

Air Quality Analysis Worksheet for New Bus Service - Spaulding Express Commuter Routes

FILL IN SHADED BOXES AND ASSUMPTIONS/NOTES ONLY

Category: New Bus Service
 Description: New Bus Service from Dover, Berwick/Somersworth and Rochester to the Portsmouth Naval Shipyard
 Sponsor: COAST
 Opening Analysis Year: 2012
 Location: NH Seacoast

Analysis Years	2012	2017	2026	2035
Projected Annual Ridership*	81,432	103,878	161,298	250,038
Projected Riders per Day**	312	398	618	958
Avoided Auto Trips per Day****	284	362	562	871

SOV Emission Reduction 2012						Nonattainment Area Zone 1				Attainment Area Zone 2				Out of State Zone 3				Nonattainment Area Reduction		Attainment Area Reduction		Out of State Reduction		Total Area Reduction	
SOV Trip Segments Removed	Avoided Auto Trips/Day FY 12**	Zone 1 VMT/Trip Nonattainment*	Zone 2 VMT/Trip Attainment	Zone 3 Out of State	VMT/Day Removed FY 12	Avg. Link Speed	Factor Type	Auto Emission Factors VOC***	Auto Emission Factors NOx***	Avg. Link Speed	Factor Type	Auto Emission Factors VOC	Auto Emission Factors NOx	Avg. Link Speed	Factor Type	Auto Emission Factors VOC***	Auto Emission Factors NOx***	Emission VOC (kg/day)	Emission NOx (kg/day)	Emission VOC (kg/day)	Emission NOx (kg/day)	Emission VOC (kg/day)	Emission NOx (kg/day)	Emission VOC (kg/day)	Emission NOx (kg/day)
Dover	95	10	0	10	1,900	45	Freeway	0.490	0.893	NA	NA	0.000	0.000	35	Arterial	0.513	0.802	0.419	0.764	0.000	0.000	0.049	0.076	0.468	0.840
Berwick/Somersworth	95	15	0	15	2,850	45	Freeway	0.490	0.893	NA	NA	0.000	0.000	35	Arterial	0.513	0.802	0.524	0.954	0.000	0.000	0.183	0.286	0.706	1.240
Rochester	95	20	0	20	3,800	45	Freeway	0.490	0.893	NA	NA	0.000	0.000	35	Arterial	0.513	0.802	0.884	1.612	0.000	0.000	0.049	0.076	0.933	1.688
Totals																		1.827	3.330	0.000	0.000	2.107	3.768		
Bus Emissions (kg/day)																		0.025		1.257		0.014		0.548	
Total Emission saved (kg/day)																		1.803	2.073	0.000	0.000	2.069	1.963		

SOV Emission Reduction 2017						Nonattainment Area Zone 1				Attainment Area Zone 2				Out of State Zone 3				Nonattainment Area Reduction		Attainment Area Reduction		Out of State Reduction		Total Area Reduction	
SOV Trip Segments Removed	Avoided Auto Trips/Day FY 17**	Zone 1 VMT/Trip Nonattainment*	Zone 2 VMT/Trip Attainment	Zone 3 Out of State	VMT/Day Removed FY 17	Avg. Link Speed	Factor Type	Auto Emission Factors VOC***	Auto Emission Factors NOx***	Avg. Link Speed	Factor Type	Auto Emission Factors VOC	Auto Emission Factors NOx	Avg. Link Speed	Factor Type	Auto Emission Factors VOC***	Auto Emission Factors NOx***	Emission VOC (kg/day)	Emission NOx (kg/day)	Emission VOC (kg/day)	Emission NOx (kg/day)	Emission VOC (kg/day)	Emission NOx (kg/day)	Emission VOC (kg/day)	Emission NOx (kg/day)
Dover	121	10	0	10	2,420	45	Freeway	0.318	0.444	NA	NA	0.000	0.000	35	Arterial	0.333	0.400	0.385	0.537	0.000	0.000	0.403	0.484	0.788	1.021
Berwick/Somersworth	121	15	0	15	3,630	45	Freeway	0.318	0.444	NA	NA	0.000	0.000	35	Arterial	0.333	0.400	0.577	0.806	0.000	0.000	0.604	0.726	1.182	1.532
Rochester	121	20	0	20	4,840	45	Freeway	0.318	0.444	NA	NA	0.000	0.000	35	Arterial	0.333	0.400	0.770	1.074	0.000	0.000	0.806	0.968	1.575	2.042
Totals																		1.732	2.418	0.000	0.000	3.545	4.596		
Bus Emissions (kg/day)																		0.032		0.838		0.018		0.365	
Total Emission saved (kg/day)																		1.699	1.579	0.000	0.000	3.495	3.392		

SOV Emission Reduction 2026						Nonattainment Area Zone 1				Attainment Area Zone 2				Out of State Zone 3				Nonattainment Area Reduction		Attainment Area Reduction		Out of State Reduction		Total Area Reduction	
SOV Trip Segments Removed	Avoided Auto Trips/Day FY 26**	Zone 1 VMT/Trip Nonattainment*	Zone 2 VMT/Trip Attainment	Zone 3 Out of State	VMT/Day Removed FY 26	Avg. Link Speed	Factor Type	Auto Emission Factors VOC***	Auto Emission Factors NOx***	Avg. Link Speed	Factor Type	Auto Emission Factors VOC	Auto Emission Factors NOx	Avg. Link Speed	Factor Type	Auto Emission Factors VOC***	Auto Emission Factors NOx***	Emission VOC (kg/day)	Emission NOx (kg/day)	Emission VOC (kg/day)	Emission NOx (kg/day)	Emission VOC (kg/day)	Emission NOx (kg/day)	Emission VOC (kg/day)	Emission NOx (kg/day)
Dover	187	10	0	10	3,740	45	Freeway	0.209	0.220	NA	NA	0.000	0.000	35	Arterial	0.222	0.206	0.391	0.411	0.000	0.000	0.415	0.385	0.806	0.797
Berwick/Somersworth	187	15	0	15	5,610	45	Freeway	0.209	0.220	NA	NA	0.000	0.000	35	Arterial	0.222	0.206	0.586	0.617	0.000	0.000	0.623	0.578	1.209	1.195
Rochester	187	20	0	20	7,480	45	Freeway	0.209	0.220	NA	NA	0.000	0.000	35	Arterial	0.222	0.206	0.782	0.823	0.000	0.000	0.830	0.770	1.612	1.593
Totals																		1.759	1.851	0.000	0.000	3.627	3.585		
Bus Emissions (kg/day)																		0.031		0.185		0.018		0.081	
Total Emission saved (kg/day)																		1.727	1.667	0.000	0.000	3.578	3.320		

SOV Emission Reduction 2035						Nonattainment Area Zone 1				Attainment Area Zone 2				Out of State Zone 3				Nonattainment Area Reduction		Attainment Area Reduction		Out of State Reduction		Total Area Reduction	
SOV Trip Segments Removed	Avoided Auto Trips/Day FY 35**	Zone 1 VMT/Trip Nonattainment*	Zone 2 VMT/Trip Attainment	Zone 3 Out of State	VMT/Day Removed FY 35	Avg. Link Speed	Factor Type	Auto Emission Factors VOC***	Auto Emission Factors NOx***	Avg. Link Speed	Factor Type	Auto Emission Factors VOC	Auto Emission Factors NOx	Avg. Link Speed	Factor Type	Auto Emission Factors VOC***	Auto Emission Factors NOx***	Emission VOC (kg/day)	Emission NOx (kg/day)	Emission VOC (kg/day)	Emission NOx (kg/day)	Emission VOC (kg/day)	Emission NOx (kg/day)	Emission VOC (kg/day)	Emission NOx (kg/day)
Dover	290	10	0	10	5,800	45	Freeway	0.203	0.178	NA	NA	0.000	0.000	35	Arterial	0.215	0.167	0.589	0.516	0.000	0.000	0.624	0.484	1.212	1.001
Berwick/Somersworth	290	15	0	15	8,700	45	Freeway	0.203	0.178	NA	NA	0.000	0.000	35	Arterial	0.215	0.167	0.883	0.774	0.000	0.000	0.935	0.726	1.818	1.501
Rochester	290	20	0	20	11,600	45	Freeway	0.203	0.178	NA	NA	0.000	0.000	35	Arterial	0.215	0.167	1.177	1.032	0.000	0.000	1.247	0.969	2.424	2.001
Totals																		2.649	2.323	0.000	0.000	5.455	4.502		
Bus Emissions (kg/day)																		0.042		0.172		0.023		0.075	
Total Emission saved (kg/day)																		2.607	2.151	0.000	0.000	5.389	4.255		

Bus Emission Calculations 2012					2012 Bus Emission Factors***		2012 Bus Emissions		2012 Bus Emission Factors***		2012 Bus Emissions		2012 Bus Emissions	
Bus Trip Segment/Route	Total Round Trip Distance (mi)	Round Trips/Day	Daily Mileage	Avg Link Speed	NOx (g/mi)	VOC (g/mi)	NOx Kg/day	VOC kg/day	NOx (g/mi)	VOC (g/mi)	NOx Kg/day	VOC kg/day	NOx Kg/day	VOC kg/day
Dover	26	2	52	45	10.302	0.201	0.474	0.009	10.302	0.201	0.062	0.001	0.536	0.010
Berwick/Somersworth	26	2	52	45	10.302	0.201	0.062	0.001	9.224	0.245	0.424	0.011	0.486	0.012
Rochester	38	2	76	45	10.302	0.201	0.721	0.014	10.302	0.201	0.062	0.001	0.783	0.015
Round Trip Distance	90		180		Non Attainment Area Bus Emissions		1.257	0.025	Out of State Bus Emissions		0.548	0.014	Total Bus Emissions	
													1.805	0.038

Bus Emission Calculations 2017					2017 Bus Emission Factors***		2017 Bus Emissions		2017 Bus Emission Factors***		2017 Bus Emissions		2017 Bus Emissions	
Bus Trip Segment/Route	Total Round Trip Distance (mi)	Round Trips/Day	Daily Mileage	Avg Link Speed	NOx (g/mi)	VOC (g/mi)	NOx Kg/day	VOC kg/day	NOx (g/mi)	VOC (g/mi)	NOx Kg/day	VOC kg/day	NOx Kg/day	VOC kg/day
Dover	26	3	78	45	4.581	0.175	0.316	0.012	4.581	0.175	0.041	0.002	0.357	0.014
Berwick/Somersworth	26	3	78	45	4.581	0.175	0.041	0.002	4.092	0.212	0.282	0.015	0.324	0.016
Rochester	38	3	114	45	4.581	0.175	0.481	0.018	4.581	0.175	0.041	0.002	0.522	0.020
Round Trip Distance	90		270		Non Attainment Area Bus Emissions		0.838	0.032	Out of State Bus Emissions		0.365	0.018	Total Bus Emissions	1.203 0.050

Bus Emission Calculations 2026					2026 Bus Emission Factors***		2026 Bus Emissions		2026 Bus Emission Factors***		2026 Bus Emissions		2026 Bus Emissions	
Bus Trip Segment/Route	Total Round Trip Distance (mi)	Round Trips/Day	Daily Mileage	Avg Link Speed	NOx (g/mi)	VOC (g/mi)	NOx Kg/day	VOC kg/day	NOx (g/mi)	VOC (g/mi)	NOx Kg/day	VOC kg/day	NOx Kg/day	VOC kg/day
Dover	26	3	78	45	1.009	0.172	0.070	0.012	1.009	0.172	0.009	0.002	0.079	0.013
Berwick/Somersworth	26	3	78	45	1.009	0.172	0.009	0.002	0.905	0.21	0.062	0.014	0.072	0.016
Rochester	38	3	114	45	1.009	0.172	0.106	0.018	1.009	0.172	0.009	0.002	0.115	0.020
Round Trip Distance	90		270		Non Attainment Area Bus Emissions		0.185	0.031	Out of State Bus Emissions		0.081	0.018	Total Bus Emissions	0.265 0.049

Bus Emission Calculations 2035					2035 Bus Emission Factors***		2035 Bus Emissions		2035 Bus Emission Factors***		2035 Bus Emissions		2035 Bus Emissions	
Bus Trip Segment/Route	Total Round Trip Distance (mi)	Round Trips/Day	Daily Mileage	Avg Link Speed	NOx (g/mi)	VOC (g/mi)	NOx Kg/day	VOC kg/day	NOx (g/mi)	VOC (g/mi)	NOx Kg/day	VOC kg/day	NOx Kg/day	VOC kg/day
Dover	26	4	104	45	0.705	0.173	0.065	0.016	0.705	0.173	0.008	0.002	0.073	0.018
Berwick/Somersworth	26	4	104	45	0.705	0.173	0.008	0.002	0.634	0.21	0.058	0.019	0.067	0.021
Rochester	38	4	152	45	0.705	0.173	0.099	0.024	0.705	0.173	0.008	0.002	0.107	0.026
Round Trip Distance	90		360		Non Attainment Area Bus Emissions		0.172	0.042	Out of State Bus Emissions		0.075	0.023	Total Bus Emissions	0.247 0.066

Assumptions/Notes:

*Assumes 261 days of operation/year, 65% seating capacity filled per trip, and 5% Annual Growth Rate

**Based on estimates provided by COAST

***Emission Factors supplied by NHDES during CMAQ round 9

****Using a 1.1 vehicle occupancy rate

Percentage of Total SOV Trips Avoided by Route		
Route	New Hampshire	Maine
Rochester	95%	5%
Berwick/Somersworth	75%	25%
Dover	90%	10%

i.e. 95% of the Total SOV trips avoided from Rochester would've traveled through NH to get to the Shipyard

Roundtrip Bus Miles per State by Route		
Route	New Hampshire	Maine
Rochester	35mi	3mi
Berwick/Somersworth	3mi	23mi
Dover	23mi	3mi