I-205 Toll Project

MEMORANDUM

Date	February 11, 2021
To	Lucinda Broussard, Mandy Putney, Natalie Liljenwall, Michael Holthoff, Ben White, and Robert Schiavone (ODOT)
From	Rebecca Frohning, WSP
Subject	Energy and Greenhouse Gas Emissions Methodology Memorandum – Draft #4
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INTRODUCTION

This memorandum describes the methods that will be used in the I-205 Toll Project (Project) Environmental Assessment (EA) analysis to evaluate energy and greenhouse gas (GHG) emissions impacts of the Project alternatives. The analysis and results will be documented in a technical report and summarized in the EA that will be developed to comply with federal guidelines and regulations, including the National Environmental Policy Act (NEPA) and local and state policies, standards, and regulations.

The energy and GHG emissions analysis will evaluate impacts from the construction, operations, and maintenance of the Project and will identify mitigation measures as needed.

LEGAL REGULATIONS AND STANDARDS

Laws, Plans, Policies, Regulations, and Guidance

The following is a list of federal, state, and local laws, regulations, plans, policies, and guidance documents that guide or inform the assessment of energy and GHG emissions:

- FHWA Technical Advisory T 6640.8A Guidance for Preparing and Processing Environmental and Section 4(f) Documents
- Interim Guidance for Evaluating Mobile Source Air Toxics (MSAT) in NEPA Documents (FHWA 2016b)
- FHWA, Frequently Asked Questions (FAQ) Conducting Quantitative MSAT Analysis for FHWA NEPA Documents
- Using MOVES for Estimating State and Local Inventories of On-Road Greenhouse Gas Emissions and Energy Consumption (EPA 2016)
- NEPA of 1969
- Oregon Statewide Planning Goal 13 (Oregon Administrative Rules (OAR) 660-015-0000(13))
- Transportation Planning Rule (OAR 660-12-035)

- Oregon Department of Transportation (ODOT) Air Quality Manual (ODOT 2018)

AREA OF POTENTIAL IMPACT

The area of potential impact (API) is a geographic boundary within which impacts to the human and natural environment could occur as a result of implementing Project alternatives. The energy and GHG emissions API was developed using the same methodology as the API for the Air Quality Technical Report. The energy and GHG emissions API encompasses the roadway segments (links) that could experience changes in congestion (e.g., traffic volumes and speed) due to the Project. Toll projects have the potential to impact vehicle trips at great distances from the project location because travelers may choose different routes or times of day to travel. Analyzing a metropolitan area's entire roadway network will result in emissions estimates for many roadway links not affected by the project, diluting the results of the analysis, and not allowing for a meaningful comparison between alternatives. The energy and GHG emissions analysis will be limited to areas expected to experience a meaningful change in emissions based on recommendations outlined in FHWA's Frequently Asked Questions (FAQ) Conducting Quantitative MSAT Analysis for FHWA NEPA Documents, consistent with the API used for the Air Quality Technical Report. There is currently no standard guidance to define a study area for energy use or GHG emissions, and for projects that require a quantitative MSAT analysis, it is common practice to use the MSAT study area for the energy and GHG emissions analysis.

The MSAT guidance defines a meaningful change in emissions as approximately plus or minus 10 percent between the future No-Build and Build conditions, and it includes recommended metrics to define the affected network and emphasizes using project-specific knowledge and consideration of local circumstances. The energy and GHG API was determined using link-level traffic data to compare the change in volumes on each link (roadway segment) between the 2045 No-Build condition and the 2045 Build Alternative expected to result in changes in annual average daily traffic (AADT) with the broadest geographical extents. This was determined by first identifying roadway links associated with the Project plus roadway links that meet the following criteria:

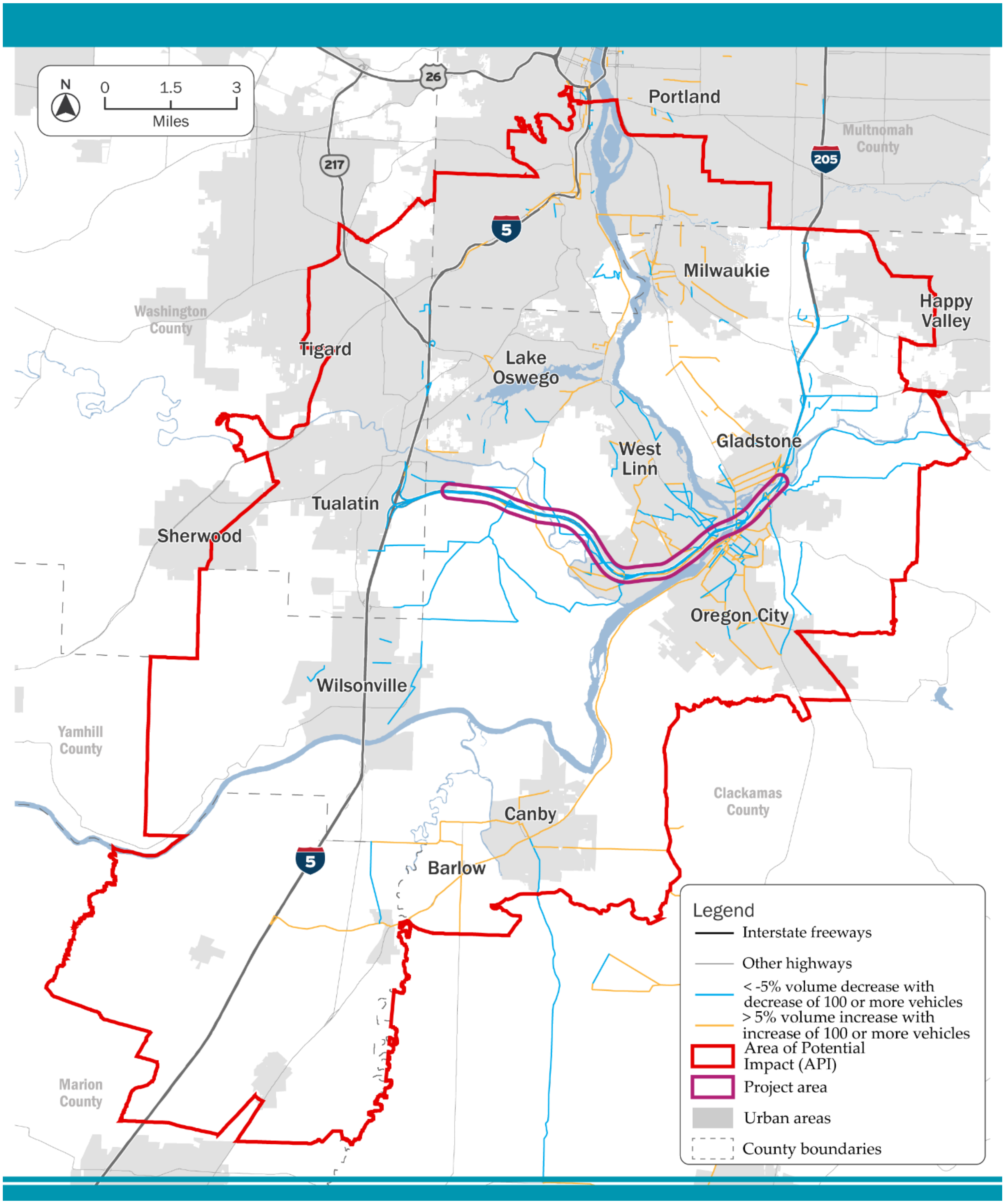
- Plus or minus five percent or more change in annual average daily traffic (AADT)
- Increase or decrease in 100 or more vehicles AADT

The resulting set of links was further refined based on Project-specific knowledge and circumstances. The FHWA FAQ acknowledges that it is possible that low-volume links far removed from the project footprint may appear to show a change in traffic volumes that can be attributed to a modeling artifact. In order to focus on the API on roadways that are expected to capture a meaningful impact on emissions, census tract boundaries were used to develop the API boundary. To the south of the Project area, census tracts were removed that were rural, had relatively lower traffic volumes, and were not part of a connected network. To the north of the Project area, census tracts were removed that were associated with the downtown Portland area because the modeled changes in traffic are not attributed to the Project, and the high traffic volumes would dilute the analysis results.

The API boundary is shown in Figure 1, including the segments with a predicted change in AADT greater than five percent or less than negative five percent that were used to determine the affected network. Only the highlighted links within the boundary will be included in emissions calculations. This methodology assumes that for each alternative analyzed in the EA, direct GHG emissions impacts would predominantly originate from within the proposed API boundary. Direct impacts to energy consumption due to fuel use would occur within this boundary. GHG emissions associated with each alternative would be dispersed into the atmosphere where no boundary can be defined. Prior to preparation of the Energy and GHG Emissions Technical Report, this API may be modified once the alternatives to be studied in the EA have been identified and projected traffic volumes have been refined.

The API for indirect impacts to energy consumption and GHG emissions is a larger area for which no boundary can be defined. Indirect effects encompass upstream production of materials and energy processes and can be considered to include the global atmosphere.

Figure 1. Preliminary Energy and Greenhouse Gas Emissions Direct Impacts API



DESCRIBING THE AFFECTED ENVIRONMENT

Published Sources and Databases

Data used in the 2018 Documented Categorical Exclusion (DCE) prepared for the I-205 Improvements Project will be reviewed to confirm its relevancy and applicability to this study. The following is a list of the data that will be used to determine and describe the existing conditions for energy and GHG emissions:

- Metro regional travel demand model output
- Energy consumption statistics from the U.S. Energy Information Administration
- GHG emission trends from the Oregon Global Warming Commission
- Climate change discussion and trends from Fourth Oregon Climate Assessment Report, State of Climate Science: 2019
- Metro MOtor Vehicle Emissions Simulator (MOVES) input files

Contacts and Coordination

Vehicle emission modeling files will be requested from Metro. Metro develops MOVES input files for regional emissions analyses, and these files will be supplemented with Project-specific data to complete the energy and GHG analysis. The Project data will be provided by the traffic analysis team using output from the regional travel demand model that captures volume and speed changes due to the project alternatives, described in detail in the Transportation Methodology Memorandum. The Project Team will coordinate with ODOT and FHWA during the preparation of the technical report, particularly if any potential revisions to the analysis methodology are needed.

Field Surveys or Testing

No field surveys or testing will be performed for the energy and GHG emissions analysis.

IMPACT ASSESSMENT METHODS

The impacts analysis will address the long-term and short-term impacts upon energy and GHG emissions for each of the Project alternatives.

Long-Term Impact Assessment Methods

The analysis of direct long-term impacts resulting from the Project will include an evaluation of projected energy consumption and GHG emissions from the roadway segments expected to experience meaningful changes in emissions as described in the API section above. The quantitative analysis will be based on calculations using the same study area as the MSAT emissions analysis included in the Air Quality Technical Report.

As part of the air quality analysis, an MSAT Study Area will be refined by conducting a comparison of traffic volumes for all links in the regional model between the No Build Alternative and all Build Alternatives that will be evaluated in the EA. Using the recommendations described above, along with a level of judgment and local knowledge, one roadway analysis network will be developed that will allow for a comparison of all alternatives evaluated. The roadways chosen for inclusion in the air quality analysis will also be used for the energy and GHG emissions analysis. Total energy consumption and GHG emissions from the selected roadway segments will be calculated for each scenario.

Model Inputs and Options

EPA's MOVES model version MOVES2014b will be used to estimate emissions and energy consumption from the study area network. MOVES2014b is the EPA's state-of-the-art tool for estimating emissions from highway vehicles. The model is based on analyses of millions of emission test results and considerable advances in EPA's understanding of vehicle emissions. Compared to previous tools, MOVES2014b incorporates the latest emissions data, more sophisticated calculation algorithms, increased user flexibility, new software design, and substantial new capabilities. MOVES run specifications as recommended in the FHWA FAQ are summarized in Table 1.

Table 1: MOVES RunSpec Options

MOVES Tab	Model Selections
Scale	County Scale Inventory Calculation Type
Time Span	Hourly time aggregation including all months, days, and hours Analysis years 2015, 2027, and 2045
Geographic Bounds	Clackamas County Other counties will be added if final modeled domain from the air quality analysis extends beyond one county
Vehicles/Equipment	All on-road vehicle and fuel type combinations
Road Type	Rural restricted, rural unrestricted, urban restricted, and urban unrestricted
Pollutants and Processes	CO2 equivalent, total energy consumption, and predecessors are selected (predecessor pollutants are atmospheric CO2, methane, nitrous oxide, and total gaseous hydrocarbons) Processes include running exhaust, crankcase running exhaust, evaporative permeation, and evaporative fuel leaks
Manage Input Data Sets	Database provided by Metro will be imported to account for adoption of California's Low Emission Vehicle (LEV) program as well as participation in the Multi-State Zero Emission Vehicle (ZEV) Action Plan
Output	Output will be in an annual inventory of total emissions by pollutant and total energy consumption

MOVES input files provided by Metro will be used to represent regional conditions, and these will be combined with input files developed with Project-specific data to characterize the differences in traffic volumes and speeds. Link-by-link traffic data will be used to develop input files to demonstrate the effects of the Project for each scenario analyzed: 2015, 2027 No Build, 2027 Build, 2045 No Build, 2045 Build. It is assumed that two Build scenarios will be evaluated for the energy and GHG analysis. Specific inputs and their sources are summarized in Table 2.

Table 2: MOVES County Data Manager Inputs

County Data Manager Tab	Data Source
Ramp Fraction	Metro
Source Type Population	Metro
Age Distribution	Metro
Fuel	Metro
Inspection/Maintenance Programs	Metro
Meteorological Data	Metro
Vehicle Type Vehicle Miles Traveled (VMT)	Created from project data
Average Speed Distribution	Created from project data
Road Type Distribution	Created from project data

The link-by-link traffic data will indicate the link length and roadway type, and it will include volume and average modeled speed data for each hour of an average weekday. The data will be processed for use in MOVES using the following assumptions:

- Roadway Type: The roadway types (also called functional class) included in the regional travel demand model will be mapped to the four MOVES roadway types: rural restricted, rural unrestricted, urban restricted, and urban unrestricted. The off-network road type will not be used for this analysis.
- Average Speed: The link-level traffic data is provided for each of hour of the day. Speeds will be mapped to respective MOVES 5-mile per hour speed bins, and the same speed will be applied for all hours of the day that fall within the respective time period.
- Vehicle Miles Traveled (VMT): Each MOVES run requires the user to provide an annual VMT. VMT from the four time periods will be added to develop a daily VMT value for each scenario modeled. The daily VMT will converted to annual VMT using the EPA's AADVMT Converter for MOVES2014. The annual VMT must be provided by five highway performance monitoring system (HPMS) vehicle types: motorcycles, light duty vehicles, buses, single unit trucks, and combination trucks. The link-level volume data will be provided by three vehicles types: passenger vehicle, medium truck, and heavy truck. The VMT from these three categories will be applied to the five HPMS vehicle types by using the annual VMT inputs provided by Metro to determine an appropriate distribution. MOVES also requires VMT distribution files that specify how the annual VMT is distributed by month, day, and hour. MOVES inputs from Metro will be used for a consistent representation of the regional assumptions.

MOVES will be used to estimate annual on-road GHG emissions in units of tons of carbon dioxide equivalent ($CO_2e$and energy consumption in British thermal units (Btu) from the MSAT study area for each scenario. CO_2e emissions are output directly from MOVES based on the total emissions of CO_2, methane, and nitrous oxide. Additional operational emissions of GHG will be calculated using the FHWA fuel cycle factor of 0.27, which accounts for emissions released during fuel extraction, refining, and transport prior to use by vehicles. The VMT, CO_2e emissions, and total energy consumption of each alternative will be presented in a table and compared with the existing and No Build scenarios. The implications of the changes in GHG emissions and energy consumption to climate change will be discussed qualitatively.

In addition to the quantitative analysis at the regional scale, the analysis will qualitatively address potential impacts to sub-areas, such as specific neighborhoods or communities. Results from the travel demand model will be reviewed to identify geographical areas that show a consistent trend in changes to vehicle volumes or speeds on the associated roadway links due the Project. The potential impacts to specific sub-areas will be qualitatively discussed by comparing travel model metrics. The qualitative discussion will describe the general relationship between changes in VMT, vehicle speeds, GHG emissions, and energy consumption.

FHWA's Infrastructure Carbon Estimator (ICE) Tool will be used to estimate GHG emissions and energy use from equipment performing routine maintenance on the facility, based on the centerline miles of affected roadways. ICE provides energy consumption estimates based on details about the project type and size. The tool includes assumptions based on a nationwide database of construction bid documents, data collected from state departments of transportation, and consultation with transportation engineers and lifecycle analysis experts. ICE produces annualized maintenance emissions and energy output per year over the project life cycle. The annualized values will be added to the annual operational emissions and energy use from on-road vehicles for a total annual operation value for each analysis year and build alternative.

Short-Term Impact Assessment Methods

The analysis of direct short-term energy and GHG emissions impacts that would occur during Project construction will consider:

- GHG emissions and energy consumption from construction equipment during the construction period
- GHG emissions and energy consumption from vehicle delay during construction

Impacts due to construction activities and vehicle delay during construction will be calculated using ICE. Inputs to the tool will include details about the types of activities performed and the characteristics of the affected roadways, as well as road closure duration data.

Indirect Impacts Assessment Methods

Indirect impacts to energy consumption and GHG emissions during construction include upstream activities related to the materials and fuels used during construction of the Project. These indirect impacts are estimated by ICE. Long-term sources of indirect energy consumption and GHG emissions are from the production of energy required for project operation of the tolling infrastructure, such as lighting, variable message signs, and other electricity used by the toll gantries. ICE will be used to estimate impacts from the sources that are available in the model.

Cumulative Impacts Assessment Methods

The analysis of cumulative impacts to energy and GHG emissions is described in the I-205 Toll Project Cumulative Impacts Methodology Memorandum.

MITIGATION APPROACH

Methods to minimize short-term impacts to energy and GHG emissions from construction will be described qualitatively based on ODOT Standard Specifications Section 290, which include air pollution control measures and methods to reduce the impact of construction delays on traffic flow, which also reduce energy consumption and GHG emissions.

PERFORMANCE MEASURES

3 presents a preliminary list of performance measures identified to evaluate how the alternatives compare in terms of impacts and benefits to energy and greenhouse gas emissions.

Table 3. Energy and GHG Performance Measures

Performance Measure	Tool and/or Data Source used for Assessment of Measure
Change in annual regional energy consumptions and CO_2e emissions from vehicle operations	MOVES model – using 24-hour VMT output by vehicle type and speed bin from the regional travel demand model

Additional performance measures may be identified during the course of analysis.

REFERENCES

Federal Highway Administration (FHWA). 2016. Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents. Federal Highway Administration. October 18. https://www.fhwa.dot.gov/environMent/air_quality/air_toxics/policy_and_guidance/msat/

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