bicycle equipment has been shown to change behavior. After three years of a focused outreach campaign, Smart Trips of Portland has shown real returns. Several stakeholders said that the best way to change behavior is to focus on changing environments and systems. For example, the Safe Routes to School program is effective because it goes beyond just education—it uses engineering and enforcement to create a holistic system that encourages alternative transportation.

Other Comments on Incentives

Funding Concerns

Many people have questions about which taxes will be implicated by the proposed incentives, and would oppose any incentives that reduce transit funding. Some elected officials said that jurisdictions are already struggling with a shortage of revenues, so impacting tax revenues may be harmful.

Other Incentives

Some people provided other ideas for incentives, including:

- Parking tax, if revenues are used to fund active transportation projects.
- Incentives to employers or groups of employers who help provide the “last mile” of the active transportation commute, such as shuttles from the nearest transit stop or a bike sharing program.
- Metro and local governments can build incentives into their zoning plans and codes to encourage higher density and transit-oriented development. They could also lessen the parking requirements for developers or businesses that provide alternative transportation options and amenities, such as zip car parking, bike share programs, affordable housing, etc.
- Incentives to encourage residential and commercial builders to bring old buildings up to better efficiency standards.
- Incentives for businesses to purchase EV, hybrid, or low-emissions vehicles for their fleet.

Regional Partnerships and Strategy

Elected officials discussed ways that the region could best work together to create a preferred scenario, and suggested elements that should be part of a legislative agenda.

Question: How can the region best work together to develop a shared strategy for implementing a preferred approach that may include a transportation legislative package for 2015?

Many elected officials stressed that the preferred approach must be a “menu of options” that can be adapted to fit the needs of communities with diverse needs; this will be the only way to gain the broad support needed. This means that the selected actions and investments must be implementable by urban, rural and suburban communities, and each of these community types must receive benefits from the CSC Scenarios project. Elected officials warned that projects should not have to fit within a narrow set of criteria to be fundable (i.e., criteria that only a dense urban community could meet).

Several people suggested that the state develop clear climate change goals and then let local jurisdictions determine how to meet them using their own unique approach. This type of local control, they suggested, will make it more likely that all jurisdictions support the project; adding local decision-making can be more effective, adaptable and responsive to local needs than federal decision-making.

Some ideas for the best ways to work together include:

- Local, regional and state government officials should engage in a joint lobbying effort before the state legislature. If their messaging is consistent and shows strong consensus, diverse officials lobbying together would be very powerful.
- Create a true private-public partnership with area businesses and economic drivers. For example, get Nike, Intel and other key employers on board.
- Continue working through and improving the processes of JPACT county-level transportation committees. Make sure that each county’s transportation group is involved.

- Make it clear what the cost of the project will be to different communities within the region, and where the benefits will be felt.
- Plug into existing regional affiliations and get them to work together. The process should unite groups across the region including the Multnomah County 3C/4C alliances, Westside alliances, Clackamas County C4, and Washington County alliances.

Question: What ideas do you have of the key items a legislative strategy should include?

Elected officials provided the following ideas for items that should be included in the legislative agenda:

- Revisions to UGB laws to allow decision-makers to consider locational factors and to require that new developments locate jobs, housing and recreation near one another.
- Change to enterprise zones, since rural areas no longer need this incentive to compete.
- Funding issues:
 - Include proposals to increase the gas tax.
 - Funding criteria should be streamlined and speak to local values. It would be nice if local jurisdictions could get federal or state funding for projects that meet local or regional standards, as opposed to meeting federal or state standards.
 - Any evaluation criteria for grants and funding should not be urban-centric. All types of geographic areas should be eligible to apply and be able to effectively compete.
- Specific projects to include:
 - Improvements to I-205 and Hwy 34, including bicycle/pedestrian paths on Hwy 34.
 - Bicycle/pedestrian paths along Willamette Falls Drive.
 - Road maintenance and preservation projects that have already been identified as needs.
- Emissions standards for construction vehicles.
- Measures to curb GHG emissions from residential homes and buildings.
- Lift the preemption on inclusionary zoning. This is a particular concern for the Powell-Division High Capacity Transit project, which could lead to gentrification if protections are not put in place.

Community Outreach

Stakeholders were asked to provide additional comments on ways that Metro can better engage the community in the CSC Scenarios project and to suggest other individuals and organizations that should be involved in the process. They described what they would do to demonstrate local support for the preferred scenario ultimately selected. This information was provided to Metro staff to continue to improve their engagement efforts. Some of the ways stakeholders said they would demonstrate support include: writing a letter, speaking and making presentations in support of the project, adopting local resolutions, lobbying the Oregon legislature, providing written or oral testimony, and engaging their constituents or membership in the process.

Outreach to Underserved Populations

Leaders of the environmental justice, equity and public health communities were asked more specific questions about upcoming discussion groups that Metro is planning to hold with these interest groups.

They were also asked for input on better engagement strategies that Metro can use with low-income and vulnerable populations. The information collected was also provided to Metro staff to help shape the public engagement process.

Generally, these leaders said there is a need for Metro to engage low-income communities and communities of color in a meaningful and collaborative way, which means engaging them early, helping to build capacity so that they can participate fully, and keeping them engaged throughout the entire process. The project messaging also needs to be written in a way that is relevant to the daily lives of these communities. Leaders pointed to Metro's Equity Baseline Workgroup as a good start to creating the kind of collaboration that is needed.

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

A regional approach simply makes sense when it comes to providing services, operating venues and making decisions about how the region grows. Metro works with communities to support a resilient economy, keep nature close by and respond to a changing climate. Together, we're making a great place, now and for generations to come.

Stay in touch with news, stories and things to do.

www.oregonmetro.gov/connect

Metro Council President

Tom Hughes

Metro Council

Shirley Craddick, District 1

Carlotta Collette, District 2

Craig Dirksen, District 3

Kathryn Harrington, District 4

Sam Chase, District 5

Bob Stacey, District 6

Auditor

Suzanne Flynn

MAKING A GREAT PLACE



Materials following this page were distributed at the meeting.

2015 regional urban growth management decision:

Draft regional population and employment
forecast

Metro Technical Advisory Committee

April 2, 2014

Presentation and discussion topics

- Growth management decision timeline and context
- Peer review of forecast
- Draft 2035 range forecast

2015 Urban Growth Management Decision

Phase I: urban growth report

Take stock of development trends and long-term needs for housing and jobs.

- Spring 2014 – draft population and employment forecast
- July 2014 – draft urban growth report (UGR)
- Fall 2014 – MPAC recommendation to Council on UGR
- December 2014 – Metro Council acceptance of final urban growth report

2015 Urban Growth Management Decision

Phase II: decision

Decide on how much household and employment growth to plan on and take additional measures, if needed, to accommodate it.

- September 2015 – COO recommendation to Council
- Fall 2015 – MPAC recommendation to Council
- December 2015 – Metro Council growth management decision

Metro Regional Forecast Advisory Panel

Dr. Tom Potiowsky, NW Economic Research Center, PSU

Dr. Jennifer Allen, Institute for Sustainable Solutions, PSU

Jerry Johnson, Johnson Economics

Dr. Jason Jurjevich, Population Research Center, PSU

Dave Lenar, NW Natural

Dr. Randall Pozdena, ECONorthwest

Steve Storm, NW Natural

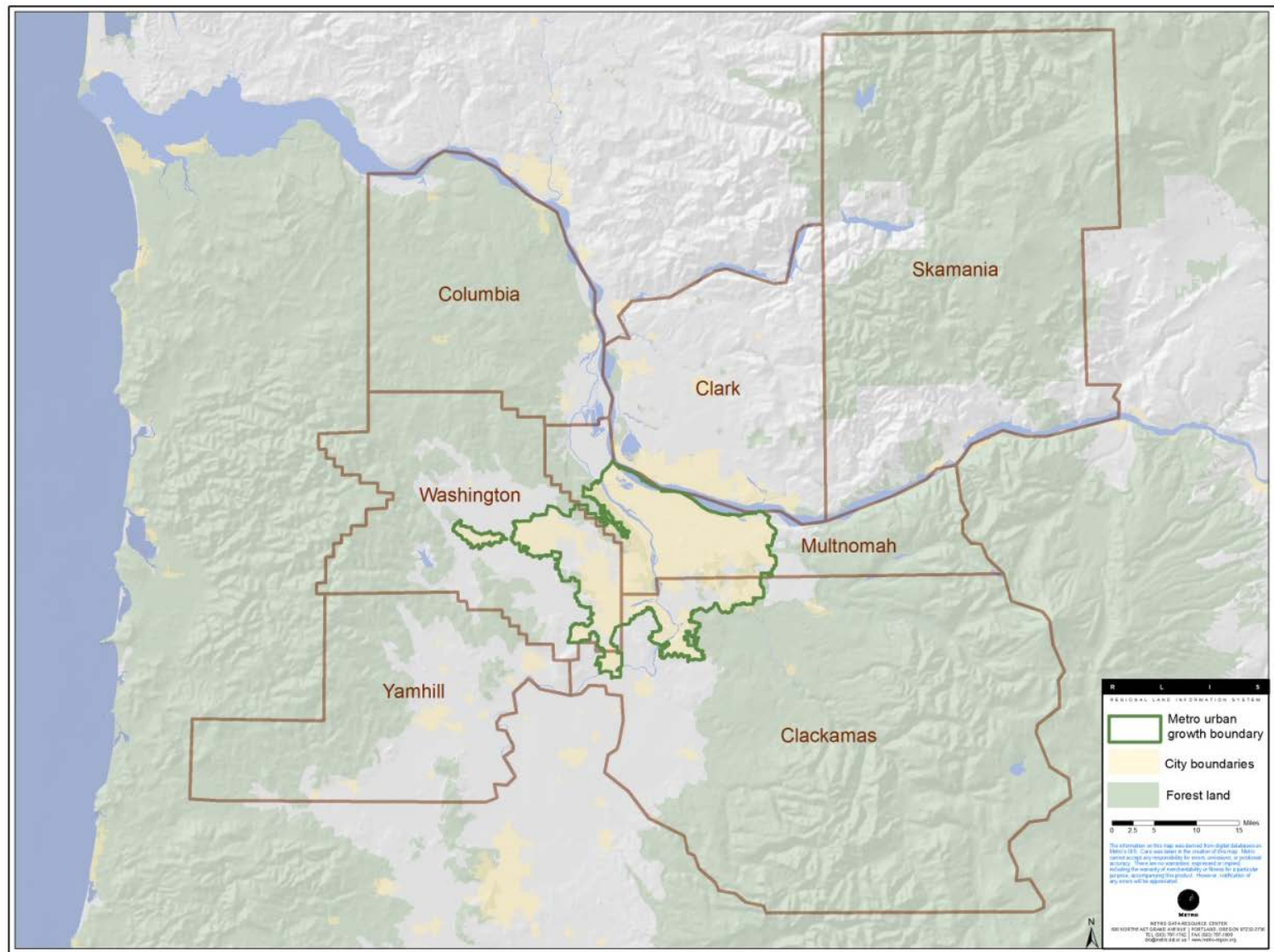
Dennis Yee, Metro

Metro Regional Forecast Advisory Panel

Group charge

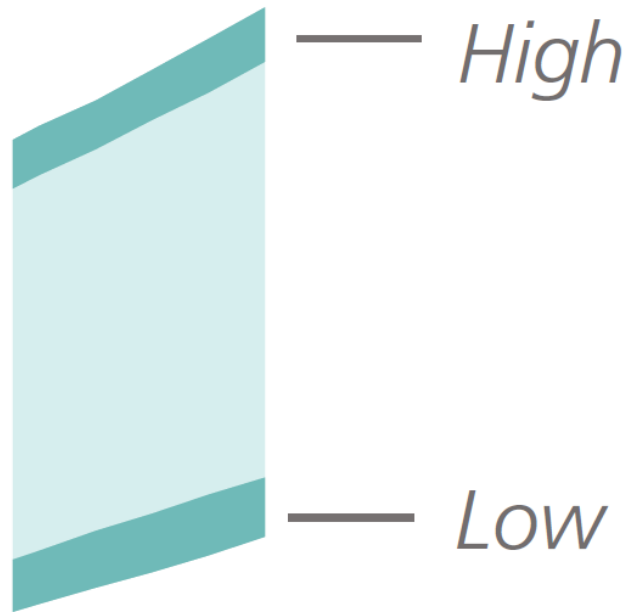
- Review forecast assumptions
- Review forecast results
- Describe potential scenarios that could lead to low growth or high growth

7-county forecast geography



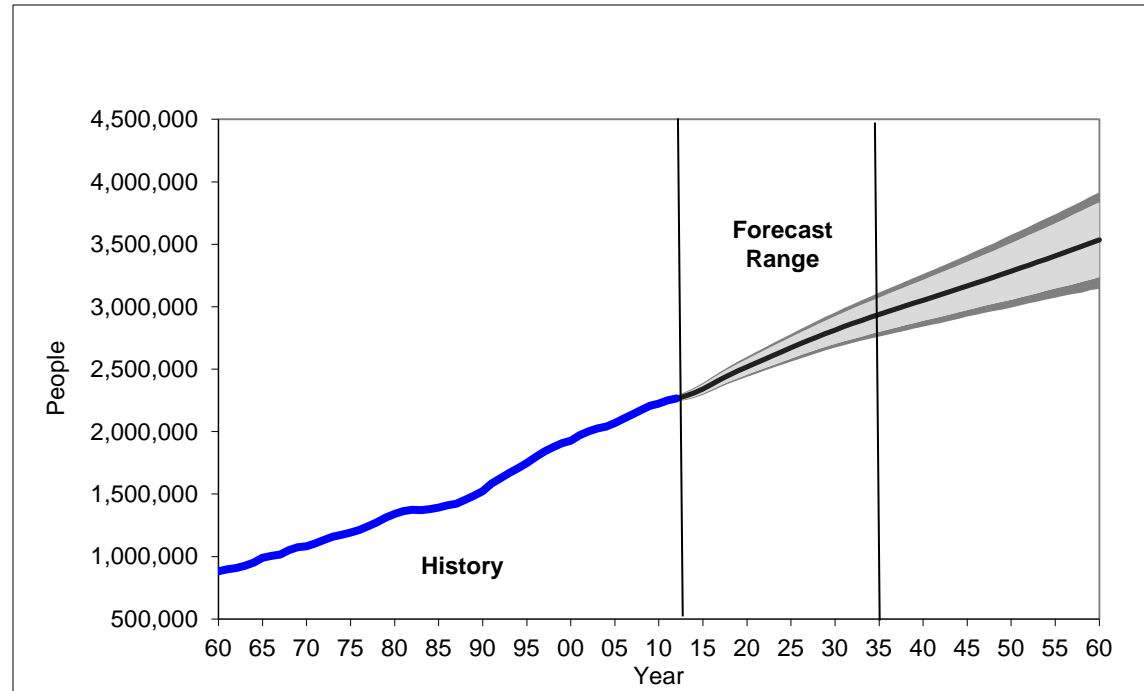
What the range means

Forecast range probability
90 percent probability



Draft population range forecast (7-county PMSA)

Not all of this growth will be in the Metro urban growth boundary



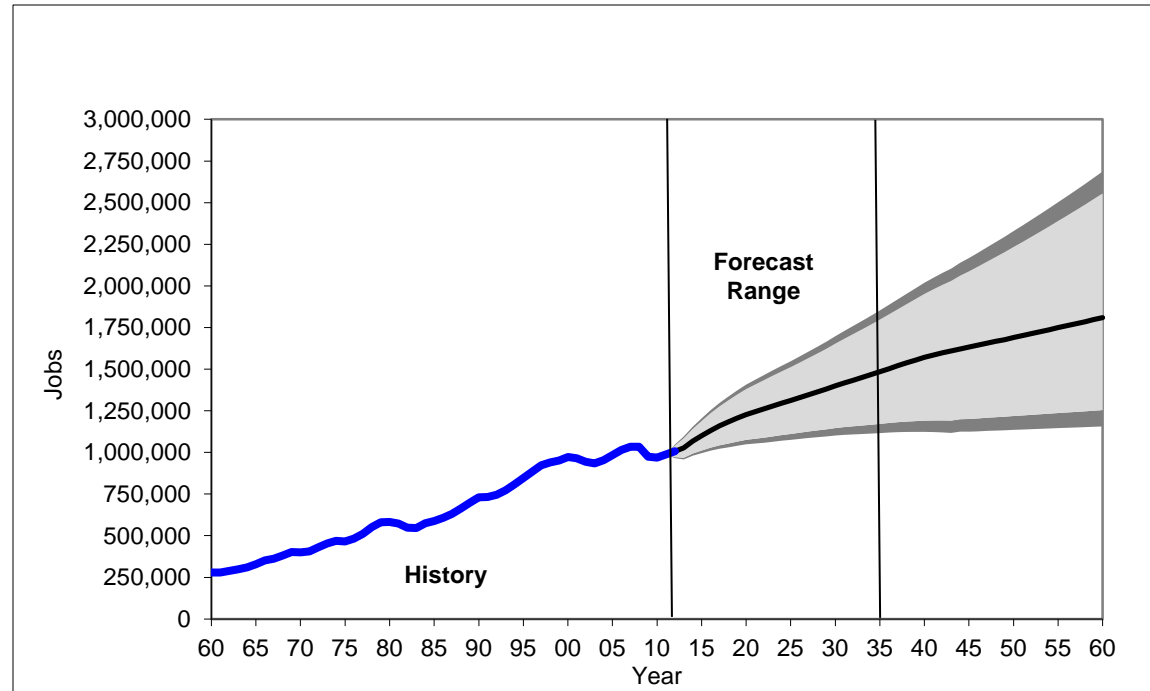
- About 470,000 to 725,000 new residents between 2015 and 2035.
- Baseline forecast would be equivalent to adding current population of Portland to 7-county area.

Comparison with other population forecast sources

Annual percentage rate (2010 to 2040)	Geography	Forecast source
1.1% baseline (range .9% to 1.4%)	Metro region (7 counties)	Metro 2014 preliminary forecast
1.1%	Metro region (7 counties)	OR Office of Economic Analysis (2013) Washington Office of Financial Analysis (2012)
1.1%	Metro region (7 counties)	IHS Global Insight (Sept 2013)
1.0%	Oregon State	OR Office of Economic Analysis (2013)
1.2%	Oregon State	U.S. Census (2005)
0.8%	Oregon State	IHS Global Insight (Oct 2013)
0.7%	U.S.	U.S. Census (2012)
0.7%	U.S.	IHS Global Insight (Nov 2013)
0.6%	U.S.	World Bank (2013)

Draft employment range forecast (7-county PMSA)

Not all of this growth will be in the Metro urban growth boundary



About 121,000 to 650,000 new jobs between 2015 and 2035

Overarching policy considerations

What plans and investments will make the region adaptable in the face of uncertainty?

- What if we plan for low growth and high growth occurs?
- What if we plan for high growth and low growth occurs?