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Traffic Equity in Buffalo, New York

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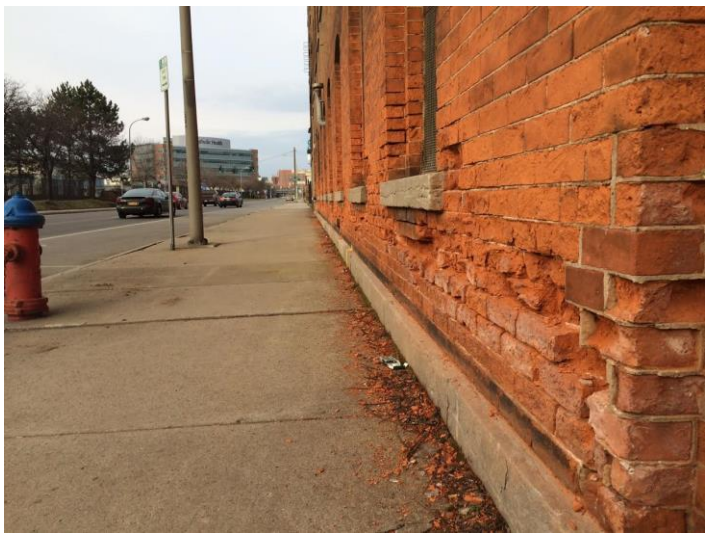
Introduction

Traffic is not good *or* bad –it's good *and* bad. For example, traffic serves stores, restaurants, and cultural organizations. However, traffic, especially vehicular traffic, also causes property damage, personal injury, pollution, illness, and premature death. So, for example, by channeling motor vehicle traffic on expressways and major urban arterials, we are concentrating the bad in some places but also starving other areas of the good. We need to build a more equitable solution to the distribution of traffic's "goods" and "bads" in urban environments.

Issues Surrounding Traffic Equity

Traffic is complicated. It is intertwined with commerce, lifestyles, health, cultural heritage, social justice, and our daily lives. Not surprisingly, then, there are many questions that come up when discussing traffic equity. For example:

- Do the benefits of travel by urban expressways outweigh the negative effects on ***walkability and connectivity*** between neighborhoods that have been divided by them?
- Should those who implement bad roadway designs be held liable for resulting ***property damage, injuries,*** and ***illnesses*** to pedestrian, drivers, and property owners?
- Traffic pollution contributes to increased rates of ***decay*** to our ***architecture and monuments*** (e.g., Brimblecombe 2003, Rodriguez-Navarro & Sebastian 1996). Should the costs to maintain and repair our architectural heritage be paid for with a tax on gas or oil?



A cocktail of traffic pollutants including rock salt and reactive chemicals like nitrogen oxides (NOX) is causing the brick on this privately owned building on Elm Street in Buffalo to decompose prematurely.

- Do the ***tax dollars*** spent on various modes of transportation infrastructure equitably reflect the modes of transportation on which tax payers rely?
- Do inequitable distributions of traffic result in inequitable distributions of goods and services, leaving the most vulnerable among us without access to affordable fresh foods (i.e., ***food deserts***)?
- Traffic pollution has disparate impacts by ***race, ethnicity, age, income,*** and ***education*** (e.g., Bell 2012). Does that indicate inequitable representation in traffic planning for those groups?
- And most significantly, do the conveniences of some modes of travel justify the ***illness and premature death*** that results from exposure to ***traffic pollution***?

Traffic Pollution

Traffic pollution has major effects on our health and well-being. According to a study from MIT, emissions from road pollution cause 53,000 premature deaths in the United States each year. A person who dies from air pollution typically dies about ten years earlier than he or she should have (Chu, 2013). A recent study in Canadian cities found that nine times more people **die prematurely** from air pollution than from traffic accidents (Brauer et al., 2013). Similarly, in Europe, about 400,000 premature deaths related to air pollution occur each year (Amatoa et al., 2014). In developed countries, vehicular traffic is the dominant source of air pollution, accounting for as much as 90% in urban areas (Jensen, 1998). So, how does something like traffic pollution, which we generally take for granted, do so much damage?

Road pollution causes 53,000 premature deaths in the United States each year

Oil and gas are fossilized remains of plants from the Carboniferous Period (360 to 300 million years ago), when dead vegetation built up so fast that it buried itself before it could completely decompose. The carbon we burn in gasoline is a major factor in climate change. Transportation accounts for 33% of carbon emissions in the U.S., up from 31% in 1990. The U.S. Department of Energy predicts that driving will increase 59% between 2005 and 2030, despite a population increase of only 23%. Even with the predicted fuel efficiency improvements of 12% over that period, carbon emissions will increase by 41% (Ewing et al., 2007). Climate change is bad for everyone on the planet, but it is particularly bad for people with low incomes, who are the most vulnerable to heat waves, extreme storms, flooding, crop failures, and other climate impacts.

In addition to petroleum, inorganic and toxic chemicals are added when oil is refined into the stable, uniform fluids we use to power and lubricate our vehicles. Chemicals are added, for example, that maintain certain octane levels, act as detergents, and act as anti-corrosives. As the gas containing this cocktail of chemicals is combusted in our engines, it produces the pollution that makes us sick.

Harmful traffic pollutants include volatile organic compounds, or VOCs, (e.g., benzene, ethylbenzene, toluene and xylene), carbonyls (e.g., acetaldehyde and formaldehyde), black carbon (i.e., soot from

diesel engines), polycyclic aromatic hydrocarbons (PAHs), and particulate matter. Particulate matter is broken down into three general categories based on size: coarse particles, fine particles, and ultrafine particles. The particulate matter generated along expressways comes from exhaust as well as from tire wear, brake dust, road paints, and from the organic dust that is re-suspended after being contaminated by oil, gas, brake fluid, power steering fluid, transmission fluid, and battery acid that leak from the vehicles (Amatoa et al., 2014).

Current federal regulations limit fine particles, but not ultrafine particles, despite a growing consensus that the ultrafine particles are doing us more harm (e.g., Delfino et al., 2005). It has already been shown experimentally that ultrafine particles can travel from the airways to other organs, including the liver, spleen, kidneys, heart, brain, soft tissue and bone (e.g., Oberdörster et al., 2004, Elder et al., 2006, Kreyling et al., 2009).

To summarize, the pollutants emitted by burning fossil fuels form tiny particles suspended in the air that combine with organic and inorganic particles (e.g., brake dust with asbestos), and then travel quite far from our roadways. The incredibly small size of the particles makes it easy for them to enter our bodies and travel to various organs. People in urban, traffic rich, environments are immersed in a bath of microscopic pills containing a cocktail of pollutants. This is why traffic pollution is associated with so many different illnesses.

Illnesses Related to Traffic Pollution

It's unclear whether certain pollutants are causing certain illnesses, or whether the constant exposure to the various toxins is making people more vulnerable to illness to which they already were predisposed. It's likely a combination of the two factors. For example, emerging research presented at the March 23, 2015 national meeting of the American Chemical Society showed that free radicals in traffic pollution can affect immune response. Free radicals can damage parts of cells, including DNA, proteins and lipids. They also cause oxidative stress and can switch on an immune-regulating protein. This causes a cascade of changes in the immune system. Baby mice exposed to a type of free radical found in air pollution had more virus particles in their lungs and more severe illness than mice not exposed to the free radicals. About 20 percent more of them died than the mice not exposed to the free radicals. Conversely, it also led to hyperimmune responses, causing, for example, severe asthma (Mole, 2015, Lee et al., 2014).

Illnesses Linked to Traffic Pollution

Pre-Eclamspsia
Obesity
Autism
Cancer
Depression
Anxiety
Pneumonia
Asthma
Heart disease
Kidney disease

Recent research from The Endocrine Disruption Exchange and University of Colorado at Boulder has also recently been shown that VOC's, even at levels currently deemed

safe by the US Environmental Protection Agency, can disrupt our **endocrine** systems. Endocrine system refers to the hormones that regulate sleep, metabolism, growth and development, mood, sexual function, and many other processes. Many health problems, including cardiovascular disease, asthma, low birth weights, pre-term births, and abnormal sperm, are rooted in early-life disruptions of our endocrine systems (Bienkowski, 2015).

Traffic pollution's ability to disrupt our endocrine systems may help explain findings recently published by the National Bureau of Economic Research. Researchers analyzed over two million crimes over a 12 year period in Chicago against proximity to expressways and wind direction. The researchers discovered a 2.2% increased incidence of **serious crimes** (homicide, rape, assault, and battery) in areas down wind of expressways. So it wasn't just the neighborhood, when the wind direction changed, so did the rates of violent crime. The same was not true of non-violent crimes like vandalism. Extrapolating these findings to the national level, they found that pollution-induced crime is costing the country $100-200 million annually (Herrnstadt and Muehlegger, 2015).

A study of 23,452 births by University of Western Australia's Centre for Child Health Research found an increased risk of **pre-eclampsia** due to exposure to traffic pollution during pregnancy. Pre-eclampsia is a pregnancy complication that results in high blood pressure and damage to other organs, often kidneys. Untreated, it can result in death of mother or child (Pereira et al., 2013).

A similar study out of Boston Children's Hospital's Division of Endocrinology used proximity to traffic and roadway volume to study the effects of traffic pollution on post-birth growth rates. They found an association between increased exposure to traffic pollution and **reduced fetal growth** as well as **increased post-birth weight gain.** The authors concluded that traffic pollution is contributing to the obesity epidemic (Fleisch et al. 2015).

A study in California found that children with **autism** were much more likely to have lived near sources of traffic pollution during gestation and the first year of their lives than children without autism (Volk et al., 2013). The same was true of **cancer** for children who lived near sources of traffic pollution at the time of their birth (Heck et al., 2013 and Ghosh et al., 2013).

A study from Columbia University reported children exposed to high levels of polycyclic aromatic hydrocarbons (PAHs) while in the womb were five times as likely to experience **attention problems** like attention deficit disorder (Perera et al., 2012a). PAHs are also linked to **lower I.Q.** (Perera et al., 2009), **anxiety**, and **depression** in children (Perera et al., 2012b). Traffic pollution is also associated with an increased risk of **otitis media**, or inner ear infections (Brauer et al., 2006). A study of over 317,000 Taiwanese school age children found a positive association with incidence of **flexural eczema** (an autoimmune disorder) and traffic pollution (Lee et al., 2008).

Living closer to major roadways is also correlated with **decreased kidney function**. And as with most of the cited research, the magnitude of the decreased kidney function did not diminish when controls were evaluated for potential confounding factors like age, sex, race, history of hypertension, diabetes, or socioeconomic status (Lue et al., 2013).

Traffic pollution, in this case diesel exhaust particles, is also associated with **aeroallergen sensitization** (an autoimmune disorder) (Codispoti et al., 2014). Urban particulate matter is also associated with increased cases of **bacterial pneumonia**. Oxidative stress caused by particulate matter has been shown to increase the adhesion of Streptococcus pneumoniae (a common bacterial cause of pneumonia) to the airway epithelial cells (Mushtaq et al., 2011).

Exposure to ultrafine and fine PM during exercise is associated with **decreased physical performance and lung function** (Rundell & Caviston 2008, Rundell et al., 2007, and Rundell et al., 2008). A study of 6,339 participants of the Framingham Heart Study showed that increased exposure to traffic pollution or PM 2.5 is associated with an **accelerated decrease in lung function** in adults over time. (Rice et al., 2015).

A study of incidents of **asthma**, spanning 28 zip codes in Erie County, NY, found a statistically significant spatial correlation between incidences of asthma diagnosis and treatment and proximity to major sources of traffic pollution. In fact, two thirds of asthma sufferers in the study area lived between 204 and 700 meters from major sources of traffic pollution (Oyana and Lwebuga-Mukasa, 2004). Similarly, between 1991 and 2000, there was a statistically significant temporal correlation between traffic volume at the Peace Bridge in Buffalo and incidents of asthma treated at hospitals in the Kaleida Health System (Lwebuga-Mukasa, J. S. 2003).

Several studies have linked asthma incidence in Erie County to proximity to traffic pollution, including that generated by Peace Bridge traffic.

Over the same period, there was again a statistically significant spatial correlation between incidents of asthma and proximity to the Peace Bridge Plaza and I-190 (Lwebuga-Mukasa, J. S. 2004). This means both traffic volume and proximity to traffic are associated with incidents of asthma. While asthma is often regarded as a treatable disease, 158 people in Western New York died from asthma between 1991 and 1996. Eighty percent of those people lived in the counties with the largest volumes of traffic, Erie and Niagara (Almeida and Lwebuga-Mukasa, 2001).

A study of over 90,000 nurses in the US, found an increased risk for **rheumatoid arthritis** (an autoimmune disorder) among those living with 50 meters of a road (Hart et al., 2009). For older adults, exposure to PM is also associated with **lower cognitive function** as well as **cognitive decline** over time (Tonne et al., 2014).

A study in 10 Canadian provinces found an increased risk of developing breast **cancer** with increased exposure to traffic pollution (Hystad et al., 2015). A study in Montreal also found increased exposure to traffic pollution to be associated with increased risk for prostate cancer (Parent et al., 2013). Of course traffic pollution is also associated with lung cancer (e.g., Beelen et al., 2008 and Raaschou-Nielsen, 2011).

The American Heart Association issued a Scientific Statement in 2010 that summarized the state of the research on PM and **cardiovascular disease**. According to a rapidly expanding body of research, exposure to PM increases the risk of cardiovascular disease and mortality. For people with greater exposure, it can reduce life expectancy by a few months to a few years. According to the NYS Department of Health, cardiovascular disease is the #2 cause of **premature death**. The good news is reductions in PM levels can quickly reduce the added risk of cardiovascular disease and mortality (Brook et al., 2010 and Langrish et al., 2012).

Improving Traffic Equity in Buffalo

Public Transit

The cornerstone of traffic equity is making public transit affordable, accessible, and popular. Good public transit reduces both pollution and poverty dramatically. In Western New York, the Niagara Frontier Transit Authority (NFTA) has been struggling with decreased federal and state aid and increased costs for health care, workers' compensation, and maintenance and repair. The inevitable results are fare increases and route cuts. Buffalo-Niagara's economy depends heavily on mass transit, with the NFTA providing 27 million passenger trips per year. Roughly 84% of riders use NFTA to get to work; of these, 77% do not own a car (New York State Transportation Equity Alliance, 2011). Cutting bus routes will worsen the effects of the region's spatial mismatch between jobs and affordable housing and will hinder economic recovery.

Steps toward Adequate NFTA Funding

New York State should create funding parity between the NFTA and other upstate regions by considering the extra services and costs provided by Metro Rail.

Erie County should increase its sales and mortgage recording tax contributions to the NFTA, and Niagara County should begin contributing.

Local Industrial Development Agencies should stop granting exemptions from mortgage recording taxes.

Public transit investments create jobs. It is estimated that every $1.25 billion invested in transportation infrastructure supports 35,000 jobs (American Public Transportation Association, 2009). Public transit saves families money. Families in large metropolitan areas save $9,656 per year by taking transit instead of driving (APTA, 2011).

Public transit saves the environment and reduces dependence on foreign oil. Each year, public transit saves the United States 4.2 billion gallons of gasoline and eliminates 37 million metric tons of carbon dioxide emissions (APTA, 2014).

Under Executive Order 24, New York State is attempting to reduce its greenhouse gas emissions 80% by 2050. Transportation accounts for over one third of the state's emissions; no climate strategy can succeed without significant investment in public transit; and thus the State's Climate Action Plan calls for the State to "Invest in the maintenance, enhancement, and expansion of public transit systems" (New York State Climate Action Council, 2010). Expanding public transit, as called for by the Plan, would save 900 million gallons of gas by 2030 (Climate Action Council, 2010). It would also, of course, dramatically reduce traffic pollution.

Smart Growth

Rolf Pendall has aptly summarized Buffalo's development pattern as "sprawl without growth." Between 1950 and 2000, the region gained only 80,881 people, but the urbanized area nearly tripled, going from 123 square miles to 367 square miles. The city of Buffalo's population declined from 580,132 to 292,648 (a loss of 287,484), while the rest of Erie County grew from 319,106 to 657,617 (a gain of 338,511) (Erie-Niagara Framework for Regional Growth, 2006).

One key result of our development pattern is much more driving. As of 2000, 41% of the households in the metro area were living at least 10 miles from the central business district (Diversitydata.org). Between 1984 and 1999, the average number of miles driven each day increased by 50%, from 10 to 15 miles (Framework for Regional Growth, 2006).
Between 1970 and 2000, even as the population was falling, the total miles of roads in Erie and Niagara counties rose 5,410 miles. All those road miles are expensive. To give a few figures, it costs roughly $4 million per mile to build a single lane roadway, and $4,800 per mile a year to maintain a highway. Erie County estimated the cost of its highway and bridge projects for 2006-2010 at $685 million (League of Women Voters, 2006).

All the added driving dramatically increases the negative health impacts outlined in this report; but it has many other costs as well. As the Regional Framework explains, vehicular travel hurts the environment in myriad ways: "Pollution from motor vehicles contributes to declines in air quality, paved surfaces increase urban runoff and threaten water quality, and transportation infrastructure can fragment agricultural and forested lands and wildlife habitat" (Erie-Niagara Framework for Regional Growth, 2006). Of course, driving is also dangerous: over 41,000 Americans die in car crashes each year (LWV, 2006).

Suburban households drive 31% more miles per year than those who live in cities.

Suburban households drive 31% more miles per year than households with the same size and income who live in cities (Kahn, 2006). In general, with more compact development, people drive 20 to 40% less. For example, while Atlanta averages 34 vehicle miles per person each day, Portland averages only 24 miles. Smart growth could reduce transportation emissions by 7% to 10% by 2050 (Ewing et al., 2007). Compact development patterns also improve equity, as they reduce travel expenses and make jobs and education more accessible to people without cars.

For more information about sprawl and policies to combat it, see the PPG policy brief, "Buffalo's Sprawl: Fiscal, Environmental, and Social Costs," available at www.ppgbuffalo.org.

Biking, Walking, and Complete Streets

Policies that encourage, facilitate, and reward bicyclists and pedestrians have two important effects on traffic equity. First, they reduce vehicular pollution and its disparate impacts on the poor. Second, they make life easier and less expensive for households that cannot afford a car. In Western New York, the leading advocate for bicycling is GoBike Buffalo. GoBike won a major victory when it persuaded the City to adopt a complete streets ordinance – which requires that, whenever the City builds or renovates a street, it consider the needs of bikers, walkers, and transit users, not just drivers. As a result, bike lanes, traffic calming measures, street trees, and other improvements are increasingly visible. GoBike is now working with the City on a new bicycle master plan.

Large volumes of data have shown that increasing infrastructure for vehicular traffic does not reduce congestion. Widening roads ***induces demand*** until a similar level of congestion is again achieved. It's not just the workday commute; increased traffic infrastructure also changes people's ideas about where they are willing to drive, for example to get a haircut or buy groceries (Duranton, 2009). It would stand to reason a similar process would affect pedestrian and public transportation infrastructure. So, to induce a more equitable distribution of traffic in cities, we need to reduce our expressway infrastructure while increasing the infrastructure for other modes of travel, like complete streets, including well maintained and well-lit sidewalks and protected bike lanes.

Car Sharing

Car sharing promotes traffic equity by reducing pollution and transit costs. It reduces pollution in two main ways. First, when people share cars, less cars need to be manufactured and shipped. Second, when people use car sharing instead of owning a car, they use public transit, walking, and biking more. As a result, Buffalo Carshare, a relatively young start up, already projects to save nearly 1 million tons of carbon emissions per year. That means city residents are also spared an equivalent amount of traffic pollution. A car share membership is also dramatically cheaper than owning a car. A large portion of Buffalo Carshare members are people with low incomes. For them, car sharing is a vital, affordable supplement to public transit, biking, and walking, enabling them to go to job interviews, medical

appointments, evening classes, and grocery stores without owning a car. Supporting Buffalo Carshare is a simple and proven way to improve traffic equity.

Peace Bridge

With millions of cars and trucks crossing each year, the Peace Bridge is a major source of traffic pollution. Unfortunately, the Peace Bridge is also located upwind of a densely populated, historic urban neighborhood with a high concentration of people with low incomes, people of color, and refugees. As noted above, studies have shown high rates of asthma in the west side neighborhood nearest the Peace Bridge.

One important strategy is to shift truck traffic from the Peace Bridge to the Lewiston-Queenston Bridge, which is located in a much less dense and less impacted area. The Peace Bridge crossing, located near downtown Buffalo and a host of historic parks, buildings, and trails, should prioritize tourists, business travelers, and bicyclists, rather than trucks. Impeding this potential, however, is the fact that the Peace Bridge and the other bi-national bridges are operated by two separate public authorities, and the fact that the bridge authorities rely on truck tolls for revenue. A merger of the two authorities would help spur a more unified and rational weighing of costs and benefits when considering where trucks should cross. In addition to re-routing truck traffic, the Public Bridge Authority should expand on efforts to mitigate traffic pollution with barriers, plantings, anti-idling policies, and other measures.

> The Peace Bridge crossing should prioritize tourists, business travelers, and bicyclists, rather than trucks.

Self-Organizing Traffic Signals.

Self-organizing traffic signals greatly reduce wait times by allowing the lights to prepare for incoming surges of traffic. Rather than relying on timers or sensors that detect traffic only once it has arrived at the red light, these signals detect vehicles as they are approaching. This allows them to begin the transition to a green light sooner than the traditional sensors embedded in the road. This system can reduce wait time by 10 to 30% (Science Daily, 2010). Self-organizing traffic signals with transit signal priority can further reduce wait times by as much as 60% when used with coordinated–actuated control (Cesme & Furth, 2014). That means each signal communicates with its nearest neighbors (i.e., only with one traffic signal in each direction) to prepare them for surges in traffic. More important than reducing wait times, or increasing the efficiency of our commutes, this also means that we would eliminate 60% of the pollution generated by idling vehicles.

Mitigating Traffic Pollution Impacts

As we work toward a more equitable distribution of traffic and better regulations for traffic pollution, there are small steps we should take to protect ourselves. The first is to block pollution and filter our air, both indoors and out.

Studies of **physical barriers** (i.e., walls) consistently show that concentrations of traffic pollution are significantly lower behind barriers (Heist et al., 2009 and Finn et al., 2010). Likewise, **vegetative barriers** (e.g., hedgerows) have also been shown to block, capture, and filter traffic pollution (Baldauf et al., 2008, Fujii et al., 2008, and MacNaughton et al., 2014). It is easy to combine the two types of protection by, for example building elevated planters with textured walls that encourage climbing vegetation. Thus, physical and vegetative barriers to traffic pollutions should be incorporated into roadway construction and maintenance wherever possible, as well as around facilities like the Peace Bridge Plaza and toll booths.

Physical and vegetative barriers to pollution should be incorporated into roadway construction and maintenance.

A study by the Harvard School of Public Health used pollution monitors on bicycles and compared the results between bike lanes that share the roadway and bike paths that followed roadways, but were separated by vegetation. The data showed that vegetative barriers of all kinds can filter or block about a third of the pollution generated by traffic. Those findings held true for roadways of all sizes (MacNaughton et al., 2014). So yes, just gardening, especially in our front yards and curbsides, can have a measurable effect on health and wellbeing.

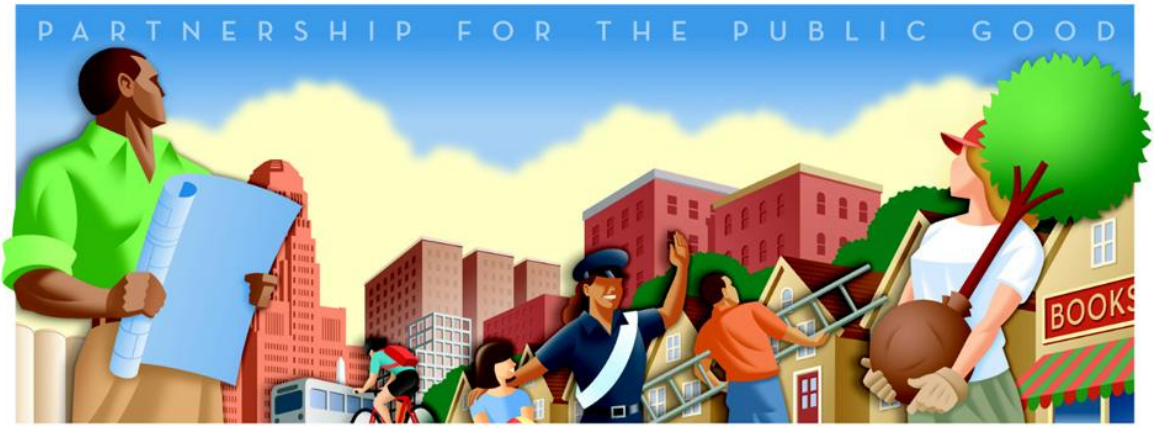
We tend to think of air pollution as a concern that only matters when we are outside. In reality, however, the outside air is the ambient or background air quality. Indoor air quality is typically much poorer due to chemicals in the cleaning solutions, flame retardants in textiles and furniture, or pollution from gas appliances (especially unvented gas stoves), to name a few. If you have a gas stove and stainless steel cookware, you can see the long term effects of secondary aerosol species by examining the bottom of your pans –that's not food residue, that's tar.

Fortunately, there are also steps that can be taken to improve indoor air quality. Air purifiers with **HEPA filtration** are one solution. These filters must capture 99.97% of 0.3 µm particles to qualify as a HEPA filter. That range covers a great deal of the spectrum of sizes considered coarse and fine. However, some HEPA filtration system can produce ozone, a pollutant associated with breathing and cardiovascular illnesses, in excess of public health standards (Britigan et al., 2006). According to Consumer Reports, the ozone is produced by air purifiers with electrostatic precipitators (ionizers). In theory, these help capture particles in the ultrafine range. However, if you suffer from respiratory problems, cardiovascular disease, or any other illnesses associated with ozone, you should consult your physician before deciding on whether or how to use ionizers.

House plants are a more benign, and more attractive, way to improve air quality. The National Aeronautics and Space Administration (NASA) has found that many common houseplants not only consume carbon dioxide and produce oxygen, they are also very good at removing common toxins (e.g., benzene, formaldehyde and trichloroethylene) from the air. Plants remove the toxins by either metabolizing them (i.e., changing the chemical composition through digestion and respiration) into

inert substances or by absorbing them (e.g., heavy metals) into their tissues (Sawyer, 2000, Claudio, 2011). Studies have also shown that microorganisms in the soil also remove volatile organic compounds from the air. The combined plant-soil microorganism filtration can remove as much as 75% of VOCs from the air (Orwell et al., 2004 and 2006).

In conclusion, traffic equity and traffic pollution are issues that affect everyone. They are the result of policies and actions at federal, state, regional, community, household, and individual levels. We need to work together and individually to fix these problems as well as to protect ourselves, families, and communities.



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