

APPENDIX 3
AIR QUALITY

3.1 Annual Emissions Estimate for Development Transfer Site Building

Moynihan Station Development Project

Annual Emissions Estimate for the Proposed Development Transfer Site Building

Building Size: 1,100,000 sf
Fuel Type: Natural Gas

Total Annual Fuel Consumption Estimate for Residential Uses in New York¹ 52.81 cubic ft/ sqft NG

Emission Calculations

Pollutant	Emission Factor ² (lb/10 ⁶ scf)	Total Emissions ³ (lb/yr)	Total Emissions (Tons/year)
PM	7.6	441.5	0.22
SO ₂	0.6	34.9	0.02
NO _x	100	5809.1	2.90
CO	84	4879.6	2.44
VOC	5.5	319.5	0.16

Notes:

¹ Source: CEQR Technical Manual Appendix 7 - Table "Fuel Consumption 1993 - Residential"

² AP42 Tables 1.4-1 & 1.4-2

³ Total Emission calculated as follows: Annual fuel consumption estimate * Building square feet * Emission factor
(52.81 cf/sf / 10⁶ * 1,100,000 sf * 'x' lb/10⁶ scf)

3.2 Annual Emissions from Project Construction

Annual Emissions from Project Construction (tons per year)

		2010	2011	2012	2013	2014
PM _{2.5}	Equipment	0.0	0.0	0.0	0.0	0.0
	Trucks (Idling)	0.0	0.0	0.0	0.0	0.0
	Trucks (regional)	0.0	0.0	0.1	0.1	0.0
	Workers (regional)	0.0	0.0	0.0	0.0	0.0
	Overall	0.0	0.1	0.1	0.1	0.0
PM ₁₀	Equipment	0.0	0.0	0.0	0.0	0.0
	Trucks (Idling)	0.0	0.0	0.0	0.0	0.0
	Trucks (regional)	0.0	0.1	0.2	0.2	0.0
	Workers (regional)	0.0	0.1	0.4	0.8	0.2
	Overall	0.1	0.2	0.5	1.0	0.2
CO	Equipment	4.2	30.9	28.8	25.0	1.7
	Trucks (Idling)	0.0	0.0	0.0	0.0	0.0
	Trucks (regional)	0.3	1.4	1.7	1.8	0.2
	Workers (regional)	2.2	5.6	23.2	49.5	12.4
	Overall	6.6	38.0	53.7	76.4	14.4
SO ₂	Equipment	0.0	0.0	0.0	0.0	0.0
	Trucks (Idling)	0.0	0.0	0.0	0.0	0.0
	Trucks (regional)	0.0	0.0	0.0	0.0	0.0
	Workers (regional)	0.2	0.5	1.8	3.6	0.8
	Overall	0.0	0.5	1.8	3.6	0.8
VOC	Equipment	0.1	0.7	0.6	0.5	0.1
	Trucks (Idling)	0.0	0.0	0.0	0.0	0.0
	Trucks (regional)	0.0	0.3	0.4	0.6	0.1
	Workers (regional)	0.2	0.5	1.8	3.6	0.8
	Overall	0.4	1.5	2.9	4.7	1.0
NO _x	Equipment	0.4	4.4	4.5	3.8	1.3
	Trucks (Idling)	0.0	0.0	0.0	0.0	0.0
	Trucks (regional)	0.5	2.7	3.7	4.5	0.5
	Workers (regional)	0.1	0.3	1.1	2.2	0.5
	Overall	0.9	7.4	9.3	10.5	2.4
CO ₂	Equipment	181	1,062	1,085	1,083	413
	Trucks (Idling)	1	10	14	15	2
	Trucks (regional)	380	2,474	3,843	5,103	832
	Workers (regional)	73	190	805	1,736	439
	Overall	635	3,735	5,747	7,936	1,687

3.3 Construction Equipment List

Moynihan Station - CONSTRUCTION PHASE EQUIPMENT LIST - AT PEAK PERIODS

Location/Site	Task #	Work Task	Location	Start Date*	End Date*	Shift	Equipment Type	Equipment Code	Engine Type	Size (hp)	Quantity	Daily Use	Average Use
* Developed for the project under the assumption that it starts in 2010													
Moynihan West	1	Asbestos Abatement	Full site	1/1/2010	12/31/2010	single	water spray	WS	gas	3	1	75%	50%
Moynihan West	1	Site Demolition	Full site	10/1/2010	10/31/2011	single	cutting torches	CT			2	75%	50%
Moynihan West	1	Site Demolition	Full site	10/1/2010	10/31/2011	single	concrete saws	CS	electric	15	1	75%	50%
Moynihan West	1	Site Demolition	Full site	10/1/2010	10/31/2011	single	concrete saw, hand held	CSH	electric	3	1	75%	50%
Moynihan West	1	Site Demolition	Full site	10/1/2010	10/31/2011	single	air compressor	AC	electric	200	2	75%	50%
Moynihan West	1	Site Demolition	Full site	10/1/2010	10/31/2011	single	jack hammer	JH	air	4	2	75%	50%
Moynihan West	1	Site Demolition	Full site	10/1/2010	10/31/2011	single	bobcat w/ram	BR	gas	100	2	75%	50%
Moynihan West	1	Site Demolition	Full site	10/1/2010	10/31/2011	single	bobcat w/bucket	BB	gas	100	2	75%	50%
Moynihan West	1	Site Demolition	Full site	10/1/2010	10/31/2011	single	crawler crane	CC	diesel	350	1	75%	50%
Moynihan West	1	Site Demolition	Full site	10/1/2010	10/31/2011	single	rubber tire crane	RT	diesel	250	1	75%	50%
Moynihan West	2	Foundations	Full site	1/1/2011	6/30/2012	single	rebar bender	RB	gas	20	2	25%	25%
Moynihan West	2	Foundations	Full site	1/1/2011	6/30/2012	single	welding equipment	WE	electric	2	2	25%	25%
Moynihan West	2	Foundations	Full site	1/1/2011	6/30/2012	single	concrete pumper	CP	diesel	400	1	50%	50%
Moynihan West	3	Structural Concrete	Full site	4/1/2011	9/30/2012	single	rebar bender	RB	gas	20	2	25%	25%
Moynihan West	3	Structural Concrete	Full site	4/1/2011	9/30/2012	single	welding equipment	WE		2	25%	25%	
Moynihan West	3	Structural Concrete	Full site	4/1/2011	9/30/2012	single	troweling machine	MT	gas	11	6	75%	50%
Moynihan West	3	Structural Concrete	Full site	4/1/2011	9/30/2012	single	concrete vibrator	CV	electric	3	6	50%	50%
Moynihan West	3	Structural Concrete	Full site	4/1/2011	9/30/2012	single	concrete pumper	CP	diesel	400	1	50%	50%
Moynihan West	3	Structural Steel	Full site	4/1/2011	6/30/2014	single	tower crane	TC	diesel	300	4	75%	50%
Moynihan West	3	Structural Steel	Full site	4/1/2011	9/30/2012	single	impact wrench	IW	air	8	50%	50%	
Moynihan West	3	Structural Steel	Full site	4/1/2011	9/30/2012	single	compressor	CO	diesel	150	2	75%	75%
Moynihan West	4	Façade Restoration	Full site	6/1/2012	6/30/2014	single	portable cement mixer	PM	electric	5	2	75%	50%
Moynihan West	4	Façade	Full site	2/1/2012	10/31/2012	single	portable cement mixer	PM	electric	5	2	75%	50%
Moynihan West	6	Interior Construction	Full site	6/1/2012	6/30/2014	single	scissor lift	SL	electric	15	4	75%	50%
Moynihan West	6	Interior Construction	Full site	6/1/2012	6/30/2014	single	forklift	FL	prop	25	2	25%	25%
Moynihan West	6	Interior Construction	Full site	6/1/2012	6/30/2014	single	table saw	TS	electric	1	8	50%	50%
Moynihan West	6	Interior Construction	Full site	6/1/2012	6/30/2014	single	circular saw	CS	electric	1	8	50%	50%
Moynihan West	8	Plumbing	Full site	11/1/2011	5/31/2014	single	scissor lift	SL	electric	15	2	75%	50%
Moynihan West	8	Plumbing	Full site	11/1/2011	5/31/2014	single	forklift	FL	prop	25	1	25%	25%
Moynihan West	9	Fire Protection	Full site	2/1/2012	1/31/2014	single	scissor lift	SL	electric	15	2	75%	50%
Moynihan West	9	Fire Protection	Full site	2/1/2012	1/31/2014	single	forklift	FL	prop	25	1	25%	25%
Moynihan West	10	HVAC	Full site	10/1/2011	5/31/2014	single	scissor lift	SL	electric	15	2	75%	50%
Moynihan West	10	HVAC	Full site	10/1/2011	5/31/2014	single	forklift	FL	prop	25	1	25%	25%
Moynihan West	10	HVAC - Platform Ventilation	Full site	9/1/2011	4/30/2014	single	scissor lift	SL	electric	15	2	75%	50%
Moynihan West	10	HVAC - Platform Ventilation	Full site	9/1/2011	4/30/2014	single	forklift	FL	prop	25	1	25%	25%
Moynihan West	11	Electrical	Full site	11/1/2011	5/31/2014	single	scissor lift	SL	electric	15	2	75%	50%
Moynihan West	11	Electrical	Full site	11/1/2011	5/31/2014	single	forklift	FL	prop	25	1	25%	25%
Moynihan West	12	Sitework	Full site	10/1/2013	6/30/2014	single	portable cement mixer	PM	electric	5	2	75%	50%
Moynihan West	12	Sitework	Full site	10/1/2013	6/30/2014	single	rebar bender	RB	gas	20	2	25%	25%
Moynihan West	12	Sitework	Full site	10/1/2013	6/30/2014	single	circular saw	CS	electric	1	2	50%	50%
Moynihan West	12	Sitework	Full site	10/1/2013	6/30/2014	single	unit paver cutter	UC	electric	1	2	50%	50%
Moynihan West	12	Sitework	Full site	10/1/2013	6/30/2014	single	asphalt laying equipment	AE	diesel	250	1	20%	10%
Moynihan West	12	Sitework	Full site	10/1/2013	6/30/2014	single	tamper	TA	diesel	3	2	25%	25%
Moynihan West	12	Sitework	Full site	10/1/2013	6/30/2014	single	roller	RL	diesel	150	1	25%	25%
Moynihan West	12	Sitework	Full site	10/1/2013	6/30/2014	single	compressor	CO	diesel	200	1	75%	75%
Moynihan West	12	Sitework	Full site	10/1/2013	6/30/2014	single	jack hammer	JH	air	2	25%	25%	
Moynihan West	13	Skylight	Full site	3/1/2012	11/30/2012	single	scissor lift	SL	electric	15	4	75%	50%
Moynihan West	14	General Requirements	Full site	10/1/2010	6/30/2014	single	dual hoist - high rise	DH	electric	200	4	75%	75%
Penn West	1	Demolition	Full site	12/1/2011	6/30/2012	single	excavator	EX	diesel	200	1	75%	50%
Penn West	2	Foundations	Full site	5/1/2012	11/30/2012	single	excavator	EX	diesel	200	1	75%	50%
Penn West	2	Foundations	Full site	5/1/2012	11/30/2012	single	rebar bender	RB	gas	20	2	25%	25%
Penn West	2	Foundations	Full site	5/1/2012	11/30/2012	single	welding equipment	WE	electric	2	2	25%	25%
Penn West	2	Foundations	Full site	5/1/2012	11/30/2012	single	concrete pumper	CP	diesel	400	1	50%	50%
Penn West	3	Structural Concrete	Full site	10/1/2012	11/30/2013	single	rebar bender	RB	gas	20	2	25%	25%
Penn West	3	Structural Concrete	Full site	10/1/2012	11/30/2013	single	welding equipment	WE		2	25%	25%	
Penn West	3	Structural Concrete	Full site	10/1/2012	11/30/2013	single	troweling machine	MT	gas	11	6	75%	50%
Penn West	3	Structural Concrete	Full site	10/1/2012	11/30/2013	single	concrete vibrator	CV	electric	3	4	50%	50%
Penn West	3	Structural concrete	Full site	10/1/2012	11/30/2013	single	concrete pumper	CP	diesel	400	1	50%	50%
Penn West	3	Structural Steel	Full site	10/1/2012	12/31/2013	single	tower crane	TC	diesel	300	1	75%	50%
Penn West	3	Structural Steel	Full site	10/1/2012	11/30/2013	single	impact wrench	IW	air	4	50%	50%	
Penn West	3	Structural Steel	Full site	10/1/2012	11/30/2013	single	compressor	CO	diesel	150	2	75%	75%
Penn West	4	Façade	Full site	3/1/2013	12/31/2013	single	portable cement mixer	PM	electric	5	2	75%	50%
Penn West	5	Roofing & Waterproofing	Full site	8/1/2013	1/31/2014	single							
Penn West	6	Interior Construction	Full site	1/1/2013	2/28/2014	single	scissor lift	SL	electric	15	2	75%	50%
Penn West	6	Interior Construction	Full site	1/1/2013	2/28/2014	single	forklift	FL	prop	25	1	25%	25%
Penn West	6	Interior Construction	Full site	1/1/2013	2/28/2014	single	table saw	TS	electric	1	4	50%	50%
Penn West	6	Interior Construction	Full site	1/1/2013	2/28/2014	single	circular saw	CS	electric	1	4	50%	50%
Penn West	7	Elevators	Full site	3/1/2013	2/28/2014	single							
Penn West	8	Plumbing	Full site	12/1/2012	2/28/2014	single	scissor lift	SL	electric	15	2	75%	50%
Penn West	8	Plumbing	Full site	12/1/2012	2/28/2014	single	forklift	FL	prop	25	1	25%	25%
Penn West	9	Fire Protection	Full site	12/1/2012	2/28/2014	single	scissor lift	SL	electric	15	2	75%	50%
Penn West	9	Fire Protection	Full site	12/1/2012	2/28/2014	single	forklift	FL	prop	25	1	25%	25%
Penn West	10	HVAC	Full site	11/1/2012	2/28/2014	single	scissor lift	SL	electric	15	2	75%	50%
Penn West	10	HVAC	Full site	11/1/2012	2/28/2014	single	forklift	FL	prop	25	1	25%	25%
Penn West	11	Electrical	Full site	12/1/2012	2/28/2014	single	scissor lift	SL	electric	15	2	75%	50%
Penn West	11	Electrical	Full site	12/1/2012	2/28/2014	single	forklift	FL	prop	25	1	25%	25%
Penn West	12	Sitework	Full site	11/1/2013	3/31/2014	single	portable cement mixer	PM	electric	5	2	75%	50%
Penn West	12	Sitework	Full site	11/1/2013	3/31/2014	single	rebar bender	RB	gas	20	2	25%	25%
Penn West	12	Sitework	Full site	11/1/2013	3/31/2014	single	circular saw	CS	electric	1	2	50%	50%
Penn West	12	Sitework	Full site	11/1/2013	3/31/2014	single	unit paver cutter	UC	electric	1	2	50%	50%
Penn West	12	Sitework	Full site	11/1/2013	3/31/2014	single	asphalt laying equipment	AE	diesel	250	1	20%	10%
Penn West	12	Sitework	Full site	11/1/2013	3/31/2014	single	tamper	TA	diesel	3	2	25%	25%
Penn West	12	Sitework	Full site	11/1/2013	3/31/2014	single	roller	RL	diesel	150	1	25%	25%
Penn West	12	Sitework	Full site	11/1/2013	3/31/2014	single	compressor	CO	diesel	200	1	75%	75%
Penn West	12	Sitework	Full site	11/1/2013	3/31/2014	single	jack hammer	JH	air	2	25%	25%	
Penn West	14	General Requirements	Full site	12/1/2011	3/31/2014	single	dual hoist - high rise	DH	electric	200	1	75%	75%

Moynihan Station - Equipment Deliveries

Phase	Task #	Work task	Location	Start Date*	End Date*	Truck Type	Truck Code	Full Load Weight (tons)	Empty Load Weight (tons)	Details	Number of Days	Peak Hr Max.	Peak del. per day	Total Deliveries for Period	Average Deliveries per day
* Developed for the project under the assumption that it starts in 2010															
Moynihan West	1	Asbestos abatement	Full site	1/1/2010	12/31/2010	box truck	BT	9	4		252	5	20	500	2.0
Moynihan West	1	Site Demolition	Full site	10/1/2010	10/31/2011	dump truck	DT	30	5	20 yard	273	5	25	813	3.0
Moynihan West	1	Site Demolition	Full site	10/1/2010	10/31/2011	tractor trailer	TT	25	10		273	1	1	42	0.2
Moynihan West	2	Foundations	Full site	1/1/2011	6/30/2012	concrete truck	CT	34	10	10 yard capacity	378	5	30	1500	4.0
Moynihan West	2	Foundations	Full site	1/1/2011	6/30/2012	concrete pumper	CP	n/a	10		378	1	1	1	0.0
Moynihan West	2	Foundations	Full site	1/1/2011	6/30/2012	dump truck	DT	30	5	20 yard	378	5	25	4907	13.0
Moynihan West	2	Foundations	Full site	1/1/2011	6/30/2012	trailers of rebar	TT	25	10		378	1	1	75	0.2
Moynihan West	2	Foundations	Full site	1/1/2011	6/30/2012	trailers of formwork	TT	25	10		378	1	1.0	53	0.1
Moynihan West	3	Construction	Full site	4/1/2011	9/30/2012	concrete truck	CT	34	10	10 yard capacity	378	5	30	83	0.2
Moynihan West	3	Construction	Full site	4/1/2011	9/30/2012	concrete pumper	CP	n/a	10		378	1	1	1	0.0
Moynihan West	3	Construction	Full site	4/1/2011	9/30/2012	trailers of rebar	TT	25	10		378	1	1	4	0.0
Moynihan West	3	Construction	Full site	4/1/2011	9/30/2012	trailers of formwork	TT	25	10		378	1	1	2	0.0
Moynihan West	3	Construction	Full site	4/1/2011	9/30/2012	tractor trailer	TT	25	10	steel deliveries	378	1	1	341	0.9
Moynihan West	4	Façade Restorati	Full site	6/1/2012	6/30/2014	tractor trailer	TT	25	10	terra cotta	525	1	1	461	0.9
Moynihan West	4	Façade	Full site	2/1/2012	10/31/2012	tractor trailer	TT	25	10		189	1	1	19	0.1
Moynihan West	4	Façade	Full site	2/1/2012	10/31/2012	masonry truck	MT	24	10		189				
Moynihan West	5	Roofing & Waterpr	Full site	2/1/2012	9/30/2012	tractor trailer	TT	25	10		168	1	1	74	0.4
Moynihan West	6	Interior Constructio	Full site	6/1/2012	6/30/2014	masonry truck	MT	24	10		525	1	1	117	0.2
Moynihan West	6	Interior Constructio	Full site	6/1/2012	6/30/2014	tractor trailer	TT	25	10		525	1	3	1260	2.4
Moynihan West	6	Interior Constructio	Full site	6/1/2012	6/30/2014	box truck	BT	9	4		525	1	1	315	0.6
Moynihan West	7	Conveying System:	Full site	10/1/2012	3/31/2014	tractor trailer	TT	25	10		378	1	1	46	0.1
Moynihan West	8	Plumbing	Full site	11/1/2011	5/31/2014	tractor trailer	TT	25	10		651	1	1	56	0.1
Moynihan West	8	Plumbing	Full site	11/1/2011	5/31/2014	box truck	BT	9	4		651	2	2	326	0.5
Moynihan West	8.3	Fire Protection	Full site	2/1/2012	1/31/2014	tractor trailer	TT	25	10		504	1	1	33	0.1
Moynihan West	8.3	Fire Protection	Full site	2/1/2012	1/31/2014	box truck	BT	9	4		504	2	2	126	0.3
Moynihan West	8.4	HVAC	Full site	10/1/2011	5/31/2014	tractor trailer	TT	25	10		672	1	1	102	0.2
Moynihan West	8.4	HVAC	Full site	10/1/2011	5/31/2014	box truck	BT	9	4		672	2	2	336	0.5
Moynihan West	8.4	HVAC - Platform V	Full site	9/1/2011	4/30/2014	tractor trailer	TT	25	10		924	1	1	102	0.1
Moynihan West	8.4	HVAC - Platform V	Full site	9/1/2011	4/30/2014	box truck	BT	9	4		924	2	2	336	0.4
Moynihan West	9	Electrical	Full site	11/1/2011	5/31/2014	tractor trailer	TT	25	10		651	1	1	75	0.1
Moynihan West	9	Electrical	Full site	11/1/2011	5/31/2014	box truck	BT	9	4		651	2	2	326	0.5
Moynihan West	11	Equipment	Full site	8/1/2012	5/31/2014	tractor trailer	TT	25	10		462	1	1	4	0.0
Moynihan West	12	Sitework	Full site	10/1/2013	6/30/2014	tractor trailer	TT	25	10		189	1	1	45	0.2
Moynihan West	12	Sitework	Full site	10/1/2013	6/30/2014	concrete truck	CT	34	10	10 yard capacity	189	1	1	89	0.5
Moynihan West	12	Sitework	Full site	10/1/2013	6/30/2014	dump truck	DT	30	5	20 yard	189	1	5	18	0.1
Moynihan West	13	Skylight	Full site	3/1/2012	11/30/2012	tractor trailer	TT	25	10		189	1	1	50	0.3
Moynihan West	14	General Requirem	Full site	10/1/2010	6/30/2014	trash hauling	TH	15	5		945	3	3	2835	3.0
Moynihan West	14	General Requirem	Full site	10/1/2010	6/30/2014	fuel truck	FT	20	6	4,000 gal. capacity	945	1	1	95	0.1
Penn West	1	Demolition	Full site	12/1/2011	6/30/2012	dump truck	DT	30	5	20 yard	147	5	20	834	5.7
Penn West	2	Foundations	Full site	5/1/2012	11/30/2012	concrete truck	CT	34	10	10 yard capacity	147	5	30	143	1.0
Penn West	2	Foundations	Full site	5/1/2012	11/30/2012	concrete pumper	CP	n/a	10		147	1	1	1	0.0
Penn West	2	Foundations	Full site	5/1/2012	11/30/2012	dump truck	DT	30	5	20 yard	147	5	14	2017	13.7
Penn West	2	Foundations	Full site	5/1/2012	11/30/2012	trailers of rebar	TT	25	10		147	1	1	7	0.0
Penn West	2	Foundations	Full site	5/1/2012	11/30/2012	trailers of formwork	TT	25	10		147	1	1	2	0.0
Penn West	3	Structural concrete	Full site	10/1/2012	11/30/2013	concrete truck	CT	34	10	10 yard capacity	294	5	30	5178	17.6
Penn West	3	Structural concrete	Full site	10/1/2012	11/30/2013	concrete pumper	CP	n/a	10		294	1	1	1	0.0
Penn West	3	Structural concrete	Full site	10/1/2012	11/30/2013	trailers of rebar	TT	25	10		294	1	1	259	0.9
Penn West	3	Structural concrete	Full site	10/1/2012	11/30/2013	trailers of formwork	TT	25	10		294	1	1	55	0.2
Penn West	3	Structural Steel	Full site	10/1/2012	11/30/2013	tractor trailer	TT	25	10	steel deliveries	294	1	11	2964	10.1
Penn West	4	Façade	Full site	3/1/2013	12/31/2013	tractor trailer	TT	25	10		210	1	2	410	2.0
Penn West	4	Façade	Full site	3/1/2013	12/31/2013	masonry truck	MT	24	10		210				
Penn West	5	Roofing & Waterpr	Full site	8/1/2013	1/31/2014	tractor trailer	TT	25	10		126	1	1	21	0.2
Penn West	6	Interior Constructio	Full site	1/1/2013	2/28/2014	masonry truck	MT	24	10		294	1	6	1671	5.7
Penn West	6	Interior Constructio	Full site	1/1/2013	2/28/2014	tractor trailer	TT	25	10		294	1	6	1563	5.3
Penn West	6	Interior Constructio	Full site	1/1/2013	2/28/2014	box truck	BT	9	4		294	1	2	391	1.3
Penn West	7	Conveying System:	Full site	3/1/2013	2/28/2014	tractor trailer	TT	25	10		252	1	1	4	0.0
Penn West	8	Plumbing	Full site	12/1/2012	2/28/2014	tractor trailer	TT	25	10		315	1	1	151	0.5
Penn West	8	Plumbing	Full site	12/1/2012	2/28/2014	box truck	BT	9	4		315	2	2	168	0.5
Penn West	8.3	Fire Protection	Full site	12/1/2012	2/28/2014	tractor trailer	TT	25	10		315	1	1	137	0.4
Penn West	8.3	Fire Protection	Full site	12/1/2012	2/28/2014	box truck	BT	9	4		315	2	2	84	0.3
Penn West	8.4	HVAC	Full site	11/1/2012	2/28/2014	tractor trailer	TT	25	10		336	1	1	258	0.8
Penn West	8.4	HVAC	Full site	11/1/2012	2/28/2014	box truck	BT	9	4		336	2	2	185	0.6
Penn West	9	Electrical	Full site	12/1/2012	2/28/2014	tractor trailer	TT	25	10		315	1	1	175	0.6
Penn West	9	Electrical	Full site	12/1/2012	2/28/2014	box truck	BT	9	4		315	2	2	168	0.5
Penn West	11	Equipment	Full site	2/1/2013	2/28/2014	tractor trailer	TT	25	10		273	1	1	0	0.0
Penn West	12	Sitework	Full site	11/1/2013	3/31/2014	tractor trailer	TT	25	10		105	1	1	7	0.1
Penn West	12	Sitework	Full site	11/1/2013	3/31/2014	concrete truck	CT	34	10	10 yard capacity	105	1	1	13	0.1
Penn West	12	Sitework	Full site	11/1/2013	3/31/2014	dump truck	DT	30	5	20 yard	105	1	5	15	0.1
Penn West	13	Special Constructio	Full site	12/1/2011	3/31/2014	tractor trailer	TT	25	10		588	1	1	48	0.1
Penn West	14	General Requirem	Full site	12/1/2011	3/31/2014	trash hauling	TH	15	5		588	3	3	1764	3.0
Penn West	14	General Requirem	Full site	12/1/2011	3/31/2014	fuel truck	FT	20	6	4,000 gal. capacity	588	1	1	59	0.1

3.5 Construction Workforce Projections

Moynihan Station - Workforce Projections

Location/Site	Task	Work Task	Start Date*	End Date*	men/day
* Developed for the project under the assumption that it starts in 2010					
Moynihan West	1	ASBESTOS ABATEMENT	1/1/2010	12/31/2010	51
Moynihan West	1	SITE DEMOLITION	10/1/2010	10/31/2011	45
Moynihan West	2	FOUNDATIONS	1/1/2011	6/30/2012	8
Moynihan West	3	CONSTRUCTION	4/1/2011	9/30/2012	116
Moynihan West	4	FAÇADE RESTORATION	6/1/2012	6/30/2014	69
Moynihan West	4	FAÇADE	2/1/2012	10/31/2012	9
Moynihan West	5	ROOFING & WATERPROOFING	2/1/2012	9/30/2012	25
Moynihan West	6	INTERIOR CONSTRUCTION	6/1/2012	6/30/2014	339
Moynihan West	7	CONVEYING SYSTEMS	10/1/2012	3/31/2014	10
Moynihan West	8	PLUMBING	11/1/2011	5/31/2014	6
Moynihan West	8.3	FIRE PROTECTION	2/1/2012	1/31/2014	4
Moynihan West	8.4	HVAC SYSTEMS	10/1/2011	5/31/2014	26
Moynihan West	8.4	HVAC - PLATFORM VENTILATION	9/1/2011	4/30/2015	16
Moynihan West	9	ELECTRICAL SYSTEMS	11/1/2011	5/31/2014	14
Moynihan West	11	EQUIPMENT	8/1/2012	5/31/2014	3
Moynihan West	12	SITWORK	10/1/2013	6/30/2014	61
Moynihan West	13	SKYLIGHT	3/1/2012	11/30/2012	145
Moynihan West	14	GENERAL REQUIREMENTS	10/1/2010	6/30/2014	17
Penn West	1	SITE DEMOLITION	12/1/2011	6/30/2012	16
Penn West	2	FOUNDATIONS	5/1/2012	11/30/2012	19
Penn West	3	CONSTRUCTION	10/1/2012	11/30/2013	232
Penn West	4	FAÇADE	3/1/2013	12/31/2013	191
Penn West	5	ROOFING & WATERPROOFING	8/1/2013	1/31/2014	40
Penn West	6	INTERIOR CONSTRUCTION	1/1/2013	2/28/2014	432
Penn West	7	CONVEYING SYSTEMS	3/1/2013	2/28/2014	15
Penn West	8	PLUMBING	12/1/2012	2/28/2014	57
Penn West	8.3	FIRE PROTECTION	12/1/2012	2/28/2014	16
Penn West	8.4	HVAC SYSTEMS	11/1/2012	2/28/2014	48
Penn West	9	ELECTRICAL SYSTEMS	12/1/2012	2/28/2014	72
Penn West	11	EQUIPMENT	2/1/2013	2/28/2014	7
Penn West	12	SITWORK	11/1/2013	3/31/2014	13
Penn West	13	SPECIAL CONSTRUCTION	12/1/2011	3/31/2014	74
Penn West	14	GENERAL REQUIREMENTS	12/1/2011	3/31/2014	33

3.6 Annual Emissions from Project Construction - Equipment Contribution

Emission factors for PM_{2.5}, PM₁₀, CO, SO₂, VOC, nitrogen oxides (nitrogen oxide and NO₂, collectively referred to as NO_x), and CO₂ from on-site construction engines were developed using the EPA's NONROAD2005 Emission Model (NONROAD). The emission factors for each type of equipment were calculated from the NONROAD output files (i.e., calculated from regional emissions estimates). The model is based on source inventory data accumulated for specific categories of nonroad equipment. These emission factors were calculated assuming the exclusive use of ultra-low-sulfur diesel (ULSD), diesel engines of Tier 2 or cleaner certification, the use of electrically powered engines where practicable, and the application of diesel particle filters (DPFs) on all nonroad diesel engines 50 hp or greater.

The annual emissions from project construction equipment were then prepared by multiplying the above emission rates by the number of engines, the work hours per day, the number of work days within the year, and fraction of the day each engine would be expected to work during each day and each month.

Moynihan Station - Annual Emissions from Projection Construction Equipment (CO₂)

			Operating Hours*					*from Nonroad Emission Model	CO2 Emission (tons/yr)**				
Diesel Equipment Type	Equipment Code	Size (hp)	2010	2011	2012	2013	2014	Emission factor g CO2/hp-h	2010	2011	2012	2013	2014
asphalt laying equipment	AE	250	0	0	0	17	30	316	0	0	0	1	3
compressor	CO	150	0	1,701	2,268	2,552	851	228	0	64	86	96	32
concrete pumper	CP	400	0	882	1,050	462	0	316	0	123	146	64	0
crawler crane	CC	350	189	630	0	0	0	228	17	55	0	0	0
excavator	EX	200	0	63	819	0	0	316	0	4	57	0	0
roller	RL	150	0	0	0	53	95	316	0	0	0	3	5
rubber tire crane	RT	250	189	630	0	0	0	228	12	40	0	0	0
tamper	TA	2.5	0	0	0	105	189	621	0	0	0	0	0
tower crane	TC	300	0	2,268	3,213	3,780	1,512	228	0	171	242	285	114
Total:									29	457	531	450	154
* Operating Hours calculated from Construction Equipment List - Number of Days Equipment is Present per Year * Quantity * Daily Use % * Average Use % * 8hr/day													
** CO ₂ Emissions = Size (hp) * Operating Hours * Emission factor (g/hp-h) * 1ton / 907,184g													
			Operating Hours*					*from Nonroad Emission Model	CO2 Emission (tons/yr)**				
Gas Equipment Type	Equipment Code	Size (hp)	2010	2011	2012	2013	2014	Emission factor g CO2/hp-h	2010	2011	2012	2013	2014
rebar bender	RB	20	0	441	525	336	189	503	0	5	6	4	2
troweling machine	MT	11	0	3,402	4,536	4,158	0	512	0	21	28	26	0
bobcat w/bucket	BB	100	378	1,260	0	0	0	460	19	64	0	0	0
bobcat w/ram	BR	100	378	1,260	0	0	0	460	19	64	0	0	0
water spray	WS	2.5	756	0	0	0	0	581	1	0	0	0	0
Total:									40	154	34	30	2
* Operating Hours calculated from Construction Equipment List - Number of Days Equipment is Present per Year * Quantity * Daily Use % * Average Use % * 8hr/day													
** CO ₂ Emissions = Size (hp) * Operating Hours * Emission factor (g/hp-h) * 1ton / 907,184g													
			Operating Hours*					*from Nonroad Emission Model	CO2 Emission (tons/yr)**				
Propane Equipment Type	Equipment Code	Size (hp)	2010	2011	2012	2013	2014	Emission factor g CO2/hp-h	2010	2011	2012	2013	2014
forklift	FL	25	0	116	819	1,512	441	142	0	0	3	6	2
Total:									0	0.5	3	6	2
* Operating Hours calculated from Construction Equipment List - Number of Days Equipment is Present per Year * Quantity * Daily Use % * Average Use % * 8hr/day													
** CO ₂ Emissions = Size (hp) * Operating Hours * Emission factor (g/hp-h) * 1ton / 907,184g													
			Operating Hours*						CO2 Emission (kWh)**				
Electric Equipment Type	Equipment Code	Size (hp) or amps	2010	2011	2012	2013	2014	Size (kW)	2010	2011	2012	2013	2014
air compressor	AC	200	378	1,260	0	0	0	149.1	56,375	187,916	0	0	0
circular saw	CS	15	189	630	2,352	6,468	3,108	11.2	2,114	7,047	26,308	72,348	34,765
concrete saw, hand held	CSH	2.5	189	630	0	0	0	1.9	352	1,174	0	0	0
concrete saws	CS	15	189	630	2,352	6,468	3,108	11.2	2,114	7,047	26,308	72,348	34,765
concrete vibrator	CV	3	0	2,268	2,772	1,848	0	2.2	0	5,074	6,201	4,134	0
cutting torches	CT	0	378	1,260	0	0	0	0.0	0	0	0	0	0
dual hoist - high rise	DH	200	1,134	4,631	5,670	5,670	2,552	149.1	169,125	690,593	845,624	845,624	380,531
portable cement mixer	PM	5	0	0	2,016	3,402	1,890	3.7	0	0	7,517	12,684	7,047
scissor lift	SL	15	0	1,386	12,096	18,144	5,292	11.2	0	15,503	135,300	202,950	59,194
table saw	TS	0.5	0	0	2,352	6,048	2,352	0.4	0	0	877	2,255	877
unit paver cutter	UC	0.5	0	0	0	420	756	0.4	0	0	0	157	282
welding equipment	WE	0	0	441	525	231	0	0.0	0	0	0	0	0
Total (kWh):									230,080	914,354	1,048,135	1,212,499	517,459
Total (tons):***									113	450	516	597	255
* Operating Hours calculated from Construction Equipment List - Number of Days Equipment is Present per Year * Quantity * Daily Use % * Average Use % * 8hr/day													
** CO ₂ Emissions (kWh) = Size (kW) * Operating Hours													
*** CO ₂ Emissions (tons) = CO ₂ Emissions (kWh) * Emission Factor (tons/MWh); Emission Factor from PlanNYC Inventory -> 98.02 lb/MWh = 0.493 tons/MWh													

Total Equipment Emissions: 181 1,062 1,085 1,083 413 tons CO₂e

3.7 Annual Emissions from Project Construction - Idling Trucks Contribution

With respect to trucks, idling emission rates for PM_{2.5}, PM₁₀, CO, VOC, and NO_x for on-site truck engines were developed using the EPA MOBILE6.2 Emission Model (MOBILE6). Emissions rates for SO₂ and CO₂ were developed using diesel fuel content factors. Controlled truck fleets (i.e., truck fleets under long-term contract, such as concrete trucks) was assumed to use only trucks equipped with DPFs.

The annual emissions from idling construction trucks were then calculated by multiplying the above idling emission rates by the number of trucks per day, the idling time and the DPF reduction factor.

Emissions from Construction Truck Trips

An analysis was performed to estimate emissions from construction truck trips generated by the project. Mobile 6.2 emission rates, truck fuel efficiencies, and the predicted addition of vehicle miles traveled (VMT) were used to calculate these emissions.

		Data Extracted from Construction Equipment Deliveries							
		2010	2011	2012	2013	2014			
Truck Counts by Type & by Year	BT = Box Trucks	BT	500	105	667	1493	405		
	DT = Dump Trucks	DT	188	4015	4368	12	21		
	TT = Tractor Trailers	TT	10	321	1778	5939	828		
	CT = Concrete Trucks	CT	0	1041	1794	4104	67		
	CP = Concrete Pumps	CP	0	2	2	1	0		
	MT = Material trucks	MT	0	0	33	1489	267		
	TH = Trash Hauling	TH	189	819	1512	1512	567		
	FT = Fuel Trucks	FT	6	27	50	50	19		
	BT,DT,TT,MT		Counts	698	4,441	6,846	8,933	1,521	Sum of BT, DT, TT, MT per year
	CT,CP,TH,FT		Counts	195	1,889	3,358	5,667	653	Sum of CT, CP, TH, FT per year
All		Counts	893	6,330	10,204	14,600	2,174		
*All Pollutants except CO2	BT,DT,TT,MT	VMT (miles)	34,900	222,050	342,300	446,650	76,050	Number of Trucks * Roundtrip Distance, where Roundtrip Distance = 25 miles * 2 = 50 miles	
	CT,CP,TH,FT	VMT (miles)	9,750	94,450	167,900	283,350	32,650	Number of Trucks * Roundtrip Distance, where Roundtrip Distance = 25 miles * 2 = 50 miles	
	All	VMT (miles)	44,650	316,500	510,200	730,000	108,700		
*CO2 only	BT,DT,TT,MT	VMT (miles)	194,044	1,234,598	1,903,188	2,483,374	422,838	Number of Trucks * Roundtrip Distance, where Roundtrip Distance = 139 miles * 2 = 278 miles	
	CT,CP,TH,FT	VMT (miles)	9,750	94,450	167,900	283,350	32,650	Number of Trucks * Roundtrip Distance, where Roundtrip Distance = 25 miles * 2 = 50 miles	
	All	VMT (miles)	203,794	1,329,048	2,071,088	2,766,724	455,488		
MPG for Trucks during construction (2010-2017) from annual energy outlook			6.0	6.0	6.1	6.1	6.1		
*All Pollutants except CO2	BT,DT,TT,MT	Gallons	5,792	36,806	56,571	73,363	12,373	VMT (miles) * MPG	
	CT,CP,TH,FT	Gallons	1,618	15,656	27,749	46,541	5,312	VMT (miles) * MPG	
	All	Gallons	7,410	52,461	84,320	119,904	17,686	VMT (miles) * MPG	
*CO2 only	BT,DT,TT,MT	Gallons	32,204	204,641	314,537	407,900	68,796	VMT (miles) * MPG	
	CT,CP,TH,FT	Gallons	1,618	15,656	27,749	46,541	5,312	VMT (miles) * MPG	
	All	Gallons	33,822	220,296	342,286	454,441	74,109	VMT (miles) * MPG	
SO2	g/gallon EF	0.1007	0.1007	0.1007	0.1007	0.1007	See Calculation Below		
CO2	g/gallon EF	10,186	10,186	10,186	10,186	10,186	based on the gasoline and diesel fuel carbon content, assuming that all carbon is transformed to CO2 (The Code of Federal Regulations (40 CFR 600.113))		
Tons SO2 from construction truck trips		Tons	0.0008	0.0058	0.0094	0.0133	0.0020	Gallons * g/gallon EF	
Tons CO2e from construction truck trips		Tons	380	2,474	3,843	5,103	832	Gallons * g/gallon EF	

Information Below from NYMTC Emissions Report for Manhattan, NY				Emission Factor from Mobile 6.2					
VMT	Speed			2010	2011	2012	2013	2014	
31% Freeways	3,349,022 23.7mph	PM2.5 EF (g/vh-mi)		0.1730	0.1333	0.0963	0.0847	0.0683	
		PM10 EF (g/vh-mi)		0.2209	0.1776	0.1376	0.1250	0.1071	
		CO EF (g/vh-mi)		2.43	1.98	1.39	1.05	0.91	
		VOC EF (g/vh-mi)		0.53	0.491	0.449	0.436	0.422	
		NOx EF (g/vh-mi)		7.607	6.539	5.495	4.724	3.869	
47% Arterials	5,173,540 9.1mph	PM2.5 EF (g/vh-mi)		0.1730	0.1333	0.0963	0.0847	0.0683	
		PM10 EF (g/vh-mi)		0.2209	0.1776	0.1376	0.1250	0.1071	
		CO EF (g/vh-mi)		5.58	4.31	3.18	2.41	2.09	
		VOC EF (g/vh-mi)		0.948	0.879	0.802	0.78	0.755	
		NOx EF (g/vh-mi)		9.317	7.898	6.508	5.548	4.432	
22% Locals	2,373,946 3.7mph	PM2.5 EF (g/vh-mi)		0.1730	0.1333	0.0963	0.0847	0.0683	
		PM10 EF (g/vh-mi)		0.2209	0.1776	0.1376	0.1250	0.1071	
		CO EF (g/vh-mi)		8.36	6.45	4.77	3.61	3.13	
		VOC EF (g/vh-mi)		1.233	1.143	1.043	1.014	0.982	
		NOx EF (g/vh-mi)		11.318	9.571	7.876	6.71	5.347	
		PM2.5 EF (g/vh-mi)		0.173	0.133	0.096	0.085	0.068	*Weighed Average: EF (Freeway) * % + EF (Arterials) * % + EF (Locals) * %
		PM10 EF (g/vh-mi)		0.381	0.337	0.297	0.285	0.267	*Includes Road Dust
		CO EF (g/vh-mi)		5.218	4.029	2.976	2.253	1.954	
		VOC EF (g/vh-mi)		0.882	0.817	0.746	0.725	0.702	
		NOx EF (g/vh-mi)		9.227	7.845	6.495	5.548	4.458	

Resuspended Road Dust (PM10 Only)

Emission Factor	k	a	b	C	Avg. Vehicle Weight	Silt content
g/VMT	g/VMT				tons	lb
0.160	7.3	0.65	1.5	0.2119	2.5	5.085
						0.03

Tons PM2.5 from construction truck trips	Tons	0.0085	0.0465	0.0542	0.0682	0.0082	VMT (miles) * EF (g/miles)
Tons PM10 from construction truck trips	Tons	0.0187	0.1177	0.1672	0.2290	0.0320	VMT (miles) * EF (g/miles)
Tons CO from construction truck trips	Tons	0.2568	1.4058	1.6738	1.8133	0.2341	VMT (miles) * EF (g/miles)
Tons VOC from construction truck trips	Tons	0.0434	0.2851	0.4196	0.5836	0.0841	VMT (miles) * EF (g/miles)
Tons NOx from construction truck trips	Tons	0.4542	2.7369	3.6526	4.4643	0.5342	VMT (miles) * EF (g/miles)

SO2

15 ppm = 15 mg S / kg diesel fuel
 Density of diesel fuel = 6.7 - 7.4 lb/gal
 1lb = 0.4535924kg
 1g = 1000 mg
 15 ppm = 15 mg S / kg diesel fuel * 1g / 1000mg * 7.4lb/gal * .453kg/lb = 0.0503 g S /gallon

MW S = 32
 MW SO2 = 64

Diesel SO2 per gallon of fuel =
 0.0503 * (64/32) = 0.1007 g SO2 /gal

Emissions from Construction Worker Car Trips

An analysis was performed to estimate emissions from construction worker car trips generated by the project. Mobile 6.2 emission rates, auto fuel efficiencies, and the predicted addition of vehicle miles traveled (VMT) were used to calculate these emissions.

Location/Site	Task	Work Task	Start Date	End Date	men/day	Number of Workdays*					Number of Round trips by car**				
						2010	2011	2012	2013	2014	2010	2011	2012	2013	2014
* Developed for the project under the assumption that it starts in 2010						Extracted from Construction Workforce Projections					**Number of Workers * Number of Workdays * 2 * Model Split Car / Vehicle Occupancy, where 2 accounts for roundtrips, model split = 40%, vehicle occupancy = 1.2				
Moynihn West	1	ASBESTOS ABATEMENT	1/1/2010	12/31/2010	51	252					10,496	0	0	0	0
Moynihn West	1	SITE DEMOLITION	10/1/2010	10/31/2011	45	63	210				2,315	7,718	0	0	0
Moynihn West	2	FOUNDATIONS	1/1/2011	6/30/2012	8		252	126			0	1,646	823	0	0
Moynihn West	3	CONSTRUCTION	4/1/2011	9/30/2012	116		189				0	17,905	17,905	0	0
Moynihn West	4	FAÇADE RESTORATION	6/1/2012	6/30/2014	69			147	252	126	0	0	8,283	14,200	7,100
Moynihn West	4	FAÇADE	2/1/2012	10/31/2012	9			189			0	0	1,389	0	0
Moynihn West	5	ROOFING & WATERPROOFING	2/1/2012	9/30/2012	25			168			0	0	3,430	0	0
Moynihn West	6	INTERIOR CONSTRUCTION	6/1/2012	6/30/2014	339			147	252	126	0	0	40,697	69,766	34,883
Moynihn West	7	CONVEYING SYSTEMS	10/1/2012	3/31/2014	10			63	252	63	0	0	515	2,058	515
Moynihn West	8	PLUMBING	11/1/2011	5/31/2014	6	42	252	252	105		0	206	1,235	1,235	515
Moynihn West	8.3	FIRE PROTECTION	2/1/2012	1/31/2014	4			231	252	21	0	0	755	823	69
Moynihn West	8.4	HVAC SYSTEMS	10/1/2011	5/31/2014	26	63	252	252	105		0	1,338	5,351	5,351	2,230
Moynihn West	8.4	HVAC - PLATFORM VENTILATIC	9/1/2011	4/30/2015	16	84	252	252	252		0	1,098	3,293	3,293	3,293
Moynihn West	9	ELECTRICAL SYSTEMS	11/1/2011	5/31/2014	14	42	252	252	105		0	480	2,881	2,881	1,201
Moynihn West	11	EQUIPMENT	8/1/2012	5/31/2014	3		105	252	105		0	0	257	617	257
Moynihn West	12	SITEWORK	10/1/2013	6/30/2014	61			189	63	126	0	0	3,138	6,277	0
Moynihn West	13	SKYLIGHT	3/1/2012	11/30/2012	145			189			0	0	22,381	0	0
Moynihn West	14	GENERAL REQUIREMENTS	10/1/2010	6/30/2014	17	63	252	252	252	126	875	3,499	3,499	3,499	1,749
Penn West	1	SITE DEMOLITION	12/1/2011	6/30/2012	16		126				0	274	1,646	0	0
Penn West	2	FOUNDATIONS	5/1/2012	11/30/2012	19		147				0	0	2,281	0	0
Penn West	3	CONSTRUCTION	10/1/2012	11/30/2013	232		63	231			0	0	11,936	43,767	0
Penn West	4	FAÇADE	3/1/2013	12/31/2013	191			210			0	0	0	32,757	0
Penn West	5	ROOFING & WATERPROOFING	8/1/2013	1/31/2014	40				21		0	0	0	0	686
Penn West	6	INTERIOR CONSTRUCTION	1/1/2013	2/28/2014	432			252	42		0	0	0	88,906	14,818
Penn West	7	CONVEYING SYSTEMS	3/1/2013	2/28/2014	15			210	42		0	0	0	2,573	515
Penn West	8	PLUMBING	12/1/2012	2/28/2014	57			252	42		0	0	978	11,731	1,955
Penn West	8.3	FIRE PROTECTION	12/1/2012	2/28/2014	16			21	252	42	0	0	274	3,293	549
Penn West	8.4	HVAC SYSTEMS	11/1/2012	2/28/2014	48			42	252	42	0	0	1,646	9,878	1,646
Penn West	9	ELECTRICAL SYSTEMS	12/1/2012	2/28/2014	72			21	252	42	0	0	1,235	14,818	2,470
Penn West	11	EQUIPMENT	2/1/2013	2/28/2014	7			231	42		0	0	0	1,321	240
Penn West	12	SITEWORK	11/1/2013	3/31/2014	13			42	63		0	0	0	446	669
Penn West	13	SPECIAL CONSTRUCTION	12/1/2011	3/31/2014	74		21	252	252	63	0	1,269	15,229	15,229	3,807
Penn West	14	GENERAL REQUIREMENTS	12/1/2011	3/31/2014	33		21	252	252	63	0	566	6,791	6,791	1,698
						378	1,197	3,759	5,271	1,764	13,686	35,998	154,710	338,370	87,139

MPG for light vehicles during construction (2010-2015) from annual energy outlook

	2010	2011	2012	2013	2014
	20.6	20.8	21.0	21.3	21.7

worker vehicle trips during construction period (veh)
trip distance per vehicle (miles/veh)
VMT for construction workers during construction period (miles)

13,686	35,998	154,710	338,370	87,139
11.19	11.19	11.19	11.19	11.19
153,143	402,816	1,731,207	3,786,355	975,087

gallons used by workers commuting by car during construction period (gal)

7.426	19,374	82,311	177,399	44,907
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g SO2 per gallon gasoline
g CO2 per gallon gasoline

0.0826	0.0826	0.0826	0.0826	0.0826
8.877	8.877	8.877	8.877	8.877

See Calculation Below based on the gasoline and diesel fuel carbon content, assuming that all carbon is transformed to CO2 (The Code of Federal Regulations (40 CFR 600.113))

Tons SO2 from construction worker trips by car
Tons CO2e from construction worker trips by car

0.0097	0.0018	0.0075	0.0162	0.0041
73	190	805	1,736	439

Information Below from NYMTC Emissions Report for Manhattan, NY

VMT	Speed	Emission Factor from Mobile 6.2					
		2010	2011	2012	2013	2014	
31% Freeways 3,349,022	23.7mph	PM2.5 EF (g/wh-mi)	0.0116	0.0116	0.0116	0.0115	0.0115
		PM10 EF (g/wh-mi)	0.0252	0.0251	0.0251	0.0250	0.0250
		CO EF (g/wh-mi)	9.94	9.64	9.29	9.08	8.86
		VOC EF (g/wh-mi)	0.5663	0.5114	0.4585	0.4145	0.3785
		NOx EF (g/wh-mi)	0.4315	0.3935	0.3605	0.3285	0.3025
47% Arterials 5,173,540	9.1mph	PM2.5 EF (g/wh-mi)	0.0116	0.0116	0.0116	0.0115	0.0115
		PM10 EF (g/wh-mi)	0.0252	0.0251	0.0251	0.0250	0.0250
		CO EF (g/wh-mi)	12.38	11.98	11.5	11.22	10.94
		VOC EF (g/wh-mi)	0.9393	0.8455	0.7556	0.6837	0.6257
		NOx EF (g/wh-mi)	0.7098	0.6489	0.5959	0.5459	0.5039
22% Locals 2,373,946	3.7mph	PM2.5 EF (g/wh-mi)	0.0116	0.0116	0.0116	0.0115	0.0115
		PM10 EF (g/wh-mi)	0.0252	0.0251	0.0251	0.0250	0.0250
		CO EF (g/wh-mi)	19.47	18.55	17.68	17.17	16.69
		VOC EF (g/wh-mi)	2.6608	2.3595	2.087	1.8714	1.6987
		NOx EF (g/wh-mi)	0.959	0.8781	0.8061	0.7402	0.6842
		PM2.5 EF (g/wh-mi)	0.012	0.012	0.012	0.012	0.012
		PM10 EF (g/wh-mi)	0.185	0.185	0.185	0.185	0.185
		CO EF (g/wh-mi)	13.175	12.692	12.167	11.859	11.553
		VOC EF (g/wh-mi)	1.200	1.073	0.954	0.869	0.793
		NOx EF (g/wh-mi)	0.679	0.620	0.569	0.521	0.481

*Includes Road Dust

Resuspended Road Dust (PM10 Only)

Emission Factor	k	a	b	C	Avg. Vehicle Weight	Silt content
g/VMT	g/VMT				lb	g/m ²
0.160	7.3	0.65	1.5	0.2119	2.5	5.085

Tons PM _{2.5} from construction worker trips by car	Tons	0.0020	0.0052	0.0221	0.0480	0.0124	VMT (miles) * EF (g/miles)
Tons PM ₁₀ from construction worker trips by car	Tons	0.0312	0.0820	0.3525	0.7706	0.1984	VMT (miles) * EF (g/miles)
Tons CO from construction worker trips by car	Tons	2.2440	5.6357	23.2189	49.4945	12.4182	VMT (miles) * EF (g/miles)
Tons VOC from construction worker trips by car	Tons	0.2025	0.4763	1.8212	3.5882	0.8421	VMT (miles) * EF (g/miles)
Tons NOx from construction worker trips by car	Tons	0.1145	0.2754	1.0665	2.1762	0.5173	VMT (miles) * EF (g/miles)

SO2

15 ppm = 15 mg S / kg diesel fuel
Density of diesel fuel = 6.073 lb/gal
1lb = 0.4535924kg
1g = 1000 mg
15 ppm = 15 mg S / kg diesel fuel * 1g / 1000mg * 6.073lb/gal * .453kg/lb = 0.0413 g S / gallon

MW S = 32
MW SO2 = 64

Gasoline SO2 per gallon = 0.0413 * (64/32) = 0.0826 g SO2 / gal

3.10 Total Annual Trip Generation

Annual Trip Generation -

**Table 4.5-3A. Trip Generation - Commercial Office and Commercial Retail
2015 Future without the Proposed Action**

NB

Annual Trip	Auto	Taxi	Truck/Delivery
Commercial Office	158964	41704	23504
Commercial Retail	1036204	726960	48100
Total	1,195,168	768,664	71,604

**Table 4.5-4A. Trip Generation
2015 Future with the Proposed Action**

BD- Onsite

Annual Trip	Auto	Taxi	Truck Delivery
Transit Station	11284	154208.8889	0
Transit Retail	10244	18200	8008
Hotel	20800	30992	3848
Commercial Retail	1024608	455364	48100
Banquet Facilities	6864	10712	520
Total	1,073,800	669,477	60,476

**Table 4.5-5A Trip Generation - FF Penn West (Mixed-Use development option)
2015 Future with the Proposed Action**

BD-Off Site

Annual Trip	Auto	Taxi	Truck Delivery
Hotel	51792	106184	5356
Residential	0	201916	5356
Local Retail	85488	226616	11128
Total	137,280	534,716	21,840

Annual Build Increments

Annual Trip	Auto	Taxi	Truck Delivery
Total	15,912	435,529	10,712
Distance (miles)	9	9	9
Annual VMT	143,208	3,919,760	96,408

Emissions (grams/year)	Auto	Taxi	Truck Delivery	Total 2015 (t/yr)	Emission Factors 2015 (g/veh-mile)	
					Cars	Trucks
NOx	72,907	1,995,550	317,182	2.63	0.509	3.29
VOC	181,115	4,957,320	208,241	5.89	1.265	2.16
CO	1,772,242	48,508,206	1,260,053	56.81	12.375	13.07
PM10	3,552	97,210	7,317	0.12	0.0248	0.0759
PM2.5	1,618	44,293	4,763	0.06	0.0113	0.0494

Emission factors for HDT (from the CMAQtraq database (MOBILE6 runs with NYSDOT assumptions)):
 Since the emission lookups are by 1 mph increments, the speed of 3.8 is rounded to 4 and the speed of 4.5 is rounded to 5 mph.
 The speeds are from 2012 output. There was no 2015 output in the conformity report.