APPENDIX S: GREENHOUSE GAS ANALYSIS

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526 EAST LOWCOUNTRY CORRIDOR

TECHNICAL MEMORANDUM:
GREENHOUSE GAS ANALYSIS

Prepared for:

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1.0 GREENHOUSE GAS ANALYSIS

1.1 GREENHOUSE GAS AND CLIMATE CHANGE

1.1.1 Introduction and Regulatory Framework

There is a general consensus in the scientific community that climate change on a global scale is and will continue to occur due to increases in concentrations of greenhouse gas (GHG) in the atmosphere. Since the beginning of the industrial age, GHG emissions from sources associated with human activity (anthropogenic sources) have increased dramatically, outstripping the atmospheric removal capacity of natural processes. The increased atmospheric concentrations associated with these emissions has resulted in statistically significant changes to global climatic conditions which vary by geographic location, including but not limited to changes to precipitation levels and patterns, oceanic circulation patterns, and the frequency of extreme weather events.

Changes in local and regional climate patterns affect both natural and human environments, including the availability of clean drinking water and disease propagation. Sea level rise associated with the global melting of sea ice is predicted to have dramatic effects on coastal areas.

The National Environmental Policy Act (NEPA) of 1969 was established to ensure that federal actions use all practicable means to create and maintain conditions under which man and nature can exist in productive harmony. The Council of Environmental Quality (CEQ) is assigned as the entity responsible for overseeing NEPA implementation. On January 9, 2023, the CEQ issued *NEPA Guidance on Consideration of Greenhouse Gas Emissions and Climate Change*, establishing a common approach for Federal agencies for consideration of the effects of GHG emissions and climate change relative to a proposed action.[1] This interim GHG guidance builds upon and updates the CEQ's *2016 Final Guidance for Federal Departments and Agencies on the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Review*, highlighting best practices for analysis grounded in science and agency experience. The CEQ guidance calls for the quantification and disclosure of a proposed action's projected direct and indirect GHG emissions to a degree commensurate with the quantity of projected emissions attributable to the project, a comparison of those emissions to those of the No-Action alternative, quantification of those emissions in the context of the best available applicable social cost of GHG (SC-GHG) estimates, consideration of environmental justice implications of climate change associated with the proposed action or its alternatives as applicable, and integration of relevant climate-related mitigation and resiliency measures.

[1] CEQ. *National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change*. January 2023. https://www.federalregister.gov/d/2023-00158.

1.1.2 Methodology

1.1.2.1 Greenhouse Gas Emission Estimates

The CEQ guidance instructs that GHG emission impacts of a proposed action should either be evaluated by means of reference to a program-level assessment, incorporating a variety of statewide, MPO area, corridor, or sub-area projects improvements, or by means of a project-level assessment. This GHG assessment was completed at the project level. Thus, emissions from the No-Build Alternative and all other Reasonable Alternatives were analyzed. Emission sources evaluated in this analysis include GHGs which would result from project construction activities, GHGs which would result from project lifetime maintenance activities, and GHGs which would result from vehicle travel in the study area.

Construction- and maintenance-related GHG emissions were estimated using the Federal Highway Administration (FHWA) Infrastructure Carbon Estimator (ICE) tool, version 2.1. The tool incorporates lifecycle GHG emissions from materials and fuels used during construction activities and is specifically designed for evaluation of GHG emissions from transportation facilities.[2] The tool estimates emissions based on project-specific parameters, such as length of construction or count of lanes, for all major roadway infrastructure categories (i.e., bridges, ramps, highways, etc.). The tool also includes inputs to estimate widening and other roadway expansion activities. Construction- and maintenance-related GHG lifecycle emissions were estimated for each of the evaluated Reasonable Alternatives.

Vehicular GHG emissions during operation were estimated using project specific VMT projections and average speeds by roadway segment. Emission factors were estimated using the EPA MOtor Vehicle Emission Simulator (MOVES) version 3.0.4 from the MOVES default national database for the design year of 2050. Vehicular emissions, including tailpipe emissions accounting for a fuel cycle correction factor (0.27), were estimated for each of the evaluated Reasonable Alternatives by multiplying the VMT for light-duty automobiles, medium duty-trucks, and heavy-duty trucks on each study area roadway segment by the respective MOVES emission factor for that vehicle class at the roadway segment's projected average speed.[3] Operations-related vehicular GHG emissions were estimated for the No-Build Alternative and each of the evaluated Reasonable Alternatives.

1.1.2.2 Social Cost of Greenhouse Gas Estimates

Estimates of the social costs of GHG are one way of providing additional context for the effects of climate change associated with an action's GHG emissions. SC-GHG are the cost, in US dollars, of global climate-related damages which would be associated with an action's GHG emissions. These costs are estimated in a manner consistent with the best available science at the time of publication, the current Technical Support Document for the Social Cost of GHG from the Interagency Working Group on Social Cost of Greenhouse Gases.[4, 5]

[2] MnDOT. *Infrastructure Carbon Estimator, version 2.1 (ICE2.1) Final Report and User's Guide*. August 17, 2020. https://edocs-public.dot.state.mn.us/edocs_public/DMResultSet/download?docId=11949837.
[3] WSDOT. *Guidance for Project-Level Greenhouse Gas Evaluation*. 2018. https://wsdot.wa.gov/sites/default/files/2021-10/ENV-ANE-GHGGuidance.pdf.
[4] IWG SC-GHG. *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide - Interim Estimates under Executive Order 13990*. February 2021. https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.
[5] The SC-GHG values provided in the current Technical Support Document and used throughout this analysis are projections based on the best available science at the time of publication; However, these values may be conservative underestimates because various damage categories (like ocean acidification) are not currently included.

Consistent with U.S. Department of Transportation (USDOT) guidance for the estimation of SC-GHG, SC-GHG are estimated using three (3) percent discount rate cost factors and are presented in baseline analysis year (2021) dollars.[6,7] SC-GHG are estimated from the sum of both direct and indirect study area vehicular emissions and annualized construction and maintenance emissions for each year of operation over the projected project lifetime and are summed for comparison of alternatives. SC-GHG are estimated for the combined climate-related damages associated with emissions of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

Climate change impacts inherently raise social justice concerns, as it will disproportionately and adversely affect human health and the environment in some communities, including communities of color, low-income communities, and Tribal Nations and Indigenous communities. In the evaluation of SC-GHG, this analysis also considers the effects of climate change on the project, the project's climate resiliency implications, and consideration of whether the project would amplify climate change-related hazards such as storm surge, heat waves, drought, flooding, or sea level change for communities in the area affected by the Proposed Action.

1.1.2.3 Greenhouse Gas and Climate Commitments

No local, regional, or state climate commitments have been developed for the reduction of GHG. On February 19, 2021, executive action brought the United States back into the Paris Agreement, a framework for global action on the reduction of GHG emissions and climate impacts.[8] Current Federal strategies for achieving emission reductions in fulfillment of the agreement include the deployment of clean energy, the acceleration of electric vehicle infrastructure deployment and electric vehicle sales, improvements to building energy efficiency, and reduction in methane emissions from industry and agriculture.[9] It is not expected that the proposed action would obstruct or otherwise conflict with these national strategies.

1.1.3 Existing Conditions

Nationally, transportation activities account for approximately 27 percent of total U.S. GHG emissions, making it the single largest source of GHG emissions in the country. Between 1990 and 2020, GHG emissions in the U.S. from transportation sources increased more than any other GHG source.[10]

Implementation of any of the Reasonable Alternatives would result in changes to traffic patterns within the study area. The primary roadways for which traffic patterns would be affected include segments of Interstate 526 (I-526) and Long Point Road. In 2021, the segment of I-526 west of Long Point Road, was estimated to have experienced 75,300 annual average daily trips (AADT), and the segment of I-526 east of Long Point Road was estimated to have experienced 61,900 AADT. The segment of Long Point Road north of I-526 was estimated to have experienced 28,200 AADT, and the segment of Long Point Road south of I-526 was estimated to have experienced 19,900 AADT. A complete breakdown of estimated

[6] USDOT. *Benefit-Cost Analysis Guidance for Discretionary Grant Programs*. January 2023. https://www.transportation.gov/sites/dot.gov/files/2023-01/Benefit%20Cost%20Analysis%20Guidance%202023%20Update.pdf.
[7] The three (3) percent discount rate scenario is a moderate scenario representing an expected potential intergenerational economic impact severity associated with climate change.
[8] USDoS. *The United States Officially Rejoins the Paris Agreement*. February 19, 2021. https://www.state.gov/the-united-states-officially-rejoins-the-paris-agreement/.
[9] National Climate Task Force. *President Biden's Actions to Tackle the Climate Crisis*. Accessed February 1, 2023. https://www.whitehouse.gov/climate/.
[10] EPA. *Carbon Pollution from Transportation*. Accessed August 4, 2022, https://www.epa.gov/transportation-air-pollution-and-climate-change/carbon-pollution-transportation

traffic parameters and emissions for study area roadway segments is provided in **Appendix A**. **Table 1-1** presents the estimated GHG emissions associated with vehicle operation in the study area under existing conditions.

Coastal urban areas across the Southeast were among the fastest-growing metropolitan areas in the country in recent years and are anticipated to face new climate vulnerabilities associated with more highly urbanized and dense development. The global mean sea level has risen more than 3 inches since 1990 and is expected to continue rising, exacerbating the effects of extreme weather events and flooding in the study area. Local tide gauges indicate that in certain low-lying areas of the Southeast, the local relative sea level has risen between 1 to 3 feet over the past 100 years.[11]

Table 1-1: Study Area Annual GHG Emissions under Existing Conditions

Scenario	Passenger Vehicles (VMT)	Medium Trucks (VMT)	Heavy Trucks (VMT)	Overall Average Speed (mph)[1]	Annual Emissions (MT CO_2e)[2]
Study Area Existing Conditions	61,386,065	1,798,355	7,209,115	50	41,071

CO_2e = carbon dioxide equivalents
MT = metric tons
mph = miles per hour
VMT = vehicle miles traveled
[1] Overall average speed represents the average speed across all analyzed roadway segments in the study area weighted by segment length and annual average day vehicle trips. Average vehicle speeds along individual roadway segments would differ from the value shown.
[2] Vehicular GHG emissions are inclusive of fuel cycle emissions.

1.1.4 Environmental Consequences

1.1.4.1 Greenhouse Gas Emissions

Vehicle traffic in the study area is anticipated to grow between the existing conditions and project design year (2050). For this analysis, direct exhaust from vehicle operations within the study area roadways, fuel cycle-related emissions, and construction/maintenance emissions were estimated. Emissions were analyzed for the No-Build Alternative and for each of the Reasonable Alternatives. Operations and fuel cycle emissions were estimated based on project-specific vehicle miles traveled (VMT) traffic data and default MOVES national database emission rates for the Charleston County area.

Construction emissions were estimated using the FHWA ICE tool and project-specific details. The ICE tool emission estimates include GHG emissions from energy demand, materials usage, construction equipment operation, and maintenance activities at the project life-cycle level. A project lifetime of 60 years was assumed for this analysis.

The results of this analysis are presented in **Table 1.2** below and additional model inputs and assumptions are detailed in Appendix A.

As shown, overall annual study area GHG emissions would be comparable between the No-Build and each of the evaluated Reasonable Alternatives. Due to the relatively minor changes to VMT and average

[11] USGCRP. *National Climate Assessment 4*. Accessed February 1, 2023, https://nca2018.globalchange.gov/chapter/19/

roadway speeds which would occur between the No-Build Alternative and each Reasonable Alternative, the difference in GHG emissions between the alternatives would be commensurately minor.

Table 1-2: Annual study area GHG emissions under the No-Build and each Reasonable Alternative

Emission Source	No-Build	Alternative 1A	Alternative 2	Alternative 3	Alternative 6
Study area roadway vehicle operations					
Passenger Vehicles (VMT)	99,674,200	99,941,380	99,560,685	98,333,920	98,386,115
Medium Trucks (VMT)	2,899,560	2,919,635	2,803,200	2,830,575	2,811,960
Heavy Trucks (VMT)	12,000,835	12,099,020	10,151,745	11,391,650	10,157,585
Overall Average Speed (mph)[1]	50	50	50	50	49
Annual vehicle emissions (MT CO_2e)[2]	**49,081**	**49,410**	**47,133**	**48,938**	**48,813**
Construction and maintenance emissions annualized over 50 years (MT CO_2e)[3]					
Materials	--	10	36	14	16
Transportation	--	1	4	2	2
Construction	--	8	28	11	12
Maintenance	138	144	195	136	136
Total annualized construction and maintenance	**138**	**164**	**264**	**163**	**166**
Vehicle operations plus construction and maintenance emissions annualized over 50 years (MT CO_2e)					
Study Area Emissions	**49,219**	**49,574**	**47,397**	**49,101**	**48,979**

CO_2e = carbon dioxide equivalents
MT = metric tons
mph = miles per hour
VMT = vehicle miles traveled

[1] Overall average speed represents the average speed across all analyzed roadway segments in the study area weighted by segment length and annual average day vehicle trips. Average vehicle speeds along individual roadway segments would differ from the value shown.

[2] Vehicular GHG emissions are inclusive of fuel cycle emissions.

[3] No-Build construction and maintenance emissions assume no construction and account only for the maintenance of existing roadways.

1.1.4.2 Social Cost of Greenhouse Gas Emissions Estimates

The GHG emissions associated with construction of a build alternative, maintenance of proposed and existing roadways, and the operation of vehicle traffic in the project area would result in GHG emissions which would contribute to global climate impacts. The SC-GHG, in adjusted 2021 dollars, were estimated based on these GHG emissions for each year of construction and operation and summed over the Project's lifetime for comparison across alternatives. SC-GHG estimates represent the costs in global climate-related damages associated with GHG emissions. Negative SC-GHG values represent the potential for reduction in global climate-related damages.

A summary of project lifetime SC-GHG for each Reasonable Alternative are presented in **Table 1.3** below. A detailed breakdown of SC-GHG by calendar year and GHG source and additional assumption details are provided in Appendix A.

Table 1-3: SC-GHG Summary in 2021 Dollars of Global Climate-Related Damages

Lifetime SC-GHG in Adjusted 2021 Dollars[1]	No-Build	Alternative 1A	Alternative 2	Alternative 3	Alternative 6
Total SC-GHG	$100,250,000	$100,770,000	$97,743,000	$100,102,000	$100,306,000
SC-GHG Percent Change Relative to No-Build	--	+0.5%	-2.5%	-0.1%	+0.1%
SC-GHG Difference Relative to No-Build	--	$520,000	-$2,507,000	-$148,000	$56,000

SC-GHG = social cost of greenhouse gas emissions
[1] Values shown represent 2021 dollars discounted at a 3% rate and summed over the project lifetime.

As shown, SC-GHG estimates would be similar between the No-Build and each of the evaluated Reasonable Alternatives, ranging from 0.5 percent higher under Alternative 1A to 2.5 percent lower under Alternative 2. SC-GHG are global damage cost estimates and may not represent project-related climate damage costs or cost reductions to communities in the project area specifically. While projections are based on the best available science at the time of publication, SC-GHG estimates may underestimate actual climate damage costs due to various climate damage categories not being considered (such as ocean acidification).

Global social costs of climate change would be disproportionately borne by underserved communities most vulnerable to climate impacts. Each build alternative would improve vehicle flow on the I-526 in the project area and none of the alternatives would be expected to increase or exacerbate the effects of climate impacts on underserved communities in the project area.

1.1.4.3 Climate Change Impacts

Based on Flood Insurance Rate Map (FIRM), published by FEMA, each build alternative would involve construction near to, but not within, the 100-year flood limits of waterways near to the project area, including the Wando River and Hobcaw Creek.[12] While the project would not fall within the 100-year floodplain, sea level rise could be a potential climate change impact on the project due to influences to the Atlantic Ocean, Wando River, and Hobcaw Creek, especially during storm surges. Any selected build alternative would be constructed with resiliency in mind to meet or exceed current applicable construction standards. The I-526 is a major route connecting the Lowcountry area and a hurricane evacuation route for the Mount Pleasant, Isle of Palms, and Daniel Island areas and cannot be relocated to avoid this potential impact. By improving vehicle flow and providing resilient vehicle infrastructure built to current resiliency standards, construction of a build alternative would make affected communities would be more resilient to the effects of the changing climate.

[12] FEMA. *Flood Insurance Rate Map – Number 45019C0528K*, January 29, 2021. https://msc.fema.gov/arcgis/rest/directories/arcgisjobs/nfhl_print/agolprintb_gpserver/j5538a1fdea8e4c1d99736f47ebeeb708/scratch/Full_FIRM_7ff0a43e-5f0a-492b-b549-74feb4be8b5d.pdf

APPENDIX A

I-526 LCC Long Point Road Interchange Project

Annual Metric Tons (MT) Carbon Dioxide Equivalent (CO_2e) Emissions and Vehicle Miles Traveled (VMT) Traffic Statistics

		Existing Conditions	No-Build	Alternative 1A: Improved Existing Ramps	Alternative 2: New Port Access Ramps with Improved Existing Ramps	Alternative 3: Diverging Diamond Interchange (DDI)	Alternative 6: New Port Access Ramps with Diverging Diamond Interchange (DDI)
Study Area Roadways	Cars (VMT)	61,386,065	99,674,200	99,941,380	99,560,685	98,333,920	98,386,115
	Med. Trucks (VMT)	1,798,355	2,899,560	2,919,635	2,803,200	2,830,575	2,811,960
	Heavy Trucks (VMT)	7,209,115	12,000,835	12,099,020	10,151,745	11,391,650	10,157,585
Total (VMT)		**70,393,535**	**114,574,595**	**114,960,035**	**112,515,630**	**112,556,145**	**111,355,660**
Average Speed (mph)		**50**	**50**	**50**	**50**	**50**	**49**
Annual Emissions (MT CO_2e)		**32,340**	**38,646**	**38,905**	**37,112**	**38,534**	**38,435**
Annual Emissions (MT CO_2e) (including Fuel Cycle correction		**41,071**	**49,081**	**49,410**	**47,133**	**48,938**	**48,813**

		Existing Conditions	No-Build	Alternative 1A: Improved Existing Ramps	Alternative 2: New Port Access Ramps with Improved Existing Ramps	Alternative 3: Diverging Diamond Interchange (DDI)	Alternative 6: New Port Access Ramps with Diverging Diamond Interchange (DDI)
I-526 West of LPR	Cars (VMT)	32,353,235	53,705,370	53,705,370	24,304,620	53,705,370	24,304,620
	Med. Trucks (VMT)	1,150,115	1,850,185	1,850,185	837,310	1,850,185	837,310
	Heavy Trucks (VMT)	4,150,415	6,850,685	6,850,685	3,100,310	6,850,685	3,100,310
	Average Speed (mph)	56	56	56	56	56	56
	Emissions (MT CO_2e)	15,735	18,792	18,792	8,504	18,792	8,504
I-526 East of LPR	Cars (VMT)	8,155,560	12,718,790	12,718,790	12,718,790	12,718,790	12,718,790
	Med. Trucks (VMT)	83,220	138,700	138,700	138,700	138,700	138,700
	Heavy Trucks (VMT)	346,750	540,930	540,930	540,930	540,930	540,930
	Average Speed (mph)	59	59	59	59	59	59
	Emissions (MT CO_2e)	2,712	3,038	3,038	3,038	3,038	3,038
Long Point Road North of I-526	Cars (VMT)	3,786,510	5,118,030	5,118,030	5,118,030	5,252,715	5,252,715
	Med. Trucks (VMT)	83,220	110,960	110,960	110,960	113,880	113,880
	Heavy Trucks (VMT)	41,610	55,480	55,480	55,480	56,940	56,940
	Average Speed (mph)	11	11	10	10	8	8
	Emissions (MT CO_2e)	2,420	2,368	2,368	2,368	2,430	2,430

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Annual Metric Tons (MT) Carbon Dioxide Equivalent (CO_2e) Emissions and Vehicle Miles Traveled (VMT) / Miles Per Hour (MPH) Traffic Statistics

		Existing Conditions	No-Build	Alternative 1A: Improved Existing Ramps	Alternative 2: New Port Access Ramps with Improved Existing Ramps	Alternative 3: Diverging Diamond Interchange (DDI)	Alternative 6: New Port Access Ramps with Diverging Diamond Interchange (DDI)
Long Point Road South of I-526	Cars (VMT)	4,286,925	7,391,250	7,391,250	7,361,685	7,482,500	7,452,570
	Med. Trucks (VMT)	177,390	295,650	295,650	266,085	299,300	269,370
	Heavy Trucks (VMT)	1,419,120	2,424,330	2,424,330	857,385	2,454,260	867,970
	Average Speed (mph)	17	17	16	21	8	8
	Emissions (MT CO_2e)	5,615	7,326	7,326	3,747	8,716	5,278
I-526 EB Off-ramp to LPR	Cars (VMT)	927,465	1,586,655	1,511,100	7,218,240	1,586,655	7,293,430
	Med. Trucks (VMT)	61,320	99,645	94,900	420,480	99,645	424,860
	Heavy Trucks (VMT)	199,290	344,925	328,500	--	344,925	--
	Average Speed (mph)	52	52	52	50	52	50
	Emissions (MT CO_2e)	618	778	741	1,670	778	1,687
I-526 EB Loop On-ramp from LPR	Cars (VMT)	769,055	1,224,210	1,395,030	1,395,030	--	--
	Med. Trucks (VMT)	15,695	31,390	35,770	35,770	--	--
	Heavy Trucks (VMT)	15,695	15,695	17,885	17,885	--	--
	Average Speed (mph)	50	50	50	50	--	--
	Emissions (MT CO_2e)	244	274	312	312	--	--
I-526 EB Straight On-ramp from LPR	Cars (VMT)	357,700	562,100	602,250	602,250	622,325	622,325
	Med. Trucks (VMT)	71,540	112,420	120,450	120,450	124,465	124,465
	Heavy Trucks (VMT)	30,660	40,880	43,800	43,800	45,260	45,260
	Average Speed (mph)	63	63	63	63	63	63
	Emissions (MT CO_2e)	203	227	243	243	251	251
I-526 WB Off-ramp to LPR	Cars (VMT)	578,160	886,950	837,675	837,675	985,500	985,500
	Med. Trucks (VMT)	26,280	39,420	37,230	37,230	43,800	43,800
	Heavy Trucks (VMT)	19,710	26,280	24,820	24,820	29,200	29,200
	Average Speed (mph)	45	45	45	45	45	45
	Emissions (MT CO_2e)	214	234	221	221	261	261
I-526 WB Loop On-ramp from LPR	Cars (VMT)	537,280	1,040,980	1,222,020	788,400	--	--
	Med. Trucks (VMT)	50,370	83,950	98,550	--	--	--
	Heavy Trucks (VMT)	335,800	638,020	748,980	--	--	--
	Average Speed (mph)	19	19	19	60	--	--
	Emissions (MT CO_2e)	1,005	1,465	1,719	146	--	--

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Annual Metric Tons (MT) Carbon Dioxide Equivalent (CO_2e) Emissions and Vehicle Miles Traveled (VMT) / Miles Per Hour (MPH) Traffic Statistics

		Existing Conditions	No-Build	Alternative 1A: Improved Existing Ramps	Alternative 2: New Port Access Ramps with Improved Existing Ramps	Alternative 3: Diverging Diamond Interchange (DDI)	Alternative 6: New Port Access Ramps with Diverging Diamond Interchange (DDI)
I-526 WB Straight On-ramp from LPR	Cars (VMT)	1,259,615	1,958,225	1,958,225	1,958,225	2,498,425	2,498,425
	Med. Trucks (VMT)	52,925	84,680	84,680	84,680	108,040	108,040
	Heavy Trucks (VMT)	10,585	21,170	21,170	21,170	27,010	27,010
	Average Speed (mph)	55	55	55	55	55	55
	Emissions (MT CO_2e)	390	448	448	448	571	571
I-526 EB Off-ramp to WWT	Cars (VMT)	--	--	--	33,945	--	33,945
	Med. Trucks (VMT)	--	--	--	33,945	--	33,945
	Heavy Trucks (VMT)	--	--	--	1,799,085	--	1,799,085
	Average Speed (mph)	--	--	--	22	--	22
	Emissions (MT CO_2e)	--	--	--	3,133	--	3,133
I-526 WB On-ramp from WWT	Cars (VMT)	--	--	--	35,405	--	35,405
	Med. Trucks (VMT)	--	--	--	35,405	--	35,405
	Heavy Trucks (VMT)	--	--	--	2,195,110	--	2,195,110
	Average Speed (mph)	--	--	--	17	--	17
	Emissions (MT CO_2e)	--	--	--	4,221	--	4,221
I-526 Overpass	Cars (VMT)	8,374,560	13,481,640	13,481,640	13,481,640	13,481,640	13,481,640
	Med. Trucks (VMT)	26,280	52,560	52,560	52,560	52,560	52,560
	Heavy Trucks (VMT)	639,480	1,042,440	1,042,440	893,520	1,042,440	893,520
	Average Speed (mph)	57	57	57	57	57	57
	Emissions (MT CO_2e)	3,185	3,697	3,697	3,535	3,697	3,535
I-526 West Between Overpass and WWT Ramps	Cars (VMT)	--	--	--	23,706,750	--	23,706,750
	Med. Trucks (VMT)	--	--	--	629,625	--	629,625
	Heavy Trucks (VMT)	--	--	--	602,250	--	602,250
	Average Speed (mph)	--	--	--	56	--	56
	Emissions (MT CO_2e)	--	--	--	5,526	--	5,526

I-526 LCC Long Point Road Interchange Project

Annual Metric Tons (MT) Carbon Dioxide Equivalent (CO_2e) Emissions and Vehicle Miles Traveled (VMT) / Miles Per Hour (MPH) Traffic Statistics

		Existing Conditions	No-Build	Alternative 1A: Improved Existing Ramps	Alternative 2: New Port Access Ramps with Improved Existing Ramps	Alternative 3: Diverging Diamond Interchange (DDI)	Alternative 6: New Port Access Ramps with Diverging Diamond Interchange (DDI)
I-526 West of LPR	Length (miles)	1.37	1.37	1.37	0.62	1.37	0.62
	Average Speed (mph)	56	56	56	56	56	56
	Cars (AADT)	64,700	107,400	107,400	107,400	107,400	107,400
	Med. Trucks (AADT)	2,300	3,700	3,700	3,700	3,700	3,700
	Heavy Trucks (AADT)	8,300	13,700	13,700	13,700	13,700	13,700
I-526 East of LPR	Length (miles)	0.38	0.38	0.38	0.38	0.38	0.38
	Average Speed (mph)	59	59	59	59	59	59
	Cars (AADT)	58,800	91,700	91,700	91,700	91,700	91,700
	Med. Trucks (AADT)	600	1,000	1,000	1,000	1,000	1,000
	Heavy Trucks (AADT)	2,500	3,900	3,900	3,900	3,900	3,900
Long Point Road North of I-526	Length (miles)	0.38	0.38	0.38	0.38	0.39	0.39
	Average Speed (mph)	11	11	10	10	8	8
	Cars (AADT)	27,300	36,900	36,900	36,900	36,900	36,900
	Med. Trucks (AADT)	600	800	800	800	800	800
	Heavy Trucks (AADT)	300	400	400	400	400	400
Long Point Road South of I-526	Length (miles)	0.81	0.81	0.81	0.81	0.82	0.82
	Average Speed (mph)	17	17	16	21	8	8
	Cars (AADT)	14,500	25,000	25,000	24,900	25,000	24,900
	Med. Trucks (AADT)	600	1,000	1,000	900	1,000	900
	Heavy Trucks (AADT)	4,800	8,200	8,200	2,900	8,200	2,900
I-526 EB Off-ramp to LPR	Length (miles)	0.21	0.21	0.20	0.96	0.21	0.97
	Average Speed (mph)	52	52	52	50	52	50
	Cars (AADT)	12,100	20,700	20,700	20,600	20,700	20,600
	Med. Trucks (AADT)	800	1,300	1,300	1,200	1,300	1,200
	Heavy Trucks (AADT)	2,600	4,500	4,500	--	4,500	--
I-526 EB Loop On-ramp from LPR	Length (miles)	0.43	0.43	0.49	0.49	--	--
	Average Speed (mph)	50	50	50	50	--	--
	Cars (AADT)	4,900	7,800	7,800	7,800	--	--
	Med. Trucks (AADT)	100	200	200	200	--	--
	Heavy Trucks (AADT)	100	100	100	100	--	--

I-526 LCC Long Point Road Interchange Project

Annual Metric Tons (MT) Carbon Dioxide Equivalent (CO_2e) Emissions and Vehicle Miles Traveled (VMT) / Miles Per Hour (MPH) Traffic Statistics

		Existing Conditions	No-Build	Alternative 1A: Improved Existing Ramps	Alternative 2: New Port Access Ramps with Improved Existing Ramps	Alternative 3: Diverging Diamond Interchange (DDI)	Alternative 6: New Port Access Ramps with Diverging Diamond Interchange (DDI)
I-526 EB Straight On-ramp from LPR	Length (miles)	0.28	0.28	0.30	0.30	0.31	0.31
	Average Speed (mph)	63	63	63	63	63	63
	Cars (AADT)	3,500	5,500	5,500	5,500	5,500	5,500
	Med. Trucks (AADT)	700	1,100	1,100	1,100	1,100	1,100
	Heavy Trucks (AADT)	300	400	400	400	400	400
I-526 WB Off-ramp to LPR	Length (miles)	0.18	0.18	0.17	0.17	0.20	0.20
	Average Speed (mph)	45	45	45	45	45	45
	Cars (AADT)	8,800	13,500	13,500	13,500	13,500	13,500
	Med. Trucks (AADT)	400	600	600	600	600	600
	Heavy Trucks (AADT)	300	400	400	400	400	400
I-526 WB Loop On-ramp from LPR	Length (miles)	0.46	0.46	0.54	0.48	--	--
	Average Speed (mph)	19	19	19	60	--	--
	Cars (AADT)	3,200	6,200	6,200	4,500	--	--
	Med. Trucks (AADT)	300	500	500	--	--	--
	Heavy Trucks (AADT)	2,000	3,800	3,800	--	--	--
I-526 WB Straight On-ramp from LPR	Length (miles)	0.29	0.29	0.29	0.29	0.37	0.37
	Average Speed (mph)	55	55	55	55	55	55
	Cars (AADT)	11,900	18,500	18,500	18,500	18,500	18,500
	Med. Trucks (AADT)	500	800	800	800	800	800
	Heavy Trucks (AADT)	100	200	200	200	200	200
I-526 EB Off-ramp to WWT	Length (miles)	--	--	--	0.93	--	0.93
	Average Speed (mph)	--	--	--	22	--	22
	Cars (AADT)	--	--	--	100	--	100
	Med. Trucks (AADT)	--	--	--	100	--	100
	Heavy Trucks (AADT)	--	--	--	5,300	--	5,300
I-526 WB On-ramp from WWT	Length (miles)	--	--	--	0.97	--	0.97
	Average Speed (mph)	--	--	--	17	--	17
	Cars (AADT)	--	--	--	100	--	100
	Med. Trucks (AADT)	--	--	--	100	--	100
	Heavy Trucks (AADT)	--	--	--	6,200	--	6,200

I-526 LCC Long Point Road Interchange Project

Annual Metric Tons (MT) Carbon Dioxide Equivalent (CO_2e) Emissions and Vehicle Miles Traveled (VMT) / Miles Per Hour (MPH) Traffic Statistics

		Existing Conditions	No-Build	Alternative 1A: Improved Existing Ramps	Alternative 2: New Port Access Ramps with Improved Existing Ramps	Alternative 3: Diverging Diamond Interchange (DDI)	Alternative 6: New Port Access Ramps with Diverging Diamond Interchange (DDI)
I-526 Overpass	Length (miles)	0.48	0.48	0.48	0.48	0.48	0.48
	Average Speed (mph)	57	57	57	57	57	57
	Cars (AADT)	47,800	76,950	76,950	76,950	76,950	76,950
	Med. Trucks (AADT)	150	300	300	300	300	300
	Heavy Trucks (AADT)	3,650	5,950	5,950	5,100	5,950	5,100
I-526 West Between Overpass and WWT Ramps	Length (miles)	--	--	--	0.75	--	0.75
	Average Speed (mph)	--	--	--	56	--	56
	Cars (AADT)	--	--	--	86,600	--	86,600
	Med. Trucks (AADT)	--	--	--	2,300	--	2,300
	Heavy Trucks (AADT)	--	--	--	2,200	--	2,200

I-526 LCC Long Point Road Interchange Project

Highway Traffic MOVES3 Emission Rates Summary

Calendar Year	Vehicle Type	Speed Range (miles/hour)	CO_2e Rate (grams/mile)
2021	Passenger Vehicles	< 2.5mph	1,704
2021	Passenger Vehicles	≥ 2.5mph || < 7.5mph	909
2021	Passenger Vehicles	≥ 7.5mph || < 12.5mph	572
2021	Passenger Vehicles	≥ 12.5mph || < 17.5mph	450
2021	Passenger Vehicles	≥ 17.5mph || < 22.5mph	381
2021	Passenger Vehicles	≥ 22.5mph || < 27.5mph	338
2021	Passenger Vehicles	≥ 27.5mph || < 32.5mph	307
2021	Passenger Vehicles	≥ 32.5mph || < 37.5mph	292
2021	Passenger Vehicles	≥ 37.5mph || < 42.5mph	282
2021	Passenger Vehicles	≥ 42.5mph || < 47.5mph	274
2021	Passenger Vehicles	≥ 47.5mph || < 52.5mph	267
2021	Passenger Vehicles	≥ 52.5mph || < 57.5mph	262
2021	Passenger Vehicles	≥ 57.5mph || < 62.5mph	259
2021	Passenger Vehicles	≥ 62.5mph || < 67.5mph	262
2021	Passenger Vehicles	≥ 67.5mph || < 72.5mph	271
2021	Passenger Vehicles	≥ 72.5mph	286
2021	Medium Trucks	< 2.5mph	4,446
2021	Medium Trucks	≥ 2.5mph || < 7.5mph	2,470
2021	Medium Trucks	≥ 7.5mph || < 12.5mph	1,696
2021	Medium Trucks	≥ 12.5mph || < 17.5mph	1,410
2021	Medium Trucks	≥ 17.5mph || < 22.5mph	1,237
2021	Medium Trucks	≥ 22.5mph || < 27.5mph	1,099
2021	Medium Trucks	≥ 27.5mph || < 32.5mph	1,066
2021	Medium Trucks	≥ 32.5mph || < 37.5mph	925
2021	Medium Trucks	≥ 37.5mph || < 42.5mph	890
2021	Medium Trucks	≥ 42.5mph || < 47.5mph	864
2021	Medium Trucks	≥ 47.5mph || < 52.5mph	850
2021	Medium Trucks	≥ 52.5mph || < 57.5mph	839
2021	Medium Trucks	≥ 57.5mph || < 62.5mph	805
2021	Medium Trucks	≥ 62.5mph || < 67.5mph	829
2021	Medium Trucks	≥ 67.5mph || < 72.5mph	855
2021	Medium Trucks	≥ 72.5mph	879
2021	Heavy Trucks	< 2.5mph	6,887
2021	Heavy Trucks	≥ 2.5mph || < 7.5mph	3,860
2021	Heavy Trucks	≥ 7.5mph || < 12.5mph	2,693
2021	Heavy Trucks	≥ 12.5mph || < 17.5mph	2,420
2021	Heavy Trucks	≥ 17.5mph || < 22.5mph	2,198
2021	Heavy Trucks	≥ 22.5mph || < 27.5mph	2,028
2021	Heavy Trucks	≥ 27.5mph || < 32.5mph	1,977
2021	Heavy Trucks	≥ 32.5mph || < 37.5mph	1,724
2021	Heavy Trucks	≥ 37.5mph || < 42.5mph	1,690
2021	Heavy Trucks	≥ 42.5mph || < 47.5mph	1,664
2021	Heavy Trucks	≥ 47.5mph || < 52.5mph	1,594
2021	Heavy Trucks	≥ 52.5mph || < 57.5mph	1,518
2021	Heavy Trucks	≥ 57.5mph || < 62.5mph	1,532

I-526 LCC Long Point Road Interchange Project

Highway Traffic MOVES3 Emission Rates Summary

Calendar Year	Vehicle Type	Speed Range (miles/hour)	CO_2e Rate (grams/mile)
2021	Heavy Trucks	≥ 62.5mph || < 67.5mph	1,616
2021	Heavy Trucks	≥ 67.5mph || < 72.5mph	1,688
2021	Heavy Trucks	≥ 72.5mph	1,764
2050	Passenger Vehicles	< 2.5mph	1,046
2050	Passenger Vehicles	≥ 2.5mph || < 7.5mph	679
2050	Passenger Vehicles	≥ 7.5mph || < 12.5mph	409
2050	Passenger Vehicles	≥ 12.5mph || < 17.5mph	322
2050	Passenger Vehicles	≥ 17.5mph || < 22.5mph	272
2050	Passenger Vehicles	≥ 22.5mph || < 27.5mph	242
2050	Passenger Vehicles	≥ 27.5mph || < 32.5mph	219
2050	Passenger Vehicles	≥ 32.5mph || < 37.5mph	208
2050	Passenger Vehicles	≥ 37.5mph || < 42.5mph	201
2050	Passenger Vehicles	≥ 42.5mph || < 47.5mph	196
2050	Passenger Vehicles	≥ 47.5mph || < 52.5mph	191
2050	Passenger Vehicles	≥ 52.5mph || < 57.5mph	187
2050	Passenger Vehicles	≥ 57.5mph || < 62.5mph	185
2050	Passenger Vehicles	≥ 62.5mph || < 67.5mph	187
2050	Passenger Vehicles	≥ 67.5mph || < 72.5mph	194
2050	Passenger Vehicles	≥ 72.5mph	205
2050	Medium Trucks	< 2.5mph	3,162
2050	Medium Trucks	≥ 2.5mph || < 7.5mph	2,144
2050	Medium Trucks	≥ 7.5mph || < 12.5mph	1,403
2050	Medium Trucks	≥ 12.5mph || < 17.5mph	1,164
2050	Medium Trucks	≥ 17.5mph || < 22.5mph	1,021
2050	Medium Trucks	≥ 22.5mph || < 27.5mph	901
2050	Medium Trucks	≥ 27.5mph || < 32.5mph	874
2050	Medium Trucks	≥ 32.5mph || < 37.5mph	755
2050	Medium Trucks	≥ 37.5mph || < 42.5mph	725
2050	Medium Trucks	≥ 42.5mph || < 47.5mph	702
2050	Medium Trucks	≥ 47.5mph || < 52.5mph	691
2050	Medium Trucks	≥ 52.5mph || < 57.5mph	683
2050	Medium Trucks	≥ 57.5mph || < 62.5mph	650
2050	Medium Trucks	≥ 62.5mph || < 67.5mph	670
2050	Medium Trucks	≥ 67.5mph || < 72.5mph	691
2050	Medium Trucks	≥ 72.5mph	713
2050	Heavy Trucks	< 2.5mph	4,607
2050	Heavy Trucks	≥ 2.5mph || < 7.5mph	3,195
2050	Heavy Trucks	≥ 7.5mph || < 12.5mph	2,133
2050	Heavy Trucks	≥ 12.5mph || < 17.5mph	1,899
2050	Heavy Trucks	≥ 17.5mph || < 22.5mph	1,717
2050	Heavy Trucks	≥ 22.5mph || < 27.5mph	1,587
2050	Heavy Trucks	≥ 27.5mph || < 32.5mph	1,543
2050	Heavy Trucks	≥ 32.5mph || < 37.5mph	1,315
2050	Heavy Trucks	≥ 37.5mph || < 42.5mph	1,282
2050	Heavy Trucks	≥ 42.5mph || < 47.5mph	1,255

I-526 LCC Long Point Road Interchange Project

Highway Traffic MOVES3 Emission Rates Summary

Calendar Year	Vehicle Type	Speed Range (miles/hour)	CO_2e Rate (grams/mile)
2050	Heavy Trucks	≥ 47.5mph || < 52.5mph	1,178
2050	Heavy Trucks	≥ 52.5mph || < 57.5mph	1,091
2050	Heavy Trucks	≥ 57.5mph || < 62.5mph	1,091
2050	Heavy Trucks	≥ 62.5mph || < 67.5mph	1,133
2050	Heavy Trucks	≥ 67.5mph || < 72.5mph	1,169
2050	Heavy Trucks	≥ 72.5mph	1,215

I-526 LCC Long Point Road Interchange Project

Highway Traffic MOVES3 Input Parameters

Description

charleston_county_2021_2050

Scale

Model	Domain	Calculation
Onroad	Default Scale	Emission Rates

Time Spans

Years	Months	Days	Hours
2021; 2050	All	Weekend & Weekday	All

Geographic Bounds

Charleston County, SC (45019)

Onroad Vehicles

Passenger Car; Single Unit Long-haul Truck; Combination Long-haul Truck

Road Type

Urban Restricted Access; Urban Unrestricted Access

Pollutants and Processes

CO2 Equivalent; + Select Prerequisites

General Output

Output Database	Units		
	Mass Units	Energy Units	Distance Units
charleston_county_2021_2050	Grams	Joules	Miles

Output Emissions Detail

Output Aggregation	for All Vehicle/Equipment Categories	Onroad
default	default	☑ Source Use Type

I-526 LCC Long Point Road Interchange Project

Infrastructure Carbon Estimator (ICE) Tools Results Summary

No-Build

Bridges

Source	**Annualized Greenhouse Gas Emissions**	
Materials	--	MT CO_2e
Transportation	--	MT CO_2e
Construction	--	MT CO_2e
O&M	--	MT CO_2e
Bridges Subtotal	**--**	**MT CO_2e**

Roadways

Source	**Annualized Greenhouse Gas Emissions**	
Materials	--	MT CO_2e
Transportation	--	MT CO_2e
Construction	--	MT CO_2e
O&M	138	MT CO_2e
Roadways Subtotal	**138**	**MT CO_2e**

No-Build Overall

Source	**Annualized Greenhouse Gas Emissions**	
Materials	--	MT CO_2e
Transportation	--	MT CO_2e
Construction	--	MT CO_2e
O&M	138	MT CO_2e
Overall Total	**138**	**MT CO_2e**

I-526 LCC Long Point Road Interchange Project

Infrastructure Carbon Estimator (ICE) Tools Results Summary

Alternative 1A: Improved Existing Ramps

Bridges

Source	**Annualized Greenhouse Gas Emissions**	
Materials	1	MT CO_2e
Transportation	<1	MT CO_2e
Construction	<1	MT CO_2e
O&M	--	MT CO_2e
Bridges Subtotal	**1**	**MT CO_2e**

Roadways

Source	**Annualized Greenhouse Gas Emissions**	
Materials	10	MT CO_2e
Transportation	1	MT CO_2e
Construction	8	MT CO_2e
O&M	144	MT CO_2e
Roadways Subtotal	**163**	**MT CO_2e**

Alternative 1A: Improved Existing Ramps Overall

Source	**Annualized Greenhouse Gas Emissions**	
Materials	10	MT CO_2e
Transportation	1	MT CO_2e
Construction	8	MT CO_2e
O&M	144	MT CO_2e
Overall Total	**164**	**MT CO_2e**

I-526 LCC Long Point Road Interchange Project

Infrastructure Carbon Estimator (ICE) Tools Results Summary

Alternative 2: New Port Access Ramps with Improved Existing Ramps

Bridges

Source	**Annualized Greenhouse Gas Emissions**	
Materials	3	MT CO_2e
Transportation	<1	MT CO_2e
Construction	1	MT CO_2e
O&M	--	MT CO_2e
Bridges Subtotal	**4**	**MT CO_2e**

Roadways

Source	**Annualized Greenhouse Gas Emissions**	
Materials	33	MT CO_2e
Transportation	4	MT CO_2e
Construction	27	MT CO_2e
O&M	195	MT CO_2e
Roadways Subtotal	**260**	**MT CO_2e**

Alternative 2: New Port Access Ramps with Improved Existing Ramps Overall

Source	**Annualized Greenhouse Gas Emissions**	
Materials	36	MT CO_2e
Transportation	4	MT CO_2e
Construction	27	MT CO_2e
O&M	195	MT CO_2e
Overall Total	**264**	**MT CO_2e**

I-526 LCC Long Point Road Interchange Project

Infrastructure Carbon Estimator (ICE) Tools Results Summary

Alternative 3: Diverging Diamond Interchange (DDI)

Bridges

Source	Annualized Greenhouse Gas Emissions	
Materials	--	MT CO_2e
Transportation	--	MT CO_2e
Construction	--	MT CO_2e
O&M	--	MT CO_2e
Bridges Subtotal	**--**	**MT CO_2e**

Roadways

Source	Annualized Greenhouse Gas Emissions	
Materials	14	MT CO_2e
Transportation	2	MT CO_2e
Construction	11	MT CO_2e
O&M	136	MT CO_2e
Roadways Subtotal	**163**	**MT CO_2e**

Alternative 3: Diverging Diamond Interchange (DDI) Overall

Source	Annualized Greenhouse Gas Emissions	
Materials	14	MT CO_2e
Transportation	2	MT CO_2e
Construction	11	MT CO_2e
O&M	136	MT CO_2e
Overall Total	**163**	**MT CO_2e**

I-526 LCC Long Point Road Interchange Project

Infrastructure Carbon Estimator (ICE) Tools Results Summary

Alternative 6: New Port Access Ramps with Diverging Diamond Interchange (DDI)

Bridges

Source	**Annualized Greenhouse Gas Emissions**	
Materials	2	MT CO_2e
Transportation	<1	MT CO_2e
Construction	<1	MT CO_2e
O&M	--	MT CO_2e
Bridges Subtotal	**2**	**MT CO_2e**

Roadways

Source	**Annualized Greenhouse Gas Emissions**	
Materials	14	MT CO_2e
Transportation	2	MT CO_2e
Construction	11	MT CO_2e
O&M	136	MT CO_2e
Roadways Subtotal	**163**	**MT CO_2e**

Alternative 6: New Port Access Ramps with Diverging Diamond Interchange (DDI) Overall

Source	**Annualized Greenhouse Gas Emissions**	
Materials	16	MT CO_2e
Transportation	2	MT CO_2e
Construction	12	MT CO_2e
O&M	136	MT CO_2e
Overall Total	**166**	**MT CO_2e**