

Appendix C

Air Quality Analysis Supportive Files

Appendix C-1

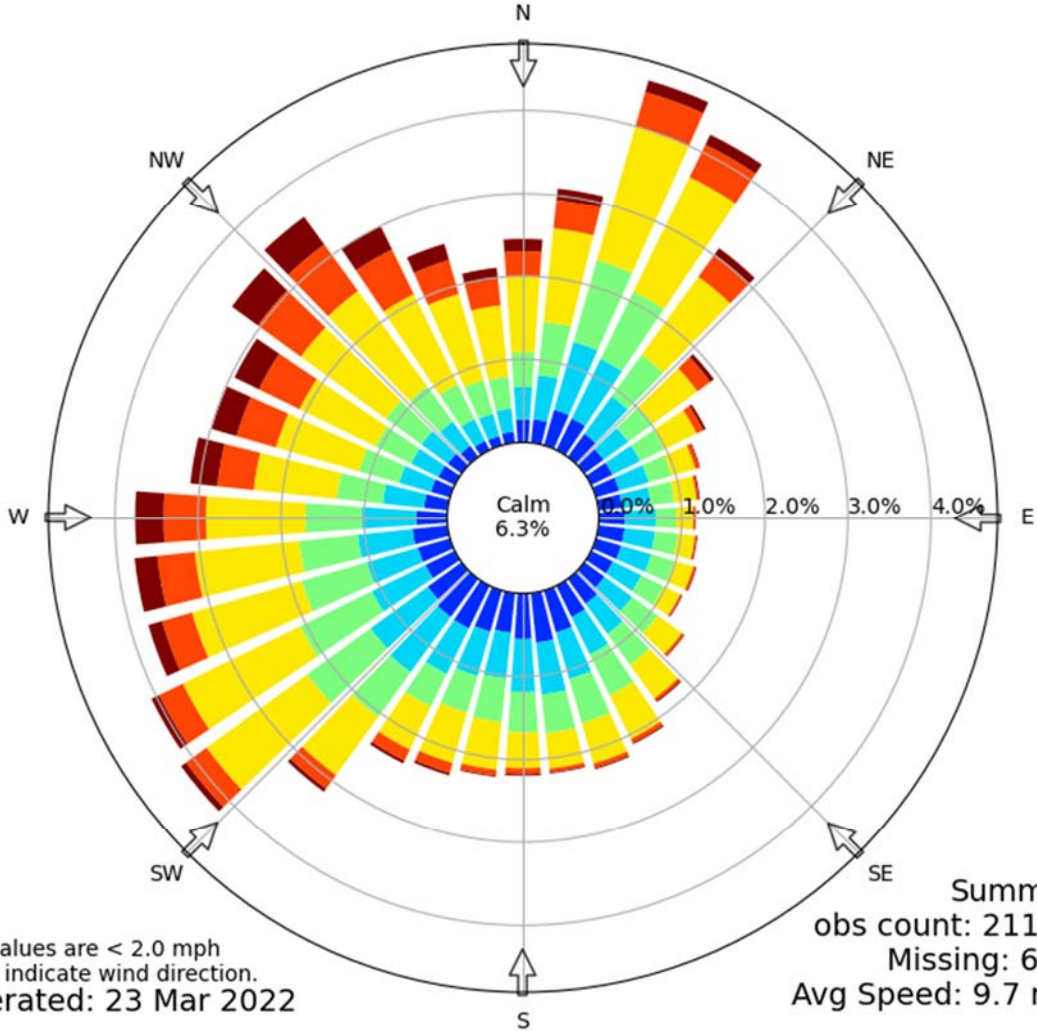
20-Year Newark Liberty International Airport Wind Rose

20 Year Wind Rose



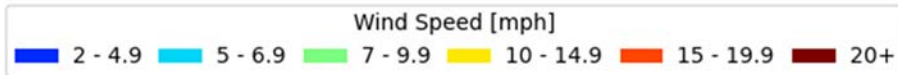
[EWR] NEWARK INTL AIRPORT
Windrose Plot

Time Bounds: 01 Jan 2001 01:51 AM - 31 Dec 2021 11:51 PM America/New_York



Calm values are < 2.0 mph
Arrows indicate wind direction.
Generated: 23 Mar 2022

Summary
obs count: 211412
Missing: 6326
Avg Speed: 9.7 mph



Appendix C-2

2050 No Action Microscale Hot-Spot Assessment Results

**2050 No Action Alternative
Microscale Air Quality Assessment Modeling Results**

Pollutant	Averaging Period	Units	Background Concentration ³	Max Modeled Concentration	Total Concentration	NAAQS	Exceedance YES/NO
CO	1-hour	ppm	3.0	0.42	3.42	35	NO
	8-hour		2.1	0.19	2.29	9	NO
PM _{2.5}	24-hour	µg/m ³	21.0	2.07	23.07	35	NO
	Annual ¹		8.6	0.83	9.43	12	NO
	Annual ²		8.6	0.83	9.43	9	YES

Notes:

¹2012 annual PM_{2.5} standard

²2024 annual PM_{2.5} standard

³Background concentrations represent USEPA Design Values from the 2021 Design Values Reports.

	1-hr			8-hr		
	Max Conc.	X	Y	Max Conc.	X	Y
CO_AM_2016_East1.8	0.403070	575450	4504900	0.168329	575575	4504850
CO_AM_2017_East1.8	0.374003	575450	4504900	0.168862	575670	4504808
CO_AM_2018_East1.8	0.398775	575450	4504900	0.187983	575450	4504900
CO_AM_2019_East1.8	0.394803	575450	4504900	0.159923	575709	4504872
CO_AM_2020_East1.8	0.407597	575450	4504900	0.179817	575450	4504900
CO_PM_2016_East1.8	0.327210	575450	4504900	0.138843	575670	4504808
CO_PM_2017_East1.8	0.309346	575450	4504900	0.138791	575670	4504808
CO_PM_2018_East1.8	0.310803	575450	4504900	0.138617	575450	4504900
CO_PM_2019_East1.8	0.305208	575709	4504872	0.134341	575709	4504872
CO_PM_2020_East1.8	0.335398	575450	4504900	0.153320	575450	4504900
CO_AM_2016_East2nd	0.410083	575450	4504900	0.166700	575691	4504885
CO_AM_2017_East2nd	0.380257	575450	4504900	0.161524	575670	4504808
CO_AM_2018_East2nd	0.406045	575450	4504900	0.177399	575450	4504900
CO_AM_2019_East2nd	0.400714	575450	4504900	0.161033	575691	4504885
CO_AM_2020_East2nd	0.415001	575450	4504900	0.176549	575575	4504850
CO_PM_2016_East2nd	0.331649	575450	4504900	0.127973	575670	4504808
CO_PM_2017_East2nd	0.316668	575450	4504900	0.134901	575691	4504885
CO_PM_2018_East2nd	0.316205	575450	4504900	0.135781	575691	4504885
CO_PM_2019_East2nd	0.311030	575709	4504872	0.136390	575691	4504885
CO_PM_2020_East2nd	0.340504	575450	4504900	0.152939	575575	4504850

	Annual			24-hr		
	Max Conc.	X	Y	Max Conc.	X	Y
PM2.5_East1.8	0.829640	575670	4504808	2.072210	575670	4504808
PM2.5_East2nd	0.731870	575691	4504885	1.860380	575875	4504625

AERMOD Receptor Network and Peak Concentration Locations - NoBuild Condition



Appendix C-3

2050 Proposed Action Microscale Hot-Spot Assessment Results

**2050 Proposed Action Alternative
Microscale Air Quality Assessment Modeling Results**

Pollutant	Averaging Period	Units	Background Concentration ³	Max Modeled Concentration	Total Concentration	NAAQS	Exceedance YES/NO
CO	1-hour	ppm	3.0	0.45	3.45	35	NO
	8-hour		2.1	0.20	2.30	9	NO
PM _{2.5}	24-hour	µg/m ³	21.0	2.37	23.37	35	NO
	Annual ¹		8.6	0.93	9.53	12	NO
	Annual ²		8.6	0.93	9.53	9	YES

Notes:

¹2012 annual PM_{2.5} standard

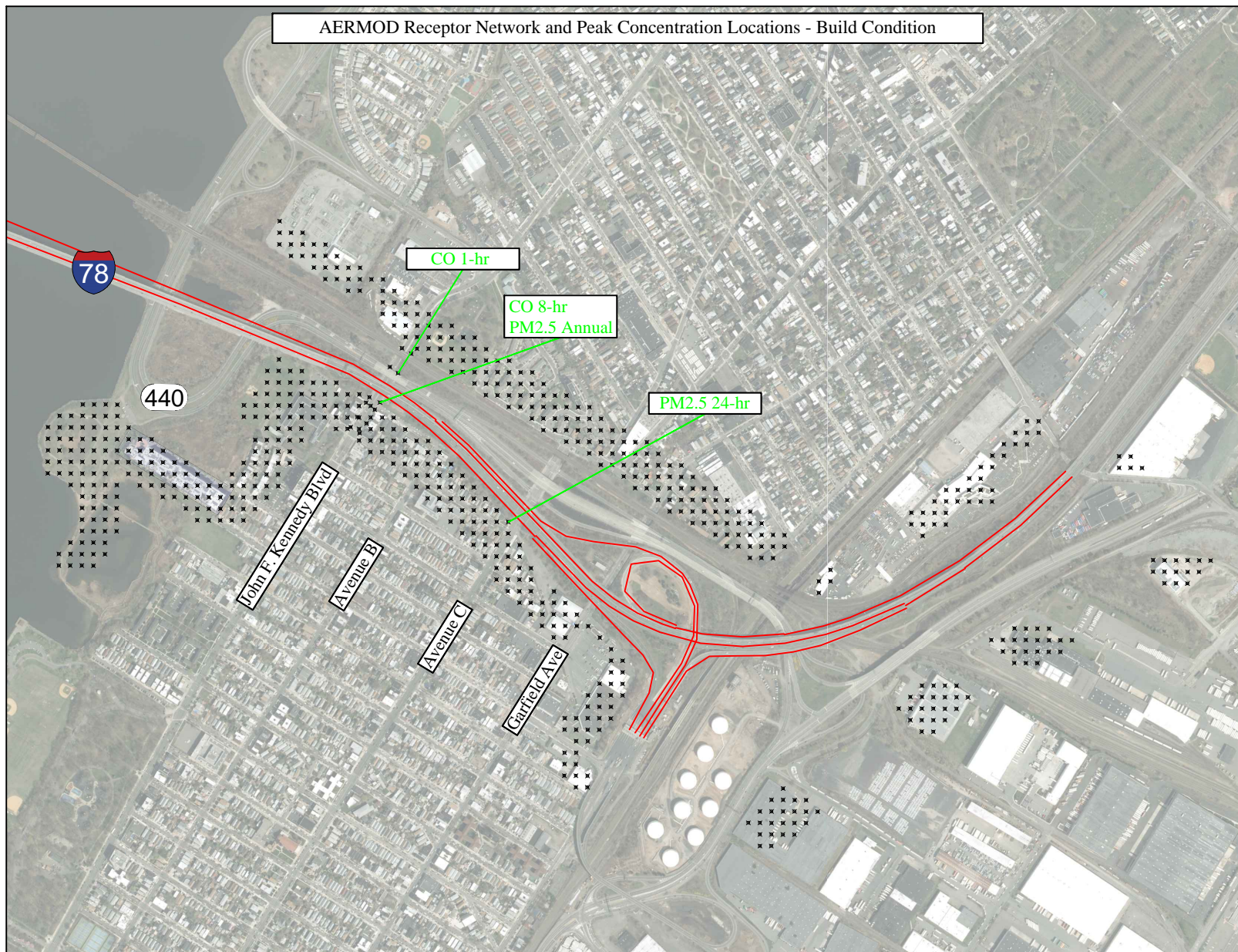
²2024 annual PM_{2.5} standard

³Background concentrations represent USEPA Design Values from the 2021 Design Values Reports.

	1-hr			8-hr		
	Max Conc.	X	Y	Max Conc.	X	Y
CO_AM_2016_East1.8	0.406276	575670	4504808	0.183763	575670	4504808
CO_AM_2017_East1.8	0.387469	575670	4504808	0.185053	575670	4504808
CO_AM_2018_East1.8	0.373078	575670	4504808	0.197477	575670	4504808
CO_AM_2019_East1.8	0.399439	575709	4504872	0.169651	575950	4504550
CO_AM_2020_East1.8	0.428762	575709	4504872	0.189174	575670	4504808
CO_PM_2016_East1.8	0.393549	575670	4504808	0.170923	575670	4504808
CO_PM_2017_East1.8	0.370821	575670	4504808	0.169166	575670	4504808
CO_PM_2018_East1.8	0.356860	575691	4504885	0.168215	575691	4504885
CO_PM_2019_East1.8	0.399260	575691	4504885	0.166956	575691	4504885
CO_PM_2020_East1.8	0.439392	575709	4504872	0.180415	575670	4504808
CO_AM_2016_East2nd	0.398612	575670	4504808	0.178874	575691	4504885
CO_AM_2017_East2nd	0.387600	575950	4504550	0.173701	575875	4504625
CO_AM_2018_East2nd	0.375855	575670	4504808	0.179958	575875	4504625
CO_AM_2019_East2nd	0.407050	575709	4504872	0.168412	575691	4504885
CO_AM_2020_East2nd	0.436648	575709	4504872	0.173058	575670	4504808
CO_PM_2016_East2nd	0.387521	575670	4504808	0.161691	575691	4504885
CO_PM_2017_East2nd	0.375001	575950	4504550	0.161575	575775	4504725
CO_PM_2018_East2nd	0.366088	575691	4504885	0.167906	575691	4504885
CO_PM_2019_East2nd	0.407563	575691	4504885	0.167283	575691	4504885
CO_PM_2020_East2nd	0.447576	575709	4504872	0.170271	575670	4504808

	Annual			24-hr		
	Max Conc.	X	Y	Max Conc.	X	Y
PM2.5_East1.8	0.928900	575670	4504808	2.374910	575950	4504550
PM2.5_East2nd	0.846100	575875	4504625	2.317450	575875	4504625

AERMOD Receptor Network and Peak Concentration Locations - Build Condition



Appendix C-4

2050 No Action & 2050 Proposed Action Regional MSAT/GHG Emissions

MSATs

Pollutant	Total Emissions (kilograms)		
	2050 No Action	2050 Proposed Action	% Change
Benzene	720.81	721.67	0.12%
Naphthalene Particle + Naphthalene Gas	33.85	33.88	0.11%
1,3 Butadiene	0.00	0.00	0.00%
Formaldehyde	539.09	539.21	0.02%
Acetaldehyde	397.80	397.74	-0.01%
Acrolein	20.91	20.92	0.04%
Ethyl Benzene	288.76	289.06	0.10%
POM	14.28	14.30	0.12%
DPM	698.28	690.48	-1.12%

CO2e

Pollutant	Total Emissions (metric tons)		
	2050 No Action	2050 Proposed Action	% Change
CO2e	504,006.20	504,883.02	0.17%

Appendix C-5

2028 & 2029 Construction-Related Emission Spreadsheets

	2028	2028	2028	2028	2029	2029	2029	2029
	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall
Fugitive Dust PM2.5 Emissions Per Quarter (US Tons)								
PM2.5 Fugitive Dust	0.265300	0.265300	0.265300	0.265300	0.265300	0.265300	0.265300	0.265300
PM2.5 Emissions Per Crew Per Quarter (US Tons)								
PM2.5 Demolition Crew	0.000000	0.000000	0.000000	0.000000	0.090834	0.093974	0.093995	0.090841
PM2.5 Pile Driving Crew	0.000000	0.000000	0.000000	0.078983	0.069561	0.071966	0.000000	0.000000
PM2.5 Cofferdam Sheeting Crew	0.000000	0.000000	0.000000	0.000000	0.033338	0.034493	0.034506	0.033343
PM2.5 Civil Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
PM2.5 Drilled Shaft Crew	0.000000	0.000000	0.000000	0.000000	0.027787	0.028749	0.028762	0.027791
PM2.5 Finegrade Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
PM2.5 Labor Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
PM2.5 Carpenter Crew	0.000000	0.000000	0.000000	0.053544	0.000000	0.000000	0.000000	0.000000
PM2.5 Lather Crew	0.000000	0.055390	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
PM2.5 Excavation Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003790
PM2.5 Concrete Pour Crew	0.068167	0.069723	0.069745	0.067399	0.059641	0.000000	0.000000	0.000000
PM2.5 Steel Erection Crew	0.000000	0.000000	0.000000	0.000000	0.051249	0.053022	0.000000	0.000000
PM2.5 Temporary Trestle Construction	0.000000	0.000000	0.000000	0.006827	0.006102	0.006317	0.000000	0.000000
PM2.5 Paving Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CH4 Emissions Per Crew Per Quarter (N/A)								
CH4 Demolition Crew	0.000000	0.000000	0.000000	0.000000	6276.534300	6492.969880	6492.970294	6276.537857
CH4 Pile Driving Crew	0.000000	0.000000	0.000000	5232.924442	4541.463902	4698.068492	0.000000	0.000000
CH4 Cofferdam Sheeting Crew	0.000000	0.000000	0.000000	0.000000	2162.005592	2236.557332	2236.557946	2162.005651
CH4 Civil Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CH4 Drilled Shaft Crew	0.000000	0.000000	0.000000	0.000000	2342.798573	2423.578694	2423.575440	2342.786108
CH4 Finegrade Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CH4 Labor Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CH4 Carpenter Crew	0.000000	0.000000	0.000000	3747.194736	0.000000	0.000000	0.000000	0.000000
CH4 Lather Crew	0.000000	3876.405500	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CH4 Excavation Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	66.303639
CH4 Concrete Pour Crew	4559.934472	4663.567196	4663.570998	4508.117104	3908.569678	0.000000	0.000000	0.000000
CH4 Steel Erection Crew	0.000000	0.000000	0.000000	0.000000	3911.795049	4046.688353	0.000000	0.000000
CH4 Temporary Trestle Construction	0.000000	0.000000	0.000000	664.253558	555.137516	574.281050	0.000000	0.000000
CH4 Paving Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CO2 Emissions Per Crew Per Quarter (N/A)								
CO2 Demolition Crew	0.000000	0.000000	0.000000	0.000000	973559988.598032	1007132314.154040	1007131173.633020	973559489.789888
CO2 Pile Driving Crew	0.000000	0.000000	0.000000	496460950.716896	496499604.792416	513620562.350912	0.000000	0.000000
CO2 Cofferdam Sheeting Crew	0.000000	0.000000	0.000000	0.000000	286092859.549446	295958422.229160	295958033.827570	286092732.771919
CO2 Civil Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CO2 Drilled Shaft Crew	0.000000	0.000000	0.000000	0.000000	356491900.938352	368784993.212501	368784819.539915	356492206.079263
CO2 Finegrade Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CO2 Labor Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CO2 Carpenter Crew	0.000000	0.000000	0.000000	525467896.789464	0.000000	0.000000	0.000000	0.000000
CO2 Lather Crew	0.000000	543586720.877998	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CO2 Excavation Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	59801109.604902
CO2 Concrete Pour Crew	597981242.836152	611571527.885748	611571828.903924	591186109.228653	591216870.996588	0.000000	0.000000	0.000000
CO2 Steel Erection Crew	0.000000	0.000000	0.000000	0.000000	518964488.265171	536859325.292797	0.000000	0.000000
CO2 Temporary Trestle Construction	0.000000	0.000000	0.000000	127122695.246272	127125255.906549	131508749.448151	0.000000	0.000000
CO2 Paving Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

10210 CO2 to Fuel = Diesel fuel consumption calculated from CO2 emissions (10.21 kg CO2/gal x 1000 g/kg = 10210 g CO2/gal)

		2028	2028	2028	2028	2029	2029	2029	2029
		Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall
Fuel Emissions Per Crew Per Quarter									
Fuel	Demolition Crew	0.000000	0.000000	0.000000	0.000000	95353.573810	98641.754569	98641.642863	95353.524955
Fuel	Pile Driving Crew	0.000000	0.000000	0.000000	48624.970687	48628.756591	50305.637840	0.000000	0.000000
Fuel	Cofferdam Sheeting Crew	0.000000	0.000000	0.000000	0.000000	28020.848144	28987.112853	28987.074812	28020.835727
Fuel	Civil Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Fuel	Drilled Shaft Crew	0.000000	0.000000	0.000000	0.000000	34915.955038	36119.979747	36119.962737	34915.984925
Fuel	Finegrade Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Fuel	Labor Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Fuel	Carpenter Crew	0.000000	0.000000	0.000000	51466.003603	0.000000	0.000000	0.000000	0.000000
Fuel	Lather Crew	0.000000	53240.619087	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Fuel	Excavation Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	5857.111617
Fuel	Concrete Pour Crew	58568.192246	59899.268157	59899.297640	57902.655164	57905.668070	0.000000	0.000000	0.000000
Fuel	Steel Erection Crew	0.000000	0.000000	0.000000	0.000000	50829.039007	52581.716483	0.000000	0.000000
Fuel	Temporary Trestle Construction	0.000000	0.000000	0.000000	12450.802669	12451.053468	12880.386822	0.000000	0.000000
Fuel	Paving Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

0.26 Fuel to N2O = N2O emissions calculated from diesel fuel consumption (Diesel construction equipment = 0.26 g N2O/gal)

N2O Emissions Per Crew Per Quarter									
N2O	Demolition Crew	0.000000	0.000000	0.000000	0.000000	24791.929191	25646.856188	25646.827144	24791.916488
N2O	Pile Driving Crew	0.000000	0.000000	0.000000	12642.492379	12643.476714	13079.465839	0.000000	0.000000
N2O	Cofferdam Sheeting Crew	0.000000	0.000000	0.000000	0.000000	7285.420517	7536.649342	7536.639451	7285.417289
N2O	Civil Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
N2O	Drilled Shaft Crew	0.000000	0.000000	0.000000	0.000000	9078.148310	9391.194734	9391.190311	9078.156080
N2O	Finegrade Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
N2O	Labor Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
N2O	Carpenter Crew	0.000000	0.000000	0.000000	13381.160937	0.000000	0.000000	0.000000	0.000000
N2O	Lather Crew	0.000000	13842.560963	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
N2O	Excavation Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1522.849020
N2O	Concrete Pour Crew	15227.729984	15573.809721	15573.817386	15054.690343	15055.473698	0.000000	0.000000	0.000000
N2O	Steel Erection Crew	0.000000	0.000000	0.000000	0.000000	13215.550142	13671.246286	0.000000	0.000000
N2O	Temporary Trestle Construction	0.000000	0.000000	0.000000	3237.208694	3237.273902	3348.900574	0.000000	0.000000
N2O	Paving Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

GWP	Pollutant	CO2e Nonroad emissions calculated from CH4 (GWP = 25), CO2 (GWP = 1), and N2O (GWP = 298)
25	CH4	
1	CO2	
298	N2O	

CO2e Nonroad Emissions Per Crew Per Quarter (Metric Tons)									
CO2e	Demolition Crew	0.000000	0.000000	0.000000	0.000000	981.104897	1014.937402	1014.936252	981.104394
CO2e	Pile Driving Crew	0.000000	0.000000	0.000000	500.359237	500.380897	517.635695	0.000000	0.000000
CO2e	Cofferdam Sheeting Crew	0.000000	0.000000	0.000000	0.000000	288.317965	298.260258	298.259866	288.317837
CO2e	Civil Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CO2e	Drilled Shaft Crew	0.000000	0.000000	0.000000	0.000000	359.255759	371.644159	371.643984	359.256066
CO2e	Finegrade Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CO2e	Labor Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CO2e	Carpenter Crew	0.000000	0.000000	0.000000	529.549163	0.000000	0.000000	0.000000	0.000000
CO2e	Lather Crew	0.000000	547.808714	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CO2e	Excavation Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	60.256576
CO2e	Concrete Pour Crew	602.633105	616.329112	616.329416	595.785110	595.801116	0.000000	0.000000	0.000000
CO2e	Steel Erection Crew	0.000000	0.000000	0.000000	0.000000	523.000517	541.034524	0.000000	0.000000
CO2e	Temporary Trestle Construction	0.000000	0.000000	0.000000	128.103990	128.103842	132.521079	0.000000	0.000000
CO2e	Paving Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

CO2e Onroad emissions calculated normally below

	2028	2028	2028	2028	2029	2029	2029	2029	
	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	
CO2e Onroad Emissions Per Crew Per Quarter (Metric Tons)									
CO2e	Demolition Crew	0.000000	0.000000	0.000000	0.000000	36.110822	37.356722	38.938100	36.111498
CO2e	Pile Driving Crew	0.000000	0.000000	0.000000	29.025067	28.240753	29.215205	0.000000	0.000000
CO2e	Cofferdam Sheeting Crew	0.000000	0.000000	0.000000	0.000000	20.370685	21.073689	22.654145	20.371233
CO2e	Civil Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CO2e	Drilled Shaft Crew	0.000000	0.000000	0.000000	0.000000	20.370685	21.073689	22.654145	20.371233
CO2e	Finegrade Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CO2e	Labor Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CO2e	Carpenter Crew	0.000000	0.000000	0.000000	28.893342	0.000000	0.000000	0.000000	0.000000
CO2e	Lather Crew	0.000000	29.889664	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CO2e	Excavation Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	36.111498
CO2e	Concrete Pour Crew	37.485693	38.338259	39.967349	37.060317	36.110822	0.000000	0.000000	0.000000
CO2e	Steel Erection Crew	0.000000	0.000000	0.000000	0.000000	28.111736	29.081738	0.000000	0.000000
CO2e	Temporary Trestle Construction	0.000000	0.000000	0.000000	20.989818	20.370685	21.073689	0.000000	0.000000
CO2e	Paving Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

CO2e Nonroad emissions and CO2e Onroad emissions added together below

CO2e Emissions Per Crew Per Quarter (Metric Tons)									
CO2e	Demolition Crew	0.000000	0.000000	0.000000	0.000000	1017.215719	1052.294123	1053.874352	1017.215892
CO2e	Pile Driving Crew	0.000000	0.000000	0.000000	529.384304	528.621651	546.850900	0.000000	0.000000
CO2e	Cofferdam Sheeting Crew	0.000000	0.000000	0.000000	0.000000	308.688650	319.333947	320.914011	308.689070
CO2e	Civil Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CO2e	Drilled Shaft Crew	0.000000	0.000000	0.000000	0.000000	379.626444	392.717848	394.298128	379.627299
CO2e	Finegrade Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CO2e	Labor Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CO2e	Carpenter Crew	0.000000	0.000000	0.000000	558.442505	0.000000	0.000000	0.000000	0.000000
CO2e	Lather Crew	0.000000	577.698378	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CO2e	Excavation Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	96.368074
CO2e	Concrete Pour Crew	640.118797	654.667371	656.296765	632.845426	631.911938	0.000000	0.000000	0.000000
CO2e	Steel Erection Crew	0.000000	0.000000	0.000000	0.000000	551.112253	570.116262	0.000000	0.000000
CO2e	Temporary Trestle Construction	0.000000	0.000000	0.000000	149.093808	148.474527	153.594768	0.000000	0.000000
CO2e	Paving Crew	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Watercraft Equipment Used Per Quarter

Tugboat				1	2	0	0	0
Work Boat				2	2	0	0	0
Barge w Aux Eng.				1	2	0	0	0

Watercraft Average Installed Propulsion Power (Kilowatts)

Tugboat	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559
Work Boat	1,037	1,037	1,037	1,037	1,037	1,037	1,037	1,037
Barge w Aux Eng.	622	622	622	622	622	622	622	622

Watercraft CO Emission Rates

Tugboat	0.8275	0.8275	0.8275	0.8275	0.8275	0.8275	0.8275	0.8275
Work Boat	0.6060	0.6060	0.6060	0.6060	0.6060	0.6060	0.6060	0.6060
Barge w Aux Eng.	0.4916	0.4916	0.4916	0.4916	0.4916	0.4916	0.4916	0.4916

Watercraft CO Emissions (Grams)

Tugboat	0	0	0	897,890	1,795,781	0	0	0
Work Boat	0	0	0	874,821	874,821	0	0	0
Barge w Aux Eng.	0	0	0	212,804	425,609	0	0	0

Watercraft CO Emissions (US Tons)

Tugboat	0.000000	0.000000	0.000000	0.989754	1.979507	0.000000	0.000000	0.000000
Work Boat	0.000000	0.000000	0.000000	0.964324	0.964324	0.000000	0.000000	0.000000
Barge w Aux Eng.	0.000000	0.000000	0.000000	0.234577	0.469153	0.000000	0.000000	0.000000
Total				2.188654	3.412984			

	2028	2028	2028	2028	2029	2029	2029	2029
	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall
Watercraft NOx Emission Rates								
Tugboat	3.6938	3.6938	3.6938	3.6938	3.6938	3.6938	3.6938	3.6938
Work Boat	3.0145	3.0145	3.0145	3.0145	3.0145	3.0145	3.0145	3.0145
Barge w Aux Eng.	2.9470	2.9470	2.9470	2.9470	2.9470	2.9470	2.9470	2.9470
Watercraft NOx Emissios (Grams)								
Tugboat	0	0	0	4,008,037	8,016,073	0	0	0
Work Boat	0	0	0	4,351,460	4,351,460	0	0	0
Barge w Aux Eng.	0	0	0	1,275,805	2,551,610	0	0	0
Watercraft NOx Emissios (US Tons)								
Tugboat	0.000000	0.000000	0.000000	4.418099	8.836197	0.000000	0.000000	0.000000
Work Boat	0.000000	0.000000	0.000000	4.796658	4.796658	0.000000	0.000000	0.000000
Barge w Aux Eng.	0.000000	0.000000	0.000000	1.406333	2.812665	0.000000	0.000000	0.000000
Total				10.621089	16.445520			
Watercraft VOC Emission Rates								
Tugboat	0.0825	0.0825	0.0825	0.0825	0.0825	0.0825	0.0825	0.0825
Work Boat	0.0835	0.0835	0.0835	0.0835	0.0835	0.0835	0.0835	0.0835
Barge w Aux Eng.	0.0889	0.0889	0.0889	0.0889	0.0889	0.0889	0.0889	0.0889
Watercraft VOC Emissios (Grams)								
Tugboat	0	0	0	89,502	179,003	0	0	0
Work Boat	0	0	0	120,535	120,535	0	0	0
Barge w Aux Eng.	0	0	0	38,503	77,006	0	0	0
Watercraft VOC Emissios (US Tons)								
Tugboat	0.000000	0.000000	0.000000	0.098658	0.197317	0.000000	0.000000	0.000000
Work Boat	0.000000	0.000000	0.000000	0.132867	0.132867	0.000000	0.000000	0.000000
Barge w Aux Eng.	0.000000	0.000000	0.000000	0.042442	0.084884	0.000000	0.000000	0.000000
Total				0.273968	0.415068			
Watercraft PM10 Emission Rates								
Tugboat	0.0758	0.0758	0.0758	0.0758	0.0758	0.0758	0.0758	0.0758
Work Boat	0.0613	0.0613	0.0613	0.0613	0.0613	0.0613	0.0613	0.0613
Barge w Aux Eng.	0.0608	0.0608	0.0608	0.0608	0.0608	0.0608	0.0608	0.0608
Watercraft PM10 Emissios (Grams)								
Tugboat	0	0	0	82,215	164,431	0	0	0
Work Boat	0	0	0	88,469	88,469	0	0	0
Barge w Aux Eng.	0	0	0	26,300	52,599	0	0	0
Watercraft PM10 Emissios (US Tons)								
Tugboat	0.000000	0.000000	0.000000	0.090627	0.181253	0.000000	0.000000	0.000000
Work Boat	0.000000	0.000000	0.000000	0.097520	0.097520	0.000000	0.000000	0.000000
Barge w Aux Eng.	0.000000	0.000000	0.000000	0.028990	0.057981	0.000000	0.000000	0.000000
Total				0.217137	0.336754			
Watercraft PM2.5 Emission Rates								
Tugboat	0.0735	0.0735	0.0735	0.0735	0.0735	0.0735	0.0735	0.0735
Work Boat	0.0594	0.0594	0.0594	0.0594	0.0594	0.0594	0.0594	0.0594
Barge w Aux Eng.	0.0589	0.0589	0.0589	0.0589	0.0589	0.0589	0.0589	0.0589
Watercraft PM2.5 Emissios (Grams)								
Tugboat	0	0	0	79,755	159,510	0	0	0
Work Boat	0	0	0	85,816	85,816	0	0	0
Barge w Aux Eng.	0	0	0	25,510	51,021	0	0	0

	2028	2028	2028	2028	2029	2029	2029	2029
	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall
Watercraft PM2.5 Emissios (US Tons)								
Tugboat	0.000000	0.000000	0.000000	0.087915	0.175829	0.000000	0.000000	0.000000
Work Boat	0.094595	0.094595	0.094595	0.094595	0.094595	0.094595	0.094595	0.094595
Barge w Aux Eng.	0.000000	0.000000	0.000000	0.028120	0.056240	0.000000	0.000000	0.000000
Total				0.210630	0.326665			

CO2e Watercraft Calculations

Watercraft Load Factors	
Tugboat	0.5
Work Boat	0.45
Barge w Aux Eng.	0.43

Watercraft CH4 Emission Rates								
Tugboat	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031
Work Boat	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038
Barge w Aux Eng.	0.0039	0.0039	0.0039	0.0039	0.0039	0.0039	0.0039	0.0039

Watercraft CH4 Emissios (Grams)								
Tugboat	0	0	0	1,695	3,391	0	0	0
Work Boat	0	0	0	2,472	2,472	0	0	0
Barge w Aux Eng.	0	0	0	732	1,463	0	0	0

3.19 Carbon Content Factor (g CO2/g fuel) for diesel

Watercraft CO2 Emission Rates								
Tugboat	679.4700	679.4700	679.4700	679.4700	679.4700	679.4700	679.4700	679.4700
Work Boat	679.4700	679.4700	679.4700	679.4700	679.4700	679.4700	679.4700	679.4700
Barge w Aux Eng.	679.4700	679.4700	679.4700	679.4700	679.4700	679.4700	679.4700	679.4700

Watercraft CO2 Emissios (Grams)								
Tugboat	0	0	0	368,634,218	737,268,436	0	0	0
Work Boat	0	0	0	441,367,948	441,367,948	0	0	0
Barge w Aux Eng.	0	0	0	126,484,808	252,969,616	0	0	0

0.000156 N2O Conversion Factor (g N2O/g fuel) for C1 and C2 engines

Watercraft N2O Emission Rates								
Tugboat	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
Work Boat	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
Barge w Aux Eng.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332

Watercraft N2O Emissios (Grams)								
Tugboat	0	0	0	18,027	36,055	0	0	0
Work Boat	0	0	0	21,584	21,584	0	0	0
Barge w Aux Eng.	0	0	0	6,185	12,371	0	0	0

Watercraft CO2e Emissios (Grams)								
Tugboat	0.0000	0.0000	0.0000	374,048,724.8347	748,097,449.6694	0.0000	0.0000	0.0000
Work Boat	0.0000	0.0000	0.0000	447,861,821.4083	447,861,821.4083	0.0000	0.0000	0.0000
Barge w Aux Eng.	0.0000	0.0000	0.0000	128,346,365.8687	256,692,731.7374	0.0000	0.0000	0.0000

Watercraft CO2e Emissios (Metric Tons)								
Tugboat	0.000000	0.000000	0.000000	374.048725	748.097450	0.000000	0.000000	0.000000
Work Boat	0.000000	0.000000	0.000000	447.861821	447.861821	0.000000	0.000000	0.000000
Barge w Aux Eng.	0.000000	0.000000	0.000000	128.346366	256.692732	0.000000	0.000000	0.000000
Total				950.256912	1,452.652003			

Appendix C-6

FY 2024-2027 Transportation Improvement Program Project Listing

Non-Federally Funded Transportation Authority Projects in the NJTPA Region

New Jersey Turnpike Authority

DBNUM: GSP1406

GSP Interchange 145

The purpose of this project is to improve the safety and operations of Interchange 145 within the City of East Orange, Essex County to accommodate the high travel volume at this interchange between I-280, the Garden State Parkway and the local road network. The proposed improvements will include the replacement of the Central Avenue bridge over the Garden State Parkway including relocation of the bridge abutments to allow the widening of the Parkway. The widening will allow for two standard width deceleration lanes to the Interchange 145 toll plaza in the northbound direction and two standard width acceleration lanes from the Interchange 145 toll plaza to the southbound Garden State Parkway to be constructed. . The proposed improvements will also include the demolition of the northbound exit toll plaza to I-280 and conversion to one-way tolling (southbound entrance to the Garden State Parkway to remain).

Regionally Significant: Yes

DBNUM: GSP22100

GSP Interchange 80 Completion and Widening between MP 80 - 83

Proposed improvements include completing the missing moves at Interchange 80. This interchange consists of a southbound exit ramp and northbound entrance ramp at US Route 9 and County Route 530, as well as increase capacity and eliminate unsafe weaving conditions by implementing collector-distributor roads (between Interchanges 81-82/82A; in each direction to accommodate future traffic demands. Auxiliary lanes will be lengthened, and full left and right shoulders will be provided for safety and operational enhancement. These improvements will require reconstruction and or replacement of several structures, including bridges over Toms River and Lakehurst Road (County Route 527).

Regionally Significant: Yes

DBNUM: GSP24006

Interchange 69 Improvements

This project will improve operational safety at the Route 80 and Route 95 interchange utilizing minor widening and revised striping in order to maintain route continuity as well as extending auxiliary lanes within merges, diverges, and weaves to the greatest extent feasible.

DBNUM: TPK24001

TPK Newark Bay - Hudson County Extension Improvements Program

The New Jersey Turnpike Authority is proposing to reconstruct and widen the 8.1 mile Newark Bay-Hudson County Extension (NB-HCE) from New Jersey Turnpike Interchange 14 in Newark to Jersey Avenue in Jersey City. - Project 1: From Interchange 14 to Interchange 14A, replacing bridges and widening the roadway from two lanes to four lanes in each direction plus full shoulders (12-foot right shoulder, 12-foot left shoulder), including the Newark Bay Bridge over the Newark Bay;- Project 2: From Interchange 14A to Columbus Drive, replacing bridges and widening the roadway from two lanes to three lanes in each direction plus full shoulders (12-foot right shoulder, 10-foot left shoulder);- Project 3: From Interchange 14A to Columbus Drive, replacing bridges and widening the roadway from two lanes to three lanes in each direction plus full shoulders (12-foot right shoulder, 10-foot left shoulder); - Project 4: From Columbus Drive to Jersey Avenue, replacing the viaduct structure and providing full shoulders (12-foot right shoulder, 5-foot minimum left shoulder).

Regionally Significant: Yes

DBNUM: TPK22108

TPK Tremley Point Connector at Interchange 12

This project will provide access from Interchange 12 through Carteret, NJ, over the Rahway River, and into Tremley Point in Linden, NJ. The project consists of a new roadway and bridges featuring two lanes in each direction with full shoulders. The total length of the project is approximately 1.1 miles.