THE POTENTIAL IMPACT OF CHANGES IN THE REGIONAL VEHICLE FLEET ON FUTURE NOx AND PM2.5 EMISSIONS — A SENSITIVITY TEST

TPB Technical Committee Meeting
June 1, 2012

PURPOSE & SCOPE OF THE SENSITIVITY TEST

Purpose:

- To assess the potential impact of changes in the mix and age of the vehicle fleet on NOx and PM2.5 emissions for 2017 and 2025

Scope:

- To calculate and compare NOx and PM2.5 emissions for 2017 and 2025 with
  (1) 2011 VIN data and
  (2) 2005 VIN data,
  keeping all other input data unchanged

2011 and 2005 REGIONAL VEHICLE FLEETS

Fleet Composition

	2011 VIN		2005 VIN	
	# of Units	Percent	# of Units	Percent
Passenger Cars/Trucks	3,326,987	88.35%	3,056,520	89.01%
Light Commercial Trucks	389,406	10.34%	325,843	9.49%
Buses	16,033	0.43%	21,629	0.63%
Heavy Duty Trucks	33,083	0.88%	29,784	0.87%
All Vehicle Types	3,765,509	100%	3,433,776	100%

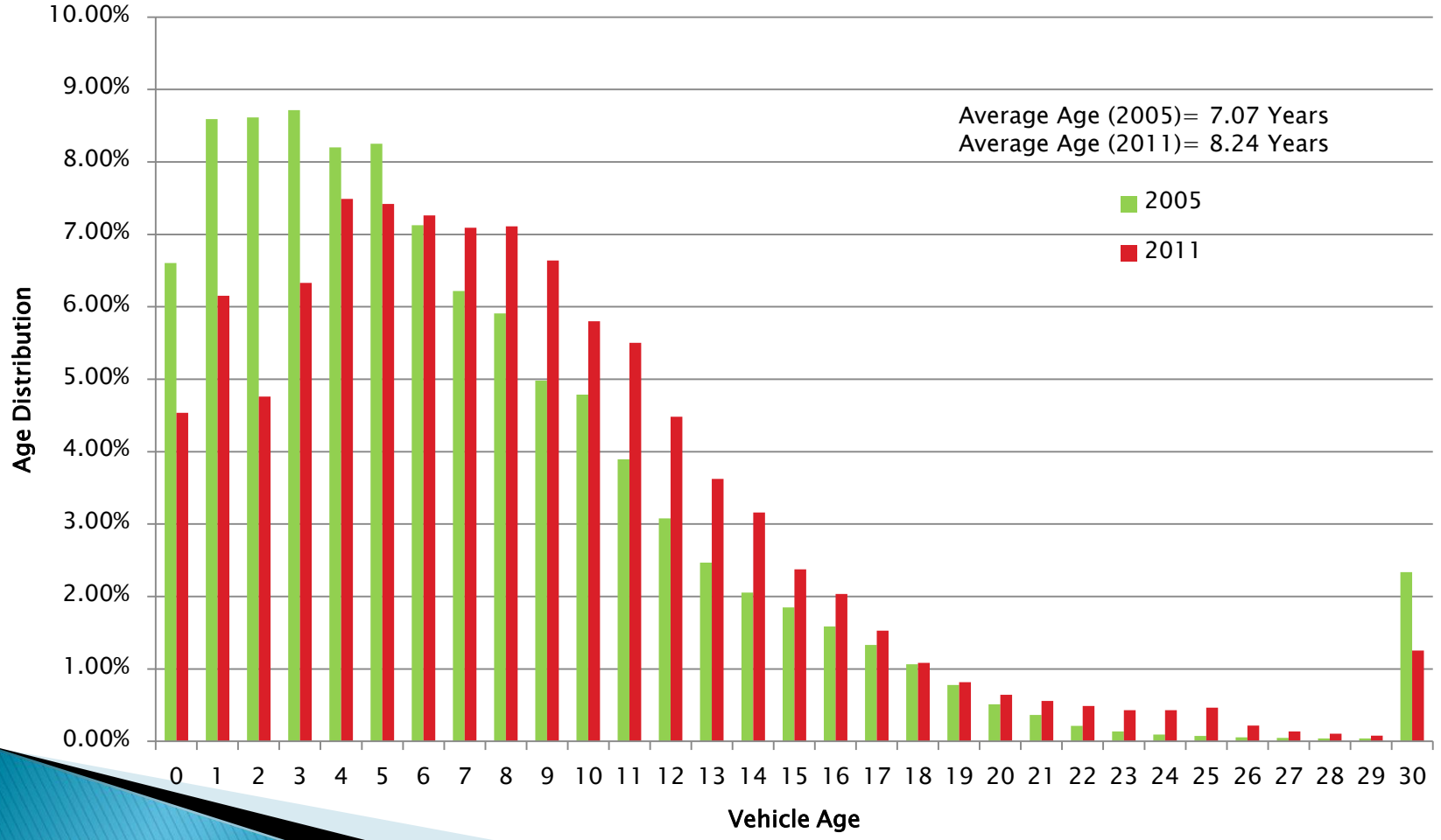
2011 and 2005 REGIONAL VEHICLE FLEETS

Average Vehicle Age

	2011 VIN	2005 VIN	Difference
Passenger Cars/Trucks	8.21	7.08	1.13
Light Commercial Trucks	8.09	6.63	1.46
Buses	10.36	9.99	0.37
Heavy Duty Trucks	11.28	9.15	2.13
All Vehicle Types	**8.24**	**7.07**	**1.17**

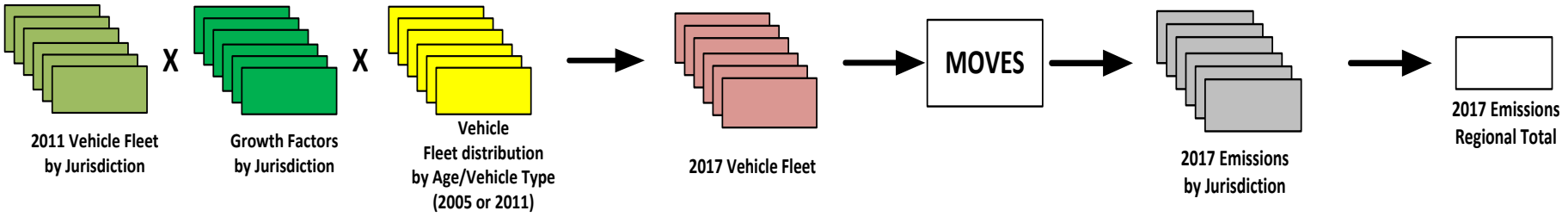
2011 and 2005 REGIONAL VEHICLE FLEETS

Vehicle Age Distribution

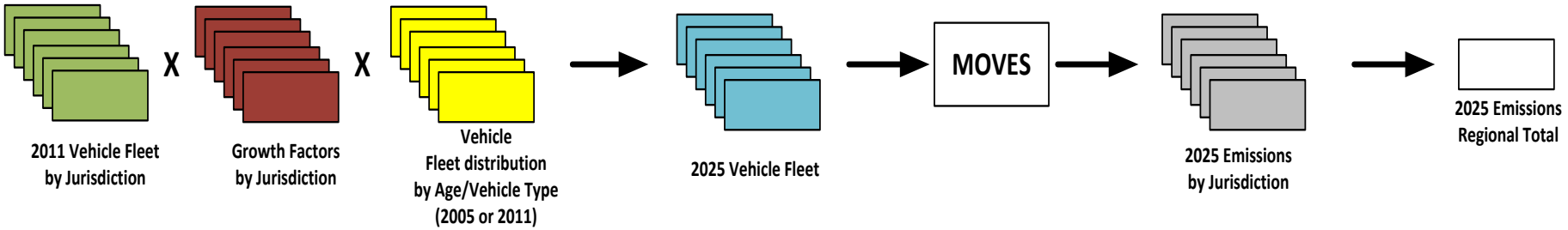


DEVELOPMENT OF MOTOR VEHICLE EMISSIONS ESTIMATES

Conceptual Flow Chart



2017 Inventories



2025 Inventories

MOTOR VEHICLE EMISSIONS COMPARISON

	2017		2025	
	NOx (t/yr)	PM2.5 (t/yr)	NOx (t/yr)	PM2.5 (t/yr)
2011VIN Basis	41,709 (1)	1,787 (4)	27,400 (7)	1,322 (10)
2005VIN Basis	33,468 (2)	1,465 (5)	25,406 (8)	1,187 (11)
Difference	8,241 (3)	322 (6)	1,994 (9)	136 (12)
Ratio	1.25	1.22	1.08⊛	1.11⊛

Source:

(1): Appendix Table 1.1
(2): Appendix Table 1.2
(3): Appendix Table 1.3
(4): Appendix Table 1.4
(5): Appendix Table 1.5
(6): Appendix Table 1.6
(7): Appendix Table 2.1
(8): Appendix Table 2.2
(9): Appendix Table 2.3
(10): Appendix Table 2.4
(11): Appendix Table 2.5
(12): Appendix Table 2.6

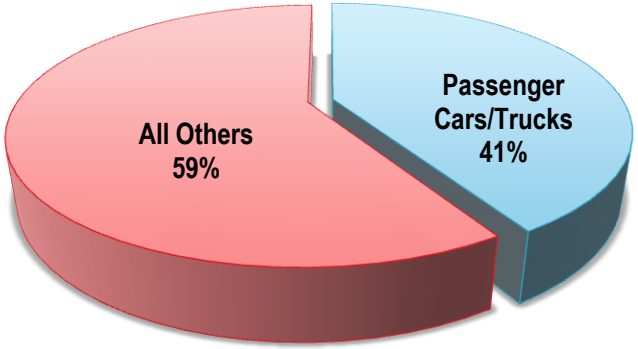
⊛ Note: Ratios of 1.19 and 1.16 provided on page 12 of the March 21 PowerPoint were incorrect due to use of a vehicle age distribution for 2002 rather than for 2005

ORIGINS OF THE MOTOR VEHICLE EMISSIONS DIFFERENCES

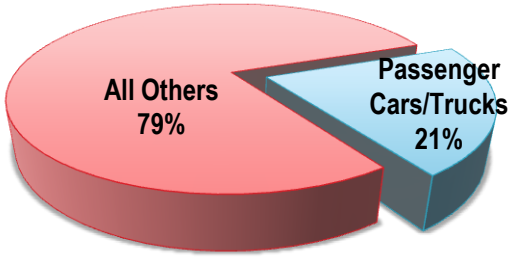
	2017				2025			
	NOx		PM2.5		NOx		PM2.5	
	t/yr	Percent	t/yr	Percent	t/yr	Percent	t/yr	Percent
Passenger Cars/Trucks	3,399	41%	60	19%	423	21%	55	40%
Light Commercial Trucks	1,040	13%	26	8%	244	12%	12	9%
Buses	256	3%	18	6%	160	8%	15	11%
Heavy Duty Trucks	3,546	43%	217	67%	1,168	59%	54	40%
All Vehicle Types	**8,241** (1)	100%	**322** (2)	100%	**1,994** (3)	100%	**136** (4)	100%

Source:
(1): Appendix Table 1.3 (2): Appendix Table 1.6 (3): Appendix Table 2.3 (4): Appendix Table 2.6

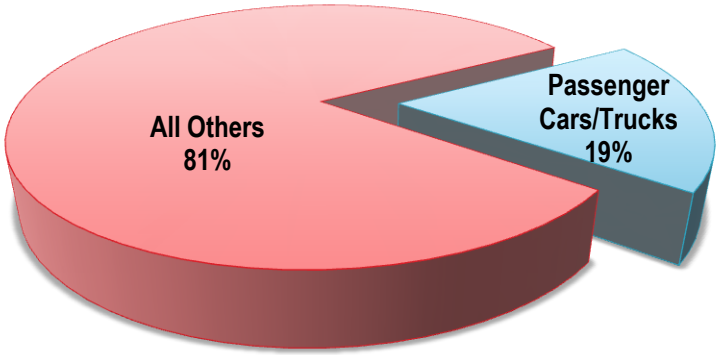
ORIGINS OF THE MOTOR VEHICLE EMISSIONS DIFFERENCES



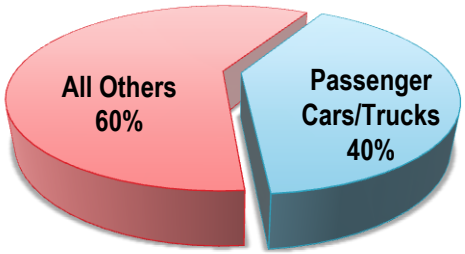
2017 NOx Emissions Difference = 8,241 t/yr



2025 NOx Emissions Difference = 1,994 t/yr



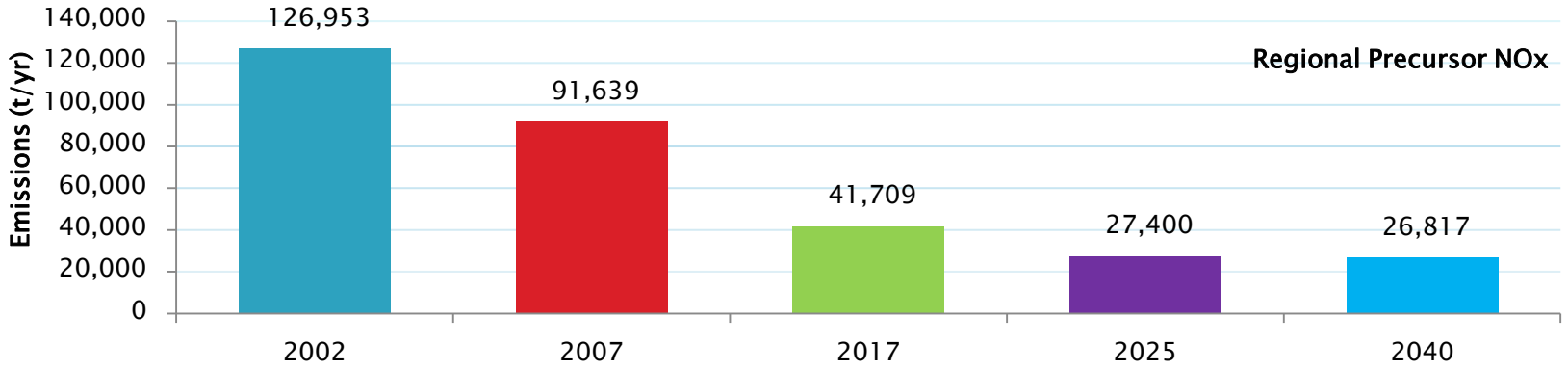
2017 PM2.5 Emissions Difference = 322 t/yr

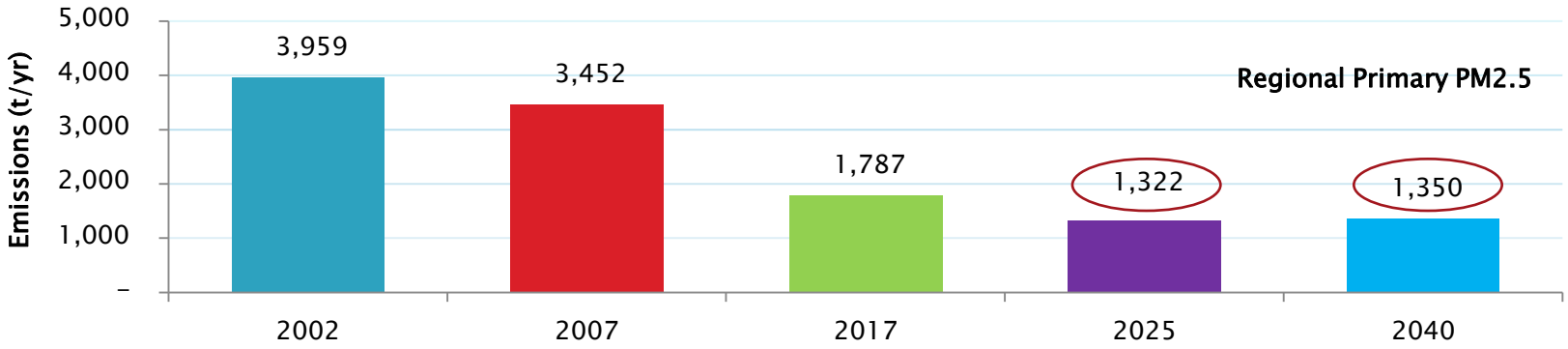


2025 PM2.5 Emissions Difference = 136 t/yr

MOTOR VEHICLE EMISSIONS BUDGETS

Implications for the 2011 Constrained Long Range Plan (CLRP)



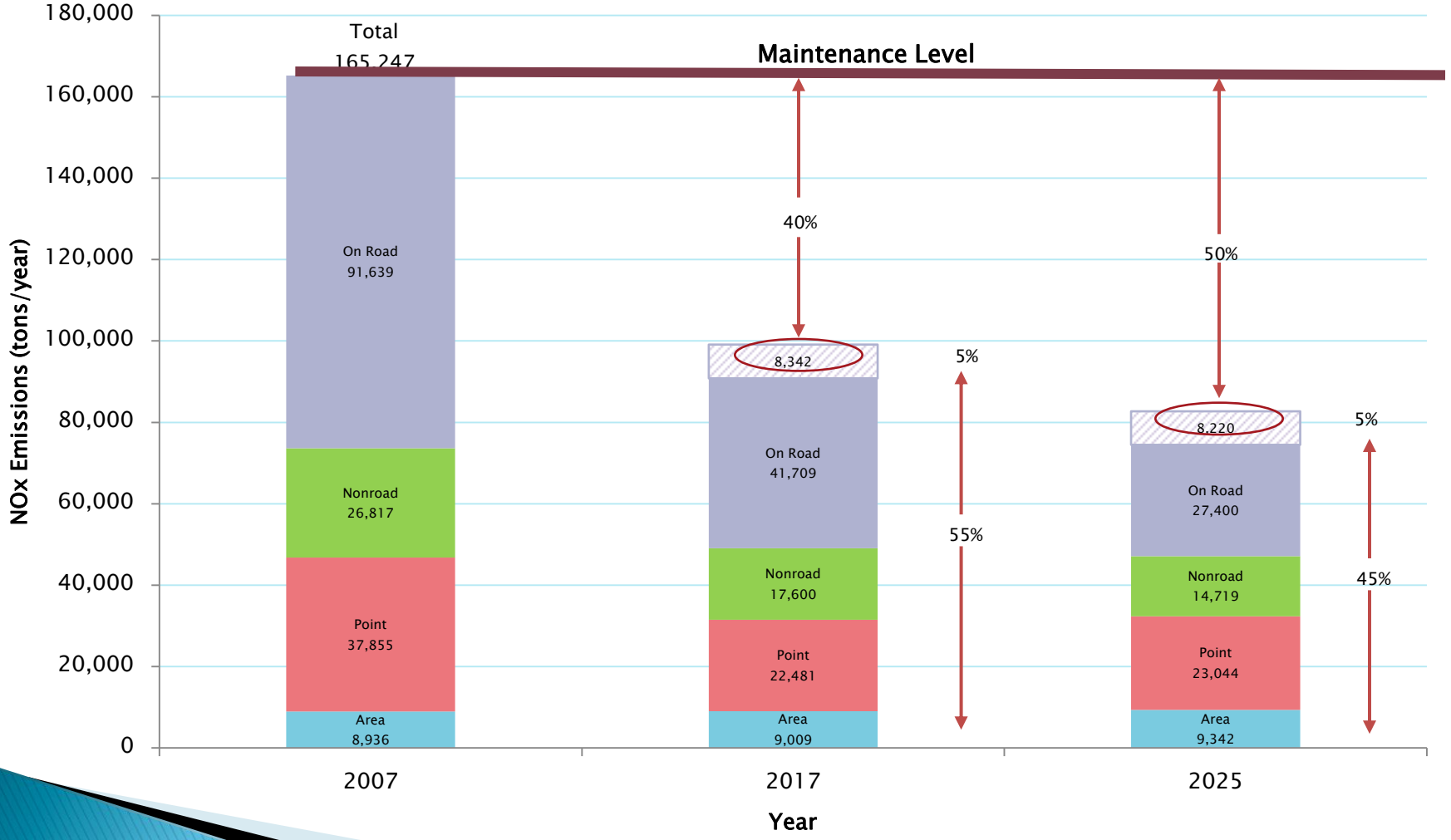


Example:

- If the 2025 mobile budget for primary PM2.5 had been set and in effect at the inventory level of 1,322 tons per year, conformity could not have been demonstrated for 2040.
- The new 2017 and 2025 budgets for precursor NOx and primary PM2.5 could be in effect for the 2013 CLRP update.

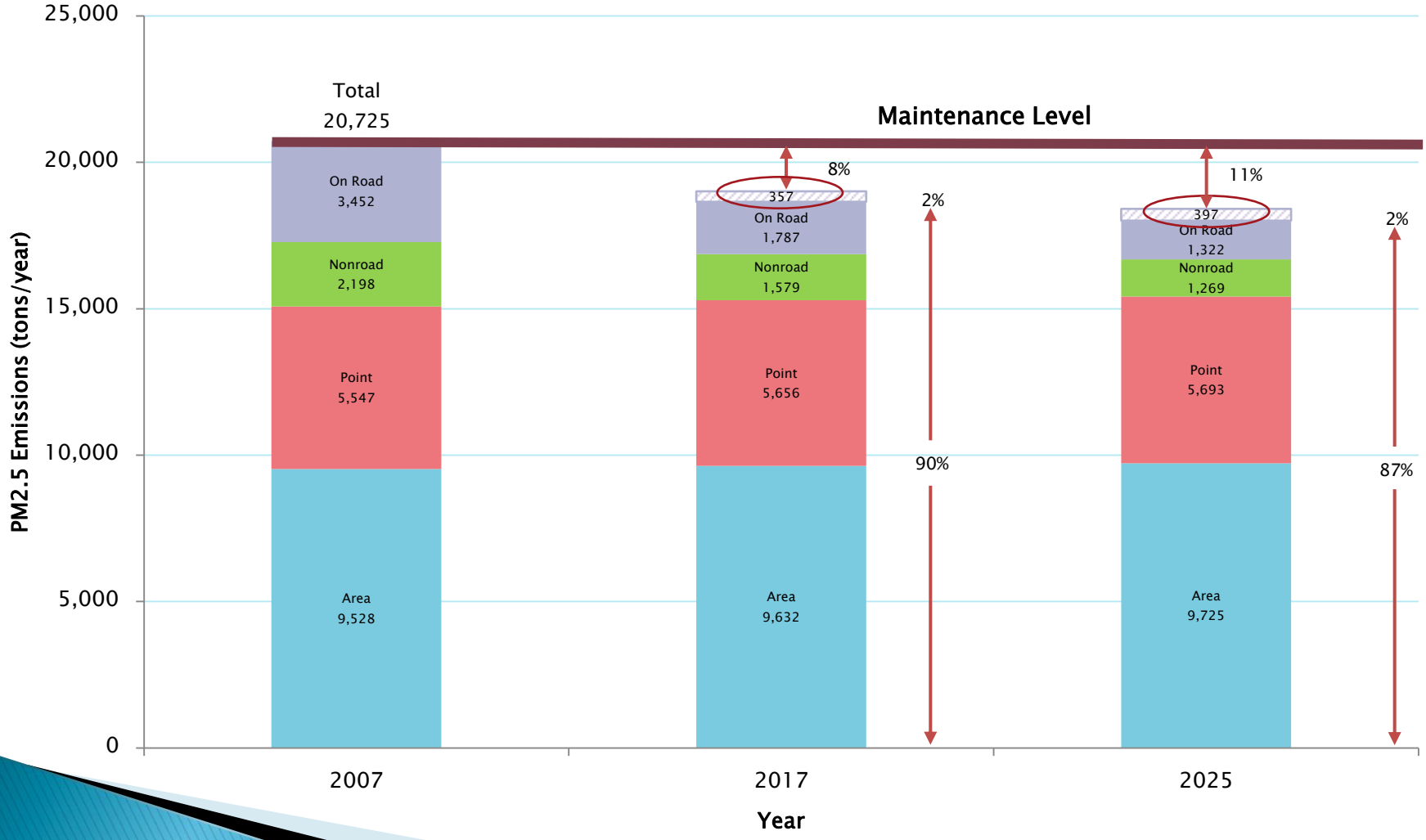
SETTING MOTOR VEHICLE EMISSIONS BUDGETS

Safety Margins as Percentages of Maintenance Level for NOx



SETTING MOTOR VEHICLE EMISSIONS BUDGETS

Safety Margins as Percentages of Maintenance Level for PM2.5



Appendix

Emissions by Vehicle Type and Vehicle Age in Tons/Year

TPB Technical Committee Meeting
June 1, 2012

2011 VIN Basis

Table 1.1 2017 NOX Emissions (by Vehicle Type and Vehicle Age) in tons/year

	MOVES SourceUseType Vehicle Categories													
	MC	PC	PT	LCT	IB	TB	SB	RT	SUSH	SULH	MH	CUSH	CULH	
Veh_Age	Motorcycle	Passenger Car	Passenger Truck	Light Commercial Truck	Intercity Bus	Transit Bus	School Bus	Refuse Truck	Single Unit Short-haul Truck	Single Unit Long-haul Truck	Motor Home	Combination Short-haul Truck	Combination Long-haul Truck	TOTAL
0	8	108	238	125	3	9	3	6	107	6	1	70	180	864
1	7	160	292	150	6	14	1	4	74	4	1	54	145	912
2	13	134	179	94	7	17	2	5	89	5	1	65	177	789
3	11	154	294	159	5	12	4	5	97	6	2	55	146	951
4	12	257	410	211	6	11	5	16	251	16	5	203	452	1,854
5	10	245	409	220	15	25	4	14	193	12	4	184	400	1,735
6	8	272	523	269	14	26	2	14	228	15	5	190	412	1,977
7	6	258	512	264	8	15	8	8	153	10	4	113	242	1,601
8	7	347	581	317	19	38	9	19	188	13	4	270	369	2,182
9	5	346	548	288	26	50	14	14	172	12	5	191	253	1,923
10	4	373	524	260	28	52	14	18	205	15	6	244	338	2,081
11	3	445	509	272	66	115	26	32	343	26	10	468	536	2,849
12	2	375	486	300	26	44	29	22	243	19	8	305	349	2,207
13	1	385	456	293	41	68	14	15	179	14	6	217	253	1,942
14	2	627	773	345	49	78	9	12	134	11	5	167	205	2,417
15	1	569	571	244	18	27	10	14	103	8	3	219	258	2,047
16	1	551	395	177	15	22	14	17	148	12	6	247	269	1,875
17	1	359	298	125	18	25	14	11	83	7	3	168	203	1,315
18	1	316	207	88	11	14	7	7	60	5	3	98	117	932
19	0	331	170	63	21	20	7	6	74	7	3	91	94	887
20	0	248	143	56	14	16	20	7	75	7	4	101	109	799
21	0	196	134	54	15	19	25	7	95	9	6	103	103	767
22	0	207	315	112	43	48	24	6	66	6	4	94	110	1,036
23	0	155	317	109	37	42	9	6	67	6	5	91	111	954
24	0	125	389	131	32	35	4	8	78	8	5	112	141	1,067
25	0	95	491	158	27	30	2	5	73	7	6	80	91	1,066
26	0	74	155	54	23	26	1	3	47	5	5	39	38	470
27	0	58	76	27	22	23	1	1	19	2	2	15	14	260
28	0	42	52	18	24	25	1	1	20	2	3	15	14	218
29	0	21	45	15	21	21	1	1	12	1	2	11	11	162
30	2	558	399	168	24	23	96	6	63	7	10	93	122	1,569
SUBTOTAL	109	8,392	10,891	5,163	684	989	381	308	3,738	284	138	4,372	6,259	41,709
% OF SUBTOTAL	0.3%	20.1%	26.1%	12.4%	1.6%	2.4%	0.9%	0.7%	9.0%	0.7%	0.3%	10.5%	15.0%	100.0%
TOTAL	19,392			5,163	2,054			15,100						
% OF TOTAL	46%			12%	5%			36%						

2005 VIN Basis

Table 1.2 2017 NOX Emissions (by Vehicle Type and Vehicle Age) in tons/year

	MOVES SourceUseType Vehicle Categories													
	MC	PC	PT	LCT	IB	TB	SB	RT	SUSH	SULH	MH	CUSH	CULH	
Veh_Age	Motorcycle	Passenger Car	Passenger Truck	Light Commercial Truck	Intercity Bus	Transit Bus	School Bus	Refuse Truck	Single Unit Short-haul Truck	Single Unit Long-haul Truck	Motor Home	Combination Short-haul Truck	Combination Long-haul Truck	TOTAL
0	26	154	333	179	5	13	1	17	271	15	4	222	599	1,839
1	17	192	475	257	6	15	8	9	169	10	3	109	285	1,556
2	16	195	447	243	6	14	3	8	125	7	2	101	285	1,453
3	11	198	442	235	6	14	6	6	118	7	2	72	192	1,309
4	8	277	462	241	8	14	8	11	170	11	3	130	292	1,635
5	6	296	407	216	14	23	6	14	196	13	4	177	383	1,754
6	4	295	446	231	3	7	10	9	165	11	4	112	235	1,532
7	3	262	370	181	10	18	7	9	141	10	3	112	249	1,374
8	3	323	400	216	45	89	11	21	211	15	4	283	389	2,010
9	2	292	338	175	5	10	15	9	118	8	3	126	165	1,266
10	2	364	299	150	13	24	30	11	159	12	5	143	183	1,394
11	2	347	278	146	18	31	28	15	152	11	4	196	229	1,455
12	1	301	228	137	13	23	23	11	123	9	4	153	183	1,209
13	1	302	199	131	24	40	20	5	93	7	4	64	62	953
14	1	476	323	140	17	27	18	5	82	7	4	64	68	1,230
15	1	497	287	127	19	29	37	12	133	11	5	169	173	1,500
16	1	375	324	143	57	84	58	11	99	8	4	158	171	1,493
17	0	245	315	129	82	116	22	12	104	9	4	178	209	1,426
18	0	230	265	109	43	56	41	9	84	7	4	124	141	1,114
19	0	223	239	87	5	5	23	6	72	6	3	93	98	861
20	0	155	134	56	20	23	15	5	67	6	4	80	84	648
21	0	100	103	42	7	8	16	3	40	4	3	35	33	393
22	0	88	109	40	3	3	13	0	7	1	1	6	6	276
23	0	50	71	26	3	4	6	1	8	1	1	9	10	188
24	0	30	51	19	4	4	3	1	11	1	1	7	6	139
25	0	17	40	15	5	5	3	1	25	2	3	16	13	146
26	0	10	35	13	6	6	1	1	12	1	1	9	9	104
27	0	6	32	12	8	8	1	1	13	1	2	7	5	96
28	0	3	28	10	12	13	0	0	3	0	0	2	2	75
29	0	2	29	10	15	15	0	0	1	0	0	1	2	75
30	0	920	1,153	410	14	14	114	7	83	9	13	102	127	2,966
SUBTOTAL	106	7,225	8,661	4,122	495	756	548	230	3,054	221	103	3,060	4,886	33,468
% OF SUBTOTAL	0.3%	21.6%	25.9%	12.3%	1.5%	2.3%	1.6%	0.7%	9.1%	0.7%	0.3%	9.1%	14.6%	100.0%
TOTAL	15,992			4,122	1,799			11,554						
% OF TOTAL	48%			12%	5%			35%						

Table 1.3 2017 NOX Emissions Differences (by Vehicle Type and Vehicle Age) in tons/year

	MOVES SourceUseType Vehicle Categories													
	MC	PC	PT	LCT	IB	TB	SB	RT	SUSH	SULH	MH	CUSH	CULH	
Veh_Age	Motorcycle	Passenger Car	Passenger Truck	Light Commercial Truck	Intercity Bus	Transit Bus	School Bus	Refuse Truck	Single Unit Short-haul Truck	Single Unit Long-haul Truck	Motor Home	Combination Short-haul Truck	Combination Long-haul Truck	TOTAL
0	(18)	(46)	(95)	(54)	(2)	(4)	2	(11)	(164)	(9)	(2)	(152)	(419)	(975)
1	(10)	(32)	(183)	(108)	(0)	(1)	(7)	(4)	(96)	(5)	(2)	(56)	(140)	(644)
2	(3)	(61)	(268)	(149)	1	2	(1)	(3)	(36)	(2)	(1)	(37)	(108)	(665)
3	0	(44)	(147)	(75)	(1)	(2)	(2)	(1)	(21)	(1)	(1)	(17)	(46)	(358)
4	4	(19)	(53)	(30)	(2)	(4)	(3)	5	81	5	2	73	160	218
5	5	(51)	2	4	1	2	(2)	0	(2)	(0)	(0)	7	17	(19)
6	4	(23)	77	38	10	20	(9)	4	63	4	1	79	177	445
7	3	(3)	141	83	(2)	(3)	1	(1)	12	1	1	1	(7)	227
8	4	24	181	101	(26)	(51)	(1)	(2)	(23)	(2)	(0)	(13)	(20)	173
9	3	54	210	114	21	40	(1)	5	54	4	1	65	88	657
10	2	8	224	111	16	29	(16)	7	47	3	1	101	155	687
11	1	98	231	126	48	84	(2)	17	191	14	6	272	307	1,394
12	1	75	258	163	12	21	6	10	120	9	4	152	167	998
13	1	83	257	162	17	27	(6)	10	86	7	2	152	191	989
14	1	151	450	205	32	51	(9)	7	52	4	1	103	137	1,186
15	1	73	284	117	(1)	(2)	(27)	2	(29)	(3)	(2)	50	86	548
16	1	176	71	35	(42)	(62)	(44)	5	49	4	2	89	98	382
17	1	114	(17)	(4)	(64)	(91)	(8)	(1)	(21)	(2)	(1)	(10)	(5)	(111)
18	0	85	(58)	(21)	(32)	(42)	(35)	(2)	(24)	(2)	(1)	(25)	(24)	(182)
19	(0)	108	(68)	(24)	16	15	(16)	(0)	2	0	0	(2)	(5)	25
20	(0)	93	10	(0)	(6)	(7)	6	1	8	1	0	21	25	151
21	0	96	31	13	9	11	9	5	56	5	3	68	70	374
22	0	119	206	72	40	45	11	6	59	6	3	88	104	759
23	0	106	246	83	34	39	3	6	59	5	4	82	101	766
24	0	95	338	111	28	31	1	7	67	6	4	105	135	928
25	0	78	450	143	23	25	(1)	4	48	5	3	63	78	920
26	0	64	120	41	18	19	0	2	35	4	4	30	29	367
27	0	52	45	14	14	15	0	0	6	1	1	8	8	164
28	0	39	24	8	12	12	1	1	17	2	3	13	12	144
29	0	19	16	6	6	6	1	1	11	1	2	9	10	87
30	2	(362)	(754)	(243)	10	9	(18)	(1)	(20)	(2)	(4)	(9)	(5)	(1,397)
SUBTOTAL	3	1,167	2,230	1,040	189	233	(167)	78	684	63	34	1,312	1,374	8,241
% OF SUBTOTAL	0.0%	14.2%	27.1%	12.6%	2.3%	2.8%	-2.0%	1.0%	8.3%	0.8%	0.4%	15.9%	16.7%	100.0%
TOTAL	3,399			1,040	256			3,546						
% OF TOTAL	41%			13%	3%			43%						

2011 VIN Basis

Table 1.4 2017 PM2.5 Emissions (by Vehicle Type and Vehicle Age) in tons/year

	MOVES SourceUseType Vehicle Categories													
	MC	PC	PT	LCT	IB	TB	SB	RT	SUSH	SULH	MH	CUSH	CULH	
Veh_Age	Motorcycle	Passenger Car	Passenger Truck	Light Commercial Truck	Intercity Bus	Transit Bus	School Bus	Refuse Truck	Single Unit Short-haul Truck	Single Unit Long-haul Truck	Motor Home	Combination Short-haul Truck	Combination Long-haul Truck	TOTAL
0	1	14	17	5	0	0	0	0	2	0	0	3	2	44
1	0	20	20	6	0	1	0	0	1	0	0	2	2	54
2	1	17	13	4	0	1	0	0	2	0	0	2	2	42
3	1	19	21	7	0	0	0	0	2	0	0	2	2	54
4	1	25	31	10	0	0	0	1	5	0	0	7	6	86
5	1	24	31	10	1	1	0	1	4	0	0	6	5	83
6	1	25	33	10	1	1	0	1	4	0	0	6	5	87
7	0	24	32	10	0	0	0	0	3	0	0	4	3	77
8	0	26	33	10	0	0	0	0	2	0	0	3	3	80
9	0	24	30	9	0	1	0	0	2	0	0	2	2	71
10	0	26	28	9	1	1	0	0	2	0	0	3	3	73
11	0	26	27	12	7	9	2	3	20	2	0	38	37	183
12	0	20	20	11	3	3	3	2	14	1	0	25	24	127
13	0	16	15	10	4	5	1	1	10	1	0	18	18	101
14	0	13	15	9	5	6	1	1	8	1	0	14	14	86
15	0	15	12	7	1	1	1	1	5	0	0	11	12	66
16	0	14	9	6	1	1	1	1	8	1	0	12	12	66
17	0	12	8	4	1	1	1	1	4	0	0	8	9	50
18	0	8	5	3	1	1	0	0	3	0	0	5	5	32
19	0	7	3	1	1	1	0	0	3	0	0	3	3	24
20	0	8	4	2	1	1	1	0	4	0	0	6	6	34
21	0	6	4	2	1	1	2	0	5	1	0	6	5	33
22	0	5	5	3	3	2	2	0	4	0	0	5	6	33
23	0	4	5	3	2	2	1	0	4	0	0	5	6	31
24	0	3	6	3	2	1	0	0	3	0	0	5	6	31
25	0	3	8	3	1	1	0	0	3	0	0	4	4	27
26	0	2	3	1	1	1	0	0	2	0	0	2	2	14
27	0	2	2	1	1	1	0	0	1	0	0	1	1	9
28	0	1	1	1	1	1	0	0	1	0	0	1	0	7
29	0	1	1	0	1	1	0	0	0	0	0	0	0	5
30	0	28	12	6	2	1	6	0	4	0	0	7	10	76
SUBTOTAL	7	440	449	177	43	48	23	18	135	11	4	214	217	1,787
% OF SUBTOTAL	0.4%	24.6%	25.1%	9.9%	2.4%	2.7%	1.3%	1.0%	7.6%	0.6%	0.2%	12.0%	12.2%	100.0%
TOTAL	896			177	114			599						
% OF TOTAL	50%			10%	6%			34%						

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Table 1.5 2017 PM2.5 Emissions (by Vehicle Type and Vehicle Age) in tons/year

	MOVES SourceUseType Vehicle Categories													
	MC	PC	PT	LCT	IB	TB	SB	RT	SUSH	SULH	MH	CUSH	CULH	
Veh_Age	Motorcycle	Passenger Car	Passenger Truck	Light Commercial Truck	Intercity Bus	Transit Bus	School Bus	Refuse Truck	Single Unit Short-haul Truck	Single Unit Long-haul Truck	Motor Home	Combination Short-haul Truck	Combination Long-haul Truck	TOTAL
0	2	19	23	7	0	0	0	1	5	0	0	8	7	74
1	1	23	33	11	0	1	0	0	3	0	0	4	3	81
2	1	24	31	10	0	1	0	0	2	0	0	4	3	77
3	1	24	31	10	0	1	0	0	2	0	0	3	2	74
4	1	26	35	11	0	1	0	0	3	0	0	4	4	86
5	0	28	31	10	1	1	0	1	4	0	0	6	5	86
6	0	26	28	9	0	0	0	0	3	0	0	3	3	75
7	0	23	23	7	0	1	0	0	2	0	0	3	3	65
8	0	24	23	7	1	1	0	0	2	0	0	3	3	65
9	0	20	18	6	0	0	0	0	1	0	0	1	1	49
10	0	25	16	5	0	0	1	0	2	0	0	2	2	53
11	0	20	15	6	2	2	2	1	9	1	0	16	16	91
12	0	16	10	5	1	2	2	1	7	1	0	13	13	70
13	0	13	7	5	2	3	2	1	5	0	0	5	4	47
14	0	10	6	4	2	2	2	0	5	0	0	5	5	41
15	0	13	6	4	1	2	2	1	7	1	0	8	8	52
16	0	10	8	5	4	4	4	1	5	0	0	8	8	56
17	0	8	8	4	5	6	1	1	5	0	0	9	10	58
18	0	6	6	3	3	3	3	1	4	0	0	6	6	42
19	0	5	4	2	0	0	1	0	2	0	0	3	4	23
20	0	5	4	2	1	1	1	0	4	0	0	4	4	27
21	0	3	3	2	0	0	1	0	2	0	0	2	2	16
22	0	2	2	1	0	0	1	0	0	0	0	0	0	7
23	0	1	1	1	0	0	0	0	0	0	0	0	0	5
24	0	1	1	0	0	0	0	0	0	0	0	0	0	4
25	0	1	1	0	0	0	0	0	1	0	0	1	1	5
26	0	0	1	0	0	0	0	0	0	0	0	0	0	3
27	0	0	1	0	0	0	0	0	1	0	0	0	0	3
28	0	0	1	0	0	0	0	0	0	0	0	0	0	2
29	0	0	1	0	1	0	0	0	0	0	0	0	0	2
30	0	45	33	14	1	1	7	1	5	1	0	8	11	125
SUBTOTAL	7	422	408	151	29	34	32	12	96	8	3	134	130	1,465
% OF SUBTOTAL	0.5%	28.8%	27.8%	10.3%	2.0%	2.4%	2.2%	0.8%	6.6%	0.5%	0.2%	9.1%	8.9%	100.0%
TOTAL	836			151	96			382						
% OF TOTAL	57%			10%	7%			26%						

Table 1.6 2017 PM2.5 Emissions Differences (by Vehicle Type and Vehicle Age) in tons/year

	MOVES SourceUseType Vehicle Categories													
	MC	PC	PT	LCT	IB	TB	SB	RT	SUSH	SULH	MH	CUSH	CULH	
Veh_Age	Motorcycle	Passenger Car	Passenger Truck	Light Commercial Truck	Intercity Bus	Transit Bus	School Bus	Refuse Truck	Single Unit Short-haul Truck	Single Unit Long-haul Truck	Motor Home	Combination Short-haul Truck	Combination Long-haul Truck	TOTAL
0	(1)	(5)	(7)	(2)	(0)	(0)	0	(1)	(3)	(0)	(0)	(6)	(5)	(29)
1	(1)	(3)	(13)	(4)	(0)	(0)	(0)	(0)	(2)	(0)	(0)	(2)	(2)	(27)
2	(0)	(7)	(19)	(6)	0	0	(0)	(0)	(1)	(0)	(0)	(1)	(1)	(35)
3	0	(5)	(10)	(3)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(1)	(1)	(20)
4	0	(1)	(4)	(1)	(0)	(0)	(0)	0	2	0	0	2	2	(0)
5	0	(4)	0	0	0	0	(0)	0	(0)	(0)	(0)	0	0	(3)
6	0	(1)	5	1	1	1	(0)	0	1	0	0	2	2	12
7	0	0	9	3	(0)	(0)	0	(0)	0	0	0	0	(0)	13
8	0	2	10	3	(0)	(1)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	14
9	0	4	11	4	0	0	(0)	0	1	0	0	1	1	22
10	0	1	12	4	0	0	(0)	0	1	0	0	1	1	21
11	0	6	12	5	5	7	(0)	2	11	1	0	22	21	92
12	0	4	11	6	1	2	1	1	7	1	0	12	11	56
13	0	4	9	6	2	2	(1)	1	5	0	0	12	13	53
14	0	3	8	5	3	4	(1)	1	3	0	0	8	10	45
15	0	2	6	4	(0)	(0)	(2)	0	(1)	(0)	(0)	2	4	14
16	0	5	2	1	(3)	(3)	(3)	0	3	0	0	4	4	11
17	0	4	(0)	(0)	(4)	(5)	(0)	(0)	(1)	(0)	(0)	(1)	(0)	(8)
18	0	2	(1)	(1)	(2)	(2)	(2)	(0)	(1)	(0)	(0)	(1)	(1)	(10)
19	(0)	2	(1)	(0)	1	1	(1)	(0)	0	0	0	(0)	(0)	1
20	(0)	3	0	(0)	(0)	(0)	0	0	0	0	0	1	1	6
21	0	3	1	0	1	0	1	0	3	0	0	4	4	17
22	0	3	3	2	2	2	1	0	3	0	0	5	5	27
23	0	3	4	2	2	2	0	0	3	0	0	4	5	26
24	0	3	5	2	2	1	0	0	3	0	0	5	6	27
25	0	2	7	3	1	1	(0)	0	2	0	0	3	4	23
26	0	2	2	1	1	1	0	0	1	0	0	1	1	11
27	0	2	1	0	1	0	0	0	0	0	0	0	0	5
28	0	1	0	0	0	0	0	0	1	0	0	0	0	5
29	0	1	0	0	0	0	0	0	0	0	0	0	0	3
30	0	(17)	(21)	(8)	1	0	(1)	(0)	(1)	(0)	(0)	(1)	(0)	(49)
SUBTOTAL	0	19	41	26	14	13	(9)	6	39	3	1	81	87	322
% OF SUBTOTAL	0.0%	5.9%	12.8%	8.2%	4.4%	4.1%	-2.8%	1.7%	12.2%	1.1%	0.3%	25.1%	27.1%	100.0%
TOTAL	60			26	18			217						
% OF TOTAL	19%			8%	6%			67%						

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Table 2.1 2025 NOX Emissions (by Vehicle Type and Vehicle Age) in tons/year

	MOVES SourceUseType Vehicle Categories													
	MC	PC	PT	LCT	IB	TB	SB	RT	SUSH	SULH	MH	CUSH	CULH	
Veh_Age	Motorcycle	Passenger Car	Passenger Truck	Light Commercial Truck	Intercity Bus	Transit Bus	School Bus	Refuse Truck	Single Unit Short-haul Truck	Single Unit Long-haul Truck	Motor Home	Combination Short-haul Truck	Combination Long-haul Truck	TOTAL
0	8	119	260	136	4	9	3	7	118	7	2	77	200	949
1	7	176	319	164	6	14	1	5	81	5	1	59	161	1,000
2	14	147	196	103	7	17	2	6	98	6	2	71	197	866
3	12	169	322	174	5	12	4	5	107	7	2	61	163	1,044
4	13	283	448	231	6	11	5	17	278	17	6	225	504	2,044
5	11	269	448	241	13	24	4	14	204	13	4	183	430	1,857
6	9	298	572	294	13	25	2	14	242	16	6	189	442	2,120
7	6	285	549	286	7	14	8	8	162	11	5	112	261	1,714
8	7	354	567	283	6	13	4	7	115	8	3	96	241	1,704
9	5	328	516	253	8	17	6	5	105	7	4	68	166	1,487
10	4	331	446	217	9	19	6	7	124	9	4	86	222	1,484
11	3	333	370	182	11	21	5	6	126	9	5	83	210	1,366
12	2	262	300	148	4	8	6	4	90	7	4	54	137	1,026
13	1	217	224	105	7	14	3	3	69	5	3	43	103	799
14	1	179	196	96	9	16	2	2	50	4	3	33	84	676
15	1	151	151	70	2	3	1	2	32	3	2	24	63	503
16	1	152	110	59	4	7	5	5	80	7	4	73	107	614
17	1	119	86	44	5	7	5	4	46	4	2	50	81	454
18	1	92	60	30	3	4	2	2	34	3	2	30	47	309
19	0	83	47	25	9	12	4	3	46	4	3	40	49	324
20	0	66	47	27	5	7	9	3	41	4	3	39	51	302
21	0	66	55	36	6	7	11	3	52	5	4	40	48	334
22	0	90	127	57	17	20	11	3	37	4	3	37	52	458
23	0	72	123	54	25	29	7	5	46	4	3	66	87	522
24	0	57	153	65	22	24	3	6	53	5	4	83	112	587
25	0	37	193	75	18	20	1	4	49	5	5	59	74	541
26	0	35	70	30	16	16	1	2	32	3	4	29	30	268
27	0	37	41	15	17	13	1	1	18	2	2	14	13	175
28	0	28	30	12	17	15	0	1	17	2	2	13	12	150
29	0	15	26	10	15	14	0	1	10	1	2	9	10	113
30	2	599	458	191	17	15	78	5	55	6	7	75	104	1,612
SUBTOTAL	113	5,450	7,511	3,709	315	445	199	159	2,618	193	104	2,121	4,461	27,400
% OF SUBTOTAL	0.4%	19.9%	27.4%	13.5%	1.1%	1.6%	0.7%	0.6%	9.6%	0.7%	0.4%	7.7%	16.3%	100.0%
TOTAL	13,075			3,709	959			9,657						
% OF TOTAL	48%			14%	4%			35%						

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Table 2.2 2025 NOX Emissions (by Vehicle Type and Vehicle Age) in tons/year

	MOVES SourceUseType Vehicle Categories													
	MC	PC	PT	LCT	IB	TB	SB	RT	SUSH	SULH	MH	CUSH	CULH	
Veh_Age	Motorcycle	Passenger Car	Passenger Truck	Light Commercial Truck	Intercity Bus	Transit Bus	School Bus	Refuse Truck	Single Unit Short-haul Truck	Single Unit Long-haul Truck	Motor Home	Combination Short-haul Truck	Combination Long-haul Truck	TOTAL
0	28	170	365	196	5	13	1	19	300	17	4	246	670	2,033
1	18	211	520	282	6	15	8	9	188	11	3	122	320	1,714
2	17	214	489	266	6	15	4	9	138	8	2	112	318	1,599
3	12	219	483	257	6	14	6	6	131	8	3	80	215	1,440
4	9	304	505	264	8	14	8	12	188	12	4	145	327	1,800
5	6	325	445	236	12	22	6	13	207	13	4	176	411	1,878
6	4	324	487	252	3	6	10	9	175	12	4	110	252	1,648
7	3	290	397	196	9	17	7	9	149	10	4	111	268	1,469
8	3	330	390	192	15	30	4	8	129	9	3	100	255	1,467
9	2	278	318	153	2	3	6	3	72	5	2	45	108	996
10	2	325	255	125	4	8	12	4	96	7	4	51	119	1,011
11	2	260	202	97	3	6	6	3	56	4	2	35	91	766
12	1	210	141	67	2	4	5	2	45	3	2	27	74	584
13	1	170	98	47	4	8	5	1	35	3	2	13	25	413
14	1	137	82	39	3	5	4	1	30	2	2	13	28	347
15	0	132	76	36	2	3	5	2	41	3	3	18	42	364
16	0	104	91	47	17	25	19	4	53	5	3	46	67	481
17	0	82	91	46	24	35	8	4	57	5	3	53	83	490
18	0	67	77	37	12	18	14	3	48	4	3	37	56	376
19	0	56	66	34	2	3	12	3	45	4	3	41	52	322
20	0	42	44	27	8	10	6	2	36	3	3	31	39	251
21	0	34	42	27	3	3	7	1	22	2	2	13	15	172
22	0	39	45	21	1	1	6	0	4	0	0	2	3	123
23	0	24	28	13	2	2	4	0	6	1	1	6	8	95
24	0	14	20	10	3	3	2	0	8	1	1	6	5	72
25	0	7	16	7	3	3	2	1	17	2	2	13	11	85
26	0	5	16	7	4	4	1	0	8	1	1	7	7	61
27	0	4	18	7	6	5	1	1	13	1	1	6	5	69
28	0	3	18	7	9	8	0	0	2	0	0	2	2	50
29	0	2	19	7	11	10	0	0	1	0	0	1	1	52
30	1	989	1,327	464	10	9	92	5	72	8	10	83	109	3,177
SUBTOTAL	112	5,370	7,170	3,465	204	324	271	137	2,371	165	81	1,750	3,985	25,406
% OF SUBTOTAL	0.4%	21.1%	28.2%	13.6%	0.8%	1.3%	1.1%	0.5%	9.3%	0.6%	0.3%	6.9%	15.7%	100.0%
TOTAL	12,652			3,465	799			8,489						
% OF TOTAL	50%			14%	3%			33%						

Table 2.3 2025 NOX Emissions Differences (by Vehicle Type and Vehicle Age) in tons/year

	MOVES SourceUseType Vehicle Categories													
	MC	PC	PT	LCT	IB	TB	SB	RT	SUSH	SULH	MH	CUSH	CULH	
Veh_Age	Motorcycle	Passenger Car	Passenger Truck	Light Commercial Truck	Intercity Bus	Transit Bus	School Bus	Refuse Truck	Single Unit Short-haul Truck	Single Unit Long-haul Truck	Motor Home	Combination Short-haul Truck	Combination Long-haul Truck	TOTAL
0	(19)	(51)	(105)	(59)	(2)	(4)	3	(12)	(182)	(10)	(2)	(169)	(470)	(1,084)
1	(11)	(35)	(201)	(118)	(0)	(1)	(7)	(5)	(107)	(6)	(2)	(62)	(159)	(714)
2	(3)	(67)	(294)	(163)	1	2	(1)	(3)	(40)	(2)	(1)	(41)	(121)	(733)
3	0	(49)	(161)	(83)	(1)	(2)	(2)	(1)	(23)	(1)	(1)	(19)	(52)	(395)
4	4	(22)	(57)	(33)	(2)	(4)	(3)	6	89	6	2	81	177	244
5	5	(57)	2	5	1	1	(2)	0	(3)	(0)	(0)	7	19	(22)
6	4	(26)	85	42	9	19	(8)	4	68	4	1	78	190	472
7	4	(4)	152	90	(2)	(3)	1	(1)	13	1	1	1	(7)	246
8	4	24	177	91	(8)	(17)	(1)	(1)	(14)	(1)	(0)	(4)	(14)	236
9	3	51	198	100	7	13	(0)	2	33	2	1	23	58	491
10	2	7	191	92	5	10	(7)	2	28	2	0	36	103	473
11	1	73	168	85	8	15	(1)	3	71	5	3	48	120	600
12	1	52	159	80	2	4	1	2	45	3	2	27	63	442
13	1	47	126	58	3	5	(2)	2	33	3	1	30	78	386
14	1	43	114	57	6	10	(2)	1	20	2	1	21	56	328
15	1	19	75	33	(0)	(0)	(4)	0	(9)	(1)	(1)	5	20	139
16	0	48	19	11	(12)	(18)	(15)	2	27	2	2	26	40	133
17	0	37	(5)	(1)	(18)	(27)	(3)	(0)	(11)	(1)	(1)	(3)	(3)	(37)
18	0	24	(17)	(7)	(9)	(13)	(12)	(1)	(14)	(1)	(1)	(7)	(9)	(67)
19	(0)	26	(19)	(10)	7	9	(8)	(0)	1	0	0	(1)	(3)	3
20	(0)	25	3	(0)	(2)	(3)	2	1	4	0	0	8	12	51
21	0	32	13	8	3	4	4	2	31	3	2	26	33	161
22	0	51	83	36	16	19	5	3	34	3	2	34	49	334
23	0	48	95	41	23	26	2	4	41	4	3	60	80	427
24	0	43	133	55	19	21	0	5	46	4	3	77	107	514
25	0	30	177	68	15	17	(0)	3	32	3	2	47	63	457
26	0	29	54	23	12	12	0	2	24	3	3	22	23	206
27	0	33	23	8	11	8	0	0	5	1	1	7	8	106
28	0	25	12	5	9	8	0	1	14	2	2	11	11	100
29	0	14	7	3	4	4	0	1	9	1	1	8	8	61
30	2	(390)	(868)	(273)	7	6	(14)	(1)	(17)	(2)	(3)	(7)	(4)	(1,564)
SUBTOTAL	2	80	341	244	111	121	(72)	22	248	29	23	371	476	1,994
% OF SUBTOTAL	0.1%	4.0%	17.1%	12.2%	5.6%	6.1%	-3.6%	1.1%	12.4%	1.4%	1.1%	18.6%	23.9%	100.0%
TOTAL	423			244	160			1,168						
% OF TOTAL	21%			12%	8%			59%						

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Table 2.4 2025 PM2.5 Emissions (by Vehicle Type and Vehicle Age) in tons/year

	MOVES SourceUseType Vehicle Categories													
	MC	PC	PT	LCT	IB	TB	SB	RT	SUSH	SULH	MH	CUSH	CULH	
Veh_Age	Motorcycle	Passenger Car	Passenger Truck	Light Commercial Truck	Intercity Bus	Transit Bus	School Bus	Refuse Truck	Single Unit Short-haul Truck	Single Unit Long-haul Truck	Motor Home	Combination Short-haul Truck	Combination Long-haul Truck	TOTAL
0	1	15	18	6	0	0	0	0	2	0	0	3	2	49
1	1	22	22	7	0	1	0	0	2	0	0	2	2	59
2	1	19	14	4	0	1	0	0	2	0	0	3	2	46
3	1	21	23	7	0	0	0	0	2	0	0	2	2	60
4	1	28	34	10	0	0	0	1	5	0	0	7	6	94
5	1	26	34	11	1	1	0	1	4	0	0	6	6	89
6	1	26	36	11	1	1	0	1	4	0	0	6	6	93
7	0	25	35	11	0	0	0	0	3	0	0	4	3	83
8	0	28	35	11	0	0	0	0	2	0	0	3	3	84
9	0	26	32	10	0	1	0	0	2	0	0	2	2	75
10	0	27	29	9	0	1	0	0	2	0	0	3	3	76
11	0	27	24	8	1	1	0	0	2	0	0	3	3	69
12	0	21	20	6	0	0	0	0	2	0	0	2	2	53
13	0	17	15	4	0	0	0	0	1	0	0	1	1	42
14	0	14	13	4	0	0	0	0	1	0	0	1	1	36
15	0	15	11	3	0	0	0	0	1	0	0	1	1	32
16	0	14	8	2	0	0	0	0	1	0	0	1	1	27
17	0	10	6	2	0	0	0	0	1	0	0	1	1	20
18	0	7	4	1	0	0	0	0	0	0	0	0	0	13
19	0	5	3	1	1	1	0	0	3	0	0	3	3	21
20	0	6	3	1	1	1	1	0	2	0	0	3	4	21
21	0	4	2	1	1	1	1	0	3	0	0	3	3	21
22	0	3	3	2	2	2	1	0	2	0	0	3	4	21
23	0	2	3	2	2	2	0	0	2	0	0	3	4	21
24	0	2	4	2	1	1	0	0	3	0	0	4	5	23
25	0	2	6	2	1	1	0	0	3	0	0	3	3	22
26	0	1	2	1	1	1	0	0	2	0	0	1	1	11
27	0	1	1	0	1	1	0	0	1	0	0	0	0	6
28	0	1	1	0	1	1	0	0	1	0	0	1	1	6
29	0	0	1	0	1	1	0	0	1	0	0	0	0	5
30	0	14	7	5	1	1	5	0	3	0	0	4	5	46
SUBTOTAL	8	430	445	147	19	19	12	8	64	5	2	82	82	1,322
% OF SUBTOTAL	0.6%	32.5%	33.7%	11.1%	1.4%	1.4%	0.9%	0.6%	4.8%	0.4%	0.2%	6.2%	6.2%	100.0%
TOTAL	882			147	50			243						
% OF TOTAL	67%			11%	4%			18%						

2005 VIN Basis

Table 2.5 PM2.5 Emissions (by Vehicle Type and Vehicle Age) in tons/year

	MOVES SourceUseType Vehicle Categories												
	MC	PC	PT	LCT	IB	TB	SB	RT	SUSH	SULH	MH	CUSH	CULH	
Veh_Age	Motorcycle	Passenger Car	Passenger Truck	Light Commercial Truck	Intercity Bus	Transit Bus	School Bus	Refuse Truck	Single Unit Short-haul Truck	Single Unit Long-haul Truck	Motor Home	Combination Short-haul Truck	Combination Long-haul Truck	TOTAL
0	2	20	26	8	0	0	0	1	6	0	0	9	8	81
1	1	26	36	12	0	1	0	0	4	0	0	5	4	89
2	1	26	34	11	0	1	0	0	3	0	0	4	4	85
3	1	26	34	11	0	1	0	0	3	0	0	3	3	81
4	1	29	38	12	0	1	0	1	4	0	0	5	4	94
5	0	31	33	11	1	1	0	1	4	0	0	6	5	93
6	0	28	31	10	0	0	0	0	3	0	0	4	3	80
7	0	25	25	8	0	1	0	0	3	0	0	4	3	69
8	0	25	24	7	1	1	0	0	2	0	0	3	3	69
9	0	21	20	6	0	0	0	0	1	0	0	1	1	52
10	0	26	17	5	0	0	1	0	2	0	0	2	2	54
11	0	21	13	4	0	0	0	0	1	0	0	1	1	42
12	0	16	9	3	0	0	0	0	1	0	0	1	1	32
13	0	13	6	2	0	0	0	0	1	0	0	0	0	24
14	0	11	5	2	0	0	0	0	1	0	0	0	0	20
15	0	13	6	2	0	0	0	0	1	0	0	1	1	23
16	0	9	6	2	0	0	0	0	1	0	0	1	1	20
17	0	7	6	2	0	0	0	0	1	0	0	1	1	18
18	0	5	5	1	0	0	0	0	1	0	0	0	1	14
19	0	4	4	2	0	0	1	0	3	0	0	3	4	21
20	0	3	2	1	1	1	1	0	2	0	0	3	3	17
21	0	2	2	1	0	0	1	0	1	0	0	1	1	10
22	0	1	1	1	0	0	1	0	0	0	0	0	0	4
23	0	1	1	0	0	0	0	0	0	0	0	0	0	3
24	0	0	1	0	0	0	0	0	0	0	0	0	0	3
25	0	0	0	0	0	0	0	0	1	0	0	1	0	4
26	0	0	0	0	0	0	0	0	0	0	0	0	0	3
27	0	0	0	0	0	0	0	0	0	0	0	0	0	2
28	0	0	0	0	1	0	0	0	0	0	0	0	0	2
29	0	0	1	0	1	0	0	0	0	0	0	0	0	2
30	0	23	20	11	1	0	6	0	4	0	0	5	6	76
SUBTOTAL	8	413	407	135	10	11	14	6	52	4	2	64	61	1,187
% OF SUBTOTAL	0.6%	34.8%	34.3%	11.4%	0.8%	0.9%	1.2%	0.5%	4.4%	0.3%	0.1%	5.4%	5.1%	100.0%
TOTAL	827			135	35			189						
% OF TOTAL	70%			11%	3%			16%						

Table 2.6 2025 PM2.5 Emissions Differences (by Vehicle Type and Vehicle Age) in tons/year

	MOVES SourceUseType Vehicle Categories													
	MC	PC	PT	LCT	IB	TB	SB	RT	SUSH	SULH	MH	CUSH	CULH	
Veh_Age	Motorcycle	Passenger Car	Passenger Truck	Light Commercial Truck	Intercity Bus	Transit Bus	School Bus	Refuse Truck	Single Unit Short-haul Truck	Single Unit Long-haul Truck	Motor Home	Combination Short-haul Truck	Combination Long-haul Truck	TOTAL
0	(1)	(5)	(7)	(2)	(0)	(0)	0	(1)	(3)	(0)	(0)	(6)	(6)	(33)
1	(1)	(3)	(14)	(5)	(0)	(0)	(0)	(0)	(2)	(0)	(0)	(2)	(2)	(30)
2	(0)	(7)	(21)	(7)	0	0	(0)	(0)	(1)	(0)	(0)	(2)	(1)	(39)
3	0	(5)	(11)	(3)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(1)	(1)	(22)
4	0	(1)	(4)	(2)	(0)	(0)	(0)	0	2	0	0	3	2	(0)
5	0	(5)	0	0	0	0	(0)	0	(0)	(0)	(0)	0	0	(3)
6	0	(1)	5	2	0	1	(0)	0	1	0	0	3	2	13
7	0	0	9	3	(0)	(0)	0	(0)	0	0	0	0	(0)	14
8	0	3	11	4	(0)	(1)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	15
9	0	4	12	4	0	0	(0)	0	1	0	0	1	1	24
10	0	1	12	4	0	0	(0)	0	1	0	0	1	1	21
11	0	6	11	4	0	0	(0)	0	1	0	0	2	2	26
12	0	5	10	3	0	0	0	0	1	0	0	1	1	21
13	0	4	8	2	0	0	(0)	0	1	0	0	1	1	18
14	0	4	7	2	0	0	(0)	0	0	0	0	1	1	16
15	0	2	6	2	(0)	(0)	(0)	0	(0)	(0)	(0)	0	0	9
16	0	4	1	0	(0)	(0)	(0)	0	0	0	0	0	0	7
17	0	3	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	2
18	0	2	(1)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
19	(0)	2	(1)	(0)	1	1	(1)	(0)	0	0	0	(0)	(0)	1
20	(0)	2	0	(0)	(0)	(0)	0	0	0	0	0	1	1	4
21	0	2	1	0	0	0	0	0	2	0	0	2	2	11
22	0	2	2	1	2	2	0	0	2	0	0	3	3	17
23	0	2	2	1	1	1	0	0	2	0	0	3	4	17
24	0	1	4	2	1	1	0	0	2	0	0	4	5	21
25	0	1	5	2	1	1	(0)	0	2	0	0	2	3	18
26	0	1	2	1	1	1	0	0	1	0	0	1	1	8
27	0	1	0	0	1	0	0	0	0	0	0	0	0	3
28	0	1	0	0	1	0	0	0	1	0	0	1	1	4
29	0	0	0	0	0	0	0	0	1	0	0	0	0	3
30	0	(9)	(13)	(7)	0	0	(1)	(0)	(1)	(0)	(0)	(0)	(0)	(30)
SUBTOTAL	0	17	38	12	9	8	(2)	1	12	1	1	17	21	136
% OF SUBTOTAL	0.0%	12.3%	28.0%	8.9%	6.6%	6.2%	-1.7%	0.9%	8.7%	1.0%	0.5%	12.7%	15.8%	100.0%
TOTAL	55			12	15			54						
% OF TOTAL	40%			9%	11%			40%						