Vehicle Type Energy Usage

Energy consumption in traffic varies drastically depending on the type of vehicle and the driving conditions. Passenger vehicles generally consume fuel most efficiently at steady, moderate speeds, whereas frequent acceleration and deceleration in stop-and-go traffic significantly degrades fuel economy. Heavier vehicles like trucks and buses have much higher inertia, requiring substantially more energy to regain speed after stopping, which disproportionately impacts total emissions in congested areas.

Electric vehicles (EVs) and hybrids behave differently, often regaining energy during braking through regenerative systems. This makes them surprisingly efficient in stop-and-go city traffic compared to internal combustion engines. However, they still consume significant resources when overcoming aerodynamic drag at high speeds or rolling resistance on rough surfaces, and their efficiency drops in extreme temperatures due to battery chemistry and climate control needs.

The fleet composition?the specific mix of cars, trucks, and buses?is essential for accurate energy modeling. A single heavy-duty truck can consume the fuel equivalent of 20 or more passenger cars. Therefore, logistics hubs and industrial zones will naturally have a much higher "energy intensity" per mile of road than residential suburbs, even if the total vehicle count is lower.

Idling is a major source of wasted energy, particularly for older heavy diesel engines. Modern vehicles with start-stop technology mitigate this, but for long-haul trucks, idling to power onboard systems during rest breaks remains a significant consumer of fuel. Electrifying truck stops and providing shore power can drastically reduce this stationary consumption.

Public transit efficiency is a function of occupancy. A diesel bus is highly inefficient if carrying only two passengers, often worse than if those passengers drove separate cars. However, a fully loaded bus is incredibly energy-efficient per passenger-mile. Optimizing transit routes to maximize load factors is therefore not just an economic imperative but a critical energy conservation strategy for the transportation network.