

3 EMISSIONS FROM MOBILE SOURCES

3.1 Approach

Mobile sources of GHG emissions include all manner of private and public on-road vehicles (e.g., sedans and SUVs), transportation (e.g., commuter trains) and off-road engines, vehicles and equipment (e.g., construction equipment and lawn mowers). Mobile GHG emitters may be either local (registered within the jurisdiction) or transient (passing through).

It is difficult to obtain definitive usage data for mobile source emissions in large part because fuel purchase and consumption is highly dispersed. All vehicles, whether local or transient, may release GHGs both within and outside the county's jurisdictional boundaries.

Three vehicle categories were considered for this GHG inventory:

1. *Local and transient on-road vehicles*, including passenger vehicles, light and heavy duty trucks, per vehicle class descriptions in Table 1 of Appendix B;
2. *Off-road engines, vehicles and equipment*, as defined and modeled by EPA, per categories described in Table 2 of Appendix B.
3. *Local trains with stations in the county*, specifically electric Metrorail rapid transit trains and diesel-powered VRE commuter trains.

Emissions related to local airports and major train stations were excluded as they exist outside the county's jurisdictional boundary. Other potential sources of mobile GHG emissions, such as commercial watercraft, were excluded as *de minimis*.

The methods described below aim to estimate annual fossil fuel consumption for each vehicle class or train type, then derive CO₂e using the conversion factor for that unit's energy type (Appendix B, Table 7). The inventory only considers the predominant energy use for a given vehicle, be it gasoline, diesel fuel or electricity.⁵

⁵ Alternative fuel blends, such as E10, were not analyzed. Emissions associated with electric vehicles are reflected in the electricity consumption of the stationary unit where the vehicle is recharged.

Fuel consumption in gallons was determined indirectly as the quotient of annual vehicle miles traveled (AVMT) per vehicle class divided by its fuel economy (MPG). For the county government fleet, which is a subset of locally registered vehicles, direct fuel consumption was also recorded (Appendix C) but excluded from mobile calculations in order to prevent double accounting of emissions.

Over 940,000 vehicles are locally registered and their weight and/or year, make and model recorded by Fairfax County. In 2006, this local vehicle fleet was composed of 67% passenger vehicles, 33% light duty trucks and less than 1% heavy duty trucks.

MPG estimates for each vehicle class of locally registered vehicles is provided in Table 4. MPG from 2006 to 2010 improved only very slightly, no more than 0.3%, for all vehicle classes.

Table 4: MPG for locally registered on-road vehicle fleet, 2006-2010

Vehicle Type	2006	2007	2008	2009	2010
Passenger	28.3	28.3	28.3	28.3	28.3
Light Duty	20.8	20.8	20.9	20.9	21.1
Heavy Duty	5.5	5.5	5.5	5.5	5.5
Total Local Vehicles	25.7	25.9	25.9	26.0	26.1

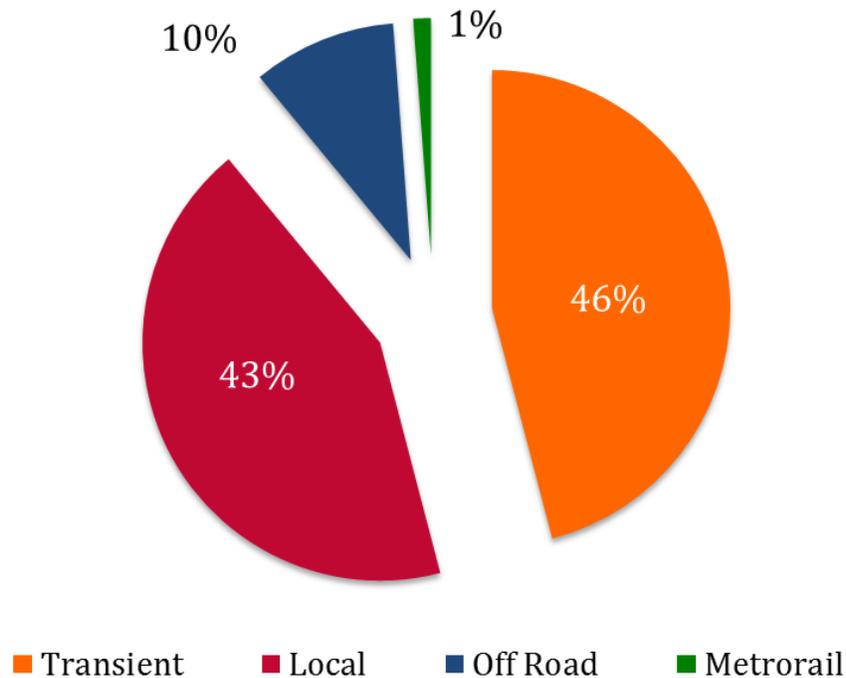
Integrating multiple agencies' survey data produced estimates of AVMT for both local and transient vehicles within each vehicle class, per methods in Appendix B.5.1. Over the five-year period, AVMT increased for both passenger vehicles and light duty trucks, and for both locally registered and transient fleets.

3.2 Results

Emissions from On-Road Vehicles (89%)

On-road vehicles accounted for 89% of mobile emissions in 2006, as shown in Figure 7. A slight majority of these vehicles were transient (46%), while the rest were locally registered (43%). Off-road engines, vehicles and equipment contributed 10% of GHGs and Metrorail 1%. VRE emissions of 0.04% were too small to register on this chart.

Figure 7: Distribution of mobile sources of GHG emissions in 2006



Mobile GHGs per resident were 4.23 MTCO₂e, of which 1.94 came from transient and 1.82 from local vehicles. Transient and local vehicles each accounted for about one-sixth of the county's total 11.4 MTCO₂e per resident.

Passenger vehicles dominated mobile emissions. As shown in Table 7, passenger vehicles created more GHGs than all other mobile units combined in both 2006 and later years. In second position, heavy duty trucks produced about one-fifth the GHGs as passenger vehicles, despite relatively tiny numbers and much lower AVMT. Slightly lower GHGs levels were created by light duty trucks and by off-road engines, vehicles and machinery.

Over the five-year period 2006-2010, GHG emissions increased from most mobile sources, with the exception of heavy duty trucks.

Table 5: AVMT by vehicle class and year, in million miles per year, 2006 - 2010

Vehicle Type	2006	2007	2008	2009	2010
Total Passenger	8,647	8,724	8,831	8,961	9,006
Total Light Duty	1,094	1,132	1,146	1,126	1,152
Total Heavy Duty	320	305	311	292	315
Total Vehicles	10,061	10,161	10,287	10,379	10,473
Transient Passenger	4,462	4,519	4,621	4,697	4,740
Transient Light Duty	565	586	600	590	606
Transient Heavy Duty	165	158	163	153	166
Total Transient	5,192	5,263	5,383	5,440	5,512
Local Passenger	4,185	4,205	4,209	4,264	4,266
Local Light Duty	529	546	546	536	546
Local Heavy Duty	155	147	148	139	149
Total Local	4,869	4,898	4,904	4,939	4,961

For purposes of converting fuel to GHG emissions, passenger vehicles and light duty trucks were considered to use gasoline, while heavy duty trucks used diesel fuel. These data were used to produce a fleet-wide average fuel economy for each vehicle class for both transient and local fleets. Table 6 illustrates fuel consumption for 2006.

Table 6: Fuel consumption by on-road vehicles in 2006, in million gallons

Vehicle Class	Gasoline (Million gallons)	Diesel (Million gallons)
All Vehicles		
Total Passenger	305	
Total Light Duty	53	
Total Heavy Duty		58
Total Vehicle	358	58
Transient		
Passenger	158	
Light Duty	27	
Heavy Duty		30
Total Transient	185	30
Local		
Passenger	148	
Light Duty	25	
Heavy Duty		28
Total Local	173	28

Emissions from Off-Road Engines, Vehicles and Equipment (10%)

Off-road sources were modeled using EPA software that provided only carbon dioxide emissions, not methane or nitrous oxide (14). Since off-road sources' contribution was small, and carbon dioxide comprises roughly 95% of combustion emissions for on-road vehicles, off-road methane and nitrous oxide emissions were dismissed as negligible (15). Appendix B provides technical detail on the methods used to derive GHG emissions from the above approach, including conversion factors.

Emissions from Rapid Transit and Commuter Trains (1%)

Railway emissions were determined using energy usage data provided by VRE and the Washington Metropolitan Area Transit Authority (WMATA), which operates Metrorail. VRE provided monthly systemwide diesel consumption data for its commuter trains. WMATA provided calendar year systemwide electricity usage for Metrorail rapid transit. The proportion of total VRE and Metrorail passengers residing in the county was estimated on a July-June fiscal year basis⁶ in order to allocate a portion of these two systems' total energy usage to Fairfax County riders.

⁶ Proportion of ridership attributable to Fairfax County residents in a calendar year was allocated the same value as ridership for the corresponding fiscal year (ending June 30). The proportion of train energy used by Fairfax residents while they were passengers outside the county was assumed to be equivalent to the proportion used by visitors while inside the county. Thus, local railway energy use was a proxy for use by both residents and visitors inside county boundaries.

Table 7: GHG emissions in Million MTCO₂e by mobile source and year, 2006 – 2010

Source	2006	2007	2008	2009	2010
Total Vehicles					
Total Passenger	2.822	2.845	2.880	2.923	2.936
Total Light Duty	0.486	0.502	0.507	0.497	0.505
Total Heavy Duty	0.596	0.567	0.578	0.544	0.587
Total Vehicle	3.905	3.914	3.965	3.964	4.028
Transient Vehicles					
Passenger	1.456	1.474	1.507	1.532	1.545
Light Duty	0.251	0.260	0.265	0.261	0.266
Heavy Duty	0.308	0.294	0.302	0.285	0.309
Total Transient	2.015	2.027	2.075	2.078	2.120
Local Vehicles					
Passenger	1.366	1.371	1.373	1.391	1.391
Light Duty	0.235	0.242	0.242	0.237	0.239
Heavy Duty	0.288	0.273	0.275	0.259	0.278
Total Local	1.890	1.886	1.890	1.886	1.908
Local Rail					
Metrorail	0.053	0.052	0.050	0.048	0.054
VRE	0.002	0.004	0.005	0.004	0.004
Total Local Rail	0.055	0.056	0.055	0.052	0.058
Other Mobile Units					
Off-Road	0.429	0.438	0.448	0.458	0.468
Mobile Total	4.388	4.408	4.467	4.474	4.554